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STEEL

1942 YEARBOOK OF INDUSTRY ISSUE

Contents

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Volume 110—No. 1 January 5, 1942

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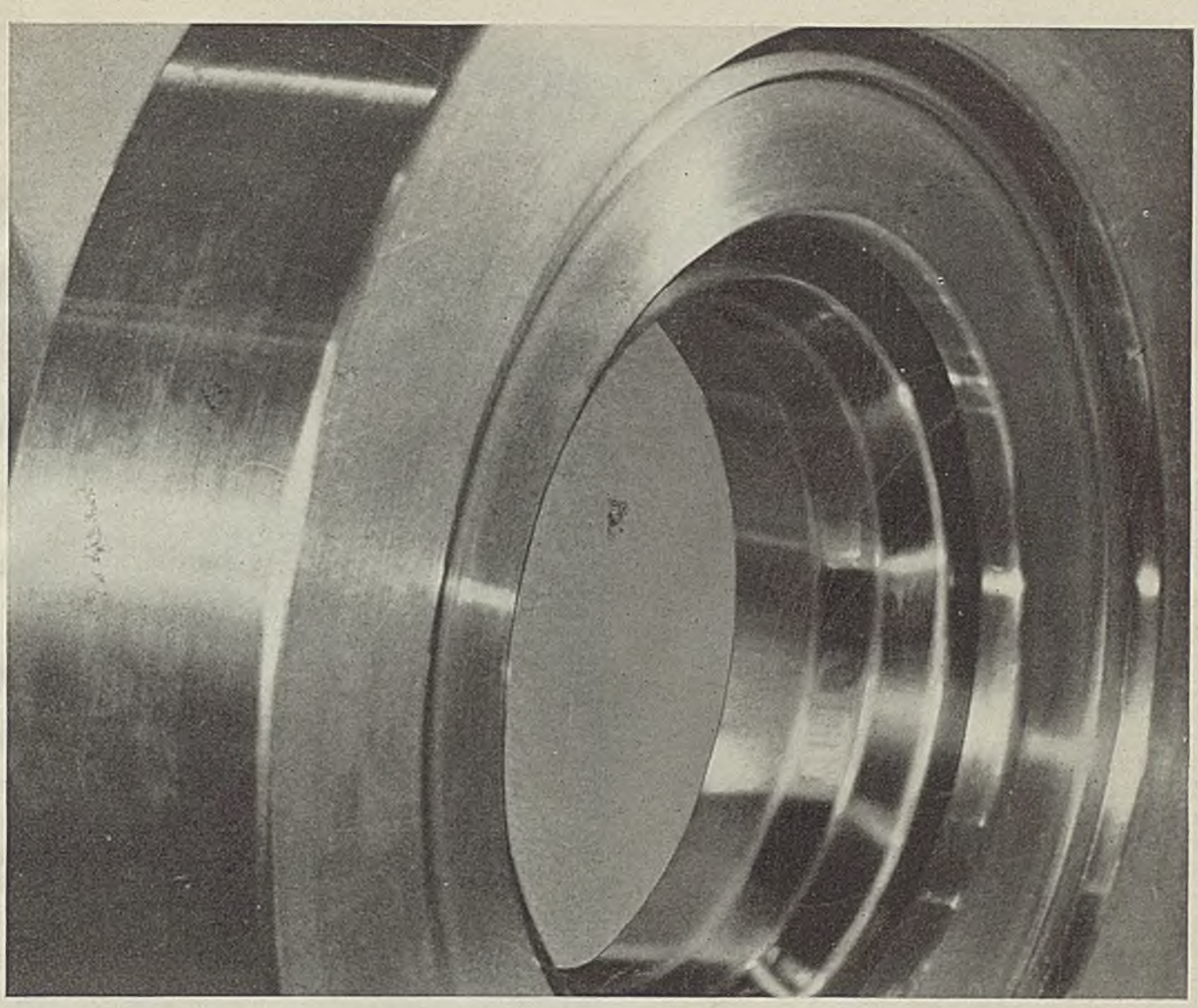

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Particularly noticeable during the past year has been the trend toward use of Carboloy dies in large sizes. During 1941, sheet metal forming dies having Carboloy nibs as large as 9¼" hole size by 11¾" outside diameter, as well as large sheet metal drawing dies, were successfully employed. Use of these larger dies has been amply justified by better finish, closer tolerances and longer die life.

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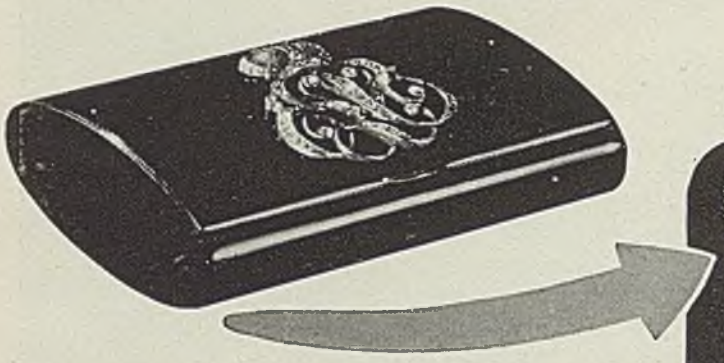

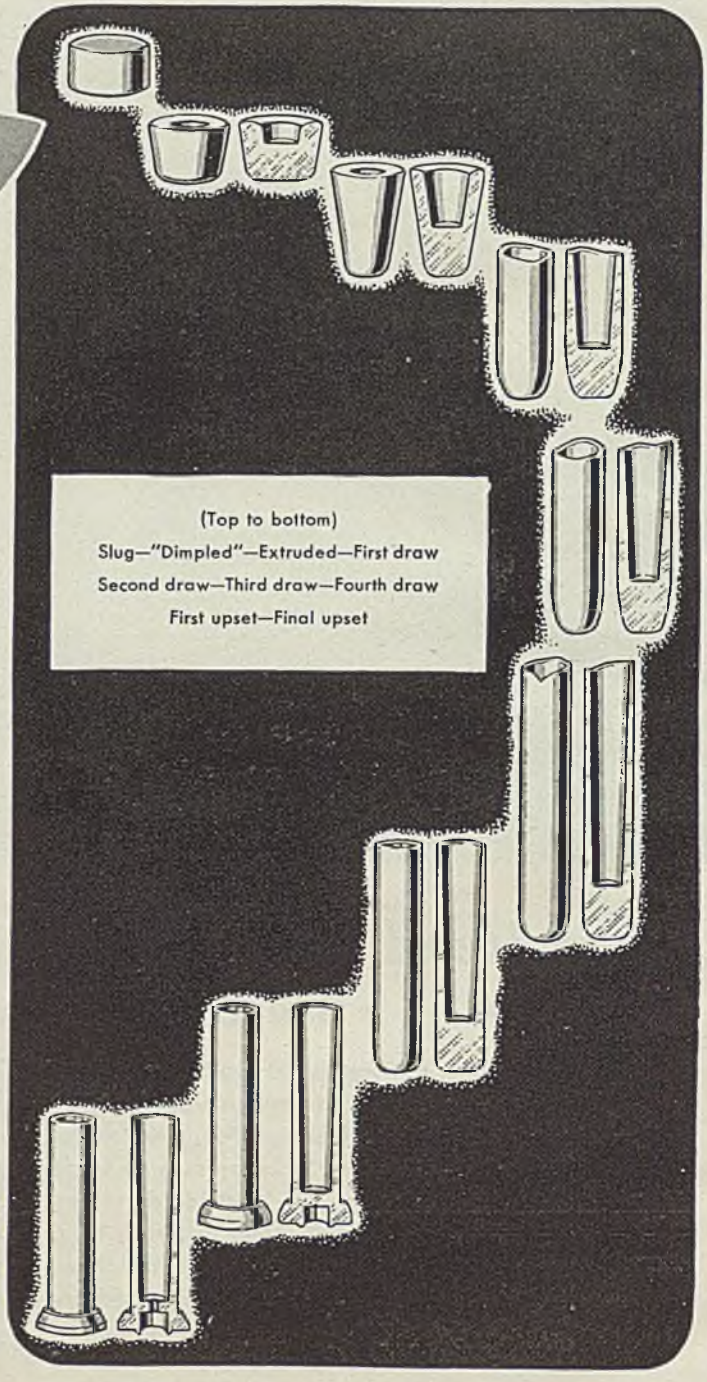

when Volupte and Revere put their heads together

When Volupte, Inc., one of the leading manufacturers of compacts, wanted to use its facilities to make primer bodies for Uncle Sam, the change-over involved more than merely a shift from beauty to utility.

Everything was new. Appearance had once been vitally important. Now performance took its place. Emphasis on surface finish gave way to emphasis on ductility, uniformity, precision. The brass had to be of a new analysis, responding differently to the various operations. New equipment had to be selected, and new methods worked out.

Here was a situation full of potential "headaches" for the manufacturer, but also full of opportunity for a Revere Technical Advisor to assist in eliminating them. After calculating a temper for the brass providing the correct balance between ductility and machinability, the customer was provided with a specification which made it easy to specify materials on repeat orders. A correct method was developed for each new operation. Recommendations on sizes of stock were made, to minimize scrap loss.

Quite some time has passed since Volupte, Inc. worked out these problems with the Revere Technical Advisor. America now has a large new source of dependable primer bodies . . . a prominent manufacturer has successfully added a new type of business . . . and Revere has helped an old friend. The Revere Technical Advisors will be glad to help you with your problems. Write us.

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STEEL

The Tide To Victory

■ A YEAR ago the challenge of 1941 to American industry was summarized on this editorial page in the following words:

"We enter the new year with one clearly defined objective—total defense. It will be a banner year for industry if during the next 12 months its contributions to preparedness are so outstanding as to win the approbation of the public."

* * *

Industry's accomplishments during the past year were outstanding. As indicated in text, table and chart in this issue, they top all previous records.

If these vital contributions to defense did not win from public opinion the approbation they merit, it was not the fault of industry. If the man in the street was somewhat unappreciative of industry's record, it was because the entire defense effort of 1941 was conducted for 11 months and one week in a mist of confusion, uncertainty and doubt.

During the first forty-eight and one-half weeks of the past year, every move to increase production for defense was unintentionally sabotaged. The nation was not united. The people were not informed properly. They did not understand. They were suspicious because so many deeds of the government administration did not jibe with its avowal that total defense was the nation's No. 1 objective.

Strike after strike occurred, with no evidence that the government really desired to prevent them. Lack of co-ordination almost wrecked the defense program late in August, yet the crisis was met with a feeble reshuffling of personnel rather than with decisive, effective measures.

These and many other indications of complacency in high places made men wonder whether defense was a trumped-up emergency or the real thing.

The insidious drag of apathy and misunderstanding was felt right up to the early afternoon of Dec. 7. Then word came to the mainland of the Japanese attack upon Pearl Harbor—a cleverly executed trick performed under the cover of peace gestures at Washington.

In split seconds the American nation was transformed from a sleepy, easy-going giant into a determined, fighting-mad warrior. That sudden change is more important to the iron, steel and metalworking industries than anything that has happened in the lifetime of the republic.

The immediate effect, which was to unite almost instantaneously a disunited people, will reverberate throughout industry all through 1942 and thereafter until the war is won. A united people will not countenance the delays, inefficiency and distractions which characterized the defense effort prior to Dec. 7.

* * *

Therefore, thanks to the bitter tragedy of Pearl Harbor, industry in 1942 will have the assistance of two great aids which were denied it in 1941. It will be working with a more sympathetic, realistic and efficient defense organization in government and with a more alert, appreciative and determined public.

Under these more auspicious circumstances, industry's effort in 1942 will be more effective than in the past year. In fact, it will be even thrilling and spectacular.

In spite of the many mistakes and handicaps of the past, considerable progress

Jan. 5, 1942

Beginning the 100th Year of Ryerson Steel-Service

Large and complete stocks, steel of known quality, prompt and dependable service . . . . these are the rugged cornerstones on which the Ryerson business has been built. 100 years of experience is at the disposal of Ryerson customers to help them meet every steel problem. Today, our stock in many lines is depleted and war needs have the right of way. However, we continue to serve every customer to the best of our ability in accordance with the Government Program. Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

RYERSON STOCKS
include:

Beams and Heavy Structurals
Channels, Angles, Tees and Zees
Rails, Spikes, Bolts, etc.
Plates and Sheets
Hot Rolled Bars, Hoops and Bands
Cold Finished Shafting
Alloy and Tool Steels
Heat Treated Alloy Steels
Strip Steel, Flat Wire, etc.
Stainless Steel
Mechanical Tubing
Boiler Tubes and Fittings
Welding Rod, Wire
Rivets, Bolts, Nuts, Washers, etc.
Concrete Reinforcing Bars
Babbitt Metal and Solder

RYERSON *Certified* **STEELS**

RYERSON CERTIFIED STEELS

has been made in mobilizing industrial resources for war. While one portion of industry has been busy with actual production, another section has been engaged in tooling up for future operations.

Japan struck at a time when the tooling up process was almost completed in thousands of plants. These establishments will be hitting their stride in 1942. It is safe to say that the new year will be notable for the extent to which the American unique system of mass production proved its ideal adaptation to the needs of war.

★ ★ ★

Another service which the disaster of Pearl Harbor may render to this nation is a reappraisal of values.

Ever since September, 1929, the American people have been suffering from a bad case of jitters. Seldom in history has a strong nation embraced an inferiority complex as demoralizing and as unjustified as that which has gripped the public during the past decade.

With resources far exceeding those of any other world power, the American people had assumed an apologetic, defensive attitude. We had grown soft and cynical. We had looked with disfavor upon the very institutions which have made our nation strong.

In the depths of our despondency we criticized the machine as a social and economic menace. We ridiculed and condemned the profit motive. We pointed the finger of scorn at private enterprise. We persecuted business and finance. We approached dangerously near the point of counting success and accomplishment an evil and failure and shiftlessness a virtue.

Is it too much to hope and to pray that the lesson of Pearl Harbor already is in the process of correcting these grave faults?

Is it not possible that the shock even now is working quietly within us—causing us to re-examine ourselves and to reassess the values of the tangibles and intangibles around us?

Such critical self-examination will be good for our souls. It will heighten our appreciation of the liberties we possess in a democratic nation. It will rekindle respect for honest accomplishment and for fairly achieved success.

It will re-establish the importance of private enterprise, reveal to us the great social and economic potentialities of our fine machines and equipment, renew our belief in the efficacy of government by law, and impress us with a more realistic appreciation of our social and political obligations to our country.

Having purged ourselves of the poison of fallacious doctrines, we will see that our nation is strong—physically and spiritually.

It is strong physically because generations of individuals had the courage and initiative under free institutions to develop new products, to manufacture them and to market them to the people. It is strong physically because pioneers were encouraged to take a chance, to try to do the impossible.

It is strong spiritually because the people never have permitted the light of freedom to die out. The light has faltered—it has been feeble in recent years. But the deeds of men since Dec. 7, 1941, have fanned it into full flame again.

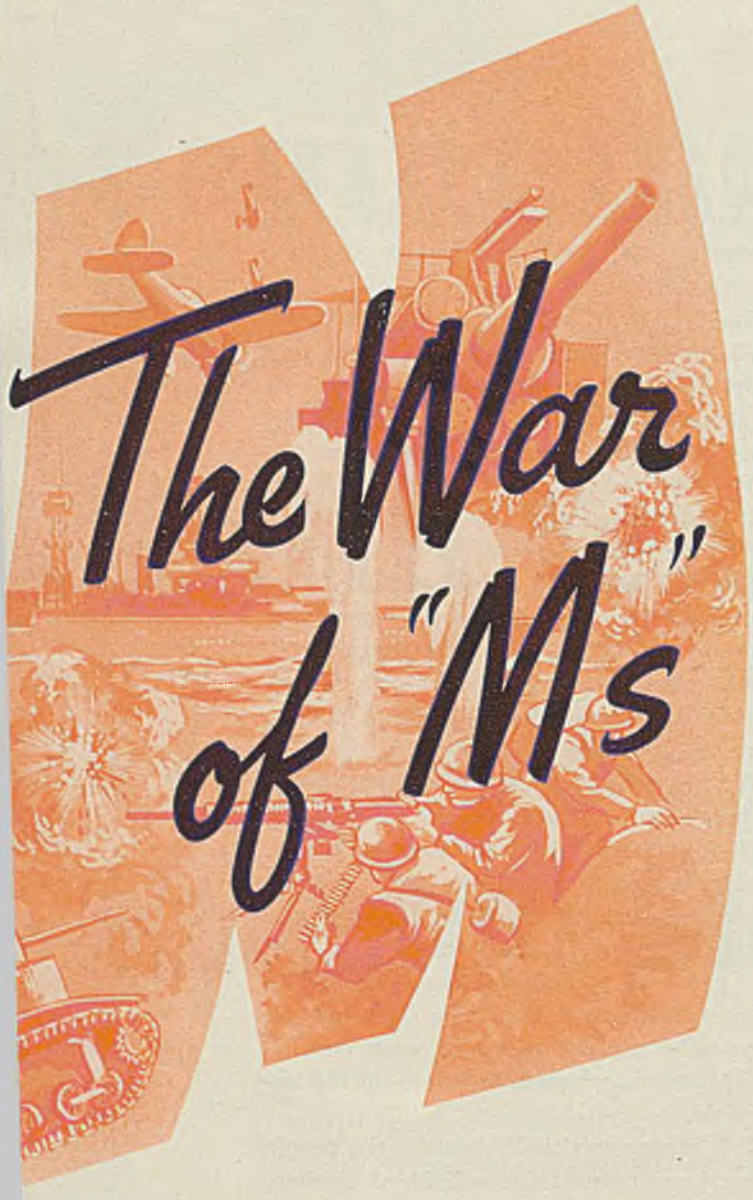
★ ★ ★

Shakespeare said that "there is a tide in the affairs of men, which taken at the flood, leads on to fortune."

Pearl Harbor has incited a tide of spiritual awakening, which taken at flood in 1942 will lead on to victory.

E. L. Shaner

EDITOR-IN-CHIEF



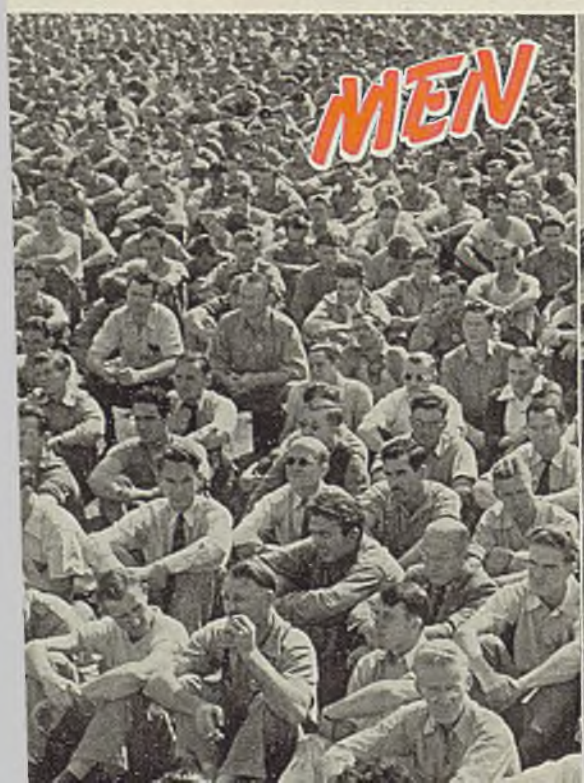
DURING the weeks this "Yearbook of Industry" issue of STEEL has been in preparation, more spectacular events of far-reaching importance to the iron, steel and metalworking industries have occurred than in any like period in the history of this nation.

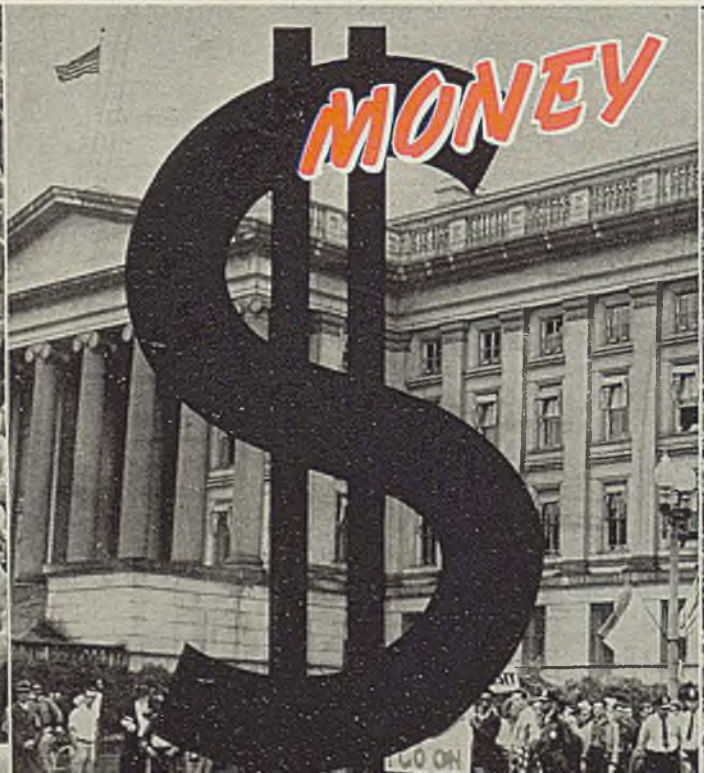
When the initial tentative plans for the editorial content of this issue were laid out, the United States was pointing its industrial effort to the objectives of national defense and aid to belligerents opposed to the Axis powers.

The nation was in a state of confusion. Its administration's foreign policy was under criticism from many quarters. Its attitude on labor relations problems was opposed by a 6 to 1 majority of the public, according to numerous polls. Its direction of the defense program was under fire from individuals in all walks of like. The distribution of critical materials was questioned on the ground that small businesses were being harmed unnecessarily.

On Dec. 7, a bombing attack by Japanese on Pearl Harbor shocked the American public into an attitude of unity. In the few seconds required for the significance of the tragedy to sink home in the mind of the man in the street, almost all of the quibbling, dissension, doubt and uncertainty which contributed to disunity in the United States was dispelled. The Japs, attacking without warning while their envoys were waving olive branches in Washington, rendered the United States a service of incalculable value. They incited in Americans a spirit of unity which we, relying upon our own devices, had been unable to develop in more than two years of intensive effort.

The attack on Pearl Harbor also caused a sudden shift in the emphasis on many internal problems. Issues which seemed extremely important on Dec. 6 were pushed far into the background on Dec. 8. For instance, the final decision in the captive coal mine dispute—which would have received 7-column





headline attention under ordinary circumstances—was given scant notice in the Monday morning papers of Dec. 8.

Again, on Dec. 23, when the President's "industrial peace" conference made its report, Mr. Roosevelt gave it about two hurried minutes of his time—sandwiched in between conferences with Prime Minister Churchill. Under conditions prevailing prior to Pearl Harbor, the conference report would have rated as one of the outstanding events of the year. As it was, it and many other important questions of domestic policy, are being all but lost in the shuffle of much weightier affairs.

Since Dec. 7, world-shaking events have occurred with almost monotonous regularity. Sinking of the PRINCE OF WALES and the REPULSE. The retreat of the Hitler armies from Moscow. The British advance in Libya. The courageous stand of marines at Wake island. The stubborn defense of Hong Kong. General MacArthur's resourceful defense of the Philippines. Hitler's dismissal of the "von" generals in the Russian campaign, and his assumption of direct responsibility for the German army. The reported resignation of the aged Philip Petain. The historic visit of Winston Churchill and staff to Washington. Conjecture over Hitler's next face-saving exploit. The fall of Wake island and the surrender of Hong Kong. Churchill's address to the joint session of Congress. The ruthless bombing of defenseless Manila after it had been proclaimed an open city.

These and other events make a pattern of highlighted excitement unsurpassed in world history. Their implications will affect American industry vitally in 1942 and for the duration of the war. Equally important is the influence which these happenings will cast upon events during the postwar period. Many alignments now being crystallized in the heat of emergency will endure long after victory has been achieved. Every day events are occurring which will help to remold the economic pattern of world relationships in the future. War in Europe, Africa and the Far East may be creating new markets for the future consumption of the output of American mills and manufacturing establishments.

It is futile, of course, to attempt to predict the tide of conflict in the new year. It is sufficient, at this time, to know that America is in a war provoked by others, that industry is committed to whatever is essential to victory and that after long delays the nation now realizes its true position and is resolved to meet whatever challenge is offered.

And so, in preparing this issue of STEEL, the editors have tried to determine the basic facts which bear upon the contributions which the iron, steel and metalworking industries will make to the war effort in 1942.

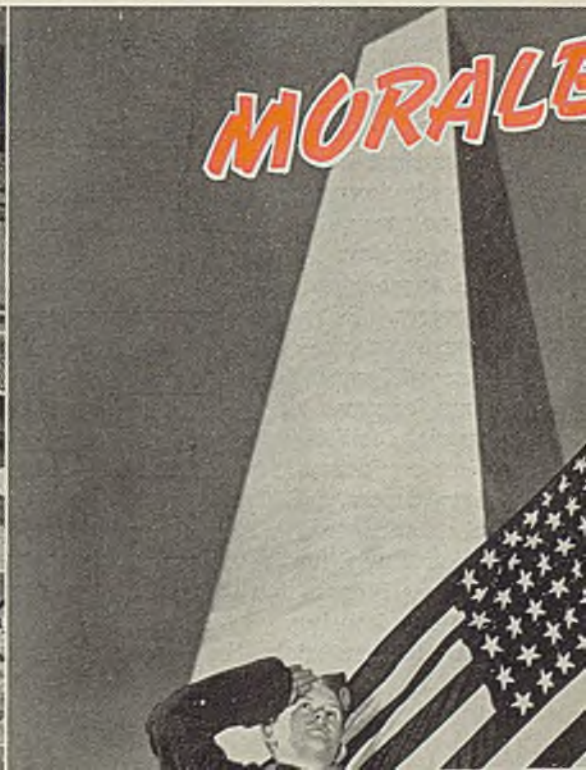
This is a war in which the ultimate result will be determined by the extent of the resources each side possesses and can put to use effectively.

It is essentially a battle of the "M"s—men, money, materials, machines and morale. Throughout this issue of STEEL, the major emphasis in editorial content is upon these "M" resources of the nation.

In manpower, both quantitatively and qualitatively, the Allies hold a marked advantage over their opponents. Throughout the world there are more than five individuals who favor the Allied cause to every one who supports the Axis objectives.

Of the approximately two billion inhabitants of the world, at least 1,400,000,000 are allied with the United States and its associates in war. About 410,000,000 are nominally on the side of the Axis powers, but of these 179,000,000 are in countries occupied by the armies of the dictators. Therefore, it may be assumed that less than a quarter of a billion persons really favor the Berlin-Rome-Tokyo program.

The Census Bureau of the Department of Commerce figures that the Allied nations can muster 56,643,000 soldiers between the ages of 18 and 35, where-



■ Figures in the accompanying illustration represent the annual steelmaking capacity of belligerent nations in net tons, as estimated recently by the American Iron and Steel Institute. The total for Germany includes the estimated capacities of occupied countries, such as Poland, Czechoslovakia, France, Luxembourg, etc. The total for Russia includes the capacity in portions of the U. S. S. R. recently or now occupied by German troops. The capacity in this area is estimated at 13,080,000 tons, which under conditions existing at the present time, probably is not available for use by Russians or Germans

as the Axis powers can call upon only 28,560,000 men in the same age range.

A similar margin of superiority rests with the Allies in the number of individuals available for production, manufacturing and services on the home fronts.

More important than sheer numbers, however, is the effectiveness of man-power. Colin Clark, in "Conditions of Economic Progress," presents the following indexes of the productivity of industrial workers: United States 1485, Canada 1352, United Kingdom 1275, Australia 1212, Germany 828 and Italy 399.

The Axis powers are dependent for much of their industrial labor upon men of low productivity and upon workers taken from occupied nations whose status as virtual slaves provides a greater incentive for sabotage than for efficient work.

If the mere employment of money could decide the issue, the Allies would win the war. The amounts which the United States, the British Empire, Russia, China and nations associated with them are spending for war far surpass the war budgets of the Axis powers.

In this connection, a comparison of national debts is illuminating. Total national debts of the principal belligerents as of September, 1939, and as of September, 1941, and the percentage of increase during the period, are approximately as follows:

	Total National Debt (Billions of Dollars) Sept., 1939	Sept., 1941	Per Cent of Increase
United States	40	52	31
Great Britain	33	52	56
Germany	15	43	186
Italy	11	15	46
Japan	4	8	93

The important point, of course, is that the war budget of the United States, as increased by Congress just before it recessed for the holidays, far exceeds any appropriation any nation has ever made for any war at any time.

As of Nov. 30, 1941, the United States government had appropriated $71,100,000,000 for defense and war purposes. Of each dollar thus appropriated, 23 cents were earmarked for ordnance, including naval ordnance; 17 cents for airplanes, engines, parts, etc.; 13 cents for naval ships and accessories; 11 cents for industrial facilities; 9 cents for stockpiles of materials, other equipment, etc.; 7 cents for military and naval posts, depots, fortifications, etc.; 6 cents for the pay, subsistence, travel, etc. of armed forces; 5 cents for "other munitions"; 5 cents for merchant ships and fittings; 3 cents for "other defense agencies"; and 1 cent for housing.

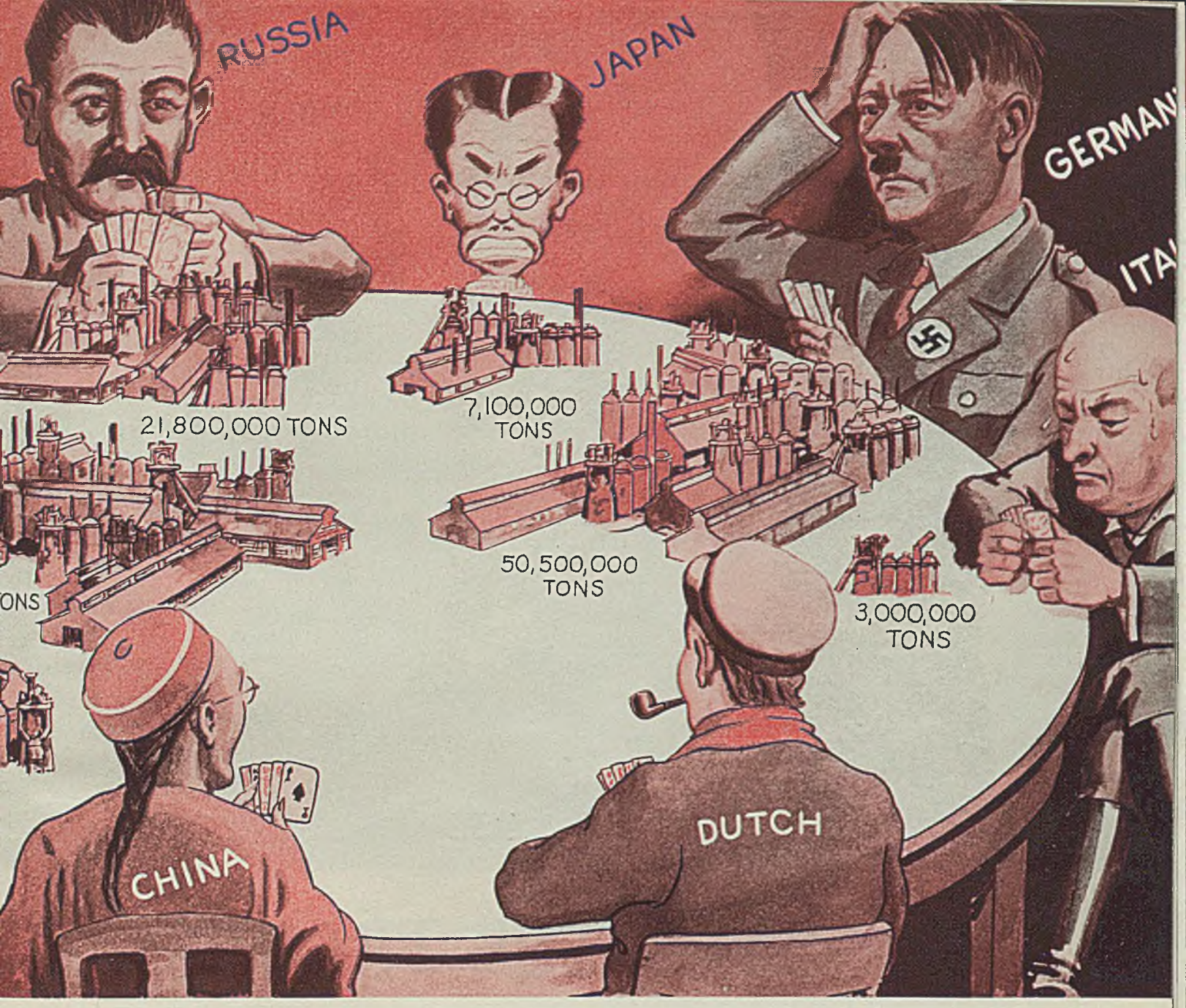
As for materials, the democracies and Russia are much more self-sufficient than the Axis powers. The Allies hold the upper hand in oil, nickel, cotton, copper, gold, lead, wool, tin, zinc, crude rubber, coal, iron ore, manganese and numerous items of lesser importance. The Axis powers have an advantage in synthetic rubber, aluminum and bauxite.

Recent events may have changed this line-up slightly. Germany's edge in aluminum probably has disappeared, owing to the rapidly increasing output of aluminum by the Anglo-American countries.

Future events may affect the balance in rubber, tin and some other materials vital to war. A Japanese success in southern Asia would disturb, for a time at least, the Allied superiority in tin and rubber, and might give the Axis powers a slight relief in regard to petroleum.

However, the principal material in war is steel. Mere possession of iron ore, coking coal and scrap is not as important as the ability to make steel.

As shown in the illustration on this and the facing



page, the Allies are playing the game of war with ace cards of steelmaking capacity which the Axis powers cannot possibly match.

Important as is the advantage of the free nations in the matter of essential materials, it is surpassed by the margin of superiority possessed by the Allies in the effective utilization of machines. The United States, as the arsenal of democracy, is just now reaching the stage where the tremendous output of its mass production industries will count heavily.

No nation has facilities comparable to those of the automobile, refrigerator, electrical manufacturing and other industries in the United States in which mass production methods have been highly developed. Many of these plants have been tooling for war production and now are about to go into operation.

These plants, equipped with the finest equipment turned out by an American machine tool industry which has been keyed to mass production requirements for years, will startle the world in their output in 1942 of airplanes, airplane engines, bombing turrets, tanks, ships, guns, shells, and other war equipment and supplies.

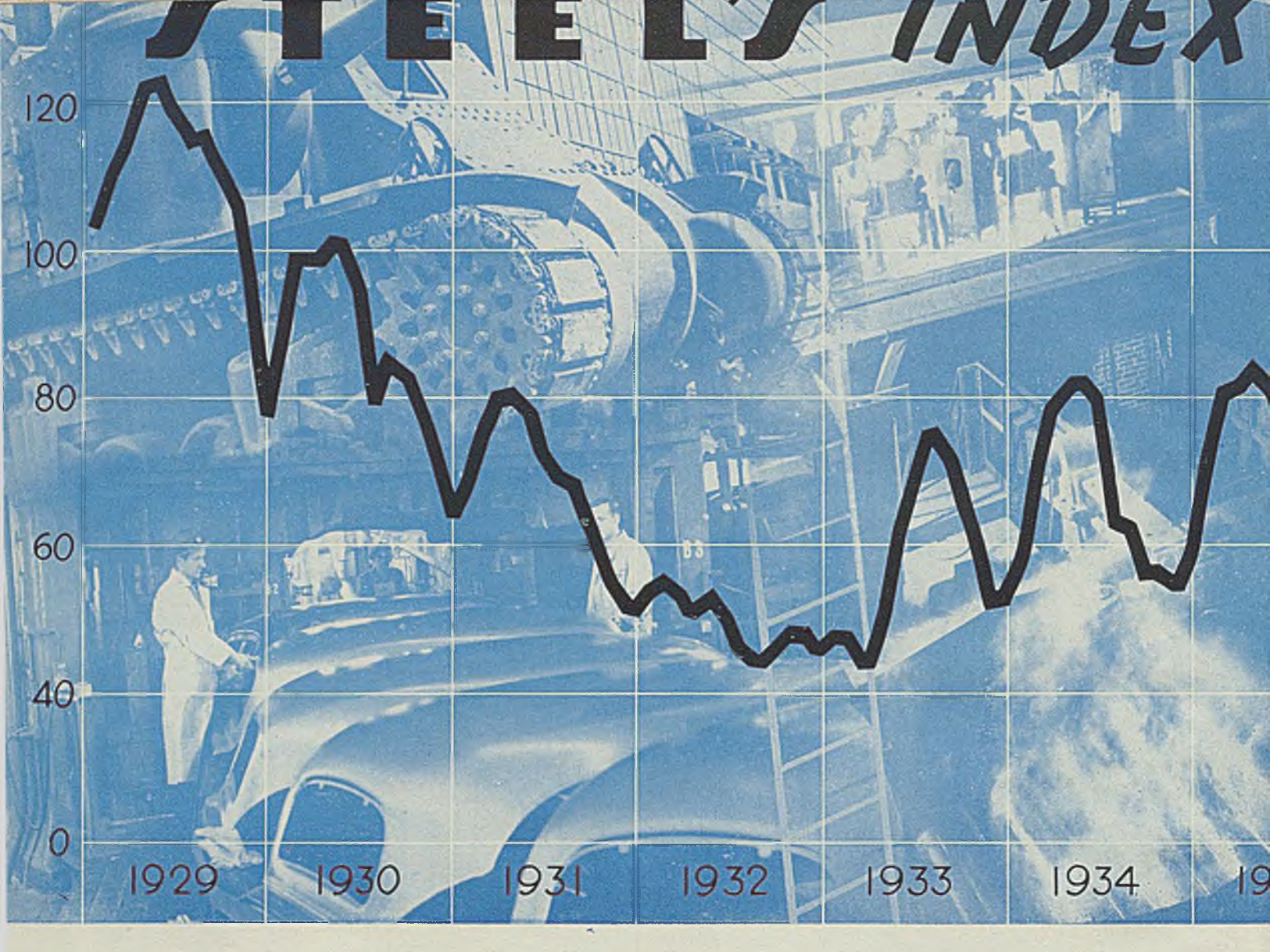
This war presents a climatic test for the American system of mass production. The experience gained in the peacetime utilization of machines and methods through past decades will prove to be one of America's great contributions in the present war.

In morale, the Allies have the greatest advantage of all. They are fighting for the principle that Right makes Might—for freedom in preference to slavery.

The righteousness of their cause will inspire in Americans at home the same spirit which in recent weeks has been demonstrated so effectively at Pearl Harbor, Wake island and Luzon.

Elsewhere in this issue, the superiority of this nation in the five "M"s is presented in greater detail. It is a census of the resources which will make for ultimate victory.

—The Editors



The *BUSINESS TREND*

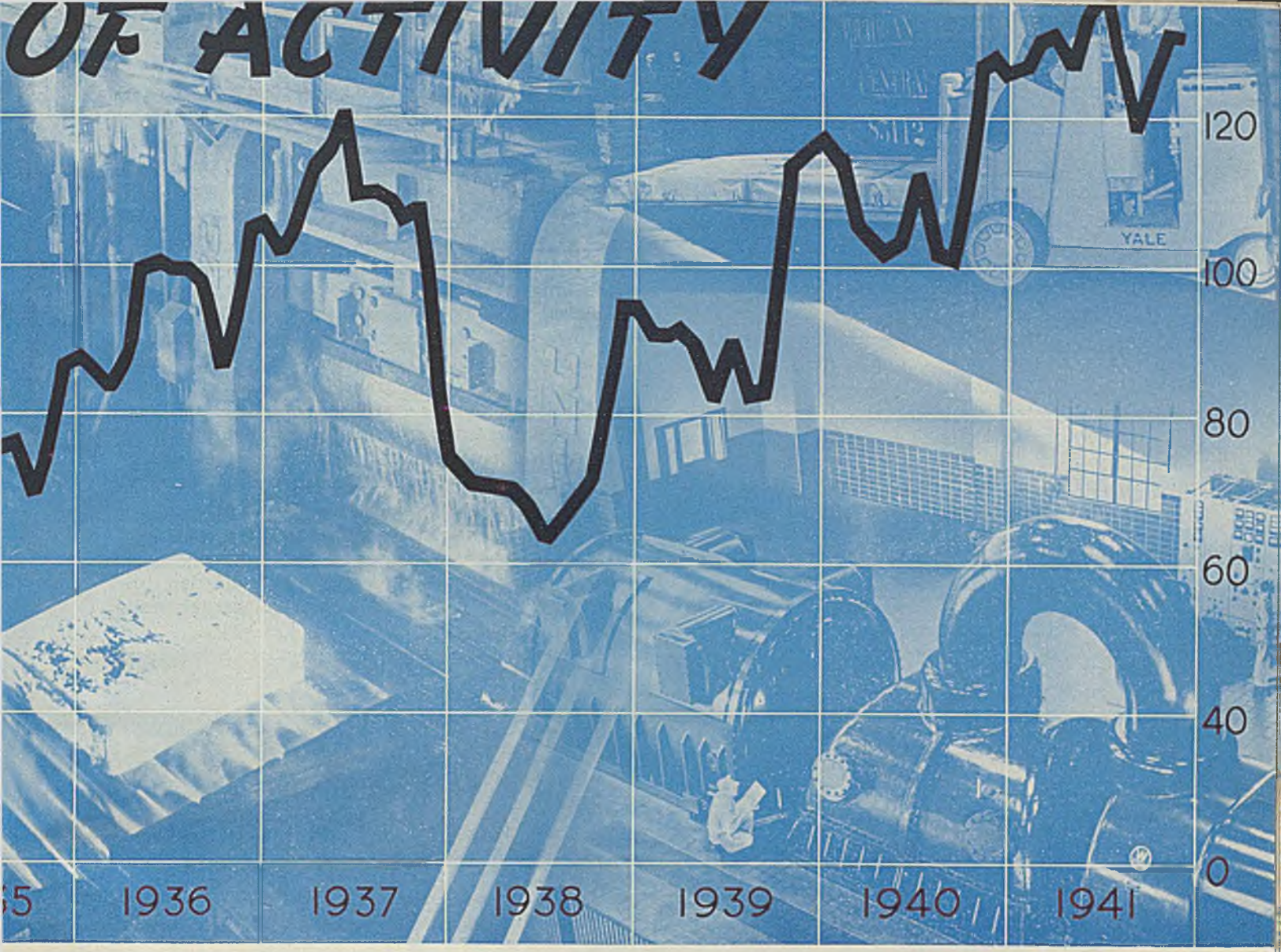
Industry on War Footing As It Enters 1942

AT THE turn of the year, the outstanding new factor bearing upon the trend of business is the advent of a shooting war in which this nation is involved as a principal belligerent.

Just as the statistical record of business in 1941 was a reflection of the American effort toward defense and lend-lease, that of 1942 will mirror the nation's accomplishment in war.

In spite of many difficulties, including the inertia of a complacent and disunited public, American industry established many new records in 1941. The output of numerous important items soared well above the previous highs, most of which were established in 1929.

The two most important indicators of the general trend of industrial activity, for which figures are available on a weekly basis, are the rate of steelworks operations and the output of electric power.



Both of these barometers registered new records in 1941. A third dependable indicator of industrial activity, namely revenue freight car loadings, rose to the highest level recorded since 1930.

These three barometers, together with the weekly estimates of automobile production, have been the ingredients in STEEL's index of activity in the iron, steel and metalworking industry. They also are heavily weighted factors in virtually every general index of industrial activity, including the much used "index of industrial production" compiled by the Federal Reserve Board.

Early in 1941 it became evident that the general indexes could not be relied upon to reflect industrial activity accurately if major branches of industry, such as for instance the automobile industry, were to continue to devote less and less of their effort to peacetime goods and more and more to war equipment and supplies.

Therefore, the Federal Reserve index was modified to give more adequate recognition of the increased activity in certain lines, such as the output of planes. In fact, it introduced a factor to take care of wartime industrial activity.

Some other indexes were revised to meet the new situation. However, compilers of such indexes are handicapped by the absence of weekly figures on many important items.

STEEL has recognized this problem and is meeting it temporarily by reducing the weight ascribed to automobile output. This corrective, applicable from September, 1941, to date, is reflected in the graph of the index on this page and in the table of index numbers on Pages 214 and 215. The editors are seeking one or more series of weekly statistics which may be incorporated into STEEL's index for the duration of the war to reflect wartime industrial activity which cannot be measured by the barometers already included in the index.

Throughout 1942, the record of pig iron and steel ingot production will be extremely important, but scarcely more so than the figures on iron and steel scrap consumption. The monthly records of automobile output, imports and exports and iron and steel foreign trade will receive less attention than in previous years. On the other hand, the statistics of machine tools and other productive equipment will hold the high prestige gained last year.

Machine tool production during 1941 is estimated at $765,000,000. This record-breaking output was 70 per cent above the former peak of $450,000,000 reported during 1940, and 313.5 per cent greater than

the $185,000,000 worth of machine tools produced in 1929. During the closing months of last year output reached $77,200,000 monthly, or at a rate of $925,000,000 annually.

Large orders for machine tools are being superimposed on already heavy backlogs with inquiry developing in greater volume for supplemental requirements for enlarged armament programs. Although the industry has expanded facilities greatly in the last 18 months and many of the new units are now in production, additional facilities are being prompted by the government. Production next year should easily top $100,000,000.

Also reflecting the boom in capital goods production, foundry equipment sales climbed sharply during the past year to reach a new peak level for the period. Industrial gear sales also recorded a substantial increase during 1941, exceeding any previous year on record.

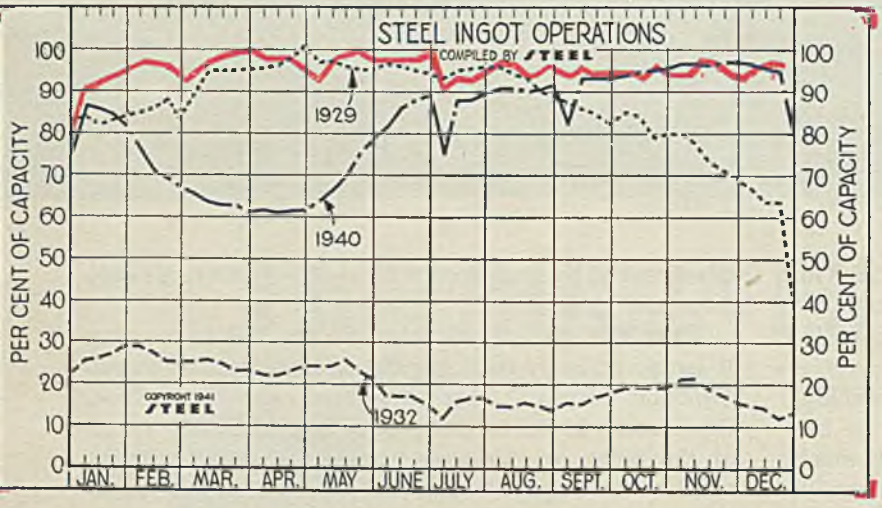
The dollar value of building contracts, as reported for 37 eastern states by the F. W. Dodge Corp., reached a new monthly peak of $760,233,000 in August, 1941. Building construction awards for the full year exceeded those of any year since 1928.

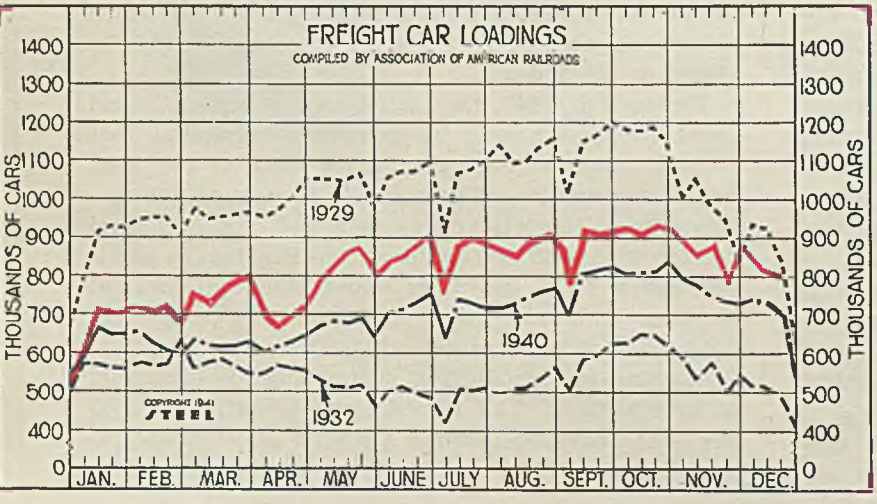
Residential construction during 1942 may be restricted by government order and by difficulty in obtaining certain materials. On the other hand, new cantonments and other facilities for the increased army and another wave of plant expansion should make for a continued high rate of activity in building construction.

The role of steel in defense building activity is indicated in part by the record of awards for fabricated structural steel. Bookings, as compiled by the American Institute of Steel Construction, increased sharply in the last half of 1940 and shot up to a near record early in 1941. Tonnage booked has eased in recent months, but shipments continue at a high level. Structural steel constructors enter the new year with expectations of new demands for further expansion of industrial plants and military and navy structures.

Commodity price trends have been under sharp scrutiny in recent months. The nation is conscious of the inflationary influences of war and the government, pending effective price control legislation, has been exercising piece-meal restraints through arbitrary price ceilings.

How much these attempts to regulate prices have





For week ended	STEEL'S index	Steel rate % capacity	Electric power output million KWH	Freight carloadings 1000 cars	Automobile output 1000 units
Jan. 4	114.5	92.5	2,705	614	76.7
Jan. 11	128.2	93.0	2,835	712	115.9
Jan. 18	130.8	94.5	2,844	703	124.0
Jan. 25	130.7	95.5	2,830	711	121.9
Feb. 1	132.0	97.0	2,830	714	124.0
Feb. 8	132.7	97.0	2,824	710	127.7
Feb. 15	132.3	96.5	2,810	721	127.5
Feb. 22	131.2	94.5	2,820	678	129.2
Mar. 1	133.0	96.5	2,826	757	126.6
Mar. 8	133.1	97.5	2,835	742	125.9
Mar. 15	135.0	98.5	2,818	759	131.6
Mar. 22	133.5	99.5	2,809	769	123.8
Mar. 29	133.9	99.5	2.802	792	124.2
Apr. 5	128.9	98.0	2,779	683	116.3
Apr. 12	123.8	98.0	2,721	680	99.3
Apr. 19	124.2	98.0	2,702	709	99.9
Apr. 26	126.5	96.0	2,750	722	108.2
May 3	132.6	95.0	2,734	794	130.6
May 10	135.9	97.5	2,792	837	132.6
May 17	136.1	99.5	2,800	861	127.3
May 24	138.6	100.0	2,838	866	133.6
May 31	128.4	99.0	2,730	802	106.4
June 7	138.4	99.0	2,877	853	133.6
June 14	138.7	99.0	3,066	863	134.7
June 21	138.7	99.0	3,056	886	133.6
June 28	138.8	99.5	3,121	909	127.9

influenced trends to date is in doubt. The sharpest rise in wholesale commodity prices since the outbreak of war in September, 1939, occurred in the first month of hostilities. This was followed by a period of slight fluctuation in prices, which extended through 1940. From March, 1941, the index of wholesale commodity prices increased rather sharply. Since October, however, the index has leveled off slightly, according to the weekly reports.

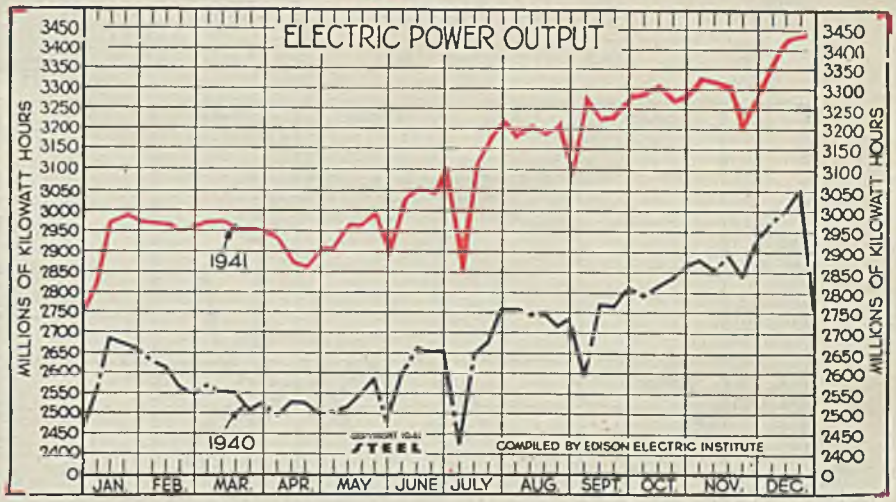
Another spurt in commodity prices may be expected, due in part to the influence of rising wages and of commodities not subject to control. Hourly and weekly wages have increased more since September, 1939, than the cost of living. Unit labor costs have risen about 11 per cent since that date, whereas the cost of living has increased less than 7 per cent in the same period.

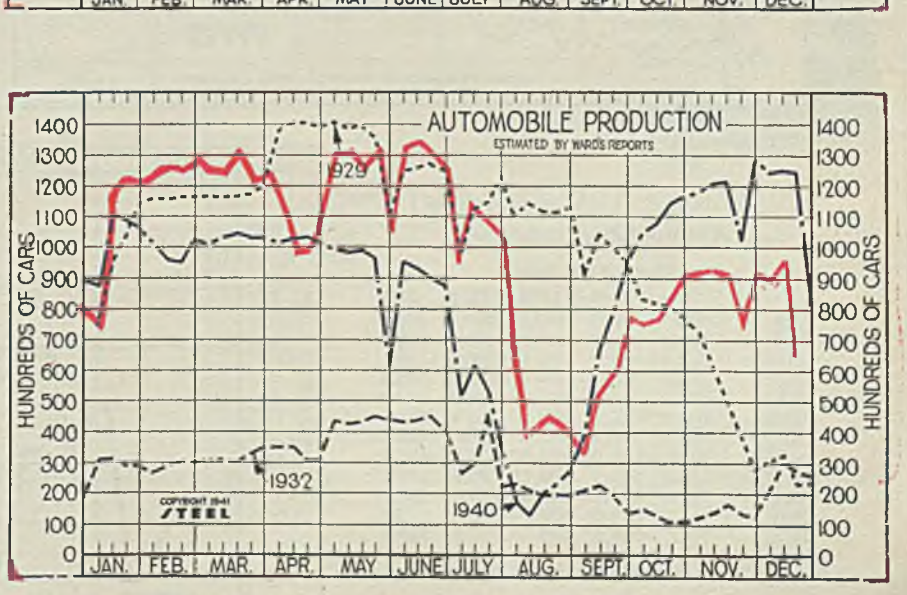
Throughout 1942, the trend of business will be influenced more by government regulations and controls than at any previous period in the nation's history. Business charts will reflect the effect of war economy as exerted through man-made arbitrary rules more than they will reflect fluctuations due to the play of natural economic factors.

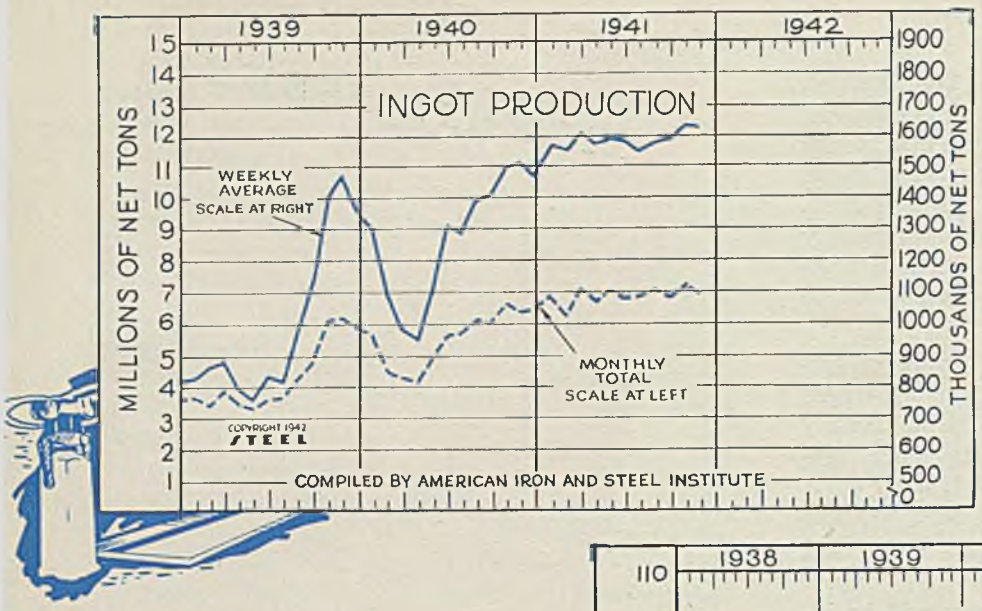
Charts IN THIS ISSUE

For week ended	STEEL'S index	Steel rate % capacity	Electric power output million KWH	Freight carloadings 1000 cars	Automobile output 1000 units
July 5	120.9	92.0	2,867	740	96.5
July 12	133.4	95.0	3,141	876	114.3
July 19	133.2	95.0	3,163	899	109.9
July 26	132.9	96.0	3,184	897	105.6
Aug. 2	123.3	97.5	3,226	883	62.1
Aug. 9	117.5	96.5	3,196	879	41.8
Aug. 16	118.2	95.5	3,201	890	45.6
Aug. 23	118.5	96.0	3,193	900	45.5
Aug. 30	118.2	96.5	3,224	913	40.0
Sept. 6	111.8	95.5	3,096	798	32.9
Sept. 13	131.3	96.5	3,281	914	53.2
Sept. 20	130.6	96.0	3,232	908	60.6
Sept. 27	132.0	96.0	3,233	920	78.5
Oct. 4	132.7	96.0	3,290	918	76.8
Oct. 11	132.3	94.5	3,315	904	79.1
Oct. 18	133.4	96.5	3,273	923	85.6
Oct. 25	133.5	95.5	3,299	914	91.9
Nov. 1	133.8	95.5	3,339	895	92.9
Nov. 8	134.4	97.5	3,326	874	93.6
Nov. 15	133.8	97.0	3,304	884	93.0
Nov. 22	128.4	95.5	3,205	799	76.8
Nov. 29	132.2	95.0	3,295	866	93.5
Dec. 6	133.4	96.5	3,369	833	90.2
Dec. 13	134.8	97.5	3,431	807	96.0
Dec. 20	131.1	97.5	3,449	800*	65.9

*Estimated.





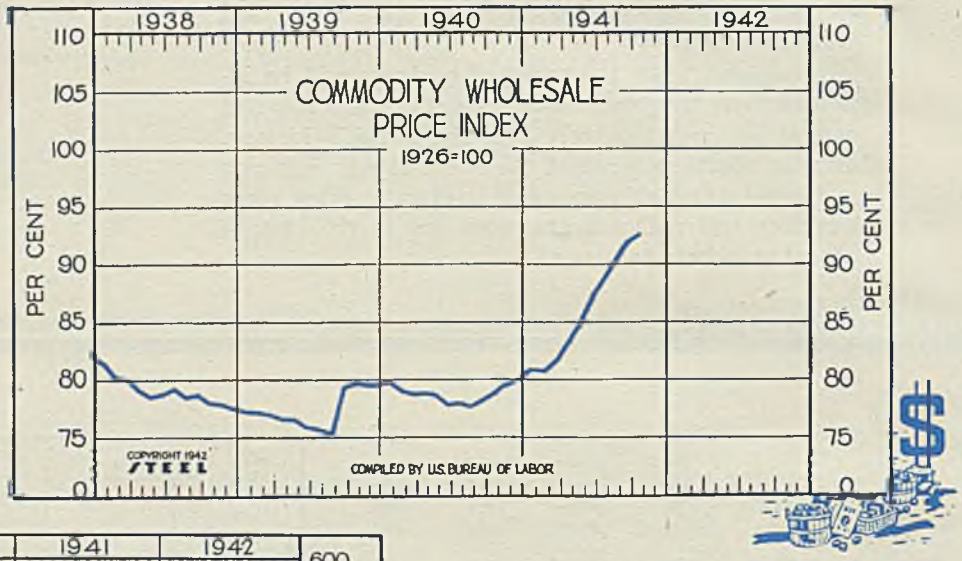


Steel Ingot Production

(Unit 100 Net Tons)

	Monthly Total		Weekly Average	
	1941	1940	1941	1940
Jan.	6,928.8	5,764.7	1,563.9	1,301.3
Feb.	6,237.9	4,525.8	1,559.5	1,093.2
Mar.	7,131.6	4,389.2	1,609.9	990.8
Apr.	6,756.9	4,100.5	1,575.0	955.8
May	7,053.2	4,967.8	1,592.2	1,121.4
June	6,800.7	5,657.4	1,585.3	1,318.8
July	6,821.7	5,724.6	1,543.4	1,295.2
Aug.	7,001.0	6,186.4	1,580.4	1,396.5
Sept.	6,819.7	6,056.2	1,593.4	1,415.0
Oct.	7,242.7	6,644.5	1,634.9	1,499.9
Nov.	6,970.0	6,469.1	1,624.7	1,507.9
Dec.	.....	6,495.4	.....	1,469.5
Total	.....	66,981.7	.....	1,281.2†

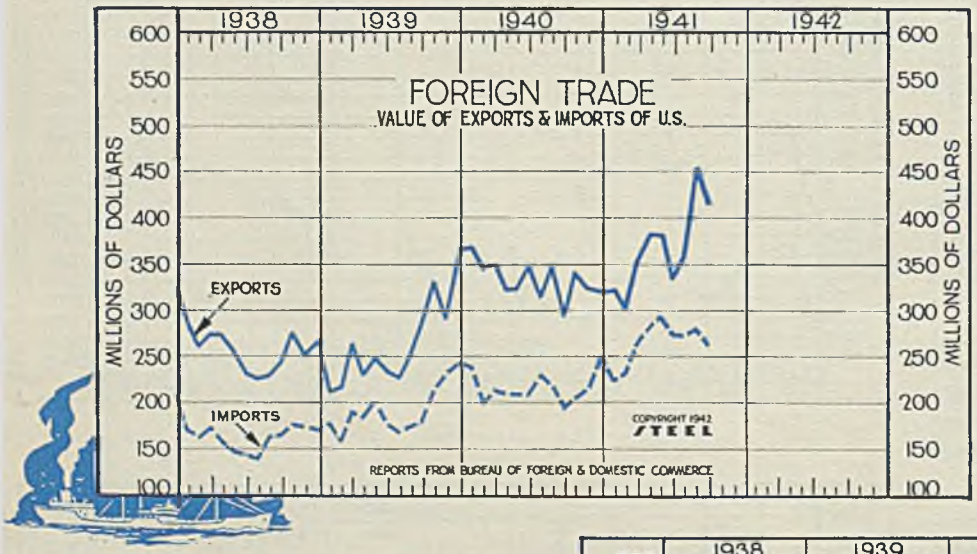
†Weekly average.



All Commodity Wholesale Price Index U. S. Bureau of Labor

(1926 = 100)

	1941	1940	1939	1938	1937
Jan.	80.8	79.4	76.9	80.9	85.9
Feb.	80.6	78.7	76.9	79.8	86.3
March	81.5	78.4	76.7	79.7	87.8
April	83.2	78.6	76.2	78.7	88.0
May	84.9	78.4	76.2	78.1	87.4
June	87.1	77.5	75.6	78.3	87.2
July	88.8	77.7	75.4	78.8	87.9
Aug.	90.3	77.4	75.0	78.1	87.5
Sept.	91.8	78.0	79.1	78.3	87.4
Oct.	92.4	78.7	79.4	77.6	85.4
Nov.	....	79.6	79.2	77.5	83.3
Dec.	....	80.0	79.2	77.0	81.7
Ave.	....	78.5	77.1	78.6	86.3



United States Foreign Trade

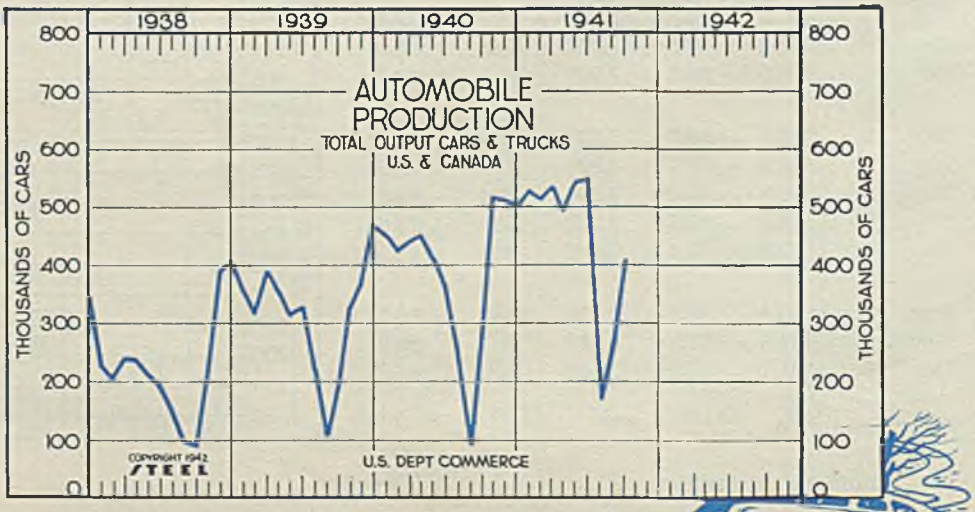
(Unit: $1,000,000)

	Exports		Imports	
	1941	1940	1941	1940
Jan.	$325.4	$368.6	$228.7	$241.9
Feb.	303.4	347.0	233.7	199.8
Mar.	357.6	352.3	267.8	216.7
April	385.5	324.0	287.6	212.2
May	384.6	325.3	296.9	211.5
June	337.7	350.2	279.5	211.4
July	358.6	317.0	277.8	232.3
Aug.	455.3	349.9	282.5	220.5
Sept.	417.1	295.2	262.7	194.9
Oct.	.....	343.5	.....	207.1
Nov.	.....	327.7	.....	223.4
Dec.	.....	322.3	.....	253.1
Total	.....	$4,021.6	.....	$2,625.4

Automobile Production

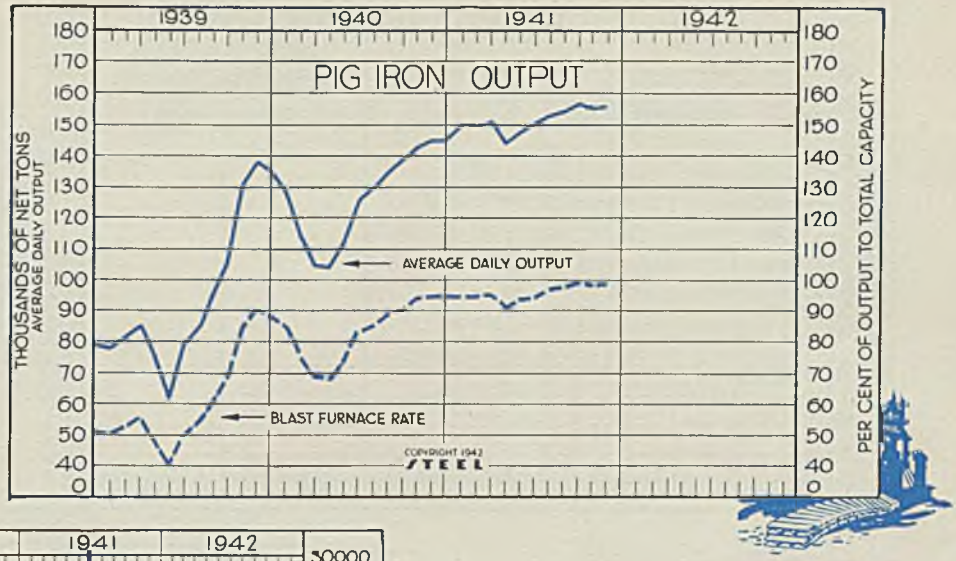
(Unit: 1000 Cars)

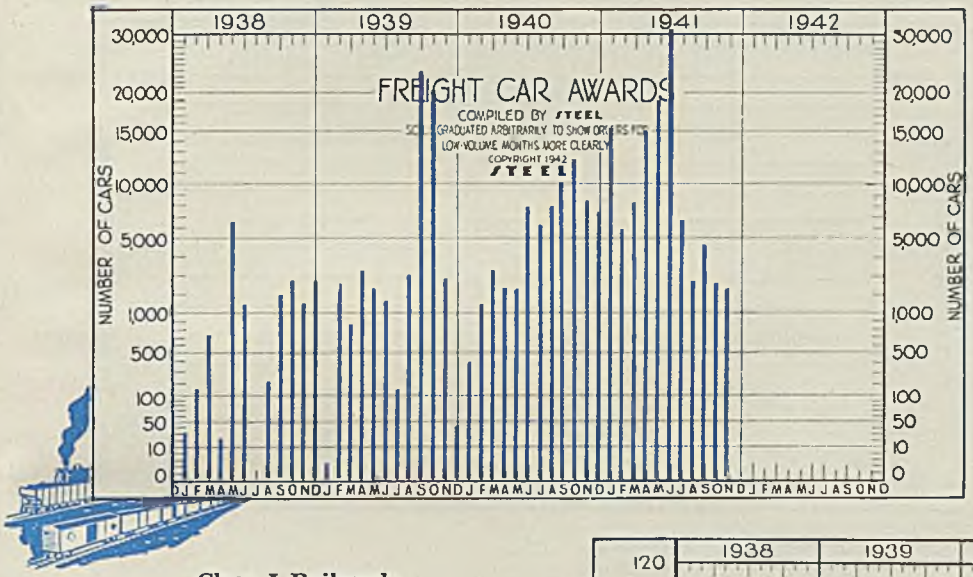
	1941	1940	1939	1938	1937
Jan.	524.1	449.3	357.0	227.1	399.2
Feb.	509.3	421.8	317.5	202.6	383.9
March	533.9	440.2	389.5	238.6	519.0
April	489.8	452.4	354.3	238.1	553.4
May	545.3	412.5	313.2	210.2	540.4
June	546.3	362.6	324.2	189.4	521.1
July	468.8	246.2	218.5	150.4	456.9
Aug.	164.8	89.9	103.3	96.9	405.1
Sept.	248.8	284.6	192.7	89.6	175.6
Oct.	401.4	514.4	323.0	215.3	338.0
Nov.	.....	511.0	370.2	390.4	376.6
Dec.	.....	506.9	469.0	407.0	346.9
Ave.	.....	391.0	311.0	221.3	418.0



Pig Iron Production

	Daily average —Net Tons—			Blast furnace —Rate (%)—		
	1941	1940	1939	1941	1940	1939
Jan.	150,524	129,825	78,596	95.5	85.4	51.0
Feb.	150,244	113,943	82,407	95.3	75.0	53.5
Mar.	151,707	105,502	86,465	96.3	69.5	56.1
Apr.	144,685	104,635	76,732	91.8	68.9	49.8
May	148,262	112,811	62,052	94.1	74.2	40.2
June	151,701	127,103	79,125	95.7	83.6	51.4
July	153,749	130,984	85,121	97.0	86.1	55.0
Aug.	154,343	136,599	96,122	97.4	89.9	62.4
Sept.	157,378	139,085	107,298	99.3	91.5	69.7
Oct.	156,775	143,152	131,053	98.9	94.2	85.2
Nov.	156,906	146,589	138,883	99.0	96.4	90.3
Dec.	.....	146,544	136,119	....	96.4	88.5
Ave.	.....	128,128	86,375	....	84.3	62.6





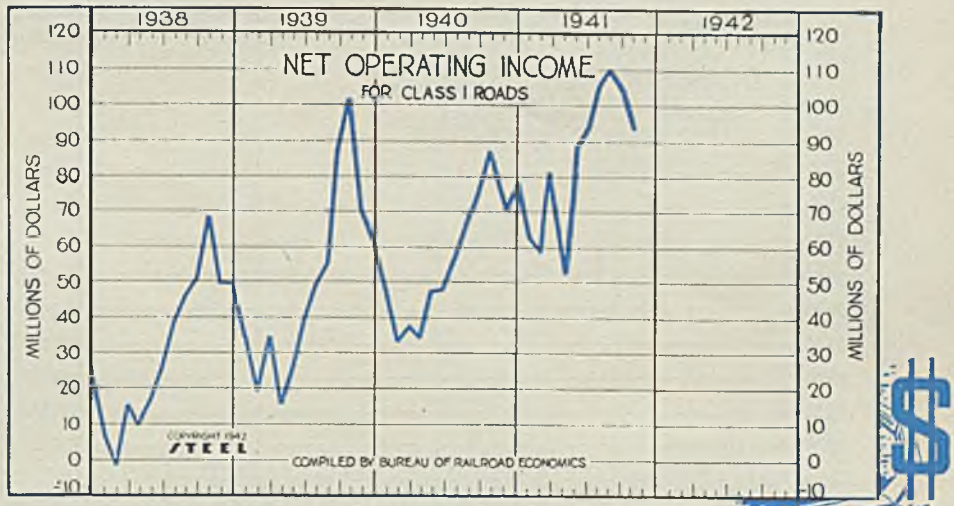
Freight Car Awards

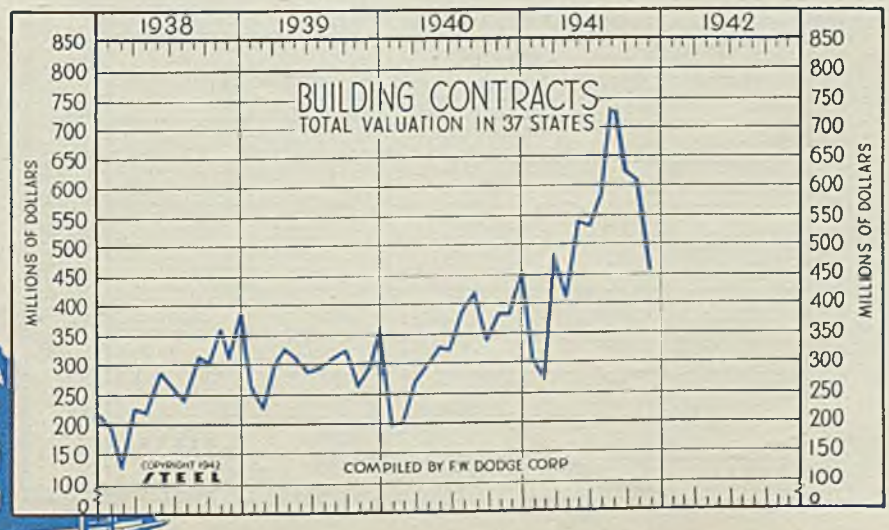
	1941	1940	1939	1938
Jan.	15,169	360	3	25
Feb.	5,508	1,147	2,259	109
March	8,074	3,104	800	680
April	14,645	2,077	3,095	15
May	18,630	2,010	2,051	6,014
June	32,749	7,475	1,324	1,178
July	6,459	5,846	110	0
Aug.	2,668	7,525	2,814	182
Sept.	4,470	9,735	23,000	1,750
Oct.	2,499	12,195	19,634	2,537
Nov.	2,222	8,234	2,650	1,232
11 mos.	113,093	59,708	57,740	13,822
Dec.	.....	7,181	35	2,581
Total	.....	66,889	57,775	16,303

Class I Railroads
Net Operating Income
(Unit: $1,000,000)

	1941	1940	1939	1938
Jan.	$62.36	$46.01	$32.95	$7.14
Feb.	58.48	32.86	18.64	1.91*
Mar.	80.63	37.03	34.38	14.73
April	52.57	34.12	15.32	9.40
May	88.63	47.41	25.17	16.67
June	93.26	48.09	39.17	25.16
July	106.31	57.73	49.00	38.43
Aug.	111.32	66.53	54.57	45.42
Sept.	104.07	74.72	86.53	50.41
Oct.	93.66	87.64	101.72	68.60
Nov.	.....	72.00	70.41	49.69
Dec.	.....	78.79	60.98	49.42
Average	.....	$56.91	$49.07	$31.42

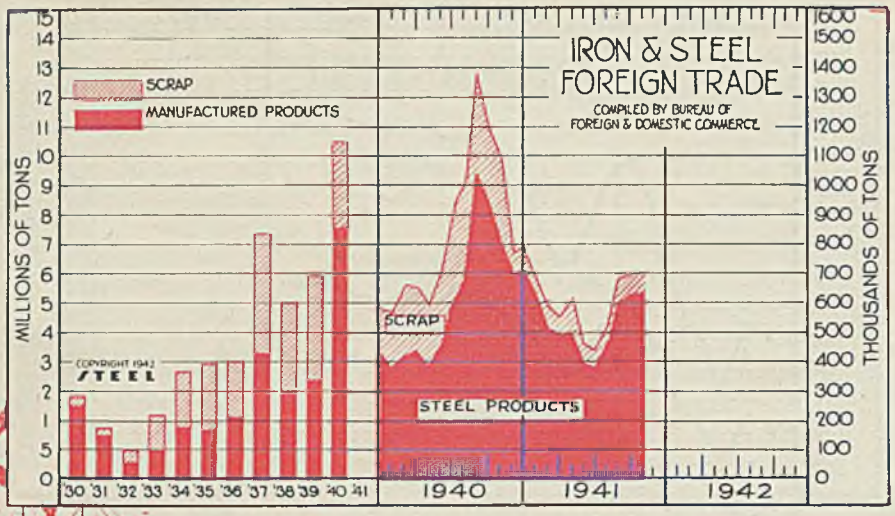
*Indicates deficit.





Construction Total Valuation
In 37 States
(Unit: $1,000,000)

	1941	1940	1939	1938	1937
Jan.	$305.2	$196.2	$251.7	$192.2	$242.7
Feb.	270.4	200.6	220.2	118.9	188.3
Mar.	479.9	272.2	300.7	226.6	231.2
April	406.7	300.5	330.0	222.0	269.5
May	548.7	328.9	308.5	283.2	243.7
June	539.1	324.7	288.3	251.0	317.7
July	577.4	398.7	299.9	239.8	321.6
Aug.	760.3	414.9	312.3	313.1	281.2
Sept.	623.3	347.7	323.2	300.9	207.1
Oct.	606.3	383.1	261.8	357.7	202.1
Nov.	458.6	380.3	299.8	301.7	198.4
Dec.	.....	456.2	354.1	389.4	209.5
Ave.	.....	$333.7	$295.9	$266.4	$242.8



Iron and Steel Exports

(Thousands of Gross Tons)

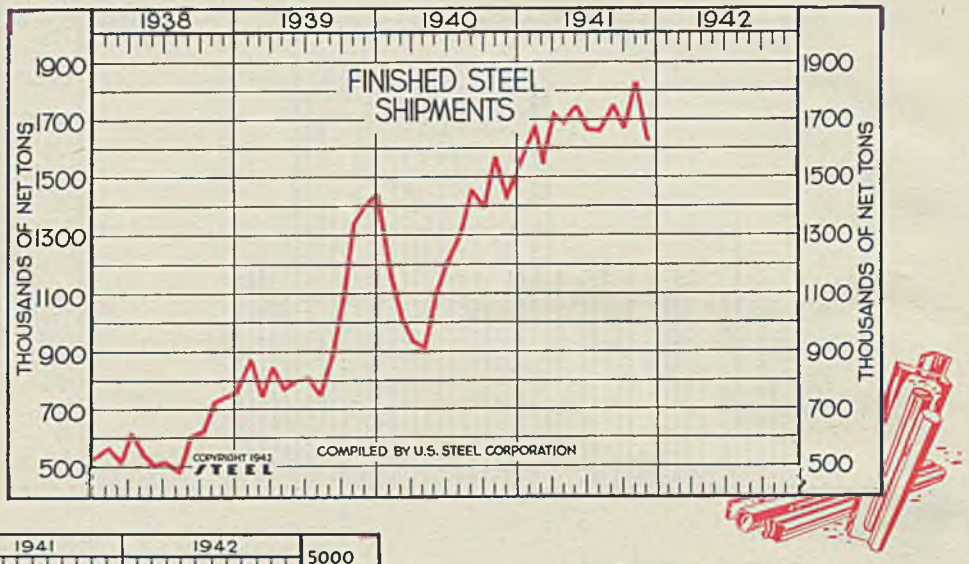
	Steel Products		Scrap		Total
	1941	1940	1941	1940	1941
Jan.	653.8	396.1	45.1	187.5	698.9
Feb.	525.9	436.6	74.4	234.7	600.2
Mar.	512.8	457.1	54.4	206.9	567.2
April	515.7	391.8	120.2	221.2	635.8
May	409.8	471.5	62.9	312.5	472.7
June	398.7	617.7	59.0	318.4	457.7
July	478.0	707.8	59.9	327.1	537.9
Aug.	617.5	1046.1	80.3	346.1	697.7
Sept.	641.1	965.4	65.5	251.1	706.6
Oct.	.....	846.6	.....	258.5	.....
Nov.	.....	713.8	.....	74.3	.....
Dec.	.....	735.2	.....	70.0	.....
Total	.....	7,785.5	.....	2,823.1	.....

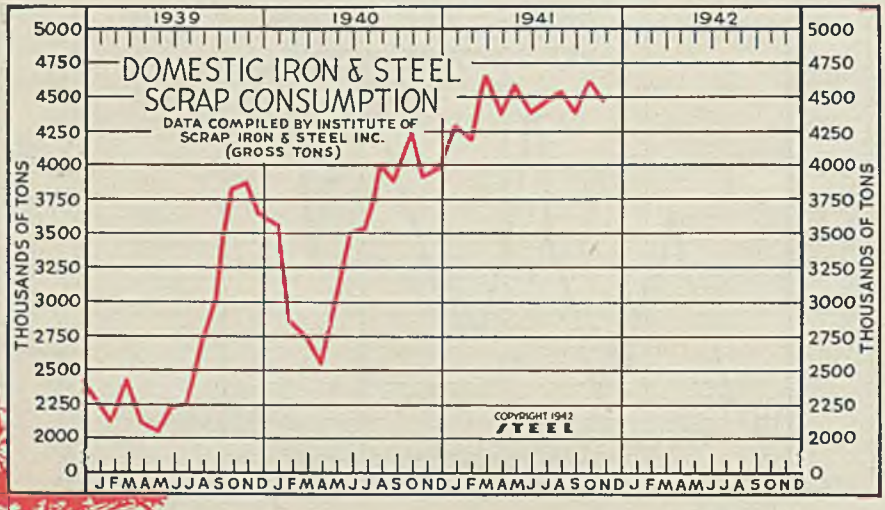
Finished Steel Shipments
U. S. Steel Corp.

(Unit 1000 Net Tons)

	1941	1940	1939	1938	1937
Jan.	1682.5	1145.6	870.9	570.3	1268.4
Feb.	1548.5	1009.3	747.4	522.4	1252.8
Mar.	1720.4	931.9	845.1	627.0	1563.1
Apr.	1687.7	907.9	771.8	550.5	1485.2
May	1745.3	1084.1	795.7	509.8	1443.5
June	1668.6	1209.7	807.6	525.0	1405.1
July	1666.7	1296.9	745.4	484.6	1315.3
Aug.	1753.7	1455.6	885.6	615.5	1225.9
Sept.	1664.2	1392.8	1086.7	635.6	1161.1
Oct.	1851.3	1572.4	1345.9	730.3	876.0
Nov.	1624.2	1425.4	1406.2	749.3	648.7
Dec.	.....	1544.6	1444.0	765.9	539.5
Tot.†	.....	14976.1	11707.3	7315.5	14097.7

†After year-end adjustments.





Iron and Steel
Scrap Consumption

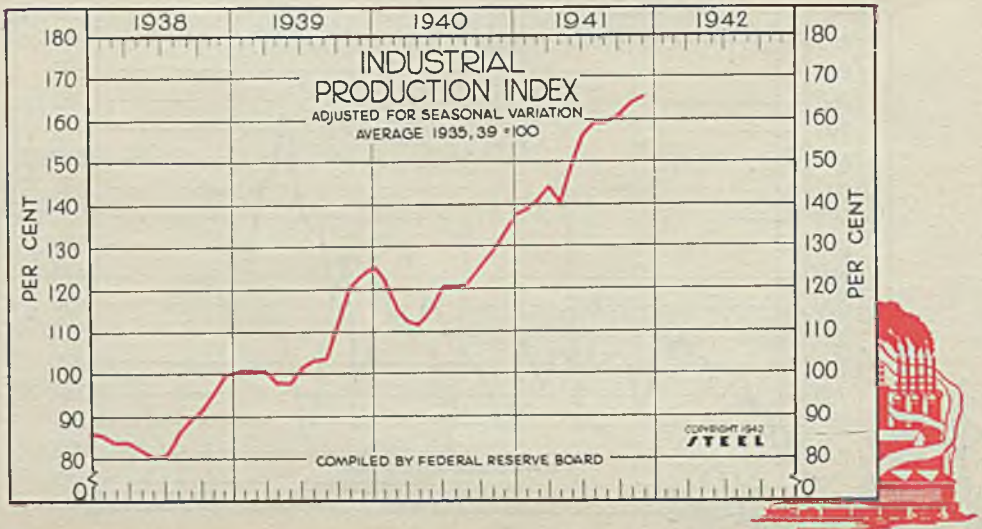
(Gross Tons)

	1941	1940	1939	1938
		(000 omitted)		
Jan.	4,278	3,581	2,257	1,331
Feb.	4,172	2,812	2,124	1,306
Mar.	4,662	2,728	2,419	1,543
Apr.	4,406	2,548	2,114	1,477
May	4,609	3,061	2,079	1,387
June	4,406	3,482	2,221	1,257
July	4,415	3,526	2,247	1,520
Aug.	4,518	3,968	2,675	1,953
Sept.	4,392	3,876	3,018	2,218
Oct.	4,649	4,233	3,809	2,393
Nov.	4,482	3,922	3,858	2,732
Dec.	.....	3.950	3,613	2,411
Total	.....	41,687	32,434	21,528
Mo. Av.	.....	3,474	2,703	1,794

Industrial Production
Federal Reserve Board's Index

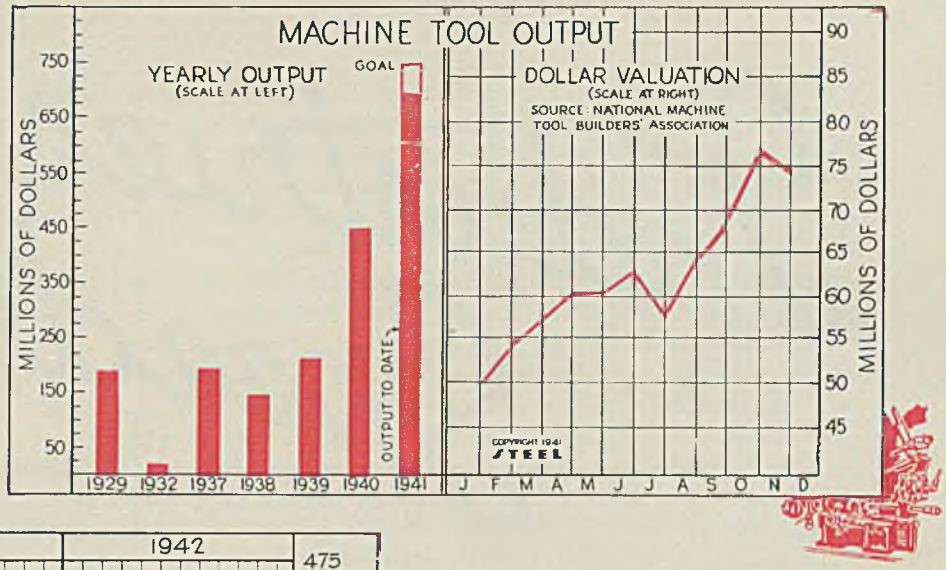
(1935-39 = 100)

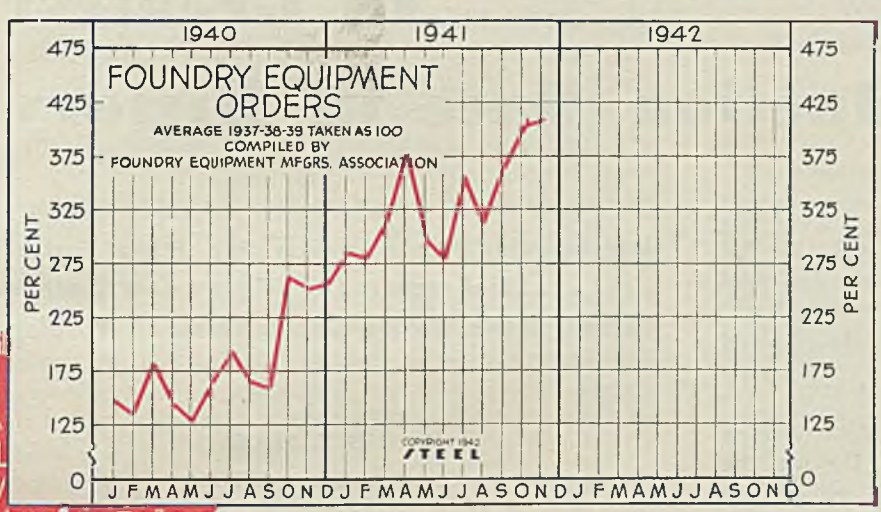
	1941	1940	1939	1938	1937
Jan.	139	122	102	86	116
Feb.	141	116	101	84	117
March	143	112	101	84	120
April	140	111	97	82	120
May	150	115	97	80	121
June	157	121	102	81	119
July	160	121	104	86	120
Aug.	160	121	104	90	120
Sept.	161	125	113	92	115
Oct.	163	129	121	95	107
Nov.	167	133	124	100	95
Dec.	...	138	126	101	87
Year Ave.	...	122	108	88	113



Machine Tool Output

	1941
January	$50,000,000
February	54,000,000
March	57,400,000
April	60,300,000
May	60,800,000
June	63,000,000
July	57,900,000
August	64,300,000
September	68,400,000
October	77,200,000
November	74,600,000
Year	
1929	185,000,000
1932	22,000,000
1937	195,000,000
1938	145,000,000
1939	210,000,000
1940	450,000,000
1941—Est.	765,000,000





Foundry Equipment Orders

Monthly Average

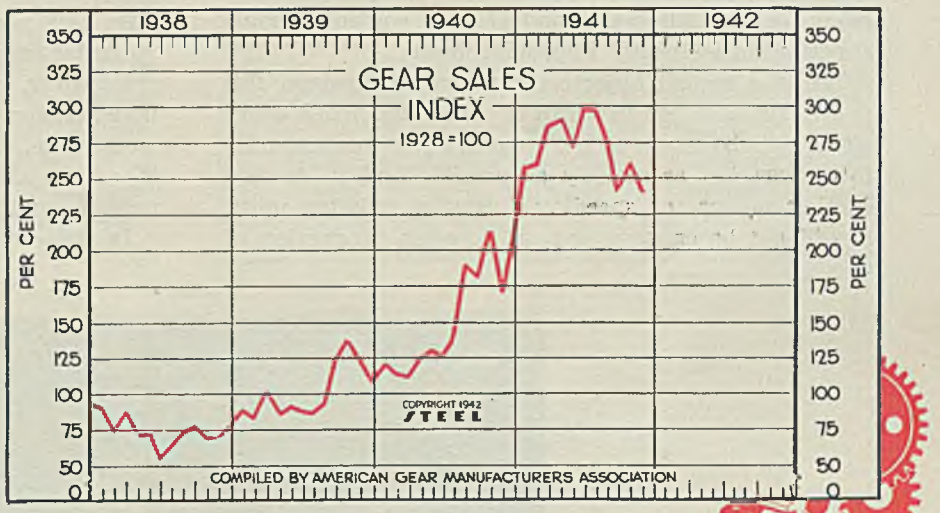
(1937-38-39 equals 100)

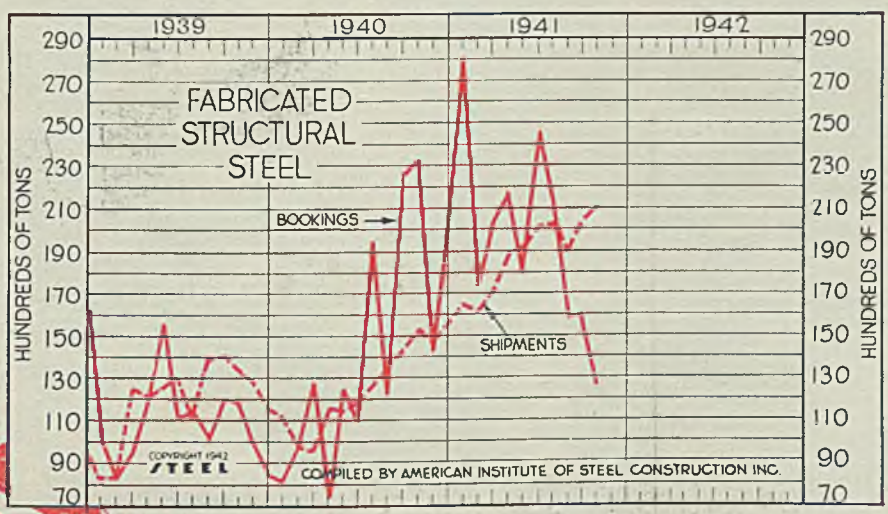
	1941	1940
Jan.	285.3	149.0
Feb.	281.1	135.7
March	315.2	183.2
April	377.2	145.2
May	298.7	129.1
June	281.1	164.9
July	358.1	194.4
Aug.	312.9	165.4
Sept.	363.8	161.2
Oct.	403.8	264.0
Nov.	408.5	254.2
Dec.	.....	257.8

Gear Sales Index

(1928 = 100)

	1941	1940	1939	1938	1937
Jan.	259	123	91.0	93.0	144.0
Feb.	262	116	86.0	77.0	130.5
Mar.	288	114	104.0	91.0	195.0
April	292	128	88.0	74.0	164.0
May	273	133	93.0	70.0	125.5
June	299	129	90.0	58.0	134.0
July	298	141	89.0	67.0	124.0
Aug.	276	191	96.0	76.5	125.0
Sept.	243	183	126.0	80.5	123.0
Oct.	261	216	141.0	72.5	139.5
Nov.	241	173	126.0	72.0	127.5
Dec.	...	208	111.0	81.0	97.0
Ave.	...	155.0	103.0	76.0	135.5





Fabricated Structural Steel

(1000 tons)

	Shipments			Bookings		
	1941	1940	1939	1941	1940	1939
Jan.	164.6	110.9	84.3	281.2	81.7	101.7
Feb.	161.4	97.2	84.4	173.6	98.9	82.7
Mar.	170.2	95.9	125.3	206.1	128.3	95.1
Apr.	189.8	116.3	120.9	218.0	73.8	118.3
May	191.9	115.6	125.9	179.9	126.8	156.9
June	200.5	119.1	130.1	246.9	109.7	111.6
July	203.0	127.1	110.5	214.8	194.9	114.1
Aug.	189.3	134.9	139.7	158.7	122.5	100.9
Sept.	204.1	142.8	140.8	158.9	225.5	121.4
Oct.	210.6	153.2	133.8	126.5	233.1	118.8
Nov.	.....	147.0	128.2	.. ..	141.9	99.3
Dec.	.....	155.5	116.2	.....	203.1	84.4
Tot.	....	1515.5	1440.1	.....	1748.1	1305.0

Industries Speeding up

In Greatest Production Race in History

Metalworking Plants Lead in New Era of Expansions . . . Steel Prepared . . . Government Controls Spread, While Nation Concentrates on Winning War

By BEN K. PRICE
Associate Editor, STEEL

WITH this country in the thick of a world-wide war which dwarfs all previous wars, the steel industry is faced with two major objectives: (1) Efficient distribution of tonnage produced; and (2) development of sufficient quantities of pig iron and scrap to utilize existing capacity.

The first may be gained within reasonable degree before the year becomes far advanced. Despite the lack of balance which prevailed through the greater part of 1941, distribution, through refinements now being made in allocation and priority controls, should function on a steadily improving basis.

But the second objective can not be attained this year. The shortage in scrap is acute, and while every effort will be made to get as much pig iron capacity into operation as quickly as possible and to develop further means for speeding output at existing units, it will not be enough, and, as a result, production of steel this year likely will fall substantially short of potential ingot capacity.

However, while it may not meet all war demands here and abroad as quickly as all procurement agencies would like, the industry is confident that in general it will be able to supply steel as quickly as actually needed—and still have some to spare.

In these hectic days of transition to a real all-out

■ Supply Priorities and Allocations Board (SPAB), appointed last August, is the nearest approach to a centralized war production agency named since the emergency began. Here is the seven-member board in session. NEA photos

performance, with plans for doubling production of armaments; with expenditures scheduled to run up to 150 billion dollars, if necessary; with still pressing needs from the country's allies and now even more important than ever before, with the need for getting more steel to the countries to the South to balk a menace which threatens the entire hemisphere, the task at first may appear insurmountable.

Yet such further gigantic expansion as is now proposed, as all realize, cannot possibly be accomplished over night.

Development of an overall, centralized system of planning, so sadly lacking to date; broadening of supply of skilled manpower; planning and construction of still greater armament facilities and still more tools to equip them; actual mechanics of financing; temporary bottlenecks which are bound to crop up in any such program, and especially under pressures which vary with the fortunes of war—these and other factors are going to hold the program to a certain measured pace.

Steel supply this year probably will be no greater than last, if as large, due to the above mentioned shortage of metals. However, last year the industry produced far more steel than was required for rearmament, direct or indirect, and for meeting lease-lend requirements abroad. As the year wore on government demands became intensified, but meanwhile enough steel had gone into commercial channels to sustain them at a generally high level.

This year the story with respect to commercial needs will undoubtedly be different, with a sharp curtailment in supplies inevitable, but with a cut in actual commercial demands offsetting it to large degree, particularly as the year advances. How far it will go no one can say at this time. Mandatory production curtailments by certain major steel consuming commercial industries began in the last half of last year. More drastic curtailments of this character are now scheduled, and curtailments affecting more industries.

Small commercial metal consumers face increasingly tough sledding until they can get war or essential civilian work. Their general fortunes, though, should improve in the last half. Those who can not make the transition may be given some help, and insofar as steel is concerned this is considered possible, once the whole matter of distribution becomes better organized.

And, admittedly, while the lesser of the two major difficulties, effective distribution still has a long way to go. It was principally this problem that harassed the industry last year, although considering the increasing amount of government work and the continued groping of the emergency administration, with its various changes in organization and personnel, with its lack of centralized control and with none of its officers, however capable, holding any real authority, it is surprising that distribution was as effective as it was.

Forward Buying Heavy

There were many times when leaders in the industry did not know from one day to the next what was expected of them. Even in matters of broad industrial expansion, they were not upon occasion called in until the whole program had reached final stages. Fortunately there has been some change in this respect, and there has been a tightening in the general administrative organization, which should prove more effective.

Lest it be assumed from the foregoing that difficulties in Washington were the sole major cause of an unbalanced distribution last year, it should be pointed out that much of the trouble stemmed from anticipatory buying on the part of commercial consumers, as well as government agencies.

It was a movement which got underway with the outbreak of the war in Europe in September, 1939, and carried on through with particular fervor until last summer, when most consumers realized they stood little chance of getting much of the tonnage they already had on mill books.

The mills exercised certain controls, some effective,

■ War Plans Division of the United States Army studies tactical problems on the map of the world — practically all of which is now engulfed by war

but despite the acceleration in actual consumption, substantial tonnages not needed for nearby operations went into stock. With the allocation system now getting underway, such hoarding will be difficult, if not impossible—at least insofar as private buyers are concerned.

Monthly war expenditures, now double those of 12 months ago, will probably be doubled again by the end of 1942. This means about three billion dollars monthly, and even this is regarded by many as too conservative an estimate. This will require around the clock operations, seven days a week; a minimum of labor disturbances; much further spreading of war work to many companies not yet so engaged; and still greater concentration on the training of skilled workmen.

Authorizations Outrun Expenditures

Since June a year ago government authorization and the placing of contracts have far outrun actual expenditures for goods, materials and services received; and up to a point this is only natural in getting such a fast expanding program underway. However, one criticism of the direction of the emergency program to date has been that entirely too much emphasis has been placed on spending and not nearly enough on actual detailed planning.

Authorizations so far, including the latest item of 10 billion dollars just recently passed, total more than $74 billions. Contracts as of Oct. 15 exceeded $39.2 billions. Actual expenditures, as of Dec. 1, were about $13.6 billions. Now there is Washington's proposal of a war program involving $150 billions, with expenditures to average as high as $50 billions a year over the next two years. It is here that talk of monthly expenditures running much higher than $3 billions by the end of the year comes in, with later monthly outlays naturally running still much heavier.

The general trend in authorizations and contract placements is indicated by figures as of Oct. 15, the latest available on contracts. These figures showed at the time total appropriations of approximately $63.9 billions, and contracts in excess of $39.2 billions. Of these sums, respectively (all in billions), $24.6 and $15.6 were for the Army; $17.6 and $13.7, Navy; $2.4 and $1.6, Maritime Commission; $13.0 and $4.5, lease-lend; $3.9 and $2.8, RFC and subsidiaries; and $2.2 and less than $1 billion ($812,000,000), all other defense agencies.

What has been accomplished so far in major lines of rearmament can only be approximated, as recent official figures have been withheld in various instances. In war planes, the last official production figures were 1914 for September; however, unofficial estimates place total production for the year at 18,000 to 20,000 and the current monthly rate at around 2500, including 800 bombers. These same estimates place monthly production late in the year at 4000 warplanes or more. It appears safe to assume production of planes, especially bombers, will be stepped up as rapidly as possible, in the light of this country's experience so far in the war.

Production of combat tanks last year was estimated

at 5000, against 500 in the preceding year, when the program was first getting underway. By the end of this year, 2800 to 3000 a month is expected. Incidentally, it is pointed out that more tanks are now being finished in one day than were turned out in this country during all of the first World war.

At Detroit, where an important part of this program is being carried on, rapid strides are also being made in the production of other types of motorized military equipment. Production of military trucks, for instance, jumped from practically nothing at the start of the emergency more than a year and a half ago to 5000 a month by late summer and now, this month, is scheduled to reach 7500. Reconnaissance cars, ambulances, armored troop cars, trailers and other such items of military equipment are being produced in quantity.

Explosives Supply Adequate

Whatever the production of guns, cannon and ammunition at present, it is safe to assume that it will be much greater long before the year is over. In some items, such as machine guns, mass production has already been approached. As for the larger guns and cannon, only greater facilities can materially speed progress, and these are being provided. Incidentally, lack of explosives at the start, involving powder and TNT, has been overcome, with an adequate supply now apparently assured.

Meanwhile, machine tool production, one of the most feared of all potential bottlenecks at the beginning of the emergency, increased from $450,000,000 in 1940 to more than $750,000,000 last year, and now is said to be at the rate of approximately $1 billion annually.

William S. Knudsen, OPM director general, recently estimated that orders for machine tools this year

■ Armed guards were placed at airports and other strategic centers immediately after Japan's attack. Here state militiamen guard the Chicago airport

would aggregate between $1,250,000,000 and $1,750,000,000.

Precisely what the added emergency spending this year will mean in the way of added demand for steel cannot be gaged for two reasons. No one knows what will be spent finally and, secondly, there is no precise way of knowing what would be required, if the amount were known. It might be assumed for the purpose of broad calculation that the requirements will be double last year, if expenditures reach $24 billions, or twice as much as was spent in 1941.

65 Per Cent of Steel Output for War

One difficulty all along has been in establishing where rearmament left off and purely commercial needs began. Last year the A-10 rating came to be somewhat generally accepted as the dividing line. By the end of the year certain of the large producers of diversified products figured their rated tonnage on order as amounting to around 80 per cent of total. Producers of some certain products, such as plates, figured their rated tonnage as much higher. However, the general average for the industry as a whole was much lower, some estimates placing it at around 65 per cent.

In view of the stepping up in rearmament program this year, this might make the outlook appear particularly dark. It might be figured that with 65 per cent of production for war only 35 per cent would be available for commercial purposes, which in terms of raw steel, on the basis of the current rate of production of 83,000,000 tons, would mean a little more than 29,000,000 tons and which in terms of finished steel, allowing for a 30 per cent scrap loss, a little more than 20,000,000 tons.

Admittedly the outlook for commercial tonnage is far from bright, but it is not to be overlooked that a considerable portion of this rated tonnage has been for purely commercial needs. For example, warehouse tonnage is covered with an A-9 blanket priority. In 1940, this tonnage represented 12½ per cent of all shipments of finished steel to consumers, and during the first eight months of last year, according to an 80 per cent sampling survey, 13.1 per cent.

Of the total tonnage shipped in 1940 and the first eight months of last year, one-fourth was pipe. Next came wire and wire products, then carbon bars, and after that, hot and galvanized sheets. The total shipments of the products in these four classifications amounted to two-thirds of all jobber shipments.

Not one of these products could be described as heavy war items, except possibly carbon bars, and even bars are surpassed by various other products, from the standpoint of indicated proportion of production going into defense classifications.

War Declaration Accepted Calmly

Another case is that of railroads and railroad equipment builders with an A-3 rating. Undoubtedly many of the requirements are highly important. Yet by no stretch of imagination could all, or even half, of them over the past year be attributed to the emergency. Locomotive buying last year admittedly took a sharp spurt, especially diesel electrics, but that is not a heavy tonnage line, and while domestic car purchases of probably 116,000 are much more than in recent years, most couldn't be charged to preparedness.

Steel took the actual declaration of war itself much in its stride, as did, in fact, business and industry in general. It naturally stimulated war preparations, but it was all within a general course, which had long been laid out. Not even the stock market underwent any sweeping gyrations. And after the declared period of emergency of a year and half almost to a day, this was not surprising.

Yet it, and still more particularly the treachery of Japan's attack on Pearl Harbor, did have one very salutary effect. It brought the nation to a much higher degree of unity. Up to that time, and even all apart from the position of the isolationist groups, there had been an appreciable lag in morale.

Despite its determination to defeat Hitlerism, its requests for billions upon billions, and the swelling armed forces of the country, the federal administration had contributed much toward the creation of a spirit of apathy toward the emergency. And to find an answer, one needed go no further than review the administration's steady resistance to all proposals for modification of the Wagner act, which had created more strife than any other piece of labor legislation in the history of the country; its refusal to curtail nondefense spending; and its continued insistence upon retaining all of the so-called social gains of the past several years, regardless of whether they were sound or false, or whether they fitted into the pattern of a wartime economy.

But with the actual outbreak of war, there came a

sweeping conviction that this was something that had to be won at all costs, and that means somehow would be shaped to that end.

In steel, the outbreak of war found capacity at an all-time high of approximately 88,000,000 net tons, far more in itself than that of all the Axis and Axis-dominated countries. This capacity represented an increase of almost 2,000,000 tons since the end of the first half, and 4,000,000 tons since the end of 1940. Another million tons is expected to be made available very shortly.

The largest overall program now due for acceleration is that proposed early last October by W. A. Hauck, chief of the plant extension division, OPM, Iron and Steel Branch. His report was the third to have been made last year, and followed two previous ones by Gano Dunn, at that time special consultant to OPM. The first Dunn report, early in the year, pointed to the need of little new capacity for 1941 and 1942. The second, late in May, indicated the need for an additional 6,400,000 tons, on the basis of later developments.

Calls for 10,000,000 Ton Expansion

The Hauck program calls for about 10,000,000 tons, but of this amount 2,861,000 tons already had been accounted for at the time it was proposed by 2,315,200 tons included in previously approved work; by 462,000 tons included in proposals submitted and financed by companies and by 84,000 tons submitted and financed by the Navy.

Of the balance of 7,138,800 tons, 5,465,300 tons is suggested for West coast expansion and certain other specific purposes, with the remaining 1,673,500 tons to be allocated among various other programs described as especially meritorious.

Among specific shortages mentioned are alloy steels for aircraft, tanks and tools; steel plates for ships, freight cars and boilers; armor plate for tanks, ships, gun mounts, helmets and planes; and bessemer steel, which can be made with a minimum of scrap. To meet shortages in alloy steel, bessemer and plates, an additional 1,000,000 tons each will be required, and 100,000 tons needed for rolled armor.

West coast expansion, according to the plan, will take 1,865,300 tons of ingot capacity with 500,000 tons additional required for balancing facilities throughout the country.

The increase of 10,000,000 tons will cost close to one and a quarter billion dollars, with practically all of the financing to be done by the government, which will retain title to much of the new facilities.

However, it is emphasized the major production task ahead is to obtain metals. Shortage of such materials last year kept capacity from being fully utilized—that, and labor disturbances. The latter resulted in the loss of several hundred thousand tons due to the spring coal strike alone, while strikes, slowdowns and other interruptions in the steel mills themselves accounted for a still larger loss. But loss due to metals shortage was even greater than to labor difficulties.

As a general consequence, steel production last year probably fell short of 83,000,000 tons, and present indications are production this year will be little, if any, higher because of increasing lack of materials. Some authorities believe it will be at least late in 1943, if not after that, before the metals situation can be brought into line, and as a result a production of no more than 86,000,000 tons is estimated for that year, despite the fact that capacity, on the basis of present plans, will be in the 90 millions and headed for approximately 100 million early in 1944.

In view of the particular scarcity of scrap, it is estimated that 72,000,000 tons of pig iron will be required eventually, against a capacity of 57,000,000 tons in the middle of last year, and more than 63,000,000 tons definitely approved up to early last November. This, it is pointed out, means that some 36 blast furnaces will have to be constructed, funds for at least half of which have already been provided by the Defense Plant Corp. and private financing.

To meet this expanding steel consumption, ferroalloy production also will have to be further increased, with heavy stimulation of production of all domestic alloy ores expected. Shortage of ships is cramping importations, and supplies from the Far East, involving tungsten notably, cannot be relied upon. To spur production, domestic producers are being given greater leeway in prices.

A salutary development late in the year was the appointment of nine top-flight steel executives to serve as full-time consultants to the OPM Iron and Steel Branch. Their appointment followed closely the selection of Charles E. Adams, chairman, Air Reduction Co. and the United States Industrial Alcohol Co., New York, as chief of the division to succeed Arthur D. Whiteside. Undoubtedly problems of distribution and production will come in for further searching consideration, with distribution probably the first on the agenda.

Throughout the year and from the first of the emergency the various technical committees of the American Iron and Steel Institute, its committee on manufacturing problems, working in co-operation with the general technical committee and its various subgroups, and the special committee of government specifications, all performed invaluable service.

Served on Special Technical Advisory Committees

Last fall their members were drawn liberally upon by the OPM administrative committee of national emergency steel specifications in setting up special technical advisory committees on alloy steel plates (low-alloy high tensile steels, stainless steel and armor plate not included), carbon steel plates, shapes and aeronautical steels, covering bar stock, tubes and stainless flats and bars. These committees were all comprised of representatives of government agencies, industrial consumers and general interests and producers.

In addition to the general technical committee and the committees on manufacturing problems and government specifications, there are 13 institute committees devoted, respectively, to alloy steel, carbon steel bars, cold-finished steel bars, cold-rolled strip, hot-rolled strip, pig iron and ferroalloys, plates, rails, semifinished steel, track accessories, tubular prod-

Small Business

Given Broader Opportunity To Aid in National Effort

■ Manufacturers and war production planners sit down at the conference table to discuss how production facilities may best be utilized at one of the many clinics held during recent months

ucts, wire rods and wire, and wrought steel wheels. Also there is a committee dealing with packaging, loading and shipping problems, and another, an editorial committee on technical publications.

Most of the technical committees were formed about eight years ago and one of their more important contributions has been the compilation of *Steel Products Manual,* with the more recently organized committee on manufacturing problems also assisting. Following is a list of the various sections which have been revised and brought up to date during the past year:

	Title	Current Edition
1.	Standard Pig Iron and Ferroalloy Compositions	June 1941
2.	Semifinished Steel Products	Dec. 1941
3.	Shell Steel Tolerances	Nov. 1941
4.	Rolled Steel Structural Sections	Dec. 1938
6.	Carbon Steel Plates	Oct. 1941
8.	Hot-Rolled Carbon Steel Bars	July 1941
8a.	Standard Methods for Packaging, Loading and Shipping Hot-Rolled Steel Bars	July 1941
9.	Cold-Finished Steel Bars and Shafting	July 1940
10.	Alloy Steels	May 1941
11.	Sheet Tolerances	Aug. 1940
11a.	Standard Methods for Packaging, Loading and Shipping Flat Steel Sheets	May 1941
12.	Hot-Rolled Carbon Steel Strip	July 1940
13.	Cold-Rolled Carbon Steel Strip	July 1940
12a. & 13a.	Standard Methods for Packaging, Loading and Shipping Hot-Rolled Strip, Cold-Rolled Strip, Coils and Cut Lengths	Sept. 1941
14.	Tin Mill Products	May 1940
14a.	Standard Packaging for Tin Mill Products	Sept. 1940
15.	Hot-Rolled Carbon Steel Wire Rods	July 1941
16.	Carbon Steel Wire	Oct. 1939
18.	Steel Tubular Products	Oct. 1941
19.	Railway Track Materials	May 1941
20.	Wrought Steel Wheels	Nov. 1941
21.	Concrete Reinforcement Bars	Mar. 1939
22.	Forged Axles	Sept. 1941

Considering the record-breaking volume of business done by the industry last year, earnings were relatively modest. Combined net income of 18 companies,

(*Please turn to Page* 426)

URGENCY for utilizing every available facility and piece of equipment possible, now that the country is actively engaged in war, may bring quicker relief to many companies than was probable a month ago, particularly to small concerns, faced with suspension of operations due to shortage of materials for commercial purposes, or to drying up of their own markets for that and possibly other reasons.

The road for the first six months looks rough for many, but by the end of that time the government hopes to have extended its contracts considerably among commercial companies and to have checked their facilities sufficiently with growing war needs that everyone who can fit into the country's emergency program will have an opportunity to do so. This is desirable not only for speeding up war production, but from the standpoint of general economic welfare. Moreover, it is thought by that time a more orderly distribution will make it possible to spare more materials for civilian uses than recently seemed possible and congressional committee investigations have shown increasing alertness to the whole problem.

Floyd B. Odlum, director, Contract Distribution Service, OPM, is driving hard for the release of a limited quantity of materials to keep these plants going on a skeletonized basis over the first six months. After that he thinks it will be easier. Speaking generally, he thinks that 2 per cent of the total supply, excluding some rare materials, will do the trick.

Mr. Odlum, who was chairman of the Atlas Corp., New York, soon found after his appointment by the President early last September to head the newly-

■ PRIORITIES CLINIC: Thousands of manufacturers attended meetings held by the OPM Priorities Division to explain the workings of the priorities system

created contract distribution service, that he was confronted by a particularly stiff task. He remarked, after he had a chance to look around, that organization of this service was at least six months and maybe a year late.

He found that the government contract service had only 39 field offices, when, in his opinion, there should have been at least 200. He found Army and Navy procurement officers still largely opposed to subcontracting, and that they had concentrated 75 per cent of the rearmament contracts in 56 large companies up to the end of May; also that of 11,819 plants listed by the Army and Navy for rearmament production, less than 6700 have been awarded contracts.

Number of Field Offices Extended to 96

The number of field offices has since been extended to 96, with still more to open as soon as possible. Clinics are held in increasing number, so as not only to bring prime contractors and potential subcontractors together, but also to bring in Army and Navy representatives, thus making possible a broader and freer exchange of information as to what is needed and what is available in facilities for manufacturing these needs. Three special clinic trains are touring the country, with a schedule covering 37 states, and are meeting with encouraging success. Engineering and civic and commercial organizations are being enlisted as never before in the job of getting emergency work circulating.

Up to the early part of last month, the division had certified 11 distressed areas for special attention, areas which faced priorities unemployment, and had distributed more than $35,000,000 worth of contracts, including $12,000,000 for antiaircraft gun mounts to the washing machine and ironer industry, the latter representing the first certification of an entire industry under the rearmament program. About 100 other areas are under study.

Such distress contracts as mentioned above are not, it is pointed out, to be confused with the overall volume of business in which the Contract Distribution Division figures. Thus, in October the various branch offices arranged a total of 538 prime contracts and 1615 subcontracts, aggregating $178,658,529. This compared with $139,700,000 for September and $97,000,000 for August, gains that undoubtedly could be attributed in part, of course, to the increasing tempo of emergency spending.

Meanwhile, Mr. Odlum is urging remedial legislative action, in such matters as antitrust regulations, which interfere with regional bidding and limit intra-industry planning. These, he believes, should be relaxed in the interest of national emergency. He also suggests removal of the necessity of competition in many cases; reduction of performance bond requirements; expedition of certificate of nonreimbursements; and elimination of certain unfavorable freight-rate differentials.

The Navy has always had more restrictions in mak-

ing awards than the Army, and consequently when the Navy let down the barriers somewhat last month it was hailed as an important step toward bringing relief to the "distressed areas" and toward stimulating the flow of supplies the navy needs.

Under the new system, specifications are to be relaxed wherever possible, with plans to be worked out for cutting much red tape which heretofore has slowed up awards, particularly of initial contracts. Further, some procurement programs are to be split in a manner which will restrict bidding on limited lots of material to manufacturers in certain definite regions, who in the past have been unable to compete successfully with those in other districts because of higher costs.

It is also understood that the Department of Labor has agreed to exempt manufacturers under some circumstances from the provisions of the Walsh-Healey act, which set up special standards for employment on government work. The new program will be carried directly to small manufacturers by a new force of officers delegated to work in the various offices of the Contract Distribution Division.

Relaxing of specifications is expected to result from early completion of a study which has been under way for some time. Precisely what items will be affected, or what changes will be made, has not been revealed, but the principal change, it is said, will provide freer tolerances in certain machine operations.

Rapidly increasing concern over small business in recent months, not only because of its importance to the general welfare, but because of its potential value to the war program, may find root in Department of Commerce figures, which show that 84 per cent of the industrial plants of the country lie in this so-called "small business" category. Out of a total of 184,230 plants, more than 155,000 employ less than 500 workers each. Yet these small companies employ a total of about 3,000,000 or approximately one-fourth of all the industrial workers in the country. Their production amounts to 16 billion dollars out of a total industrial production of 57 billion dollars.

Pool Manufacturing Facilities

Senator Carl A. Hatch, New Mexico, of the special committee to investigate emergency contracts, carried the breakdown further, when he recently reported that there were 130,000 manufacturers who employed less than 20 persons each, adding that in the aggregate they employed approximately 10 per cent of all persons gainfully employed in the country. Between 30,000 and 45,000 of these, he further stated, were engaged in the metalworking industries, and would, therefore, be principally affected by scarcity of materials.

He then added that the committee "particularly desires that the United States should avoid the bitter experiences of England, where 20,000 manufacturing plants were shut down almost over night, when a complete shift from what may be called a business-as-usual program to an all-out-war-effort program was attempted."

Early in the emergency many small companies were, as were, in fact, some of the larger ones, lulled into a policy of going along more or less as usual by talk out of Washington of heavy civilian requirements to come, with emergency work to be superimposed largely upon that. It was not, to say the least, conducive to stimulating these companies to seek government work. Moreover, it was difficult for them to find out where to apply if they did decide to go after it, for broadly speaking, no place in the picture had been provided for them at that time.

Industry did much itself, through the action of individual companies and the instrumentality of their trade associations, to make such a place, at least to provide a wedge. For instance, manufacturers of York, Pa., pooled their facilities and went after government work and finally got it. Their success led to creation of similar pools throughout the country. Some of the more recent pools have been organized on an industry basis, instead of on the basis of a general lumping of all the equipment within a given area, but the object has been the same.

The National Association of Manufacturers early last year instituted a self-census of industry, whereby every manufacturer, large or small, was urged to register his facilities. These and various other measures have proved highly valuable, but clearly much still remains to be done, if many companies are to be kept alive in some war or useful civilian pursuit.

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Planning for Postwar Economy

WHEN plans for the editorial content of this issue were laid out last fall, the editors arranged for a comprehensive article on the steps being taken by American industry to prepare for postwar economic conditions.

Questionnaires were sent to the officers of numerous companies to ascertain how much importance they attached to the problem of postwar planning.

Of 90 executives who replied, 59 stated that they were planning carefully for peacetime economy, 14 said they had planning programs under contemplation and 17 declared that they were devoting all energies to defense production and had no time to plan for the future. Two of the 17 expressed the opinion it would be unpatriotic to devote any attention to the future.

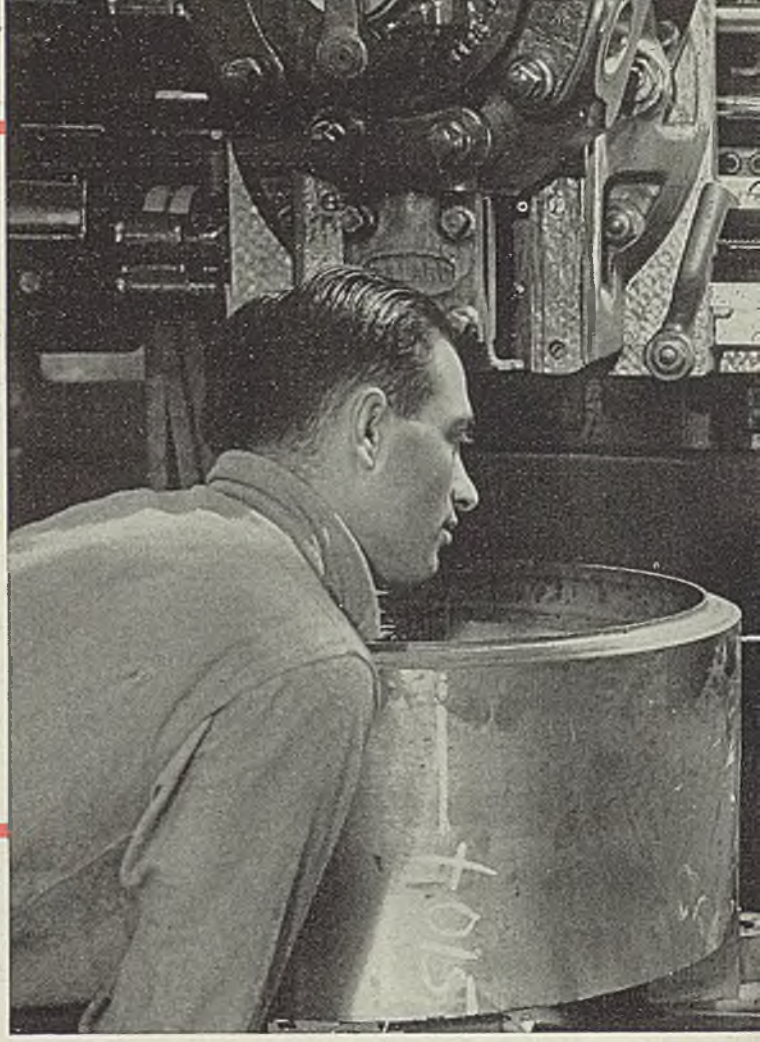
The editors of STEEL believe that postwar planning is extremely important. However, the advent of actual war has altered the situation decisively. Until the country has fully met the latest challenge, consideration of postwar problems must give way to the immediate business of war.

Therefore the article is being withheld from publication at this time. STEEL deeply appreciates the co-operation of those who replied to the questionnaire. The subject will be revived at a more opportune time.

—THE EDITORS

Labor

Organizations Rise in Power . . . Until Pearl Harbor

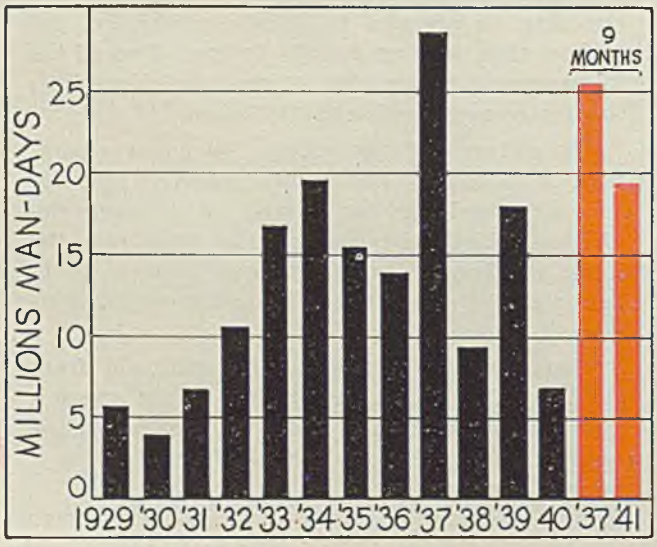


WHILE first reports of Japan's attack on Hawaii were coming over the radio Dec. 7, there was a flash that John L. Lewis had won the closed shop in the captive coal mines.

To those familiar with the situation the news came as no surprise. But to millions of other Americans who listened to the news of this country's first major naval disaster the Lewis victory struck a harsh and discordant note. It was a stern reminder of labor disturbances, which had been hamstringing rearmament efforts for months. The reaction was: " . . . . and that's something else that shouldn't happen again."

In lieu of antistrike legislation, however, President Roosevelt, upon the outbreak of war, called a meeting of 26 union leaders, industrialists and government representatives to plan and to co-operate voluntarily, in a program for insuring industrial peace "for the duration".

Conferees agreed on a three-point program on Dec. 23, as follows: (1) There shall be no strikes or lockouts during the war; (2) all disputes shall be settled by peaceful means; (3) the president shall set up a war labor board to handle disputes.

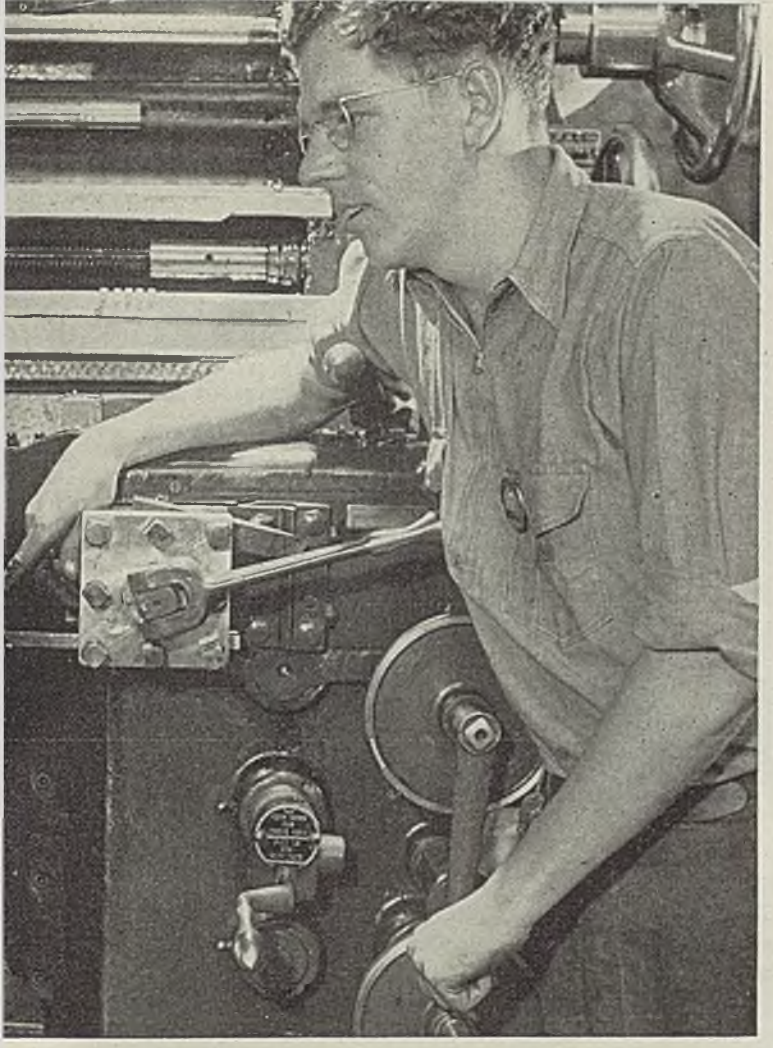


■ MAN DAYS LOST BY STRIKES: More time was lost by strikes during the early months of 1941 than any other year except 1937. Such stoppages declined abruptly after America entered the war

The formula bypasses the closed shop issue, most controversial in labor relations today. Industrial representatives insisted in a statement that the new board should have no jurisdiction over disputes involving the closed shop issue.

At present the country is in no mood to tolerate work stoppages and revival of the closed shop issue likely would spur antistrike legislation. After the strike in the captive coal mines, an aroused House of Representatives passed the drastic Smith bill by a 252 to 136 vote.

Designed primarily to deal with the present emergency, rather than with certain basic aspects of the problem created by the passage of the Wagner act in 1937, the bill, nevertheless, went far beyond the wishes of the administration. It called for a ban on strikes for the closed shop and for organizational and jurisdictional reasons in the rearmament industries, prohibition of all rearmament strikes unless approved by a majority of the workers at a government supervised election; a 30-day "cooling off" period; for the outlawing of mass picketing and importation of pickets into strike zones; and provision for a media-



Upsurge in industrial production early caused a shortage of skilled workers and training programs were instituted by many companies. Here youths are learning to produce vital marine equipment in the Westinghouse South Philadelphia plant

tion board with the power to operate through the Department of Justice to obtain injunctions against non-co-operating unions or employers.

The bill passed by almost as great a margin as the 258 to 129 majority with which the House had passed the Smith amendments to the Wagner act in June, 1940. Those amendments died in the Senate, and the fate of the new antistrike bill is admitted to be about as promising.

Now that the country is at war the administration apparently is disposed to rely on workers' patriotism. Labor disturbances have declined sharply, and war industries are getting underway on 24-hour, seven-days-a-week schedules. Prior to our entry into the war strikes were running double the monthly average of the first World war.

Stoppages Delayed Arms Production

Bureau of Labor Statistics reports that in first 17 months of the emergency program there were 5307 strikes, involving 2,527,942 men and a loss of 25,748,-627 man-days of labor. However, OPM's labor division declares that this picture is not as bad as indicated; that of these totals, only 143 walkouts, involving 259,000 workers and a loss of 2,556,500 man-days, were "of primary significance to rearmament." An additional 129 strikes, involving 350,700 men and a loss of 3,119,800 man-days, in plants having emergency work did not retard the rearmament program.

One fault to be found with any such group of figures is that they do not tell the whole story, for there is no way of knowing just how much these disturbances delay production in other plants not troubled by strikes themselves, but depending upon parts and materials thus held up. Such delay is often important, and in some instances vitally important, as demonstrated more than once during the past year.

The division says that during the same period governmental agencies, including the National Defense Mediation Board, the United States Conciliation Service and the Mediation Service of OPM, had adjusted 481 disputes, involving 1,026,500 employes with no stoppage in rearmament production. These adjustments may not have satisfied all parties concerned, but they at least kept work going.

Meanwhile, Assistant Attorney General Thurman Arnold condemned certain practices of labor unions, declaring that "labor union restrictions which have nothing to do with wages or hours or conditions of labor are costing the American consumer over one billion dollars a year."

Labor Supply Lower

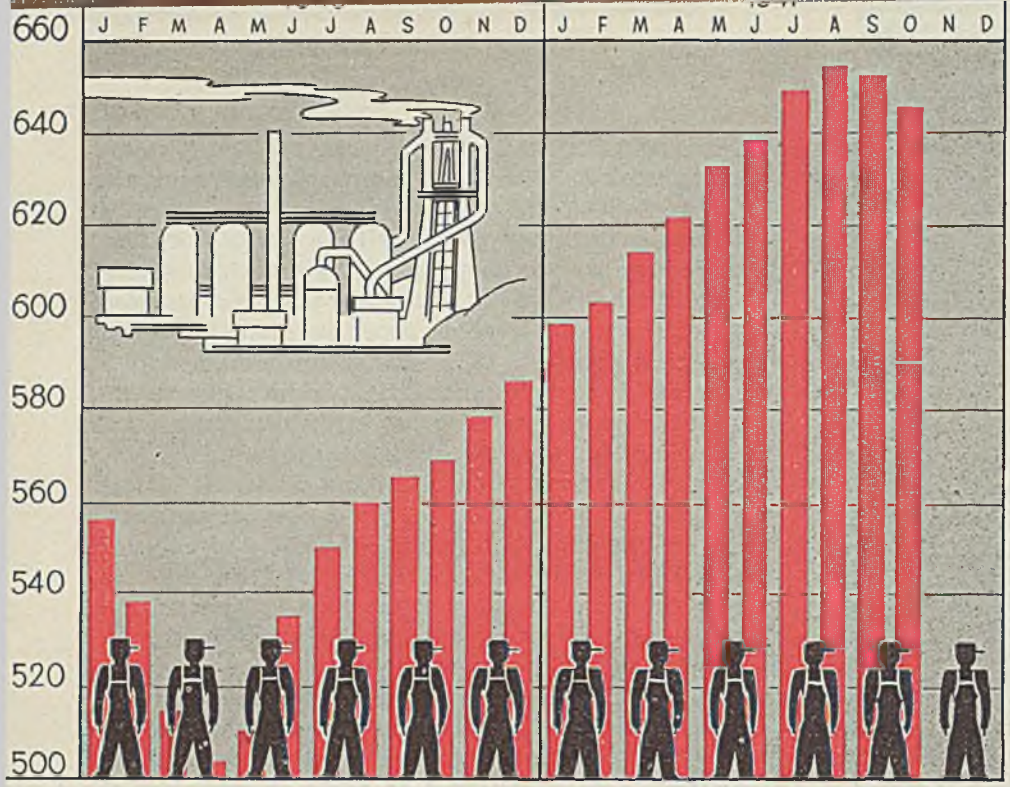
That industrial, as well as military manpower, will be a vital factor in the war has been emphasized by the Congressional program calling for the registration of every man between the ages of 18 and 64. This undoubtedly will provide the government with greater detail than ever before as to the scope and character of the resources it has to draw upon.

The plan first came up when the Selective Service act was originally introduced in Congress, but this overall survey fell short of enactment. Great Britain, meanwhile, had taken such a census, but not until long after the need arose.

The National Industrial Conference Board estimates that since the emergency program began there has been no more than a normal increase in the general labor supply. In fact, the estimated total of 55,-000,000 either employed or seeking employment is only 400,000 more than a year ago, and this, the board adds, includes the more than 1,500,000 men who have gone into the armed services since June, 1940. Considering those who have gone into military service, the actual available supply is substantially less, and with military enrollments to be stepped up considerably over coming months the supply is going to be further limited. However, displacement of workers due to lack of materials, the change-over to a war-time economy and seasonal declines in agriculture and trade may combine to minimize the scarcity of labor, temporarily.

General lengthening of working hours undoubtedly will come as the quickest approach to a solution of the problem. The administration has indicated no broad changes in the basic 40-hour work week, beyond which time and a half has to be paid. This will add to labor costs. Speeding up in training new employes may be expected.

While steel employment has increased to an all-time peak, the labor supply has not proved to be



■ Steel employment, left, rose steadily from the beginning of the emergency until August when an all-time high of 654,000 workers were on the industry's payrolls

■ Below, variations in total employment (large figures) and in manufacturing employment (small figures)

particularly difficult. Operations this year are not expected to be as heavy as in 1941. However, increasing competition for labor generally, as a result of greater activities in other important industries and an increasing military force may cause complications.

Since the emergency program was inaugurated in June, 1940, and up to and including last October, employment in the 18 war industries, as defined by the Bureau of Labor Statistics, increased more than 1,100,000 persons, or 69.1 per cent. This compares with an increase of 2,500,000 wage earners in all manufacturing establishments, a rise of 31 per cent. The number of wage earners employed in the 18 war industries in October was 2,730,800.

Accompanying Table No. 1 as compiled by the bureau presents percentage figures for October for all of these industries except those manufacturing firearms, ammunition and explosives. Figures for the latter are not published, although their data are included in the aggregate for the 18 industries.

Table No. 2 shows the monthly employment trends in the 18 war industries, durable goods, nondurable goods and all manufacturing for the first three quarters of 1941.

In the past year labor unions gained sweeping immunities from antitrust laws. The United States Supreme Court, in the Hutcheson case, last February upset precedents of 20 years, in ruling they were not subject to federal antitrust laws "so long as a union acts in self-interest and does not combine with nonlabor groups" despite whatever interference there may be with interstate commerce.

In a dissenting opinion, Justice Roberts, speaking for himself and Chief Justice Hughes, said that the majority decision constituted a "usurption by the courts of the function of Congress not only novel but fraught, as well, with the most serious dangers to our constitutional system of division of powers."

This and other decisions have added to the scope and freedom of labor unions. It is now legal, apparently, for a union to boycott an employer for dealing with another union, even though that other union has been certified by the Labor board, and the employer has no choice. As another example, it can

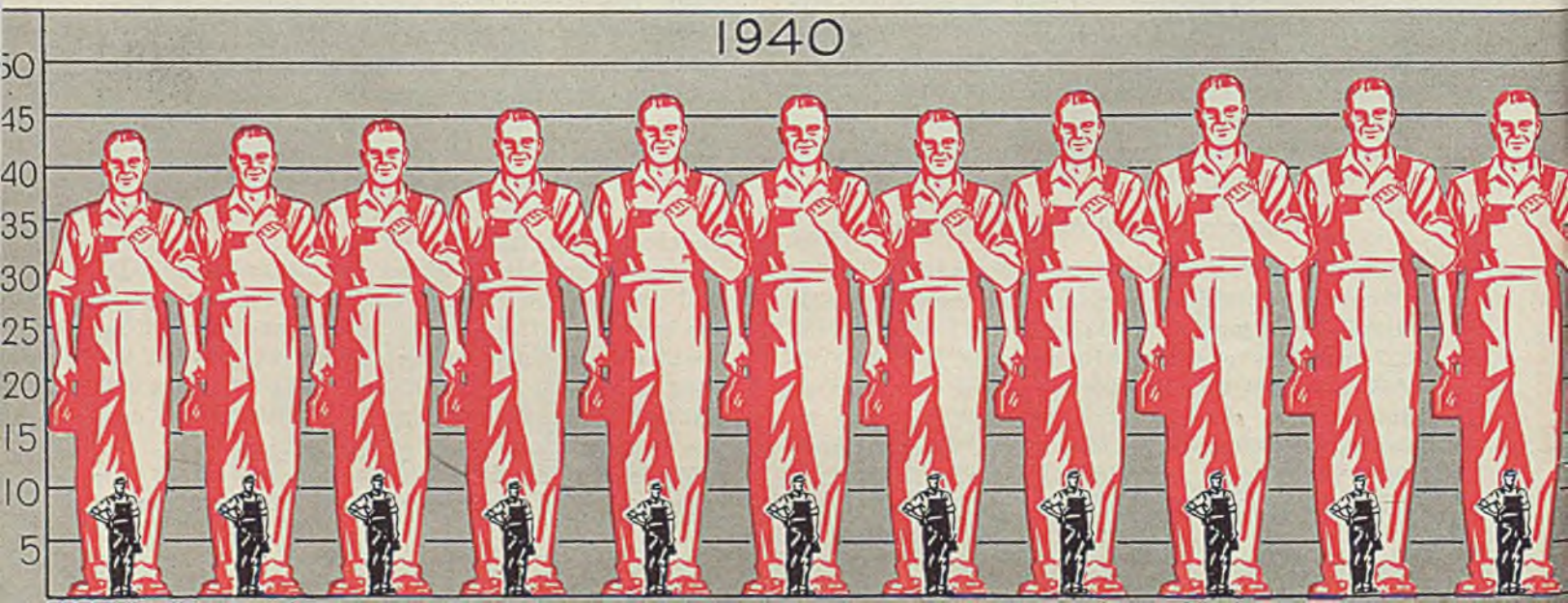


Table No. 1

Employment in 18 Selected War Industries, October, 1941

Industry	Index (1939=100) October, 1941 (Preliminary)	Percentage Change Since June 1940
18 selected war industries[1]	202.8	+ 69.1
Blast furnaces, steelworks, and rolling mills	145.3	+ 29.6
Foundry and machine-shop products	172.8	+ 52.2
Electrical machinery, apparatus, and supplies	188.8	+ 64.5
Smelting and refining — copper, lead, and zinc	128.3	+ 16.2
Brass, Bronze, and copper products	170.8	+ 52.1
Aluminum manufactures	157.9	+ 33.4
Machine tools	239.5	+ 57.8
Machine-tool accessories	248.7	+ 84.6
Abrasives	193.6	+ 67.2
Screw-machine products	209.5	+ 81.7
Aircraft and parts (exclusive of aero engines)	646.5	+214.3
Aero engines	804.5	+199.3
Shipbuilding	394.2	+197.1
Optical goods	177.0	+ 49.6
Instruments	219.6	+ 93.8

[1] Includes figures for firearms, ammunition and explosives.
Source: Bureau of Labor Statistics.

Table No. 2

Employment in 18 Selected Private War Industries Compared with Manufacturing Employment, January, 1941 to October, 1941

Year and Month	All manufacturing	18 defense industries combined	Durable goods	Non-durable goods
1941				
January	115.6	151.4	131.1	103.2
February	117.9	156.8	134.1	105.1
March	120.0	161.6	137.1	106.5
April	122.7	168.2	141.5	107.9
May	125.0	174.4	145.5	108.8
June	128.0	181.2	149.7	110.9
July	130.8	188.1	152.6	113.5
August	133.1	193.4	153.7	117.0
September	135.4	198.4	157.6	117.9
October	135.2*	202.8*	159.2*	116.2*

*Preliminary. Source: Bureau of Labor Statistics.

conspire to keep more efficient methods of production out of a state.

Last March the National Defense Mediation Board was created, with a personnel of 11 members. From the first it was handicapped, for it could act only upon disputes certified by Secretary of Labor Perkins and had no legal authority, having to rely mainly on the implied backing of the President and public opinion to enforce its findings.

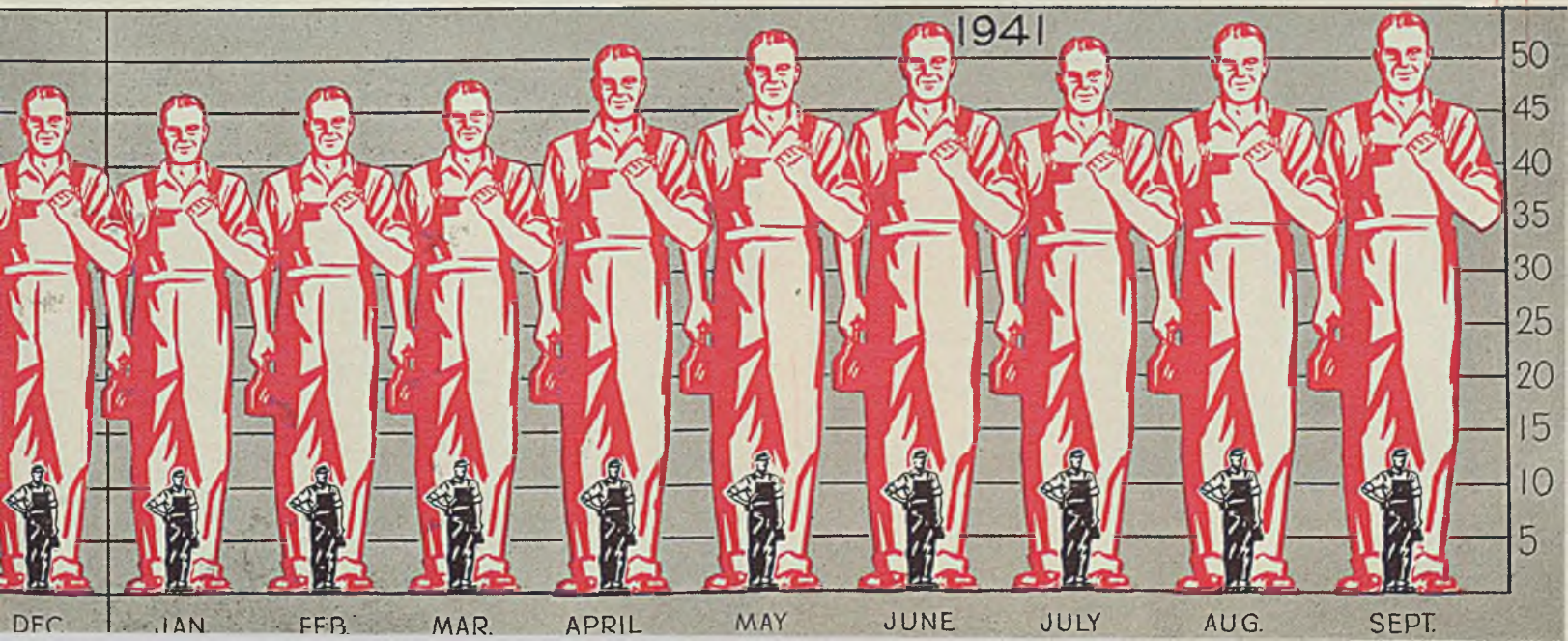
Then to add to its difficulties it refused from the first to accept the policy—such as followed by the War Labor Board 24 years ago—of freezing basic relations between management and labor for the duration of the emergency. This applied principally to the question of an open or closed shop. The mediation board decided to settle each case on its merits—and soon found itself in hot water.

A noteworthy instance was the Federal Shipbuilding case last summer. Workers demanded a closed shop, and after long negotiations the entirely new "maintenance of union membership" proposal was evolved, and subsequently ruled as a compromise. However, the distinction between it and the closed shop was so finely drawn and the ruling so contrary to principles which the company regarded as fair, that it refused to accept the decision and offered its plant to the government. After important navy work had been tied up for weeks by strike, the Navy "seized" the plant.

Then finally came the captive coal mine case, with Mr. Lewis demanding a closed shop. This was a particularly hard nut to crack. Closed shop, and nothing else would do. The mediation board eventually turned it down by a vote of 9 to 2, and the dissenting members, Philip Murray and Thomas Kennedy of the CIO, resigned, saying that they found it "impossible to retain any confidence" in the board.

Nor was its position strengthened by what immediately followed. Rather it was weakened. The President declared that the government would not compel workers to join a union; that would be "too much like the Hitler methods toward labor."

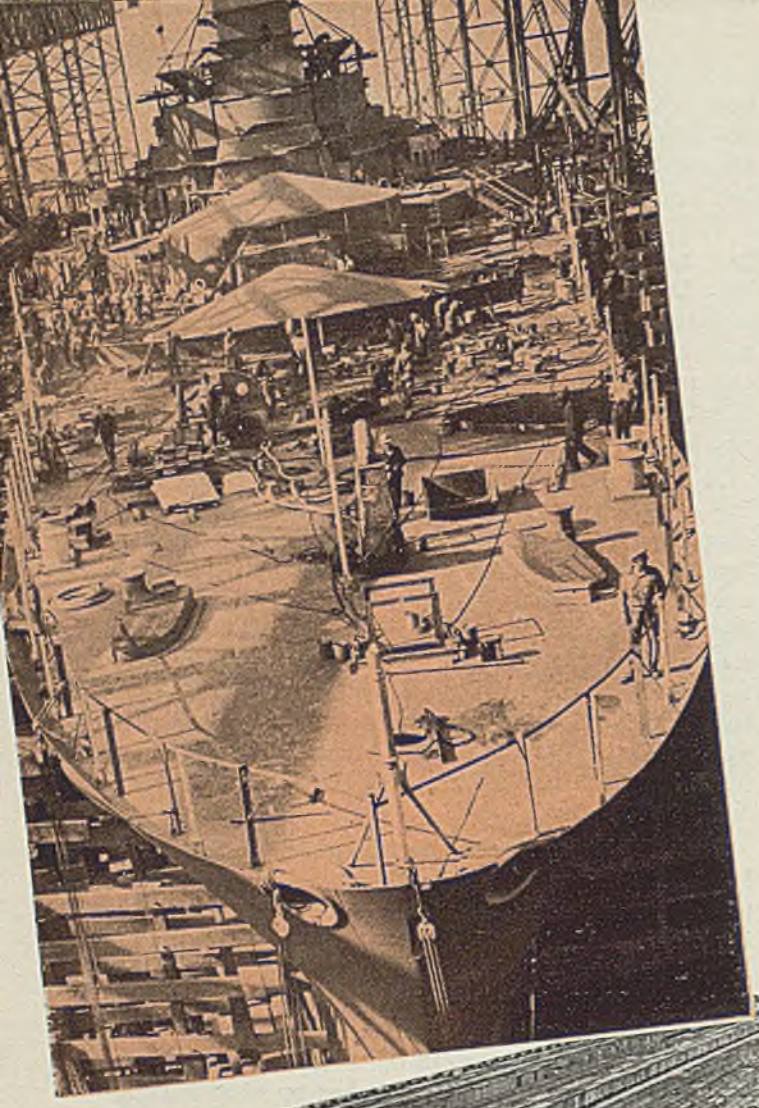
But he then proceeded to appoint a special 3-man arbitration board, comprising Benjamin F. Fairless, president, United States Steel Corp., Dr. John R. Steelman, who took leave of his government post temporarily to serve as the "public representative," and Mr. Lewis to deal with the situation. The rest is history. Mr. Lewis got his closed shop—and the mediation board, a repudiation.



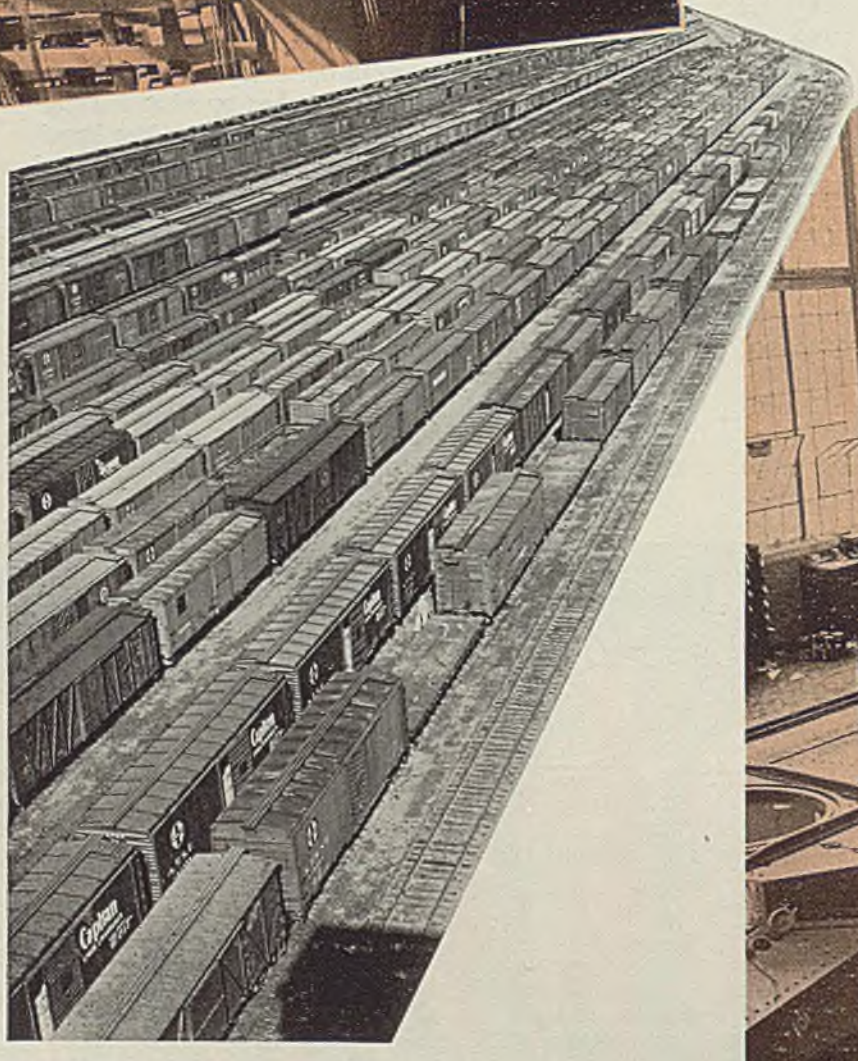
War

BLANKET

Civilian Goods Manufacture To Give Way to Arms Production . . . Flow of Steel Into Consuming Industries Will Shift Sharply . . . Subcontracting To Be "Small Plants' Only Salvation"



■ Construction work on the two-ocean navy was stepped up to as near 168 hours a week as available man-power and materials would permit following the attack on Pearl Harbor. Left, U. S. S. INDIANA nears completion at Newport News, Va. At left below, grain-filled cars pack Kansas City yards. NEA photos



Demands

COUNTRY'S BASIC INDUSTRIES

WAR requirements will dominate all the metal-working industries during 1942. The sharp shifts in the flow of materials into consuming industries—which became increasingly apparent in 1941 as the "defense" program gained momentum—will be much more pronounced.

Civilian goods manufacture will give way to war *materiel* production to a much greater degree.

Production will be limited only by shortage of labor, materials and capacity. There will be no surpluses.

Priorities and allocations—strict and realistic—will govern where steel and other metals will be used. Before the year ends it may even become necessary to allocate labor.

Small plants, not yet converted to military production, will be mobilized. Subcontracting, which floundered through 1941, will become a reality by necessity. The picture confronting those plants which cannot be converted to war *materiel* manufacture is not a bright one.

Plant expansions underway will be speeded up and more expansions launched. Plants now operating at capacity will exceed that "capacity."

Machine tool builders, for example, will be aiming at a goal of $1,250,000,000 to $1,750,000,000 output. In 1941 they easily bettered a goal of $750,000,000, a phenomenal record when it is remembered that as recently as 1932 the industry's output was valued at only $22,000,000.

Shipbuilding, already scheduled for the biggest program in history, will be further expanded, due to the necessity for fighting a war on all the seas, and for bringing critical materials from the far corners of the earth.

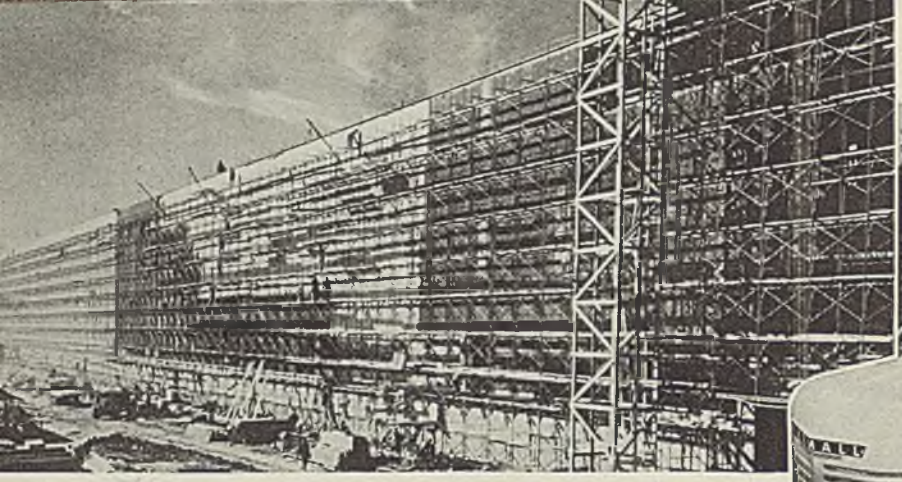
The United States Maritime Commission, which at the time of the Japanese attack on this country, had planned to launch more than 6,000,000 tons of merchant bottoms, will seek new ways to increase the quota. New warships may be laid down. Heavy volume of repair work, both for United States naval vessels and British warships, is inevitable.

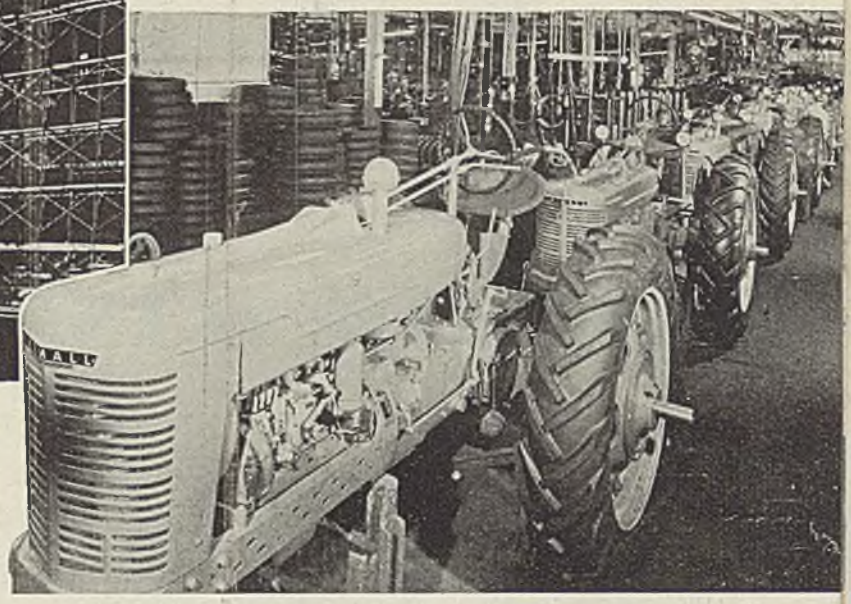
Expanding Plate Capacity

Principal deterrents to expanding shipbuilding will be shortages of plates and of skilled labor and supervisors. Plate capacity expansion, both by building new facilities and by converting present mills is underway, but mills will be hard-pressed for many months to meet demand. Workers can be trained within reasonable periods, but supervisory ability comes only with experience. Extension of working hours will be one solution to the labor problem.

Planned increase in food production will necessitate

■ Fifteen tanks a day were coming off assembly lines at the Chrysler tank arsenal at year-end. The M-3 medium tank now being built has been redesigned and the arsenal shortly will be doubled in size and retooled for production of the M-4 tank, a model which will also be built by the Ford Motor Co. and by General Motors, the latter in process of erecting a new tank arsenal near Flint, Mich.





■ War and the concomitant necessity for doubling and trebling arms production may bring a new wave of defense plant construction, such as made steel erection scenes like the one above common in 1941. At right, farm tractors roll down the assembly line at International Harvester's Co.'s plant

high activity in the farm machinery industry, which in 1941 experienced its best year in history. Although implement builders anticipate some decrease in 1942 production, due to the shortage of materials, the OPM recently raised the industry's priority rating from B-1 to A-8 and the Department of Agriculture has called for more farm products to assure food for our armed forces and civilians and for Great Britain and other allies. It is unlikely that farm equipment production will be allowed to fall below 80 per cent of the 1940 output.

Heavy increases in freight traffic caused by the vastly accelerated industrial activity will continue the railroads in a favorable position to purchase new equipment. High priority ratings for steel and other materials already has been granted them, and the conversion of sheet rolling mills to light plate production should improve the materials situation for rail equipment manufacturers early this year.

Many railroad equipment manufacturers, of course, hold large orders for tanks, gun mounts and other military items.

The container industry will be caught between necessity for stringent measures to conserve tin stocks and the demand for more containers to package food for the armed forces and for the democracies we are aiding. Substitute coatings is a topic that certainly will come up for much attention in the war planning agencies.

Effect of the outbreak of hostilities on the construction industry is not immediately clear. Before America was attacked in the Pacific, it appeared the peak caused by the "defense" program had passed and that a gradual recession would appear in 1942. Now, however, new arms plant programs may continue the industry on the same high level it has experienced during the past year.

The durable consumers goods industries—automobiles, light trucks, refrigerators, washing machines, ironers, vacuum cleaners and other appliances—will be hard hit. Automakers and some of the others, of course, are building or will build war implements, but the civilian goods lines as such undoubtedly will be curtailed more sharply. From 1941, which in most lines was a record year, these manufcaturers are heading into a depression year, with many resulting dislocations.

The manufacturers of small miscellaneous equipment requiring metals will be the hardest hit of all. These include, for example, makers of musical instruments, slide fasteners, costume jewelry, metal furniture and similar items. Unable to obtain a sufficient supply of metals in the latter part of 1941, they now face further curtailments, and their only salvation lies in the possibility of obtaining prime or subcontracts for military materials. For many, this will be difficult.

Exceed Billion Dollars

PLEDGED at the beginning of 1941 to achieve output of at least $750,000,000, the American machine tool industry more than met that promise. Many factors have contributed to an achievement which less than five years ago would have been considered impossible from the standpoint of obtaining the necessary workmen, plant and equipment.

Of the many precedent-breaking achievements in the interest of national defense, none is more impressive nor basically more important than this by the makers of machines by which—and only by which—mass production of military and naval equipment and *materiel* can be carried out.

Impressive though these accomplishments have been over the last 12 months, the end is not yet in sight. "As far as the machine tool industry's part is concerned, we are a long way from the top of this job," said Clifford S. Stilwell in accepting the presidency of the National Machine Tool Builders' Association on Oct. 14, 1941.

Late in December, OPM officials asked machine tool

builders to increase 1942 output to 50 to 100 per cent above 1941 production, or to a total of $1,250,000,000 to $1,750,000,000 value.

While it is true there has been considerable plant expansion in the industry in the past year—in a number of cases under government subsidy—there has been no such thoughtless overbuilding as was indulged in by some companies in the first World war. Primary effort now is to get maximum production out of existing plant and equipment before resorting to additions.

It must be remembered machine tools are at a premium in the machine tool industry just as in any other vital defense industry. While machine tool builders are accorded preferential treatment on machines for their own use, there has been little or no indication they have taken undue advantage of this.

They themselves have been among the best customers of companies whose specialty is the rebuilding, modernization and alteration of used tools to do the work for which in normal times new machine tools—often of special design—would be purchased. This has been true particularly in the case of large planers and planer-type milling machines, large lathes and boring mills, both horizontal and vertical. All these are "critical" machines as far as arsenals and shipyards are concerned, and new ones could ill be spared, even to machine tool builders.

In the expansion of manpower in the American machine tool industry to over 100,000—more than double what it was less than three years ago—youth has made a place for itself and the fallacy of men being too old at 45 or even 75 has been punctured.

It is no more possible to train "all-around" skilled mechanics in a month or six weeks than it ever was, but through modern intensive methods of teaching "right on the job" it has been found possible to impart to properly selected candidates a surprising amount of "limited skill" in that length of time. Friendly co-operation on the part of older workmen in these training programs and lack of discrimination against the new workers has played a very important part in the success of these emergency training programs.

While women have not as yet been employed to any extent in machine tool shops in the United States, there is good reason to believe this will happen in 1942.

Subcontracting of both parts and complete machine tools hit its stride in 1941. Nearly 100 machine tool builders now are farming out work to the extent of more than 25,000,000 man-hours per year and the system continues to spread.

Last year was not one of spectacular design changes in the machine tool industry for obvious reasons. It is fortunate the production crisis hit the American machine tool industry just after it had passed through one of its most active periods of design improvement—that immediately preceding the time set for the 1939 National Machine Tool Show.

If anything, machine tool designs will be simplified in 1942 rather than made more complicated. This is being urged by OPM and other government authorities. It does not mean revival of semiobsolete designs, but it does mean current model machines will be stripped of all competitive nonessentials and will be built in basic form with only those extras included which are absolutely required.

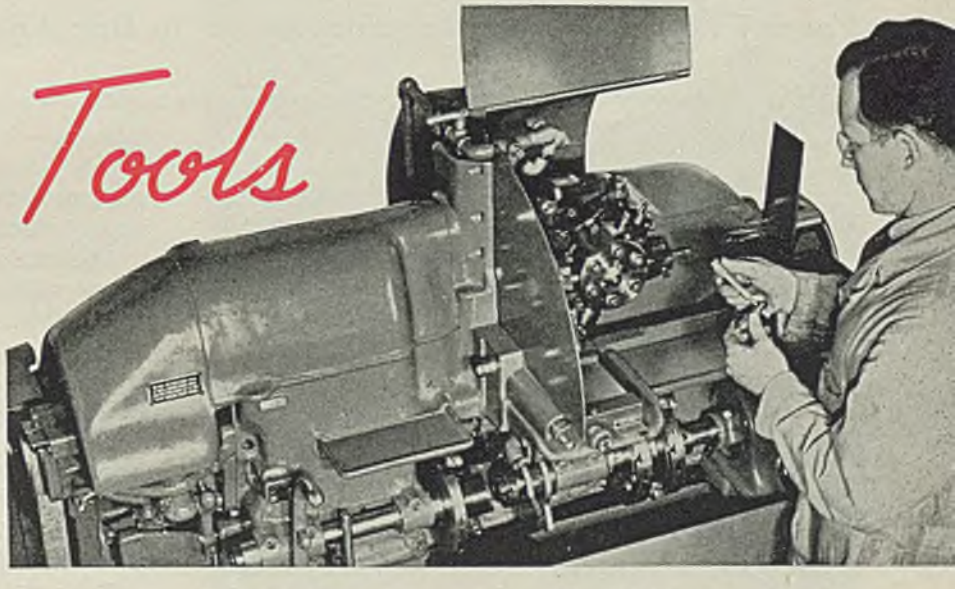
The industry is hopeful 1942 will bring about simplification of lend-lease procedure, and that Army and Navy programs will become stabilized to the extent some degree of production planning can be carried out by machine tool builders.

The greatest potential possibilities for increased production of machine tools lie in the expansion of

(*Please turn to Page* 406)

Machine Tools

Output Will in Next 12 Months



■ Ingenuity of American machine tool builders and their tooling experts in transferring skill to machines such as this high-speed, cam-controlled automatic, is of extreme importance at this time. Through these standard machines and special tools, abilities of the limited number of highly skilled technicians are multiplied, and extended to an almost unlimited number of routine workers

Windows of WASHINGTON

By L. M. LAMM
Washington Editor, STEEL

Controls Over Business and Industry To Be Tightened Further.

Opposition to Social and Pro-Labor Legislation Increases.

Taxes Will Be Heavier, But How Much No One Knows.

Social Security Revision and Higher Levies Are Probable.

WASHINGTON

■ INDUSTRY'S eyes have been and will continue to be focused on Washington. From here stem the legislation, regulations and other war-time controls by which all business will be governed for the duration.

During the year past an intricate network of rules has been established. To keep abreast of these, industrialists have been required to spend much time in the capital.

As the armament program requirements increased, the Chief Executive has softened his attitude toward business slightly. He was forced to lean too heavily upon industry to continue to keep it tied to the whipping post. The more rabid left-wing New Dealers have had to be relegated somewhat to the background and be replaced by a slightly more conservative element. However, the leftists are still in the picture, waiting to whisper in the presidential ear.

Late in the year, the President was forced to take an apparently firm stand against labor leaders capitalizing on the war program to obtain union "security." When John L. Lewis closed the captive coal mines in defiance of Mr. Roosevelt's personal appeals, the President declared the government would never compel a worker to join a union. A few weeks later, however, Mr. Lewis had won his point—with the aid of a Department of Labor employe.

During the next 12 months, the controls over business and industry undoubtedly will be tightened and extended. Just what pattern these controls will assume depends largely on events to come.

One thing that still is as certain as death is that taxes will be heavier.

Another strong probability is revision of the social security legislation and upward revision of social security levies.

Doubtful is further social and pro-labor legislation. Word reaching Congress and administration officials both by mail and by word of mouth from the folks back home indicates growing opposition to this type of legislation.

It is the belief of most thinking people that there is no excuse for the sorry spectacle of constant strikes which this country has exhibited to the world at large. The repeated surrenders to labor by the administration for political reasons has led step by step to the present situation.

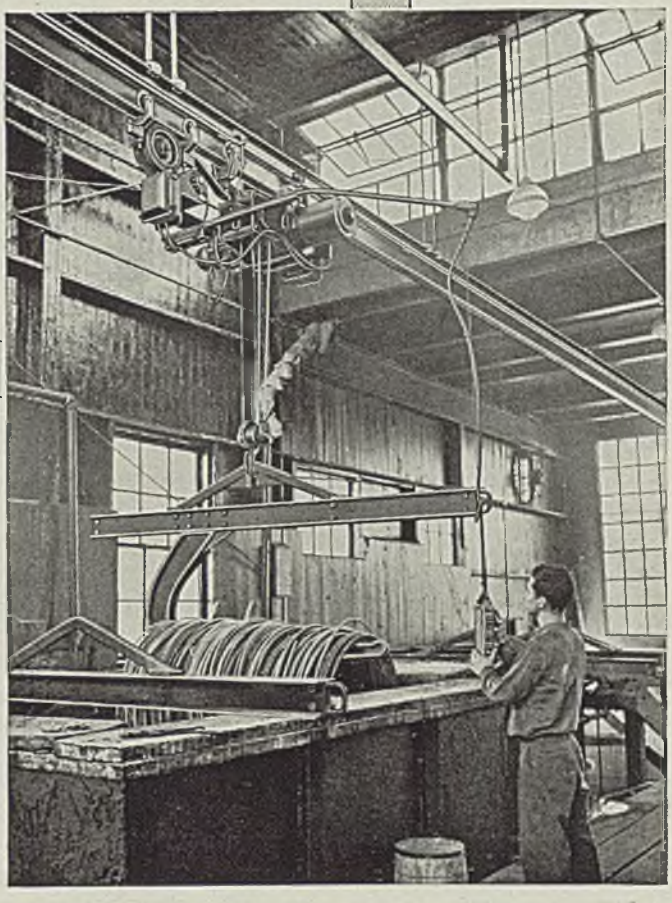
The public generally does not believe there has been any real necessity for some of the plant seizures which have taken place and are likely to take place again. There is no gainsaying the fact that responsibility for today's set-up belongs solely to the President. The chaos that has occurred in the labor situation can be traced right back to the White House doorstep, and apparently no one in the administration is willing to take the rap for its occupant on this score.

Most of the right-wing New Dealers feel that the labor situation is due entirely to the President's attitude, which has led rabid labor racketeers to get into the limelight with their closed shop goals. This situation along with other events which have taken place during the present emergency has set up a definite reaction against the social and labor legislation which has become law during the present administration.

First session of the 78th Congress convened at noon Saturday, Jan. 3.

Probably the question of greatest interest to industry is that of taxes. The administration has said

Now PRODUCTION Doubled-Trebled



Finger tip operation of power driven carrier speeds up pickling process.

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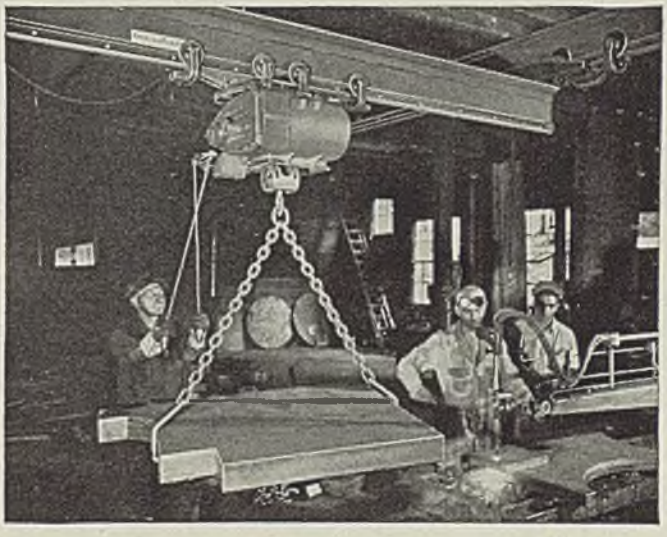

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it will have more revenue legislation to offer, and Congress has agreed. So, the only question is, just what will it be? A bill carrying administrative amendments to present tax laws was promised. Just what else it will contain nobody knows, although there is talk of another few billion dollars to be added to an already staggering tax program.

Because the bill with administrative changes was even then underway, the Revenue Act of Sept. 20 largely excluded such changes. On several occasions since September there have been signs that a new tax bill was about to come through. The Secretary of the Treasury called the legislative tax leaders and told them what he wanted. This was followed by a meeting of the House Ways and Means Committee, which initiates tax legislation. At this meeting it was decided to hold off the tax bill temporarily. A specific letter from the President followed this decision, outlining the tax situation.

A number of "trial balloons" regarding heavier taxes, were released soon after the September revenue bill became law, and others are still going up. One such was obviously that of Secretary Morgenthau which provoked an adverse attitude on the part of Ways and Means Committee members, who obviously took no relish in the proposal that individuals in 1942 pay income taxes for two years, or added Social Security taxes, even though given in lower rates than advertised by earlier soundings of general public sentiment.

Those who watch the business situation at the capital are predicting that before March 15 there may be some administrative changes and possibly something more than that. In any event it is being freely forecast that 1942 will see another tax summer.

All kinds of fantastic suggestions have been made by government and so-called tax experts in other quarters. Some such may find their way into the 1942 tax law. For instance, Treasury Department specialists have suggested collecting future income taxes from wage earners by requiring employers to deduct so much per week or month from the pay envelope in the same manner in which social security taxes have been deducted.

Plan May Be Put Into Effect This Year

Talk has been that this idea may be tried in 1942 in actual operation. The suggestion is based on belief at the Treasury that it would be difficult for the Treasury to collect $100 or more from any wage earner for taxes at one time, or even four times during the year.

Dr. Carl Shoup, of Columbia University, has reputedly made a tax study for the Treasury. While nothing official has become known regarding this survey, unofficially it is said that the study indicated that workers of the country now have from 5 to 8 billion dollars additional purchasing power since the beginning of the emergency and the study purportedly suggested ways to "mop up" this supposed surplus in an effort to stave off inflationary effects.

Another important legislative question is that of steep increases in social security taxes. As this is written there is nothing official on the subject, but Secretary Morgenthau at a recent press conference stated the increase would be designed to accomplish the "mop-up" of supposed "extra money in people's pockets for which there will not be goods to buy."

Whispers around Washington are to the effect that the Secretary of Treasury favors increasing employes' old age pension taxes from 1 to 5 per cent. The steepness of the proposed increases was emphasized by the secretary recently when he related that he and Federal Security Administrator Paul V. McNutt had agreed that the new tax rate should be based not so much on the actual needs of the social security program, as on the need of the government to head off inflation and also to finance the defense program.

$12,000,000,000 Deficit Expected for 1942

In the current fiscal year, ending June 30, the Treasury expects a deficit of more than $12 billions on its budget of $24 billions. One of the important sources of borrowing to meet this deficit is social security taxes. While such tax goes directly into the old age reserve fund, it is immediately borrowed by the Treasury in substantially the same way in which the Treasury borrows from banks and other investors by the sale of securities. Some government officials estimate that the Treasury could borrow up to $5 billions annually from social security taxes if the present taxes are increased. At present the Treasury is borrowing from this source about $1,000,000,000 annually.

It was recently explained by Mr. Morgenthau that social security taxes are under consideration in conjunction with regular taxes and borrowing.

"My first job is to finance the national defense program," he said. "We get as much as we can from the regular taxes. Then we have to borrow the rest, and any move we can make that will help must be considered."

Mr. Morgenthau also has disclosed that his aides have prepared a confidential estimate of the amount these experts think ought to be immobilized, either through taxes or borrowing, to prevent bidding up of prices and consequent inflation. Such figure, he said, may be his principal guide in determining the social security tax rate.

Present social security payments by both employers and employes are 1 per cent on payrolls for old age pensions. In addition, employers pay 3 per cent for unemployment insurance.

Under one plan supposed to be under consideration at both the Treasury and White House, employers' tax for old age pensions would be raised to 2 per cent, so that their total social security tax would be 5 per cent, or the same amount that would be charged against the employe for pensions alone.

Price control legislation has caused a considerable stir. Several bills were introduced in the house and referred to the Committee on Banking and Currency. The committee literally played around with the subject for months before it finally reported a bill. Due to pressure from the farm bloc and labor lobbyists, it was seemingly impossible for the committee to report the bill out. When it finally was reported the

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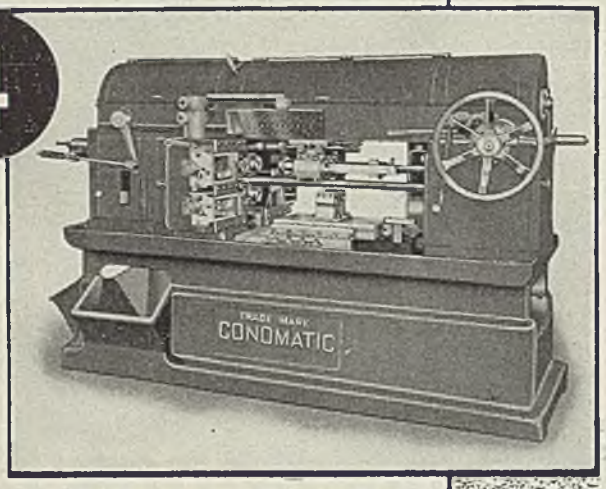
CONOMATIC
SCREW MACHINES

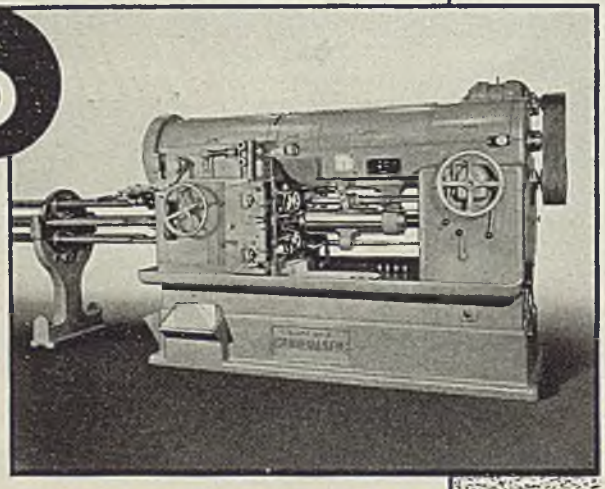
ECONOMY

4



ACCURACY

6



PRODUCTION

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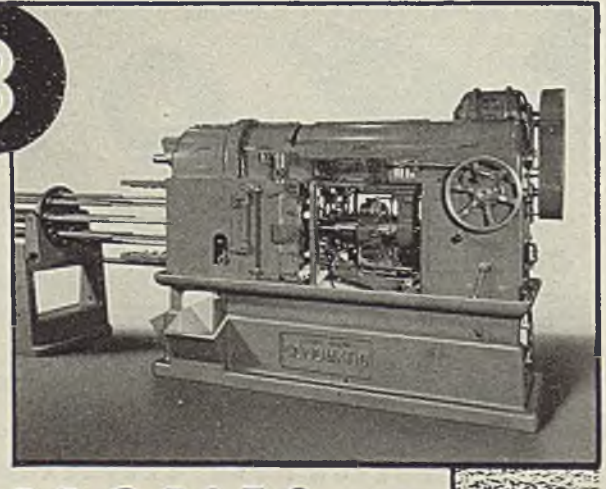

PROFITS

CONOMATICS are built with 4, 6 and 8 spindles to cover the complete demands of those manufacturers who want to streamline their production to the point where profits are assured.

Parts may be produced from bars up to 6 inches in diameter with a milling length of 7 inches. The Cone policy of exceptionally rigid construction permits taking unusually heavy forming cuts at maximum speeds and feeds. This, together with rigid slides, accessible tooling, cams out of the way, individual forming slides, and individual positive forming stops, are but a few of many profitable CONOMATIC features. Your inquiries on machines and time studies will incur no obligation.

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CONE AUTOMATIC MACHINE COMPANY, INC.
WINDSOR, VERMONT

committee did not put a ceiling on farm products or take wages into consideration.

In addition to dozens of bills of general interest and application to the steel industry Congress passed a number that specifically dealt with it. Among these was a bill which was signed and became law on May 31, authorizing vessels of Canadian registry to transport iron ore on the Great Lakes.

The law provides that by reason of emergency conditions in transportation on the Great Lakes, notwithstanding certain laws which specifically prohibit, vessels of Canadian registry "shall be permitted to transport iron ore between United States ports on the Great Lakes during the 1941 season of navigation on the Great Lakes."

It is assumed this law will be extended for the present year if conditions warrant.

Another bill of interest to the industry became law on May 28, providing for appropriation of the proceeds of sales "or other dispositions of" strategic and critical materials which had been acquired in order to prevent depletion of the stocks of such materials available for national defense purposes.

During the last session also, a law was passed dealing with the power of government to establish priorities and to allocate materials, which has directly affected practically all manufacturers. This particular law amended a previous one by not only controlling deliveries of material to the Army and Navy but "to any country whose defense the President deems vital to the defense of the United States."

Congress during the last session also passed a bill increasing by a billion and a half dollars the money for use of the RFC. This law now reads that "the amount of notes, bonds, debentures, and other such obligations which the Reconstruction Finance Corp. is authorized to issue and have outstanding at any one time under existing law is hereby increased by $1,500,000,000."

Another law of interest to the metalworking industries was that authorizing the President to requisition private property required for defense.

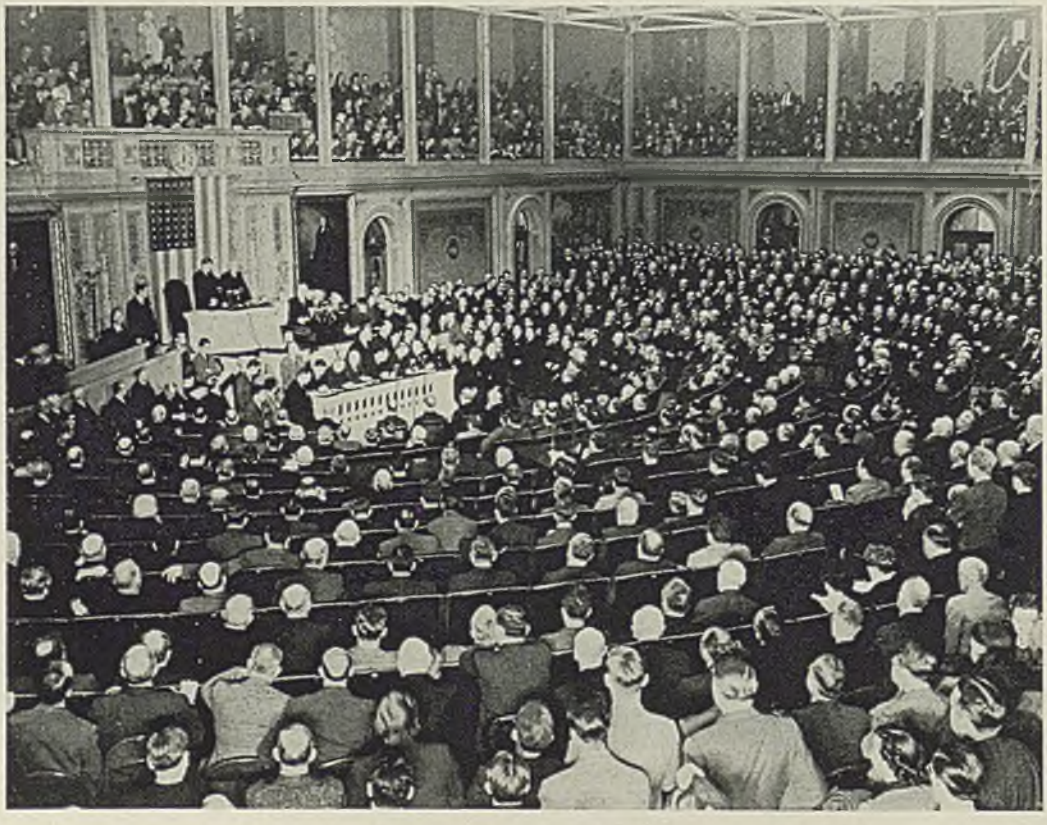
This law is effective until June 30, 1943, and provides that the President can requisition property any time he finds that "(1) the use of any military or naval equipment, supplies or munitions or component parts thereof, or machinery, tools, or materials necessary for the manufacture, servicing, or operation of such equipment, supplies or munitions needed for the defense of the United States; (2) such need is immediate and impending and such as will not admit of delay or resort to any other source of supply; and (3) all other means of obtaining the use of such property for the defense of the United States upon fair and reasonable terms have been exhausted."

There is a further provision in this law that nothing in the act shall be construed as authorizing "the requisition of any machinery or equipment which is in actual use in connection with any operating factory or business and which is necessary to the operation of such factory or business."

Provision is also made in the act for payment of a "fair and just compensation" by the government. If the owner is not satisfied with the amount offered by the government, there are provisions to permit of recourse to the courts. It is also provided that when the property is "no longer needed for the defense of the United States" it shall be turned back to the owner at a just compensation if he so desires it.

Following outbreak of war with Japan, the whole legislative situation changed, almost all members of

(*Please turn to Page* 426)



■ **AS AMERICA WENT TO WAR: President Roosevelt appeared before Congress on Dec. 8 to ask recognition that a state of war existed between this country and Japan. Within a matter of minutes the resolution was approved and the nation—united for the first time in a decade—became an all-out combatant.**
NEA photo

ALL-AROUND DOOR EFFICIENCY

More ESSENTIAL THAN EVER!

CLEAR CEILINGS! Doors coil compactly above the opening; permit fullest use of conveyors, cranes, etc.; never block off light from above.

EXTRA PROTECTION! Kinnear Rolling Doors' all-steel construction resists fire, riot, sabotage, intrusion, storms, accidental damage.

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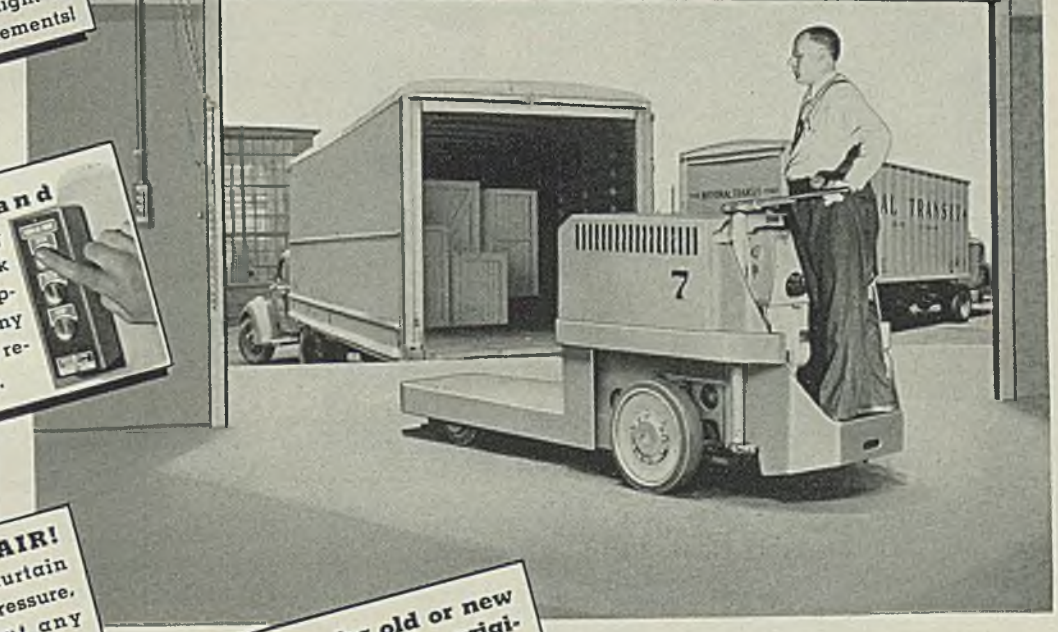
SAVES LABOR and avoids delay. Coiling upward action gets peak efficiency from motor operation . . . permits any number of convenient remote control stations.



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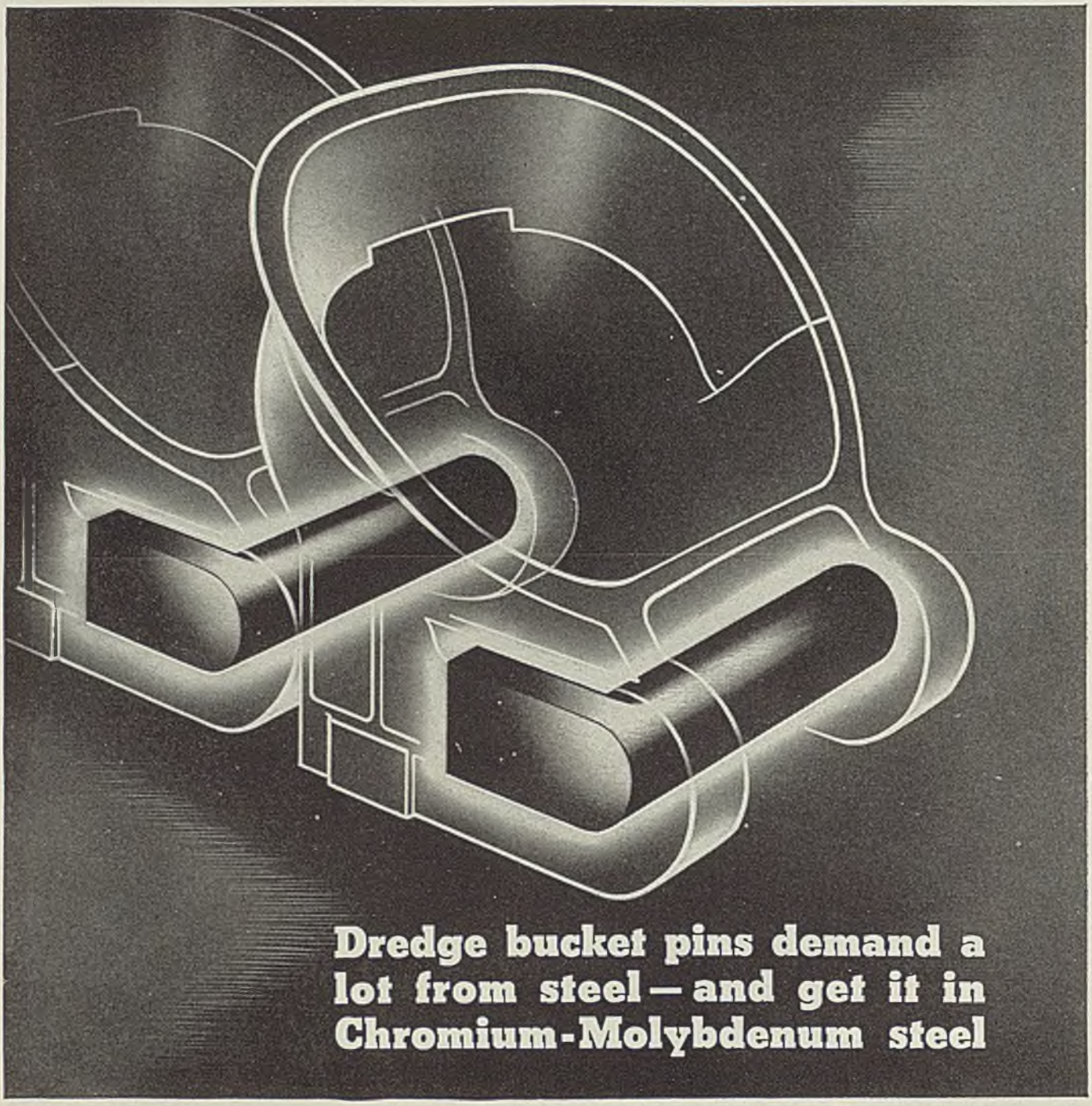

Dredge bucket pins demand a lot from steel—and get it in Chromium-Molybdenum steel

Dredge bucket pins are heavy (4-8 inches diameter), must withstand heavy static and impact loads, and must have extra good wear resistance. It is a tough assignment for any steel.

A medium carbon Chromium-Molybdenum steel developing uniform hardness in heavy sections is being used for this application.

Here is a permanent place for one of the most versatile of alloy steels—a steel that, with minor variations in carbon and manganese content, is meeting requirements in parts ranging from 0.065" wall aircraft tubing to 12" shafting. This steel, together with many other Molybdenum Steels, is covered in detail in our free technical book "Molybdenum in Steel".

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Mirrors of *MOTORDOM*

By A. H. ALLEN
Detroit Editor, STEEL

Automotive Industry's War Equipment Awards Approximate $5,000,000,000.

Victory Program Will Release Added Billions This Year

1941 Output Increases 8 Per Cent, Breaking Traditional Three-Year Cycle.

Many Workers To Be Disemployed, Despite Shifts to Arms Factories.

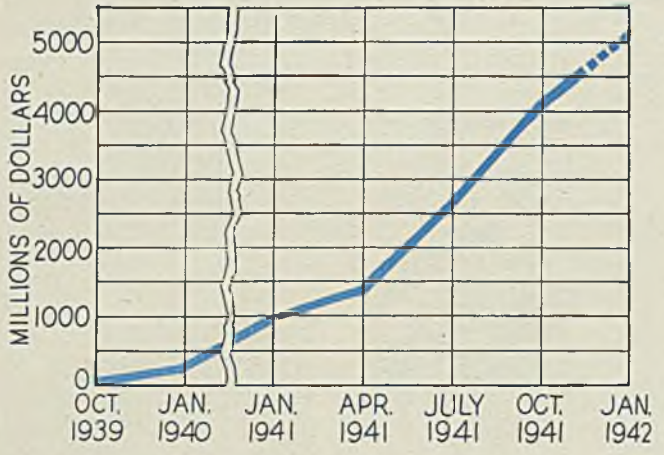
DETROIT

PRODUCTION of war implements (defense equipment has become a decided misnomer) by the automobile industry last year found itself in the gestation period of really big business. Only 12 months ago motor vehicle producers were toying with a cumulative total of something under a billion dollars of "defense" contracts, placed with them since September, 1939, a good bit of this total already delivered and the bulk of it standard types of equipment like trucks, trailers and marine equipment. This, in an industry which was turning out from two to three billion dollars worth of cars and trucks every year, could be taken in stride.

But in the intervening months, arming for a world offensive, then the decision to become the arms breadbasket for all anti-Axis powers and now the status of an all-out combatant have worked a not too unexpected change. By Oct. 1 cumulative armament awards to motor vehicle manufacturers had swept past four billions, and by the end of December were estimated in the neighborhood of five billions. Contracts were released at a rate of 124 millions a

■ Heavy 4 x 4 trucks rumble across a ponton bridge which engineers have thrown across the Chattahoochee river in Georgia in 41 minutes. Motor industry will have filled orders for 256,000 army trucks by spring, full complement of transportation needs for the 1941 army

Cumulative Defense Orders to Motor Vehicle Producers



Includes orders from British and other nonaxis belligerents but does not include value of new plants and equipment. Totals from October, 1939 only

month in the first quarter; 423 millions a month in the second quarter; 484 millions a month in the third quarter, and around 400 millions a month in the fourth.

How much of "the stuff" has been produced out of this cumulative total of five billions? No complete statistics are available, but some clues are. As of Sept. 10, General Motors Corp. had received orders for $1,200,000,000 worth of armament and had shipped $225,000,000, not counting trucks, with expectations that another $200,000,000 would be finished by the end of the year. On this basis—and General Motors may be considered typical of most motor car companies—one-third of the military orders on hand as of Oct. 1 and covering the two-year period from September, 1939, will have been shipped by year end, or about $1,350,000,000. This leaves a backlog as of the first of this year totaling nearly four billions—big business in every sense of the word.

Breakdown of armament orders awarded the motor industry, according to types of equipment involved, shows about 50 per cent for aircraft, aircraft engines, subassemblies and parts; 19 per cent for motor vehicles and parts; 15 per cent for tanks; 12 per cent for guns and ammunition; and 4 per cent for marine equipment. Recent tank orders probably have altered these figures in some degree.

In any mass production job, such as the motor industry is now undertaking in behalf of armament, the incubation or tooling period runs variously from six months to 18 months, depending upon the intricacy of the job and the industry's familiarity with it. Thus, a new car model can be tooled in six months—maybe less; but something like a tank takes nearer a year, airplanes and airplane engines even longer. Once the incubation comes to fruition, however, production rates are little short of spectacular. When this time arrives some months hence on the major share of motor industry war contracts, they will have to be expanded considerably more if production is not to outrun the contracts. However, this danger has been minimized by U. S. entry in the war.

A few more data relating armament production to capacity to produce may paint the picture more clearly at the present moment. Again considering General Motors, which represents about 40 per cent of the automotive industry, and 8 per cent of the total durable goods industries of the U. S., plans call for producing about 700 millions of armament in the current year, which is equivalent to about 25 per cent of total production by GM of finished durable goods during 1941, the latter amounting to better than 2½ billions.

But General Motors, like all other automobile producers, wants more armament business. The figures in October showed GM to have only 4½ per cent of the total military and naval contracts thus far placed. To keep pace with its share of durable goods manufacture, GM figured, it should at least double the amount of such contracts. After all, was it not trimming its passenger car output—the bread and butter of its business—by 54.5 per cent for the 1942 model year?

Shift from a consumer economy to a military economy has serious dislocative effects on all business, a fact all too apparent in Washington today. Plans and more plans have been proffered to aid the small business man in his fight to remain solvent while consumer goods manufacture gives way to guns, tanks and airplanes. In this connection it should be emphasized that the automobile companies, through their operating divisions, have had more experience in subcontracting of manufacture than any industry in the country. For three decades they have bought hundreds of millions of dollars of supplies annually from thousands of small companies throughout the country. They are familiar with all the problems of subcontracting and follow-up. This experience, common to many other large industrial enterprises, ought not to be sacrificed in the present stress.

Urgency To Force Subcontracting

Large companies are proved to be more able at the job of quick and efficient subcontracting than procurement sections of the Army or Navy, or hastily organized subcontracting agencies in the federal government. Already such agencies which have been functioning, have gone through the long process of surveying the field, listing available facilities, interviewing prospective suppliers—and usually placing no business.

Purchasing, scheduling and production control of materials and equipment is a much more complex job than is generally realized. C. E. Wilson, president of General Motors, said recently: "It is only a matter of time until the subcontracts or orders from the primary contractors will be 'fanned out' to the smaller concerns, to the extent that they have organizations and equipment capable of doing part of the job. The magnitude of the task the nation is undertaking is so great that its execution will undoubtedly require the entire productive capacity of the country—men, machines and management alike."

A glance at motor car production achievements in 1941 shows them to have exceeded predictions being made a year ago—and by a wide margin—but not as a result of natural causes but because of artificially

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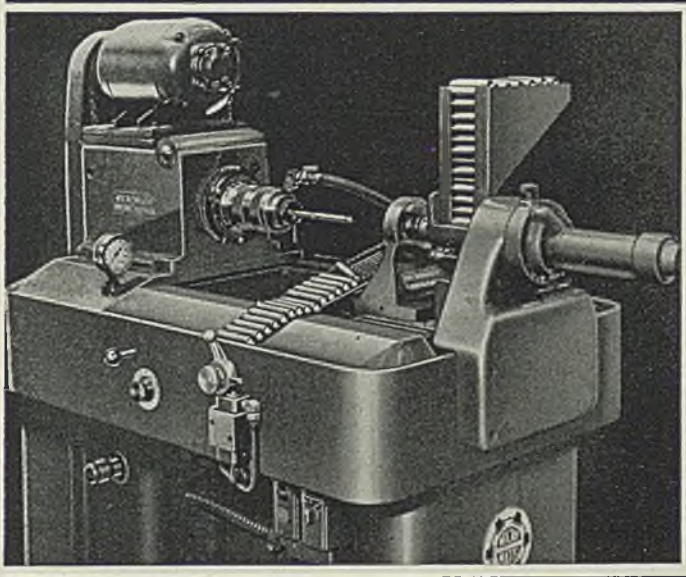

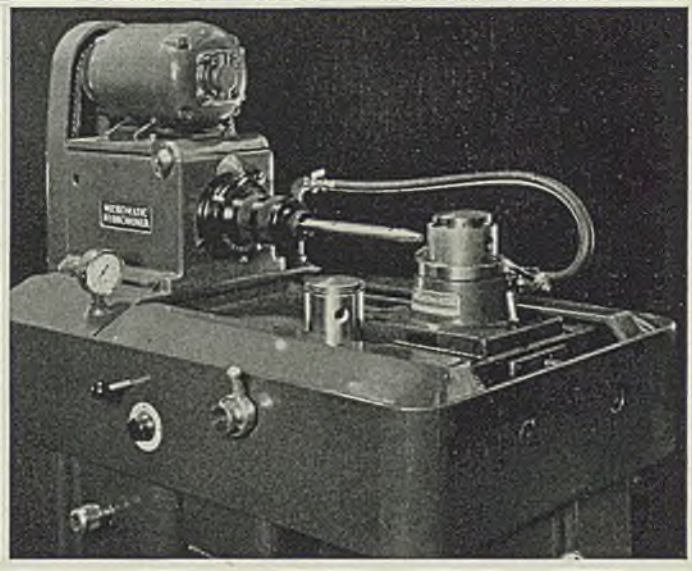

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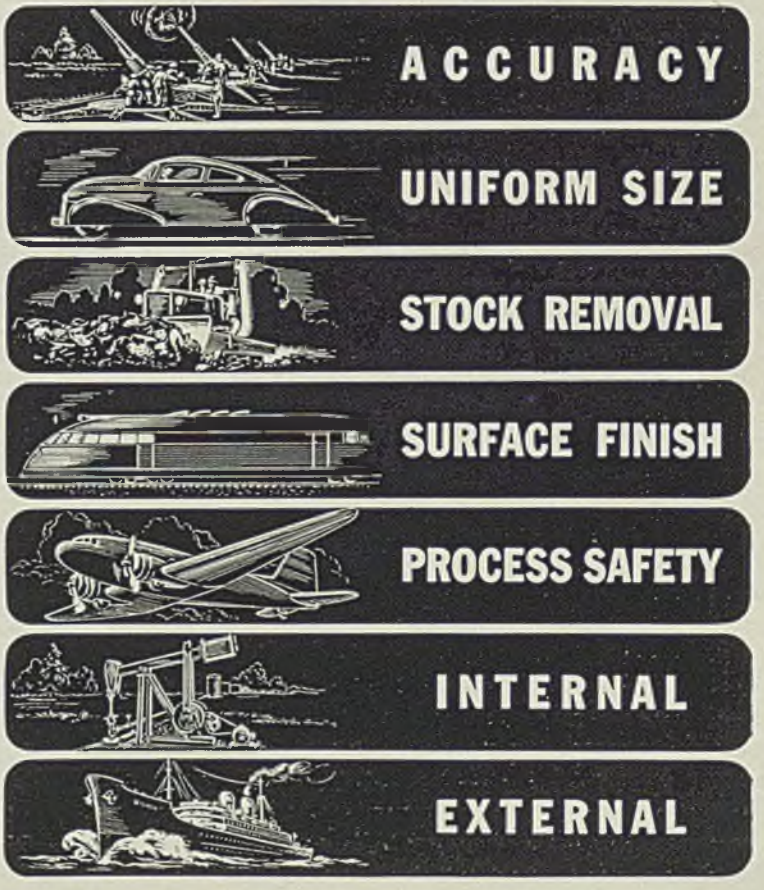
- Instantaneous abrasive expansion only to average rough bore size—by hydraulic pressure control—and thereafter positively restrained against any backlash; followed by—
- A controlled, uniform rate of abrasive expansion feed-out to uniform size and finish—under variable pressure, hydraulically actuated control, synchronized with an adjustable time cycle, and,
- Expansion collapse of the abrasive members always to the same starting diameter—under mechanical control—and automatic compensation for average stone wear.

This equipment, for the first time in honing makes completely automatic operation successful, in high production as shown above left.



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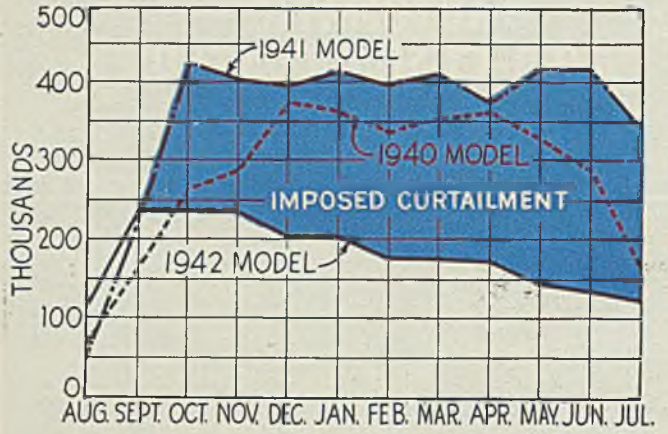
1940 and 1941 Passenger Car Output, vs. Ceilings for 1942 Models*



*Sudden transition to a full war basis in December has lowered these predetermined ceilings for monthly production in 1942—how much remains to be seen.

induced stimulants, powerful but not permanent. Sustained demand for new cars, steady purchasing of new trucks, plus near-peak military demand for trucks, was sufficient to push total output, U. S. and Canada, beyond the five million mark for the third calendar year in automotive history. So, instead of the expected 15 per cent drop for 1941 assemblies, an 8 per cent increase resulted, indicated total for the year being 5,099,408.

This total, incidentally, broke the normal three-year cycle of motor car production which had been a pattern for twenty-odd years, since 1941 was the fourth successive year of a rising level of motor car production.

Not even in the hectic days of 1929 was there the sustained output of automobiles which began in October, 1940, and saw ten straight months in which assemblies were close to or beyond the 500,000 per month mark. Only in April and July did the total drop below the half-million mark and then only by a few thousand.

An accompanying chart compares the output of passenger cars by model years for 1940 and 1941, as well as the projected output of 1942 models according to production ceilings decided upon by the OPM last summer. While allotted production totals are announced on the 15th of the month for the second following month, the announcements so far have coincided closely with the model year schedule drawn up last summer. By July this year it was the intention to have passenger car output curtailed 64 per cent from the rate of July, 1941, and according to conversations among automotive officials, they are expecting to build passenger cars of the 1943 model at a rate only about 25 per cent of the 1942 model production. Following outbreak of war, further sharp reductions in passenger car quotas were ordered, principally to conserve rubber and tin.

Automobile Production by Months

Cars and Trucks, U. S. and Canada

	1929	1937	1939	1940	1941
Jan.....	422,538	399,186	356,962	449,492	524,058
Feb.....	497,705	383,900	317,520	422,225	509,326
March...	626,076	519,022	389,499	440,232	533,849
April....	663,811	553,231	354,266	452,433	489,854
May.....	636,250	540,377	313,248	412,492	545,355
June	567,424	521,153	324,253	362,566	546,278
July.....	518,301	456,909	218,600	246,171	468,895
Aug.	512,842	405,072	103,313	89,866	164,792
Sept.	429,729	175,630	192,679	284,583	248,751
Oct.....	394,540	337,979	324,689	514,374	401,360
Nov.	226,997	376,629	368,541	510,973	356,890*
Dec.....	125,502	347,349	469,118	506,931	310,000*
	5,621,715	5,016,437	3,732,718	4,692,338	5,099,408*

*Preliminary.

Trucks 20 Per Cent of Total Output

Roughly 20 per cent of the combined U. S. and Canadian output for the year constituted trucks and commercial cars, which will not be as sharply affected this year as will passenger cars. At the end of the year, military truck production in the U. S. was averaging 5000 units a week, or about 25 per cent of total nonpassenger car output. Orders on hand are scheduled to be completed by April 15 of this year, and will bring the Army's truck and scout car field force to its authorized strength of 256,000 units. Had not this country become involved in actual war, undoubtedly necessitating a considerable increase in the size of the Army, truck output for this year would have been confined to lease-lend requirements and the replacement and maintenance needs of the Army. However, in December the truck industry was looking for more orders, in view of war conditions and the fact that five months are required between receipt of orders and the start of deliveries.

The call for doubling and trebling production of all the materials necessary to prosecute the war, issued by the President and high OPM officials soon after the attack by Japan, assures truck manufacturers of sustained operations for months or years to come. While the immediate demand is focused on aircraft and ships, additional trucks will be needed not only for the Army but also for transport of vital industrial materials.

Motor vehicle registrations last year topped 33,000,000 and, related to the normal increase in national population, brought the ratio of population to vehicles to less than four for the first time in history. Inclusion of the 500,000 tax-exempt official cars in total registrations brings the ratio even lower than the 3.92 persons per vehicle shown in the following tabulation:

Year	Population United States	Registration All Motor Vehicles	Ratio of Population per Vehicle
1925.....	115,378,000	19,937,274	5.78
1929.....	121,500,000	26,501,443	4.58
1932.....	124,822,000	24,115,129	5.17
1937.....	129,257,000	29,705,220	4.35
1938.....	130,215,000	29,485,680	4.42
1939.....	131,100,000	30,615,087	4.28
1940.....	131,669,275	32,025,365	4.11
1941†.....	132,200,000	33,700,000	3.92

†Estimated.

Problems now facing the motor industry can be summed up in one word—materials. Before the 1942 models even hit the assembly lines, it became apparent that the demands of the armament program

Inland is Building Blast Furnaces To Help Win the War

We're building three huge blast furnaces to help win the war! They are a part of the government's program to provide more pig iron and to help overcome the shortage of steel scrap.

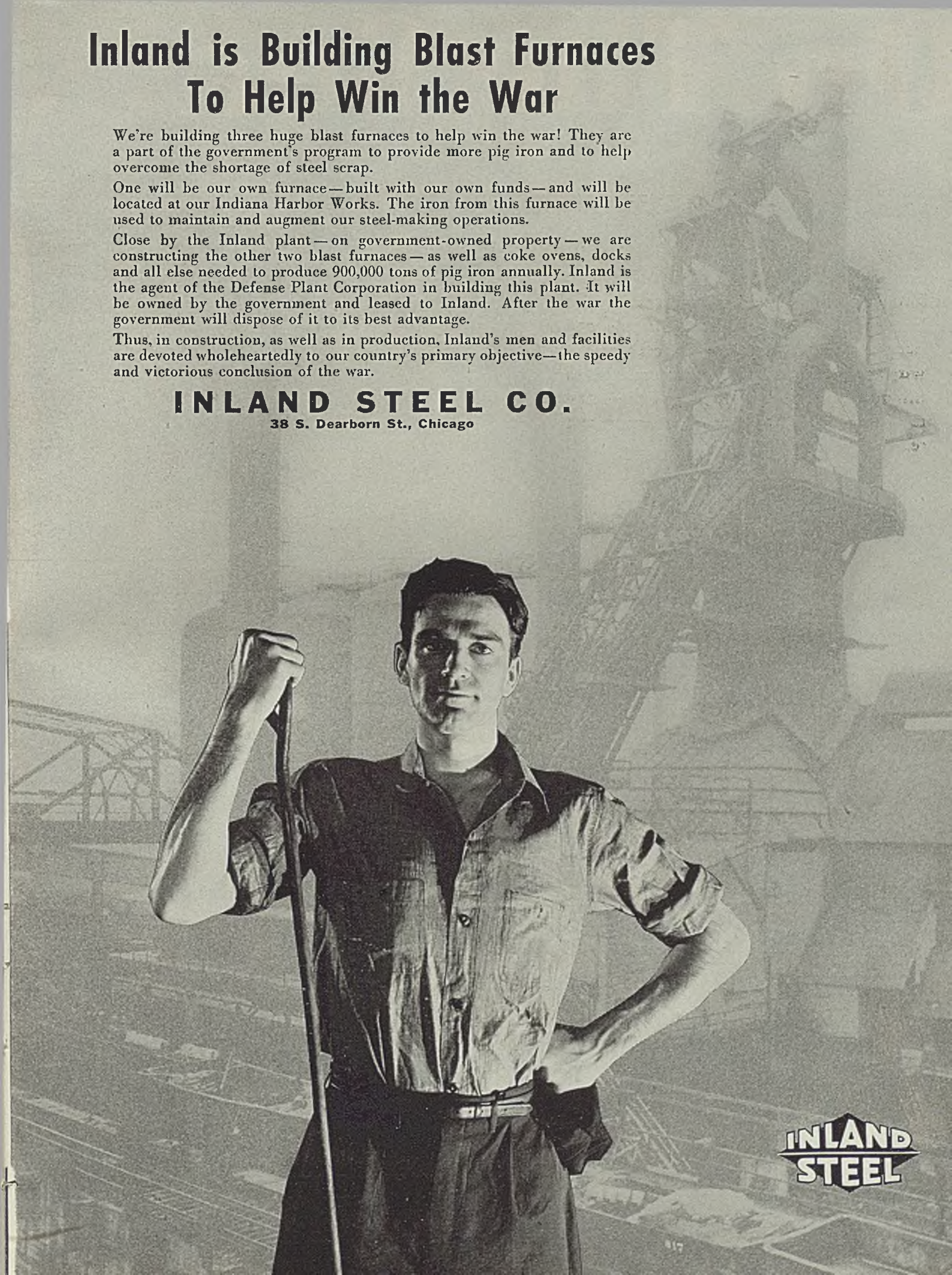
One will be our own furnace—built with our own funds—and will be located at our Indiana Harbor Works. The iron from this furnace will be used to maintain and augment our steel-making operations.

Close by the Inland plant—on government-owned property—we are constructing the other two blast furnaces—as well as coke ovens, docks and all else needed to produce 900,000 tons of pig iron annually. Inland is the agent of the Defense Plant Corporation in building this plant. It will be owned by the government and leased to Inland. After the war the government will dispose of it to its best advantage.

Thus, in construction, as well as in production, Inland's men and facilities are devoted wholeheartedly to our country's primary objective—the speedy and victorious conclusion of the war.

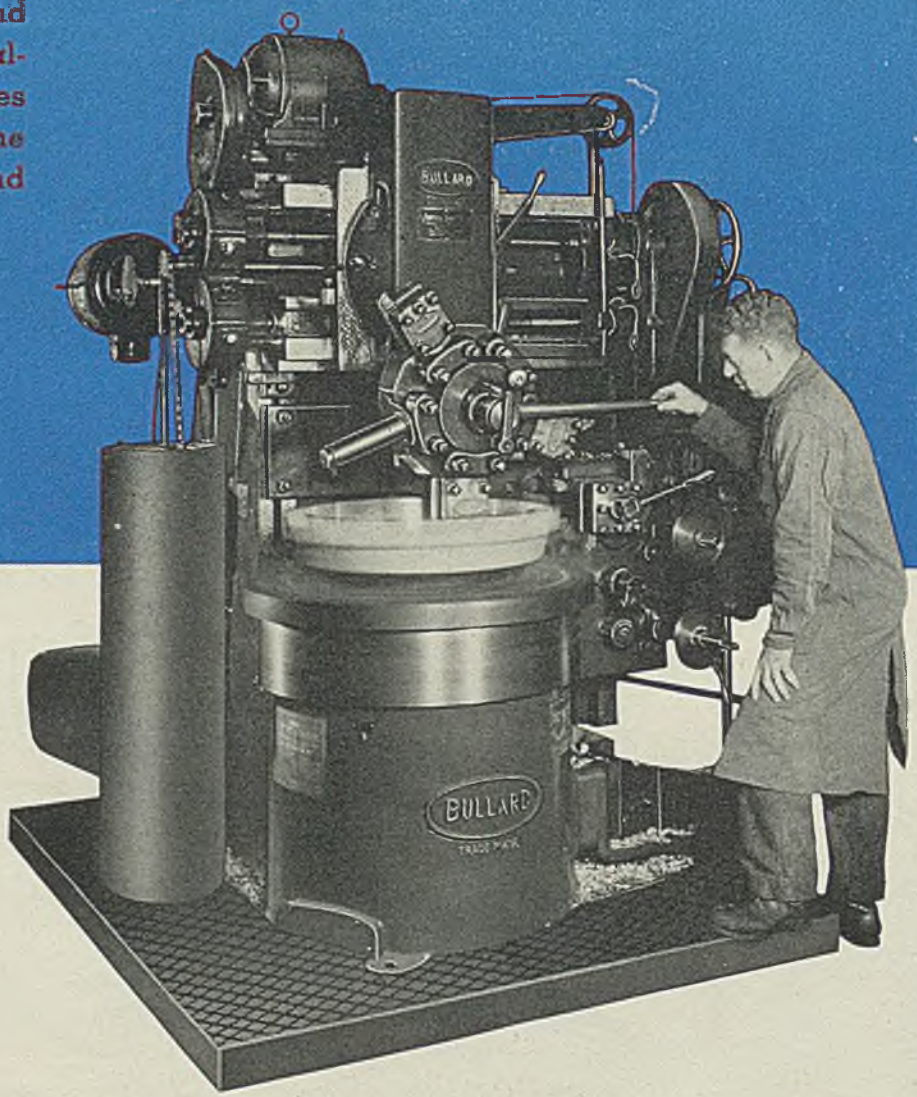
INLAND STEEL CO.

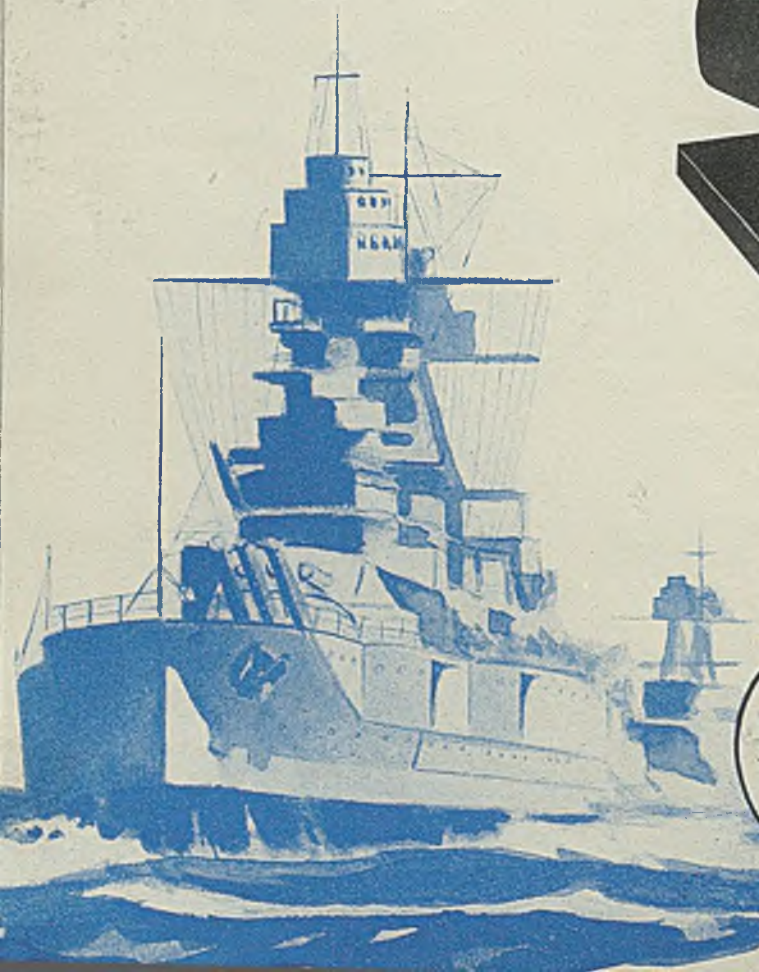
38 S. Dearborn St., Chicago



On The Sea...

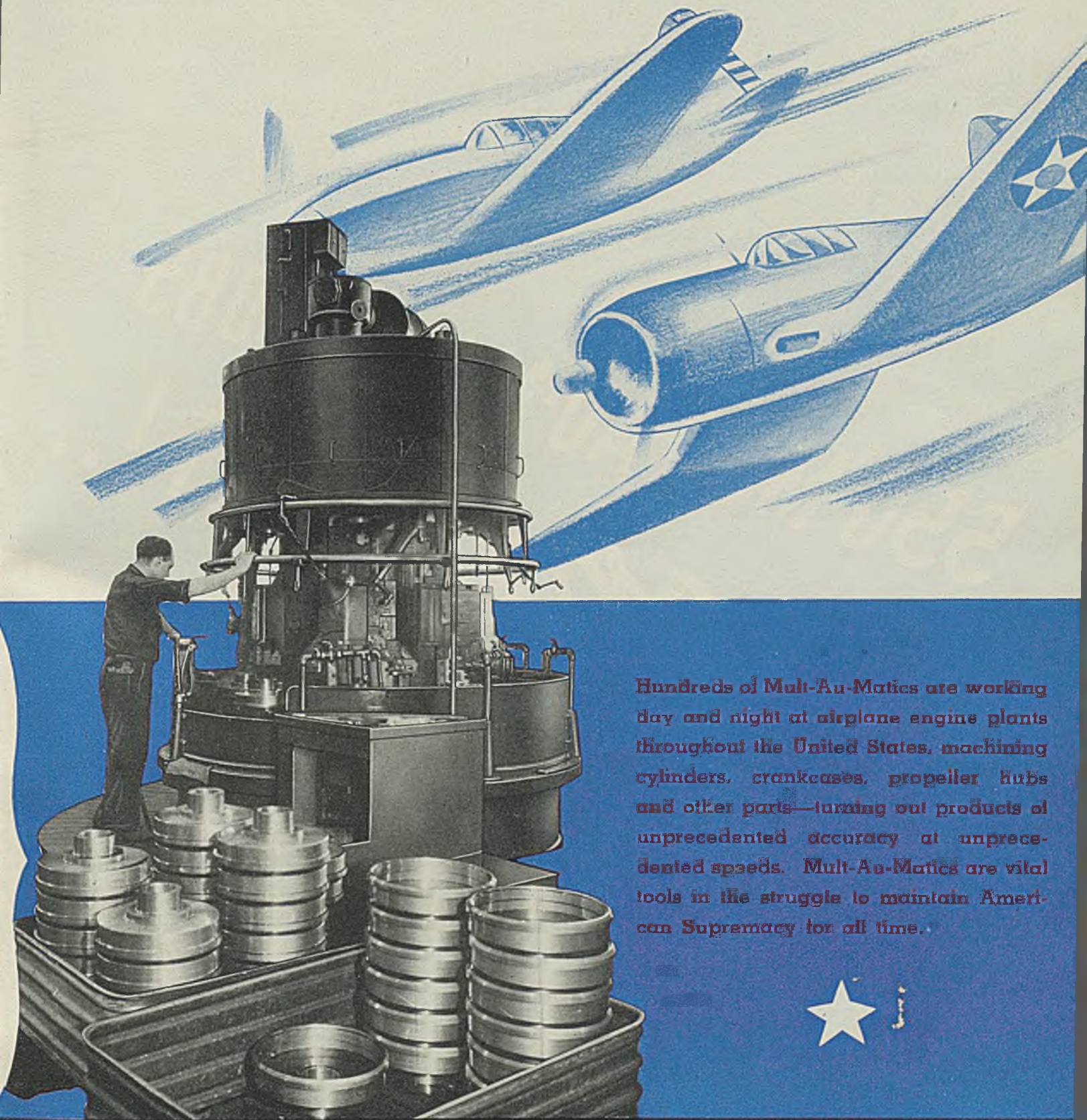
Every shipyard and naval base has its complement of Bullard Vertical Turret Lathes, backing the fleet—machining the hundreds and thousands of intricate and accurate parts that keep our ships always ready for action. Bullard machines always have and always will meet the most exacting standards of accuracy and reliability.





BULLARD

In The Air...



Hundreds of Mult-Au-Matics are working day and night at airplane engine plants throughout the United States, machining cylinders, crankcases, propeller hubs and other parts—turning out products of unprecedented accuracy at unprecedented speeds. Mult-Au-Matics are vital tools in the struggle to maintain American Supremacy for all time.

THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

550 MULT-AU-MATIC JOBS IN *one* PLANT!...

That's the task handled by 108 Mult-Au-Matics in just one huge plant. Each of these machines has five or more jobs assigned to it, and the plant manager tells us that tooling is so flexible that changeover from one job to another on any machine can be accomplished in only three or four hours.

The facts speak for themselves. Mult-Au-Matics and the Mult-Au-Matic method are without a peer in modern production practice.

BULLARD

THE BULLARD COMPANY

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for materials regularly used in automobiles were going to make car manufacture a week-to-week proposition, in spite of the re-engineering of automobiles away from the critical materials like aluminum, magnesium, zinc, nickel, neoprene, etc.

A good start was made on 1942 models, when the order was issued from Washington barring further use of chromium plating after the first of this year, except on bumpers, bumper guards, windshield wipers and one or two other minor parts. This necessitated a changeover in mid-December to what are being called the 1942-B models in which paint and lacquer were substituted for chrome plate.

Causing even more worry was the M-9-c order restricting civilian use of copper. In automobiles, the chief concern was in regard to radiators, which are universally of copper and brass. Experiments have been under way for some months in the use of steel for copper in radiators and while some success has been realized, a changeover will be no simple matter. However, it is expected some time this year.

Aluminum pistons have given way to cast iron and pearlitic malleable iron. Nickel for plating has either been sharply reduced in thickness or dispensed with altogether. Zinc die castings have given way to steel stampings, antimonial lead castings or plastics. Proportion of tin in bearing metals and solders has been cut appreciably.

Possibility of restrictions on manganese content of alloy steels, used extensively in hardened parts, plus the lack of nickel and chromium, have been anticipated by metallurgists in the wider use of Amola steels and perfection of new steels containing less than 1 per cent manganese, molybdenum, silicon and small amounts of deoxidizing and nitrogen-fixing alloys. Introduction of these steels likely will require changes in machining and heat treating procedure, but they will not require the redesign of operating parts to release critical alloys for the "arsenal."

Changes already made in materials for passenger car construction have maintained quality and performance in every respect, but they have contributed to cost increases in no small degree. Not so much from their inherent cost as materials, but because of the added expense of tooling and machining, these alternate (substitute is a bad word) materials increase the cost burden. Further cost increases have resulted from curtailed production, and the likelihood is for even greater boosts on this score.

Many May Be Disemployed

A secondary worry in the motor car outlook is the matter of employment. Conservative estimates indicated that early this year disemployment resulting from automobile curtailment would approach 200,000 in the "primary" producing plants. Add to this further unemployment generated in the thousands of parts suppliers' plants which as yet have not obtained sufficient armament business to offset the loss of automotive business.

Large numbers of auto plant workmen have been and are being transferred to arms plants but even projecting the labor needs of new arms plants to their

■ **Not the least of many factors in automotive productive ingenuity is the ability to schedule parts to arrive at assembly lines simultaneously and in adequate quantities. Assembly, key operation of production, could not go on were even the smallest part not ready at the appointed time and place. Here, at a huge control board Chevrolet superintendents balance and control flow of parts**

date of full-level operations—in many cases this will not be before late this year or early next—it does not appear possible to absorb the disemployed. Doubtless the $150 billion Victory program will alter this outlook, if it can be translated to the contract stage soon enough.

Isolated cases are the exception to this overall picture. At Lansing, Mich., the Oldsmobile Division of General Motors has estimated that, following receipt of orders for 75-millimeter cannon, projectiles and armor piercing shot in December, it would be able to absorb all men laid off because of production curtailment in passenger car output.

Summing up, the outlook for the automobile industry, as such, is a gloomy one for the current year, and probably for several years to come. Production will be scaled down to depression-year depths, prices must be expected to mount, the only change in store for 1943 models is in motor serial numbers, there may be some reduction of numbers and styles of models, deglittering will be carried to further lengths.

These are only natural consequences of an all-out war effort to which the nation's industries are committed, so in that sense, the automotive industry is no worse off than other consumer goods industries. In fact, because of its peculiar talents at planning and executing mass production, because of its intimate knowledge of all the ramifications of subcontracting, purchasing and scheduling, because of its flexible and willing *esprit de corps* in tackling new jobs, the automobile industry may well prove to be the *oomph* which is necessary to make this gigantic war program culminate in success.

Allegheny Ludlum Steel Corporation T-104
Oliver Building, Pittsburgh, Penna.
Send me a copy of the "DBL Blue Data Sheet."

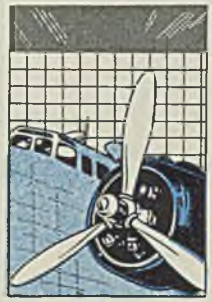
NAME_____

COMPANY_____

ADDRESS_____

ALLEGHENY LUDLUM
STEEL CORPORATION PITTSBURGH, PA.
Tool Steel Division AL *Watervliet, N.Y.*

WING TIPS



Aircraft Builders in Three War Years Acquire Stature of Automobile Industry.

Military Plane Output Totals 20,000 in 1941, May Reach 40,000 This Year.

Efficient Subassembly Subcontracting Essential To Attain Production Goals.

Need for Design Changes Clashes with Urgently Required Mass Manufacture.

■ THROUGH the murk of military censorship it is difficult to discern the proportions of the truly remarkable production job which the nation's aircraft industry has fashioned in the short space of three years. But from what official figures are available and piecemeal reports from a good share of the industry, the broad outlines of the achievement, as well as a suggestion of what the immediate future holds, can be painted.

Output of military planes during the past year ranged between 1000 and 2400 per month, on a steadily increasing scale, bringing the year's total to about 19,800. It is true that a good many of these planes were of the training type—primary, basic and advanced—but by midyear, the pursuits and fighters were rolling in extraordinary numbers, while by fall the medium and heavy bomber plants were adding their share to the grand total.

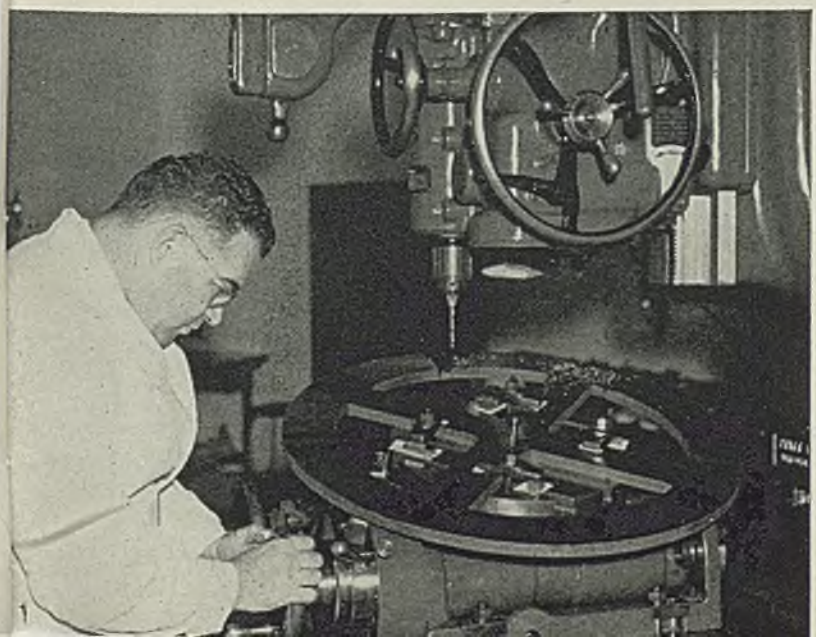
Spokesman for the industry, Col. John H. Jouett, president of the Aeronautical Chamber of Commerce, said in December: "The aircraft manufacturers of the U. S. this year are turning out several thousand more military planes than the most optimistic of government officials dared to hope for 12 months ago when they called upon the industry to speed up its output. Our manufacturers are turning out nearly 20,000 military planes this year. That is more than eight times the production two years ago, in 1939. The dollar volume of more than $1,500,000,000 in production of planes, engines and propellers in 1941 is about triple that of last year.

"The production rate is rising month by month. Our engine plants have now reached a monthly production rate of nearly 6,000,000 horsepower, 12 times the monthly rate at the outbreak of the war in late 1939. Peak production of 15,000,000 horsepower monthly will be reached in 1943."

For detailed substantiation of these figures, the results of a survey made by STEEL and covering something over 40 per cent of the entire industry show the trend. Converting the survey totals to a basis of 100 per cent of the industry, the following figures are obtained:

Production volume	1939	$ 322,004,305
	1940	554,295,132
	1941	1,442,750,000
Backlogs as of Dec. 31, 1941		$5,345,036,917
Present manufacturing floor space, square feet		47,250,500
Employment as of	Dec. 31, 1939	94,260
	Dec. 31, 1940	193,790
	Dec. 31, 1941	408,230
	Dec. 31, 1942 (est)	550,000

Wrapped up in these brief statistics is the simple



■ **Precision machinery and carefully trained operators keynote to aircraft manufacture. This Pratt & Whitney jig borer at the Douglas Aircraft plant is housed in a specially insulated and air conditioned room to avoid the temperature effect on jigs and fixtures which must be finished to microtolerances**

■ Mass delivery flights of Ryan primary training planes to civilian flying schools, with whom the Air Corps has contracted for training aviation cadets. Photo, Aeronautical Chamber of Commerce, Washington

truth that in the space of three years the infant aviation industry, which prior to 1939 contented itself with production of a few hundred planes a year, has assumed the stature of the 30-year old automobile industry, as far as employment, orders and plant space are concerned. Outlook for this year points to production of at least 30,000 military planes, possibly even 40,000, while 1943 should see this boosted still further to better than 50,000 combat airplanes.

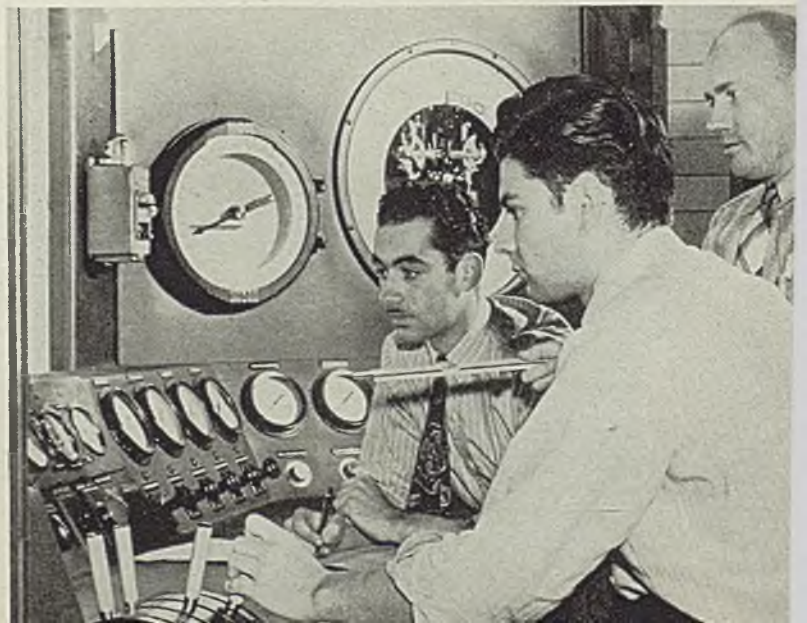
Thus war has done for aviation the equivalent of three decades of manufacturing progress in automobiles. Unhealthy expansion? Yes, but a vitally necessary one, particularly now that the shadow of war has cast itself across this republic. In the transition to such major importance, aviation becomes virtually the No. 1 customer of the metals and metalworking industries.

Looking into the matter of aircraft plant expansion, take a single company and put the spotlight on what has been happening in the past three years. United Aircraft Corp. is a perfect example, because it is an old established company and produces all three elements of modern aircraft—airframes, engines and propellers: Vought-Sikorsky Division the planes, Pratt & Whitney Aircraft the engines, and Hamilton Standard the propellers.

Thirty-odd months ago United began its expansions which, to date, have required total expenditure for plant account of better than $50,000,000 and an increase in employment to about 31,000. Early in 1939 Pratt & Whitney (not to be confused with the machine tool builder of the same name) expanded into the former Hamilton Standard Propellers plant adjacent to its own plant at East Hartford, Conn., thereby adding 100,000 square feet to its existing 400,000 square feet of engine building space. Late the same year work was begun on another plant, covering 300,000 feet, and in June, 1940, two more additions were started to give another 400,000 feet. Still another 400,000 was laid out in August, bringing the original 400,000 to 1,600,000. Corresponding increases in employment naturally were necessary, raising the original 3000 to the present 21,000, and when full production is reached employment will total 25,000. Engine production is now about 1,800,000 horsepower per month (individual engine horsepowers range from 450 to 1850, mostly of the larger sizes now), and is well ahead of schedule.

Pratt & Whitney also has licensed the Ford Motor Co., Jacobs Engine Mfg. Co., Chevrolet Motor Division and Buick Motor Division to build various size radial engines, and these companies have built new plants and are equipping them for production. Ford is already turning out completed engines, while the others will be later this year.

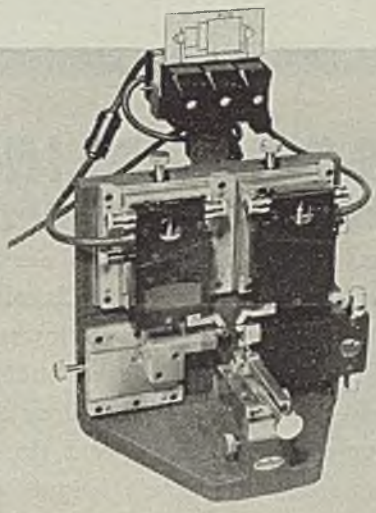
Hamilton Standard likewise began expansion early in 1939 and moved into an old Vought airplane plant, acquiring 50,000 square feet of extra production space. Since then additions have been built to both north and south ends of this plant, increasing original area 50 per cent. Then in October, 1940, 200,000 square feet of floor space was leased at Pawcatuck, Conn., and last year the Nash-Kelvinator Corp. was licensed to produce the Hamilton Standard propeller in a plant of the Reo Motors Co. at Lansing, Mich., which is now nearly equipped. Employment in the Con-



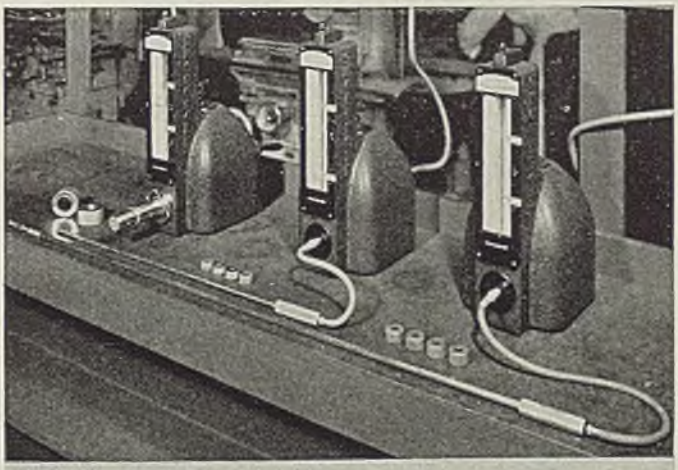
■ In a soundproof test cell adjoining the engine test block, engineers watch carefully the myriad of gages and meters which tell the performance story of the roaring engine in front of them. Controls permit regulation of all engine accessories, as well as fuel, and oil. This view was taken recently in the new manufacturing building erected by Ford Motor for production of Pratt & Whitney 1800-horsepower radial engines

SHEFFIELD PRECISION INSTRUMENTS

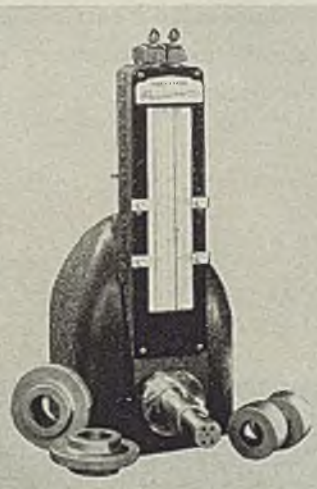
The Visual Gage in magnifications of 10,000, 5000, 2000, 1000 and 500 to one is used for the checking of master and production gages, purchased parts on arrival—also for process and production inspection, laboratory and research work. The Visual Gage checks external and internal dimensions and screw threads.



The Multichek is a combination gage to check simultaneously a number of critical dimensions. It indicates by light signals whether each dimension is within, above or below tolerance limits. A master signal light may be used to integrate all signals for maximum checking speed.



The Precisionaire Model A is a flow type air gage for checking diameter, taper and out-of-round conditions in long and/or small bores such as rifle barrels—also in relatively inaccessible holes which cannot be brought to the gage.

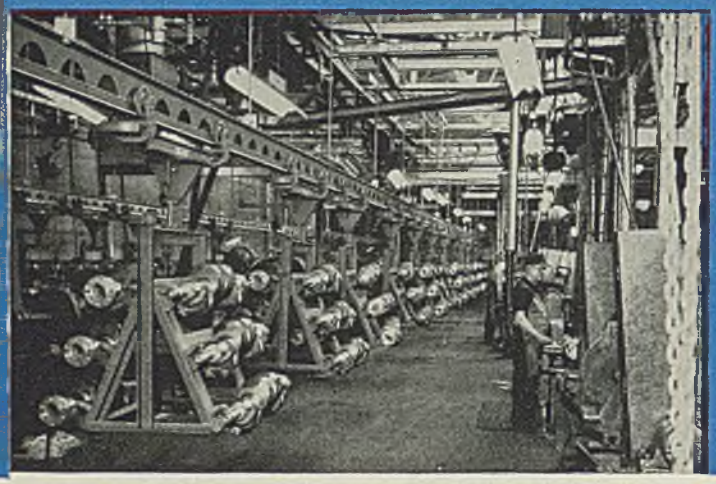


The Precisionaire Model B is similar in construction to Model A except that the work is presented to the gage. Either model may be used to check highly finished work without danger of scratching the finish.

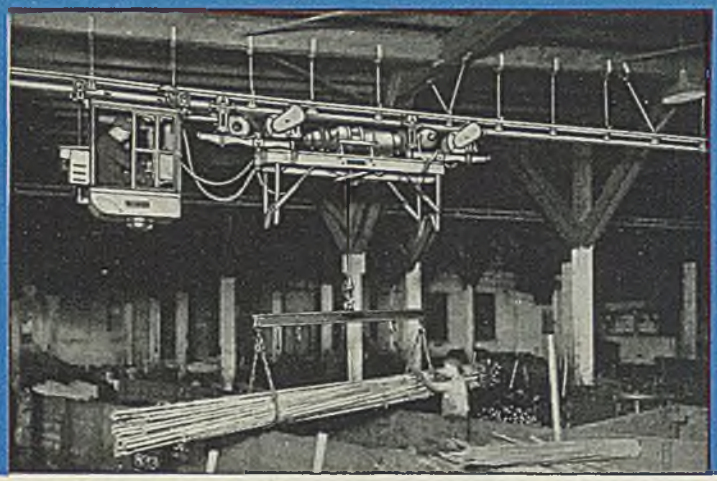
THE SHEFFIELD CORPORATION
Formerly—The Sheffield Gage Corp.
Gage Division · DAYTON, OHIO, U.S.A.

SHEFFIELD MASTER GAGEMAKERS

Here motor shafts are conveyed on hand-pushed carriers to the various machine tools. This system has stepped up production and cut costs. (Photo T-3240.)



handling bar steel and pipe from cars to stock, and from stock to point of work. Busy plants save many hours every day with systems like these. (Photo T-1835.)



MATERIALS HANDLING FOR EVERY INDUSTRY

Plants in nearly every conceivable industry are enjoying numerous advantages possible with Cleveland Tramrail. They are speeding production and lowering costs by eliminating rehandling and providing straight-line production efficiency. They are reducing floor congestion and greatly increasing warehouse and storage capacity. They are lessening workmen's fatigue and promoting safety. In many instances they are eliminating need of plant expansion by installing Cleveland Tramrail.

More than 20,000 installations of Cleveland Tramrail are serving our 4500 customers and earning big dividends for them. Most installations completely paid for themselves within a short period.

Companies engaged in defense work should consider Cleveland Tramrail now. Others without a priority rating should get the booklet described below and plan for the future when equipment can be furnished.

BOOKLET 2004 *"How to Determine Where Overhead Materials Handling Equipment Can Be Used Profitably." Profusely illustrated. Gives clear concise understanding of materials handling. It helps you to determine where and what equipment might be used to speed production and increase profits.*

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
1125 E. 283rd Street, Wickliffe, Ohio

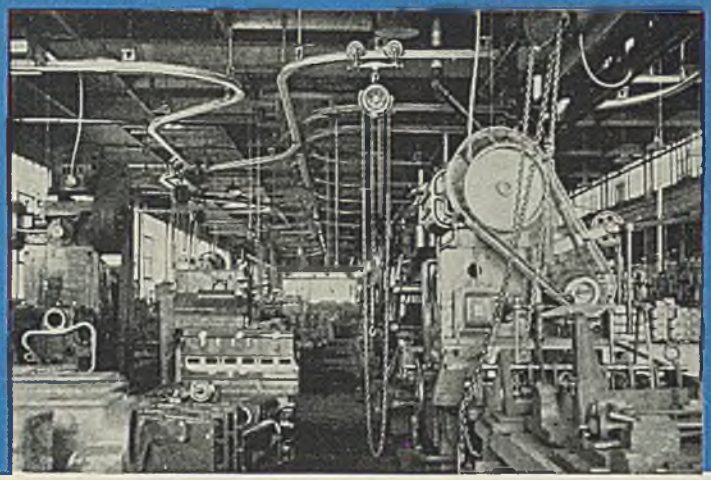
CLEVELAND

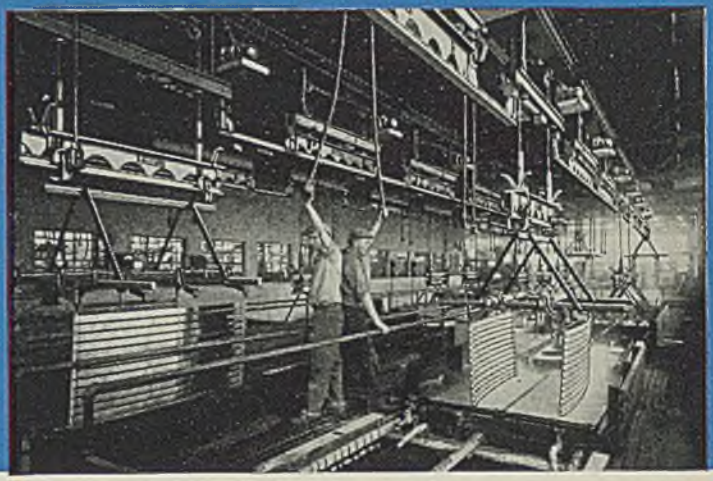
Hand-propelled gantry cranes like th ese are inexpensive and cost practically nothing to maintain. They usually are used to relieve heavy overhead cranes of local handling jobs up to 5 tons. They are especially adaptable to fitting and assembling operations that require crane service for extensive periods. (Photo T-3673.)

Hand-propelled crane with chain hoist. Heavy boxes or unwieldy crates are easily handled by one man. This crane and runway is inexpensive. It usually pays for itself in a very short period. It can be electrified whenever desired. (Photo T-3138.)

system is so laid out that hand-operated hoist carriers can deliver materials from any machine to any other machine. Completely electrified systems like these can also be furnished. (Photo T-3281.)

automobile bumpers. These sections are motor-operated and push-button controlled. They can be arranged as multiple units for progressive processing, or single units for individual operations. (Photo T-2370.)

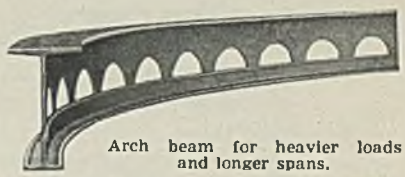




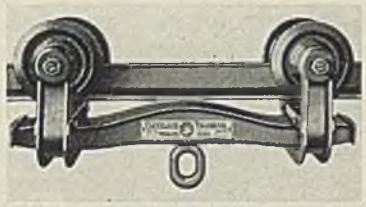
Cleveland Tramrail raised-tread rail for loads to 3 tons.

Standard Items Easily Combined to Handle Materials of Any Kind

Cleveland Tramrail consists of standard items such as rail, switches, carriers, cranes, hoists, grabs, etc., which can be combined in a thousand-fold ways to serve nearly every materials handling requirement up to 5 tons.

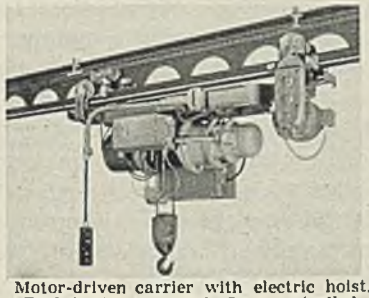


Arch beam for heavier loads and longer spans.



Hand-propelled carrier.

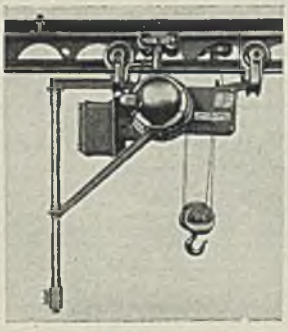
Cab-operated carrier and hoist with motor-driven roll grab.



Motor-driven carrier with electric hoist. Push-button operated, floor controlled.

Hook-On Chain Hoist

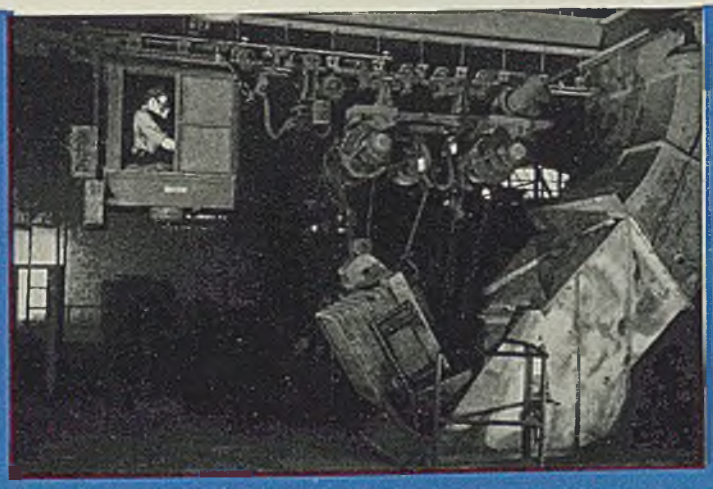
Built-In Chain-Hoist on hand-propelled carrier.



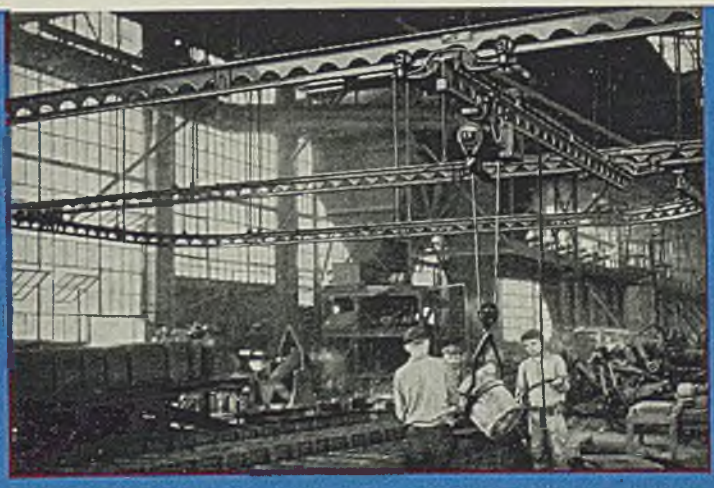
Cable Type Electric Hoist on hand-propelled carrier

Type "H" sliding switch.

TRAMRAIL



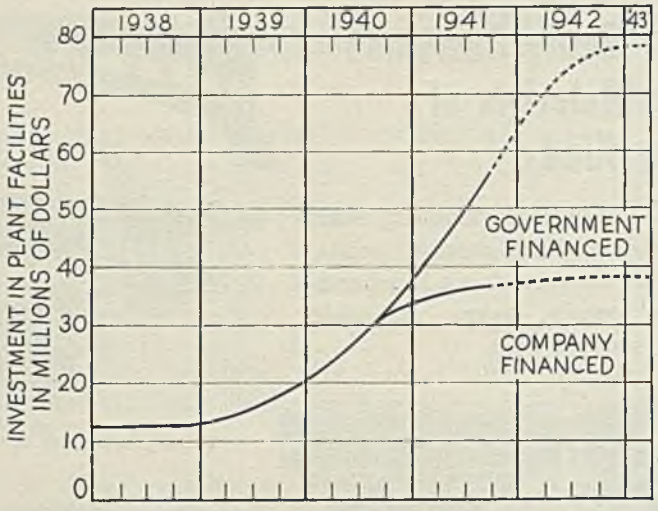
Boxes of materials may be picked up 40 or more feet below this carrier with motor-driven grab. Boxes are emptied by tilting. All operations are handled by the Tramrail operator in the cab. (Photo T-3574.)



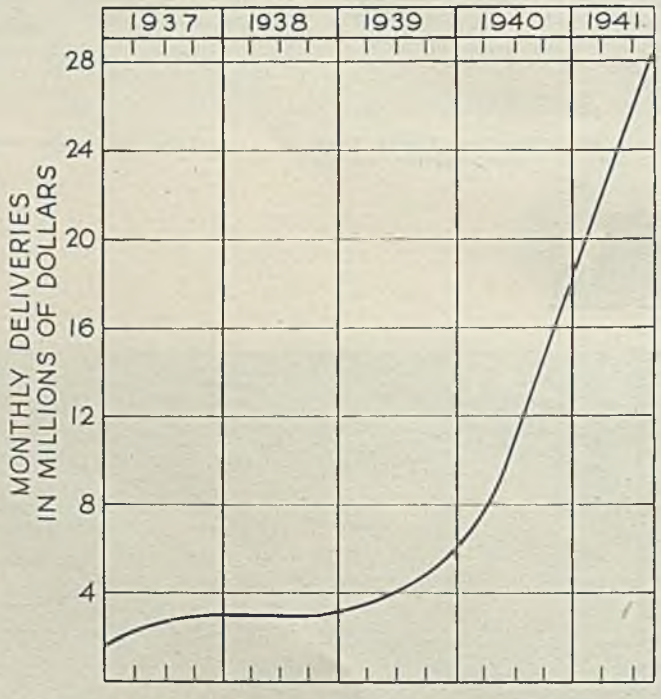
Hot metal is taken directly from the cupola to the pouring floor by this simple system and by means of the transfer bridge complete coverage is obtained without rehandling. Production time is far less. Spilled metal is reduced. Safety is greatly aided. (Photo T-2042.)

necticut propeller plants has been built from 1000 in 1939 to 5000 now, and production of propellers is estimated to be at least ten times the level of the pre-emergency period.

Vought-Sikorsky, builder of scout-bombers, shipboard fighters and observation-scout planes principally for the navy, was organized only in 1939 through consolidation of two separate divisions of United Aircraft and at that time addition of 64,500 square feet of plant space and 4000 feet of engineering space brought existing facilities at Stratford, Conn., to 370,000 feet. Currently another 260,000 feet is under construction, and the original working force of 1400 has been expanded to 5000, with another 1000 scheduled to be added when the present addition is completed. When full production is reached, Vought-Sikorsky expects to be turning out six times the volume of planes being built in 1939.



■ Quarterly increases in investment, United Aircraft Corp., including 1942 projection



■ Quarterly increases in monthly deliveries by United Aircraft Corp., following inauguration of United States defense program. United Aircraft includes Pratt & Whitney Aircraft, Hamilton Standard Propellers, and Vought-Sikorsky Aircraft divisions

Here, then, in United Aircraft a three-fold expansion of floor space and a six-fold expansion of employment have occurred in the short space of less than three years. Accompanying charts show the mounting tide of investment in plant facilities, and the result this investment has produced in terms of monthly deliveries of products.

Surveying the vast acres of his corporation's plants and watching new thousands hurrying to and from their jobs, Eugene E. Wilson, president of United Aircraft, said recently, "It is hard enough to create a product, build and administer an organization, and then expand it beyond normal needs, even in periods of clear thinking. In muddled times, when the fundamental philosophy of freedom is under attack, the difficulties are tremendously increased.

"We are well along toward the solution of the task of expanding output to meet the needs of national defense. This is child's play compared to the task that will confront us when the emergency is over and we start to reorganize for peace. We know from the cruel experience of the last war that no industry profited in the long run, and many industries suffered great losses. Some were deceived by month-to-month earnings at the peak of production, but by the time the contracts were canceled and the whole score was cast up, they were lucky if they conserved their original equities. *The same thing may happen again.*"

Success of the airplane manufacturers in attaining their stated goal of 100,000 combat aircraft in the next two years is contingent upon a number of matters outside the realm of the vast physical plant and working force now being organized. Chief of these is the smooth functioning of subcontracting procedures. By subcontracting is meant the supply of certain subassemblies which are being allocated for production outside the airplane plants themselves. It does not cover the supply of materials, standard parts and accessories, or plant equipment.

Substantial Portion Subcontracted

How much production is being subcontracted? The percentage varies with the manufacturer, but some estimates have been supplied to STEEL by various companies: North American, 35 per cent; Lockheed, 40 per cent; Bell, 33 per cent; Republic, 20 per cent; Glenn Martin, 30 per cent; Vultee, 30 per cent; Fairchild, 10 per cent. Vega reports it is now subcontracting 40 per cent of its volume of manufacture and expects to raise this to 65 by fall of this year.

With a 50 per cent increase in military plane construction likely this year, a total dollar volume of production amounting to approximately $2,500,000,000 is indicated. Assuming 30 per cent of this volume must be subcontracted, a load of three-quarters of a billion dollars on industry must be shouldered.

Summing up this situation, Ralph S. Damon, president of Republic Aviation Corp., Farmingdale, N. Y., emphasizes that the current year "will offer the greatest possible challenge to the American defense effort, for it will be necessary, assuming no radical

change in the international situation, to continue the expansion of our production rates without letup.

"I have no lack of confidence in the capabilities of American industry to meet the schedules, but that will not be enough; we shall be called upon to fill new and greater orders, to improve on existing delivery schedules. To accomplish this, there will not be the time, nor possibly the material, to build more new plants and erect more additions. Rather, we shall have to do the job with the tools and buildings now on hand. This will require development of methods to obtain new levels of efficiency, to bring forward new techniques and to utilize subcontracting and similar devices to a larger extent.

"To a great degree, as 1941 was the year of tremendous physical expansion, 1942 will be a year of expansion in the subcontracting field. The success or failure of the expanded defense effort in 1942 may well lie with success of prime contractors in scheduling work outside their plants and with the success of subcontractors in delivering the goods on time."

Talents of the automobile industry at organizing a mass production task have been enlisted during the past year for all three phases of combat airplane manufacture—engines, propellers and airframes. In fact, half of the present backlog of armament orders in the hands of the motor industry represents orders for aircraft parts.

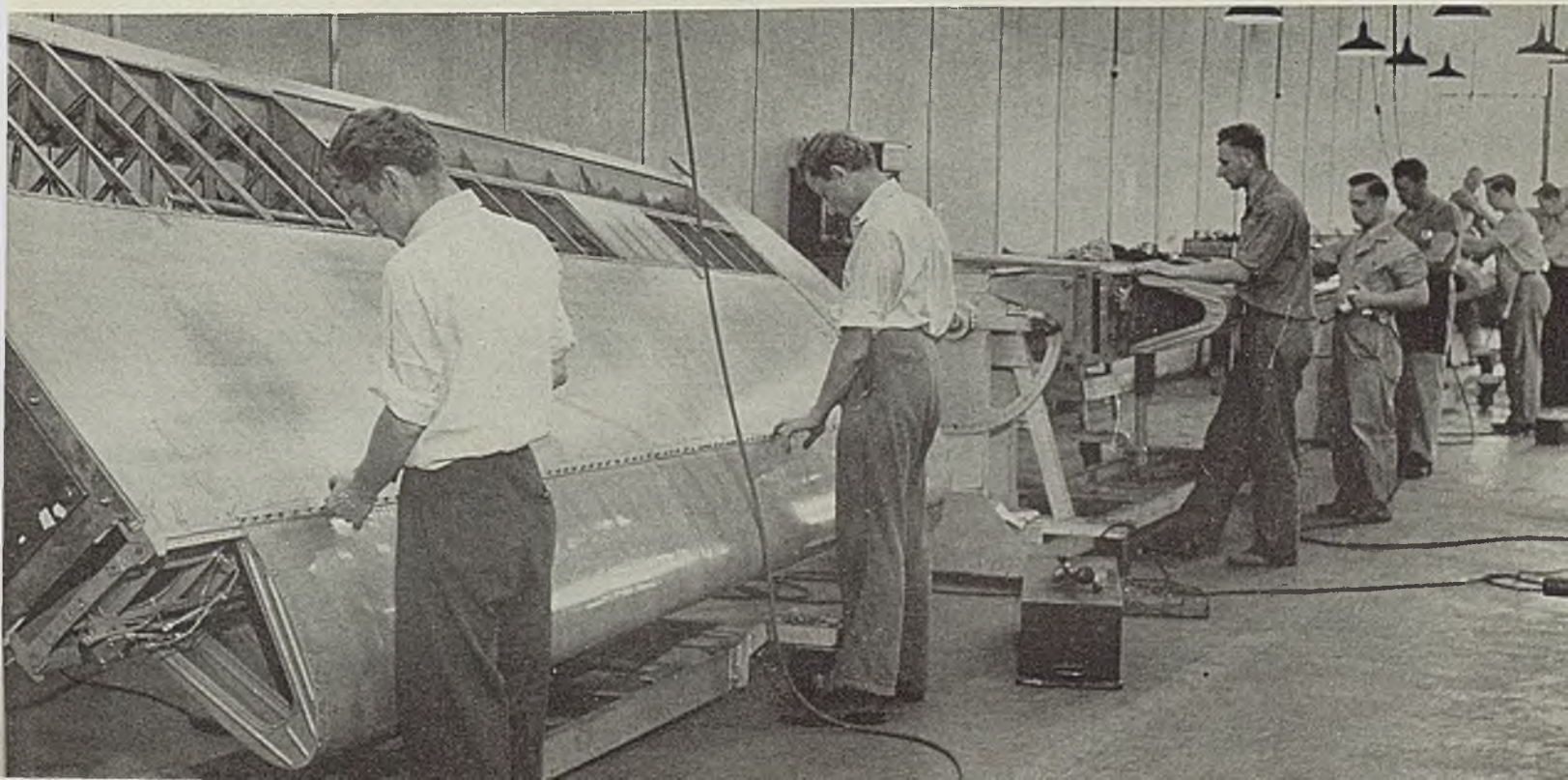
Major part of this contribution is bomber subassemblies being supplied under terms of the so-called Knudsen plan, which called for General Motors to supply North American, Chrysler to supply Martin, and Ford to supply Consolidated, the three aircraft companies building government-financed plants in the southwest for final assembly operations.

One of the drawbacks to earlier functioning of the Knudsen plan has been the large number of changes made in the bombers themselves. Originally the plan called for concentration on two-motor bombers, but this has been modified to shift the emphasis to four-motor bombers such as the Consolidated B-24 which Ford will build at a vast new plant rapidly nearing completion at Ypsilanti, Mich. Both subassemblies and completed planes will be emerging from this plant before many months have passed.

The aviation industry currently is suplying air forces of the U. S., Britain and other anti-Axis governments about 30 different types of combat craft, ranging from trainers to Flying Fortresses. And these planes are anything but "frozen" models. A steady stream of changes is constantly going through the mill, chiefly centered around improving armoring and firepower. Manufacturers themselves, in co-operation with the nerve center of army aviation—Wright Field, Dayton, O.—are experimenting with no less than 40 new models of military aircraft. These are not redesigns of present planes, but entirely new basic concepts.

The matter of design changes makes aircraft manufacture a highly hazardous business these days. On the one hand, the armed forces are clamoring for more and faster production, necessitating the partial freezing of tooling in assembly plants; and on the other hand it is imperative that the planes coming off the lines keep abreast of latest ideas of construction, gleaned from the battle air. If they do not, they are likely to meet "sudden death" at the hands of the enemy. There is great satisfaction, however, in realizing the flexibility and speed of the American industrial machine cannot be matched anywhere in the world. Added to this is the unity of purpose which engulfed the country after the Japanese attack.

■ Leading edges of a Sikorsky plane, containing a mere 11,000 rivets, nuts, bolts and screws, not to mention 1800 other separate parts, here are being fabricated in the new aircraft parts plant of Briggs Mfg. Co. in Detroit, where also in production are bomb bay doors, ducts, gas tank covers, Douglas wings and other parts



Steelworks Expansion

Government Enters Steel Business

♦

Progress Depends on Three Factors

♦

Blown Metal Helps Take Up Slack

♦

Large Building Programs Underway

By JOHN D. KNOX
Steel Plant Editor

UNCLE SAM is now sitting on a swivel chair in the "front office" poring over blue prints, for he is about to try his hand at blowing blast furnaces and putting a polish on the handle of a shovel in the open-hearth shop. Uncle Sam is soon to become the proprietor of iron and steel plants, some of which are taking shape in various districts. Additional ore boats, coke ovens, blast furnaces, open-hearth furnaces, electric furnaces—everything that it takes to get 100,000,000 tons of steel into the ladle and then into war materials will be built. The government has unleashed a program of construction of such unprecedented magnitude as to make world steelmasters look toward our shores in amazement.

Early last year President Roosevelt had Gano Dunn, a distinguished engineer, estimate the steel producing capacity in this country and domestic requirements. Mr. Dunn on Feb. 22, 1941, pointed out that there would be a surplus of 10,100,000 tons of steel in 1941 and a surplus capacity of 2,100,000 tons in 1942.

Shortly thereafter the picture changed. Because of increased requirements brought about by the lease-lend plan and defense expansion, the President asked Mr. Dunn to make further study of the steel industry's ability to supply tonnage for future needs. In his second report of May 22, 1941, Mr. Dunn pointed out that there would be a deficit of 1,400,000 tons of steelmaking capacity in 1941 and of 6,400,000 tons in 1942.

Over in the department of the Office of Production Management letters were typewritten and mailed to various steelmakers inviting them to formulate ways and means for increasing output. In the course of a few weeks 30 companies responded with plans which would increase the country's ingot capacity by some 13,100,000 tons.

After carefully studying a balanced steel plant expansion program, W. A. Hauck, steel consultant, Office of Production Management, recommended to the Supply Priorities and Allocations Board that sufficient ore vessels, by-product coke ovens, blast furnaces, open-hearth furnaces and finishing mills be placed under construction to afford 10,000,000 tons of ingots immediately as well as 5,000,000 additional tons later as the need arises. Mr. Hauck was of the opinion that such a program could be completed in anywhere from 9 months to 2 years.

The Supply Priorities and Allocations Board in Sept. 1941, after studying the Hauck report recommended that steps be taken immediately to expand steelworks capacity 10,000,000 tons. The board estimated that with this added capacity in service, the country would be in a position to turn out 99,000,000 tons of ingots annually.

The proposed expansion in the country's steelmaking capacity has brought out a difference of opinion regarding its need. There are some authorities who hold that present capacity is sufficient. Because of the inadequate supply of iron ore and scrap required for steelmaking, it is felt that an annual output of 85,000,000 tons of ingots during the next year and a half is all that can be expected. However, there are others who believe that 1942 output of basic open-hearth ingots will not exceed 74,000,000 tons. This

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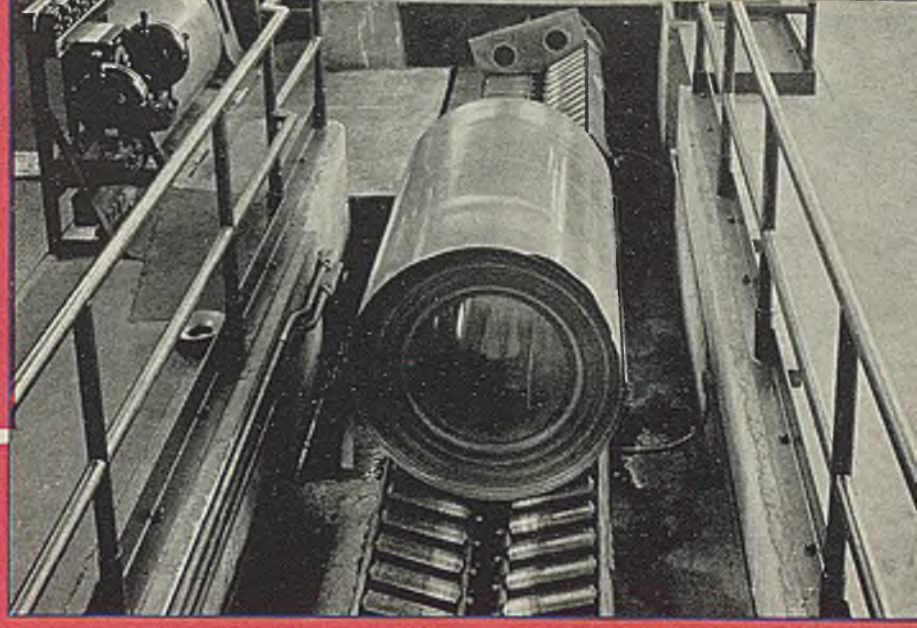

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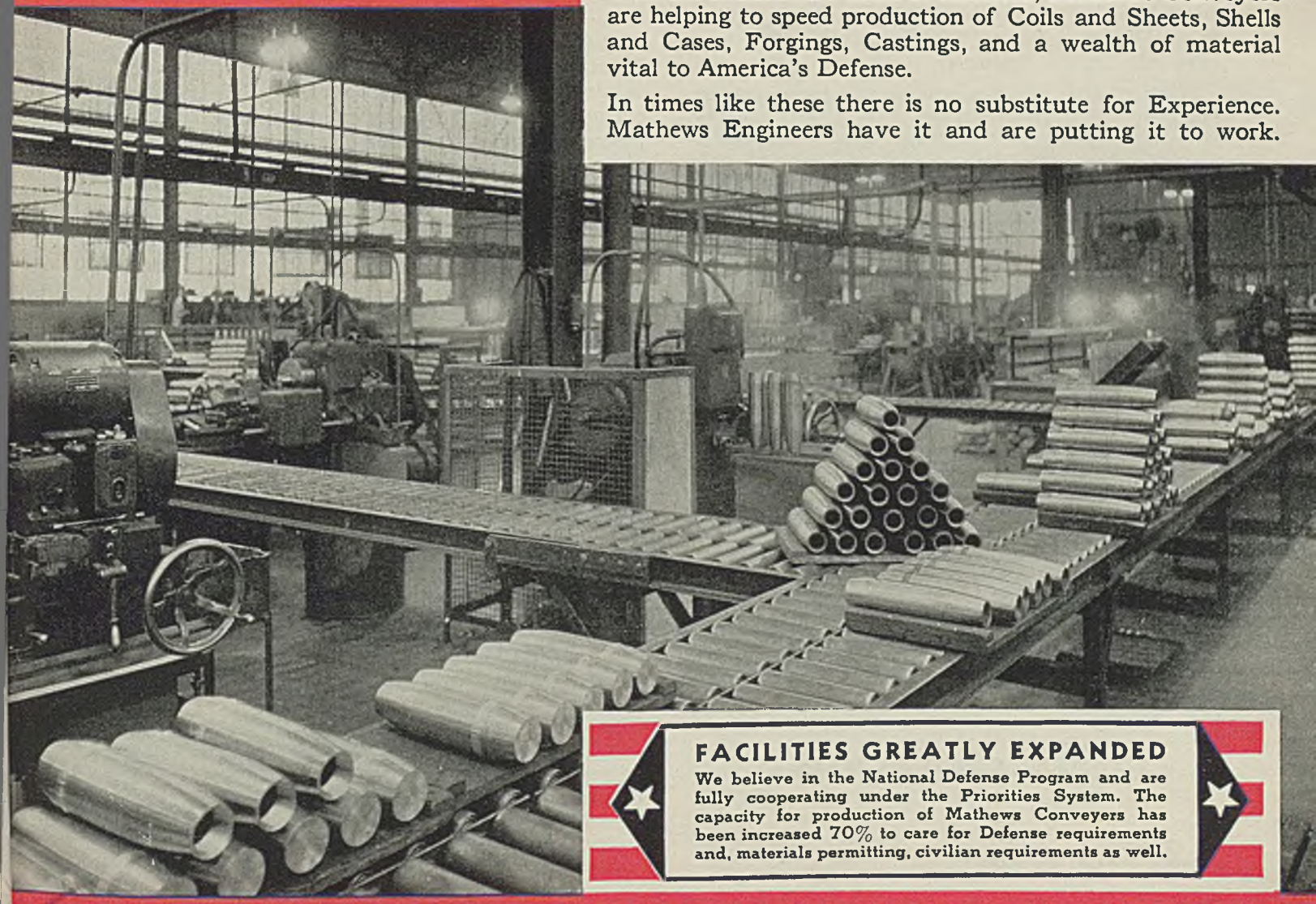


FACILITIES GREATLY EXPANDED

We believe in the National Defense Program and are fully cooperating under the Priorities System. The capacity for production of Mathews Conveyers has been increased 70% to care for Defense requirements and, materials permitting, civilian requirements as well.

MATHEWS CONVEYER COMPANY, ELLWOOD CITY, PENNA.

ENGINEERS AND SALES OFFICES LOCATED IN 18 INDUSTRIAL CENTERS

will be sufficient to satisfy domestic and emergency requirements, according to some, providing government needs are not increased to a large extent. Future circumstances, however, may change the picture.

Three factors are mentioned that may interfere with projects of expansion for the next 18 months or more, namely, the scarcity of purchased scrap and pig iron, insufficient number of ore boats, and the lack of labor with which to operate new plants. Early expectations were that there would be a 4,000,000-ton shortage below the estimated 31,000,000 tons of purchased scrap next year but this shortage is expected to be more like 6,000,000 to 8,000,000 tons, according to one estimate.

Partially offsetting this deficiency in purchased scrap was the 2,000,000 tons of new pig iron capacity brought in last year by the completion of the three new stacks and various stacks which were rebuilt along larger lines. This deficiency will be sliced further by another 2,000,000 tons of iron if all the five large stacks slated for completion this year are placed in blast.

Last July the OPM submitted a proposal to RFC for the construction of new blast furnaces to yield an annual output of 6,500,000 tons of pig iron. This proposal was acted upon favorably.

But in early December, OPM's steel expansion unit reported that its estimate had been revised and that an increase of 15,000,000 tons of pig iron capacity annually would be required by the proposed expansion in steel ingot facilities. To provide this added tonnage calls for the construction of 36 stacks.

Whether any of these stacks can be completed ready for the torch within the next 12 to 15 months is an open question. There are many idle drafting boards which once had blast furnace designers bending over tracings. Today men familiar with this class of designing are at a premium. But granted that conditions in this respect were favorable, there is still another serious problem to be solved—that of blowing equipment.

Last month a new 1200-ton stack was blown in but the management was obliged to use blowers serving a couple of its older stacks because of the scarcity of turboblowers. The 36-furnace expansion will require 108 turbos, allowing one for a spare on each furnace. This quota of blowers is more than a single manufacturer of this equipment can turn out in four years. So that unless the green light and priorities in the A-1 rating are given turbomakers there appears to be some question as to whether many skip cars will be passing one another on the incline of many of the projected stacks until well into 1943.

At present four bessemer vessels are under construction for the production of partially blown metal for the open hearth to fill in the gap because of the shortage of home scrap. This will afford about 2,400,000 tons annually in case sufficient iron is available and the converters are operated continuously. In addition, the OPM has proposed the installation of a vessel at a plant in the Chicago district, which by the utilization of existing facilities including equipment and buildings, will add another 600,000 tons annually.

A few weeks ago many steel makers were concerned about the postwar industrial condition. What will this country do with so many blast furnaces? Will iron be selling below cost? With open-hearth scrap-iron ratios in reverse because of an abundance of scrap how can all the new stacks operate at a profit? These were some of the questions being discussed openly. Today, the thing uppermost in the mind of executives is to meet the need of the hour, namely, push every steelmaking unit to capacity. There is a job to be done and after that, excess capacity will be discussed.

Major improvements at various iron and steel

(*Please turn to Page* 266)

Equipment Completed, Building and Authorized in 1941

By-Product Coke Ovens Completed

Company	Number of ovens	Type of ovens*	Est. annual coking cap., tons
Alabama By-Products Corp., Tarrant, Ala.	25	B	121,500
American Rolling Mill Co., Hamilton, O.	25	B	159,100
Bethlehem Steel Co., Bethlehem, Pa.	102[1]	B	448,000
Bethlehem Steel Co., Lackawanna, N. Y.	76	W	.....
Bethlehem Steel Co., Sparrows Point, Md.	61	B	384,000
Carnegie-Illinois Steel Corp., Gary, Ind.	142[2]	B	948,500
Citizens Gas & Coke Utility, Indianapolis	41	B	352,800
Connecticut Coke Co., New Haven, Conn.	9	B	53,800
du Pont de Nemours, Inc., E. I., Morgantown, W. Va.	37	W	181,300
Portland Gas & Coke Co., Portland, Oreg.	4	Kn	24,100
Socony-Vacuum Oil Co., E. St. Louis, Ill.	2	Kn	12,050
Tennessee Coal, Iron & Railroad Co., Fairfield, Ala.	73	B	427,780
Total	353		1,706,430

*B, Becker; Kn, Knowles; W, Wilputte. [1] Replaces 106 Koppers type ovens; not included in total. [2] Replaces 280 Koppers type ovens; not included in total.

By-Product Coke Ovens Building

Company	Number of ovens	Type of ovens*	Est. annual coking cap., tons
Bethlehem Steel Co., Bethlehem, Pa.	102[1]	B	453,390
Bethlehem Steel Co., Lackawanna, N. Y. Bethlehem Steel Co., Sparrows Point, Md. Bethlehem Steel Co., Steelton, Pa.	180		1,194,000†
Carnegie-Illinois Steel Corp., Gary, Ind.	70[3]†		360,000
du Pont de Nemours, Inc., E. I., Morgantown, W. Va.	37	W	181,300
Inland Steel Co., Indiana Harbor, Ind.	150		990,000
Monessen Coke & Chemical Co., Monessen, Pa.	74	B	464,720
Philadelphia Electric Co., Chester, Pa.	25[2]	B	111,250
Republic Steel Corp., Cleveland	150	B	990,000
Republic Steel Corp., Gadsden, Ala.	65	W	328,450
Republic Steel Corp., Warren, O.	61	W	308,250
Semet-Solvay Co., Ironton, Pa.	76	W	372,400
Tennessee Products Corp., Chattanooga, Tenn.	20	W	117,200
Weirton Steel Co., Weirton, W. Va.	45	B	290,250
Total	858		5,236,570

*B, Becker; W, Wilputte. †Authorized by DPS. [1] Replaces 106 Koppers type ovens. Not included in total. [2]Replaces 25 Roberts-Morrissey type ovens. Not included in total. [3] Rebuilding for annual capacity of 360,000 net tons. Not included in total.

Blast Furnaces Completed

Blast Furnaces Completed

Company	Number furnaces	—Capacity, tons— Daily	Annual
Bethlehem Steel Co., Lackawanna, N. Y.	1	1200	414,000
Bethlehem Steel Co., Sparrows Point, Md.	1	1200	414,000
Carnegie-Illinois Steel Corp., Braddock, Pa.	1*	1000	345,000
Great Lakes Steel Corp., Detroit	1†	1200	.....
Total	2		818,000

*Replaces obsolete stack.
†This stack replaces 550-ton stack.

Equipment Completed, Building and Authorized in 1941 (Continued)

Blast Furnaces Building and Authorized

Company	No. of Stacks Building	No. of Stacks Authorized	Capacity, Tons Daily	Capacity, Tons Annual
American Rolling Mill Co., Ashland, Ky.	1	..	1200	414,000
Bethlehem Steel Co., Bethlehem, Pa.	..	1	1200	414,000
Bethlehem Steel Co., Lackawanna, N. Y.	..	1	1200	414,000
Bethlehem Steel Co., Sparrows Point, Md.	..	1	1200	414,000
Carnegie-Illinois Steel Corp., Braddock, Pa.	..	2	1200	818,000
Carnegie-Illinois Steel Corp., Gary, Ind.	1	..	1300	448,500
Colorado Fuel & Iron Corp., Pueblo, Colo.	1	..	750	258,750
Columbia Steel Co., Provo, Utah	..	2	1100	759,000
Inland Steel Co., Indiana Harbor, Ind.	1	1	1200	828,000
Republic Steel Corp., Gadsen, Ala.	..	1	800	276,000
Republic Steel Corp., Cleveland	..	2	1275	879,750
Republic Steel Corp., Youngstown, O.	..	1	1200	414,000
Sheffield Steel Corp. of Texas, Houston, Tex.	..	1	700	245,000
Tennessee Coal, Iron & Railroad Co., Ensley, Ala	1	..	850	293,250
Weirton Steel Co., Weirton, W. Va.	1	..	850	293,250
Total, building	6	..		2,121,750
Total, authorized	..	14		5,047,750

*Replacement.

Blast Furnaces Remodeled

Company	Identification
Alan Wood Steel Co., Conshohocken, Pa.	No. 3
American Rolling Mill Co., Hamilton, O.	No. 2
American Steel & Wire Co., Donora, Pa.	No. 1
Bethlehem Steel Co., Bethlehem, Pa.	"A"*
Bethlehem Steel Co., Steelton, Pa.	"E"*
Carnegie-Illinois Steel Corp., Clairton, Pa.	No. 3
Carnegie-Illinois Steel Co., Duquesne, Pa.	No. 4*
Carnegie-Illinois Steel Co., Rankin, Pa.	No. 3*
Hanna Furnace Corp., Buffalo, N. Y.	No. 1*
Koppers Co., Granite City, Ill.	No. 2
National Tube Co., Lorain, O.	No. 3*
National Tube Co., McKeesport, Pa.	No. 3
Otis Steel Co., Cleveland	No. 1
Republic Steel Corp., Youngstown, O.	No. 4
Wisconsin Steel Co., S. Chicago, Ill.	No. 2
Tennessee Coal, Iron & Railroad Co., Holt, Ala.	Tuscaloosa
Tennessee Coal, Iron & Railroad Co., Ensley, Ala.	No. 2
Youngstown Sheet & Tube Co., Campbell, O.	No. 3*
Total	18

*Enlarged .

Open-Hearth Furnaces Completed

Company	Number Furnaces	Capacity, tons—Daily	Capacity, tons—Annual
Bethlehem Steel Co., Bethlehem, Pa.	2	175	240,000
Bethlehem Steel Co., Sparrows Point, Md.	3	175	360,000
Midvale Co., Nicetown, Philadelphia	2	90	65,000
Wisconsin Steel Co., S. Chicago, Ill.	2	150	160,000
Worth Steel Co., Claymont, Del.	1	100	84,000
Total	10		909,000

Open-Hearth Furnaces Building and Authorized

Company	No. of furnaces Building	No. of furnaces Authorized	Capacity, tons Daily	Capacity, tons Annual
Bethlehem Steel Co., Sparrows Point, Md.	..	2	150	180,000
Carnegie-Illinois Steel Corp., Gary, Ind.	..	1	...	300,000
Carnegie-Illinois Steel Corp., Homestead, Pa.	12	..	...	1,700,000
Columbia Steel Co., Pittsburg, Calif.	..	1	100	77,000
Columbia Steel Co., Provo, Utah	..	7	100	550,000
Granite City Steel Co., Granite City, Ill.	..	4	..	300,000
Laclede Steel Co., Alton, Ill.	1*	..	150	....
Scullin Steel Co., St. Louis	..	1	50	40,000
Sheffield Steel Corp. of Texas, Houston, Tex.	3	2	100	385,000
Sheffield Steel Corp., Kansas City, Mo.	1	..	100	77,000
Total building	16	..		1,977,000
Total authorized	..	20		1,601,000

*Replaces 60-ton furnace.

Electric Furnaces Building and Completed

Company	—Number— Building	—Number— Completed	Capacity, tons
Allegheny Ludlum Steel Corp., Brackenridge, Pa.	..	2	35
American Rolling Mill Co., Middletown, O.	3	..	6
Byers Co., A. M., Ambridge, Pa.	..	1	15
Carnegie-Illinois Steel Corp., Duquesne, Pa.	2	..	35
Carnegie-Illinois Steel Corp., S. Chicago, Ill.	..	1	30
Carnegie-Illinois Steel Corp., S. Chicago, Ill.	..	1	70
Columbia Steel Co., Pittsburg, Calif.	..	1	10
Conners Steel Co., Birmingham, Ala.	1	..	6
Copperweld Steel Co., Warren, O.	2	..	40
Copperweld Steel Co., Warren, O.	..	1	50
Copperweld Steel Co., Warren, O.	..	1	11
Copperweld Steel Co., Warren, O.	..	2	7
Ford Motor Co., Dearborn, Mich.	1	..	12
Midvale Co., Nicetown, Philadelphia	..	1	15
Northwestern Steel & Wire Co., Sterling, Ill.	1	..	10
Republic Steel Corp., Canton, O.	..	3	50
Rustless Iron & Steel Co., Baltimore	..	1	25
Sharon Steel Corp., Lowellville, O.	..	1	20
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.	..	1	5
Texas Steel Co., Fort Worth, Tex.	1	..	5
Timken Steel & Tube Co., Canton, O.	..	1*	25
Total	11	17	

*Replacement.

Bessemer Converters Building

Company	Number vessels	Capacity, tons—Rated	Capacity, tons—Annual
American Rolling Mill Co., Ashland, Ky.	1	25	600,000
Carnegie-Illinois Steel Corp., Braddock, Pa.	2	25	1,200,000
Great Lakes Steel Corp., Detroit	1	25	600,000
Inland Steel Co., Indiana Harbor, Ind.	1*	25	600,000
Total	4		2,400,000

*Recommended by OPM.

Rolling Mills Completed

Company	No. mills	Type mills
Allegheny Ludlum Steel Corp., Leechburg, Pa.	1	25" cold strip
Allegheny Ludlum Steel Corp., Brackenridge, Pa.	1	42" cold strip
American Rolling Mill Co., Ashland, Ky.	1*	68" 4-h cold strip
American Rolling Mill Co., Middletown, O.	1	54" cold strip
American Steel & Wire Co., Cleveland	1	28" 4-h cold strip
American Steel & Wire Co., Joliet, Ill.	1	10" 5-st. rod
American Steel & Wire Co., Worcester, Mass.	7	4½" cold strip
American Steel & Wire Co., Worcester, Mass.	1	8½" 4-h cold strip
Bopp Steel Corp., Detroit	1	24" cold strip
Carnegie-Illinois Steel Corp., Homestead, Pa.	1[1]	plate
Carnegie-Illinois Steel Corp., Irvin, Pa.	1	42" 5-st. cold tin
Chace & Co., W. M., Detroit	1	24" cold strip
Copperweld Steel Co., Warren, O.	1	12" merchant
Empire Sheet & Tin Plate Co., Mansfield, O.	1[2]	3-h roughing
Follansbee Steel Corp., Follansbee, W. Va.	2	34" cold strip
Follansbee Steel Corp., Follansbee, W. Va.	1	42" 4-h temper
Granite City Steel Co., Granite City, Ill.	1*	90" 4-h hot strip
Great Lakes Steel Corp., Detroit	1	cold strip
Heller Bros. Co., Newark, N. J.	1	10" merchant
Hind Steel Co., Inc., Union, N. J.	1	16" 4-h cold strip
Hind Steel Co., Inc., Union, N. J.	2	7" 3-h cold strip
Hind Steel Co., Inc., Union, N. J.	6	8" 2-h cold strip
Jessup Steel Co., Washington, Pa.	1	84" plate
Laclede Steel Co., Alton, Ill.	1*	12" 2-h hot strip
Laclede Steel Co., Alton, Ill.	1[2]	35" blooming
Republic Steel Corp., Cleveland	1	54" 4-h cold strip
Republic Steel Corp., Monroe, Mich.	1	4-h skin pass
Republic Steel Corp., Warren, O.	1	20" 2-h skin pass
Republic Steel Corp., Warren, O.	1[2]	22" 4-h cold strip
Reynolds Alloys Co., Lister, Ala.	1	84" 2-h temper
Reynolds Alloys Co., Lister, Ala.	1	110" 2-h temper
Reynolds Alloys Co., Lister, Ala.	1	112" 4-h cold strip
Rochester Products, Rochester, N. Y.	1	4" cold strip
Sharon Steel Corp., Sharon, Pa.	1	33" 4-h cold strip
Superior Steel Corp., Carnegie, Pa.	1	14" cold strip
Tennessee Coal, Iron & Railroad Co., Fairfield, Ala.	1	140" 4-h plate
Thomas Steel Co., Warren, O.	1	10" 4-h cold strip
United States Mint, Philadelphia	1	cold strip
Wallace Barnes Co., Bristol, Conn.	1	8½" cold strip
Wallace Barnes Co., Bristol, Conn.	1	2½" cold strip
Wallingford Steel Co., Wallingford, Conn.	1	10" 4-h cold strip
Weirton Steel Co., Weirton, W. Va.	6[2]	66" 4-h hot strip
Western Electric Co., Chicago	1	22" 4-h cold strip
Total	48	

[1] Widened from 100 to 120 inches. [2] Six stands rebuilt for strip or structural shape production. [3] Replacement. *Single stand; not included in total.

Rolling Mills Building

Company	No. mills	Type mills
American Rolling Mill Co., Butler, Pa.	1	45" 4-h. cold strip
American Steel & Wire Co., Worcester, Mass.	5	4½" cold strip
American Steel & Wire Co., Worcester, Mass.	4	8" cold strip
Bethlehem Steel Co., Steelton, Pa.	1	20" merchant
Bethlehem Steel Co., Sparrows Point, Md.	1*	132" plate
Carnegie-Illinois Steel Corp., Homestead, Pa.	1	slabbing
Carnegie-Illinois Steel Corp., Homestead, Pa.	1	132" plate
Columbia Steel Co., Pittsburg, Calif.	1	rod
Columbia Steel Co., Provo, Utah	1*	blooming
Columbia Steel Co., Provo, Utah	1*	120" plate
Great Lakes Steel Corp., Detroit	1	24" 2-h. cold strip
Sheffield Steel Corp. of Texas, Houston, Tex.	1	14" merchant
Sheffield Steel Corp. of Texas, Houston, Tex.	1	48" structural
Sheffield Steel Corp. of Texas, Houston, Tex.	1	112" plate
Sheffield Steel Corp. of Texas, Houston, Tex.	1	84" jump
Sheffield Steel Corp. of Texas, Houston, Tex.	1	plate
Western Electric Co., Chicago	1	24" 2-h. cold strip
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.	1	12" 2-h. cold strip
Youngstown Sheet & Tube Co., Campbell, O.	1	24"
Total	23	

*Authorized; not included in total.

Steelworks Expansion

(*Continued from Page 264*)

plants, both completed and building in 1941, follow:

REPUBLIC STEEL CORP.

Completed

Youngstown District: Refinements to electric weld tube mills, new railroad equipment, enlarged soaking pits, new skelp pickler, improved No. 4 blast furnace.

Warren District: Strip-tin plate continuous annealer, continuous pickler, 3-stand tandem cold strip, 2 tin pots at Niles works.

Central District: Light armor platemaking facilities at Massillon, 2 electric furnaces at No. 2 shop, 2 of 5 electric furnaces installed in No. 3 shop at Canton, open-hearth ladle crane, opened strip coal mine.

Buffalo District: New boiler plant, new electric switchgear equipment, enlarged open hearths, diesel yard locomotive.

Chicago District: Skull cracker, alloy steel annealing facilities, wire mill warehouse facilities.

Cleveland District: Increased plate capacity, enlarged 2 open hearths, bonderizing equipment at Monroe works, strip annealing building, warehouse and shipping building, 54" cold strip mill.

Birmingham District: Air conditioned one blast furnace, completed first step of ore concentration plant, coal mining equipment, new boiler and equipment.

Gadsden District: Enlarged 2 open hearths and ingot stripping facilities, stripper crane, rolling equipment for shell steel, increased soaking pit capacity.

Adirondack District: Deepened No. 1 shaft at Chateaugay mine, improved mining methods there and Port Henry mines, new shaft at Mineville, additional concentrating equipment.

Northern Coal Mines: Combination cleaning and assorting plant, additional mining equipment.

Steel & Tubes Division: Building and equipment for processing stainless and aircraft alloy tubing, electric tube testing equipment, pickling plant.

Union Drawn Steel Division: Extensions to Chicago plant.

Bolt and Nut Division: Building for increased production at Upson plant.

Niles Steel Products: Lithographing installation.

Truscon Steel Co: Wire mesh machinery and new building.

Underway

Youngstown District: New 1200-ton blast furnace.

Warren District: 61 by-product ovens, tin plate temper mill, increasing annealing facilities.

Central District: 3 electric furnaces for 216,000 tons annual capacity, facilities for making molybdic oxide.

Chicago District: New soaking pits.

Cleveland District: Two 1275-ton blast furnaces, 150 by-product ovens, ore yard, unloading docks, boiler plants.

Birmingham District: Equipping Sayre coal mine to produce 420,000 tons annually, increasing concentrating facilities.

Gadsden District: 800-ton blast furnace, 65 by-product coke ovens, boiler plant.

Adirondack District: Fisher Hill mine opened, new concentrating plant.

Northern Coal Mines: Clyde mine production increased.

Union Drawn Steel Division: Stock handling buildings.

BETHLEHEM STEEL CO.

Completed

Bethlehem Plant: Coke quenching station, alloy billet preparation and bar finishing equipment, forging-finishing equipment for shells and hardened steel rolls, facilities for making aircraft cylinder sleeves, 34 by-product storage tanks, eight diesel locomotives, six loco. and crawler cranes, 27 transfer cars.

Steelton Plant: Pig casting machine, diesel locomotive, diesel loco. crane, 17 wire drawing blocks, 3 patenting furnaces, 5 wire stranding machines.

Lebanon Plant: Additional equipment for making bolts, nuts, rivets and spikes; facilities for heat treating alloy steel bars.

Sparrows Point Plant: Two 4-hole soaking pits, building and equipment for finishing, painting and shipping pickled plates; finishing and testing equipment for buttweld pipe, warehouse for pipe; 8 wire straightening and cutting machines, 18 continuous wire drawing machines, flash baker and rod storage room; 130 railroad cars and 3 diesel locomotives.

Lackawanna Plant: New ore bridge, 50 ingot buggies, two 4-hole soaking pits; bloom and slab handling machinery; four controlled cooling pits, extension to cold mill annealing building and 8 coil-type annealing furnaces; extension to iron foundry and machine shop; 2 diesel loco. cranes, 3 diesel-electric locomotives, fuel oil storage tank, 2 lake cargo vessels.

Underway

Bethlehem Plant: 3-story office building, 1 gas-driven blowing engine, slag preparation station, 250 gondolas and 30 insulated railroad cars, 1-strand addition to sintering plant, 3-bay extension to open-hearth building, 20 charging box cars, 2 slow-cooling furnaces, shear and billet transfer, bar turning machines, new annealing building, forging machine and equipment for aircraft cylinder sleeves, 2 heavy-duty lathes and 1 planer, structural beam straightening machine, facilities for producing tees by slitting beams.

Sparrows Point Plant: Industrial fresh water supply, larry scale car, stock yard extension, 50 charging box cars, car repair shop extension, maintenance repair shop, 100 gondolas, storehouse.

Lackawanna Plant: By-product recovery facilities, 14 by-product storage tanks, coke conveyor and storage bin, turboblower, additional power facilities, light scrap baling facilities, physical laboratory extension.

Johnstown Plant: Tar distillation unit, 50 coke rack cars, 4 twin-pot cinder and 2 hot metal cars, car dumper, turbogenerator, motor drive for 36" plate mill finishing stands, hot metal crane, wheel turning lathe, six flash bakers, die machine shop building.

JONES & LAUGHLIN STEEL CORP.

Completed

Aliquippa Works: Air conditioned one blast furnace, improved sinter and ore handling facilities, repair stand for bessemer converter, one 5-hole soaking pit, tin plate capacity increased, 13 continuous wire drawing machines.

Pittsburgh Works: New pyridine and phenol producing equipment, air conditioned two blast furnaces, improvements to handling larger open-hearth heats, two 5-hole soaking pits, billet surface conditioning machine, six strip annealing furnaces, increased 54" cold mill capacity, additional heat treating and shipping facilities at polishing mill.

Miscellaneous: 30 steel coal barges and 15 steel barges; mine cars and locomotives, haulage and electrical equipment for Vesta Coal division; extension to buildings at Muncy wire rope plant; steel drum making facilities at Port Arthur, Tex. division; drum making line and warehouse at Bayonne, N. J. plant.

WEIRTON STEEL CO.

Completed

Steelworks: Spectographic machine, 60 x 50' extension to welding shop.

Strip Steel Dept.: Revamped 16-inch mill to roll structural shapes. Installed a 17-roll leveler.

Weirton Coal Co.: Reconditioning 135 beehive coke ovens at Isabella mine.

Underway

Steelworks: Unloading facilities for fuel oil, dolomite charging machine, 10 welded steel barges, roll grinder, air compressor, changes to open-hearth and blooming mill departments for shell steel production.

Tin Mill: Heavy-duty lathe, tin machine roll grinder, new 36" electrolytic tin coating line for strip.

Strip Steel Dept.: Equipment for firing 10" hot mill furnaces with coke oven gas and auxiliary oil firing, 3 gas-purifying tanks at 48" mill, air cleaners for tandem mill motors, air compressor, new piping and burners for Nos. 3 and 4 hot mill furnaces, roll turning lathe.

GREAT LAKES STEEL CORP.

Completed

Installed bar straightening machine, 2 oil-electric locomotives, dolomite charging machine at No. 1 open-hearth shop, one 4-hole soaking pit, pickling facilities for alloy steel, system for reclaiming slushing oil at cold mills, new sintering plant, three 110-ton mixer ladles, slag shovel.

Underway

Plate finishing equipment for 350,000 tons annually, stocking and charging equipment for open-hearth shop, rebuilding No. 2 pickling line, new ore bridge, additional by-product equipment, air-conditioning "B" blast furnace.

AMERICAN ROLLING MILL CO.

Completed

Middletown Works: Additional annealing furnaces, combination coil warehouse and shearing building, new pickler and roll shops, soaking pit, enlargement of mold yard and water purification plant.

Hamilton Works: Ore storage yard enlarged, new turboblower. Pipe line from coke ovens to Middletown plant under construction.

Ashland Works: Jobbing mill widened.

FOLLANSBEE STEEL CORP.

Completed

Follansbee Works: Additional cutting line, three gas-fired bell-type annealing furnaces, machine for painting roll roofing.

Toronto Works: Three electric annealing furnaces for silicon sheets, three cold billet saws, painting machine for electrical sheets, sand blasting machine, changes in bar mill to roll up to 4 x 4-inch or equivalent sectional area.

Underway

Follansbee Works: Semicontinuous pickler for cleaning coiled stock.

Toronto Works: Electrolytic cladding plant for copper and nonferrous cladding of steel.

Miscellaneous: Equipment changes and improvements at Follansbee and Toronto Works involving expenditure of $100,000.

ALLEGHENY LUDLUM STEEL CORP.

Completed

Expansion of bar mills at Watervliet and Dunkirk plants, and wire departments and lamination division, additions to finishing equipment at all plants.

Underway

One 12,000-pound forging hammer, new laboratory equipment and a billet and alloy steel plant for DPC.

INLAND STEEL CO.

Completed

New ladle crane and charging crane at No. 1 open hearth. Four diesel locomotives.

Underway

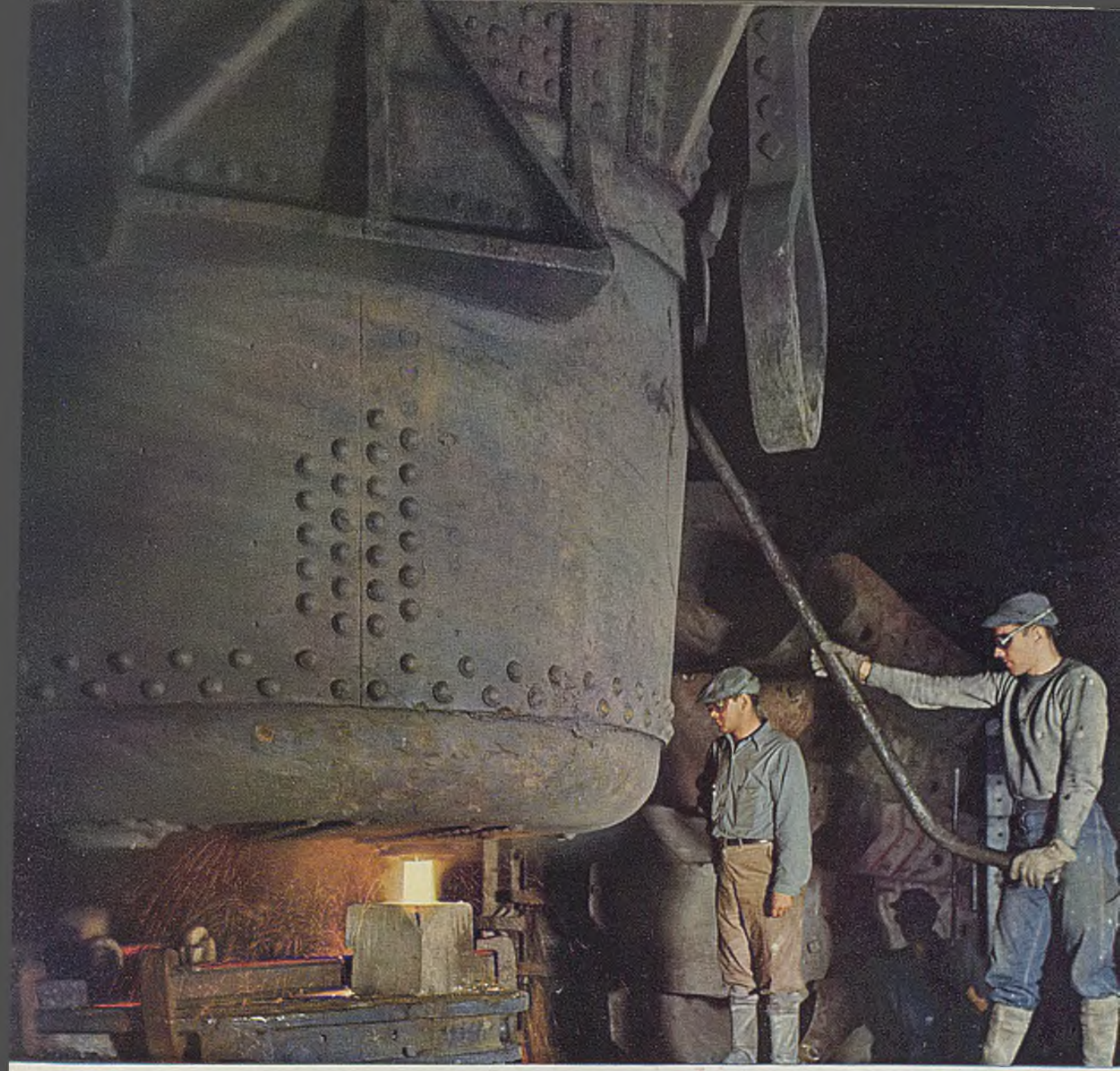
Air conditioning one blast furnace, additions to power plant for new turboblower, installing plate mill finishing facilities.

HENRY DISSTON & SONS, INC.

Completed: New roads, two scales and improved scrap handling facilities, new ladle heaters and improved facilities for pouring, 25-ton crane in melting department, 2 oil-fired annealing furnaces changed to electric, hot saw at 12-inch bar mill, heating furnaces in 18-inch bar mill converted to oil-fired units, boiler house and three 85,000-pound per hour boilers.

Underway: Improved shipping facilities, sheet and plate leveling equipment, improved handling facilities in sheet trimming department, demolition of oil

(*Please turn to Page 425*)



Kodachrome of Pouring at Hubbard Division

MEN, MORE THAN MACHINES

Men, more than machines are responsible for Continental's continued leadership and pioneering achievements in rolls, castings and heavy equipment.

Men whose experience, skill and craftsmanship have pioneered and perfected equipment for the steel industry are contributing their share for National Defense. Their contribution is production of castings, rolls for strip, bar, billet, blooming and merchant mills and of vital parts and machinery for Defense on land, sea and in the air.

Men of Continental are proud of the part they are playing. They are contributing their energy, skill and experience to develop new strength for our American Defense with Steel.

While National Defense has first call on Continental, our engineers are eager to cooperate with you on any problem concerning steel mill equipment.

Continental operates four plants, strategically located at East Chicago, Indiana, Coraopolis, Pennsylvania and Wheeling, West Virginia.

CONTINENTAL ROLL & STEEL FOUNDRY COMPANY

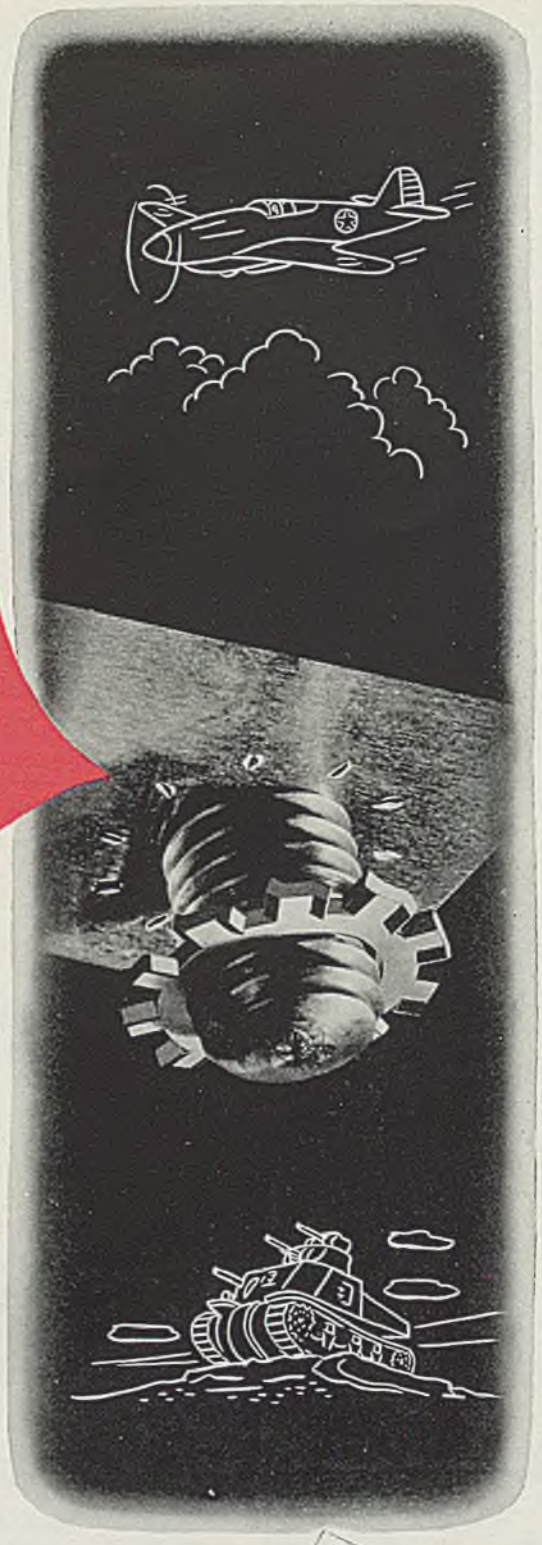
CHICAGO PITTSBURGH

The Lockwasher that

DIGS IN

for the

DURATION



In this great battle for production, work is being screwed and bolted together with every hope of *staying* . . . But hope is not enough. *Enlist EverLOCK Washers to dig in EDGEWISE and stay braced*—secure against strain, vibration, expansion and contraction "for the duration"—as long as needed!

Notice the chisel edges of the EverLOCK Washer tongues, which flex under pressure and (in the size shown) dig twenty 3/32" grooves into the nut and work. As a manufacturing policy this is just as sound for vacuum cleaners as planes, or tanks. Loss of good-will to a manufacturer is as fatal as loss of a wing to an aviator. Remember, the soldier who *intends to stay shows it* by DIGGING IN.

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A copy of this handy catalog is ready for every man in your shop or office who specifies nuts, screws and bolts. He should know the safest washer for each. Write for it. State how many.

THOMPSON-BREMER & CO., 1644 W. HUBBARD ST., CHICAGO, ILL.

Raw Materials . . .

Production and Consumption in 1941 Increase to Record Levels.

Great Lakes Ore Shipments at New Peak, Total 80,116,360 Tons.

Diminishing Scrap Supplies Threaten Curtailed Steel Operations.

New Coke Facilities, Ore Fleet Expansion To Increase Capacity.

■ PRODUCTION of raw materials last year was at an all-time high, as steel mill operations increased to and sustained near-capacity rates. Ample supplies were available most of the year, although brief periods of coke shortage were occasioned by the coal strikes and lack of scrap late in the year caused a decrease in steel production in several districts. Settlement of the mine situation early in December promises to ameliorate the coal and coke problem, but scrap scarcity is growing more serious.

Vessel shipments of Lake Superior iron ore totaled 80,116,360 gross tons, a new peak, and more than 25 per cent above shipments totaling 63,712,982 tons in 1940. Previous records were set in 1929, with 65,195,595 tons, and in 1916 with combined movement of 64,734,198 tons. Estimated all-rail shipments for the year were 1,000,000 tons, against 550,000 in 1940.

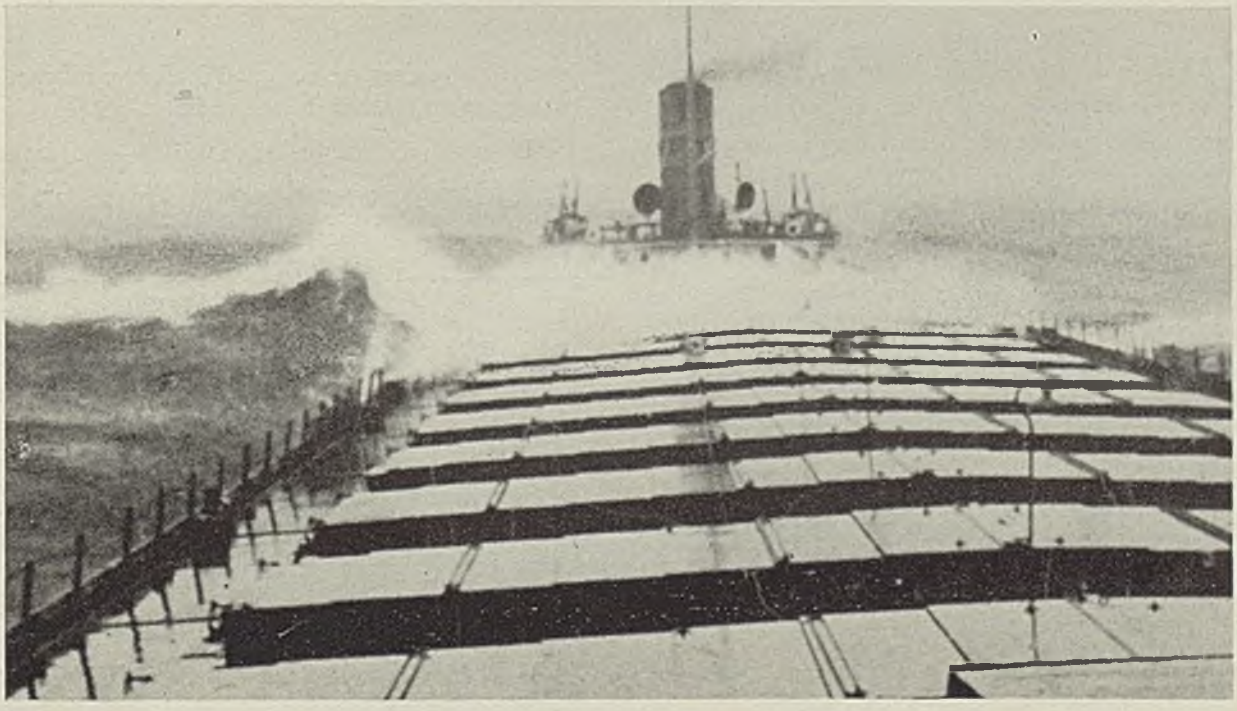
Stocks on hand at lower lake furnaces and docks Dec. 1 were approximately 43,800,000 tons, against 41,711,705 tons Dec. 1, 1940, and 40,732,096 tons a year earlier. Anticipated carryover May 1, assuming operations continue at current levels, and ore consumption remains at the rate of more than 6,000,000 tons a month, will be about 15,000,000 tons. This will be somewhat lower than the carryover on May 1, 1941, when stocks on hand totaled 16,937,173 tons, will be substantially below normal stocks, and compares with 18,106,151 tons at lower lake docks and furnaces when the shipping season opened in 1940.

Consumption of iron ore in 1941, also a new record, was approximately 75,000,000 tons, up about 20 per cent from 62,500,000 tons in 1940, and substantially above the previous high of 1929 when 63,645,000 tons was consumed.

The shipping season opened early last year, 280 of 291 lake ore vessels commissioned and in operation by April 15. From May 15 through Nov. 15 the ore fleet operated at 100 per cent of capacity, and several ves-

(*Please turn to Page* 367)

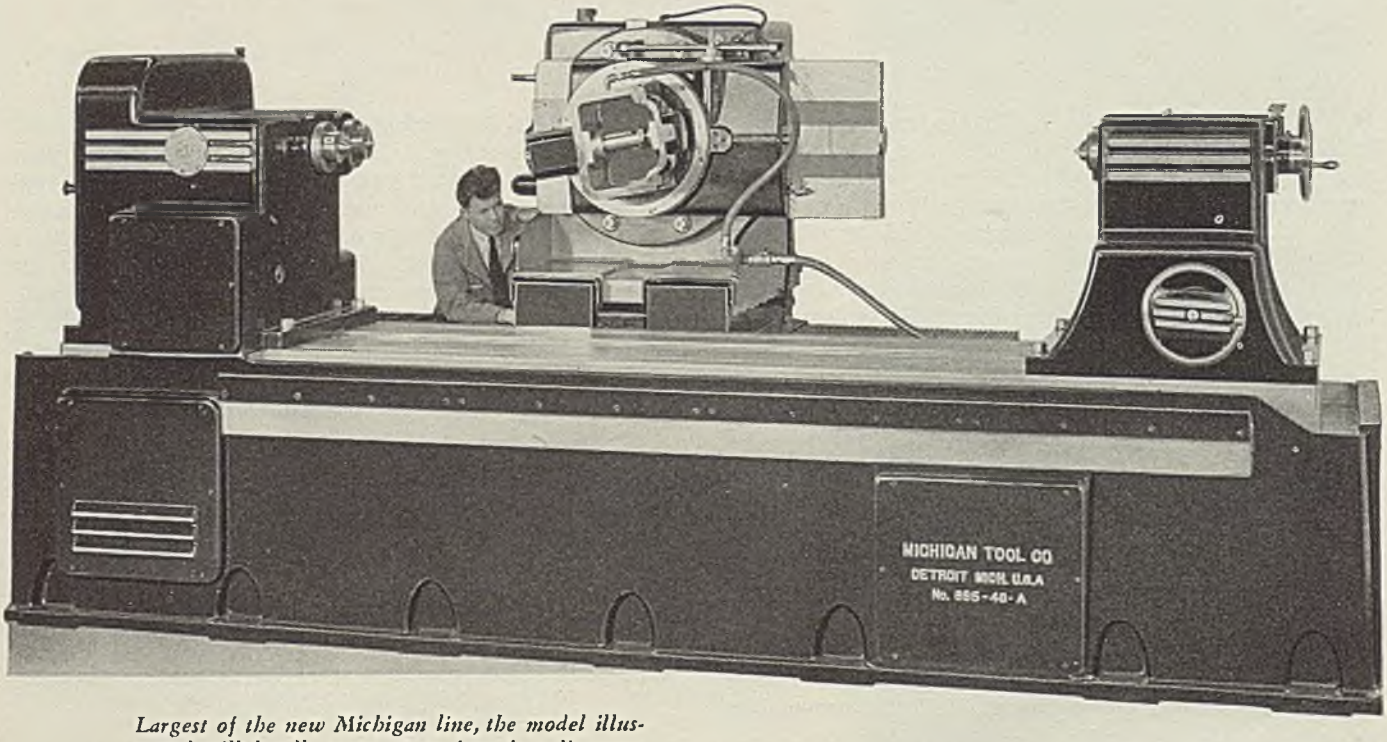
■ Stormy weather on Lake Superior. Iron ore vessels worked late in the season, many of them encountering heavy, dangerous seas



Announcing

A LINE of "FINISHERS"

FOR LARGER GEARS



Largest of the new Michigan line, the model illustrated will handle gears up to four feet diameter.

MAKING AVAILABLE the crossed axis principle of gear finishing for all sizes of gears up to 4 ft. diameter, this new line of "Michigans" is designed to provide quietness, accuracy and life for large gears comparable to those now achieved in smaller gears by use of the "shaving" process.

Today, in the smaller sizes of gears — up to 18 inches — more gears are finished on Michigans than on all other types combined. "Tomorrow," probably the majority of large gears will be shaved.

And in such gears . . . for speed reducers for ships and power plants . . . for machine tools and all kinds of heavy machinery . . . for ordnance, etc. . . . the use of this process will probably make possible a reduction in size by virtue of the higher load capacity obtained through greater accuracy.

The new line comprises three machines, as shown below. All machines are designed for heavy duty, and will take gears up to 20 inch face width.

The machine illustrated is an 865-48—the largest gear finisher ever built. It is already in operation turning out gears in a defense production plant.

Model	For Gear Diameters		Distance between Centers (in.)
	Max. (in.)	Min. (in.)	
862-24	24	1	36*
862-36	36	2	48*
865-48	48	4	97

** May be increased on special order.*

MICHIGAN TOOL COMPANY

7171 E. McNichols Road Detroit, U. S. A.

Technical Progress PACES VICTORY MARCH

Because of the great emphasis on production, 1941 will loom as a memorable year in the history of metal producing and metalworking technology. The efforts throughout industry to produce constantly more and more of a vast array of items so sorely needed for war gave renewed stimulus to American ingenuity and inventive genius. The actual record of achievement seems incredible—yet such amazing assemblies as large bombers and heavy tanks are now being made by mass production methods.

STEEL takes pride in presenting in the following pages comments from many of the men who deserve the credit for establishing this unique record. These men, in their own words, analyze the significance of those particular phases of the whole story with which they individually are concerned. To these men who found time despite their heavy responsibilities to contribute to this review of 1941 progress, STEEL extends its deepest appreciation.

The Editors

Steel Cartridge Cases Are Being Developed Rapidly

BY C. T. HARRIS JR.
Major General, Assistant to Chief of Ordnance, Chief of Industrial Service War Department, Washington

■ MATERIAL shortages during a national emergency are inevitable. The enormous quantities of mechanized equipment required and the development of the Lease-Lend Act tax our resources beyond conception. Air Corps and Navy requirements carry relatively high preference ratings, while Ordnance materiel, with few exceptions, is only a step above that of industry. Hence, it has been necessary to make substitutions, redesign parts, change methods of manufacture, or employ other means of using lesser strategic materials. Yet safety and certainty of proper functioning cannot be compromised.

A division of the present one-piece aluminum transmission housing of the M3 tank is being contemplated. Approximately 125 pounds of aluminum can be saved by making the control differential section from cast iron, retaining aluminum about the gears for heat conduction. Conversely, an anti-aircraft director utilizes aluminum to permit manual operation. Increased weight would delay the operation of this instrument to such an extent that anti-aircraft batteries would prove ineffective.

Development work on steel cartridge cases for small arms and artillery ammunition is progressing rapidly. Some parts of the caliber .50 M2 machine gun are now being cast from specially treated pearlitic iron, saving a man-day of machine tool time and approximately 50 pounds of alloy steel forgings per gun.

Successful Allocation Hinges On Full Technical Knowledge of Plants, Products Involved

BY EARLE C. SMITH
Chief Metallurgist
Republic Steel Corp., Cleveland

■ ALLOCATION faces the steel industry today. Under allocation, the governmental authority decides upon the degree of urgency, issues an order directing the producer to ship a certain amount of his product to a consumer for a specific use, and the fabricator is expectetd to use whatever material is handed to him. Such a procedure, of course, short circuits all ordinary methods of handling orders in an effort to expedite distribution of supplies according to the needs of the manufacturers of ordnance, munitions and other materiel.

But this nicely abbreviated way of handling orders can cause serious difficulties unless the governmental authority handling the allocation program has a thorough-going knowledge of the products of the steel industry, their qualifications for some applications and limitations in others as well as the ability of each individual steel plant to produce various products.

This places a tremendous responsibility upon government. With more than 5000 steel alloys to select from, obviously correct details as to what is wanted are of utmost importance if the equipment fabricator or manufacturer is to obtain material that will suit his requirements. An order without rather detailed specifications may actually be impossible to fill. Before a supplier attempted to bid on a job in the past, he first studied the requirements carefully. In fact, once it was determined precisely what

was wanted and the specifications drawn accordingly, the biggest obstacle to getting the right steel was licked.

It will be well for steelmakers to study the possible complications involved in operating under an allocation program and to be prepared to assist in compiling information of sufficiently detailed nature to afford a guide to those in government agencies who will have the responsibility of allocating steel. If, as an industry, steelmakers are to be directed in allocating their products, then the least they should undertake to do is to be sure those doing the directing are supplied with adequate road maps.

Proportion of Ship, Sheet in This War Higher than 1914-18

BY ANSON HAYES
Director, Research Laboratories
American Rolling Mill Co., Middletown, O.

■ MORE sheet and strip steel is going into war work now than in 1914-18. Some of the newer products that are fitting into the present victory program are: Formed metal plumbing ware—important since one pound of metal in this field does the job of some three pounds in cast materials. Bomb racks, land mines, ammunition cases, and many other items are now made of sheet steel products.

Means of reducing the quantity of aluminum used in the manufacture of rimming and killed grades of steel had been largely worked out by the steel industry before the extreme aluminum shortage developed. The major tonnages of rimming steels and other killed steels are using only the lower grades of remelted aluminum and in appreciably reduced quantities. Aluminum-killed mild-steel drawing sheet has been taken off the available list after January, 1942, except on special priority approval.

New Metal Sources, Revised Composition Limits, Standards Simplification Cut Shortages

BY J. R. TOWNSEND
Materials Standards Engineer
Bell Telephone Laboratories Inc., New York

■ AS A result of the seizure of the cobalt refineries on the continent, the Electrometallurgical Co. has undertaken to refine cobalt concentrates at Niagara Falls, in this manner making this critical metal available for domestic use. A California plant is now in operation employing the Hansgirg process for producing magnesium by electrothermic reduction of the oxide. Natural gas (later used as fuel in an adjoining cement mill) is employed as the cooling medium. Ultimate production of magnesium is estimated at 24,000,000 pounds yearly.

Standardization of sheet metal and wire thicknesses to replace gage sizes reduces the number and amount of stocked sizes. Decimal sizes and a simple series of preferred numbers is proposed to replace the many gage sizes now in use. This plan is receiving general acceptance. Standardization of structural shapes, actively being considered, should also result in similar reductions in stocked sizes. Elimination of odd sizes of threading tools is a further example of the advancement of the standardization program. . . The adjustment of ASTM specifications to permit the use of fire refined copper to replace electrolytic domestic copper wherever possible is an important step in conserving metal.

Why Specify Virgin Metals When Remelts Can Do the Job Right?

BY E. R. DARBY
Director of Research
Federal-Mogul Corp., Detroit

■ BECAUSE of the shortage of copper, due in a large measure to the demands of the cartridge industry, it is necessary for us to conserve copper in fields of lesser importance, even including other war industries. Immediately one thinks of the possibilities of substituting other metals for every imaginable copper base material. Substitutes will help, but in order to develop conservation to its full extent, one must go much further.

A typical example is the tremendous consumption of virgin copper in the cast bushing industry compared to the volume of the finished product. For instance, aircraft and other war bushings are made largely of gunmetal, 88-10-2 copper-tin-zinc, or similar alloys. According to all war specifications these bushings must be made of virgin metal. When only 15 to 30 per cent of the metal cast results in finished product, obviously there is a heavy consumption of virgin metal as well as an unnecessary freezing of available copper in return material due to contamination of machinings and gates by lead from leaded bronze castings. The remedy is metallurgically simple for lead is the only contaminant of importance and has no detrimental effect on the alloy in small amounts. Thus by raising the limit on lead from 0.25 per cent to 1.00 per cent, machinings and gates can be remelted, releasing a goodly amount of virgin copper.

Undoubtedly there are many such instances where not only copper but other necessary metals could be released by judicious modification of specifications.

Armor Plate Welding Takes Most Output of Stainless Steel Wire

BY J. K. FINDLEY
Sales Metallurgist
Allegheny Ludlum Steel Corp., Dunkirk, N. Y.

■ WAR demand has greatly increased the need for high-chromium-nickel core wire for weld rods used in arc welding armor plate, gun mounts, etc. It appears likely that the production of this wire will account for a fair percentage of the stainless wire being produced at present or in the near future. The aircraft building program will increase the quantities of corrosion resisting wire used in the fabrication of control cords, safety wire, cotter pins, hinge pins, ignition cable, tie rods, cable terminals, instrument parts, bolts, nuts and screws. Priority control on metals has severely curtailed the production of stainless wire for fabrication of civilian items.

Substitutions in Bronze Alloys Expedite Much War Work

BY C. J. ZAISER
President
Ampco Metal Inc., Milwaukee

■ IT HAS become evident that available supplies of some alloys and the capacity of some manufacturing equipment are not sufficient to meet actual war needs unless completely closed to civilian use. And that is not feasible. The wholehearted co-operation of the War and Navy Departments and the aircraft industry in approving substitutions to meet this situation has been greeted with sur-

prised gratification. This trend toward using specifications as a guide rather than a mandate is exceptionally pleasing.

In bronze alloys, a few outstanding examples of this co-operation include: Substitution of large centrifugally cast rings for forgings in view of the cost of forging dies and the shortage of hammer equipment; substitution of forged bar in 3-foot lengths for rolled bar when the diameters required exceeded the sizes regularly produced; substitution of centrifugally cast bar stock in 15-inch lengths for extruded material in mill lengths to avoid a 90-day delivery delay, incidentally involving waiver of the customary bend test; substitution in several instances of an alloy different in chemical and physical properties from the material originally specified.

Naturally these variations were only made after careful study, but the fact that they were permitted is a tribute to the co-operation of those responsible. It has materially contributed to expediting some phases of the victory program.

Manganese Substituted for Some Nickel in New Stainless Steel

BY E. J. W. RAGSDALE
Chief Engineer
Edward G. Budd Mfg. Co., Philadelphia

■ GREAT ideas are not born during emergencies. They are merely permitted to come to light then. This is equally true of developments. An instance is the use of a new stainless steel. When nickel became a bottleneck, attention was focused upon the long known fact that nickel and manganese are partly interchangeable. So a new alloy appears which reduces the nickel by one-half and substitutes manganese for the other half. The Budd Co. inspired the development primarily as a protection for its own sources of supply, but incidentally has passed on an even greater saving to the industry at large.

The new alloy has 4 per cent nickel (instead of 8 per cent), 4 per cent manganese and 18 per cent chromium. It is possessed of all the excellent qualities inherent to the more classic 18-8 alloy, and even goes beyond these in some respects. In America, we are not "ersatz" minded, so our emergency permits our minds to direct themselves toward a better product, not just a substitute.

Many New Alloy Developments Result from Tight Metals Supply

BY R. H. HARRINGTON
Research Metallurgist
General Electric Co., Schenectady, N. Y.

■ PRESENT stringency in supply of metals has fathered such new developments in the ferrous field as carbon-molybdenum and chromium-molybdenum steels for the automotive and machine tool industries in place of higher alloy and tungsten steels; chromium-molybdenum-vanadium steel, replacing nickel-chromium-molybdenum and somewhat better for turbine bolt material; the new cold-rolled strip low-loss transformer steel, alnico 5, about three times stronger magnetically than standard alnico; and the fact that nitrogen is necessary in the 18-8 stainless steels to make them austenitic.

Some of the developments for 1941 in the nonferrous field include an artificially aged aluminum casting alloy containing 5 per cent zinc, 0.5 magnesium, 0.5 chromium, 0.2 titanium, yielding good properties without any solution treatment, thereby saving time and eliminating warping from quenching; copper-manganese alloys with good elastic properties and high damping capacity; lead alloys as substitutes for some zinc and aluminum alloys for diecastings; alloys of 0.5 cobalt, 0.5 tin, 99.0 copper, and 0.4 chromium, 0.1 beryllium, 99.5 copper as substitutes for phosphor bronzes; improvement of elastic properties and fatigue resistance for cold-rolled brasses and bronzes by application of aging treatments at temperatures below those of recrystallization; "Roofloy", a lead-base alloy containing 0.25 tin, 0.2 calcium, 0.2 magnesium for sheet for cases, boxes, and the like; and leaded alloys of copper-cobalt-beryllium and copper-chromium-beryllium for bearings having high heat and electrical conductivities on the matrix alloy.

New Surfacing Methods and Insulation Feature Year in Wire

BY E. W. CLARK
Mechanical Engineer, Wire & Cable Section
General Electric Co., Schenectady, N. Y.

■ SYNTHETIC materials for wire and cable insulation are rapidly replacing natural materials, not because normal materials are scarce but because the synthetics offer superior insulating and mechanical qualities. Where resistance to heat or solvents is important, it is often possible to select a synthetic material that will meet the unusual physical requirements and still fill the electrical specifications.

Thinner insulations are continually in demand since they permit reduced winding space. To meet this requirement and to take full advantage of the newer insulating materials, an absolutely smooth wire surface, free from all imperfections, is required. Processes have now been developed that remove the outer surface of copper wire, leaving a surface that is perfectly satisfactory for these more stringent requirements. Such wire, with the improved insulation, permits electrical and mechanical results heretofore impossible.

Many Factors Contribute to Increased Wire Drawing Speeds

BY H. C. BOYNTON
Chief Metallurgist
John A. Roebling's Sons Co., Trenton, N. J.

■ MORE speed and greater outputs in the wire industry are resulting from a number of important features, including:

The carbide die; practically all wire mills are equipped almost 100 per cent with carbide dies, except possibly diamond dies for high-speed drawing of copper and steel dies, etc., for intricate shaped wire. Carbide dies for steel are now bored to draw both hard and soft steel down to 0.007-inch or smaller. One carbide die will often draw a hundred or more bundles true to a 0.0001-inch size without reconditioning, as against two or three bundles through chromium steel dies.

Multiple-block benches for drawing rods with the "finisher" regulated to run up to 1000 feet per minute or more, both for hard and soft steel. To keep die temperature down and to aid die life, water or air cooling of the die, or both, is standard practice. High-speed drawing of copper has reached 12,000 feet per minute with diamond dies specially designed for speed . . . . . Baking of soft steel after pickling only long enough to dry or "set" the coat. For hard steel this is counted in minutes instead of hours . . . . . Process annealing, normalizing, patenting, etc. in controlled atmospheres to eliminate one or more picklings, thereby saving money . . . . . Substitution of bronze

and brass alloys for virgin copper wire; lead-tin alloys replacing zinc in hot galvanizing.

Increased demand for electrogalvanized wire with heavy coatings, 1 to 3 ounces per square foot. More "Brutonized" wire, under various trade names, is being used in place of wire hot galvanized after drawing. . . Elimination of dipping or spraying by drawing the wire "bright" through a medium consisting of a solvent, base and inhibitor so that when the solvent has evaporated the base will remain as a thin coating of wax or other protective medium.

Rod Rolling Speeds Are Now Up to 4000 Feet per Minute

BY C. E. JOHNSON
Superintendent Rod and Wire Mills
Sparrows Point Plant
Bethlehem Steel Co.

■ HIGHER speeds are evident in the rolling of rods. Finishing small size rods at speeds over 4000 feet per minute with no sacrifice in quality has been made possible by improvements in rolling equipment, improved materials for rolls and bearings, and through a flexibility of speeds in various sections of the roll train. . . There has also been a trend toward the conversion of two-strand rolling to three-strand for increased production. Heavier rod coils seem to be gaining favor, 400-pound and larger coils having replaced the 300-pound coils in a good many cases.

The first major change in the cleaning house since the generally conceded superiority of straight-line cleaning is the adoption of the high-speed high-temperature method of baking rods. It has proved economical as well as increasing drawing quality of the rods. . . Improvements in rod quality and continuous wire drawing equipment have made possible higher drawing speed, rates from 1000 to 2000 feet per minute being not uncommon. Compare this with speeds of a few hundred feet per minute a few years ago.

The trend toward more efficient methods of handling materials has resulted in the installation of overhead rod handling equipment and facilities for the handling of finished products directly from producing unit to the car for shipment. The increased use of electric trucks in conjunction with wire racks, skids and pallets for the movement and storage of such products as wire and nails has proved beneficial.

Carbide Drawing Dies Used In Larger Sizes, More Shapes

BY J. R. LONGWELL
Chief Engineer
Carboloy Co. Inc., Detroit

■ CEMENTED carbide drawing dies are being used more widely and in still larger sizes. Die nib production equipment now being provided is capable of supplying nibs up to 17 or 18 inches inside diameter and 20 inches outside diameter. Large carbide dies are being increasingly used in drawing virtually all sizes of shell, in addition to an important increase in use of carbide dies for production of small caliber ammunition. An operation which has proved particularly effective is the drawing—in five passes—of 6-inch cartridge cases, the diameter being progressively reduced through the carbide dies from an initial 8.3 inches.

The reason for the increased use of cemented carbide dies for such purposes is their ability to insure close size control over vastly longer production runs, reducing die maintenance and down-time. For the same reason, more cemented carbide mandrels are being used for drawing tubing, particularly in drawing aluminum-brass and cupronickel tubing for naval condenser assemblies.

Too, more dies are being used for drawing sections to "machined part" specifications because it is possible with carbide dies to maintain tolerances equivalent to those obtained by machining parts. Development and introduction of commercial die shaping equipment for finishing shape-dies also has speeded their adoption. Many such special shapes are now being produced by the mills themselves—starting with round hole dies on their own shelves. They are also finishing standard square and hexagon dies obtained from the carbide suppliers in the rough cored form.

Multiple Coatings Offer Unique Combinations of Desirable Properties

BY KENNETH B. LEWIS
Consulting Engineer
43 Midland Street, Worcester, Mass.

■ PROTECTIVE metallic coatings for steel wire are more important today because of shortages of both zinc and tin and restrictions on use of stainless steel and monel. Zinc has always been pre-eminently the protector because it is a "sacrificial" coating. Being electropositive to iron, it extends electrochemical protection to the base metal even after the latter has been laid bare. Among the useful coatings, cadmium is the only metal that exceeds zinc in protective value. Aluminum, by virtue of its place in the scale, is potentially of still higher value, but unfortunately it has never been possible to get a dense adherent coat of aluminum onto a steel base by either hot or cold processes. Aluminum will shortly be a cheap metal, probably cheaper by volume than zinc, of higher protective value, and acceptable in contact with food acids.

An interesting prospect in wire coating now in the pilot plant stage is a technique for plating electrically onto a steel base, at high speed, a wide range of alloys, among them alloys in which aluminum predominates, and which appear to share the properties of the parent metal. Extremely dense adherent coats can be applied. The more metals in the alloy, the thinner the coat may be for equal protection. With equal facility coatings of the stainless compositions and of monel can be applied, which opens up a wide field for speculation. The process is being groomed for the flat products, aiming particularly at the tin-plate bottleneck, but its possibilities in wire will not be neglected.

Domestic Music Wire Substituted For Unobtainable Swedish Rods

BY B. L. McCARTHY
Chief Metallurgist
Wickwire Spencer Steel Co., Buffalo

■ BECAUSE steel wire does not require critical alloys, steel wire production is not seriously affected by shortage of chromium and nickel. In stainless steel wire some difficulty is being encountered in finding a suitable substitute for the 18-8 variety intended for civilian applications, although some substitutions are being developed. The shortage of Swedish rods is becoming more acute, and already a large tonnage of domestic music wire is being substituted. Indications are that this substitution will be permanent for the majority of applications. Apparently there is no difficulty in making the desired steel

quality, but the prime difference seems to be in the quality of the rolled surface.

Because of the scrap shortage, the contamination of steel due to the introduction of foreign elements is being felt in the wire industry, and extra precautions are being taken to select those scrap charges used for making high-quality wire. The use of fast baking equipment and a good inhibitor in the pickle bath has eliminated the 6 to 8-hour baking period in many cases and reduced it to a 10 to 12-minute drying time, greatly facilitating movement of wire in process.

Standardization Cuts Number of Brass Alloys by Two-Thirds

BY H. P. CROFT
Assistant Director of Research, Cleveland Mill Division, Chase Brass & Copper Co. Inc.

■ JOINT meetings of various government agencies and manufacturers have resulted in standardizing of specifications, and in some cases, in the widening of allowable ranges of various ingredients to permit the use of as much copper-bearing and zinc-bearing brass as possible. The number of alloys produced by brass manufacturers has been reduced approximately two-thirds. Such simplification has enabled more melting and fabricating to be carried out with the same equipment as previously used. Due to the status of both copper and zinc, these have been temporarily replaced for some industrial uses by steel, copper-coated steel and by plastics. This situation bids fair to continue throughout the emergency, as published statistics show that a shortage of copper will probably exist as long as the period of large armaments continues.

War Work Directs Attention To Value of Zinc Diecastings

BY R. DAVISON
Manager, Market Development Division
New Jersey Zinc Co., New York

■ ZINC alloy diecastings should continue to expand their scope of usefulness—in both established and new fields—when the demands of the victory program slacken to a point where the diecasting industry can, once again, direct its energies toward market development.

Consider the recent remarks of a design engineer in one of the country's largest manufacturing organizations which now finds it necessary to employ substitutes for many zinc alloy diecastings: "The present substitution program is the best publicity that zinc alloy diecastings could possibly get and is proving to both engineers and designers that diecastings in zinc alloy offer an engineering material and a fabricating process with greatest design possibilities and maximum economy." That is typical of today's thinking in engineering circles.

Commercial Hot Pressing, Direct Production of Alloy Powders Advance Powder Metallurgy

BY N. K. G. THOLAND
Ekstrand & Tholand Inc.
New York

■ GENERAL interest in powder metallurgy certainly increased during 1941. Not only a relatively few large concerns are active in this field, but now also a number of smaller ones. Schools and laboratories are giving their time increasingly to this field, and in some of these laboratories very important and fundamental developments are being sponsored. More parts are being made by powder metallurgy and wider application is expected.

Two developments that will greatly change the scope of applied powder metallurgy are: First, the development of commercial hot pressing, as distinguished from hot forging, for obtaining high strengths and densities in a single operation. Size and shape can be maintained to eliminate machining operations. Second, the application of alloys improves the strength of the parts. Diffusion alloying, however, remains a difficult and time consuming operation. Hot pressing will improve the conditions for such alloying, but the real advance will come from developments now pending in the direct production of alloy powders. Such powders often have less compressibility than pure powders and will be most easily processed into parts by hot pressing.

War Work Expected To Shift Popularity of Alloy Steels

BY D. D. BUCHANAN
Manager of Operations, Union Drawn Steel Div. Republic Steel Corp., Massillon, O.

■ THE VICTORY program has changed the trend of the cold-finished bar business toward a much larger proportion of special-carbon open-hearth alloy and electric-furnace alloy steels for aircraft, tanks, guns, ammunition and other items that require extremely accurate metallurgical control. At present, small plants all over the country are manufacturing war products that require the strongest, toughest steels available. This will undoubtedly be reflected after return to peace times in a greater demand for higher grade steel with closer metallurgical control.

War work has created an unprecedented demand for annealed and heat-treated steel bars, necessitating a 300 to 400 per cent expansion in furnace equipment. This will naturally result in a trend toward a greater use of furnace treated products with completion of the victory program.

Shortage of certain alloys such as nickel steels has caused customers to turn to substitutes which, in many cases, are cheaper than the steels they have been using. As these substitutes prove satisfactory, a shift in the popular grades of alloy steel may be expected—molybdenum steel particularly coming to the fore.

Tungsten Restrictions Met by Use of Moly High-Speed Steels

BY J. V. EMMONS
Metallurgist
Cleveland Twist Drill Co., Cleveland

■ SHORTAGE of tungsten is serious in high-speed steel, including hot work die steel. Fortunately, there is a plentiful supply of domestic molybdenum which will serve many of these purposes. The first commercial "Moly" high-speed steel, the molybdenum-tungsten type using only 1 to 2 per cent tungsten, was introduced about nine years ago. Before the present conflict its merits had already earned for it a substantial portion of the country's high-speed-steel business. Later there was developed the molybdenum-vanadium type, and more recently the tungsten-molybdenum (5-4, 6-5, and 6-6) types, also competing for a share of this business.

Because of previous acceptance of "Moly" high-speed steels, the OPM order limiting manufacture and consumption of the 18 per cent tungsten types has caused no difficulty. The molybdenum-tungsten type has been proved

thoroughly and has become the standard high-speed steel in many plants. Average performance is better than that of 18 per cent tungsten tools. There are no jobs known where it is not at least as good.

Study of Effect of Alloying Elements Helps Conservation Of Strategic Materials

BY ALVIN J. HERZIG
Chief Metallurgist
Climax Molybdenum Co., Detroit

■ THE "S-CURVE" and the end-quench hardenability test have had wide and successful application during the year to the problem of selecting alternate compositions and in the evolution of commercial heat-treating practice. Through these processes of investigation we have during 1941 gained a more positive knowledge of the effects of residual amounts of alloying elements in steel and of special deoxidizing practices that will ultimately lead to conservation of strategic materials. These same instruments have revealed the characteristics of steels containing the economic and strategic limits of the more plentiful alloying elements. A wider application of carbon-molybdenum and manganese-molybdenum steels is inevitable on this basis. Through the same technique, the carburizing grade of low-chromium molybdenum steel was revised and accepted in service.

Alloys containing relatively higher percentages of molybdenum received much attention. Low-carbon materials capable of remaining ferritic over a wide temperature range by virtue of a high molybdenum content demonstrated their usefulness in service as permanent molds. Observed characteristics and pending investigations indicate that extensions into the fields of heavy-duty brakes, gun barrels and the like are possible.

Production Capacity of Die-Casters Awaits Unitization

BY JOHN R. EHRBAR
Plant Manager
Stewart Die Casting Division
Stewart Warner Corp., Chicago

■ THE IMPORTANT problem facing the diecasting industry today is selling the services of complete modern plants. Personnel who are specialists; workers skilled and unskilled who have spent years of their lives at this particular line of manufacturing; design engineers who have been helpful in reducing cost of automobiles, washing machines, food mixers, ironers, vending machines and many other products; chemists who have perfected improved alloys; modern high-pressure diecasting machines; cleaning equipment and machine shops—all these capable production facilities must be sold to military authorities and fully utilized for the benefit of the country.

It can be done. There is no other recourse for the diecaster.

Lead-Base Diecastings Prove Satisfactory for Certain Jobs

BY BRUCE W. GONSER
Supervisor, Non-ferrous Division
Battelle Memorial Institute, Columbus, O.

■ SCARCITY of aluminum, of magnesium and, to a lesser extent, of zinc for applications other than those carrying the highest priority ratings has been a big handicap to the diecasting industry throughout 1941. Substituting of lead-base diecastings for zinc in certain automotive and other applications where parts are subjected to little stress or are largely ornamental has been successful in a number of applications. Finishing or plating troubles do not appear to be unsurmountable. Antimonial lead, with or without the addition of up to 3 per cent arsenic, is used to give desired hardness. Regular dies for casting zinc can be used.

The search for improved dies continues, particularly for dies that will give a reasonable life when casting copper-base alloys. This problem is complicated by the present tendency in casting machine construction to use higher and higher injection pressures to minimize or eliminate porosity. Pressures of 4000 pounds per square inch, combined with the cold chamber method of casting, have been particularly effective in overcoming troubles when diecasting magnesium alloys. With zinc easier but aluminum and magnesium still tight, there is a trend toward decreasing or even omitting the aluminum normally added to diecasting zinc alloys.

Ordnance Men Must Be "Educated" To Advantages of Diecastings, Production Capacity Available

BY HERBERT CHASE
Consultant
31 Fife Street, Forest Hills, N. Y.

■ THE CHIEF problem before diecasters is to find ordnance work, particularly for parts to be produced in zinc alloys, which will make possible the use of the large and highly efficient production capacity not now being utilized for lack of materials. Rapid shifts toward an almost complete war economy have left the diecasting industry rather "flat", as it was not well organized to meet such a change. Unfortunately for diecasters depending largely upon the zinc alloys, these have attained only minor use in military applications in this country—other war applications for which priorities can be had are not extensive. British authorities have approved the use of high-purity zinc alloy diecastings for fuze parts and they are being diecast in large quantities in Canada. American ordnance authorities, on the other hand, do not appear to realize the advantages that accrue from using the diecasting method. Further changes and development work are expected to remedy this situation, but much still remains to be done to "educate" the powers that be as to the advantages of diecast parts and advisability of enlisting the important production facilities that now are forced to lie dormant.

Brass Shortage Results in Many Shell, Bomb Parts Being Diecast

BY F. W. McINTYRE
Vice President and General Manager
Reed-Prentice Corp., Worcester, Mass.

■ THE DIECASTING industry has undertaken large scale production of ordnance items. Much development work has already been completed and large amounts of castings have been produced for shell nose fuze parts as well as small incendiary and practice bomb bodies. Shell fuze parts had been under development for the last few years. When shell production was recently stepped up and the resultant shortage of brass began to become serious, zinc alloy diecastings were found to replace readily some of the brass parts originally used. In many cases they permitted a reduction in machining operations formerly required with brass.

The production of diecast incendiary bombs will begin

shortly, based on experiments which are practically completed. The use of zinc alloy diecastings permits many radical changes and simplifications in making both these and the practice bombs, allowing them to be produced in much greater quantities with a minimum of time, labor and equipment. The shortage of brass is apparently more acute than that of zinc. This, together with the fact that diecastings eliminate many subsequent machining operations, indicates that the substitution will become permanent for many shell and bomb parts.

Need for "Selling" Diecasting To Government Authorities

BY CHARLES PACK
President
Doehler Die Casting Co., New York

■ UNFORTUNATELY, priorities have been running ahead of the development of the victory program. Many existing specifications were written when no shortage of metals or tool equipment existed or was visualized. As these shortages arise, the tendency is to turn to the diecasting process for relief. The main problem before the diecasting industry today is that of "selling" the use of diecastings to the government "service" branches. In many instances this requires redesigning of existing parts and actual service tests.

With additional production of aluminum and magnesium, die casting will find increasing use in war work. It is safe to assume that by the end of 1942 production facilities of the diecasting industry will be taxed to their full capacity.

Points Out Improved Quality of Diecastings Now Available

BY WILLIAM H. SCHWARTZ
Chief Engineer
Lester Engineering Co., Cleveland

■ OUR GOVERNMENT has been reluctant to make a place for the diecasting industry in the victory program because of the poor showing it made as a whole during 1914-18, due mainly to poor alloying of metals, inferior diecasting equipment, incompetent technical background.

Heeding their past mistakes, today's diecasting industry is organizing and proving to ordnance officials that modern diecasting has made tremendous advancements, and that it must be considered as an industry which is most practical for the highly geared production requirements of the war program as evidenced by increased densities and strength now being guaranteed. Present difficulties of the diecasting industry can be expected to advance it to where its importance for civilian needs as well as ordnance work will become better recognized.

War Requirements Serve To Speed Diecasting Developments

BY A. D. WEIGOLT
Precision Castings Co. Inc.
Cleveland

■ SHORTAGE of aluminum has not only stopped production of aluminum parts for civilian use but seriously jeopardizes war production of zinc castings made from the old standard alloys containing 4 per cent aluminum. A new substitute alloy containing 1½ per cent aluminum is being used but only to a limited extent. Its physical qualities are not as good, nor does it cast as well; hence it hardly can be expected to replace the standard alloys permanently.

Stringent requirements of war work are stimulating improvement of aluminum high-pressure cold-chamber process diecasting. This industry and the civilian consumer are bound to be the beneficiaries of the impetus so imparted and the resultant better aluminum diecastings. This is similar to the pronounced improvement in zinc diecastings brought about by demands of the automotive industry.

Many Instrument Parts To Be Made as Aluminum Diecastings

BY MARC STERN
Superintendent, Die Cast Division
AC Spark Plug Div., General Motors Corp.,
Flint, Mich.

■ THERE is nothing in the diecasting plant that can be used as a substitute and keep the same equipment and technical experience busily engaged. The trend is to substitute stampings, plastics and castings for many diecastings in civilian work. The victory program is calling for many instruments containing aluminum diecastings so this branch of the industry will be very active shortly.

The zinc alloys most commonly used consist either of 4 per cent aluminum and 3 per cent copper, or 4 per cent aluminum and 1 per cent copper, the balance being zinc and a trace of magnesium as a deoxidizer. An OPM ruling calls for a reduction of the aluminum content to 2 per cent or less to conserve this vital element. But this has added difficulties in diecastings, particularly for parts that must be leakproof, because of the tendency for this alloy to be hot-short.

Great Production Capacity Lies Unused in Diecasters' Plants

BY GORDON C. CURRY
Defense Products Division
Hoover Co., North Canton, O.

■ IN 1941 diecasters found it necessary to become a defense industry owing to the aluminum and zinc situation. The curtailment of the metal has caused a competitive market on war work that is far from healthy. Aluminum has decreased in cost but zinc has increased, as have wages and burden. The general picture should result in an increase in casting prices, but the opposite has resulted.

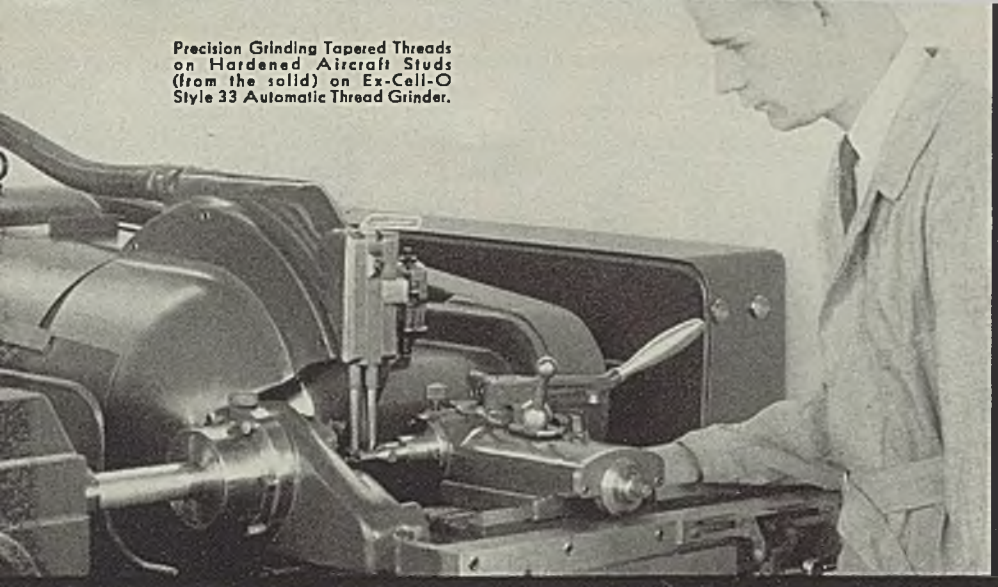
Many items that would help keep the industry operating have had to be redesigned for substitute materials made by other means. Government departments have not been able to design ordnance work for diecastings fast enough to afford relief. Some headway is being made, but much experimental work remains to be done.

The final results rest with Washington as the production capacity of the industry should be utilized.

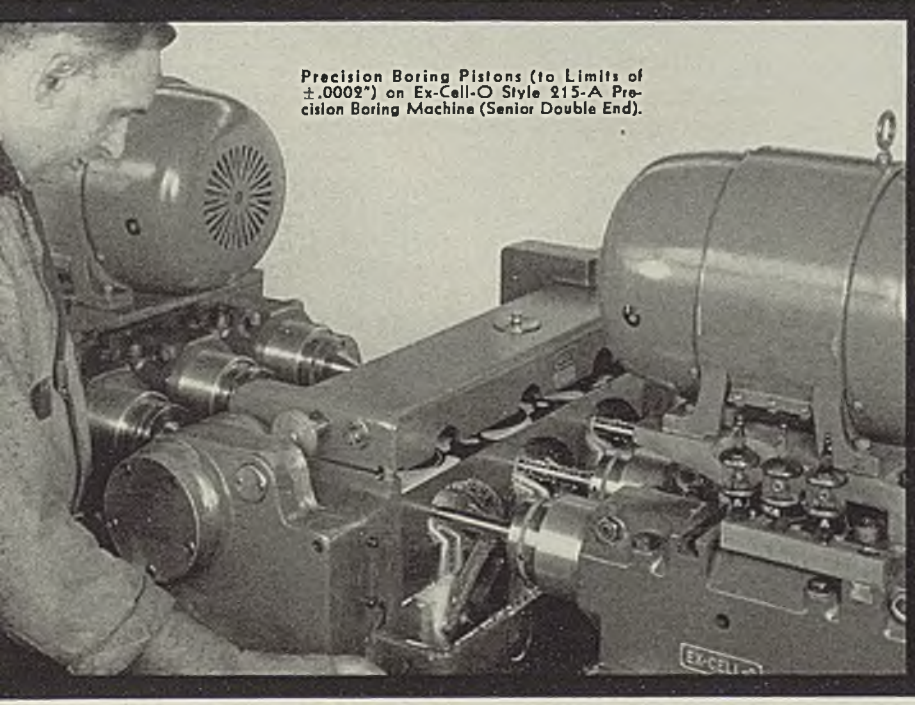
Care in Handling Extended Life Of Steelworks Refractories

BY R. KIRKPATRICK
Refractories Division
Norton Co., Worcester, Mass.

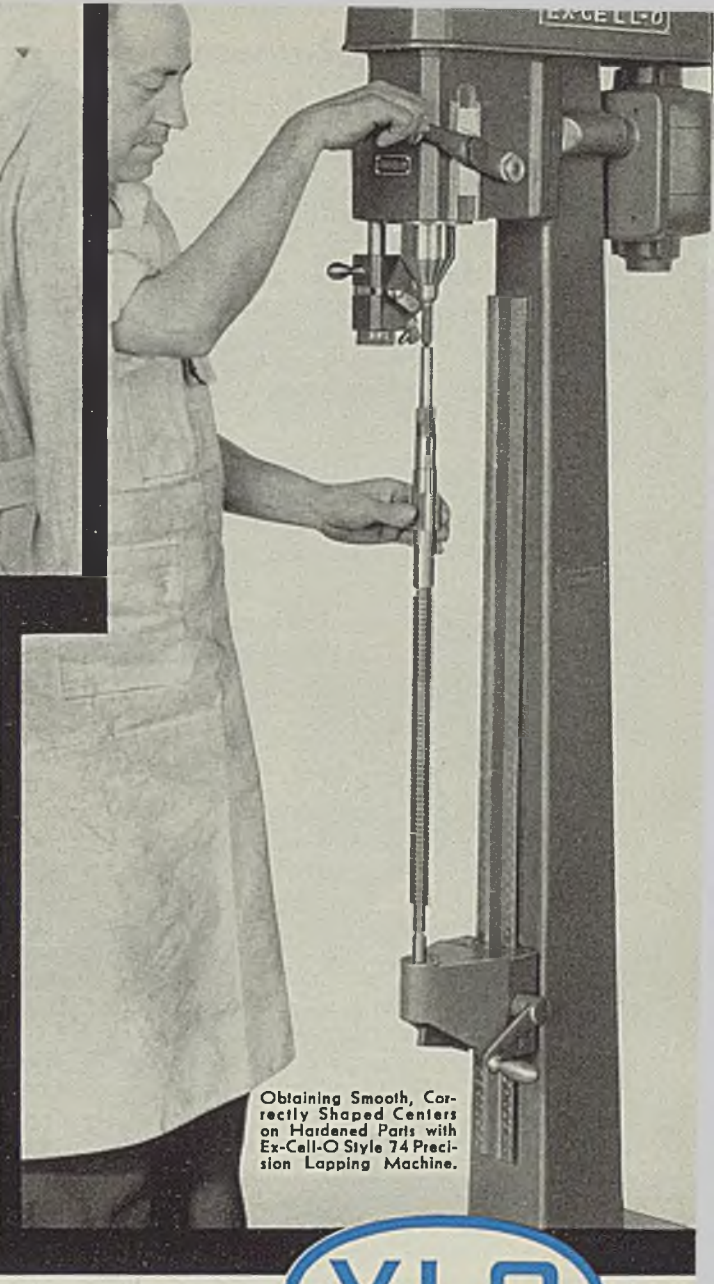
■ UNDER the extraordinary conditions existing today, the degree of co-operation evident in industry toward do-



Precision Grinding Tapered Threads on Hardened Aircraft Studs (from the solid) on Ex-Cell-O Style 33 Automatic Thread Grinder.



Precision Boring Pistons (to Limits of ±.0002") on Ex-Cell-O Style 215-A Precision Boring Machine (Senior Double End).



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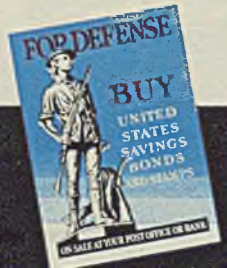

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ing the best possible job is extremely impressive. Demands on refractories have multiplied owing to war needs. Technological advancements have resulted largely from co-operation between the investigator, the maker and the user.

Operating men who depend upon refractories are giving the refractory products all the "breaks" by not expecting too much from them and by giving them careful treatment during installation and in use. Striking examples of this are evident where the user buys dry materials in the form of mixed cements and assumes the responsibility of application, which is essentially the manufacture of a refractory shape. Users have sought and have taken advice on improved tamping and ramming technique to produce first-class linings. Once installed, the linings have been subjected to greater care and detailed control to insure longer service. All this helps.

Steel Industry Is Independent Of Foreign Refractory Supplies

BY HOBART M. KRANER
Ceramic Engineer
Developments and Research Department
Bethlehem Steel Co., Bethlehem, Pa.

■ BETTER magnesia products for furnace bottoms have been brought out, the magnesia coming from various sources; higher magnesia compositions for cold ramming applications are now available. Raw dolomite is used extensively. Various designs of inverted arch bottom have been installed in open hearths. . . Perhaps most important both historically and technically is the selection by the steel companies of clay refractories for blast furnace linings from sources traditionally not offered by the refractories manufacturers for this purpose. This establishes a new trend in blast furnace lining compositions.

Conditions within the refractories industry now are in marked contrast with those during 1914-18. During World War I, we first learned how to utilize satisfactorily diaspore to produce high alumina brick; sillimanite and mullite became familiar terms; the effect of mineral developments upon the physical and thermal properties of refractories were also better understood. Car-type tunnel kilns requiring half of the fuel previously used and making better firing control possible were developed in this period. Clinkered dolomite was studied in the light of this new technology, magnesite and chrome products from our own materials were made possible. In the present conflict, therefore, our steel industry is independnt of all foreign refractory supplies, and we apparently have an ample supply to take care of all of our needs.

Refractories Are Ready for All-Basic Open-Hearth Roofs

BY FRED A. HARVEY
Director of Research
Harbison-Walker Refractories Co.,
Pittsburgh

■ CONSIDERABLE interest in an all-basic roof for the open-hearth furnace has resulted from accounts of success in Europe and by Broken Hill Proprietory Co. in Australia. American manufacturers state they are ready to produce the brick for special sprung arch or suspended arch construction. Bricks made in this country and tried out in Australia are reported fully equal to European brick.

A new plant and new tunnel and periodic kilns for fireclay brick in Pennsylvania, Kentucky, and Missouri have been completed or are still under construction. A new tunnel kiln for silica brick in the Chicago territory is expected to be operating early in 1942. Capacity for magnesite has been increased in Washington, and a new plant to utilize the magnesia in sea water for the production of refractory grain magnesite is under construction.

Blast furnaces continue to make exceptional records on their linings. Several furnaces have produced over 2 million tons. There appears to be a definite trend toward high burning temperatures for blast furnace brick.

Fire-Brick Manufacturers Need Suitable Priority Rating For Supplies, Repair Parts

BY C. E. BALES
Vice President
Ironton Fire Brick Co., Ironton, O.

■ PRODUCTION of all types of refractories reached a new high during 1941 due to the unusual demand from steel mills, blast furnace plants and new by-product coke ovens. Some fire-brick manufacturers have experienced difficulty in securing operating supplies and repair parts for their equipment, due apparently to insufficient consideration having been given the refractories industry by the Priorities Division of OPM. All steel men know the importance of refractories in their operations, and it is hoped that a suitable priority rating will be given to fire-brick manufacturers in the near future.

A new siliceous ramming refractory for open-hearth doors, electric-furnace bottoms, bessemer-converter linings, cupola spouts and ladle linings has been developed to replace "Luxit", a product formerly imported from Germany.

Drop Forgers Need Heavier Equipment for War Work

BY ROBERT H. DARNTON
Superintendent Forge Department
Buick Motor Division
General Motors Corp., Flint, Mich.

■ IT IS quite evident from any study of present drop forge shop facilities that the equipment in most shops is not heavy enough to do war work such as steel crankcase sections for aircraft engines, landing gear parts for large planes and other drop forgings of similar weight. This equipment is still being built.

Building up drop forge shop equipment to include 20,000, 25,000 and 35,000-pound steam drop hammers and large size forging machines from 7 inches up is the most important problem of all. Of course there are two or three exceptions.

Larger Brass Mill Billets Aid Product Uniformity, Quality

BY DR. ALAN MORRIS
Director of Research
Bridgeport Brass Co., Bridgeport, Conn.

■ HOT extrusion of brass has been confined to rod and shape production, and to the low-copper brasses for some time. But now developments in alloy steels for extrusion press parts permit the use of higher temperatures and pressures so it has become possible to extrude more refractory alloys. Thus extrusion has found widening application as a breakdown step in tubing production and of special value in condenser tube manufacture.

The comparatively recent advent of low-lead spelters

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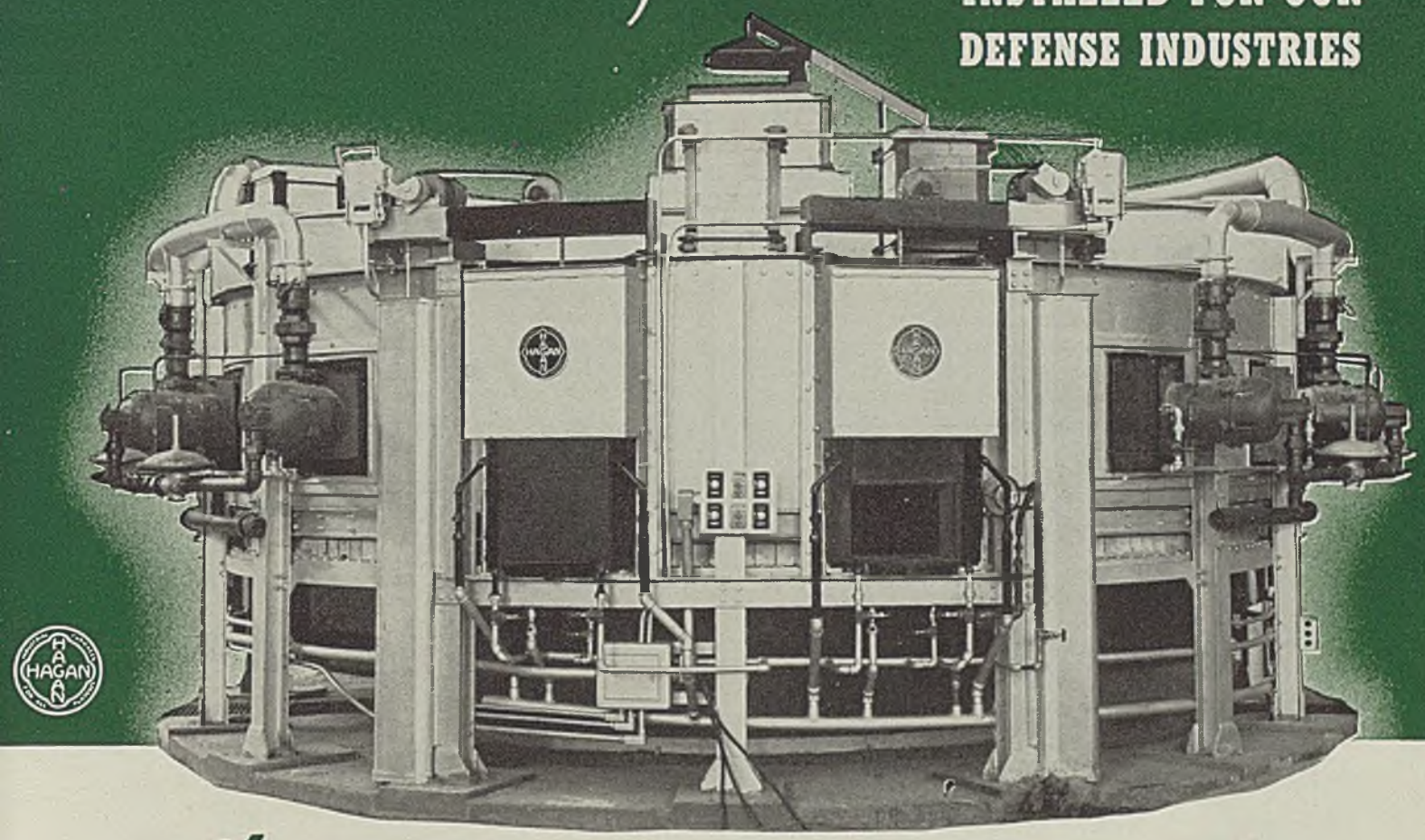

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made it possible to hot roll alloys which had previously been considered non-hot-working because of unavoidable lead contamination. Hot rolling equipment is being more and more frequently installed for breakdown operations in strip mills; particularly is this noticeable in the new war plants. Hot rolling may not be more economical than cold rolling, but it is quicker and produces a very satisfactory quality of strip. Use of more automatic controls on furnaces and rolling equipment along with mechanical handling in the form of conveyors, crane equipment and elevators now permits the use of larger castings with greater uniformity and higher quality.

Much Progress Made in Testing Super-Quality Forged Parts

BY WALDEMAR NAUJOKS
Chief Engineer
Steel Improvement & Forge Co., Cleveland

■ THE NECESSITY for continuous peak production has led to the development of many improvements to existing methods and the adoption of new ideas in the production of forgings. An important problem has been that of speeding up process inspection and testing, particularly on aircraft and similar super-quality parts which require rather elaborate and continuous inspection and testing. To increase plant testing and inspection procedure many times without affecting the accuracy of such tests, plus the assurance that results and records are absolutely correct, has offered its problems. Along with the many other production improvements, the increased speed in the testing and inspection of forgings for all phases of chemical, physical, and visual inspection has been synchronized to the production effort so that the testing, checking and inspection of quality and super-quality forgings is as thorough and accurate as it has been during the normal periods of plant operation.

Rough Machining Work in Forge Shops Expedites Production

BY R. W. THOMPSON
Transue & Williams Steel Forging Corp.
Alliance, O.

■ MANY machining operations on forged ordnance parts are now conducted in the forging plant to expedite their completion. By co-ordinating annealing, rough machining and heat-treating operations, considerable time is saved. Magnaflux testing, required on practically every aircraft forging, has been found an advantageous means of correcting errors in die design in other important forgings. This equipment is now being used as an excellent quality control according to certain standard practices.

The die situation, while still a major problem, has been relieved in some instances by having dies made in outside die shops and by two or more customers establishing ownership in the same dies for a particular part.

Aircraft Engine Work Ups Size of Forge Shop Equipment

BY M. A. MONAGHAN JR.
Vice President and Treasurer
Mondie Forge Co., Cleveland

■ FORGING hammers, presses and upsetters have been increasing in size in the past few years, due largely to manufacture of aircraft engine parts. Whether the size of this equipment has reached its apex, remains to be seen.

Regarding substitute materials, manufacturers of gears have been using the SAE 5100 and the 6100 series steels to replace those originally using nickel.

Field for High-Duty Forging Machine Expands Greatly

BY R. H. JONES
National Machinery Co.
Tiffin, O.

■ THE PAST year has witnessed the advance of the modern high-duty forging machine in the mass production of forgings for war. It is now a precision machine tool for producing forgings to closer dimensions than ever before, with subsequent savings in machining time and material. Furthermore, speed, convenience of handling and adjustment help increase output. Such equipment is now used for producing over 20 different sizes and types of shell forgings from the small 1.90-inch British trench mortar bomb to the huge 155-millimeter artillery shell, airplane engine cylinders, propeller hubs, and an endless variety of forgings for ships, tanks, trucks and other equipment for the Army and Navy. Yet this instrument of war, by a simple change of tooling, can quickly and cheaply be converted to the production of peace-time forgings for thousands of products.

More Aircraft Forgings, Some Are Welded to Steel Tubing

BY JOHN A. WEBBER
Metallurgical Engineer
Interstate Drop Forge Co., Milwaukee

■ ADOPTION of AISI standard steels caused quite a hardship in a good many forging plants. Now, however, the first shock is over and their use is becoming accepted. While it seems probable that some of the standard steel specifications will undergo changes, a great step in reducing the number of steels has undoubtedly been made. It should increase the total steelmaking capacity of the country.

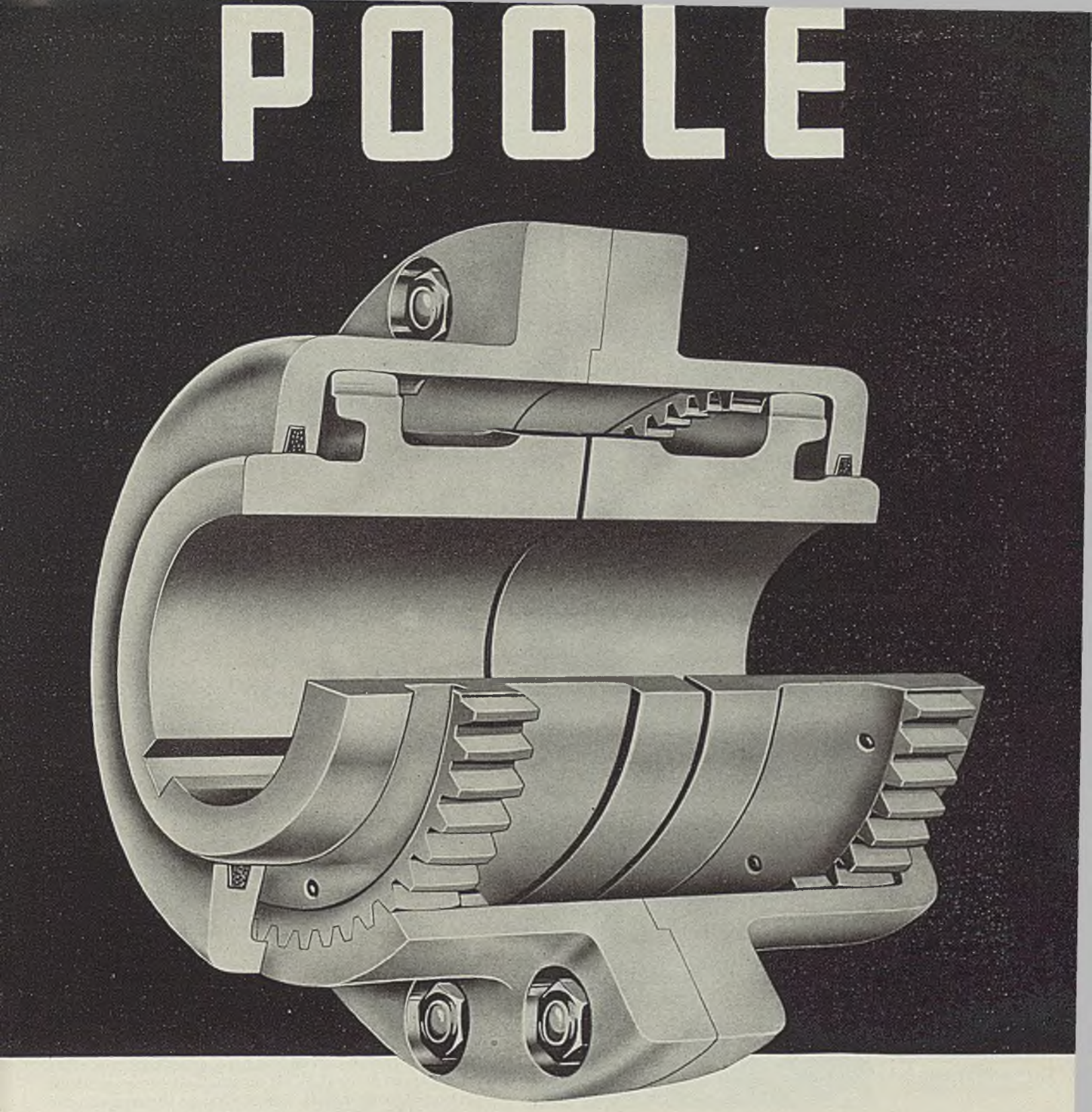
The most serious bottlenecks in the forging industry continue to be diemaking and heat treating. A year ago the forging industry was busy making new dies for aircraft work. Most of these have been completed and forgings are being produced from them. Consequently the volume of aircraft forgings has increased so this work now occupies a large per cent of forging capacity. The aircraft industry continues to substitute steel forgings where greater strength is required and it is undesirable to increase the size of the part. Steel tubing welded to forgings is beginning to be used to obtain stronger and lighter structural members.

Better Die Blocks Increase Production of Drop Forgings

BY J. A. SUCCOP
Heppenstall Co.
Pittsburgh

■ WAR work demands have caused an unprecedented need for accessories used in the drop forging industry, such as die blocks. Manufacturers of this commodity not only are putting forth all effort possible to increase production, but through research, they are improving the efficiency and uniformity of die blocks to such an extent that today the average drop forge shop is constantly able to increase its production of drop forgings. This is made possible by

POOLE



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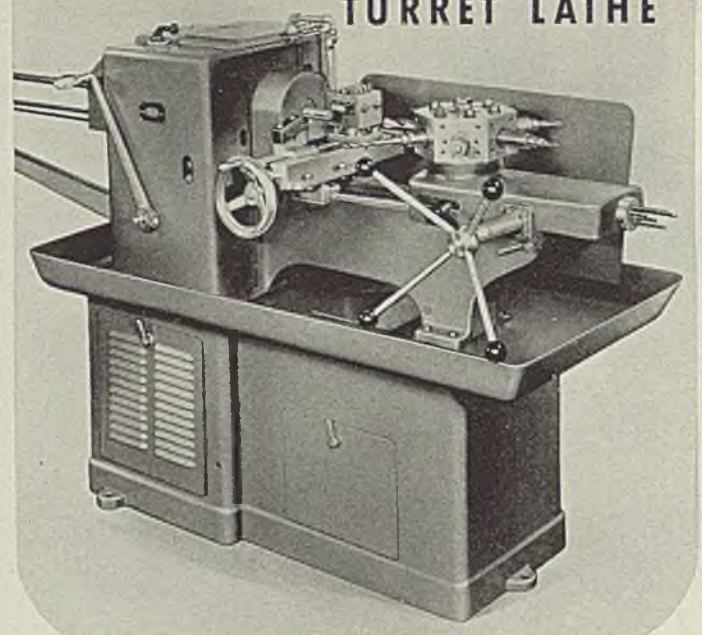
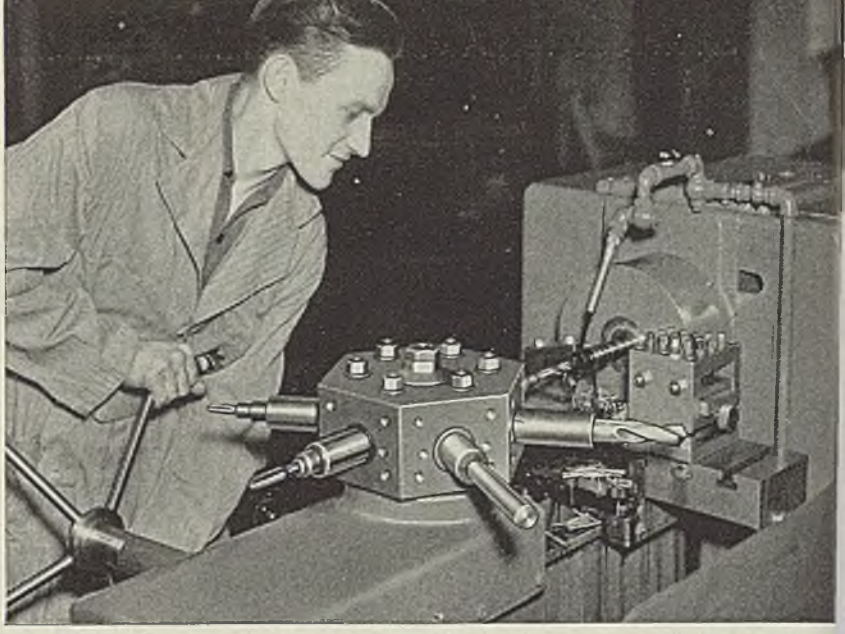
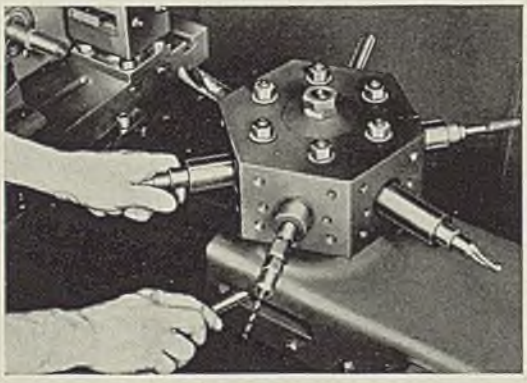
OSTER NO. 601 SIMPLIFIED
TURRET LATHE



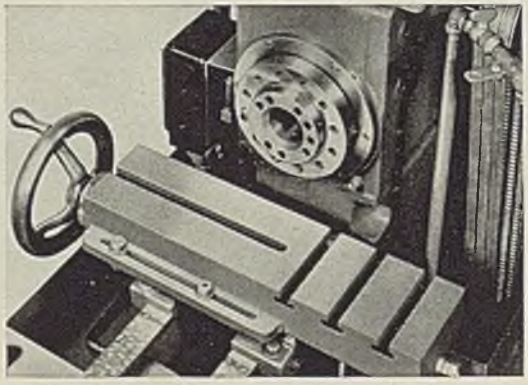


Note the extreme simplicity of this machine with its manually operated, 6-position turret. Makes possible rapid training of new men. Highly skilled operators not required.

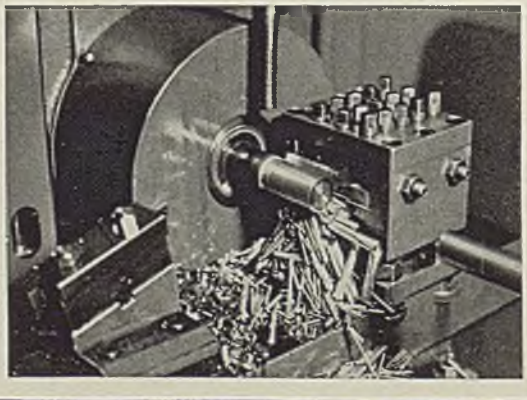
A first and second operation lathe, engineered for a diversity of uses



Manually operated and hand indexed six-position turret. Each face of turret tapped with six 1-1/2" diameter holes for mounting various sizes of tool holders. Lever below turret serves to lock turret rigidly in desired position and also serves to release lock stud when hand indexing.



Screw Feed Cross Slide is mounted on unusually ample dovetail ways and provided with taper gib. Equipped with longitudinal "T" slot on front side and three transverse "T" slots on rear side for rigidly mounting a variety of tool posts and fixtures. (No. 601 machines can be supplied with either the screw feed cross slide, or lever feed cross slide, as desired.)



Equipped with WORM DRIVE, the No. 601 machine is capable of making unusually heavy forming cuts without chatter. The hardened and ground steel worm, like the spindle, is mounted in ball bearings and transmits a smooth flow of power through a bronze worm gear to the spindle.

Form, tap, ream, chamfer, knurl, bore, thread, face, cut off. Those and more jobs are performed with speed and precision on the Oster No. 601 bar and chucking machine.

It's a strictly modern machine, easy to operate, adaptable to meet YOUR specific needs, and moderately priced. (Less than $2000.00, without tools).

Oster's 48 years of experience in meeting precision demands for power pipe threading equipment give assurance that the same high standards are built into the No. 601 machine.

Brief Outline of Details

No. 601 is motor driven. Designed with hand feed to cross slide. Equipped with manually operated, six-position turret; or with plain saddle (where the machine is required for three or fewer operations in sequence.)

Two types of drive are optional: WORM DRIVE which transmits a smooth, even flow of power through a bronze worm wheel to spindle, enabling the machine to make unusually heavy forming cuts with absence of chatter; or with DIRECT DRIVE for high speeds over a wide range up to 3000 R. P. M. on small diameter work or on non-ferrous metals. Quick change sheaves and the two-speed, 2-H.P. motor, manually controlled, drive the spindle through triple V-belts. Anti-friction bearing mounting of the spindle makes high speeds practical.

Automatic chuck capacity: 1-1/2" round bar; 1-1/16" square bar; 1-5/16" hex bar. Swing over bed: 14". Swing over cross slide: 6-1/2". Carriage travel: 11" when there is a cross slide on the 33" main ways. Maximum movement of screw feed cross slide is 6-1/2" and of lever feed cross slide, 4-1/2".

For complete details, send for Catalog No. 27-A.

THE OSTER MANUFACTURING COMPANY
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GET GOING AND KEEP GOING FASTER WITH AN OSTER

developing a steel with improved heat resisting properties and one more readily machinable at higher hardness.

Lack of sufficient forging capacity is serious, but it is rapidly being remedied by building new plants and by increasing the efficiency of existing plants through better management and improved metallurgical methods. The forging industry has learned to speed up production without sacrificing quality.

Better Forging Saves 20 Pounds On 150-Pound Projectiles

BY F. G. SCHRANZ
General Manager,
Baldwin Southwark Division
Baldwin Locomotive Works, Philadelphia

■ TO SAVE labor in the machining of shell forgings, a forged finished cavity is now specified that eliminates the expensive interior finishing of shell forgings. If all the shell forging companies knew how to make perfectly concentric shell bodies, the government could specify their forgings to be of considerably lighter weight since the outside diameter of the rough forging could be reduced; also, the thickness of base and the overall length of forging could be cut to save many pounds of material.

For instance, on a 155-millimeter shell forging, the government specifies a weight of 150 pounds for the rough forging and a weight of 74.26 pounds for the finished forging. With a good concentric forging it is possible to have the rough forging weigh less than 130 pounds, thus saving about 20 pounds of steel on every 155-millimeter rough forging. This is quite an item. Such a saving actually has been accomplished where the shell forger has a contract for completely machining his own shell forgings.

In cartridge cases, research may substitute other materials for brass. If such experiments are successful, a tremendous saving could be made. Plastic composition materials also have been substituted for parts made from composition metals.

Much Planning for Post-War Era Is Healthy Condition

BY O. SMALLEY
President
Meehanite Metal Corp., Pittsburgh

■ PLANNING for the post-war era is being done concurrently with the effort required to solve the huge production problems created by the war program—an amazing and healthy sign. It is becoming a recognized fact that the future is becoming more and more dependent upon the best use of the most suitable materials.

Modern better property castings are making definite contributions. The foundry industry, although faced with many new situations involving raw materials, shortage of alloys, new specifications, and new products is revealing more emphatically than ever the real progress which has been made in the last ten years.

Delivery of Forging Hammers Keeps Up with War Demands

BY MACDONALD S. REED
Chief Engineer
Erie Foundry Co., Erie, Pa.

■ THE INCREASE in the number of forge plants specializing in forging light metal alloys is an outstanding development. There are now almost five plants in production whereas not so long ago there was only one. The availability of these facilities and the technical skill for operating them together with a large supply of metals at lower prices will have an important bearing on many post-war developments.

In spite of the big demand for large hammers, production has pretty well kept pace with the demand, and today deliveries are being quoted on big hammers about the same as they were a year ago. At no time has the situation in hammers been as critical as that with machine tools in general. In a recent survey of production in the commercial drop forging industry only 3 per cent of the reporting volume named lack of hammer equipment as the most important factor holding back their production, and only 9 per cent had any criticism of hammer deliveries when asked to list all important bottlenecks.

Much Raw Material, Machining To Be Saved in Drop Forgings

BY EUGENE C. CLARKE
President
Chambersburg Engineering Co.
Chambersburg, Pa.

■ DROP forging industry has expanded tremendously during the past year, not only in number of units but also in their size.

The average steam drop hammer installed in 1941 is four times as large as the previous average unit. Forgings for war are larger than those required in peace-time pursuits. Still greater expansion is ahead since this conflict is a "war of forgings" for ships, tanks, guns, shell—in fact, most machines of war—are basically forged.

But too much raw material is being wasted and too many machining operations required on many drop forgings. A really modern forging is similar to one displayed at the metal show in Philadelphia. This drop forging for a breech case was so close to finish dimensions as to eliminate not only certain machining operations but also the need for the expensive machine tools involved.

New Shell Forging Presses Up Production, Cut Machining

BY R. E. DILLON
President
Lake Erie Engineering Corp., Buffalo

■ NEW HYDRAULIC machinery designs have been made not only to speed up production but also to improve the quality of the finished product. In making aircraft, the trend is toward presses of larger size and greater capacity not only to enable the production of larger parts for the larger planes but also to finish a greater number of pieces at one time. New and unique work handling devices have been devised to suit these changes.

Faster and more accurate shell forging presses enable the manufacturer to turn out more shell bodies per hour, and they are finished closer to size, eliminating considerable machining. Specially designed straightening and bending presses for gun barrels, armor plate and other products have permitted their more extensive use than would otherwise have been possible. In general forming and stamping work, more accurately and rigidly constructed presses permit more complicated parts to be made with greater speed, precision and less scrap loss. Extensive application of hydraulic plastic molding presses has released previously used steel for other purposes.

Foundrymen Develop Substitutes To Meet War Restrictions

BY GARNET P. PHILLIPS
Chief Metallurgist, Automotive Foundry Div.
International Harvester Co., Chicago

■ RESTRICTIONS on the use of alloys have caused foundrymen to develop substitute alloy combinations. Copper-chromium alloy iron truck brake drums and hardened cylinder liners and sleeves for gasoline and diesel engines are examples of substitutes for nickel-chromium alloy gray irons. Now with copper restricted, further substitutes will be forthcoming. Restrictions on nickel and copper have stimulated markedly the use of special silicon ferroalloys and the use of molybdenum.

For greater speed and economy, hot-blast equipment is finding favor where tonnages are large enough to justify installation costs. Mechanical charging equipment with greater tonnage capacities and elimination of hard manual labor are being used increasingly. Electric furnace melting for special irons has increased.

Core blowing equipment has been used for more and larger cores at reduced cost. Automatic controls on core baking equipment and improved types of ovens have increased core production and improved uniformity of resulting cores.

Don't Let Military Work Stop Developments and Improvements

BY P. J. POTTER
Executive Vice President
Pangborn Corp., Hagerstown, Md.

■ MANUFACTURERS of foundry equipment are busy designing and making special machinery for the mass production of all the new and complicated machines of war —at the cost of normal development of more efficient conventional machines. But all thinking men should be acutely aware of the accumulating shortage of new designs of equipment for regular peacetime production. Each should make his own plans for intensive resumption of work on improved designs as soon as the war terminates.

War-time work is not entirely wasted, for out of meeting of these new problems will come new abilities, not the least of which is the habit, rapidly being formed, of solving problems in a fraction of the former time.

Castings Replace Forgings As Quality of Castings Improves

BY MARSHALL POST
Vice President
Birdsboro Steel Foundry & Machine Co.
Birdsboro, Pa.

■ WITH the help of radiographic technique, continued progress has been made in the manufacture of castings of complicated shape and large size—for example, many of those used in ship construction. As a result of intensive efforts in many quarters, the average quality of such castings now being made is much higher than was thought possible even a few years ago. Co-operation between designer and foundryman in the production of these difficult jobs, leading to the elimination of some of the more undesirable features of design, has made some progress, and it is hoped and expected that more will be accomplished along these lines as engineers become more familiar with the peculiar problems of the steel foundryman.

It is interesting to note that orders are being received to an increasing extent by steel foundries for parts formerly ordered as forgings. This tendency indicates clearly the progress that has been made in improving the soundness, strength, and reliability of cast products and in familiarizing engineers with the results that have already been attained, so that they are more willing to accept castings for places where formerly they had supposed forgings to be the only reliable material to use.

The alarming scarcity of steel scrap has resulted in an increased melt of pig iron by open hearth foundries, as the proportion of pig iron to scrap in the charge has had to be considerably increased. It is not possible to go too far in that direction without slowing up furnace practice to a prohibitive degree, and the scrap problem has been and still is one of the major headaches of the industry.

Successful Production of Cast Armor Parts Dispels Prejudice Against Heat-Treated Castings

BY JOHN HOWE HALL
228 West Willow Grove Avenue
Philadelphia

■ UNDOUBTEDLY the outstanding development in the steel foundry industry during the past year has been in the production of cast armor parts of intricate shape and increased size. The experience gained by the industry and its customers in making these parts will have a profound effect upon molding and heat treatment practice in making steel castings after the present conflict has passed. In particular, existing prejudices against heat treatments designed to enhance greatly strength and shock toughness of steel castings will have been largely dispelled. The cult for restricting the heat treatment of large castings to an old-fashioned "full anneal" is doomed to speedy extinction.

Progress in eliminating undesirable restrictive clauses in certain government specifications for steel castings has been disappointingly slow. In particular, sections of these specifications instructing the foundryman in how he shall make and heat treat his castings, rather than what tests

Let a Meehanite Foundry Solve Your Casting Problems

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FROM **9** MONTHS BEHIND SCHEDULE

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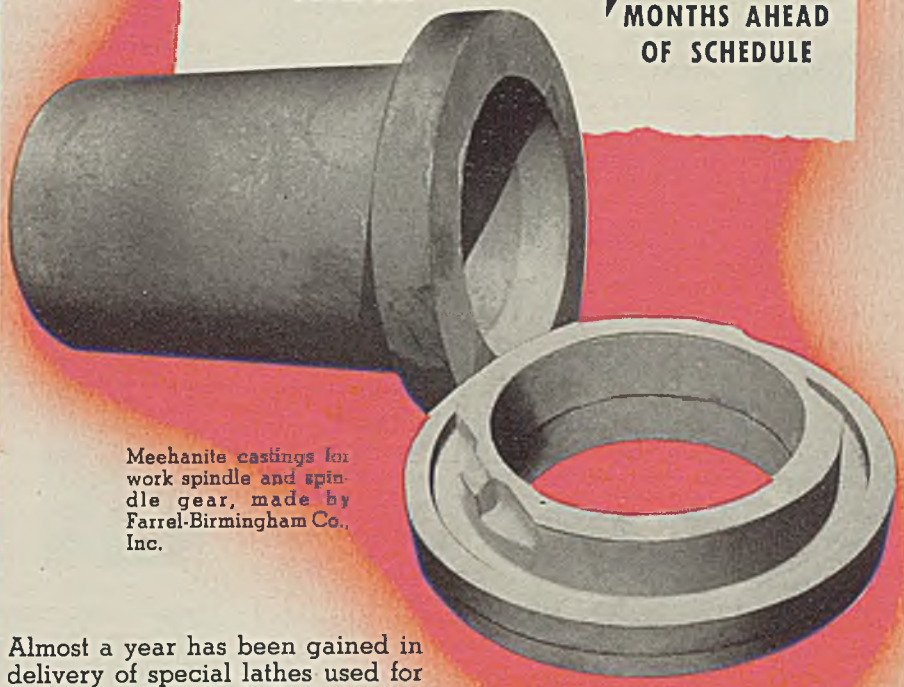

Meehanite castings for work spindle and spindle gear, made by Farrel-Birmingham Co., Inc.

Almost a year has been gained in delivery of special lathes used for machining British shells through a change to Meehanite castings for several important parts! Due to difficulty in securing materials it appeared that deliveries of these vitally needed tools would be 9 months behind schedule. But by specifying Meehanite, deliveries were actually made 2½ months *ahead* of schedule! Performance of these lathes in service has amply proved the forecast that Meehanite would do the service job required.

Meehanite castings offer many advantages to equipment and machinery manufacturers. Combining the best properties of cast iron and steel, this metallurgically controlled cast metal provides high strength, good wearing qualities, and adaptability to heat-treatment and flame-hardening. Design characteristics are reliable and such engineering properties as high damping capacity, good machinability, and maintained dimensional accuracy are provided. Let the nearest Meehanite foundry show you how to use this modern cast metal to your advantage and profit!

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MEEHANITE

SEND FOR BOOKLET

Write for Engineering Bulletin No. 9—"Meehanite, the Metal for Machine Tool Castings."

his finished product shall meet, have been clung to with disturbing pertinacity.

Nondestructive methods of testing steel castings have made further progress. Large, high-powered X-ray installations are being made in several shops, greatly speeding up radiographic examination and widening the range of castings to which radiography can be applied. A new technique in magnetic powder testing is being developed to improve the usefulness of the method and to eliminate some of its undesirable features.

As more reliably weldable cast steels have been developed, the trend toward the substitution of welded all-structural parts for steel castings has been arrested. In place of the often costly and wasteful method of building up a unit from a multiplicity of small pieces of rolled or forged steel, the welding together of several steel castings, or of castings and rolled or forged products, has made further progress.

Converters To Occupy More Important Place in Casting

BY F. A. MELMOTH
Vice President
Detroit Steel Casting Co., Detroit

■ IN THE steel castings industry, 1941 has been a year of production and still greater production. The manufacture of specialized types of work for military purposes has absorbed the energies of the industry almost to the limit of its present capacity. Probably the most remarkable factor in this situation is the realization of just how important a part steel castings are to play in an adequate victory program, and from this will develop, undoubtedly, great mass production schemes for vital steel castings for war uses.

The severe working conditions imposed upon castings for many war purposes have resulted in a wide application of nondestructive testing methods, such as Magnaflux, X-ray and gamma ray. . . A striking growth in interest in the converter method of steel production has developed, and there can be no doubt that many such furnaces will be installed in the near future for purposes for which they are entirely suited.

Stringency in certain materials is already evident, aluminum for deoxidizing and certain types of ferro alloys being outstanding examples. Supplies of steel scrap of adequate type and composition are far from easy to obtain, and in circumstances of increasing pressure for both better quality and improved delivery the effect of unsatisfactory steel scrap supplies cannot be minimized.

Nonferrous Foundries Often Find Military Work Difficult

BY N. K. B. PATCH
Secretary
Lumen Bearing Co., Buffalo

■ THE OUTSTANDING problem of the nonferrous castings industry today obviously is the difficulty of getting the requisite raw materials when they are needed and in sufficient quantities to insure continuous production. War needs control this so completely that one is constantly faced with doubt as to sufficient renewal of inventory for next month's production.

Foundries who have been specialists in consumer goods and who now have to take ordnance work to keep their men from being out of work are confronted with the problem of making types of castings that are new to them. Consequently, their production of this work must be learned from scratch. This is a very serious problem for those foundrymen who have specialized in some line that did not allow them to build a foundation of wide experience in the production of nonferrous castings.

1000-Horsepower Diesel Engine Crankshafts Cast Successfully

BY CHARLES HOEHN
President
Enterprise Engine & Foundry Co.
San Francisco

■ SHORTAGE of cast iron scrap has become a major problem in the production of iron castings, and is being met quite successfully by the substitution of more than 50 per cent of steel scrap with the necessary cupola additions to develop the required metallurgical analyses. Shortage of aluminum has been met in a number of important cases such as cast aluminum blower fans by the substitution of thin rolled sheet steel parts electrically welded.

Shortage of crankshaft forgings for diesel engines up to 1000-horsepower is being avoided quite successfully by the use of special cast iron and steel crankshafts. The use of exhaust gas superchargers on some of our diesel engines is creating from 30 to 40 per cent more horsepower for the same size and weight of engine, thereby saving the difference in weight and a large part of the cost required to produce the higher horsepower engine.

Tellurium Additions Speed the Manufacture of Malleable Iron

BY A. L. BOEGEHOLD
Head, Metallurgy Department
Research Laboratories Division
General Motors Corp., Detroit

■ Progress in manufacture and utilization of pearlitic malleable iron deserves some comment. During the year a group composed of representatives of a number of malleable iron producers has formulated specifications for three grades of pearlitic malleable iron. This was desirable since this material has been adopted for certain war items. Three grades are specified according to tensile properties and hardness as follows:

	Tensile PSI	Yield PSI	Elongation %	Brinell Hardness
A	80,000	60,000	2.5	197-241
B	70,000	48,000	4.0	163-217
C	65,000	45,000	6.0	143-179

(Values are minimum requirements except hardness, which must be within range specified.)

An outstanding development was the substitution of pearlitic malleable for aluminum in automotive pistons. The high strength and modulus of elasticity of pearlitic malleable makes it possible to produce a piston with a weight intermediate between that of aluminum pistons and cast iron pistons. The shortage of aluminum would ordinarily have caused a change back to cast iron, but a number of automobile companies have taken advantage of the properties of pearlitic malleable iron to reduce somewhat the weight increase necessary if cast iron had been used.

A new development in making malleable irons is the use of tellurium. In light castings, the use of 0.003 to 0.005-per cent tellurium permits the addition of enough silicon to reduce materially the time required for annealing. On the other hand, it makes possible the casting of heavier sections without the consequent increased annealing time ordinarily caused by the reduction in silicon required to get freedom from mottling in the heavier sections. By adding 0.005 to

0.006 per cent tellurium, the silicon content may be increased and freedom from mottling obtained with no increase in annealing time. This eliminates the necessity of melting a lower silicon iron than customary and does not cut annealing capacity on account of increased annealing time. An early commercial application of this process, covered by U. S. Patent No. 2,253,502, was in the manufacture of heavy pistons for rail car diesel engines.

Raw Material Changes Lead To New Charge Combinations

BY R. G. McELWEE
Manager Foundry Division
Vanadium Corp. of America, Detroit

■ THE RAPID changes which have occurred in the raw material situation have made it necessary for most foundry operators to find new combinations of materials to make up their charge. Many of them have not known, until forced to make these changes, how versatile their actual requirements can be; furthermore, the situation has forced many to use certain commodities much more efficiently than in the past. The tendency in gray iron seems to be toward alloy additions so timed as to be most efficient. Obviously, however, much remains to be done before means will have been developed to make up for the lack of those alloys largely responsible for the improved casting properties obtained in recent years.

Malleable Castings Can Handle Many "Steel Casting" Jobs

BY C. G. RAIBLE
Vice President
Tanner Mfg. Co., Cleveland

■ AS THE victory program swings into high gear, it is apparent there is not sufficient capacity for small steel castings. Attention should quickly be given by the proper Army and Navy authorities to the possibility of substitution of small malleable castings in their place. In case these authorities are not aware, vast strides have been made in production of malleable castings toward obtaining important values of tensile strength, shock and wearing qualities. These attributes make them a suitable substitute for many items now specified as steel castings. Specifying as malleable castings would take up capacities which are trending toward idleness and thus would utilize production capabilities efficiently.

Cumbersome Restrictions Should Be Removed for Castings Spec's

BY J. W. BOLTON
Director, Metallurgical Testing and Research
Lunkenheimer Co., Cincinnati

■ IN THE cast iron field, certain alloying agents are scarce. The most effective and economical usage of those available becomes imperative. Liberal usage of alloys often has been an easy way out of difficulties, and there is no question but that a considerable percentage of usage would not bear analysis or close scrutiny from viewpoint of engineering economy. Closer study and control of carbon and silicon is essential. Older empirical methods, successful in their day and place, should not be "petted" today.

Restrictions on pig iron compositions are not helpful to the foundryman. A real problem in the iron foundry is to produce castings of maximum machinability consistent with a prescribed strength range. In general this end is best attained with the lower carbon, higher silicon types. The authorities seeking to stimulate the production of pig iron—largely for steel usage—may be defeating some of the ends they seek—saving of man-hours in industry, especially machine tool hours and conservation of alloys and special (electric-furnace type usually) graphitizing agents in the gray iron field.

Cumbersome restrictions in a number of federal procurement specifications are a serious problem. Specifications should be "streamlined" and red tape cut out.

Co-ordination, correlation and unification of specifications should be effected promptly. The ASTM is working vigorously in this direction. Co-operation has been given by federal agencies, by the AFA, the MSS and various other groups. But far more intensive action and greater speed are needed. Pet provisions and opinions unsubstantiated by either practical observations or sound research should be thrown overboard. Iconoclasm should prevail. This country can drift along and lose much, and so can the industrial groups therein.

Bessemer Units Find Increasing Application in Foundry Work

BY M. F. BECKER
Vice President
Whiting Corp., Harvey, Ill.

■ A NOTICEABLE trend in the castings industry is the rising interest in the bessemer process. The side-blow converter is returning to favor and doing a wonderful job, due mainly to the introduction of electric eye control and to the development of a practical method for desulphurizing cupola iron, which gives easy control of the sulphur content. The side-blow converter has also proved itself a practical unit in triplexing systems for continuous pouring of steel castings. One large steel foundry now under construction for ordnance work will employ four such 6-ton units.

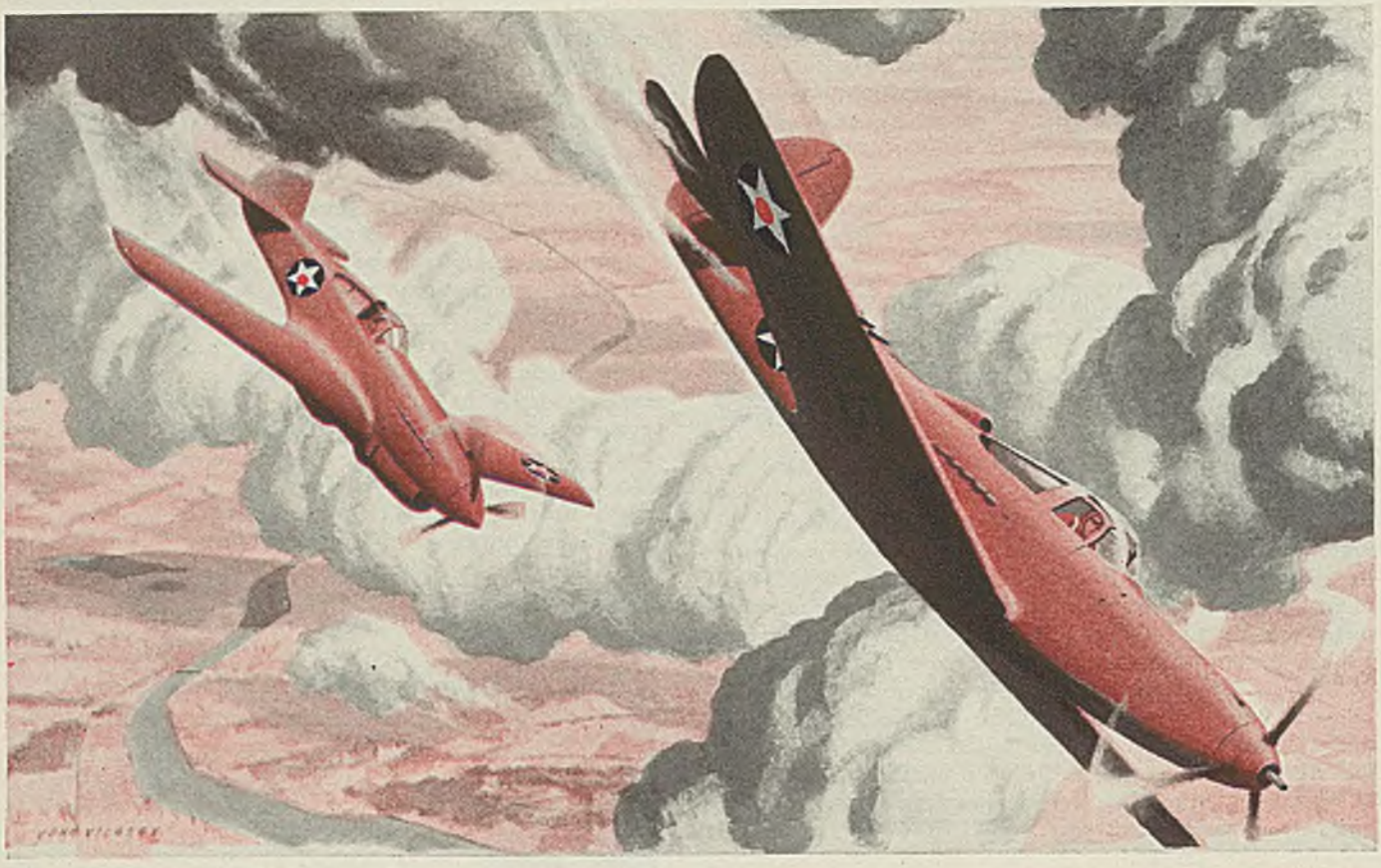
Another metallurgical development is the system of duplexing whereby iron is melted in cupolas, tapped into huge reservoir mixing ladles and then charged into the open hearths. This system speeds up production immensely and also reduces the cost of finished product. Several such installations are now under construction. Additional economies are effected by equipping cupolas with hot-blast.

Gray iron shops producing large volumes are particularly interested in hot-blast apparatus (for preheating the air for combustion). Such equipment not only makes a big saving in coke but also improves general melting practice. One large company saved $50,000 the first year after putting in hot-blast apparatus, and is now equipping another of its foundries. . . Oil as a fuel for metallurgical furnaces and ovens is being replaced with pulverized coal, direct-fired, especially in the east, which is first to suffer from any curtailment in fuel oil supply.

New Foundry Products Expand The Field that Can Be Served

BY J. H. SMITH
General Manager, Saginaw Malleable Iron Division
General Motors Corp., Saginaw, Mich.

■ THIS new year of 1942 finds the foundry industry in an excellent position to aid the victory program. Many foundries have developed a special product in which the properties have been materially increased, thereby permitting a wider use of the material. One of the more recent applications for such a metal is in the automotive



AMERICA'S PIONEER PRODUCER OF MAGNESIUM REPORTS TO THE AMERICAN PEOPLE

EVERY AMERICAN is entitled to know how his own personal efforts in this great national emergency are being matched by fellow-workers in other defense activities.

We, therefore, consider it our duty to report on what we have done—are doing—and will do to meet the nation's mounting needs for magnesium.

Magnesium is the lightest of all structural metals—a full third lighter than aluminum. Its critical value is in contributing to American air supremacy—in saving those vital pounds that spell superior fighting speed—longer cruising range—greater load capacity.

Magnesium, therefore, is of deep interest to every American who holds dear the national heritages of our past—the hopes of our future.

WHERE AMERICA STOOD IN 1939

The Dow Chemical Company began production of American made magnesium metal in 1915. It developed its own producing process, releasing this country from any dependence upon foreign sources of magnesium supply.

But, the manufacture of metal was only the first step. It required years of research and experience to develop a range of practical magnesium alloys (Dowmetal) to serve in various applications. Methods of fabrication had to be adapted to conform to the specialized characteristics of magnesium. And, equally important, American industry had to be familiarized with this ultra-light metal—to learn by test and experience how it could serve many needs. All these steps took time.

Despite all these factors, Dow, as the sole producer of magnesium for American industry, had developed by 1939 a domestic market requiring an annual production of 6,000,000 pounds—a notable accomplishment.

THE MAGNESIUM SITUATION IN 1940

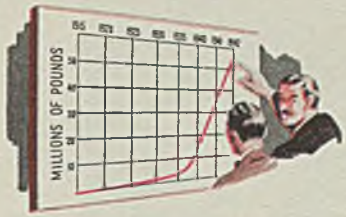
Early in 1940, Dow, having already sensed the rising need for magnesium in the awakening defense program, had voluntarily doubled the production facilities of its Midland plant.

Fast on the heels of this first step in a vast expansion program came even greater—more startling news. In March, 1940, Dow announced to American industry one of the most significant advances in modern chemical engineering—the first extraction of magnesium metal from the sea. This was the logical result of a long experience in the chemistry of natural brines.

Acquiring a 1000 acre site on the Gulf of Mexico at Freeport, Texas, work on a mammoth magnesium plant was started without an instant's delay.

Working at incredible speed—using at times a construction crew numbering 4,800 men—the first unit of this plant was completed and began production in the record-breaking time of ten months.

THE MAGNESIUM PICTURE IN 1941



On January 21, 1941, the first magnesium was poured—and shipped—from Dow's Freeport plant. This was the first time in history that magnesium metal had been extracted in commercial quantities from sea water—a goal long sought but never before realized.

Combined with the already doubled production of magnesium at Midland, this made available an annual production rate of 36,000,000 pounds—a six-fold increase in our national magnesium supply in slightly over a year!

As the year 1941 progressed so did the production facilities for magnesium. By the end of the year, American aircraft and other defense producers measured Dow's magnesium production at over 50,000,000 pounds annually—a considerably greater tonnage every 45 days than was formerly required by American industry in an entire year.

A LOOK AT TODAY—AND TOMORROW

Today, magnesium is rolling out of Dow's Midland, Michigan, and Freeport, Texas, plants in unprecedented volume and production is constantly mounting. In addition Dow is now building at great speed new plants for the government that will overshadow in size and capacity any now in existence in this country.

During those years when only the more progressive of American industrial engineers were utilizing the light-weight characteristics of Dowmetal, it would have seemed fantastic to think that some day the demand for this metal would soar to such stupendous heights.

Yet that day is here and Dow is meeting the challenge as a great opportunity to do a national duty. And, if tomorrow more is asked—Dow wants you, and every American, to know it will respond with every ounce of effort—every resource—at its command.

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DOWMETAL MAGNESIUM

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CHEMICALS INDISPENSABLE TO INDUSTRY AND DEFENSE

piston field, wherein the material offers a combination of high strength, a desirable weight and good wearing qualities. This material has also found its way into the victory program and by its use has released certain critical materials for those industries that can use no alternative materials.

Malleable Iron Castings Prove Okay As Substitute for Brass

BY ENRIQUE TOUCEDA
Malleable Founders' Society
Albany, N. Y.

■ A SPECIAL foundry product for which there is an increasing demand is one showing a very satisfactory degree of wear resistance accompanied with high tensile properties. Another development is the substitution of malleable iron for brass in a number of applications. Malleable iron male and female parts of the expansion type hose coupling for the 2½-inch diameter hose for civilian defense is an example. An order for 50 million feet of the 2½-inch diameter hose, which requires a set of couplings for every 50 feet of hose, is reported. Couplings also are to be made for the 1½-inch hose.

Owing to the scarcity of aluminum, there is a fair chance that pistons made of malleable iron will be substituted for aluminum in diesel engines. Many different malleable iron castings are now being used on midget reconnaissance cars; armored scout cars; Army tractors; Army field ranges; Army aviation gasoline trucks; and in mortar construction, while a few malleable iron castings are being used in connection with both bombers and light aircraft. The ease with which the malleable iron casting can be machined, its higher rust resistant properties and its lighter weight as compared with carbon steel are increasingly important factors.

Mechanized Handling and Use of Graphitizing Alloys Important Phases of Casting Progress

BY J. T. MacKENZIE
Chief Metallurgist
American Cast Iron Pipe Co.
Birmingham, Ala.

■ PROBABLY, the greatest activity in the foundry industry has been increased attention to mechanization, with the triple purpose of speeding up production, saving labor and making the labor that is left simpler and easier. Anything that can be done by machine is being done that way instead of by hand. Mechanized handling of sand and mechanized shake-out have been especially important moves, although core-blowing machines and molding machines have more than held their own. Naturally, the increased mechanization has demanded uniform sand since the molding machine has no "feel" like the skilled molder. Sand testing equipment is the only satisfactory method of maintaining the necessary uniformity.

In the field of metallurgy a great deal of work has been done on the graphitizing alloys, which are largely based on silicon. This has been of interest theoretically for some time, but the shortage of nickel and copper has given it great impetus. These graphitizers have been of assistance in the elimination of chill, hard spots, and differences in section sizes, replacing nickel and copper for this purpose with considerable success. They are also valuable in the elimination of the abnormal structures, which are so troublesome with modern high-temperature melting.

Foundry Process Control Speeds Production, Yet Assures Quality

BY H. W. DIETERT
President
Harry W. Dietert Co., Detroit

■ THE ADDITIONAL burden placed on the steel and casting industry by the scarcity of suitable raw materials necessitates the use of practically any type of scrap available. This, plus increased operating expenses, emphasizes production efficiency more than ever. American industry is awakened as never before to the fuller use of adequate control equipment so that quadrupled production will not entail the slightest sacrifice in quality.

Control in the steel mill or in the foundry, whether ferrous or nonferrous, no longer implies the checking of the finished product as much as it means regulating the various steps involved in the processing of a metal itself. Regulation permits standardization. Mass production of articles to precise specifications cannot be achieved as the result of individual skill but as the result of adherence to established routine. The regulating of a routine process so that it will at all times conform to a selected standard is the primary function of control. The casting industry is doing much in this direction.

Alloy Shortage Hits Foundries; Few Elements Still Available

BY H. A. SCHWARTZ
Manager of Research
National Malleable & Steel Castings Co.,
Cleveland

■ ATTEMPTS to allocate for the most urgently needed war purposes substantially all of the alloying elements procurable in the United States has deprived the foundryman of most of the important means by which improvement of properties was achieved during the past few years. Until iron itself becomes the bottleneck, the steel foundryman seems to be left without recourse except to develop further than in the past the properties obtainable from plain carbon steels.

Happily, the recent work on the fixation of nitrides and on the effect of very small amounts of rather rare elements gives some hope of improving the response of the lower carbon cast steels to heat treatment. It seems likely that in the rather near future he will have available as alloying elements only moderate amounts of manganese and reasonable amounts of silicon and molybdenum. The malleable foundryman may have to do without copper, his most useful alloying element.

Malleable Foundries Report Their Biggest Production Yet

BY F. O. PARKER
Acme Steel & Malleable Iron Works
Buffalo

■ IN ALL probability, 1941 will show the greatest tonnage of malleable castings that the industry has had. At the present time most of the malleable foundries are running at least 75 per cent war work, and some exceed this quite a little. This military work, naturally, includes a great deal of truck work, not only on industrial trucks, but on all kinds of Army and Navy trucks, as well as gasoline trucks, armored scout cars, midget reconnaissance and combat cars.

There are also many malleable castings used in connection with trench mortars, Army field range and also many mal-

leable castings used on Army tractors. In addition, many of the malleable foundries are running on machine tool castings, air compressor castings, and items for electrical trucks. Due to the victory program and the need of more power, more insulator castings are being used. The malleable industry has always depended upon the railroads for some of its business, and with the large car building program, foundries have been under pressure to get out railroad parts.

The Malleable Founders' Society, as well as individual foundries, has stressed the importance of maintaining and adhering to definite physical properties.

Concealed Fastenings Have Important Military Applications

BY ERNEST SCHAEFER
Schaefer Permagrip Enterprises
Cleveland

■ TRUE to the old adage, "necessity is the mother of invention", many time honored construction methods have been abandoned because demands of the victory program made accustomed materials, tools and equipment unobtainable. It soon became evident that substitutes had to be considered primarily upon the basis of simplicity of adoption. Along this line, a new research in concealed fastenings appears significant. In the aircraft field, for instance, it provides a smooth non-pierced non-welded outer surface. It lends itself also to attachment of the new metals-substitute fabrics that have recently been developed. For attachment of plywoods it provides a non-fiber-bruising hold that employs the strength and resilience of this material indefinitely. The system has the inherent flexibility needed. In attaching armor, it eliminates necessity for rivet holes or welding.

Many Priorities Still Not Made Known; Military Work Should Be Described to Suppliers

BY WILLIAM G. UHLER
Cleveland Cap Screw Co.
Cleveland

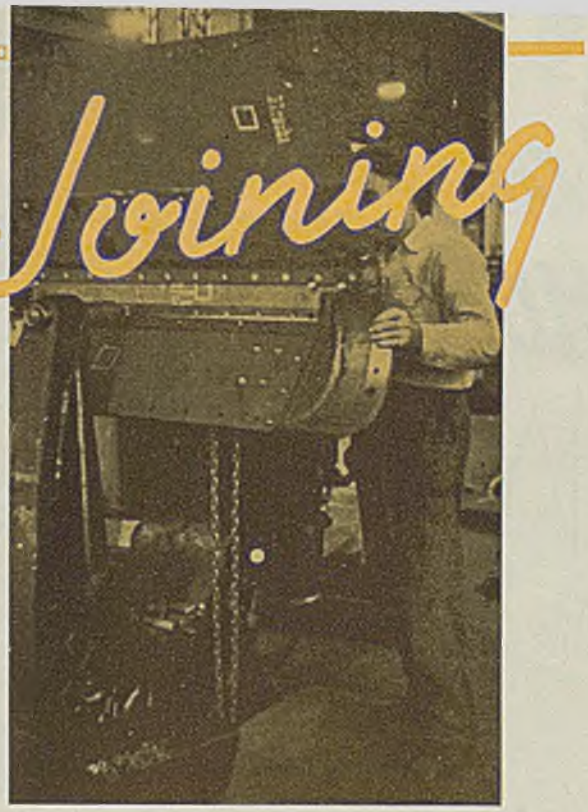
■ THERE is a definite trend toward the use of higher carbon steel and heat treatment in cap screws. And furthermore, the additional tensile strength obtained in the high-carbon heat-treated screws is being recognized by leading engineers who are incorporating it into the assembly of various products more and more each day. Military needs have emphasized a swing toward heat-treated alloy steels. In many cases, even in war work, engineers are specifying alloy steel heat treated when it is not really necessary.

The immediate problem, of course, is priorities. Unfortunately, many concerns either through ignorance or willfulness have not taken the pains to make known their position in the victory program and are suffering and will continue to suffer from want of material until they inform suppliers of their work.

Cold Riveting Still Employed Extensively in Making Tanks

BY T. PIERRE CHAMPION
President
Champion Rivet Co., Cleveland

■ A YEAR ago cold riveting was being used extensively in the manufacture of armored tanks even in rivet sizes as large as ¾-inch in diameter; the same holds true now. Much work has been done on the welding of armor plate



for tanks, but rivets are still the accepted means of joining the plate.

In the heavy sections of armor plate, welding is being employed for fabrication, but to an extent limited by the scarcity of austenitic materials. A non-austenitic electrode probably will be developed for this purpose.

Automatic "Flush" Riveting Now Done at High Speeds

BY FERNE P. DWELLEY
Tomkins-Johnson Co.
Jackson, Mich.

■ TOOLING for handling "flush" riveting, a type of riveting until now largely slow or inefficient if not both, has been developed successfully. Another development is a machine which combines the advantages of the familiar and well liked "air squeeze" action with the automatic feed feature demanded by present production schedules. A recent application of "twin" riveting is its use to rivet anchor stop nuts in aircraft assembly.

In addition to aircraft work, production riveting is being employed increasingly for many military items such as shell boxes, gas mask trappings, valves for gas masks, mess kits, bomb fins, bomb timer parts, rings for rims of anti-tank mines—to name a few. Demands for two or three-purpose machines are being increasingly encountered. This can sometimes be accomplished at not too great expense, creating definite savings where production warrants. Because of their adaptability for this, riveting machines with their automatic feed mechanisms are being increasingly employed.

Centralization of Research a Significant Trend

BY W. H. BRANDT
Assistant to President
Chain Belt Co., Milwaukee

■ THAT technological advancement is receiving unusual attention on the part of management is indicated by re-

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cent action by this company. Here G. K. Viall, vice president in charge of the Construction Machinery Division, has been named to head a new department of research and development for all divisions of the business. Among the problems anticipated will be those arising from the shortage of various materials and the necessity of developing substitutes as good, if not better than the originals. While the company has always displayed a keen interest in product and technological progress, the fact that such activities are now being centralized under an important officer of the company is significant.

When Planning Handling Systems Remember—"Time Is Short"

BY H. J. BEATTIE
Manufacturing General Department
General Electric Co., Schenectady, N. Y.

■ "TIME is short" is one of the slogans used by the government for the victory program. It also is an excellent thought to keep in mind when developing handling methods. The acid test for any system is its effectiveness in realizing the maximum machine utilization and man-hour productivity in the manufacturing departments. Studies made some time ago of several common manufacturing operations revealed that from 8 to 88 per cent of the operators' time was devoted to ordinary handling. Flexibility is another qualification of prime importance, particularly today during the transition period from civilian to war manufacture. It again will be in the limelight when the transition will be in the opposite direction in a few years.

During the last six years we have developed and expanded an industrial truck system, principally the fork truck pallet method, which is of inestimable value to us now during the change-over period. As rearrangements of existing departments are made and new buildings erected, the machines are laid out for truck servicing so that materials in unit loads are taken from stocking centers and placed at the most convenient position for the operators.

"Everything on Wheels"—Trend of Materials Handling Equipment

BY W. B. LACKEY JR.
Secretary
Service Caster & Truck Co., Albion, Mich.

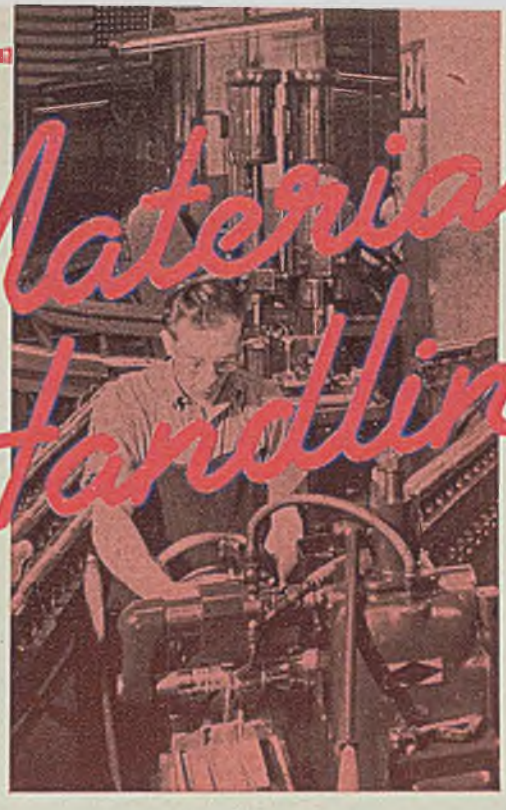
■ THE TREND in the materials handling field as I have been able to observe it might be summed up with this statement—"A swing to broader mobilization of materials handling equipment than ever before . . . everything on wheels". Just as one of man's first machines was the wheel and axle, so today putting wheels on things can also be an important step forward in speeding production to aid the victory program.

Shift Toward Welded Construction Seen in Making Handling Units

BY G. H. ATWOOD
Chief Engineer, Crane and Bridge Department
Dravo Corp., Pittsburgh

■ TREND in material handling equipment—with particular reference to shipyard and drydock cranes—continues to be influenced by welding, leading to larger and yet larger subassemblies in ship construction. Handling of such units and the maneuvering of heavy, intricate, and odd-shaped

Materials Handling



sections into place requires crane equipment furnished with fine control capable of inching these major loads in whatever direction they may need to be moved—at the same time being fast to keep up with demands put upon it by a rapidly accelerating shipbuilding program.

To illustrate—there is being completed for an eastern shipyard a lot of ten all-welded traveling whirler-type gantry cranes of the screw-luffing type, having a capacity of 28 tons at 85 feet radius on the main block and 10 tons at 136 feet on the auxiliary block. Careful planning of control together with the screw-luffing feature secured the necessary smooth accurate spotting of loads. These cranes, however, also are capable of traveling at 400 feet per minute. The all-welded construction provides increased rigidity and stiffness. The combination of screw luffing together with the welded triangular boom and welded rotating structure makes it possible to stop full load on raising or lowering without the resultant up and down oscillation.

Industrial Truck Industry Concentrates on Production

By D. L. DARNELL
Baker-Raulang Co.
Cleveland

■ TREND in materials handling equip- has become so acute during the past year that the industry has concentrated its efforts on stepping up production. Today, we are operating close to 2½ times normal capacity, and OPM has assigned a high blanket rating to assist in obtaining necessary critical materials.

While electric trucks offer opportunities for both increasing production and reducing costs, the former is by far the more important under present conditions. New developments during 1941 have been limited almost entirely to special models for military purposes such as the handling of bombs and projectiles.

Outlook for the coming year is that demand will continue at about the same rate with production gradually increasing and deliveries becoming slightly better.

Recognition of Handling Costs Significant Trend During 1941

BY F. W. JESSOP
President
Ohio Electric Mfg. Co., Cleveland

■ ONE OF the significant advances during 1941 has been the general appreciation of the fact that materials handling has been absorbing too much of our cost of doing business. It actually costs about as much to transfer a load of 200 pounds as a load of 6000 pounds. For example, when lifting magnets are the handling medium, the size of the magnet should be limited only by the capacity of the crane and the amount of material to be handled per day.

In a recent instance, the purchase of a magnet enabled the user to unload a car of long billets in one hour using three men, whereas formerly it took twelve men a whole day. In another case, one man with a magnet unloaded and stored 40,000 pounds of sheet steel in 5000-pound bundles in 30 minutes, whereas it formerly required three men 90 minutes to do the same work. In these days of high wages, such time savings take on added importance.

Use of Steel Bands Consolidates Packaging; Lowers Handling Costs

BY J. G. BUCUSS
Acme Steel Co., Chicago

■ AS IN World War I, flat steel band is again performing a major service. Steelstrapping systems have made it possible to provide adequate protection to any product through the use of substitute packaging materials or even the entire elimination of individual packages through the adoption of a nonreturnable steel-strapped skid pallet. Also they have further reduced the cost of handling. Industry will continue to exploit the possibilities of skid handling with a view of adopting it for incoming shipments.

Since the carriers have increased the speed of handling cars, the resulting revision of bracing methods also brought about the elimination of excessive dunnage.

Modern Storage Batteries Aid Industries on 24-Hour Schedule

BY GEORGE E. STRINGFELLOW
Vice President
Thomas A. Edison Inc., West Orange, N. J.

■ TODAY'S "war-time" production, as during World War I, is stimulating the use of unit loads and battery industrial trucks. Currently we are witnessing numerous refinements such as the pallet unit and the center-control fork truck which handles these units and can do more work in proportion to its size than would have been thought possible in 1917. Contributing greatly to the latter achievement is the modern steel storage battery which supplies double the capacity that could have been provided in a compartment of equivalent floor area in 1917.

Also contributing to the use of higher capacities is the growing prevalence of 24-hour-per-day operation of trucks, in which, the use of two 12-hour batteries is rapidly superseding the use of three 8-hour batteries. Other recent developments include a new battery cradle designed to fulfill the demand for larger units and quicker change-overs. There is scarcely a product of American industry that storage batteries have not helped to produce in various ways, and the current year has substantiated the truth of this statment more than ever before.

Standardization Aids Production Greatly; Avoids Substitution

BY L. M. SEARS
President
Towmotor Co., Cleveland

■ AFTER a year of incessant work, during which plant and office space was more than doubled, after completely rearranging factory and office layouts and installing new methods, we might be tempted to rest on the achievement of a production rate 300 per cent over that of a year ago if we didn't see so big a job ahead. The need for trucks and tractors keeps on increasing faster than we can enlarge our facilities. At the same time, we must meet shortages of vital materials and adapt ourselves to restrictions in the sizes and shapes in which they come. Thus, caught between increases in demands and restrictions on supplies, we foresee a lot more unusual work ahead.

To be sure, new models have been brought out to meet certain needs. But also we have steadily increased the standardization of component parts to gain greater productive efficiency and to make more efficient use of scarce materials. We have been able to accomplish two things: First, the avoidance of actual material substitution and, second, better function and service.

With all this present activity, we are none-the-less looking to the future—to the day when we can again supply civilian fields and make available to them the new machines and methods for which today's speeded-up conditions will have been the proving-ground.

Impetus of Emergency Serves To Make Handling More Efficient

BY ADOLPH LARSEN
Vice President
Gerrard Co. Inc., Chicago

■ UNUSUAL strides have been made by the material handling agencies during 1941 through the impetus of the emergency program. Equipment of all kinds, formerly shipped in individual separate containers, is now in many cases shipped on pallets or skids tied with metal binders. This naturally greatly reduces handling because such pallets or skids can be placed right in the production line.

The outlook for this method of handling even after the present conflict is that it will be here to stay. Improvements and speedier means of handling now in development will follow gradually.

Standardization of Buildings Would Aid Crane Industry

BY F. M. BLUM
Harnischfeger Corp., Milwaukee

■ ALTHOUGH the crane industry during 1941 has done all within its power to make quick deliveries of equipment to war industries, still greater savings in production could be attained if architects or building contractors would standardize all spans of overhead cranes.

Most cranes are now built to meet building dimensions rather than designing buildings to meet crane dimensions. If crane spans were standardized, considerable savings in cost and reduced time of completion would

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Tough as his position is, he's still getting results in meeting production emergencies. He still can supply you with sufficient amounts of some steels and steel products to make essential repairs, or to tide you over on war orders until mill shipments arrive. If he doesn't have the items you need, he will do everything possible to get them for you.

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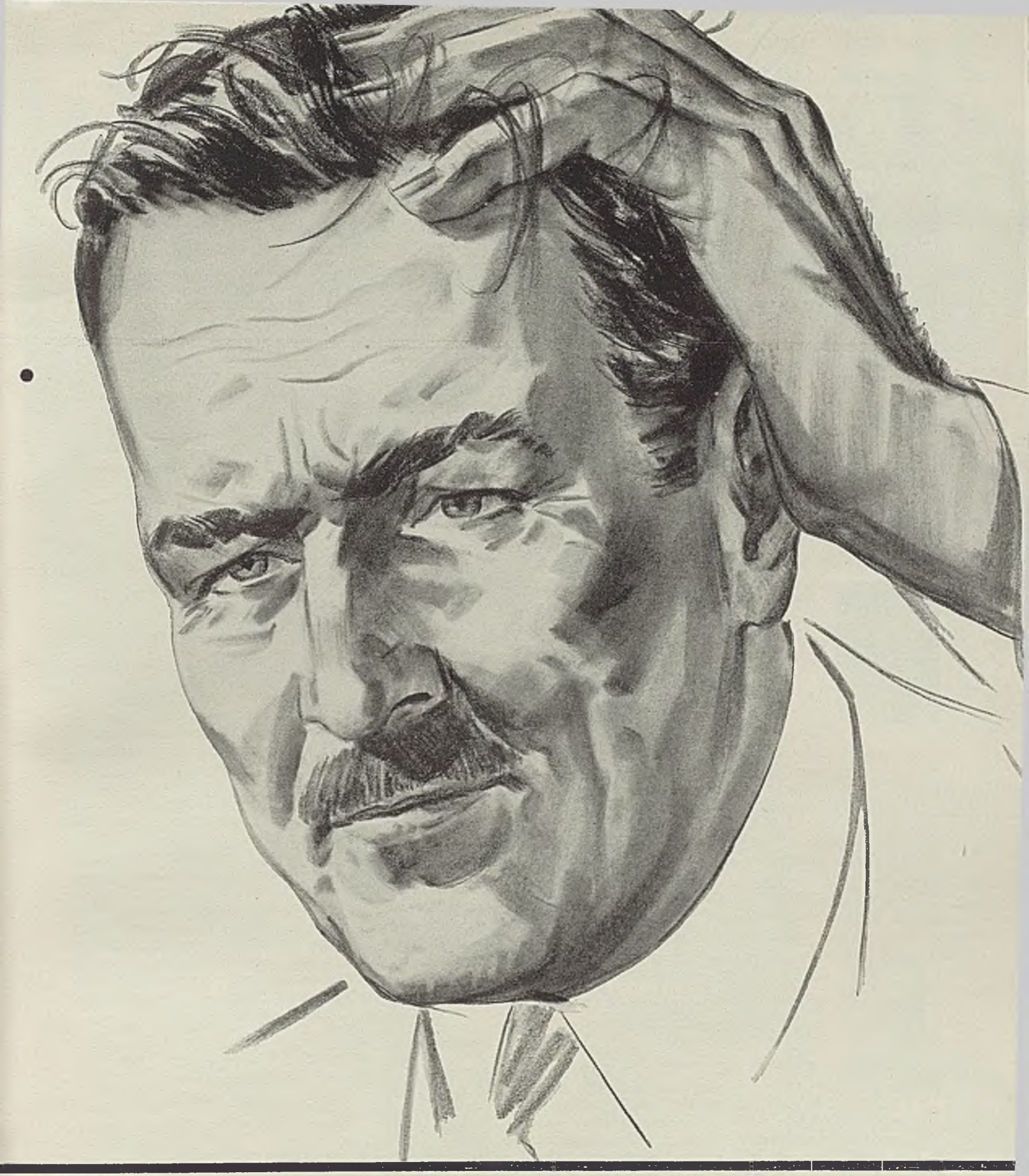

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result. It also would allow crane builders to anticipate requirements by stocking parts. Tremendous strides toward producing more cranes in this national emergency would be possible. Another important consideration is that cranes built to standard spans would have greater resale value.

Scarcity of Labor Increases Demands for Handling Devices

BY F. J. SHEPARD JR.
Treasurer
Lewis-Shepard Sales Corp., Watertown, Mass.

■ AS PRACTICALLY all armament projects necessitate handling of heavy tonnages, lift trucks and skids are in great demand. Volume of material to be handled in the aluminum, magnesium and aircraft plants is so great that lift trucks are almost essential.

In powder and loading plants, a new development has been the static-proof or conductor type of Floor-Protective wheel. The demand for special handling equipment is increasing as production engineers apply more efficient handling methods to the scarcity of labor.

The use of portable elevators, which allow piling to any height, has increased sharply due to expanding inventories and necessity of utilizing every available cubic foot of storage space.

Standardization Speeds Shipments; Helps Obtain Needed Materials

BY E. W. SCHELLENTRAGER
Vice President
Atlas Car & Mfg. Co., Cleveland

■ MOST significant development affecting output of this company during 1941 was the tendency toward standardization in the interest of making shipments more promptly. In the past, equipment manufactured by this company was always strictly "tailor made". Every attempt was made to meet purchaser's requirements fully and in every particular. This procedure does not lend itself to prompt handling of orders at a time when materials are so difficult to obtain. Therefore, with the co-operation of customers, more standardized designs have had a very satisfactory effect in helping us to obtain materials more promptly and, consequently, to expedite shipments.

New Handling Equipment To Speed Dive Bomber Assembly

BY A. F. ANJESKEY
Cleveland Tramrail Division
Cleveland Crane & Engineering Co.
Wickliffe, O.

■ DEVELOPMENTS in the field of overhead materials handling are being made in rapid succession to meet expanding requirements. One of especial significance at present is for accelerating the production of airplanes. This equipment is now being fabricated, and a large installation will be erected in the plant of a prominent aircraft company to aid in the production of dive bombers. Aircraft executives believe that it has tremendous possibilities and that it may bring about a revolutionary change in aircraft assembly. Nineteen-forty-two will witness many new applications of overhead materials handling equipment. Since the greatest savings, both in production time and cost, can be made by promoting efficiency in the moving and handling of materials, there is no discernible end to the variations in which this equipment can be built and the uses to which it can be applied.

Mechanization Speeds Joining Of Parts in Production Welding

BY H. V. INSKEEP
Development Engineer
The Linde Air Products Co., New York

■ IN PRODUCTION welding, developments have been in the direction of the mechanization of the process and efforts both to simplify and speed the joining of metal parts. A typical mechanized application is the production of "Y" gun arbors in which the parts to be welded are mounted in a jig that rotates at a constant speed during welding. Four 7-flame heads heat the edges to be joined while the operator applies bronze-welding rod through a rod guide. All operations, with the exception of the guided rod feed, are entirely automatic.

Another mechanized welding development that is speeding production is a new oxyacetylene tube welding head which is used for the continuous welding of tubing from low-carbon, stainless, and other alloy steel skelp at speeds from 30 to 150 feet per minute, depending on the gage of the material.

Rushed Handling Systems Lead to Improvements

BY JERVIS B. WEBB
President
Jervis B. Webb Co., Detroit

■ TASK of supplying handling systems which satisfy departments where materials run through a prescheduled high production and at the same time feed slow "imposible to schedule" production, and of connecting the two and other departments together with minimum of rehandling, has introduced interesting types of conveyor systems. In high-production press work of small parts, the problem of getting the work away from the discharge point under the press before it accumulated led to the development of light, durable pan and elevator-type conveyors.

To conserve materials, tightly hinged apron conveyors have been developed. These, especially where abrupt changes in elevation are required, keep fine metal scrap from "spilling" and eventually jamming machinery. In substituting metals, some exceedingly adequate yet light steel fabrications have been devised. In many cases perhaps designs have suffered; yet the paradox I believe exists that in concentration on a few sizes, simpler designs are brought forth which require less fabrication and in many cases prove superior to former designs.

Conveying People Doing "Bang-Up" Job Despite Handicaps

BY F. E. MOORE
President
Mathews Conveyer Co., Ellwood City, Pa.

■ CONVEYORS, like our transport trucks and trains, have become prime movers of defense material. Handling of semifinished and finished shell, gun parts, heavy castings and forgings, aircraft parts and innumerable other vital defense materials, has created many new problems for the conveyor manufacturer to solve, and our engineering departments are busier than ever.

As far as scarcity of materials is concerned and sub-

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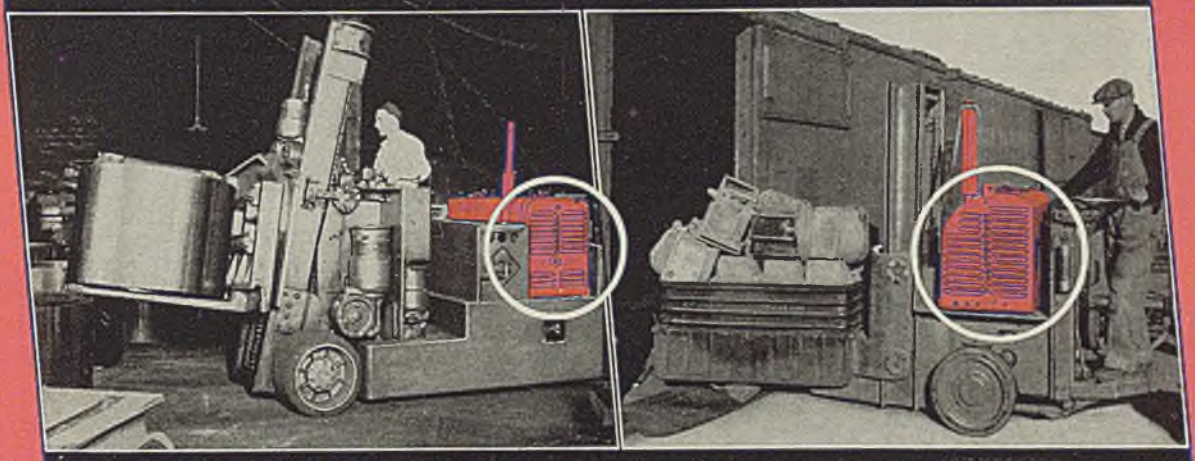

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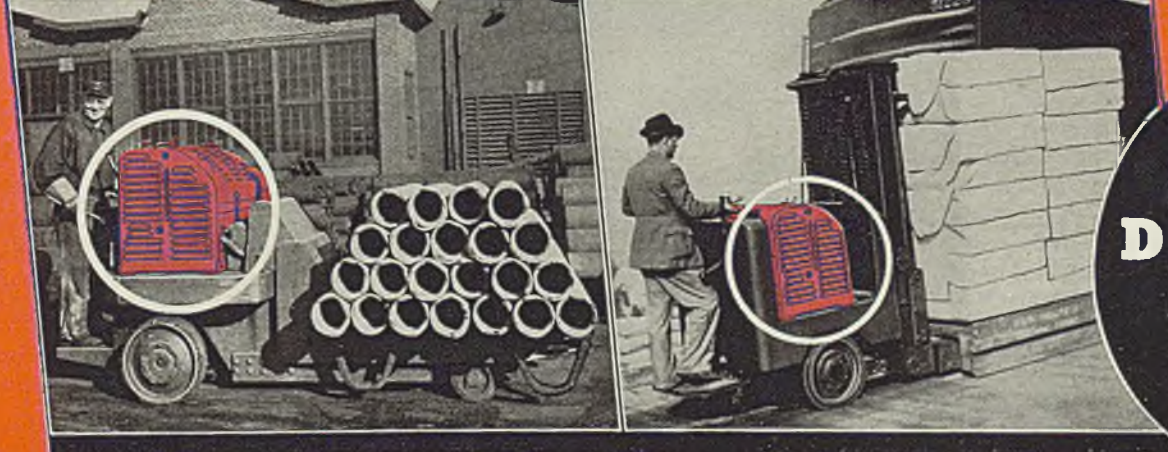

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sequent substitution, I would say that we have felt the pinch, but not to the extent that other industries have been affected. Probably our greatest difficulty has resulted from the scarcity of steel balls vital in the manufacture of our bearings. By substituting friction bearings of bronze or oil impregnated wood, we have managed pretty well to alleviate this condition. The scarcity of stainless steels and high-temperature alloys has cramped us at times but not to any serious extent.

Industrial Truck Trends Change With Needs of Ordnance Production

BY C. B. COOK
Elwell-Parker Electric Co.
Cleveland

■ REFERRING to the status of the industrial truck industry during the early part of 1941, the trend was for the following items as far as general requirements were concerned: Special purpose trucks, scoop trucks, attachments for handling various commodities, pedal guards on end-control type trucks, newer center-control types, Underwriters Laboratories approval, larger capacity units to save over cranes in first and operating costs, larger batteries in medium-sized trucks, pneumatic tired trucks, higher rated motor insulation. Steel mills had turned to gas-electric truck drive. Now some are swinging back to batteries.

After June, 1941, however, demands changed somewhat. New demands for war work include mobile floor-operated and removable trucks; acceptance of trucks as standard equipment and as means to an end similar to motor drive on tools or as elevators for multi-story buildings; industry's attempt to thwart inflation by using trucks as a means to meet increasing hand trucking costs; many concerns are inquiring who now really believe they need trucks, although they could possibly have used them before on a paying basis. There is increasing demand for "flash-proof" trucks in chemical, paint and powder making and handling plants. No one has yet designed an explosion-proof truck.

Prefinished Metal Saves Critical War Materials

BY CARL C. STRUEVER
General Manager
American Nickeloid Co., Peru, Ill.

■ WITHIN the past year, prefinished metals have established themselves as excellent substitutes for copper, nickel, chromium, brass and other "critical" metals for many applications. Most widely used as substitutes have been copper plated steel (replacing solid copper) and chromium plated steel (replacing stainless steel). An analysis of two of these critical metals against their prefinished substitutes will indicate the degree of savings effected. For 1000 square feet of 0.025-inch metal, 1159 pounds of solid copper are required as against 13.8 pounds of copper plated on steel. Similarly, solid stainless steel will require 87.8 pounds of nickel and 197.6 pounds of chromium as against 15.5 pounds of nickel, 0.37-pound of chromium and 13.8 pounds of copper for an equivalent surface area.

Prefinished chromium plated steel is now being used by the United States Army for mirrors, ferrotype plates, field kitchen equipment. Channels for army dispatch cases are being fabricated from unpolished, prefinished nickel-plated steel. Chromaloid and chromium copper are being used by the United States Navy for sinks and shelves in ships' galleys. Many more applications of prefinished metals in defense industries are now under consideration. In each case their use represents a marked saving of a critical metal, yet fully meets all specifications.

Sprayed Zinc Makes Effective Coating for Many Ordnance Items

BY E. A. ANDERSON
Research Division
New Jersey Zinc Co., Palmerton, Pa.

■ THE BROAD restrictions on bright decorative plating on zinc diecastings issued toward the close of 1941 resulted in a general movement toward the use of organic coatings. In most cases, consideration was given to the use of pigmented baking finishes based on synthetic resins and applied over phosphate-treated zinc surfaces. A new zinc tetroxy chromate pigment has created much interest. Heavy sprayed zinc coatings to protect large steel structures are of increasing importance.

Needs of Victory Program Involve Additional Research, Development

BY JOHN JOHNSTON
Director of Research
United States Steel Corp., Kearny, N. J.

■ WAR means any line of research or development which interferes with production must be deferred, yet there is more than enough to do in finding out how to select, make and treat steels for ordnance work. What is needed is the maximum output, not of ingots primarily, but of those steel products which are indispensable.

The American Iron and Steel Institute urges that manganese content be lowered wherever practicable, and has proposed and recommended a set of standard specifications designed to lessen greatly the number of different compositions which the steelmaker is called upon to supply. Such changes, together with changes in the kind of requirements which some of the steels must meet, when used in the victory program, necessitate much investigation to discover, for instance, the most available steel composition and the best mode of heat treatment to achieve the desired combination of properties.

Moreover, in spite of the large fund of information now available on heat treatments to produce a specified structure and the properties corresponding to that structure, ordnance work frequently places special emphasis on some particular property—for instance, ballistic resistance. Being of little direct significance to the everyday use of the material, information on such a property may not be available. This means additional systematic investigation is necessary.

War Work Utilizes Much More Silver; Increases Applications

BY ROBERT H. LEACH
Vice President
Handy & Harman, Bridgeport, Conn.

■ THE PAST year has seen increased industrial use of precious metals. In the chemical industry increasing amounts of silver have been used for lining equipment and as silver clad steel. For more corrosive conditions, platinum clad sheets are now available. More airplane engines now have bearings with silver wearing surfaces bonded both thermally and by electroplating methods to the steel backs of the bearings . . . The tin shortage has increased interest

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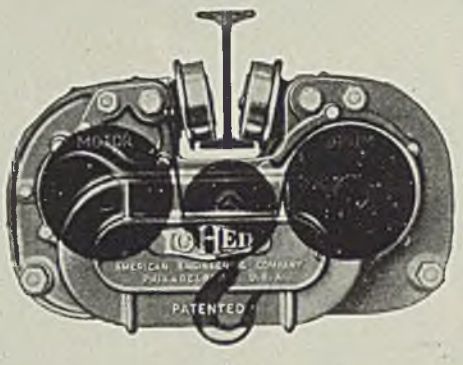

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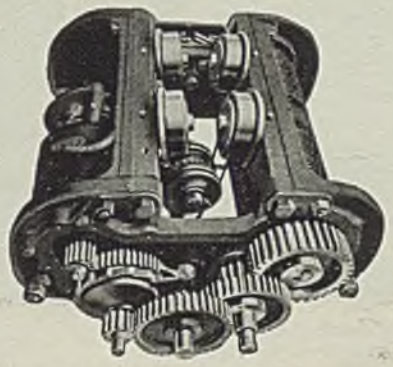

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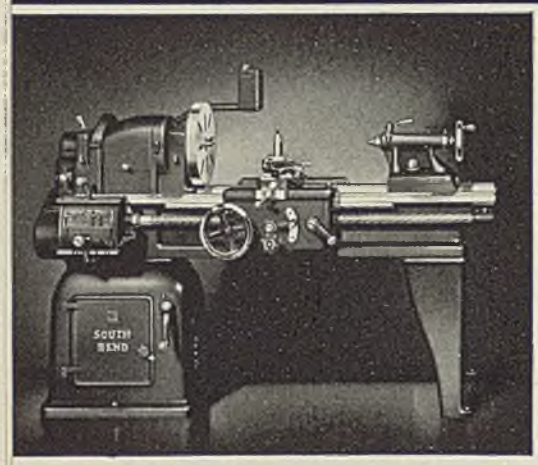
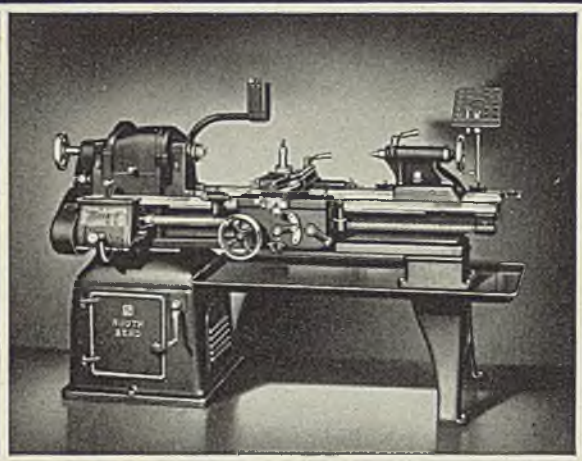
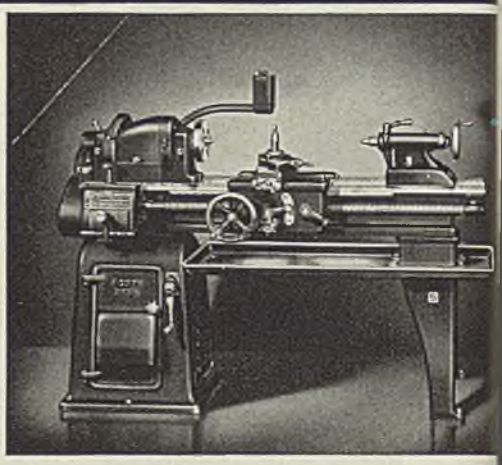


16″ swing South Bend Underneath Motor Drive Quick Change Gear Precision Lathe.

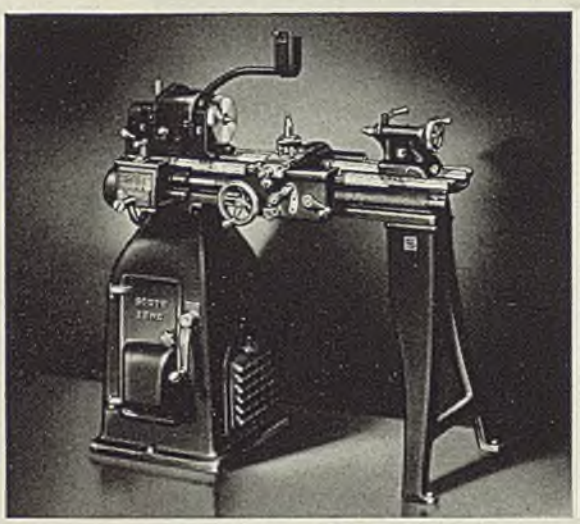


14½″ swing South Bend Toolroom Underneath Motor Drive Precision Lathe.

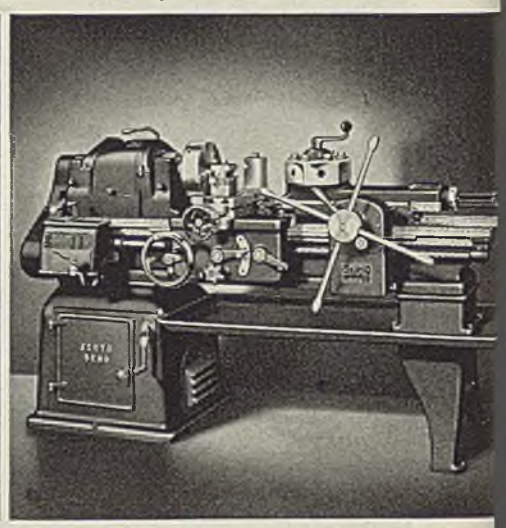


13″ swing South Bend Underneath Motor Drive Quick Change Gear Precision Lathe.

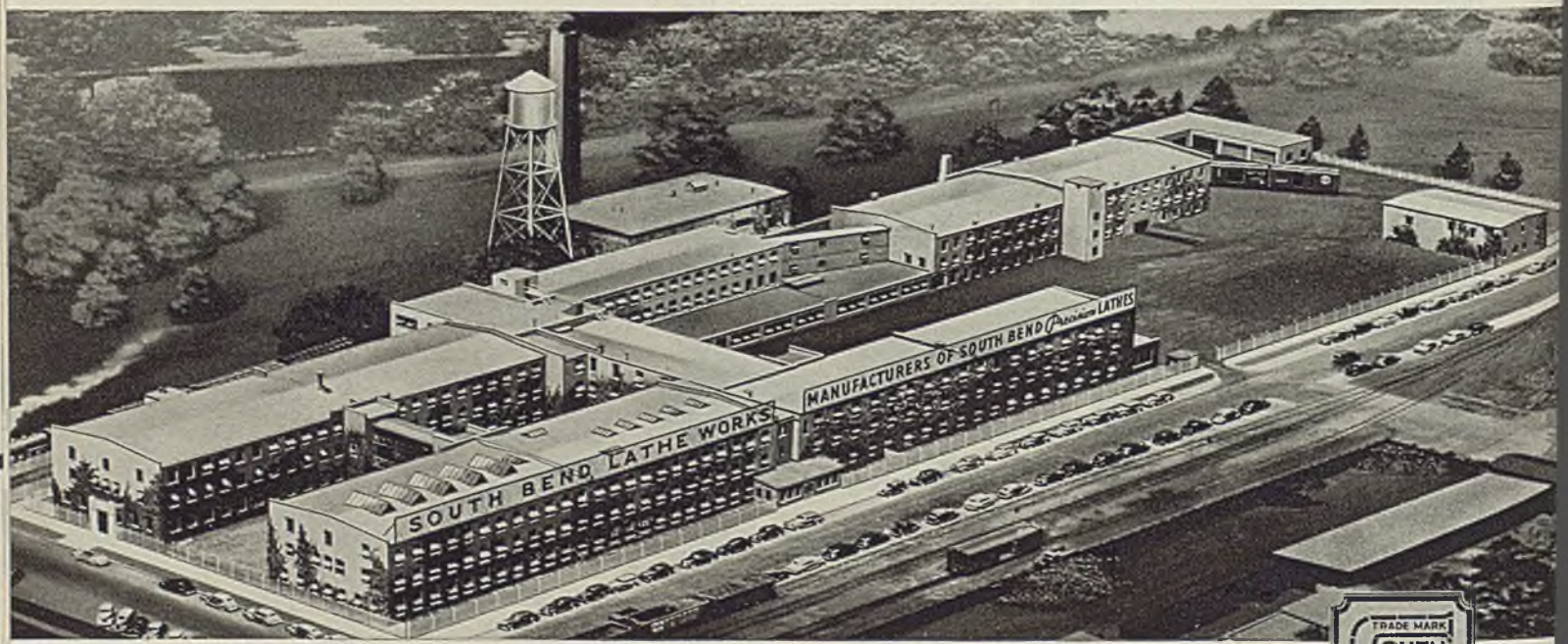
10″ swing 1″ Collet South Bend Toolroom Underneath Motor Drive Precision Bench Lathe.



10″ swing 11/16″ Collet South Bend Underneath Motor Drive Quick Change Gear Precision Lathe.



No. 2-H South Bend Underneath Motor Drive Turret Lathe.



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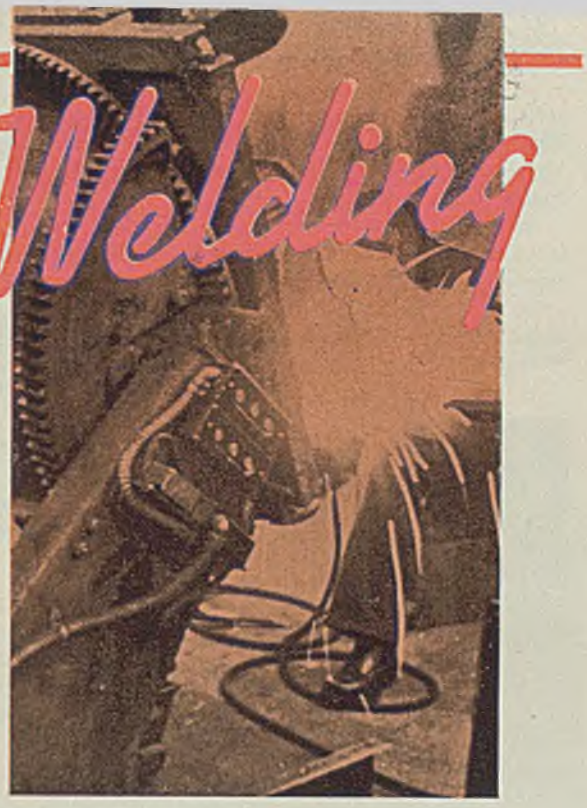

in the use of lead-silver alloys as substitutes for tin-lead solders. Alloys containing 2½ to 5 per cent silver, the balance lead, are satisfactory for many applications, although in continuous soldering work, they act somewhat differently from the tin-lead compositions.

Largest increase in use of precious metals has been in silver brazing alloys. Their low melting temperatures and strong corrosion-resistant joints produced are their two important advantages.

Fusion Welding Again Plays Important Part in War Effort

BY D. S. JACOBUS
Chairman, Handbook Editorial Committee
American Welding Society, New York

■ FUSION welding was given an impetus during the first World war through the pioneering work of the Welding Committee of the Emergency Fleet Corp. of which Dr. Comfort A. Adams was chairman. Its advance since then has been remarkable. Fifty per cent of all merchant ships under construction in this country are now being completely welded, as are all high-pressure boilers and many machine parts. Fusion welding enters largely in aircraft construction and in most fighting equipment. It has advanced to a position where it is an indispensable factor in our victory program.

Many More Aircraft Parts Are Being Fabricated by Welding

BY J. W. MEADOWCROFT
Assistant Works Manager
Edward G. Budd Mfg. Co., Philadelphia

■ RESEARCH in welding done in the past few years at an expense of many millions of dollars will without question permit industry to fabricate airplanes at greater production speeds and at lower costs by welding than through any other method. Engineers are rapidly changing the construction of airplane parts so they can be welded instead of riveted. Manufacturers are building resistance welding machines to handle such work and so speed up airplane production, at the same time obtaining low costs and unprecedented high quality. Not only has considerably more progress been made during the past few years in increasing the use of welding techniques, but welding equipment has been designed and built that is superior to any other in the world.

Is Manual Welding on Large Scale Operations Doomed?

BY ROBERT E. KINKEAD
Consulting Engineer, Welding
3441 Lee Road, Cleveland

■ THE PLAIN inescapable fact is that manual arc welding for large scale operations like building ships, gun mounts, tanks, etc., is doomed. The process is too slow, involves too much human element, and does not produce as good weldments as available machine welding processes. The operator problem in manual arc welding has reached a degree of seriousness which will force the more widespread use of processes where the operator does not hold an electrode in a holder and make a weld progressively by melting the electrode with an arc.

Use of automatic welding heads requires planning the work and providing necessary fixtures. This should be done before—not after—manual welding operations become unmanageable. New self-consuming welding processes are on the way which in many cases will mitigate the problem of positioning and turning weldments for the welding operation.

Automatic Welding Processes Replace Manual on Heavy Work

BY F. EDER
Robert W. Hunt Co., Engineers
New York

■ WAR needs have accomplished much to broaden the application of welding. Automatic processes are now utilized in place of manual welding in fabricating high-pressure marine boiler drums, the longitudinal seams being welded by the Union Melt or other automatic process. With the enormously increased volume and speed of work, safeguarding quality by means of proper inspection and testing becomes paramount. It is worthy of note that pertinent parts of the *Standard Qualification Procedure* of the American Welding Society have now been incorporated in many of the most important welding codes and specifications. Various types of steel have been grouped according to their welding characteristics for the purpose of qualifying welding procedures and operators by the AWS.

Army Air Corps Accepts First All-Stainless Steel Airplane

BY F. M. MORRIS
Process Engineer
Fleetwings Inc., Bristol, Pa.

■ FLEETWINGS recently built and had accepted by the Army Air Corps, the first United States military airplane ever made of stainless steel. The plane is a basic trainer, BT-12, and a large quantity is being furnished to the Army. During the past ten years, various component parts such as spotwelded stainless steel wings, tail, and con-

trol surfaces have been manufactured for many military airplanes, but this is the first time a completely spotwelded stainless steel airplane has been approved by any United States military service.

In addition to spotwelding, arc welding is used to a large extent in the fabrication of aircraft structures. Arc welding of the light-gage materials encountered in aircraft is now highly satisfactory because of the recent equipment developments and improvements such as special controls and "crater eliminators".

Welding Arc Saves 500,000 Tons Of Steel in Cargo Ship Work

BY A. F. DAVIS
Vice President
Lincoln Electric Co., Cleveland

■ WAR industries have utilized welding in 1941 to speed production, to save material and weight and at the same time to produce structures of improved quality and strength. The electric arc, according to a report of the United States Maritime Commission, has saved a half million tons of steel in the construction of 705 cargo ships. In the construction of beaching gears for large aircraft 20 to 25 per cent in construction time, 20 per cent in weight and 31.7 per cent in cost was saved, according to another report.

Other sample war savings due to welding during 1941 included the saving of 19 hours and 35 per cent in cost of machining a metal cutting machine; 38 hours and 15½ per cent in cost of machining a die cutting press; 15 to 25 per cent in construction time, 25 per cent in weight and 32 per cent in cost on a field service truck body; 10 to 12 weeks and 90 per cent in cost of a broken metal stamping press which otherwise would have had to be replaced. Eight hours was cut off production time of one airplane landing gear fork, saving $40 per airplane on the forks alone. At the same time, strength was increased from 79,300 to 98,160 pounds per square inch, or 23.6 per cent.

Revised AWS Building Code To Be Valuable Standards Guide

BY R. B. LINCOLN
Director, National Weld Testing Bureau
Division Pittsburgh Testing Laboratory
Pittsburgh

■ A DEFINITE forward step in 1941 is the work done by the American Welding Society in the revision of its building code, shortly to be ready for distribution. Improvements in qualification of welding processes and operators that result in better quality or decreased cost have the same effect as technical improvements which accomplish the same object. An important change is conformity to the standard qualification procedure already incorporated in the society's bridge specifications, the ASME boiler code and the unfired pressure vessel code. Thus one set of tests will qualify the process and operators under all these codes as well as any others making use of the standard procedure.

"Prequalification" of certain well known and accepted practices by the new code is another improvement which reduces repetition of tests and saves time and expense with no sacrifice in quality. It is necessary, of course, to know that the process used is capable of making satisfactory welds. But some provisions of the earlier code had almost the effect of regarding each contractor as though he had just invented welding, and as though nothing were known as to the procedure necessary to produce good welds. Tests to qualify a process simply to conform to the letter of the code represent wasted effort and will be largely avoided in the new code.

Special Flame Cutting Machines Speed Cutting Steel for Ships

BY DR. GEORGE V. SLOTTMAN
Manager, Applied Engineering Department
Air Reduction Sales Co., New York

■ FLAME cutting machines are now standard equipment in ship construction and in plants preparing shell stock. Many special types have been developed to facilitate cutting standard structural steel sections to the special shapes required in shipbuilding and for more rapidly and accurately preparing plate edges for welding on tanks and ships. Similar problems have been solved in severing shell stock blanks from billets, in trimming bomb cases and in splitting slabs and plates into sizes not otherwise obtainable under present conditions.

Flame cleaning and dehydrating is rapidly gaining acceptance as a standard method of preparing steel for painting in marine and naval base construction as well as for dam gates and other public works. The capacity of existing pickling equipment is being increased by treating the steel with the flame in a combination flame-descaling and pickling procedure . . . Low-temperature brazing alloys of the silver solder type are finding a greatly broadened field in munition production and in pipe fittings for both merchant and naval vessel construction.

Resistance Welders Refrigerate Tips, Extend Life, Up Output

BY J. A. WEIGER
Vice President
P. R. Mallory & Co. Inc., Indianapolis

■ RESISTANCE welding definitely established itself in 1941 as a precision method of assembly for many similar and dissimilar metals. Resistance welding machines today are similar to precision machine tools in their accuracy and efficiency of performance. The year also witnessed further expansion and stabilization of stored energy welding, particularly in the aircraft industry for spot welding aluminum and aluminum alloys with important savings in material and man hours.

Last year also brought a new form of resistance welding to the fore—pulsation welding, particularly advantageous because of its ability to weld satisfactorily heavy-gage metals and a multiplicity of lighter gages without undue deformation. Refrigerated cooling of tips has been used in actual production for the first time this year and is rapidly gaining favor as a means of extending tip life and cutting "down time" due to redressings. Production per machine per man hour also is substantially increased. Greatest use appears to be in aircraft and other industries which weld aluminum and aluminum alloys.

Armor Plate Welding Expands Use of Nickel-Chromium Rods

BY A. R. ECKBERG
Superintendent Engineering and Maintenance Shops
Eastman Kodak Co., Rochester, N. Y.

■ WELDING has made tremendous strides in increasing production of all types of ships including cargo vessels, destroyers, cruisers, battleships, etc. Perhaps not so well known is the application of welding to much equipment previously cast or machined such as gun mounts, fire control mounts, bomb racks, mines, depth charge car-

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riages, cupro-nickel piping, etc. This variety has resulted in application of welding to aluminum sheet, plate and castings; monel metal; cupro-nickel; stainless steel; as well as armor plate.

Probably the largest future development will lie in the revised method of constructing hulls of armor plate for tanks, both the 13 and 28-ton models being changed from a riveted to a welded construction. Such construction automatically eliminates casualties to the gun crew from the rivets torn loose by the impact of shell fire. This program will require training of a good many men in the use of high-strength ductile nickel-chromium electrodes and will hasten the development of automatic welding of armor plate. Silver-clad steel is now being successfully welded as a replacement for silver-plated copper and the high content nickel chromium alloys.

More Welded Alloy Steels Used As Confidence in Welding Grows

BY COL. G. F. JENKS
Ordnance Department, United States Army
President, American Welding Society
New York

■ A FAR-REACHING development in welding is the increased use of low-alloy steels brought about by the victory program. Naval vessels, ordnance, aircraft—all employ a larger proportion of low-alloy steels than normal. Some of these materials as aircraft steels and special ordnance steels are made in electric furnaces, requiring large increases in melting capacities. Fabrication by welding under rigid specifications is widely used in all these products. Full dependence is placed on the integrity of the weld.

In the military services, low-alloy steels are specified primarily to save weight as here reduction in weight for increased mobility is essential. In industrial equipment, low-alloy steels have been used more because of special properties than because of higher physical strength. The railroads have begun to use welded low-alloy high-strength steels in car building because of economies from weight reduction. Weight saving in a structure designed with an understanding of the magnitude of stresses acting, of the frequency and velocity of loading, and of the effect of stress concentrations may result in important economies not only in structures subject to the accelerations of transportation but to other forms of loading.

Aircraft Welding Sets Have Extremely Wide Current Range

BY KLAUS L. HANSEN
Consulting Electrical Engineer
Harnischfeger Corp., Milwaukee

■ CONSTRUCTION of aircraft calls for welding special alloy steels in thicknesses varying from extremely light gage to medium. That means the machines must have exceptionally wide welding range and good arc stability, particularly in the low ranges. This demand has been admirably met in a combination of a generator having a high degree of internal stabilization and an adjustable resistor in the arc circuit.

In shipyards, flexibility of welding equipment is of extreme importance because it permits more advantageous distribution of labor over the various shifts. This "bottleneck" condition has been overcome by a combination of arc welders consisting of two units designed to be operated singly or in pairs, which particular design has been accomplished by an extremely simple current adjustment involving but one control per operator.

Copper Alloys Now Metallic Arc Welded in 1-Inch Thickness

BY J. R. HUNTER
Welding Engineer
Research and Development Department
Revere Copper & Brass Inc., Rome, N. Y.

■ WHILE soldering, bronze welding and silver brazing continue to be used widely in joining copper base alloys, welding appears best for meeting the physical and chemical requirements of the victory program. Brazing has been found inadequate corrosionwise for acetic processing equipment and has been replaced by actual fusion welding with the carbon arc method and silicon bronze filler rods.

Besides being used in gasoline and air tanks on army field stoves, fabricated by both resistance and carbon arc welding, the silicon bronzes have been employed to replace stainless steel for shields on gun mounts. The ability of formed silicon bronze sheets to retain their shape throughout machining operations following forming and welding was the deciding factor here.

Carbon arc welding of phosphor bronze has simplified design and speeded up production of torpedo shells. Fabrication of welded cupro-nickel tubing for moderately large diameter salt water lines will eliminate a shortage of seamless tubing. Stills for obtaining drinking water from salt water have been fabricated of cupro-nickel by silver-brazing methods. Tube sheets so large and heavy that it has been impossible to obtain them in one piece are now being fabricated using carbon arc welding with phosphor bronze filler rods to join readily obtainable sections.

Large Multiple-Operator Welders Find Increasing Application

BY R. F. WYER
Welding Engineer
General Electric Co., Schenectady, N. Y.

■ OUTSTANDING has been the application of constant-potential multiple-operator arc-welding systems in shipbuilding. Hundreds of 1000-ampere and 1500-ampere welding sets, capable of supplying thousands of welding operators, have been selected because their characteristics are particularly suited to the requirements of shipyard welding loads . . . The acceptance of alternating-current arc welding has been very noticeable, particularly in defense industries where both high production and high quality are of primary importance such as in tank production, sub-assembly fabrication shops in shipyards, etc.

There has been a definite shift toward arc welding in aircraft work. Special welders have been developed to meet aircraft requirements, and in some applications production has been speeded up as much as five-fold by shifting from other methods to metallic arc welding. It is quite probable that as the arc-welding load in aircraft shops increases, constant-potential multiple-operator equipment may find applications for the same reasons as in shipyards. Atomic-hydrogen arc welding holds many possibilities, particularly on stainless steels and other alloys used in aircraft work in thin sheets, and in the fabrication and repair of vitally necessary molds, dies, and other production tools.

Speed, Capacity and Range of Resistance Welders Increases

BY I. C. BROWN
Thomson-Gibb Electric Welding Co.
Lynn, Mass.

■ PRESSURE of war work has caused the resistance welding industry to advance further in the past year or

two than during any previous 10-year period. Standard machines have been improved, made more efficient and adaptable in order to provide promptly equipment capable of handling operations that normally would require special purpose machines. Production speeds, capacity, range of materials and quality of work have been improved for all types of equipment.

This same period has seen many important long range developments. The condenser discharge process and the balanced-load 3-phase resistance welding process are solutions to troublesome power problems. Tempobrazing, a new method of hard soldering cold-worked copper, is another important and widely applicable recent development. These, together with the development of such essential emergency equipment as shell welders and aircraft welders, are the significant highlights of the past several months.

Tight Supply Situation Expands Welding in Maintenance Work

BY CHARLES H. JENNINGS
Chemical and Metallurgical Department, Research Laboratories, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

■ THE LACK of certain materials and the overtaxed capacity of all industries has made it necessary to turn to welding to keep production going in many instances. Forgings are being replaced by welded structures; bessemer steel is being used in place of open-hearth steel; fabricated dies are used in place of solid tool-steel dies; and hard facing is being applied to plain carbon parts to conserve expensive materials.

The inability to obtain certain items and materials has made it necessary to employ welding to salvage worn and broken parts heretofore considered impractical to weld. Broken springs are being welded; cutting tools, such as cracked milling cutters, are being repaired by welding; worn wheels on cranes, mine locomotives, etc., are being rebuilt by welding; and fractured or defective parts, almost irrespective of their analysis, are being repaired by some method of welding.

New AWS Welder Training Code Promotes Good Study Standards

BY E. R. FISH
Chief Engineer, Boiler Division
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

■ AN APPRECIATION of the necessity of properly training welding operators has brought a growing demand for some authoritative standards by which training courses could be established or recognized. At least one state has enacted legislation requiring trade schools to secure licenses before starting to give training courses in welding but soon found that facilities, courses, and methods of instruction varied so widely that it was practically impossible to set up any sound criteria on which to grant licenses. This and inquiries made by other interests spurred the American Welding Society to formulate and publish a "Code of Minimum Requirements for the Training of Welding Operators", now available.

This code supplies an authoritative basis for the guidance of welding schools for organizing their courses. It helps protect the better welding schools against competition from schools with lower standards. The code also contains suggestions of value for industrial training courses. Insistence by industry that new welding operators must have a certificate from a school with standards not below those of the code will assure the employment of men with an adequate background.

More Operators To Be Trained For Specific Welding Jobs

BY A. P. YOUNG
Associate Professor of Mechanical Engineering, Michigan College of Mining and Technology, Houghton, Mich.

■ THOSE engineers who attended the annual convention of the American Welding Society obtained a bird's-eye view of welding progress during the past year. The application of new techniques to war industry was well illustrated in a number of the papers presented. Welding engineers by continual observation and study will undoubtedly be able to solve many of the problems which confront them in production for war. This is particularly true if they will observe all factors which affect the welds and the material which is used in fabrication.

The victory program has called for increased production, and this in turn requires an increased number of welders in many lines. It will be necessary to train special operators for special work. Welding engineers should particularly endeavor to train adequately these individuals for commercial production so that these so-called operators do not attempt to weld in all fields without being qualified. Therein lies one danger in the urgency of production for war.

Sees Expanding Use of Arc Welded Machinery Frames and Parts

BY H. C. HETTELSATER
Standards Engineer
Harnischfeger Corp., Milwaukee

■ MANY different industries are substituting arc welded frames and machinery parts for cast or riveted steel parts with a resultant speeding up of production and a radical lowering of cost—especially significant at this time with the victory program demanding the utmost in conservation of time and materials.

In one instance a manufacturer needed a special machine tool for producing arc welding machines. The principle of single unit welded type of fabrication was applied to building up the main frame by designing it from the ground up for welding. As a result, the frame for this machine was built for less money than a pattern would have cost. In addition, the machine was completed and ready for operation in about the time which would have been required to make a pattern and to get ready to make the casting.

Composite Welded Dies Save Important Tool and Die Steels

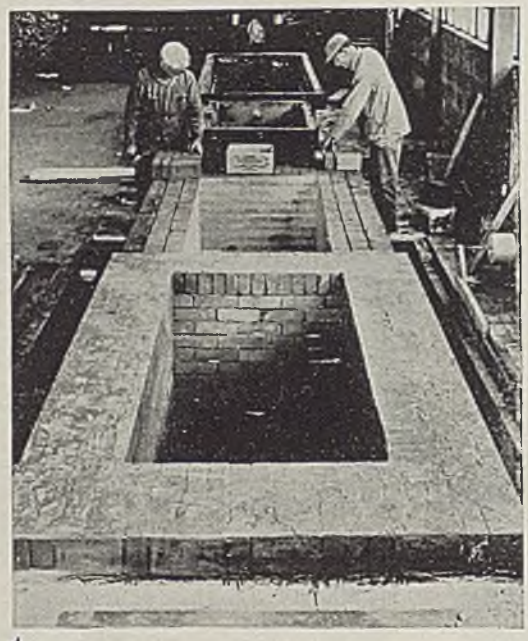
BY A. R. BUTLER
Welding Equipment & Supply Co.
Detroit

■ TOOL and die manufacture and maintenance are prime war factors. Conservation of basic tool-steel stocks is a necessity due to allocations of most of the principal ingredients. In an effort to offset the serious shortage, all industry is now resorting to composite construction of tools and dies wherever feasible. This method uses a mild steel base faced on the cutting or working edges with a metallic-arc tool-steel welding electrode having the desired characteristics.

A large manufacturer of bomber parts recently constructed 102 composite blanking dies, some being approximately 6 feet in diameter. Oil-hardening tool-steel cutting edges were welded on flame-cut boiler plate with a metallic arc electrode. No subsequent heat treatment

CARBON

The Corrosion Resistant Lining Material

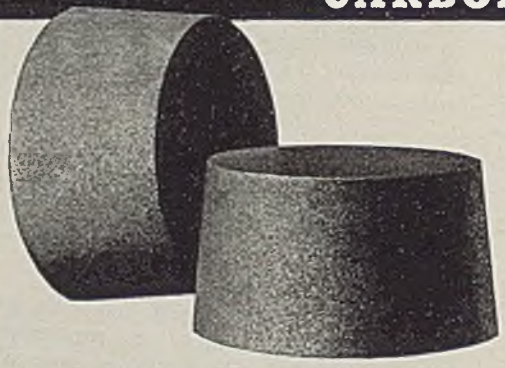


● High resistance to the destructive action of corrosive materials, including hydrofluoric acid and caustic alkalies, and ability to withstand severe thermal shock, lead to extensive use of carbon and graphite brick and structural shapes as linings for pickling tanks and other processing equipment. Experience has proved the economy of carbon and graphite linings in the presence of corrosive materials.

Corrosive waste liquids can be effectively handled in sump tanks lined with carbon or graphite brick. Temperature differential between waste materials run into the tank does not endanger the lining when carbon or graphite is used. Latent heat in hot corrosive waste can be effectively recovered by the use of heat exchangers made of graphite pipe.

This background is the machined surface of one of the several grades of "National" carbon materials.

CARBON MOLD PLUGS



offer economies when used in steel ingot molds. They eliminate ceramic inclusions and prevent sticking of plug to ingot. Each plug is good for several pourings. Sizes other than standard can be made to purchaser's order.

STANDARD SIZES

5 11/16" to 5¼" diameter by 3" long
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—other than tempering—was used. Similarly, maintenance of all types of tool-steel dies by arc welding can do much to lessen shortages and conserve present stocks.

Resistance Welding Progresses In Fabrication of Aircraft

BY J. B. JOHNSON
Chief, Materials Laboratory
Materiel Division
Wright Field, Dayton, O.

■ DURING the past year, the aircraft industry has concentrated on production methods and has studied intensively the application of resistance welding. Since combat airplanes are fabricated from aluminum alloys, the spot and seam welding of these alloys have received the most attention and, consequently, considerable progress has been made. Many accessories and subassemblies which were riveted have been redesigned and are being made with welded joints. Resistance welding departments in practically all plants are increasing as rapidly as the welding machines can be procured. The alternating-current transformer welder is becoming obsolete due to the improvement in speed of welding and the quality of welds which are produced by the latest types of stored energy or unidirection-current welders. But there are still many problems to be solved before spot welding can be accepted as a complete replacement for riveting.

Flash resistance welding of steel aircraft parts is also being applied successfully on a limited scale and expansion here is inevitable as the construction of larger airplanes requires the fabrication of heavier parts.

Steelmakers Fulfill Obligations Ahead of Original Schedule

BY W. C. BUELL, JR.
Arthur G. McKee & Co.
Cleveland

■ STEEL INGOT producers "have done it again" by meeting the war tonnage requirements of the democracies in such fulfillment that ships, armament and munitions are moving far ahead of the original schedules. The 1941 average production rate of about 93 per cent of our theoretical ingot capacity (89 million tons) is a tremendous feat of accomplishment in itself, but production of several million more tons of ingots would have been possible had it not been for labor difficulties and indifferent quality, and shortage of purchased scrap.

The great steelmaking developments of 1941 have not been in plant equipment or methods but in the inherent ingenuity of our supervisory technical personnel who have only needed the proper incentive to bring their latent abilities into full power. Unless new sources are soon uncovered and made productive, the scrap shortage will curtail 1942 ingot production by perhaps 6 million tons below 1941 figures.

Industry Faced with Approaching Shortage of Gas and Fuel Oil

BY P. M. OFFILL
Vice President
Amsler Morton Co., Pittsburgh

■ ALLOY AND high-carbon steels are rapidly replacing the more common grades. Because of the particular time-temperature requirements for reheating these special steels, most steel manufacturing plants and finishing mills find that their previously satisfactory pit and continuous type furnaces now are inadequate.

Operators are tending to seek the co-operation of metallurgists, combustion men and engineers in their studies of furnace design and operation before making purchases.

The possibility in the near future of seriously reduced supplies of natural gas and fuel oil for industrial purposes turns attention back to coal. Construction of by-product ovens and even of coal gas producer plants, involves comparatively large investments and other possible difficulties that cannot always be avoided. But there are many instances in which coal in pulverized form can be utilized to replace natural gas or oil quickly and at relatively low cost.

Wherever possible, industry will do well to prepare for shortages of natural gas and fuel oil.

Amplidynes Widely Applied by Steel Industry in 1941

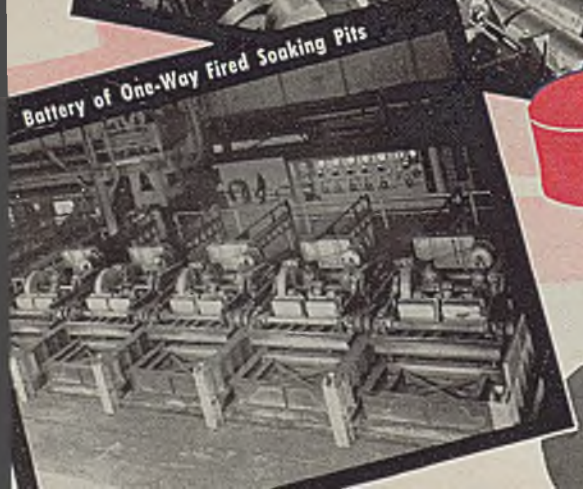
BY F. MOHLER
Industrial Engineering Department
General Electric Co., Schenectady, N. Y.

■ THE WORLD'S fastest cold-strip mill, having a nominal operating speed of 3300 feet per minute and a maximum speed of 4000 feet per minute, went into successful production early in 1941. It has already operated at 3900 feet per minute breaking all records for fast production. Amplidyne exciters on this mill play an important part in maintaining almost perfect speed regulation at all speeds as well as accurate tensions during acceleration, running, deceleration, threading.

Amplidyne exciters also were applied successfully in connection with tensiometers for the two tension reels of a reversing cold-strip mill where a wide range of tension control was required. This represented the first application of its kind. Largely due to improved amplidyne control, two revamped temper and skin-pass mills have been run as high as 3300 feet per minute with the same ease as 1000 feet per minute a few years ago.

Perhaps the greatest advance in blooming mill control in the past decade is incorporated in the equipment for a new bloomer for rolling alloy steel. Amplidyne exciters and a

"GIVE US STEEL!..."



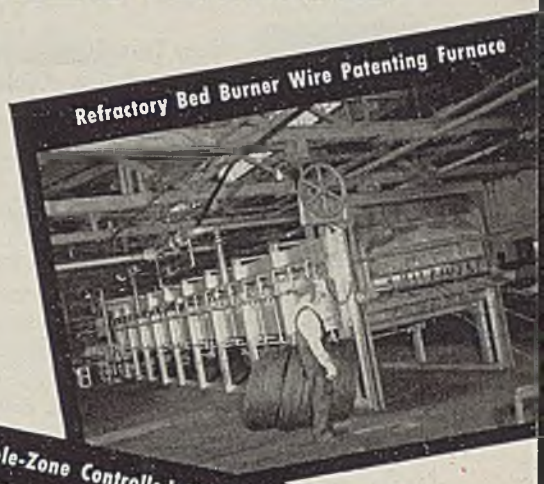
THERE'S AN SC FURNACE...

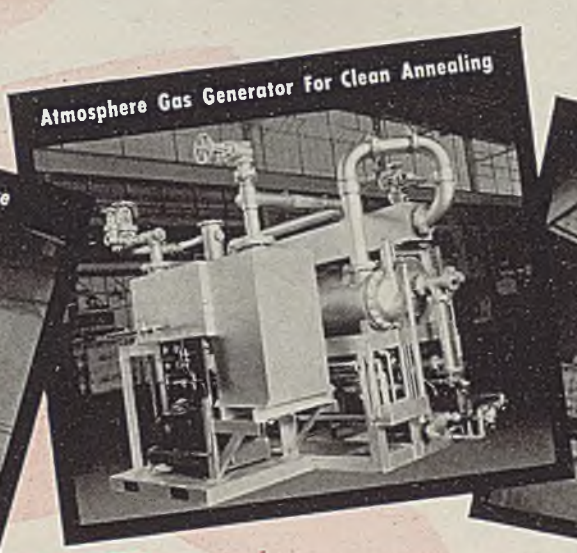
● Beginning with the soaking pit there is an SC furnace for every steel mill operation. Shown on these pages are but a few installations of the more common types. To meet the demands of Defense Production Surface Combustion has, during the past year, designed and installed many special type furnaces.

SURFACE

...THE URGENT CRY OF DEFENSE

...and Surface Combustion Equipment is aiding the Nation's Steel Mills in meeting this Emergency Demand


Refractory Bed Burner Wire Patenting Furnace


Atmosphere Gas Generator For Clean Annealing


Annealing Spheroidizing Wire


Triple-Zone Controlled Slab Heating Furnaces

...FOR EVERY STEEL MILL OPERATION

● Tanks, planes, heavy artillery, anti-aircraft guns, shells, mechanized transports, jeep cars, swift torpedo boats and ponderous supply ships—these are the sinews of Defense. They call for steel...steel ...AND STILL MORE STEEL!

The steel industry is doing everything humanly possible to satisfy this urgent demand. It is estimated that during 1941 the industry produced close to 80,000,000 tons of steel, or 35 per cent more than the combined capacity of the Axis and Axis-dominated countries. This is 167 per cent more than produced in 1938 and 60 per cent more than produced in the World War record year of 1917.

Surface Combustion is proud of the part it has been privileged to play in helping the steel industry meet this all important demand. SC soaking pits, slab furnaces, normalizing furnaces, annealing and spheroidizing furnaces, armor plate and scores of other types of Surface Combustion furnaces are on the job helping to produce steel...day and night, in most of the leading steel mills.

To take care of the unprecedented demand for SC steel treating furnaces, it has been necessary to expand our facilities and increase our personnel repeatedly...at present, our business is 98 per cent Defense. For the duration of the Emergency, Surface Combustion will continue to devote its all-out effort to the building of equipment for Defense . . . as rapidly as is humanly possible without sacrificing the high qualities which have come to be associated with Surface Combustion equipment.

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few relaying contactors, none of which carry any heavy current, do the job formerly accomplished by varied and complicated equipments carrying heavy current. Combination vacuum tube and amplidyne control for flying shears, which eliminates the necessity of a mechanical tie to the last stand of a hot strip, has now been in operation for over a year. Results have surpassed the best expectations.

New Developments in Processing Of Steel Are Acclaimed

BY JOHN L. YOUNG
United Engineering & Foundry Co.
Pittsburgh

■ LAST YEAR was principally a year of basic steel production planning and rounding out and rehabilitation of the products most needed for national defense. Greatest expansion in 1941 from the mill equipment standpoint was in the nonferrous field, with aluminum, brass and copper holding the limelight . . . Technological developments in the casting of steel centers in new methods of casting ingots and products by two newly adapted means, still experimental.

The electrolytic tinplating of strip whereby about two-thirds of the tin coating can be saved for certain containers and products, and the development of an entirely new method of temper passing tin plate and sheet products in strip form, are two important developments . . . Development by United of high production modern methods of hot and cold rolling aluminum, copper and brass sheets, strip and plate during the several years preceding the victory program has allowed tried and proved units to be put into early operation without designing and development delay . . . High-speed precision shell piercing presses have likewise aided materially in our war output.

Industry Strives for Maximum Output with Present Units

BY J. L. GREGG
Research Engineer
Bethlehem Steel Co., Bethlehem, Pa.

■ THE MAJOR problem of the steel industry has been to obtain the greatest possible quantity of steel from existing equipment. Because the supply of melting scrap is inadequate, it is necessary to increase the amount of pig iron available for steelmaking. Large blast furnaces have been built and existing furnaces enlarged when rebuilding was necessary. Humidity control of the blast is being used for increasing capacity and decreasing coke ratio.

Trend in steelmaking is the decreased use of aluminum and manganese in carbon steels and nickel and chromium in alloy steels. Entire industry is attempting to decrease the use of critical materials without seriously affecting quality or quantity of steel. More bessemer steel is now being used and the producers are employing controls that will increase the uniformity. A small amount of bessemer steel is being dephosphorized. Electric furnace capacity has been greatly increased and trend is toward the introduction of large top-charged furnaces.

Briquetted Borings Help Answer Foundrymen's Materials Problem

BY H. W. JOHNSON
Superintendent
North Western Foundry Co., Chicago

■ IN THE manufacture of gray iron castings during the present conflict, there has been much discussion as to substitutions in raw materials because of shortages. When it is all boiled down, it is found that though there have been changes in the type of alloys used to give identical physical properties, the most significant change that has taken place is the way foundrymen have utilized available raw materials which were heretofore considered inferior for the production of quality castings. More accurate control in melting with the aid of devices for measuring air supply has done much to bring this about. The wider use of briquetted borings has been the result of difficulty in obtaining the right kind of scrap, and needless to say is a very desirable substitute.

Difficulty in securing castings previously made in aluminum and the long delays in delivery of certain types of malleable and steel castings has prompted a number of customers to have these made in cast iron of a suitable analysis. The result has been that cast iron has performed very satisfactorily, especially the high-test irons, and far more applications for this material will be found.

Many Phases of Steel Production Now Controlled Automatically

BY M. J. BRADLEY
Market Extension Division
Leeds & Northrup Co., Philadelphia

■ THE NATIONAL war effort urgently demands increased production of steel and steel products and at the same time requires these products to conform to exacting chemical and physical specifications. Accurately controlled conditions are essential to meet these requirements. The number of control problems have increased appreciably during the past year and many steps in steel production heretofore considered partially controllable only are now being fully controlled automatically. This is due to the availability of new continuously acting control devices.

Disconnected control functions, such as temperature, pressure and combustion controls, and furnace operation now are being co-ordinated into a control system which stabilizes all control functions. This is especially true on batch type operations such as soaking pit furnaces. The tied-in control functions, speeds up production, maintains accurately controlled conditions, improves efficiency, and provides a completely co-ordinated control system.

Movement of Skip at Furnace Top Is Controlled Electrically

BY G. E. STOLTZ
Manager, Metal Working Engineering
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

■ FOUR of the new blast furnaces built in 1941 were provided with an arrangement to land the skip car in its dumping position at definite predetermined speeds regardless of load and position of skip car. This added feature to the control is similar to floor leveling equipment for high-speed passenger elevators developed by the Westinghouse company.

The trend in electric arc furnace melting capacity in the country is toward larger capacity furnaces. Electrical manufacturers have recently developed circuit breakers that are able to withstand this increased mechanical service as well as rupture the magnetizing current at the time the breakers are opened.

Surge equipment has been developed consisting of capacitors that are connected to the primary side of the electric furnace transformer as magnetic energy at the time the breaker is open, and not only reduces the number of

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This service is given practical effect by a staff of trained metallurgists who can give you on-the-job assistance. In addition, our extensive laboratory facilities are available for solving your special problems.

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"CMSZ" Alloy
Miscellaneous Chromium Alloys

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TUNGSTEN
Ferrotungsten
Tungsten Powder

SILICON
Ferrosilicon 50%
Ferrosilicon 75%
Ferrosilicon 80 to 90%
Ferrosilicon 90 to 95%
Silicon Metal
"Silvaz" Alloy
"SMZ" Alloy
Miscellaneous Silicon Alloys

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ZIRCONIUM
Zirconium 12 to 15%
Zirconium 35 to 40%
Aluminum-Zirconium

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surges obtained but also their value to approximately half that obtained without the surge equipment.

New plate mills will consist of tandem 4-high units having a single stand reversing breakdown roughing mill and several continuous running 4-high finishing stands. In addition to this there are several plate mills being installed consisting of but one stand of the 4-high reversing type.

1941 has been a year which shows a distinct trend toward the use of mercury arc rectifiers in the steel mill industry in place of motor-generator sets.

The past year also has witnessed a continuing demand for high-frequency generating equipment used to provide power for surface hardening particularly for bearings and electric heating where temperatures must be closely controlled and oxidation kept to a minimum.

Steelmakers Use Every Means To Secure Added Tonnage

BY L. F. REINARTZ
Manager, Middletown Division
American Rolling Mill Co., Middletown, O.

■ MANAGEMENTS in the steel industry are trying in every way to use their ingenuity to increase production at existing plants, and designing new producing units for use a year or two hence. Shortage of cast scrap has hampered some blast furnace plants from maintaining production rates. Many plants are concentrating on the production of low-silicon basic iron for open-hearth use. Much thought is being given to the increase in pig iron tonnages by use of blast conditioning and sintering of ore.

Open-hearth operators are, in most cases, using high percentages of molten iron. Careful practice and attention to details indicate that such charges can produce quality steels. Scale treatment of low-silicon iron, before it is added to the open-hearth charge, has improved the tons-per-hour and practice in some open-hearth shops.

Open-hearth metallurgists have found that an overall decrease of more than 50 per cent in the use of aluminum in many grades of steel can be made by partial substitution of other deoxidizers without serious detriment to quality.

Management's greatest problem and responsibility in this great national war effort is the use of tact, patience and understanding in employer-employe relations. More badly needed tonnage can be gained by improved labor relations in the United States than in any other way.

Furnace Builders Adapt Existing Equipment to Present Emergency

BY M. H. MAWHINNEY
Consultant
Salem, O.

■ GENERAL tendency in the present emergency is to avoid new designs, to adapt existing designs where possible, and to avoid time required for engineering. However, the necessity for speed without so much thought of expense has been reflected in the reappearance of some unsatisfactory schemes such as hot chain conveyors stressed beyond allowable limits, hot carriages, and complicated moving mechanisms. In spite of higher labor costs, manual handling is still cheaper than poorly conceived hot mechanisms.

Of various materials used in furnace construction brick, castings, and burners still are obtainable in reasonably short time. Structural steel plates are slow but frequently can be eliminated if necessary. Alloy can be replaced by iron or steel pending delivery, and lack of control equipment will not prevent operation until it is received. In general, little substitution of materials is possible.

Where natural gas shortages are only temporary the storage of butane or propane is an excellent solution because of small storage space, inexpensive equipment, and interchangeability of burners and piping. For permanent conversion, oil is a frequent substitute and anthracite or coke producer gas has been found to be an excellent substitute in many plants.

Blast Furnace Air Conditioning Is Under Close Observation

BY RALPH H. SWEETSER
Consultant
Seven Mitchell Place, New York

■ IN THIS present conflict the beneficiating of the air blast by the so-called "air conditioning" method is receiving close attention by blast furnace operating men as well as by men in OPM who are responsible for increased pig iron production. The remarkable graphs presented in the Nov. 10, 1941, issue of STEEL by Eugene Miller have opened the eyes of blast furnace men with the result that the whole matter of air conditioning is being investigated.

A controversy has arisen as to whether the moisture should be kept uniformly at 3 grains, or whether it should be reduced to less than 1 grain per cubic foot of free air. Records of my own experiences indicate that it is possible to remove too much moisture from the air blast.

Apparently it is necessary to have a certain amount of hydrogen present as a catalyst during combustion of coke in tuyere zone; coke "pushed on the green side" gives better results in the blast furnace than coke so hard-burned that there is practically no volatile matter left in it. Some connection between hard-burned coke and air blast with less than 1 grain of moisture per cubic foot may exist as well as between 3 grains of moisture and coke "pushed on the green side".

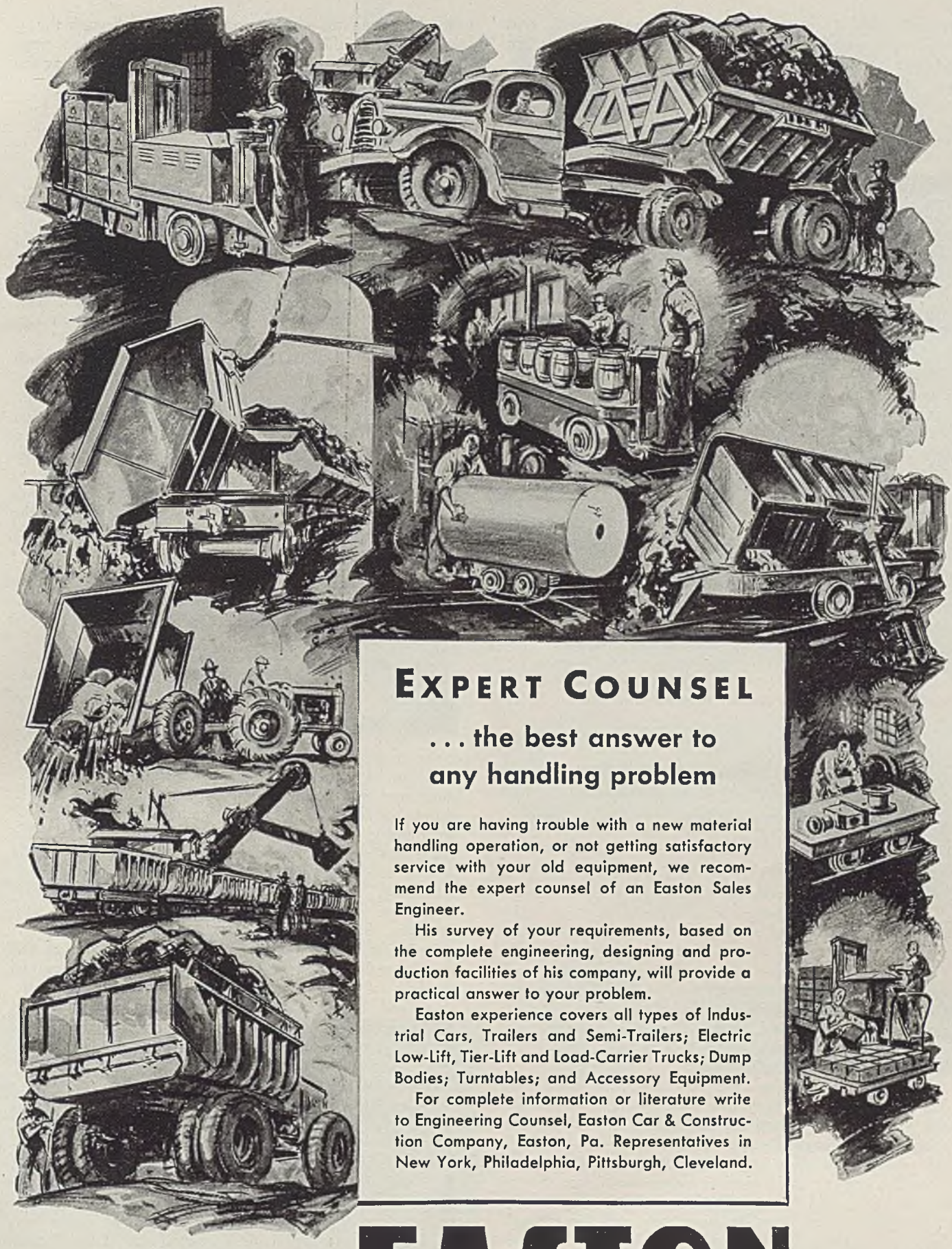
Triplex Process Provides Melt For Acid Steelmaking Furnaces

BY G. M. YOCOM
Assistant to General Manager
Wheeling Steel Corp., Benwood, W. Va.

■ DEVELOPMENT of a method to furnish a continuous supply of steel in small units for castings or ingots involves the use of triplex melting employing hot blast cupolas, acid-bessemer converters and acid-electric furnaces.

A low-cost mixture of steel scrap and pig iron is charged to produce a cupola metal of 0.070 per cent sulphur and 0.100 per cent phosphorus at 2700 to 2850 degrees Fahr. Metal is desulphurized to 0.035 per cent or below in a continuous desulphurizing unit at cupolas. After blowing to temperatures up to 3200 degrees Fahr., converter slag and metal are separated and metal dephosphorized below 0.030 per cent in steel ladle in several minutes with a special mixture. Oxidation and removal of all undesirable elements then are complete and deoxidation is begun. Deoxidation, adjustment of temperature and analysis are completed in electric furnace. Steel is of high quality and low cost and can be applied as desired.

Process is independent of special high-cost materials for the charge; melting, blowing, oxidation and deoxidation processes are more rapid than with any other method. Supply of metal is uniform, continuous and under full



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control. Capital investment is low compared with cold melt equipment and size of the unit flexible. Units can be from 10 to 50 tons per hour or multiples thereof. Process can be used to produce a low-cost molten charge for acid open-hearth furnaces. Production of existing cold melt acid-electric or open-hearth furnaces can be increased 300 to 500 per cent above present tonnages.

Steelmakers Step Up Production Of Various Alloy Grades

BY W. J. REAGAN
Edgewater Steel Co.
Oakmont, Pa.

■ ONE OF the outstanding advancements for the year 1941 is the large increase in the production of alloy steel. Stainless grades alone are predicted to reach a figure of 500,000 net tons as compared to about 50,000 net tons for 1931. Other alloy grades show similar increases in spite of shortages of chrome and nickel, for which up to the present time no substitutes are in prospect. The ability of steelmakers to step up production of these grades, and to provide personnel to make this type of steel, pays tribute to their capabilities when called upon to do what a few years ago was deemed impossible.

A large increase in electric furnace capacity has provided a large portion of this tonnage, but the basic open-hearth process still produces a great majority of the tonnage.

With a present sufficiency of nickel for priority ratings, an increase in this type of alloy production depends upon the ability of the nickel producers to increase their present output, with the possibility that the demand for this alloy will be radically changed with the development of various analyses which reduce or do without this alloy. Chromium is in the same class, with present supplies adequate for about one year.

Strip Mills Roll Light Plates To Meet War Demands

BY C. L. McGRANAHAN
Jones & Laughlin Steel Corp.
Pittsburgh

■ PRACTICALLY every strip mill in United States operated at 15 to 25 per cent over rated capacity in 1941. The gage of the hot rolled product underwent a decided increase in thickness due to the ordance production demands which caused a transition from the manufacture of cold rolled sheets for automotive purposes to that of heavy-gage sheets and plates for trucks, oil industry supplies, railroad equipment, and maritime needs. Most strip mills are capable of producing plates up to ⅜-inch thick and several larger mills up to ⅝-inch.

Tandem and skin-pass mills now are operating at 3000 feet per minute and continuous pickling speeds up to 450 feet per minute are being obtained on recent installations. A new continuous pickler operates by pushing a coil through the tanks rather than by pulling, and the coils are not stitched together. Acid yield is exceptionally low due to the use of external heat for heating the bath.

The purchase of a hot and cold strip mill for a South American country has aroused considerable discussion among strip mill designers and operators. As reported the hot mill will consist of a reversing breakdown mill, three 4-high finishing stands, runout tables and coilers. The cold mill will consist of pickling equipment, a 3-stand 4-high tandem mill, annealing facilities, flying shears and other auxiliaries. It is proposed to roll tin-plate gages on this unit by giving the pickled coil two passes through the 3-stand tandem mill. Tests have shown that this is a practical operation and no difficulty is expected in producing the desired tonnage.

Operators Gain Valuable Experience Under War-Time Conditions

BY AN ANONYMOUS STEEL COMPANY
OPERATING EXECUTIVE

■ HIGHLIGHTS of the year include having to relearn how to make steel from large percentages of inferior scrap. This promises to get worse, at least until the new blast furnaces being projected come into production . . . Never before have operators experienced so long a period of 100 per cent production. Lessons concerning equipment have been learned that will be of value. This has given also an increased respect for supervisory personnel.

Things have been learned about steel coatings that will affect practice trends for many years to come . . . Bessemer steel is regaining part of its lost standing due both to improvement in the product and to the realization that all along it has been more worthy than accepted . . . Simplification of specifications and the elimination of insignificant differences undoubtedly will be of lasting benefit to the industry as a whole and therefore to the consuming public . . . Lastly, the shortage of steel is developing the use of competing materials that may give steel producers many headaches in future years.

Autobody Makers Consider Use Of Rimming Quality Steel

BY J. H. FLAHERTY
Metallurgist, Pittsburgh Works
Jones & Laughlin Steel Corp., Pittsburgh

■ EXTREMELY deep drawn parts in automotive design have been an example of economic extravagance due to the necessity of supply there for low-carbon fine grain steel. This is a specialty product with manufacturers of strip mill sheet steel and involves longer open-hearth furnace time, aluminum additions of about 4 pounds per ton, reladling, hot topping, and low blooming and strip mill yields. This grade also requires more surface conditioning and a great deal of special testing with resultant high percentages of discarding, diversions, and rejections. Altogether there is a large loss of materials and production rate with attendant extra cost to the steelmaker.

Technical committees are attempting definitions of this special quality requirement, so that it can be classified properly in specifications, inquiries, orders, etc. Die designs and drawing practices are being developed that will accommodate rimmed steel and thus eliminate the necessity for this special steel quality.

Furnace Builders Adapt Units To War Time Requirements

BY J. L. WHITTEN
Lee Wilson Engineering Co.
Cleveland

■ SINCE ITS introduction, the firing retort type of furnace has consistently annealed low-carbon strip and wire at fuel rates of 900,000 B.t.u. per net ton of charge and has increased production over identical size units of older design by 15 to 20 per cent. . . Requirements of rifle clip strip and bullet core rod involve the annealing of larger single charges without loss of quality and this has been accomplished in furnaces with a number of recirculating fan bases in a single row in a rectangular base unit.

The tendency for increase in size, charge weight and

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No more traveling wheels . . . but stationary, roller-bearing, idler wheels support the new Bailey 24"-link mold-chain which has only half as many moving parts . . . one-quarter as many points of wear. Special high manganese steel pins and bushing in the links take all the wear . . . are quickly replaceable when necessary . . . and because there is no friction except when the links are passing over the sprockets, motion and wear is minimized.

Every feature of the Bailey Stationary Wheel Pig Casting Machine is designed to give maximum speed and flexibility in casting, long continuous service under top-speed operating conditions and an absolute minimum of maintenance.

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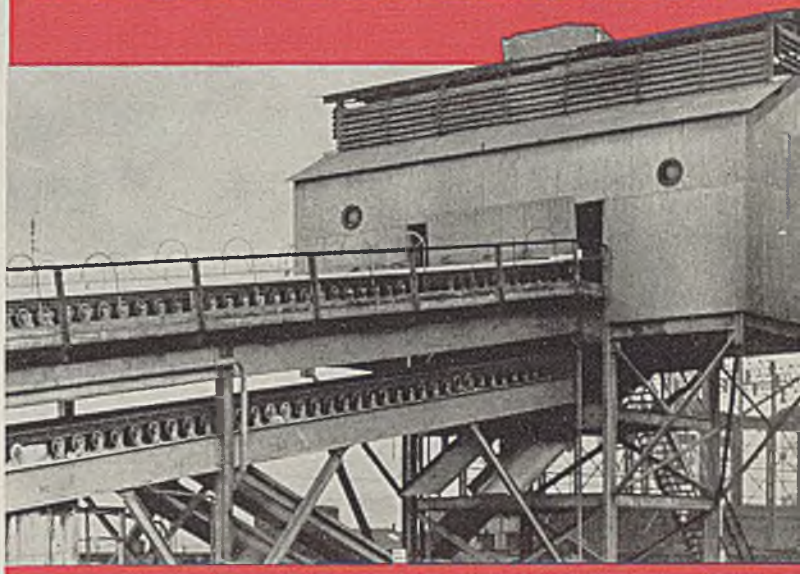
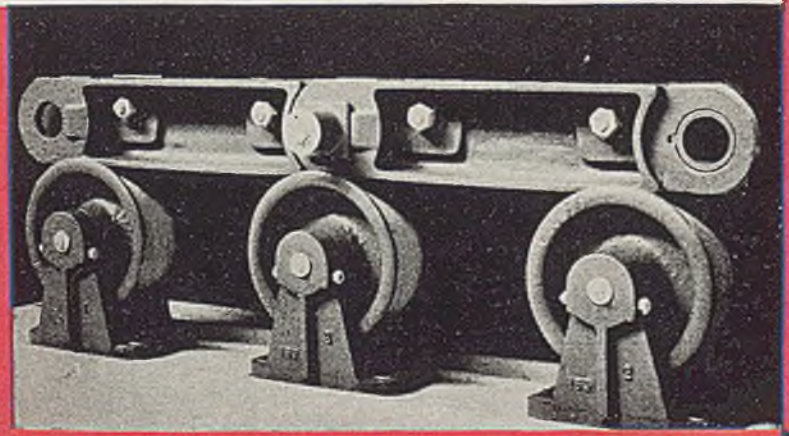


Rugged, cast steel links are twice usual length (24") . . . use only half as many moving parts . . . move only when passing over sprockets . . . have quickly replaceable pins and bushings.

High manganese steel pins and bushings take all the wear . . . give maximum service . . . are quickly replaceable and interchangeable.



Outside view of chain link shows why no movement occurs in links during travel except when passing over the sprockets. Spacer rods maintain accurate alignment.

WILLIAM M. BAILEY COMPANY

ENGINEERS

PITTSBURGH, PENNSYLVANIA

piling height has been apparent but it is now felt that a practical limit has been reached in strip or tin plate stacking of 106 inches without endangering the quality of the bottom coils or the safety of the operating personnel . . . During 1941, decided improvement was made in the use and application of furnace atmospheres for all types of ferrous and nonferrous annealing, and particularly in the field of tool steel and alloy bar annealing in lengths over 30 feet in bell-type furnaces. Superstructures with special hoisting apparatus to lift the furnace are designed as part of the installation.

An initial installation of radiant tube fired continuous furnace for tin plate annealing was made in the "A" or tower-type design. Results obtained have been most satisfactory and are considered adequate for 40 per cent of the present annealing requirements of the tin plate industry.

Practices Evolved from Present War Have Economic Value

BY GILBERT SOLER
Manager, Research and Mill Metallurgy
Timken Roller Bearing Co., Canton, O.

■ ATTENTION is being focused on the problem of greater production of alloy steel with existing facilities. Practices are being evolved which will be of definite economic value in the future. Trend in steel specifications tends to favor standardization and simplification although situation is far from clarified. It is desired that chemical specification should also consider the economy of scarce raw materials and greatest yield of finished quality product.

Carbon ranges must be inter-related to manganese and chromium ranges so that the use of low-carbon ferromanganese and low-carbon ferrochromium can be avoided to allow use of more available substitutes such as spiegel, silicospiegel, standard ferromanganese and standard ferrochromium. Aluminum should be available for use where needed to prevent reduced yields of finished product.

Sufficient attention should be given to the grouping of all analyses so that diversion of heats from one class to another is easily possible. Standardization and simplification of test methods for classes of products also will help.

Production for war has allowed alloy steelmakers to produce large quantities of certain definite steel items providing a broad base for proper evaluation of melting and processing practices, and test methods, by correlation with the quality of the finished product. This is especially true of aircraft parts such as piston pin stock, cylinders, etc., the volume production of which has increased tremendously.

Changes in Operation May Be Retained After the War

BY C. E. SIMS
Battelle Memorial Institute
Columbus, O.

■ THE STEEL industry has had to increase production without greater equipment and with a decreased supply of raw materials. In hot metal shops the scarcity of scrap has brought about various schemes for using higher hot metal charges, while in cold melt shops the scarcity of pig iron has resulted in recarburizing scrap to make synthetic pig. Ladle additions and even mold additions of alloys are increasingly favored both for conservation through better recovery and closer control of composition.

Slag control has enabled a higher residual manganese to be carried, thus aiding conservation. Spiegel is being regarded more as an alloy source of manganese than as a cleanser in the reboil. In fact, the reboil and even the blocking of heats of killed steel are being discontinued in some shops. Through more efficient slag control and other means, the time of large open-hearth heats that formerly required 12 to 14 hours is now reduced to about 8 hours.

The emergency has induced changes many of which will be retained with the result that practices will be simpler and costs lower. The increased electric steel capacity now being installed will result, in a few years, in competition with the open hearth for some of the tonnage steels, but lower costs in the latter will offset this to some extent.

Water-Cooled Molds for Casting Nonferrous Metals Gain Favor

BY EDWARD R. WILLIAMS
President
Vulcan Mold & Iron Co., Latrobe, Pa.

■ IN THE Jan. 2, 1939 Yearbook comments were made on the increased use of water-cooled ingot molds both for casting individual ingots and for continuous ingot casting. During the past two years the use of water-cooled molds has multiplied rapidly especially in the casting of aluminum, brass, and copper. Plans now under way call for further expansion in the use of continuously cast ingots for nonferrous metals and for the start of commercial operations in continuously cast steel ingots. The use of water-cooled molds for individually cast ingots in nonferrous metals is also expanding and is being experimented with in the steel industry.

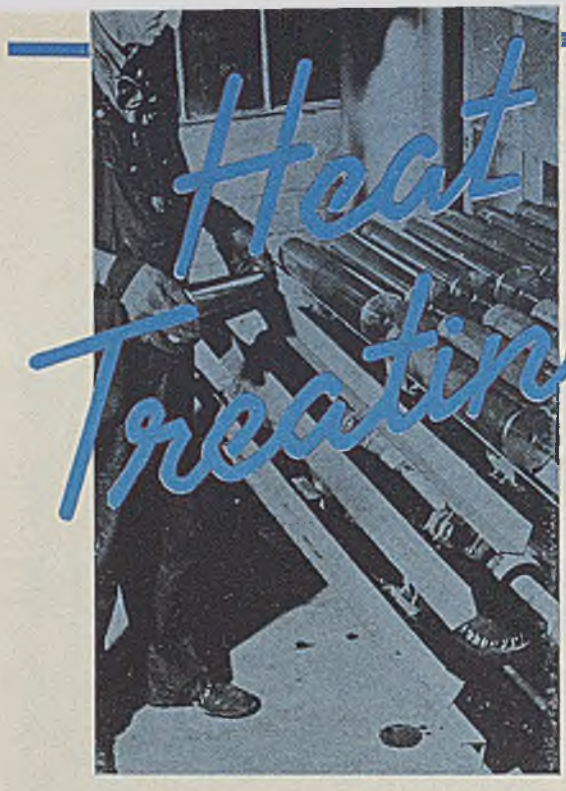
The important phase of this progress in 1942 will be the possible substitution of water-cooled molds requiring a much smaller quantity of materials per mold and thus releasing pig iron (of which molds are now being made) for the manufacture of steel. It appears that water-cooled molds will considerably outlast cast-iron molds which will further reduce the amount of pig iron tied up in molds.

Desulphurization of Molten Iron With Soda Ash Is Advantageous

BY A. J. BOYNTON
310 South Michigan avenue
Chicago

■ CONSIDERABLE addition has been made during 1941 to practical knowledge of alkaline desulphurizers and their effect on pig iron and steel. Pittsburgh Steel Co. operated a blast furnace for two months for the purpose of demonstrating desulphurizing conditions and the effect of such practice on steel made from desulphurized pig iron. Similar tests were made earlier by Republic Steel Corp. This American experience in conjunction with British practice indicates the following:

1. No bad effect on quality of steel follows the use of soda ash.
2. Under American conditions, the furnace seems to be preferably operated with a slag varying but little from that usually employed. Desulphurizing seems to be best used to obtain sulphur down to about 0.030 per cent with such a slag. Demand for high temperatures in steelmaking pig iron limits the desirable acid content of the slag.
3. Use of soda ash to remove sulphur below 0.030 per cent is not successful. For a lower range of sulphur, caustic soda is necessary.
4. Experience indicates that 9 pounds of soda ash per ton of pig iron secures best and most economical results.
5. Desulphurizing should be applied to pig iron only, not to steel.



Direct-Fired Heat Treating Of Cast Armor for Tanks

BY FREDERIC O. HESS
President
Selas Co., Philadelphia

■ DEVELOPMENT and production of *cast* armor plate is a metallurgical advance which will influence future material selections, applications and treatments to an extent which is difficult to visualize. It involves a new alloy and a sequence of heat treatments in new and exceptionally exacting cycles. Proof is offered on a large scale, and in an undisputable manner, that uniformity and accuracy of heat treatment can produce exceptional metallurgical results—and at the same time permit design simplification, assembly elimination, and other means of reducing production costs and complications. One-piece cast hulls and turrets for the heaviest of army tanks are an important culmination of this development.

The absolute necessity of uniform heating and exacting cycles may be appreciated when it is considered that single hulls weigh several tons and are often 20 feet long and vary widely in mass at different points; that normally insignificant temperature variations would in this process produce nonuniform and unacceptable armor; and that every casting is its own test piece. Direct-radiant-fired furnaces are in operation daily producing cast-armor hulls, turrets and other parts vital for the tank program.

New Nonburning Carburizer Is Now in Production and Test

BY W. P. WOODSIDE
President
Park Chemical Co., Detroit

■ A NONBURNING carburizing material which is as light in weight as the charcoal-coke compounds most generally used is now being produced in a number of plants in the middle west and is being tested by armor-plate manufacturers. Its use will effect quite a saving and produce more uniform carbon contents of the case from heat to heat, owing to the manner in which the energizer is co-mingled with the carbonaceous material which comprises the bulk of the carburizing compound. Further, the energizers in it can be controlled to the extent that the approximate carbon content of the case can be estimated in a given length of time at given temperatures.

Unusual Heating Applications Speed Defense Production

BY R. M. CHERRY
Industrial Department
General Electric Co., Schenectady, N. Y.

■ HEATING large aluminum alloy sheets for the aircraft industry requires close temperature control and temperature uniformity throughout the sheets. Several large electric elevator-type furnaces of the air-recirculating type were placed in operation during the year on such work. The charges, consisting of a number of aluminum alloy sheets, are suspended from the loading rack and heated by air recirculation. An insulated baffle is placed between the heating units and the sheets.

Heating of thin-wall parts such as the tubular-shaped items for landing gear of large aircraft is accomplished in vertical cylindrical pit-type furnaces. Work is suspended from suitable alloy supports and brought up to proper temperature in the hardening furnace. Then a high-speed hoist with a transfer hood is brought over the furnace and the charge quickly pulled into the transfer hood; now the hood is positioned over the quench tank and the charge quickly dropped into the oil. This hood minimizes cooling, warpage, and scaling of the parts during transfer.

A substantial saving in labor and floor space is accomplished by using a 3-chamber roller-hearth heating furnace for brazing and hardening track links for tanks. First chamber heats parts to required temperature for copper brazing. Second chamber cools the parts to a temperature of about 1000 degrees Fahr. Third chamber reheats these parts to the required temperature for quenching. Entire sequence is handled in a continuous roller-hearth furnace and in a protective atmosphere, thus eliminating intermediate handling.

Vertical Furnace Has Many Important Operating Advantages

BY W. G. HAMILTON
President
Accurate Steel Treating Co., Chicago

■ ALL HEAT-treating plants want to process a large tonnage in a limited floor space at a minimum handling cost. A pit-type furnace with the work heated vertically instead of horizontally would save space. Since the furnace pit could be loaded and unloaded with an overhead crane, it would also save in handling costs. Such a furnace has been developed this past year. Convected air allows a uniform temperature as high as 1800 degrees Fahr. to be maintained throughout every part of the heating chamber, or the unit can be used satisfactorily as a draw furnace at temperatures down to 200 degrees Fahr.

The first experimental furnace installed two years ago soon revealed that heating jobs vertically and evenly, quenching holding fixture and work, all without additional handling, decreased the amount of distortion noticeably over previous experience with oven-type furnaces. Numerous jobs were drawn in the same furnace with-

TESTS ON TEMPERATURE DISTRIBUTION— NO LOAD CONDITIONS

Oven controller set at 500 degrees F. Furnace controller set at 580 degrees F. Interior exploration with thermocouples through nine different openings showed no significant difference in temperatures in any of these nine positions!

TESTS UNDER FULL LOAD CONDITIONS—

Seven tests were run in which two thermocouples were inserted in drilled holes in the bases of 105 mm. cases and placed in various positions in the loads.

CONDITIONS OF TEST

Load: Four trucks weighing approximately ..... 800 lbs.
110 cases (105 mm.) on each truck at 6 lbs. each. Total weight cases ..... 2640 lbs.
3440 lbs.

Oven Controller set for 500 degrees F.
Heater Controller set for 580 degrees F.
All bare wire thermocouples used.
Oven up to temperature for varying lengths of time before loading.

RESULTS

These loads of 3440 lbs. come up to 500 degrees F. in 40 minutes. The control couple and the check couple come up to temperature in about the same time — plus or minus three minutes, about the limit of reading the times off the charts.

Check couples in the center of a loaded rack come up in 40 minutes and there is no significant difference in the temperature in any part of the load, in any part of the oven. A temperature difference of 5 degrees usually existed between the two check couples. This difference was not consistent for any location, like front or back, top or bottoms.

The temperature of 525 degrees F. was reached about 15 minutes after the work reached 500 degrees F. and remained constant at 525 degrees F. for about 45 minutes of a one-hour stress relief.

The variation throughout a loaded oven is less than the specified 10 degrees.

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out removing from the quenching fixtures. Loads of two tons or more were quenched and drawn without additional handling. The labor saved is evident. Annealing cycles, too, can be reduced since the work can be cooled at any desired rate.

Nitrided Parts Find Many New Applications in War Work

BY CARL F. FLOE
Assistant Technical Director
Nitralloy Corp., New York

■ MUCH more steel is nitrided, due mostly to expanded airplane motor output—the principal application of the process for several years. Greatest increase is in those applications requiring high wear resistance and core strength under nonlubricated conditions such as track assemblies of tank and armored cars. Recognition of the increased fatigue resistance of nitrided parts due to decreased notch sensitivity has led to many additional applications, particularly in airplane and automotive work. For such work nitriding steels containing nickel have been found particularly suitable.

Nitriding of 18-8 stainless steels has been advocated and is being done. Cases produced in a normal nitriding cycle are somewhat shallow. Also the effect of the surface precipitation of chromium nitride on the stainless properties of the steel must be considered.

Heat-Treated Cast Irons and Steels, Valuable Substitutes

BY F. O. HAMLET
Factory Metallurgist
SKF Industries Inc., Philadelphia

■ MUCH has been accomplished by the substitution of heat treatable cast irons and steels with a likelihood of many more such substitutions in the future, but at the same time it appears that a comprehensive study of heat treating methods including quench media, flushes, jigs and the like would make possible the production of machine parts of quality at least equal to those produced by less exact treating methods and requiring greater alloy additions for achievement of desired physical properties. Here could be accomplished a definite and positive advance in the conservation of strategic metals which would lead to greater output of armament needs.

Hot Pressing and Forging of Powdered Metals Being Developed

BY W. B. COLEMAN
President
W. B. Coleman & Co., Philadelphia

■ ALTHOUGH copper is scarce, its use in ferrous metallurgy is increasing as a substitute for nickel. The use of tin in collapsible tubes has been curtailed, and manufacturers are forced to resort to other base metals that can be coated with another metal or varnishes. Casting production is on the increase as substitutes are being developed to take the place of forgings.

Powder metallurgy during the past year has made considerable progress. Although the cold pressing and sintering method is a popular one at the moment, work is being done in hot pressing and hot forging powdered metal. Steam treatment of ferrous powdered metal parts is being carried out to decrease the porosity, and one observes increased hardness and wear resistance. Stainless steel parts are now being produced from powdered metal.

Controlled Atmosphere Heat Treating Furnaces Now Common

BY W. A. DARRAH
President
Continental Industrial Engineers Inc., Chicago

■ THE TREND of 1941 has emphasized one of the advantages of gaseous fuel in that practically all heat-treating furnaces installed required close control of atmosphere and at least scale-free heating. This is of particular interest because only a short period ago direct-fired furnaces were the rule, and controlled atmosphere was a subject seriously considered only by the most progressive manufacturers.

Vast plants for aluminum heat treating have created a demand for prompt and controllable quenching of bulky loads. This means carefully designed quick-moving handling devices for large weights into a water bath of controlled temperature. The trend therefore has been to automatic handling devices on a larger scale than ever before. Time periods of a fraction of a second must be controlled.

Alloys Situation Complicates Bearing Metallurgy, Manufacture

BY J. F. WYZALEK
Chief Metallurgist
Hyatt Bearings Division
General Motors Corp., Harrison, N. J.

■ THE VICTORY program has special applications of roller bearings which involve metallurgical problems. In aircraft, precision-type bearings are frequently operated at elevated temperatures, resulting in dimensional growth and early failure. To overcome this it has been necessary to develop special treatment to reduce residual stress and retained austenite. Bearings for armored tanks require designs which involve local hardening of suitably selected steels.

Present alloy situation has affected the roller bearing industry. Increasingly critical service demands have been met through the use of nickel-molybdenum SAE 4620. Substitutes offering in the finished product a fair promise of success metallurgically frequently create serious problems in machining, carburizing and hardening. Too, substitutes with satisfactory manufacturing conditions usually do not meet engineering and metallurgical specifications. In mechanized war, obviously anti-friction bearings are important. Therefore it is essential to furnish bearings which meet the necessary requirements. Increasing restrictions in the use of even the most common steel additions makes this problem extremely difficult.

Closer Heat Treating Control To Be a Lasting Benefit

By L. A. LANNING
Chief Metallurgist
New Departure Division
General Motors Corp., Bristol, Conn.

■ THE YEAR 1941 has witnessed a tremendous upsurge in volume of products heat treated for military purposes to meet exacting physical requirements. Demands of the present emergency have developed a broader appreciation of modernized heat-treatment control which will be of lasting benefit. Substitute materials require maximum control in treatment to maintain quality of product without modification in design.

The shortage of alloy steels such as the nickel and chromium series has caused a marked rise in use of molybde-

num-manganese steel. Many present applications of this alloy will be recaptured with considerable difficulty when the emergency is over. The mandatory use of molybdenum high-speed steel is of extreme importance to the heat-treater. Its tendency to harden with a soft skin requires a new technique in many plants. It will undoubtedly serve as a stimulus to the use of special-atmosphere hardening furnaces and salt-bath hardening units which are especially suited to this work. There still remains development work in molybdenum high-speed steels to produce cutting properties equal to cobalt high speed steel.

Expects High-Alloy Steels Still To Find Many Applications

BY ARTHUR E. FOCKE
Diamond Chain & Mfg. Co.
Indianapolis

■ THE NECESSITY for substituting plain carbon or lower alloy steels for the higher alloy combinations during this present condition has generally resulted in convincing everyone concerned that unless cross section of the piece is too great, it is possible to obtain just about everything from well-made plain carbon steel that is possible with alloy steels. Of course, this excludes special properties, such as resistance to corrosion or high temperature. Many practicing metallurgists and mechanical engineers have been agreeably surprised by the results which can be obtained with properly treated modern controlled plain carbon or low-alloy steel. This does not mean that the proportion of high alloy steels will be drastically reduced after this present conflict, for it is still a fact that high physicals in low alloy or carbon steels can be obtained only by very careful heat treating.

Flame Cutting, Flame Softening Speed Armor Plate Fabrication

BY P. E. TIMMERMAN
Development Engineer
The Linde Air Products Co., New York

■ THE INHERENT advantages of oxyacetylene flame hardening for imparting a hard, wear-resistant surface to quench-hardenable steels have resulted in the adoption of the process for a number of new applications. Among these are parts for automotive equipment, sprocket teeth, grousers, armor plate, automatic rifle parts and the raceways of turret rings. Flame hardening of such parts as sprocket teeth—to a uniform average depth of about 3/16-inch—has been completely mechanized, the entire sequence of hardening operations being automatically regulated by electric control.

Oxyacetylene flame softening, a method of eliminating the hardened zone on the flame-cut edges of air-hardening, high-carbon and alloy steels, is both fast and economical and is being used extensively in connection with flame cutting armor plate. In this work it has been found that handling costs are low, no additional furnace capacity is involved, and production is maintained at a high rate.

Continuous Furnaces Speed Heat Treatments in Aircraft Plants

BY N. E. WOLDMAN
Chief Metallurgical Engineer
Eclipse Aviation Division
Bendix Aviation Corp., Bendix, N. J.

■ CONTINUOUS in-line production, the watchword in the aircraft industries, was previously bottlenecked by heat-treating operations. The answer is conveyorized equipment which accomplishes heating and quenching by accurately timed belts. A belt-type drawing furnace eliminates the long period necesary between charges in the batch-type furnace. Controlled atmosphere in both hardening and drawing furnaces removes the necessity of descaling or sandblasting operations after heat treating.

While the above types of furnaces apply mainly to ferrous alloys, there are some similar developments in nonferrous alloy heat treating. New furnaces now perform the entire heat treating cycle of heating light metal alloys, quenching and artificially aging in one continuous operation. New processes for hardening austenitic stainless steels produce a case-hardened surface on the austenitic stainless steel, similar to the nitrided surface of nitralloy steels and with small loss of the stainless properties.

Replacement Alloy Steels Are Heat Treated Successfully

BY T. A. FRISCHMAN
Chief Metallurgist, Axle Division
Eaton Mfg. Co., Cleveland

■ THE PAST year has seen the successful replacement of critical materials by noteworthy alternates. An outstanding example in the automotive and related industries was the substitution of chromium-vanadium, chromium-molybdenum, manganese-molybdenum and carbon-molybdenum steels for the familiar straight nickel, nickel-chromium and nickel-molybdenum types.

The alternate steels are being handled by the consumer in much the same manner as their nickel counterparts except that greater precautions are necessary, particularly in heat treating. For instance carbon concentration of the carburized cases of chromium-vanadium and chromium-molybdenum steels are controllable, but only with more difficulty than the nickel-bearing steels. Also, the alternate steels generally require higher rehardening temperatures, which are attended by greater scale formation, increase in distortion and greater likelihood of forming a soft skin. Careful control, controlled-atmosphere furnaces and salt baths have been the solution.

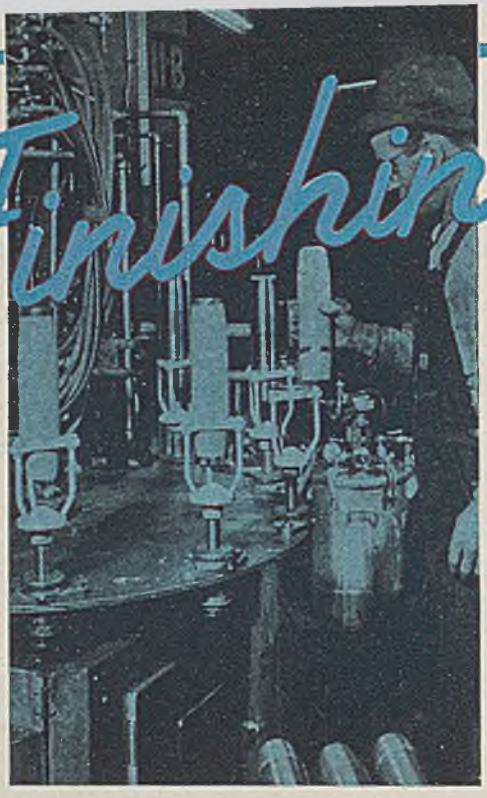
Use of Catalyst Improves Continuous Gas Carburizing

BY R. J. COWAN
Consultant
Surface Combustion Corp., Toledo, O.

■ FOR SOME time, a hydrocarbon gas has been mixed with a diluent when used in the continuous process for carburizing metals. A common diluent is "C G Gas" formed by the partial combustion of a hydrocarbon. To prepare this gas the hydrocarbon is mixed with a volume of air insufficient for complete combustion; the mixture passed through a heated alloy tube and then mixed with the carburizing hydrocarbon previous to entering the carburizing chamber. The "C G Gas" reaction was seldom ever complete and this necessitated the use of a larger amount of hydrocarbon in the carburizing chamber than necessary for the work to be done. Consequently, soot was deposited on the work.

In a new process, a catalyst has been developed which accelerates the "C G" reactions so a gas of different characteristics is produced in much larger quantities in a more compact unit. This diluent so formed is then mixed with a small amount of hydrocarbon so the mixture is close to the theoretical requirements with little if any excess carbon. The result is clean work, a smoothly operating unit and rugged construction. The parts are uniform, and a minimum of supervision is needed.

Finishing



Efforts To Save Vital Metals Now May Prove Profitable After War

BY JOHN S. NACHTMAN
Director of Development and Research
Sharon Steel Corp., Sharon, Pa.

■ RESEARCH laboratories of this corporation have developed and improved processes for conserving nonferrous metals vital to defense. Recent developments include processes for coating steel sheet, strip, and wire with tin, terne, monel, stainless, brass, bronze and alloys; also processes for rust proofing metals and production of stainless steel by an electro-chemical method. Substitution of these products for nonferrous metals can effect substantial savings.

Automobile, refrigerator and allied industries are using a considerable tonnage of nonferrous metal for rust proofing ferrous stock. A process was developed in our laboratories whereby the thickness of the nonferrous coatings can be substantially reduced with equal or better rust resistance.

Due to the expansion of the nonferrous industry, and synthetic products, the steel industry after the war will be faced with ever greater competition in every field. The processes mentioned above, we believe, will be of great assistance to the steel industry in keeping its markets.

Plan for Future Now While Pressure on Designer Is Off

BY ALFONS BACH
Designer
Alfons Bach, Stamford, Conn.

■ BECAUSE of the present emergency, there will be curtailed production of many steel fabricated items. It is therefore time to think about future development and to plan and prepare for the day of normal resumption of activity. Talking as a designer, I have always suffered under the pressure of time. Elimination of present planning allows ample time for future product development. It allows for extensive experiments in color, texture, assembly. I am sure that this period will be most beneficial to the manufacturer if he realizes that this is the time to let the designer make his plans with no immediate pressure, except the final phase.

During the past year the uses of steel have been expanded in many new fields. By a concentrated effort, the specialized steels such as stainless and others will find a greater acceptance and ultimate use.

Waste Materials May Be Used for Zinc Plating; OPM Very Helpful

BY CHARLES W. YERGER
Executive Vice President
Hanson-Van Winkle-Munning Co.
Matawan, N. J.

■ SUBSTITUTION of one metal for another has been one of the chief problems of the plating industry in 1941. When nickel was developing a scarcity, the industry turned to copper plating. A later shortage developed in copper, and this caused considerable complication. The same trouble developed in substitutions of other metals until, in some cases, it was not possible to supply metals for plating even for defense work under priority ratings. These conditions were then remedied by co-operation of the Office of Production Management, and the latter is certainly to be commended for the help it gave the plating industry.

There has been considerable development work, and a pilot plant is shortly to go into operation, whereby zinc plating can be accomplished by the substitution of waste materials of the hot zinc process or the use of zinc ore instead of zinc anodes, which will relieve the burden on the smelted zinc capacity of the country.

Stove and Refrigerator People Turn To Porcelain Enamel

BY J. E. HANSEN
Director of Service
Ferro Enamel Corp., Cleveland

■ SHORTAGES and priorities on the use of nonferrous metals have led several major refrigerator manufacturers to adopt porcelain enameled evaporators and freezing doors. At least one large producer of washing machines has replaced the cast aluminum agitator with a porcelain enameled stamped steel unit. Certain stove manufacturers have turned to porcelain enameled burners.

Unusual interest is being centered on the possible production of porcelain enameled corrugated iron and steel to replace galvanized corrugated iron roofing and siding. The past year also has seen the introduction by several producers of porcelain enameled range boilers and hot water tanks, which formerly were competitive with tanks of copper, monel metal and familiar galvanized tanks.

Shortage of Metals Makes 1941 Year of Research Curtailment

BY DR. C. B. F. YOUNG
Electrometallurgist
Flushing, Long Island, New York

■ ELECTROPLATING industries are definitely tied up with the ordnance production. Private enterprise is being severely curtailed by the scarcity of metals. Nickel has about disappeared from the market. Copper and brass are hard to obtain. One can go right through the list of engineering metals and the same holds true.

Nineteen-forty-one will go down in history as a year in which research has been curtailed. This is due directly to tremendous demands for production. At present em-

phasis is being placed upon ways and means of obtaining greater amounts of units per period of time. Price is not a factor. Whenever such a condition arises we always lose sight of the best ways of accomplishing things.

One development which should be noted has taken place in the anodizing of aluminum and its alloys. In the aviation industry all parts made from these materials must be treated in order to prevent corrosion. In this field, men in charge have found time to do some research in the control and operation of various baths used.

Research; Developments in Hot Dip Galvanizing Aid Industry

BY WALLACE G. IMHOFF
President
Wallace G. Imhoff Co., Vineland, N. J.

■ CONCERN OF hot-dip galvanizers in 1941 has been to get zinc to put in their galvanizing pots. Scarcity of this metal has brought into the foreground the dross vibrator, available for a number of years but practically ignored by the industry. It has opened up a new supply of metal to the galvanizer; it returns to him about 15,000 pounds of zinc from every 100,000 pounds purchased.

The vibrator returns about 15 per cent more zinc from the dross than can be obtained by the old hand-method of cutting and slicing. Because of increased production in some fields welding of galvanized iron has been necessary. A recent development in the welding of galvanized iron is a process known as Galv-Weld. It consists of rubbing over the bare spots, which have been heated by the welding, a stick of low melting galvanizing material to form a smooth coating of metal which will have all of the corrosion resisting and wearing qualities. During the past year some outstanding work in the scientific investigation of the relation of the steel base to hot-dip galvanizing has been made. Other studies involving furnace installations revealed that for fuels other than electricity the galvanized furnace efficiency varies from 20 to about 40 per cent as averages in the sheet industry. Electric-heated furnaces have been found to be about twice as efficient.

Use of Plating "Controls" Saves Metals for Defense

BY R. O. LEONGARD
Vice President
United Chromium Inc., New York

■ UPON BEING asked to conserve metals and prevent waste, the plating industry during 1941 responded in two ways—one, by use of stop-off or rack-coating materials. By coating the article to be plated on surfaces where no deposit is desired, it is possible to prevent excess deposition of strategic metals. Such a coating also serves to protect the rack itself, lengthening its life and reducing amount of metal used for the fabrication of new racks.

The second economy in the use of metals is through the use of plating processes which would make it possible to obtain deposits of metal such as copper, nickel, etc. having characteristics which minimize the necessary thickness of such coatings. In buffing after plating, such processes may avoid loss of metal which would occur if heavy buffing were required. In practice this may reduce the actual amount of metal that has to be deposited by 30 per cent or more.

The adaptability of chromium plating for ordnance purposes has focused increased attention on its use for salvage of machined parts, for wear and corrosion resistance, with the resulting saving of large amounts of other metals. Plated metals in many instances make possible the selection of a more readily available metal, such as steel, as a basis metal in place of copper or brass.

Aluminum Now Coated Anodically In New High-Production Setups

BY HOWARD H. BURT
General Fireproofing Co.
Youngstown, O.

■ AN OUTSTANDING development of recent months is the large-scale application of protective coatings to various metals. Some of these had for years been applied by hand methods, but war requirements have now forced the introduction of mass production processes. Typical of this group is the anodic coating of aluminum, to which large-scale practice has recently been applied satisfactorily.

Shortage of Industrial Finishes for Civilian Production Unlikely

BY G. KLINKENSTEIN
Vice President and Technical Director
Maas & Waldstein Co., Newark, N. J.

■ Makers of goods without high priorities have not been prevented from obtaining finishes to meet their needs. Some ingredients commonly used in lacquers and enamels can be supplied only in limited quantities or not at all, for use by nonessential industries. This has led to drastic changes in the composition of products. The result has been the development of a series of finishes that are not likely to be limited in supply by either our defense needs or by military operations. Very satisfactory substitute finishes are being produced in many cases.

Since we are planning to double our ordnance output in 1942 as compared to 1941, the difficulties of manufacturers without high priorities are bound to increase, but they need have no special concern about the finishing situation unless events take a totally unexpected turn.

The ordnance and essential industries are, of course, using finishes of all kinds in large quantities, and not much trouble has been experienced in supplying them. In 1940, ordnance work was being hampered by obsolete government specifications for finishes. This situation now has been remedied. At present the finishing industry is urging the government to reduce its consumption of the most modern types of finishes wherever possible to permit a large amount to go to civilian industries. The ordnance industries' heaviest demand is for air-drying and baking alkyd synthetic enamels and air-drying lacquers.

Lead Pigmented Paints Offer Best Protection to Steel Surfaces

BY GEORGE DIEHLMAN
Research Laboratories
National Lead Co., Brooklyn, N. Y.

■ FORTUNATELY, lead pigments and linseed oil are among the very few items least affected by the victory program. Paints composed wholly or largely of these products are the best protection against the ravages of rusting of steel surfaces. Basic carbonate white lead is ideally suited for the pigmentation of top coat paints, and by use of tinting colors almost any color can be obtained. Tremendous quantities of both types of lead paints are now being used.

Production schedules sometimes dictate the use of paints with faster drying rates than are obtained with a linseed oil vehicle. In such cases, a portion of the linseed oil is replaced with certain varnishes. Paints composed of red

lead or basic carbonate white lead and linseed oil or linseed oil-varnish are playing a vital role in the war.

Electroplating Fast-Moving Steel Strip Outstanding Contribution

BY COLIN G. FINK
Head, Division of Electrochemistry
Columbia University, New York

■ OF SPECIAL interest in the metal finishing field is the electroplating of steel strip with tin, zinc, copper, nickel and other metals. The application of 2000 to 3000 amperes per square foot to the fast-moving steel strip continues to arouse astonishment among old-time platers, accustomed to 20 and 30 amperes per square foot.

War orders have seriously cut into the supply of metals and salts used in electroplating. Under-coating with iron instead of with copper or nickel has reached a high state of perfection. The electrolytic iron deposit presents an equipotentialized surface easier to plate than ordinary iron with numerous surface couples. Mention too should be made of several new plastics evolved and successfully applied to steel and other metals for protective purposes.

Services of Designer Needed As Use of Bright Metals Increases

BY LAWRENCE BLAZEY
Secretary and Design Director
Designers for Industry Inc., Cleveland

■ BECAUSE industries have been frantically devising short cuts and substitutions, we are about to adopt revolutionary changes in our methods of production. Increase in aluminum and magnesium production will later be reflected in household products and building materials. A greater amount of steel will be made into stainless alloys due to our increased production of nickel and chromium. Because stainless steel may be cheaper than heretofore, it will open up a vast field where chromium plating is now used. Another surface finish which is being used more extensively is the metal spray-gun technique, depositing any kind of metal on the surface of any material, in much the same manner as different colored patterns with a paint gun.

From my observations as a designer, we are evolving into a much more colorful and vibrant world as the use of plastics and bright metals increases. Now more than ever the designer will be looked to for guidance to achieve a harmonious balance between these elements so that gaudiness and glitter will not be misused.

New Processing Equipment Supplies Refined Clays to Enameling Plants

BY E. HOGENSON
Executive Vice President
Chicago Vitreous Enamel Product Co., Cicero, Ill.

■ THREE developments of importance in connection with the enameling industry for 1941 have been:

1. Development of ground or base coat enamels with increased firing range so that the same combination of porcelain enamel frits can be used in varied proportions for a wide variety of work requiring equally wide variation in firing temperatures.

2. The further increase in opacity or covering power of porcelain enamel cover coats. As a result, it is now possible to get entirely satisfactory commercial ware with an even greater reduction in applied weight. In addition to economy, this affords additional durability.

3. Processing clay—introduction of a new type of refined clay for use in enameling plants. Since the war discontinued the use of German Vallendar clay, much development work has been done to perfect blends of domestic and available foreign clays suitable for enameling purposes. Processing equipment has been designed which is capable of thoroughly cleaning these clays so that for the first time an enameling plant will have clay available that is cleaned prior to its purchase. The equipment now blunges, dries, magnetically separates and screens clay with the result that a degree of refinement is attained that has not been possible before.

Use of Liquid Blanket on Galvanizing Kettles Saves Zinc

BY W. H. SPOWERS JR.
Lieutenant Commander, United States Navy
Bureau of Ships, Washington

■ ENORMOUS quantities of prime zinc metal are lost each year in the galvanizing industry through formation of oxides on the surface of kettles. Today wire and pipe galvanizers are saving millions of pounds of zinc by using a liquid blanket through which oxygen cannot pass. The blanket is supplied in the form of white crystals which melt on the surface of the zinc to form a fluid. It protects the zinc from oxidation, and completely eliminates formation of zinc oxide. In addition, it has excellent heat insulation properties and reduces the percentage of dross formed.

A third important saving which likewise results from the insulating value of the blanket is in the form of fuel. In one test on a gas-fired wire kettle the net saving in gas was 30 per cent, and the surface of the liquid blanket was 410 degrees cooler than the surface of zinc oxide when the blanket was not employed. Based on average savings and rate at which shipments of this liquid covering are now being made, it is estimated that approximately 15,000,000 pounds of prime zinc metal will be saved in 1942. At present, plans are being made to supply more of this material to take care of demands.

New Coating Is Rust Inhibitive, Can Be Pigmented in Any Color

BY HARRY FORSBERG
President
H. Forsberg Co., Cleveland

■ THE QUESTION before the manufacturer today is: "What am I going to substitute or use in applying a protective coating to the metal on this item?" Well known materials of yesterday are not available to the majority of manufacturers because of their "vital" classification. One of the major substitutions is the placing of a protective coating on metal which was formerly galvanized. This company has mastered this problem by the development of our own protective coating known as X1M. Made in either spraying or brushing consistency, it not only gives us a rust inhibitive coating, but also a finish coat as well. Also the material can be pigmented in practically any given color.

Plants throughout the country also must conserve on various types of reduction materials by substituting the use of mixtures of zylol and Hi-Flash to approximate the solvency and evaporation rate of toluol—so important in the manufacture of explosives. Solvents used in cleaning spray guns are reclaimed by distillation.

Flame-Priming Speeds Painting Procedure of Steel Structures

BY E. W. DECK
Development Engineer
The Linde Air Products Co., New York

■ TWO SIMILAR oxyacetylene processes—flame-descaling and flame-priming—are being used extensively in steel production and steel fabrication. The first is helpful in removing scale from steel castings and rolled or forged shapes and plates, including armor at certain stages. In some instances, this method has been found to be completely effective as an aid to subsequent machining.

Oxyacetylene flame-priming prepares steel surfaces for painting by removing rapidly loose rust and scale, leaving the surface warm and dry for the application of paint. It has the effect of giving the paint a low-temperature bake on a dehydrated surface. In addition it speeds up the painting procedure since work can proceed 24 hours per day where formerly steel structures could be painted only during the warm, dry period of the day.

Consumption of Zinc Chromate As Rust Inhibitor Increases

BY BENJAMIN JOACHIM
President
Joachim Research Laboratories Inc.,
Brooklyn, N. Y.

■ MOST outstanding achievement in the paint industry during 1941 was the large scale introduction of zinc chromate in all primer finishes used on aluminum, magnesium alloys, steel and iron surfaces. Zinc chromate pigments are used in the army specification D.S. 359 for all mobile equipment and gun carriages. It is used by the Navy for airplane work. Its consumption has increased tenfold to a production of several million pounds, with a shortage existing at the present.

Tests have shown that from 10 to 50 per cent of the pigment content of a good rust inhibitor should consist of zinc chromate. Its low specific gravity as compared to the much heavier lead pigments favors its use. Vehicle employed with zinc chromate pigments is a phenol-modified alkyd resin solution. The chemical principle involved insures at all times the presence of soluble chromate which releases sufficient chromium ion to act as a rust inhibitor.

Outlook for Plating Industry Neither Promising Nor Alarming

BY WILLIAM BLUM
Chemist
National Bureau of Standards, Washington

■ SHORTAGE of metals, especially nickel, that are applied in plating has materially reduced production of plated articles for civilian use. For the past several months only 30 per cent of the normal supply of nickel anodes has been allocated for civilian plating. Besides curtailing production of automobiles, the Office of Production Management, by its order L-2-B of Oct. 27, 1941, has restricted to bumper bars the use of copper, nickel, chromium or aluminum.

Substitution of plain carbon steel for stainless steel, brass, nickel-silver and zinc-base diecastings has led to certain increased applications of plating on steel as a means of saving strategic metals. Civilian use of zinc-plating on steel is likely to increase, especially as a substitute for thicker hot-dipped zinc coatings. Certain military and other war applications of plating have increased and other applications of plating on war products also are being developed.

Outlook for the plating industry is neither promising nor alarming. Substantial survival of this industry will depend upon increased use of plating for war products and such efficient use of the metals allocated for plating that their applications will be continued in order to supply essential civilian needs.

Rust-Resistant Coating Penetrates Deeper; Increases Production

BY D. C. MINER
E. F. Houghton & Co.
Philadelphia

■ SEARCH for alternate materials to replace cadmium, zinc, nickel and chromium, formerly used as plating for steel surfaces has resulted in the development of a controllable blackening process which provides a black oxide coating uniformly produced on the surface of steel and which is obtained by immersing parts in a highly alkaline solution maintained at 290 to 295 degrees Fahr.

Besides retarding corrosion, the coating beautifies the part. Other advantages are unchanged dimensional sizes, lower cost, and increased production. The longer parts are immersed in the blackening bath, the better the protection. Actually the coating penetrates about 0.004-inch into the surface of the steel so that it cannot be rubbed off by handling. The coating, however, is not intended for extreme exposures such as outdoor or salt air.

It is believed that this process will assume an important place in metalworking circles as a normal-time surface treatment of steel, because of its speed, attractive appearance and general suitability for many small parts.

Rigid Machines and Carbide Tools Form Record-Breaking Combination

BY E. S. AULT
Professor of Machine Design
Purdue University, Lafayette, Ind.

■ THE MOST impressive feature of production during the past year is the development of mass production methods to precision articles formerly made selectively in limited quantities, particularly aircraft engines and ordnance. Production in separate factories of component parts that must be assembled with small, precise allowances, has developed real interchangeable manufacture to a higher degree than ever before attained. This production has demanded precision machines for boring, threading, turning, grinding, and broaching—machines which assure not only close tolerances but also smooth surfaces. Instruments for checking dimensions and surface finish have done much to make this technique practically attainable.

In addition to precision in modern machinery, we have the benefit of decreased production time resulting from rapid chip removal made possible by extended use of cemented-carbide cutters in machine tools designed and built to have high resistance to deflection. Extremely rigid fixtures also contribute to this result. Again, under pressure, we are learning to do things better and more rapidly.

Lubrication Control Forestalls Machine Tool Breakdowns

BY CHARLES H. BROMLEY
Lubrication Engineer
232 Chestnut street, Kearny, N. J.

■ NO FUNDAMENTALLY different lubricants have appeared during the past year. Where loads, speeds, clearances and temperatures are normal, none other than com-

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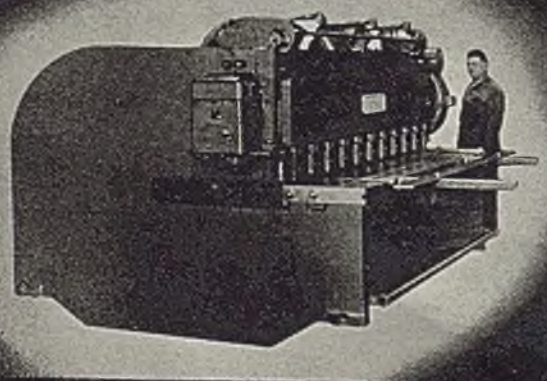
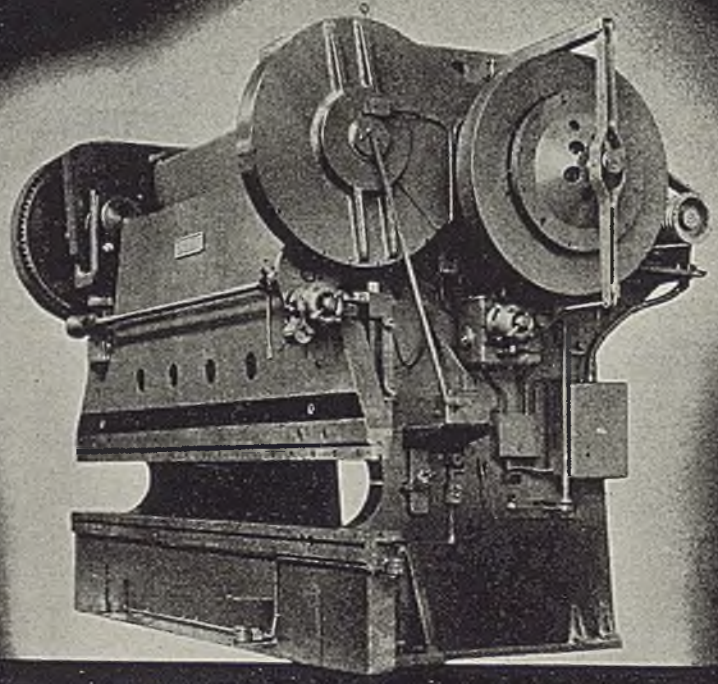




THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO

SHAPERS • SHEARS • BRAKES

mon "straight" petroleum oils seem needed. It has been confirmed by laboratory research and machine operating experience that where boundary lubrication conditions are encountered, the lubricant should contain long chain polar molecules such as are available in free fatty acids.

Designers should give more consideration to means for preventing the oil in the hydraulic system from transferring its heat to the grinding lubricant. Something more than a single metal partition between the adjoining tanks is indicated. Control of oil vapors—especially in thread-grinding operations—also should receive immediate attention.

The value of machine tools today demands that every bearing shall at all times receive an adequate supply of lubricant. If the design does not insure this, it should be changed. Proper lubrication control also is essential for coordinating the various factors encountered. Cards or plates attached to machines should list proper lubricants and where and how they should be used. Control should also cover improved methods of storage, distribution and reclamation. Organized policing and trouble-shooting by competent lubrication experts is essential.

Emphasis on Needs of the Moment Is an Inevitable Cost of War

BY JOHN S. CHAFEE
Vice President
Brown & Sharpe Mfg. Co., Providence

■ THE YEAR 1941 witnessed increased output of all essential items in our line; simplification by temporary discontinuance of items whose sales depended on customer taste rather than actual needs; emphasis on special arrangements for mass production of defense parts; increased use of subcontracting; elimination of the use of many alloy steels which the steel companies no longer furnish in the small quantities for which they previously solicited orders; greatly increased consumption of high speed steels, and modifications in processes due to the necessity of the use of molybdenum alloy.

While new designing has been continued during 1941, it seems inevitable that the increasing tempo of the victory program will require more and more emphasis on the needs of the moment, with consequent withdrawal of men and facilities from the preparation for long range future needs, this being one of the costs of war.

Mounting Machine Tool Demands Bring Simplification to Fore

BY GEORGE H. JOHNSON
President
Gisholt Machine Co., Madison, Wis.

■ DEMAND for machine tools during the year 1941 was so great that the industry devoted nearly all of its effort to increasing production. Towards the middle of the year, it became more and more difficult for the machine tool builders themselves to acquire new machine tools. This has caused many companies to investigate the possibility of increasing production by other means. Subcontracting has been thoroughly tried but found only reasonably satisfactory. There seems to be a definitely limited number of companies capable of satisfactorily subcontracting machine tool components. Apparently we are now approaching the point where simplification of design and elimination of unnecesary and elaborate features offers the most satisfactory method to further increase production.

Our company is now completing a large order for simplified 2-inch bar capacity, ram type turret lathes. As far as accuracy and productivity is concerned, this model is equal to conventional machines on nearly all kinds of work, and can be built in approximately one-half the time. This can be done with larger machines of all types and a similar saving in hours effected. If the demand for machine tools is to continue and a further large increase of production is necessary, simplification should be explored thoroughly.

Machining

Simple, Single Purpose Machines Prove Effective on Ordnance Work

BY C. N. KIRKPATRICK
Vice President and General Manager
Landis Machine Co., Waynesboro, Pa.

■ A YEAR ago I suggested that the size and scope of the ordnance output program indicated a trend towards the use of single purpose machines. As a matter of fact, during the past year there has been a very definite swing toward such simplified machine tools, and it still continues. For instance, there is a far greater demand for Landis shell tappers today than there was a year ago, also an increased demand for threading machines for second operation threading of adapters, fuses, wind-breakers and other ammunition components. Many studs, bolts, screws and similar parts for airplanes, tanks, engines, etc., are now being threaded on single purpose machines.

The reason is obvious. Threading operations on many parts are slower than many turning, drilling and other operations on multiple machine tools. Therefore, if the threading operation is confined to a single purpose tool, the multiple purpose machines in the production line can be run at higher speeds on other operations and overall production increased. Continuing shortage of skilled labor also is a deciding factor. It is far easier to instruct green hands in the operation of single purpose machines than for operation of more complicated units. In many instances cost per piece is reduced considerably by use of single purpose machines, due to lower initial investment and higher production. Then too, the simple machine lends itself to

less complicated tooling and thus earlier deliveries are provided.

New Tungsten Carbides Inspire Production and Conservation

BY PHILIP M. MCKENNA
President
McKenna Metals Co., Latrobe, Pa.

■ STEEL-CUTTING grades of cemented carbide in tipped tools for machining steel castings, forgings and bar stock were supplied in five times the quantity in 1941 as in 1940. Output of shell, guns, tank parts of armor plate, airplane parts, as well as production of machine tools, pumps, compressors, trucks, electrical motors and other machinery, was increased by the more rapid cutting with these new tools. As the metal industry has become aware of the scope of usefulness of such cemented carbide materials, "milling" with single point fly cutters, counterboring and similar jobs are being done more efficiently—without waiting for complicated multiblade tool steel cutters.

More extensive lines of single point cutting tools tipped with steel-cutting carbide have been cataloged as "standard tools". Machine tools have been given larger motors to drive the work at higher speeds and special shell turning lathes with 50 to 70-horsepower motors have become available. As in 1914-18 when use of high-speed steel became general, the utility and necessity of steel-cutting carbide tools has become equally evident in the present emergency. The fact that 60 times as much metal is cut per pound of tungsten when used in the form of cemented carbide tips than when used in 18 per cent tungsten tool steel, is a moving reason for their rapid adoption in a time when strategic metals must be conserved.

As 1941 closed, increased potential productivity per tool was decreasing the volume of cemented carbide required per pound of metal removed in the form of chips as machinists became familiar with the best methods of resharpening and applying these new cutting tools. At the same time demand was increasing as the scope of application to new jobs was developed, the net result being that demands in 1942 may be double that of 1941.

Subcontracts for Machine Tools Represent Attractive Business

BY H. J. GRIFFING
Sales Research Engineer
Grinding Machine Division, Norton Company
Worcester, Mass.

■ AN UNUSUAL situation exists today. Orders are placed for machines in large quantities. These "stock orders" permit us to order materials and to schedule manufacturing and assembling of machines which at some later date are assigned to various customers. It has never before been possible to schedule any such large quantities or to place orders with subcontractors for machine work on such an extended program. The result is we are contracting for the building of complete machines in plants that have suitable equipment.

We help these plants on certain unusual machining operations for which they do not have tools. We also supply the necessary experience by having their men spend training periods in our plant and by sending our men to supervise their work. The quantities of this work are sufficiently large to make it attractive for subcontractors particularly those having regular products for which it is difficult, because of priorities, to obtain materials. Norton supplies almost all the special tools, including jigs and fixtures, and in some cases supplies patterns where the subcontractors have foundries. In many instances, however, it may be preferable to have subcontractors make new patterns designed to fit in with their foundry practice. Patterns are either paid for outright or a sufficient number of castings ordered to amortize the pattern investment. When subcontractors make jigs and fixtures, Norton pays for them but their own tool engineers design them so they will fit their own machine tools.

Chromium plating for appearance was eliminated entirely some time ago. Substitutes for items hard to obtain are provided by making welded assemblies, pressed metal parts, etc. A trend in design of machine tools is to incorporate oiling systems which do not require attention, similar to arrangements used on automobiles.

Machines are being simplified to expedite their manufacture. Undoubtedly experience is accumulating which will result in a general redesign of machine tools after the present emergency with a tendency toward making machines more automatic for operation with less effort.

War Emphasizes Advantages of Surface Grinders on Production

BY NORMAN D. MACLEOD
President and Treasurer
Abrasive Machine Tool Co.,
East Providence, R. I.

■ IN OUR particular field production of current model machine tools has been of such vital concern lately, that many outstanding machine design developments have been forced into the background for the time being. In regard to machine shop practice developments, I would say that surface grinders, usually considered in the past as tool room accessories primarily, have now come into their own on the production lines. Many of our machines are serving that purpose in war plants all over this country and in Great Britain.

As to substitution of materials, we have changed over in a number of cases from castings of aluminum and other scarce materials, to sheet steel. This is particularly true of water guards. These new guards of formed and welded sheet steel, not only are light but also are stronger.

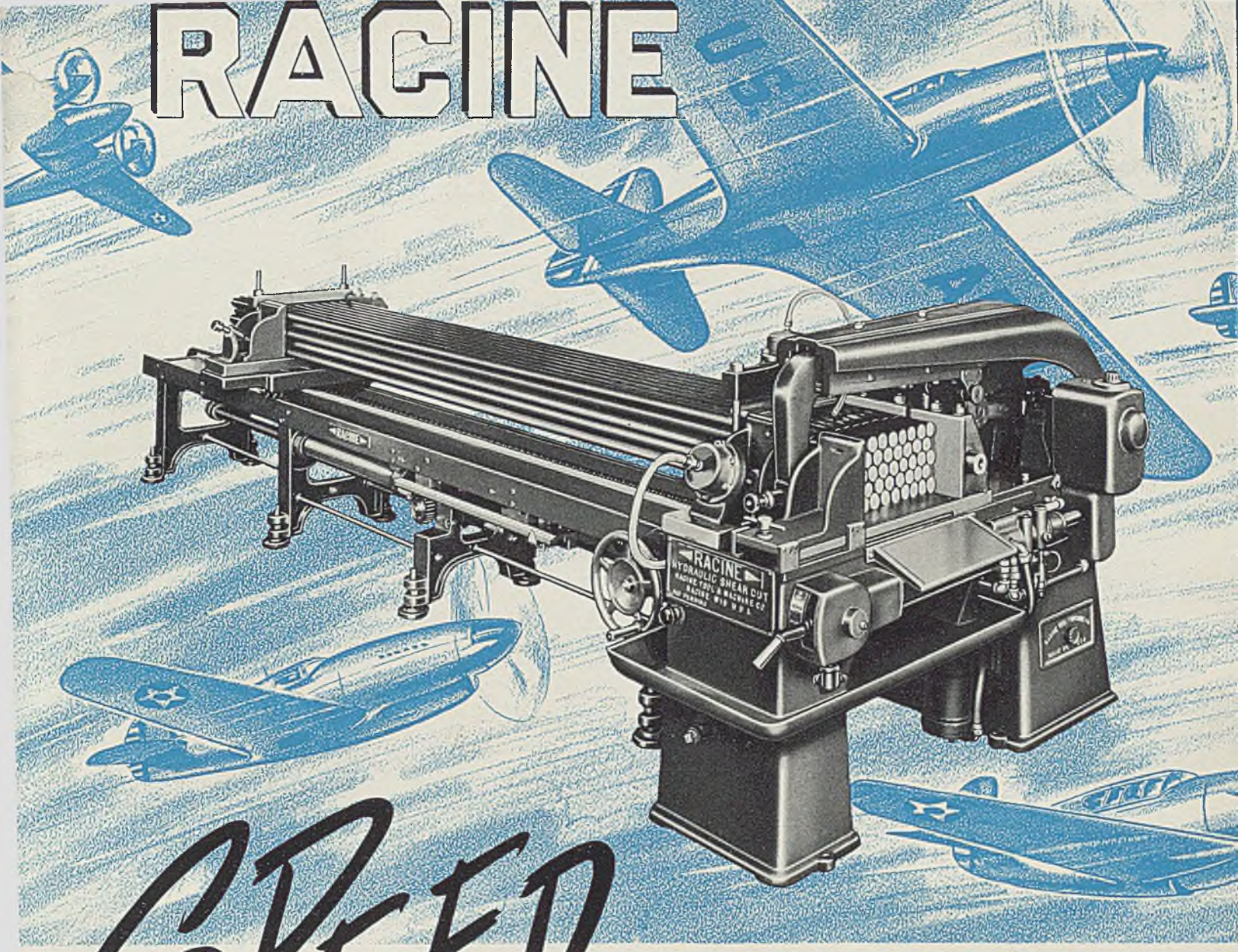
I look to plastics to take the place of metal in certain machine tool parts, these plastics possibilities including handles, knobs, hand wheels, guards and doors.

Thread Grinders Find New Work In the Field of Form Grinding

BY W. J. GRIMM
Manager, Thread Tool Division
Jones & Lamson Machine Co., Springfield, Vt.

■ APPLICATION of a standard automatic thread grinder to cutting grooves in the stems of aircraft engine valves may seem to be a far cry from the original purpose of such a machine, but it is a fact, the job being completed "from the solid" at one handling. The grooves have no lead, so the work simply is rotated—the wheel being fed in to proper depth, called "plunge grinding". The machine is equipped with a recently developed wheel dressing and trueing device which accurately translates the desired form in its entirety to the face of the wheel. The 20-inch diameter grinding wheel has sufficient face width to cover the entire length of the form at one "plunge". Approximately 90 pieces per hour can be handled—40 or

RACINE



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It takes a lot of cutting off to keep pace with the production requirements of American Industry geared to National Defense, but it's for just such high speed continuous operation that RACINE Hydraulic Saws are built.

The RACINE line offers fully Automatic Hydraulically operated Sawing Machines in five different models ranging in capacity from the RACINE Oil Cut, 6" x 6" to RACINE Heavy Duty Hydraulic, 10" x 10" to 12" x 16"—These saws will accurately measure and cut off pieces anywhere from 1/64" to 54" in length and can be equipped to handle 12, 16, and 20 foot bars or larger.

High speed production without waste of material and with economy of tools is imperative in times of emergency. RACINE Hydraulic Saws do just that by blade saving, oil-cushioned hydraulic power and by accurate fast cutting. Write for information today or have one of our specialized agents located nearest you call and explain.

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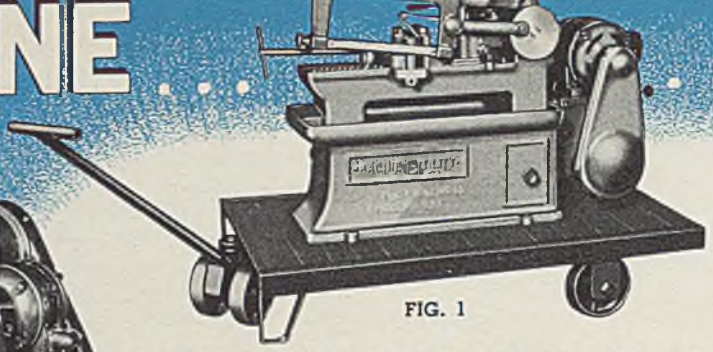

FIG. 1

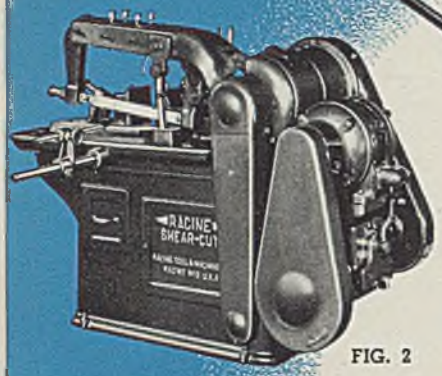

FIG. 2

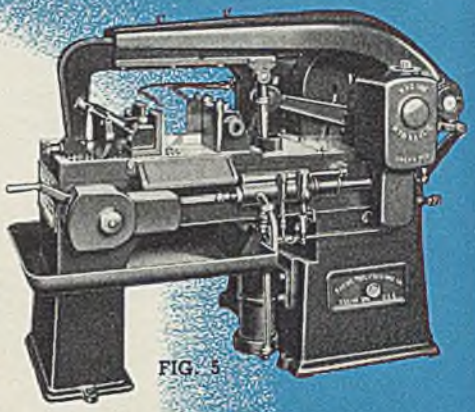

FIG. 5

Racine offers a full line of standardized and special machines to meet your metal cutting problems. Representative machines are briefly illustrated here . . . complete literature and specifications can be had upon request.

FIG. 1 — Any of RACINE machines can be equipped with portable handling equipment as is the Racine Utility Saw illustrated here. Investigate our special turntable machines, spruce cutters, and other sawing machines.

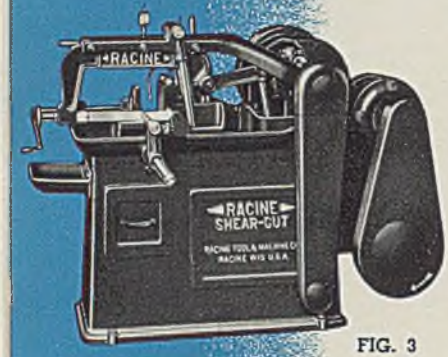

FIG. 3

FIG. 2 — RACINE Shear Cut Production Saws. The exclusive feature of positive, progressive screw feed makes them the outstanding production machines of their size. Each cut is made in exactly the same length of time. No guess work in setting production costs. 6" x 6" and 8" x 9". Write for bulletin 212-B.

FIG. 3 — RACINE Shear Cut Production Saws. The exclusive feature of positive, progressive screw feed makes them the outstanding production machines of their size. Each cut is made in exactly the same length of time. No guess work in setting production costs. 6" x 6" and 8" x 9". Write for bulletin 212-B.

FIG. 4

FIG. 4 — The RACINE Utility Saw, Wet Cut Model, 6" x 6". The wonder saw at a remarkable low price. Great simplicity. Hydraulic feed and pressure. 2 or 3 speed models available. A general all around shop saw. See Catalog No. 70-B.

FIG. 5 — RACINE Hydraulic Heavy Duty Model. Capacities 10" x 10" to 14" x 20" with hydraulic feed and control. Guaranteed accuracy and fastest sustained production speeds. The flexible hydraulic control makes these machines the most versatile saws on the market today, cutting the thinnest-walled tubing to tool steels and die-blocks. A real production machine. Write for Catalog No. 80-B.

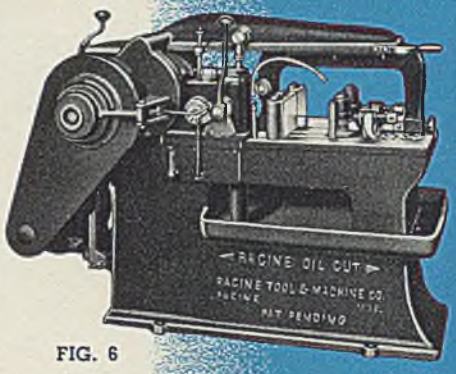

FIG. 6

FIG. 6 — The RACINE Oil Cut, hydraulic feed machine — a general purpose shop saw — fast, accurate, dependable — new in principle, modern in design — 3 speeds — capacity 6" x 6". Write for Catalog No. 60-B.

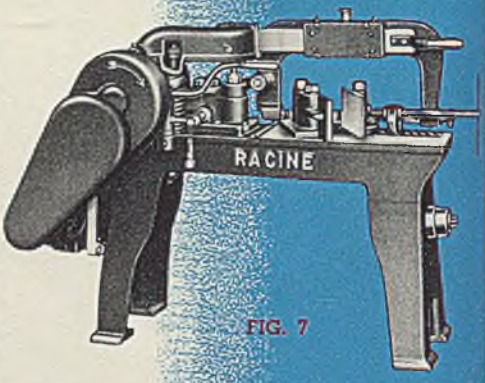

FIG. 7

FIG. 7 — The Dry Cut Model of RACINE Utility Saw, still lower in price but accurate, fast and dependable. The auxiliary machine for large shops. A producer for small shops. No machine built to match this at the price. Write for Catalog No. 70-B.

METAL CUTTING MACHINES for EVERY SIZE and PURPOSE

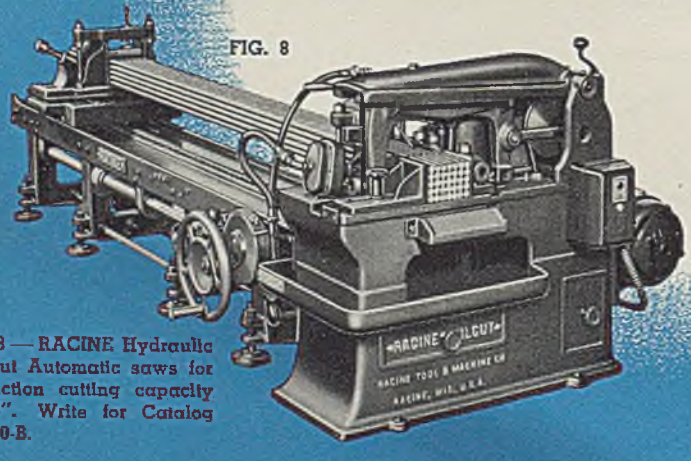

FIG. 8

FIG. 8 — RACINE Hydraulic Oil Cut Automatic saws for production cutting capacity 6" x 6". Write for Catalog No. 60-B.

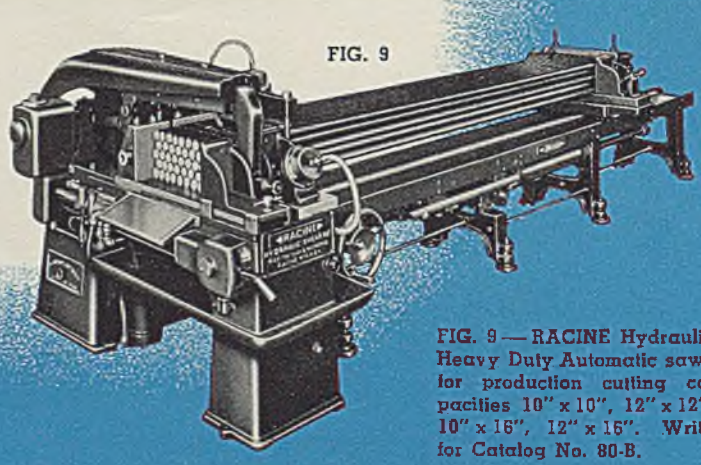

FIG. 9

FIG. 9 — RACINE Hydraulic Heavy Duty Automatic saws for production cutting capacities 10" x 10", 12" x 12", 10" x 16", 12" x 16". Write for Catalog No. 80-B.

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more being ground before redressing of the formed wheel becomes necessary.

Under a previous system, these thread-form annular grooves were ground one at a time by a narrow wheel carrying a single form. It was fed in to depth, backed out, stepped over to the next groove, repeating as many times as there were grooves.

Versatility of a modern thread grinding machine on form grinding work of this nature, is indicated by the fact that where the customer has a number of different products—valves in this case—each requiring a different form, these variations readily can be provided for by different setups on the same basic machine. Formers have been made to handle a radius, a flat, another radius and a 45-degree angle on the head end of a valve, combining all these operations into one. These formers, made four times the actual size of the form to be ground into the work, exactly control the action of the forming and trueing device which "machines" the face of the wheel into shape by means of diamonds. As many as 17 operations have been combined into one in this manner.

Work Simplification Expedites Shop Training of New Men

BY WENDELL E. WHIPP
President
Monarch Machine Tool Co., Sidney, O.

■ THERE HAS been a great and growing urgency behind the demand for increased output of machine tools with which to get both old and new plants into production on essentials of the national victory program. As a consequence, emphasis in the machine tool industry during 1941 was directed away from production of new designs and toward standardization on those tools most critically needed now. This does not mean that improvements have not been made. It simply means that improvements in product, as rapidly as they have become available, have been incorporated in current production rather than accumulated for introduction with new models. This procedure has been greatly facilitated at Monarch by following automotive manufacturing practice in keeping inventory of materials and parts small and closely tied in with production requirements. Flexibility thus provided makes it possible to introduce desired changes with maximum speed and efficiency.

It has been found increasingly advantageous to break down assembly and subassembly work into smaller and simpler groups of operations. This "work simplification" has expedited training of new men to handle these jobs. It also has served to increase our rate of production of new machine tools beyond anything previously thought possible. While we have increased plant area only about 25 per cent, we have succeeded in increasing production approximately 100 per cent. Upwards of 500 new men, most of them wholly without previous factory experience of any kind, have been hired, trained and put to work in the last 12 months with entirely satisfactory results.

Cutting Fluids Should Be Considered As Major Items in the Production Schedule

BY W. C. LOCKWOOD
Cutting Oil Engineer
Texas Co., New York

■ SOME of the unusual demands of war work for lubricants and cutting fluids at first seemed impossible, but through efforts of research divisions products have been developed which are producing results beyond our fondest hopes. As it is most important to conserve as much power, machine-and-man time and material as possible, production plants should check the practical performance of each lubricant and each cutting fluid to make sure that they have been selected to give maximum results in each case. By just such careful investigations, production by machine tools has been increased as much as 25 per cent by changing the type of cutting fluid. This does not consider other gains such as longer tool life, better finish, less down time of machine, less spoilage and less of the inevitable scrap which is made when resetting cutting tools.

Close co-operation between personnel responsible for production and competent cutting oil engineers is needed to determine scientifically the proper fluid ahead of time. Otherwise it may be necessary to operate machine tools at reduced speeds until the proper coolant can be found through "cut-and-try" methods.

Machinery Dealers Are Called on For Vital Production Advice

BY FRED B. SCOTT, JR.
President
Syracuse Supply Co., Syracuse, N. Y.
President, Associated Machine Tool Dealers

■ THROUGHOUT 1941 tremendous demands were made by industry on machine tool distributors for advice—first, as to what type and size machines should be considered to supplement those already on hand; second, whether under the priorities system they would be available to start deliveries of finished parts on the dates specified; third, if not, what alternate machines and processes could be considered.

Nearly all machine tool distributors not only had immediately available, processing information on most of the parts but also had actually studied the manufacture of these parts, both here and in Canadian plants and arsenals. In addition most machine tool builders had sent out to their distributors layouts and data on all war projects which they had tooled up. Therefore when hurried requests were made for production figures and machining recommendations, distributors were able to give it in a matter of hours where otherwise several weeks might have been required. As a result many pitfalls in manufacture were avoided.

Contrary to general belief, net profits of machine tool distributors have not increased appreciably in spite of increased volume. A recent report of the Associated Machine Tool Dealers shows that the average net profit for the last four and a half years was 2.31 per cent, and that for the first half of 1941 was only 2.81 per cent.

Canadians Are Aroused to Fact That Every Machine Is Needed Now

BY ARNOLD THOMPSON
Consulting Engineer
Tool Engineering Service
Toronto, Ontario, Canada

■ THOMAS ARNOLD, Machine Tool Controller of Canada, said recently: "Manufacturers should use their heads —take standard machines and use jigs and fixtures to turn out materiel. There are certain classes of machine tools which we simply can't get. Any idle tools—new or old—which can do the work must be utilized. We can't wait, so don't wait for new machines. Patch up the old ones and do your best."

This adapting of used machines falls definitely within

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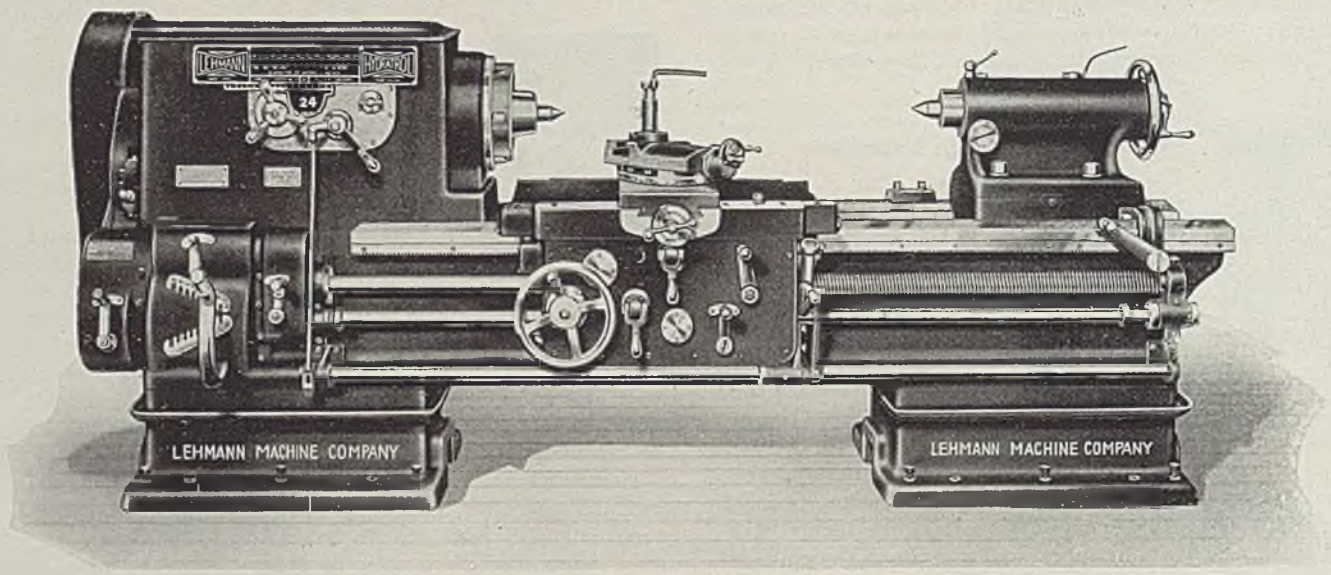

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the scope of tool engineering. Here are some typical examples out of my own experience: Broaching forged rifle bodies on a wire drawing bench; use of a power press to push a series of spline broaches through a worm; boring and turning of 6-inch shell on home-made lathes fabricated from girders, concrete, shafting and babbitt metal; cutting of worms in an engine lathe, using a generating cutter, harmonic train of gears and a short master lead screw; utilization of parts of old automatic screw machines to build special purpose automatics; "comb" chasing of threads in simple lathes; elimination of grinding by precision sizing in simple lathes using tungsten carbide tools.

There is a tendency now for machine builders to revert to simpler, smaller machines which are simple to operate and in the manufacture of which these relatively unskilled workers can be employed. Tool engineers must develop a technique to suit each existing condition, bearing in mind that tooling up first and foremost is "aid to a mechanic". Nature and volume of production in each case should determine the limits of this aid. This war will not wait for us to attain perfection, so let's make immediate use of what we can get, and not wait for what we may prefer. In the meantime, however, we must not let any wartime success with old machines bias our judgment as to the peacetime value of new equipment.

Maintenance Parts Now Require Extra Strength and Durability

BY E. S. SAWTELLE
Vice President and General Manager
Tool Steel Gear & Pinion Co., Cincinnati

■ WITH THE extra pressure put upon manufacturing, especially in heavy industries such as the steel industry, repairs and maintenance have been under unusually sharp scrutiny lately. A breakdown now is a matter of far more serious consequence than in ordinary times. This has led to a re-study of maintenance materials and particularly to a wider use of hardened gears and of very high-hardness rolls, crane wheels and similar items.

There are applications where under normal operating conditions the extra expense for a hardened part might scarcely be justified, but under present conditions its cost not only is justified but its use is imperative. Fortunately, there have been no uncomfortable restrictions or undesirable substitutions enforced on materials for parts of this sort. It is true that nickel steel is not being used quite as generally as heretofore but there are other alloys that are equally good. The important thing is to give to gears and other severe-duty maintenance parts, the highest possible hardness for extra durability, thereby reducing the downtime and resulting production losses involved in too-frequent breakdowns and replacements.

Conservation of Cutting Tools Demands Immediate Attention

BY JOHN LINDEGREN
Assistant Superintendent
Crompton & Knowles Loom Works, Worcester, Mass.
Regional Director, ASTE

■ CONSERVATION of small cutting tools is a subject which must be given immediate and very serious consideration—that is if we are to continue turning out materials for war at an ever-increasing rate. Capacity to build machine tools has been going forward by such leaps and bounds that now it probably is five or six times greater than before the victory program started. However, the small tool industry has not increased its capacity to anywhere near that extent. Where then, are we going to get our cutting tools when all of the new factories get into production and when all of the old ones get to running three shifts?

I have heard it said many times that a third shift will break three times as many tools as the regular day shift, also that new help will break at least five times as many tools as the experienced men, until eventually they "get the feel" of the machines. Frank W. Curtis, president, of the ASTE, is my authority for the statement that it now requires $300 worth of tools for every 2000 horsepower radial aircraft engine that is produced, and from $3 to $4 worth of small tools for every army rifle that is made. Those are cold facts. If other things produced for war show tool costs in proportion, it certainly is high time that everyone connected with war production should give attention to conservation of cutting tools.

Research Aids War Projects While Giving Thought to Future

BY JAMES W. COREY
Vice President
Reliance Electric & Engineering Co., Cleveland

■ DURING 1941 we increased greatly the staff and the space devoted to research work. While this step was dictated to some extent by immediate requirements of our defense orders, we are convinced that many of the research projects now under way are destined to contribute in substantial degree to the future of our business. One of the new pieces of electrical equipment which already has resulted is our adjustable speed drive for use on alternating current power circuits. This electrical means of obtaining a wide range of speeds on applications up to 30 horsepower already has enabled several machinery manufacturers to redesign their equipment completely, eliminating many gears and clutches. On some machine tools to which this variable speed unit has been applied, an increase in production of as much as 15 per cent has been achieved. With fewer gears to be heat-treated, the load on heat-treating furnaces has been correspondingly lightened, thus freeing them for use on other urgent war work.

While it is true that our "Five Year Plan Committee" composed of department heads, must for some time to come devote its research efforts primarily to those things directly identified with the national victory program, it always can be counted on to keep us on our toes and constantly awake to the fact that improvements must continue if industry is to be served adequately.

Mass Production Methods Appear In Gage and Tool Industry

BY FREDERICK S. BLACKALL JR.
President and Treasurer
Taft-Peirce Mfg. Co., Woonsocket, R. I.

■ IN A period when the country's all out efforts are in the direction of raising the nation's productivity to new high levels which will shatter all previous records, it is natural that emphasis should be on advances in machining processes and methods, rather than on design changes and new technical products. For example, the machine tool industry, for the first time in its history, has been placed on a relatively high production basis, whereas in the past its products have been built in small lots, more or less by

hand methods. Likewise, the unprecedented demand for production arising out of the victory program has stimulated tooling and gaging greatly, so that gages, setup and inspection equipment, and even to some extent jigs and fixtures, are now being produced in tooled production, more nearly comparable to mass production methods than anything previously seen in these industries.

The same thing is happening in a host of other fields. Widespread use of tools and gages characterizing this era will leave its mark on our industrial economy, resulting in the employment of production methods to a far greater degree in time to come. . . We are, of course, on the eve of a great development of "ersatz" materials, products, devices. The operation of priorities and virtual withdrawal of many materials and products will undoubtedly stimulate our native ingenuity. Invention, research and necessity, working hand in hand, will produce a great crop of substitutes for those things common to our experience, but no longer available.

Intensive Training Replenishes Reservoirs of Industrial Skill

BY OTTO W. WINTER
Vice President in Charge of Manufacturing
Republic Drill & Tool Co., Chicago
First Vice President, ASTE

■ WHILE GREAT strides have been made in the victory training program and remarkable results achieved, there still exists a tremendous shortage of skilled men in the metalwork field. Fortunately the destructive and lazy practice of stealing one another's help now is giving way before effective operation of a nation-wide victory training program. This unprecedented program now is utilizing virtually every technical school and college in the country. At the same time almost all plants holding prime war contracts and those having sub-contracts also have underway some form of "in-plant" training program. A notable example is that of Wright Aeronautical Co.'s Cincinnati plant where some 6000 men already have been trained, thus avoiding "bleeding" essential personnel from vital machine tool plants located in the vicinity.

Many traditional ideas as to rapidity at which men can be trained have been upset. Through intensive, concentrated training for limited skills, inexperienced workers are quickly being put in shape for effective use in shops. There still remains, of course, the inevitable length of time required to acquire broad experience and training. One of the great handicaps in the war training effort has been lack of suitable instructional material. In the field of machine shop practice and related subjects, this need now is being filled by the material prepared by Vocational Education Department of the New York State Department of Education. This material is being distributed by —and carries the endorsement of—Defense Training Committee of American Society of Tool Engineers.

Production Work on Jig Borers Eliminates Jigs and Fixtures

BY A. G. BRYANT
President
Bryant Machinery & Engrg. Co., Chicago

■ ONE OF the surprising transformations during this "building for war" period has been the introduction of the jig borer as a production machine. Until recently, the jig borer primarily had its place in the tool room. It originated in the need for a machine to make jigs and fixtures, involving extremely accurate spacing of holes and surfaces, and their precision machining, in jigs and fixtures used in mass production. Even top-notch tool and die shops and well equipped tool rooms of large manufacturing concerns employed jig borers only in relatively limited numbers. With the tremendous impetus to exacting mass production that has developed during the present emergency, however, the jig borer suddenly has stepped into production use to save both time and expense where parts to close tolerances are required, for which jigs and fixtures are not available quickly.

Short run production of such parts is being accomplished rapidly by using jig borers directly on the parts instead of taking time to build jigs and fixtures which otherwise would be required. Likewise, many such items involving close tolerances—which at other times have been laboriously laid out individually and by hand—are being placed on jig borers, there to be "spaced" and machined quickly and with predetermined high accuracy. Thus the inherent quality of great precision of the jig borer is being employed directly in quick manufacture of numerous essential parts.

Machine Tools and Tooling Have Boosted Aircraft Production

BY JOHN J. LEE
Co-Ordinator of Planning and Mfg.
Curtiss-Wright Corp., Buffalo

■ DURING THE past year the aircraft industry has exceeded all expectations by reaching a peak of production unthought of a few years ago. We at Curtiss-Wright attribute this production achievement, first; To the proper selection of excellent available machine tools; second, to excellent assistance by the machine tool industry; third, to well planned and well designed tooling suited to quantities involved; and last but not least, to able assistance of capable small subcontractors who were willing to learn with us when quantities were small.

In many cases machine tools selected were not just what we required so manufacturers gladly altered them to suit both our dimensions and our materials. If no machines were available for some of our particular tasks we sometimes took on the job of designing and building a machine that would produce the desired results. Many such machines are now available to the trade from the machine tool builders themselves.

Our tool design and planning men have been called upon to work long hours so that we could expedite our tool programs. Likewise our tool making force have made similar efforts. In conjunction with these tool programs we have called upon many small tool designing and tool making concerns and they have done a lot to help us out of our difficult situation. So it is that machine tool men, tool designers and tool makers share the honors of having made the completion of a great task possible. As new models are developed, this co-operation will get them into the air in shorter time than ever before.

Oxyacetylene Flames Gain Favor As Production Cutting Tools

BY R. S. BABCOCK
Development Engineer
The Linde Air Products Co., New York

■ STEPPED-UP programs in American industry have stimulated use of oxyacetylene machine-cutting for many types of work. Chief among these are preparation of plate for welding in ship construction, cutting of armor plate,

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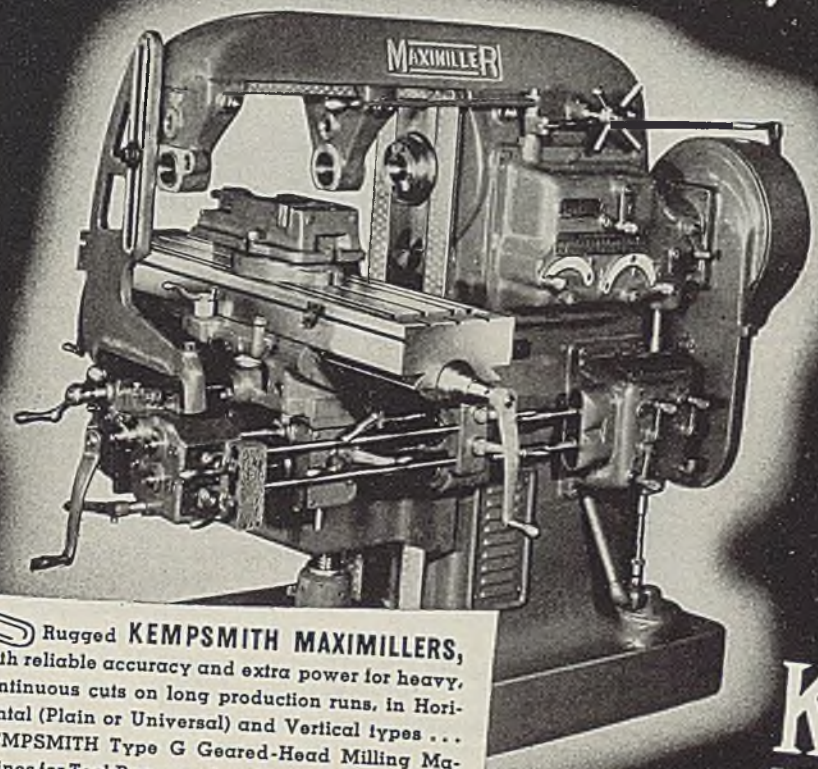

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cutting of billets, and shape-cutting of many types of parts. In shipyards and in various fabricating shops, cutting machines are used to trim, shape and bevel plate, thus making possible remarkable production rates in combination with welding. Many special installations have been devised to fit in with the various types of plate-handling equipment for rapid preparation of edges to required tolerances. Single and multiple blowpipes mounted on riding devices which accurately control distance between cutting nozzles and plate, make it possible to cut even large plates which have buckled appreciably. Popular profiles for welding—including the straight square edge, single bevel with or without nose and double bevel with or without nose—readily can be obtained.

Although flame cutting of billets, blooms, slabs and ingots—either hot or cold—has been going on for many years, today's acute demands for high-production cut-off equipment have inspired new principles and new machines. A typical example is the portable, spring-driven, hydraulically governed billet-cutting machine which can be regulated to produce automatically correct blowpipe motion for cutting either round or square billets. Fully automatic multiple machines, employing as many as five blowpipes, are being used to cut shell-forging slugs and for nicking billets.

Standardization and Schooling Promote Use of Carbide Tools

BY K. R. BEARDSLEE
Carboloy Co., Inc., Detroit

■ IN CONNECTION with war efforts, "standardization for mass production" initiated in the carbide tool industry prior to 1941 bore full fruit during the past 12 months in vast increases in production and use of carbide metal and tools. It promises to aid still further in speeding production for war in 1942. This is true particularly in connection with steel-cutting, including cast armor-plate, on which there is a decided swing to use of carbides. By far the largest percentage of increase in carbide production by our company has been in steel-cutting grades.

Carbide and tool standardization contributed substantially to this. Resulting elimination of "cut-and-try" experimentation in determining which grade provides maximum efficiency on each application has enabled defense manufacturers materially to cut time and cost of tooling up. This applies both to standard tools used "as is", and to standard tools converted by the user into "specials".

A further result of this program has been an increase in demand for standard tips both by large and small companies who are making up their own tools from them. Three reasons for this are: Quicker delivery on standard tips than on complete tools; 2, ability to save shank material by brazing new tips to shanks of carbide tools, when worn; and 3, conversion of high speed steel tools to carbide tools for increased output merely by milling recesses and brazing-in standard carbide tips.

The carbide tool industry itself is thereby enabled to devote a greater proportion of its increased facilities to manufacture of carbide metal. Our main problems now are those involving education of thousands of new workers in proper handling and use of carbide tools, and redesign of tool holders to provide readier application of standard carbide tools to machine tools. The carbide school, which was maintained in Detroit during 1941 and to which carbide users have been sending supervisory personnel for special instructions, will be expanded during the year of 1942.

Engineering Ability of Salesmen Will Assist Machine Tool Users

BY WALTER K. BAILEY
Warner & Swasey Co., Cleveland

■ WITH AN unsatisfied market in 1941, a stated requirement of $1,000,000,000 of machine tools in 1942, and still further military requirements in prospect, there can be no sales problem in the ordinary sense for the machine tool industry in the year of 1942. Market analysis, sales promotion and market coverage under these conditions will give way to production demand and most plants can and will proceed on the basis that all machines that can be built will find a ready market.

This does not mean that the salesmen of our industry are not needed. They might be called the forgotten men in our industry, but the facts are clear that without their practical engineering knowledge and experience, much of the progres of the victory program would not have been possible. Without real ability these men could not have handled the mass of engineering detail involved in the processing of $750,000,000 of machine tool orders in one year.

Though there is no basic sales problem for the year 1942, there is plenty of extremely important work for machine tool salesmen to do. They can turn their energies and their abilities as engineers toward helping customers make the most productive use of machine tools in the great struggle for maximum output for war. In short, these days management might well instruct the sales personnel to forget about orders and to devote all of their talents as production engineers to the single purpose of furthering the victory program.

American Tool Engineers Are Paving Way Toward Victory

BY FRANK W. CURTIS
Chief Engineer
Van Norman Machine Tool Co.,
Springfield, Mass.
President, American Society of Tool Engineers

■ TODAY our national armament program is definitely approximately one year ahead of our struggling arms output at a comparable time in World War I. Due in no small measure to rapid advances made in tool engineering, machine tools now are capable of turning out more than twice as many interchangeable parts per day per man as was possible a decade ago. Because of such developments, inexperienced workers—or those with very little practice—are enabled to produce parts to extremely close limits of accuracy. This releases thousands of seasoned mechanics for activities requiring maximum all around skill.

Through co-ordinated efforts of tool engineers, rapid changeovers from one kind of product to others of entirely different types now can be made in relatively short time. In many cases, complete manufacturing changes are being accomplished in from six to eight months, an almost undreamed-of achievement a few years ago, and one which immeasurably strengthens our war effort. Our great aircraft production is largely due to tool engineers' ability to apply basic principles of tool and die design for the mass-production of aircraft parts to gage-like accuracy. Obviously this represents an outstanding contribution.

Much also has been accomplished through introduction of standardized units which enable quick building of labor-saving devices such as jigs and fixtures. Through

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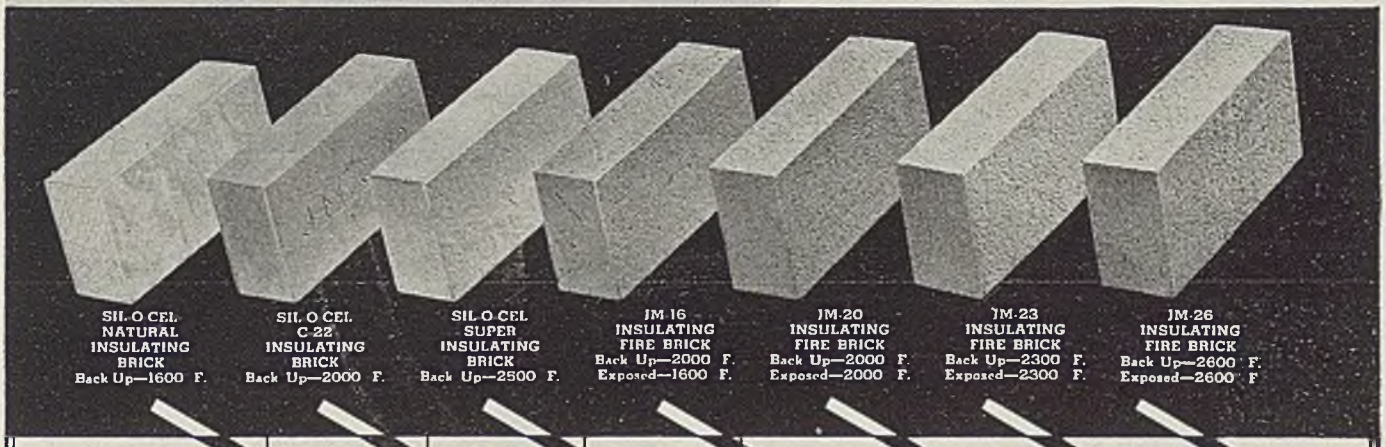

Properties	SIL-O-CEL NATURAL INSULATING BRICK Back Up—1600° F.	SIL-O-CEL C-22 INSULATING BRICK Back Up—2000° F.	SIL-O-CEL SUPER INSULATING BRICK Back Up—2500° F.	JM-16 INSULATING FIRE BRICK Back Up—2000° F. Exposed—1600° F.	JM-20 INSULATING FIRE BRICK Back Up—2000° F. Exposed—2000° F.	JM-23 INSULATING FIRE BRICK Back Up—2300° F. Exposed—2300° F.	JM-26 INSULATING FIRE BRICK Back Up—2600° F. Exposed—2600° F.
Density—lb. per cu. ft.	30	38	40	22	31	38	44
Transverse Strength—lb. per sq. in.	140	115	90	70	100	135	150
Cold Crushing Strength—lb. per sq. in.	400	700	300	70	125	170	165
Linear Shrinkage—%	1.4 @ 1600° F	0.8 @ 2000° F	2.0 @ 2500° F	0.0 @ 2000° F	0.0 @ 2000° F	0.0 @ 2300° F	0.5 @ 2600° F
Reversible Thermal Expansion—Percent	0.1 @ 1600° F	0.7 @ 2000° F	1.29 @ 2000° F	0.5—0.6 @ 2000° F	0.5—0.6 @ 2000° F	0.5—0.6 @ 2000° F	0.5—0.6 @ 2000° F
Conductivity at Mean Temperature 500° F	∥ 1.01	⊥ .67	1.67	1.70	.75	1.01	1.26	1.61
1000° F	1.13	.79	1.88	1.95	1.01	1.19	1.49	1.90
1500° F	1.24	.90	2.08	2.19	1.41	1.49	2.05	2.61
2000° F	...	..	....	2.45	...	1.91	3.37	4.29
Recommended Service Back Up	1600° F		2000° F	2500° F	2000° F	2000° F	2300° F	2600° F
Exposed	....		....	....	1600° F	2000° F	2300° F	2600° F
Recommended Mortar for Setting Brick	Sil-O-Cel Mortar		Sil-O-Cel Mortar	Sil-O-Cel Super Brick Mortar	J-M No. 1626 Cement	J-M No. 1626 Cement	J-M No. 1626 Cement	J-M No. 1626 Cement

Note:—1. Above tests are in accordance with ASTM tentative standards.
2. Conductivity is expressed in Btu. in. per hr. per sq. ft. deg. F. at the designated mean temperatures.
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these basic contributions toward phenomenal output of rifles, guns, shell, tanks, planes and ships, and also the machine tools used to produce them, American tool engineers unquestionably are paving the way to a quick victory.

Suit Operations to Capabilities Of Available Men and Machines

BY GEORGE T. TRUNDLE, JR.
President
Trundle Engineering Co., Cleveland

■ ONE OF the most important developments in connection with machine tools during the last year is the growing realization that a very great simplification in production operations is absolutely necessary to secure all-out production for war. With "learners" now depended upon for a great bulk of the work in many war plants, it is vital that the operations to be performed be suited to the experience and understanding of the "green" hand. A machine is no better than the understanding, the dexterity, and the ability of the man who runs it. The more that jobs can be simplified for new men, the more swiftly can they take their part in the production line.

On the same basis, work must be kept within the limitations of the machine on which it is placed. This is vital today because of the growing widespread extension of subcontracting. Many subcontractors' plants do not have machines capable of multiple operations. Many machines in subcontractors' plants are too old to perform highly accurate work. But all of these machines must be put to work—and kept at work around the clock. The answer is, make the individual operations simple enough to be within the capacity of the machine. And if an old machine cannot do the work to specified tolerances, rough it on this old machine and finish it on a new one. We must make use of all new hands and all old machines. Simplification will make this possible.

Sudden Demand for Instruments Poses Manufacturing Problem

BY B. G. TANG
General Superintendent
General Electric Co., Schenectady, N. Y.

■ THE MOST urgent problem that faces the metalworking industry today is the shortage of skilled manpower to operate machine tools in the production of war materials needs. This is particularly true in the case of those precision products which can be classified as "instruments." In peace times, these are produced singly or in lots of five or ten by highly skilled, all-around instrument makers, using general-purpose machine tools, general-purpose measuring devices—a considerable amount of fitting and adjusting being done at assembly.

Sudden demand for these in lots of hundreds immediately poses the problem of a shortage of men who have the skill necessary to machine and assemble such products under the system just mentioned. This skill is acquired only by long years of actual practice, for which no high-pressure, intensive course of training will serve as a substitute, regardless of the merit of such courses for certain purposes.

To meet this situation, the trend is toward application of mass production methods to limited production quantities. In our case, this has involved design and building of special purpose machine tools, fixtures and gages which are fool-proof and which can be operated by men with natural mechanical bent, after comparatively short training. It is significant that the emergency methods which will serve to meet the present situation will not necessarily serve to increase the number of all-around technicians needed for designing and making similar equipment under future conditions.

Present War Revives Interest In Monolithic Concrete Planers

BY LUCIEN I. YOEMANS
Industrial Engineer
Lucien I. Yoemans Inc., Chicago

■ DURING THE last war I built the five largest planers in the world. They were of monolithic concrete construction, and were for use by my own company. They were not regarded very seriously by the trade and—as far as I know—no large machine tools of that construction have been built since, in spite of approval by many highly qualified machine tool experts. Quite recently this subject has been brought up again and definite negotiations are now under way for construction of a quantity of such machines to meet present emergencies. In their construction radical improvements have been made and it is still possible to say that such machinery requires approximately the same number of weeks as months are required for orthodox machine tools.

Of the planers built in 1914-18, construction of the first 72-inch by 184-foot machine was startetd about Dec. 24, 1917, and two gun machines were planed on it during the last week in February, so "delivery" was approximately eight weeks. The largest planer, 144 inches by 504 feet, was completed in exactly 100 days of elapsed time. It is estimated that present hampering interference, controls and supervision will not much more than double the time which was required in 1918—therefore, the quantity now wanted can perhaps be built in six or seven months. There certainly is a marked trend toward this type of heavy machine tool construction for the present emergency.

★ ★ ★

The Cincinnati Bickford

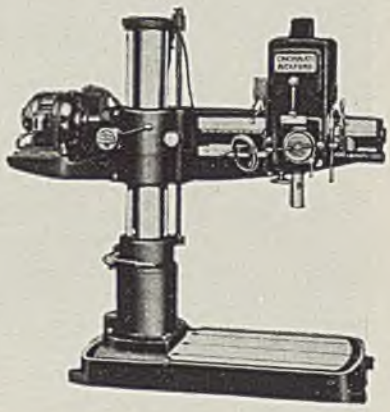
SUPER SERVICE

Upright and Radial

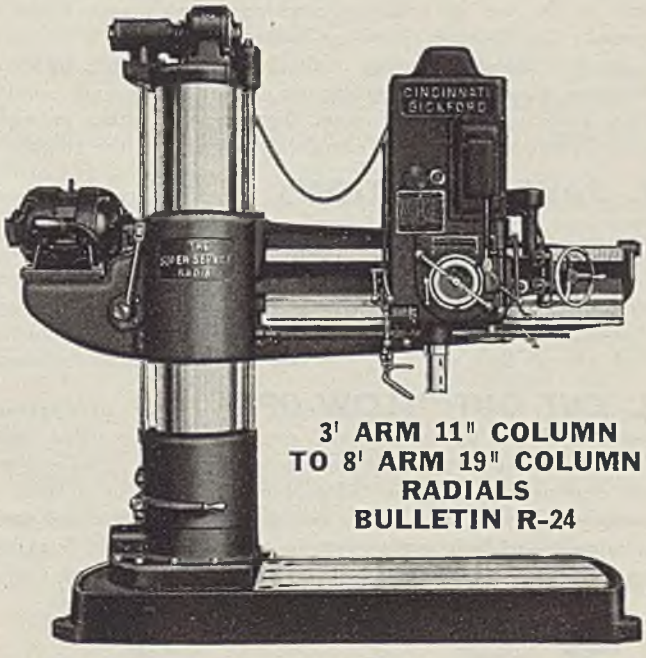
METAL DRILLING MACHINERY

Productivity, Capacity, Adaptability, Reliability, Accuracy, Convenience and Economy are the intangible components that give the Cincinnati Bickford line of drills the appropriate name of SUPER SERVICE.

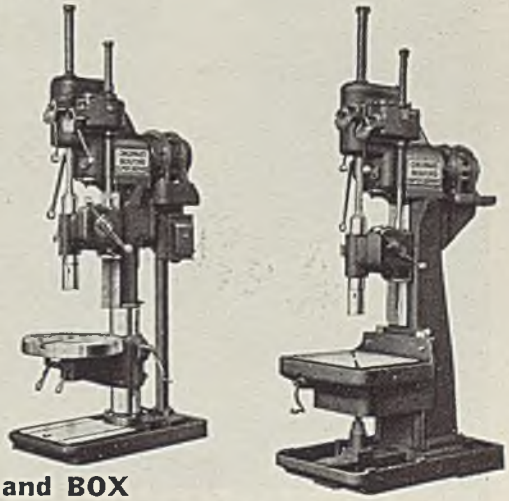
Examine the possibilities of the machines shown here and for further information send for any or all of the bulletins pertaining to the machines that interest you.



3' or 4' ARM RADIAL
WITH 9" COLUMN
BULLETIN R-21-A



3' ARM 11" COLUMN
TO 8' ARM 19" COLUMN
RADIALS
BULLETIN R-24

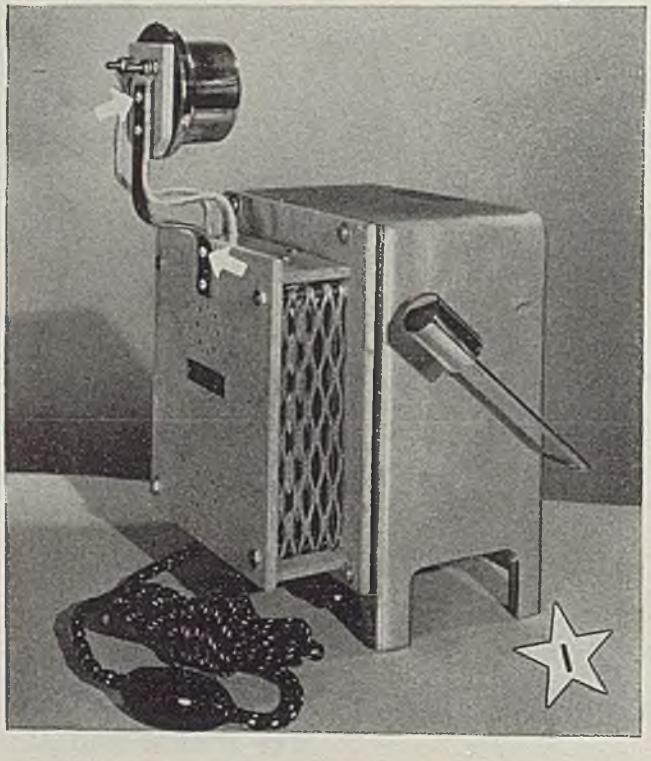


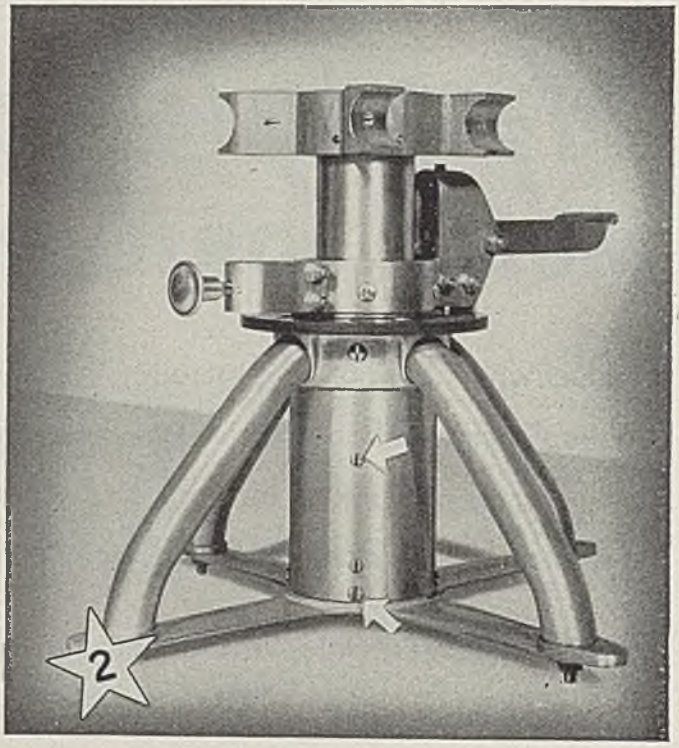
21", 24" & 28"
ROUND and BOX
COLUMN UPRIGHTS
BULLETIN U-25

THE CINCINNATI BICKFORD TOOL CO.

OAKLEY, CINCINNATI, OHIO, UNITED STATES OF AMERICA

Have you cut all





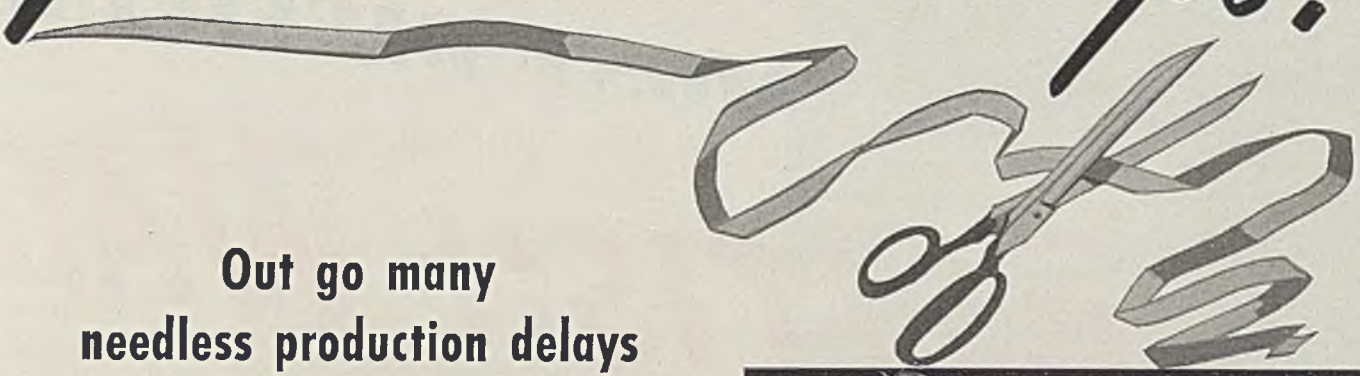
1. *SIMPLIFY ASSEMBLY* "Our saving . . . was overshadowed by elimination of what had been a troublesome fault in the use of ordinary machine screws", says Fernald Specialty Co., Chicago. They use Parker-Kalon Type "F" Screws to attach a rheostat assembly to the back of an electric furnace. "Constant expansion and contraction of the furnace body would allow machine screws to loosen. Your screw, cutting its own perfectly-fitting thread, has completely eliminated the trouble."

2. *SAVE OPERATIONS* "Tapping operations are eliminated . . . in inaccessible places we gain advantages over riveting", says Warren McArthur Corp., N. Y. They use Parker-Kalon Type "F" Self-tapping Screws in assembling aircraft seats for Martin, Douglas, Lockheed, many others. "Their design eliminates the play in the thread of ordinary screws . . . can be used without lock washers", add this well-known manufacturer.

3. *CUT OUT "SLOW-UPS"* Your production won't be slowed up by "doubtful screws" . . . screws that look all right but some of which fail to work right . . . when you use genuine Parker-Kalon Self-tapping Screws. For a further assurance of savings in hours and dollars is the Parker-Kalon Laboratory – without counterpart in the industry – which maintains a rigid quality-control over all Parker-Kalon products.

SELF-TAPPING SCREWS FOR EVERY METAL AND PLASTIC ASSEMBLY . . . AND OTHER FASTENING DEVICES

your OWN "Red Tape"?



Out go many needless production delays when you get together with a

PARKER-KALON ASSEMBLY ENGINEER

Certainly there are delays and red tape in the Defense Program. Human beings can't handle such a gigantic job without some – here and there. But what about your own plant? You're tackling a gigantic job, too. Can't we help *you* cut some red tape . . . simplify assemblies . . . save operations . . . cut out "slow ups" in defense assemblies?

Every day, in hundreds of large and small plants, time savings of 25% to 50% are effected with properly engineered use of Parker-Kalon Quality-Controlled Self-tapping Screws.

Your plant, too, can gain these extra hours of defense-production time! Parker-Kalon Assembly Engineers are ready to show you how! How to use Self-tapping Screws instead of fumbling with bolts and nuts . . . instead of riveting in hard-to-get-at places . . . instead of waiting for tapping, rejecting mis-tapped parts, taking "time out" for maintenance of taps and tapping equipment.

Thoroughly familiar with today's assembly practices, your Parker-Kalon Assembly Engineer will make unbiased recommendations – for Parker-Kalon makes all types of Self-tapping Screws, both thread-cutting and thread-forming – for every assembly of metals or plastics.

"Non-stop" Fastening

Best of all, they'll show you how Parker-Kalon Quality-Control eliminates "doubtful screws"... makes your fastening operations "non-stop".

Cut "Red Tape" Overnight!

The Parker-Kalon Assembly Engineer will show you how quickly and easily you can adopt these fastenings. No major production changes needed – no special tools or skilled hands required to use Self-tapping Screws.

Start Gaining Man-Hours . . . Now!

Mail a description of your assembly to Parker-Kalon Assembly Engineers for recommendations and samples. Or better, let them call at your plant and point out ways of speeding up your assemblies. Parker-Kalon Corporation, 194-200 Varick Street, New York, N. Y.

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Quality-Controlled

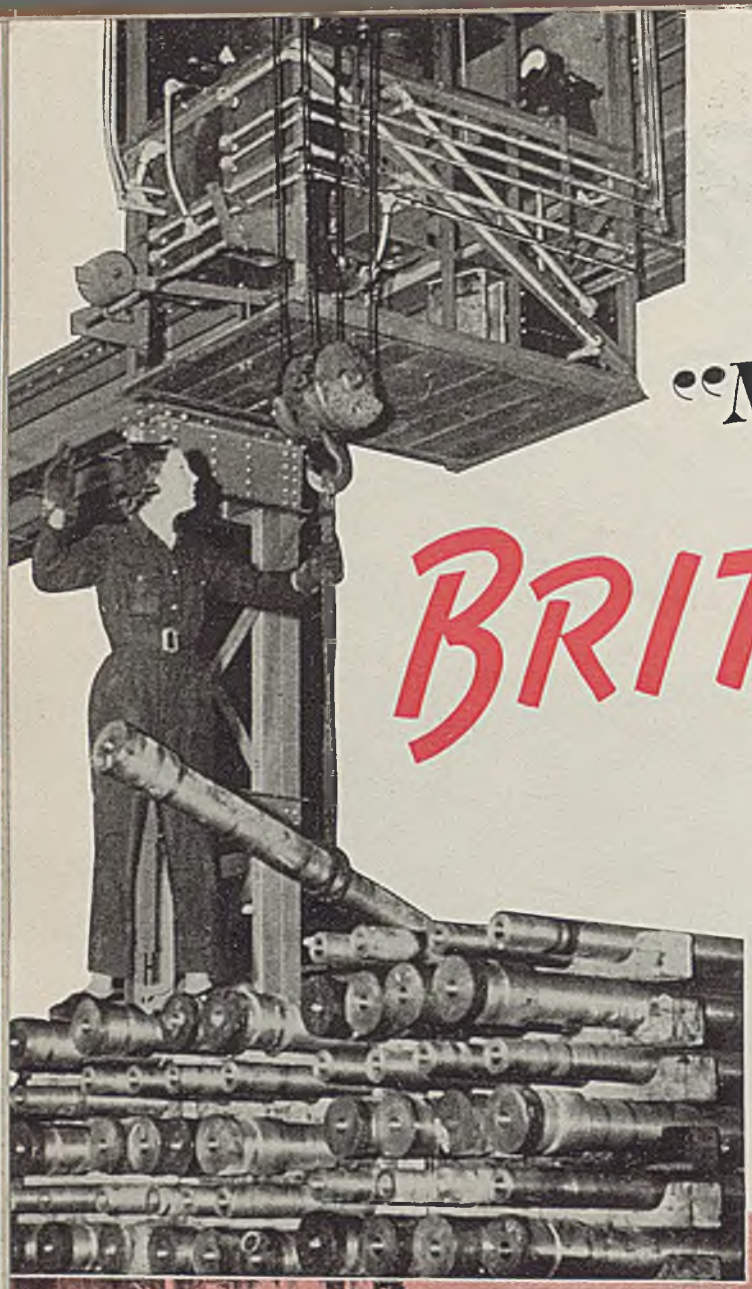
SELF-TAPPING SCREWS

Give the Green Light to Defense Assemblies

MANPOWER "MOST DIFFICULT" BRITISH WAR

By Vincent Delport

European Editor, STEEL



■ Girls "man" cranes in British munitions factory, left, due to labor shortage caused by large number of men in military service. Below, "Armored Greyhounds", tanks being produced in factory "somewhere in England." All photos not otherwise credited, NEA

BECOMES PROBLEM" IN EFFORT

Steel Situation More Favorable Than Year Ago, But Invasion Would Call for Heavier Shipments from United States . . . Doubtful if Russia's Resources Are Sufficient . . . World Steel Capacity Increasing . . . Germany Lacks Alloys

■ "Without gold" but with steel, Adolph Hitler last month promised the German people he will defeat the entire world. Above is a typical scene in a German torpedo factory

LONDON

TWO and a quarter years of the most devastating war in history have now passed. Millions of men and women have been killed or wounded on the battlefields, in the air, on the seas, or in their home towns and villages. Thousands of buildings and immeasurable amounts of material of all kinds have been destroyed. The havoc is proceeding relentlessly. Yet Hitler still is faced with the unshaken resistance of the Russians and with the indomitable will of the British Commonwealth of Nations to resist and fight until Germany recognizes herself beaten.

Apart from morale and men, what are the potential reserves of material power that each opponent can count upon to sustain the effort? This journal is concerned with one of the major factors in modern warfare, production and use of iron and steel. Steel in this war is equally important with petroleum products, food, and materials required to protect the body. It is with steel that this article deals.

At the outset it can be said there is reason to believe that world capacity for producing steel has increased since the war started. This is certainly true for two of the three major steel producing countries of the world, the United States and Germany. It is probably true for the third major country, Russia, where means of production were expanding until Russia became directly involved in the war. In Great Britain, the fourth country in importance, plant expansion has taken place with a resultant increase of output capacity. These four countries together in 1939 produced some 105,000,000 tons of steel ingots and castings out of a world total of 135,000,000 tons.

Over 50 per cent of remaining 30,000,000 tons came mostly from France, Belgium, Italy, Luxemburg, Poland, and Bohemia-Moravia in Europe. All these countries are now under German control and have suffered destruction from the war, as has Germany. It is difficult completely to destroy a blast furnace plant or a steelworks by bombs. There are known cases of furnaces being wrecked probably beyond repair, but these are comparatively few.

The main result of air raids is an interruption of production through destruction of auxiliary services, but the damage is usually reparable, and the Germans no doubt see to it that repairs are effected as expeditiously as possible. In many instances that is known to be the case. Even where production has been stopped owing to proximity of a battlefield or to a particuluarly vulnerable area, the main plant often remains.

This argument applies to practically all steel producing countries with perhaps the exception of Russia. It is known that the Russian armies, when they retreat, are instructed to destroy anything that might be of value to the enemy, the "scorched earth" policy. Much industrial plant has had to be given up by Russia. To what extent iron and steel plant will have been deliberately wrecked, and how long it will take to make good the damage, it is impossible to tell.

To summarize the situation as it now presents itself, and viewing it from the point of view of potential capacity of steel production, one arrives at the conclusion

Workmen are hoisted aloft to dismantle south pinnacle of the House of Commons, damaged by a bomb. British here salvaged 100 tons of scrap steel, enough for six medium tanks. Press Association

that the present trend is towards an increase for the world as a whole.

A year ago in STEEL'S Yearbook for 1941, an endeavor was made to estimate the proportion of European steel output available to the opposing sides in the war. Dec. 31, 1940, it was estimated that Germany had at her disposal almost 50,000,000 tons of steel output capacity, comprising her own production and that of her European ally, Italy, and of the nations she had actually overrun. Great Britain was estimated to have a capacity of 14,700,000 tons, and the then neutral countries 21,550,000 tons.

At present Germany practically controls the steel production of Europe with the exception of the greater part of Russia and Great Britain, her opponents, and Sweden and Spain. Actually, relatively little has been added to Germany's steel resources of a year ago. The combined output capacity of Great Britain and Russia is probably nearing 35,000,000 tons, but since a substantial proportion of Russian plant is now of no use to the Russians themselves, the Soviet industry is no longer self sufficient as regards steel supplies. "Neutral" steel capacity in Europe now amounts to no more than 2,000,000 tons at the most.

The above applies to potential capacity available to the respective belligerents. What is the situation, insofar as it can be ascertained, as regards actual production and use? Take Great Britain first. As already stated, the capacity for production of steel has increased since the war began, but throughout the past year, and particularly during the summer months, Britain's actual output of steel was below capacity, and even below the output of 1939. The reasons for the temporary reduction of steel output are threefold, production policy, capacity of the transforming and assembling works, problems of manpower.

From the commencement of the war, British steel production has been controlled by the government through the Ministry of Supply and the Iron and Steel Control, and a limitation was placed on the manufacture of steel products for ordinary civilian use. Restrictions tightened as war requirements expanded. Exports also were controlled. In 1940 a substantial tonnage of steel was released for the manufacture of finished products for export, mainly products taking up a relatively small volume and of high value.

Export and Civilian Steel Cut to Minimum

Since the beginning of 1941 steel available for export became increasingly restricted and licenses were given only for such products as could be used by British dominions and colonies for war requirements. Thus by the end of the year, the proportion of steel released for civilian use and export was comparatively negligible. Works that could not be adapted to the manufacture of war products either were closed or compelled to combine their facilities under the Concentration of Industries scheme.

Many peacetime uses of steel call for large tonnages and a quick turnover. Building construction and manufacture of automobiles are two cases in point. Such uses are now practically discontinued. On the other hand certain war products either do not require large tonnages or the turnover of steel is slow. For instance, a battleship may require 30,000 tons of steel but the tonnage will be spread over some three years required for building. A substantial tonnage of steel sheets was required in 1940 to build shelters and that purpose was practically fulfilled in 1941. In other words, war requirements for raw steel in 1941 appeared to be less than peacetime requirements in a peak year. The answer as to why more was not needed comes under the two following headings where reasons also emerge as to why the output capacity was not more fully used for civilian or export purposes.

We come to the second factor, capacity for transforming and assembling works. During 1939 a number of shadow factories were built in various parts of the country so that they could be put into operation for war purposes as necessity arose. These factories are now working and others have been added. Other works have had their layout and equipment changed over from peace to war manufacture. However, it is apparent that this process has not been sufficient to provide the nation with enough plant and equipment to absorb the possible maximum output of steel exclusively for war purposes.

Other incidental factors play their part, such as

changes of design, late arrival of essential imported machine tools, etc. However, additional plant and equipment was installed in 1941. Some entirely new works started operations at the end of the year and will shortly be in full swing and others will follow. An increasing consumption of steel in 1942 can thus be anticipated.

The problem of manpower is probably the most difficult that the government has to solve at this time, specially as regards skilled labor. This factor affects production and is one of the main reasons why unessential works are closed down so as to release men for war work. Unemployment is down to something over 200,000 men and women; about 15 per cent is unfit for ordinary industrial employment, and only a comparatively small proportion of the rest could be employed in specialized war work. The problem is complicated by the fact that in this kind of warfare the forces require large numbers of skilled mechanics to operate, maintain and repair airplanes, tanks and military road transport. Thus the competition that always exists between industry and the services for the engagement or conscription of men is intensified. The minister of Labor and National Service is responsible for supplying men both to the forces and to industry and he re-

(*Please turn to Page* 352)

World Production of Steel Ingots and Castings

Gross Tons

	1941	1940	1939	1938	1937	1936	1935	1934	1933	1929
United States....	**75,232,042	60,518,419	47,672,195	28,693,060	51,526,000	48,525,000	34,467,000	26,502,000	23,232,000	56,433,000
Canada	**2,366,289	1,985,000	1,300,000	1,156,000	1,352,000	1,078,000	915,000	741,000	403,000	1,391,000
Great Britain...	.....	.....	13,500,000	10,398,000	12,984,000	11,785,000	9,859,000	8,850,000	7,024,000	9,636,000
France	.....	.....	8,400,000	6,087,000	7,793,000	6,601,000	6,177,000	6,075,000	6,427,000	9,544,000
Belgium	.....	.....	3,000,000	2,248,000	3,801,000	3,117,000	2,975,000	2,901,000	2,687,000	4,066,000
Luxemburg	.....	.....	1,800,000	1,414,000	2,470,000	1,949,000	1,808,000	1,901,000	1,815,000	2,659,000
Italy	.....	.....	2,350,000	2,286,000	2,054,000	1,992,000	2,174,000	1,820,000	1,755,000	2,109,000
Spain			500,000	465,000	100,000	365,000	555,000	635,000	498,000	985,000
Sweden			1,100,000	963,000	1,088,000	962,000	882,000	848,000	620,000	683,000
Germany*			24,000,000	22,922,000	19,531,000	18,900,000	16,184,000	11,725,000	7,690,000	15,986,000
Austria			.....	.....	640,000	411,000	358,000	304,000	222,000	622,000
Czechia			1,250,000	1,733,000	2,281,000	1,463,000	1,135,000	938,000	749,000	2,103,000
Poland			1,600,000	1,517,000	1,420,000	1,123,000	930,000	831,000	805,000	1,355,000
Hungary			750,000	638,000	654,000	543,000	439,000	310,000	224,000	505,000
Russia			18,500,000	18,150,000	17,493,000	16,080,000	12,320,000	9,412,000	6,790,000	4,828,000
Japan†			6,300,000	6,000,000	5,718,000	5,174,000	4,858,000	3,682,000	3,150,000	2,249,000
India	.....	.....	1,000,000	966,000	895,000	866,000	862,000	798,000	694,000	575,000
Australia	.....	.....	1,200,000	1,151,000	1,074,000	750,000	697,000	518,000	393,000	460,000
Saar‡	.....	.....	.....	.....	.....	.....	.....	1,919,000	1,649,000	2,174,000
Miscellaneous ...	.....	.....	900,000	900,000	900,000	800,000	750,000	450,000	350,000	400,000
World total.....	.....	.....	134,983,000	107,687,000	133,774,000	122,484,000	98,345,000	81,160,000	67,177,000	118,763,000

Due to war conditions figures for 1940-41 are not available for other than Western Hemisphere countries.

*Includes Austrian production from January 1938. †Includes Manchuria and Korea. ‡Included in Germany since 1934.
**Estimated.

World Production of Pig Iron and Ferroalloys

Gross Tons

	1941	1940	1939	1938	1937	1936	1935	1934	1933	1929
United States....	**50,447,064	42,320,011	31,943,000	19,161,000	37,127,000	31,029,000	21,373,000	16,139,000	13,346,000	42,614,000
Canada	**1,298,666	1,270,000	800,000	758,000	979,000	747,000	655,000	438,000	258,000	1,160,000
Great Britain...	.....	.....	8,200,000	6,761,000	8,493,000	7,721,000	6,424,000	5,969,000	4,136,000	7,589,000
France	.....	.....	7,800,000	5,964,000	7,787,000	6,130,000	5,696,000	6,053,000	6,223,000	10,198,000
Belgium	.....	.....	3,000,000	2,426,000	3,743,000	3,110,000	2,982,000	2,860,000	2,667,000	4,030,000
Luxemburg	.....	.....	1,750,000	1,526,000	2,473,000	1,955,000	1,842,000	1,968,000	1,858,000	2,860,000
Italy	.....	.....	1,000,000	913,000	849,000	793,000	683,000	564,000	544,000	718,000
Spain			500,000	435,000	126,000	250,000	350,000	365,000	334,000	740,000
Sweden			625,000	652,000	682,000	623,000	603,000	550,000	341,000	516,000
Germany*			20,000,000	18,300,000	15,703,000	15,058,000	12,637,000	8,602,000	5,183,000	13,187,000
Austria			.....	.....	383,000	244,000	190,000	132,000	87,000	455,000
Czechia			1,000,000	1,215,000	1,648,000	1,122,000	798,000	591,000	491,000	1,618,000
Poland			1,000,000	952,000	712,000	575,000	388,000	376,000	301,000	693,000
Hungary			450,000	330,000	359,000	301,000	183,000	138,000	92,000	362,000
Russia			15,000,000	14,479,000	14,288,000	14,088,000	12,411,000	10,273,000	7,085,000	4,253,000
Japan†			3,250,000	3,000,000	2,758,000	2,823,000	2,739,000	2,400,000	2,019,000	1,491,000
India	.....	.....	1,800,000	1,634,000	1,629,000	1,543,000	1,466,000	1,331,000	1,065,000	1,343,000
Australia	.....	.....	1,100,000	1,072,000	914,000	783,000	698,000	487,000	336,000	420,000
Saar‡	.....	.....	.....	.....	.....	.....	.....	1,797,000	1,567,000	2,071,000
Miscellaneous ...	.....	.....	1,200,000	1,150,000	1,200,000	1,000,000	800,000	700,000	600,000	750,000
World total.....	.....	.....	100,418,000	80,728,000	101,853,000	89,895,000	72,918,000	61,733,000	48,533,000	97,073,000

Due to war conditions figures for 1940-41 are not available for other than Western Hemisphere countries.

*Includes Austrian production from January 1938. †Includes Manchuria and Korea. ‡Included in Germany since 1934.
**Estimated.

Iron, Steel Exports and Imports of Principal Countries

Gross tons—Scrap eliminated

	EXPORTS					IMPORTS				
	1941*	1940*	1939*	1938	1937	1941	1940	1939	1938	1937
United States	**6,337,673	7,785,540	2,499,220	2,149,000	3,472,000	**24,725	55,277	285,669	240,000	452,000
Great Britain	.....	.....	.....	1,918,000	2,576,000	.....	.....	.....	1,341,000	2,039,000
Germany	.....	.....	.....	2,784,000	3,604,000	.....	.....	.....	867,000	532,000
France	.....	.....	.....	2,002,000	2,133,000	.....	.....	.....	92,000	170,000
Belgium & Luxemburg.....	.....	.....	.....	2,503,000	3,947,000	.....	.....	.....	215,000	428,000
Total	.....	.....	.....	11,356,000	15,732,000	.....	.....	.....	2,755,000	3,621,000

*Export, import figures for 1939-1941, other than Western Hemisphere countries, not available, due to war. **Estimated.

WAR PUTS BRITISH STEEL TO SUPREME

By J. A. Horton

British Correspondent, STEEL

■ King George, above, encourages British girls working in factory making fuselage coverings for planes for the Royal Air Force. Left, center, Germans build bridge over Dnieper river in Russia, after old bridge (in background) was destroyed by Soviet troops. Nazi fuel reserves on Russian front are pictured in photo at left below

INDUSTRY TEST

Prospects for 1942 Depend Mainly on Course of Events in Russia . . . First Manufacturing Group To Be Completely Mobilized . . . Half of Welsh Tin Plate Works Closed, Workers Transferred . . . Labor Disputes Declining

BIRMINGHAM, ENGLAND

GREATER concentration of operations on the most essential products has been the outstanding feature of the British iron and steel trade in 1941. Organization to this end has been thorough and more far-reaching than anything ever known in the history of the industry, but the process is not yet complete and further developments of a drastic character may be expected in the coming year. The stage has been reached, however, at which it may be said that it is almost impossible to obtain raw material for anything other than war purposes.

Distribution under the Iron and Steel Control has been arranged so as to keep a tight grip on the use of steel for all purposes, co-ordinate output and plan for the future. The latter objective is attained by every authorization stating the period during which the steel must be delivered, even a year or 18 months in advance. The amount or ration of steel allotted to each government department is agreed by an interdepartmental committee, and this allocation of supplies is the pivotal point of the whole plan, for the simple reason that Britain requires for her armament program hundreds of different kinds of steel in a wide variety of shapes and sizes, and over-production of one or under-production of another could disorganize armament output.

Such a policy, one which has involved an effort greater than anything ever seen in Britain before, is, of course, almost revolutionary in this freedom-loving land, where buying, selling and producing has hitherto continued unfettered. But that policy has brought the country to the position in which she stands today. She is less dependent on import, a vastly important matter in view of the many claims upon shipping space and the hazards of transport by sea, while apart from the vast quantities of steel which have gone into the greatly geared-up output of airplanes, tanks, guns, ships and other munitions, at the beginning of the third year of war, in contrast with the position in 1916, there are large reserves of shells.

In the case of many vital materials capacity has been doubled, and in some instances it is three or four times what it was before the war. The application of the Essential Works Order meant that the manufacture of some products must be increased and that of others less necessary to the war effort be decreased. The object of the order was also to insure the most economical use of skilled manpower and plant and it has already involved the closing of works in the tin plate trade in South Wales. Further developments are expected throughout the iron and steel areas.

The steel industry has been the first staple industry of Britain to accomplish the transition to total mobilization for war. But it has not been done without sacrifice, heaviest of which has been the compulsory surrender of valuable export trade. Built up through many years of labor, enterprise and organization, it has had to be forfeited, and though manufacturers have had to reconcile themselves to this policy they recognize notwithstanding, the increasing difficulties which will thereby be entailed in planning post-war recovery.

Empire Countries Building Facilities

Excessive wear and tear on mills operating almost unceasingly at capacity, excess profits duty at 100 per cent, and strict limitation of prices are also clouds on the economic horizon which it is hoped will command the sympathetic consideration of the government when the preoccupations of war shall cease.

Empire countries are moving rapidly along the road leading to the point where they will be self-supporting. They were producing steel prior to the war of 1914-18. In 1940 and 1941 the process has been greatly accelerated and certainly will continue while the present war lasts.

Expansion of plant is taking place in India, Australia, South Africa and Canada, while New Zealand plans to make steel in the near future. This development is certain to have serious repercussions on Britain's export trade and the proportion of her total exports going to Empire countries will undergo a steep reduction when war ceases and the trade boom which may follow comes to an end.

For reasons which it is not necessary to develop here there was little interference to British industry by enemy action during the latter half of 1941. Transport services by road and rail have continued and have been improved where possible. This lull has enabled the steel industry to make up lost ground. It does not mean, however, that difficulties have ceased. There is still the black-out which puts a great strain on the men's health. At the beginning of the year complaints were frequent that heavy workers were not getting sufficient food supplies for their job. Conditions have improved since then and the extension of the canteen system has gone a long way in helping the worker to keep physically fit.

In steel mills and furnaces the three-shift system is still in operation and when week-end work is necessary, as it frequently is, this is done by arrangement between employers and the Iron and Steel Trades Confederation, representing the men.

As already indicated, there has been an important change from ordinary to special steels. Individual outputs for that reason may not be as great since more

time is required in their manipulation. A plant that might be producing 200 tons in an eight hour shift on ordinary heavy steel can only do about 150 tons on special steel.

Disputes in the mills are few and there has been no serious stoppage during the year. Generally speaking the men are anxious to do everything in their power to provide the goods for winning the war. There will always be a few who go slowly but leaders of the men's unions at any rate are loyal and anxious to co-operate to the best of their ability. From the men's point of view the Essential Works Order operates in their favor since a firm must guarantee their normal week's earnings and offer them alternative labor if there is no work for them on their own particular job.

It is estimated that 50 per cent of the tin plate works in South Wales have closed. Certain it is that many thousands of men have already arrived in the Midland area, where they have been drafted to war work, such as the manufacture of drop forgings. The reserved age in certain branches of the tin plate trade has been raised to 30 and this means further depletion of labor strength, which is now said to be down to the minimum. The industry, apart from the tin plate branch, is fortunate in that iron and steel workers are reserved at the age of 18. This, however, has not prevented many young men from joining the military, naval and air forces and is one of the causes of the present shortage of labor in iron and steel works.

Women Paid Same Wages as Men in Same Jobs

To overcome this difficulty female labor has been introduced. They can be given jobs only with the consent of the Iron and Steel Trades Confederation, who take the responsibility of ascertaining whether the prospective job is suitable for women. They come into the union, work under the same conditions and get the same pay when qualified. It is part of the bargain, however, that the jobs shall revert to men when the war is over. Basic wages have altered little during the year. Workers are, of course, earning high wages but there is a stabilized rate based on selling prices and this is rigidly adhered to.

The scrap position has undergone a notable change during the year, mainly because of the cessation of imports from America. These were received in heavy tonnages in the early months. Scrap campaigns have been instituted throughout Britain. Old railings have been pulled up by the thousand from mansions and churchyards in city and country and it is clear that the country must be self supporting, particularly as America needs every ton of scrap for her own rapidly growing output of war materials.

Three or four months ago, when there seemed to be a slight lull in steelworks, deliveries of stock were not suspended, as is usually the case when consumption is reduced. Producers were glad enough to accept material to build up stocks in case of emergency. Today scrap merchants are doing all they can to keep a steady flow of materials to consumers.

As far as the price situation is concerned there has been no material change throughout the last 12 months. The government has pursued the policy which it outlined at the beginning of the war, that it would prevent values from soaring. Prices have been stabilized on a basis which it is believed is likely to remain at its present level for the duration of hostilities.

The shipbuilding industry has continued the great drive for larger output and this has been facilitated by the supplies of raw material available. On the Clyde the level of unemployment has decreased considerably as more and more workers have been absorbed in engineering and shipbuilding yards. The shortage of labor here is being relieved by training of men who have come from all sorts of civilian jobs. Work in the North East coast shipyards also goes ahead. Work is limited only by supply of raw material.

Pig iron output continues on a high scale and furnaces are using home produced iron ore to a larger extent than ever before because of the difficulty of obtaining imported material. Most basic iron goes directly to steelworks. Foundry iron is wanted mainly for the heavy engineering trades, which are engaged on vital national work.

As was the case a year ago the slackest section of the industry is probably that relating to light castings. Those firms which produce domestic goods and light castings for the building trade have been short of work for many months and there seems little prospect of any improvement. But the output and distribution of pig iron is strictly rationed and only a small tonnage of this class of iron can be allocated for non-essential production.

Prospects for 1942 depend largely upon what course the war takes in Russia. Britain is pledged to help her ally to the fullest extent, and all possible aid will be given by the steel industry. One thing is certain—the resources of the industry will be taxed to the utmost. Britain will have to be more self-supporting than for many years but even so she will be able to meet all demands because during the last 12 months she has eliminated non-essentials, knowing that only by this means could she finish the job of winning the war.

Manpower Becomes "Most Difficult Problem" in Great Britain

(*Concluded from Page* 349)

ceives imperious demands from both sides for increasing numbers.

The solution he has applied is to establish a schedule of age reservations which maintains men over a certain age in their occupations if these are essential to the war effort. Another solution is to enroll an increasing number of women in industry, and in the forces, where they take up auxiliary jobs. The fact remains that these solutions further restrict the scope for non-essential industries, and that essential war industries still need more labor in order further to increase production.

Summarizing the situation, the iron and steel industry in Great Britain is in a more favorable position than it was a year ago. Sufficient iron ore is available, thanks to the considerable increase of home production, exception being made for hematite ore, which still has to be imported and is severely controlled. There is sufficient coke to meet requirements of the steel industry. The steel industry has been enabled to

accumulate a certain amount of reserves of pig iron, semifinished steel and scrap, thus relieving the United States from the necessity of exporting large tonnages that are now essential to America's own defense plans. Shipping space also has thereby been released for other essential war materials. These reserves will be a considerable asset as the increasing expansion of war industries calls for more raw materials.

No reliable information is available in regard to the situation of the steel industry on the Continent. Russia has lost, for the time being, a substantial proportion of her pre-war steel capacity and possibly half her output of iron ore. She still has considerable ore fields and large steelworks beyond the immediate reach of the enemy, right into Siberia, and, from the statements of Lord Beaverbrook after his return from his mission in Moscow with Averell Harriman, measures have been taken by Stalin to transfer production to these secluded works and intensify their output. However, this process will take some time.

The total output of steel in Russia in 1939 barely reached 20,000,000 tons. In view of the considerable loss of material experienced on the eastern front, it is doubtful whether Russia's present means of production are sufficient to turn out the necessary replacements. This underlies the urgency of her requests for help from allied and friendly nations.

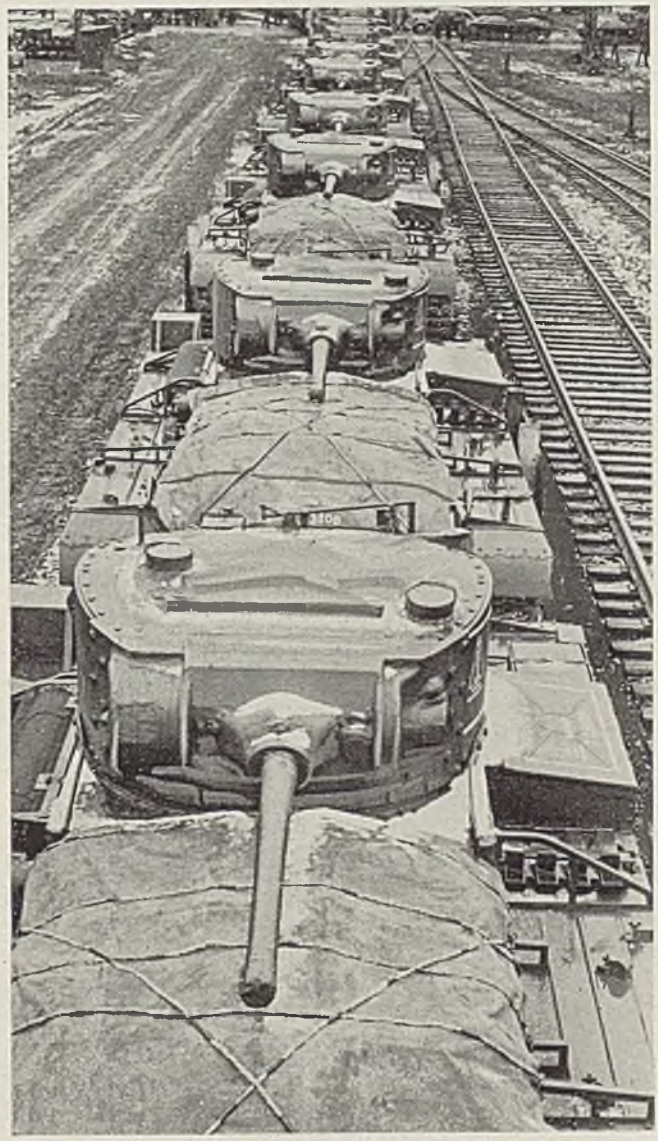
Germany Lacks Vital Metals for Steelmaking

What is the position as regards Germany? Before the war commenced she was herself producing at the rate of about 25,000,000 tons of steel a year. Now she has under her control a large proportion of the steelworks of the whole Continent. Allowing for sabotage in conquered countries, which certainly takes place; allowing for interruptions of production due to air raids over the Ruhr industrial district, she can draw upon a very considerable potential output. She can obtain iron ore from France and Poland in addition to her own resources, and she now can buy ore from Sweden. She has coal and coke. Even the labor problem presents less difficulty than in Britain or in Russia because Germany has enslaved hundreds of thousands of workers in conquered nations and has not hesitated to import forced labor into her own works. What Germany lacks most is special alloys, and the problem of transportation and long haulage is probably a weak point. On balance, and viewing the steel situation only, Germany holds the advantage over Britain and Russia, but however essential steel may be to modern warfare, its possession must be combined with that of other vital requirements which Germany is badly lacking.

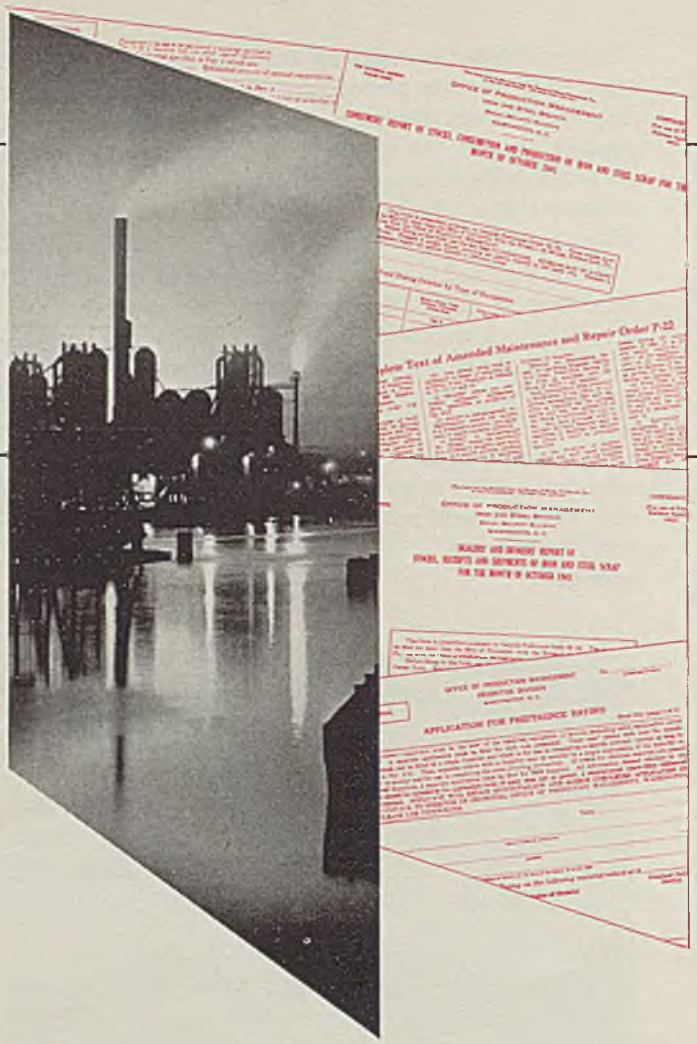
In comparing the respective positions of Great Britain and Germany, one should visualize Britain's situation as an island, limited in area and in population. Radiating from this island, distances of thousands of miles lead to large potential reserves of material in the British dominions and colonies, and in the United States. This island, at any time, can be subjected to intensive bombing attacks by air, while the seas harbor the unending menace of warfare above, upon and below the surface.

Germany, on the other hand, occupies a central position surrounded by nations that she has overrun and that contain rich resources. The vast area at her disposal enables Germany to disperse her means of production and her stores, thus minimizing the effect of aerial attack. Against this advantage, Germany's transport lines, by land or by sea, are vulnerable, and dispersion causes delay.

While the battle of the oceans has had the result of retarding or partly destroying only a relatively small proportion of the supplies shipped to Britain, her production could be seriously crippled by concentrated and persistent air attacks over her territory or by an attempted invasion. Such a possibility must be faced, and in planning war production American leaders may consider it wise to provide for a reserve of steel products which would make it possible immediately to resume shipments to Britain in the case of a serious emergency.



■ A long line of Canadian-built infantry tanks loaded aboard flat cars leaving the Angus Shops, Montreal, on the first lap of their long journey to the Russian front. In all, 100 of these tanks will be sent to Russia from Canada. Each weighs 20 tons and has a top speed of 20 miles per hour. More than 3500 men have been working at the Angus plant, operating night and day, six days a week. NEA photo



DOMESTIC MARKET SUMMARY

Defense, then war, spur production to new high level. Iron ore, pig iron, steel ingots, finished steel output break all previous records. Prices and distribution controlled by government agencies. Operations above 90 per cent all year. Labor difficulties and scrap shortage impose obstacles. Capacity expanded 2,000,000 tons by midyear. Plans for 10,000,000 tons additional under way to meet emergency

NEVER before has the steel industry passed through a year marked by as many unusual features as in 1941. Practically all previous records for production were broken and control of the industry passed from its owners to government agencies charged with providing maximum supplies for defense and later for actual war. Production records were established in the face of unusual difficulties, an unprecedented shortage of steel and iron scrap and numerous strikes interrupting output of raw and finished materials. Government control assumed the form of price ceilings and establishment of priority in delivery of defense and war materials and finally allocation of steel products. Need for further increased production and extension of government control were intensified when the United States declared war on Japan, and the Axis powers, following the Japanese attack on our outposts in the Pacific.

That the steel industry met its obligations in the defense program is proven by the record of its achievement of the greatest production in history and its full co-operation in every means undertaken to make this country in reality the "Arsenal of Democracy" and finally to supply means for waging a successful war on totalitarian powers.

Iron ore movement from Lake Superior ports reached the unprecedented total of 80,116,360 gross tons, compared with 63,712,982 tons in 1940 and the highest mark previously attained, 65,204,600 tons in 1929.

Steel ingot and castings output in 11 months was 75,763,558 net tons, which exceeded the twelve-month record of 66,981,662 tons in 1940, an increase of 25 per cent. This was 50 per cent greater than the 50,467,880 tons in 1917, the peak year in the first World War. Production for 1941 is estimated at 84,259,891 net tons.

For the first time in history steel ingot and castings production was above 90 per cent of capacity every month in the year, reaching a high of 99.7 per cent in March, the lowest mark being 93.4 per cent in July. Paralleling this is the average weekly output, which was above 1,500,000 net tons every month. The highest weekly average was 1,634,917 tons in October and the lowest 1,543,367 tons in July.

Pig iron production made records similar to those in steel ingots, output in every month being above 90 per cent of capacity. Total output for 11 months was 50,903,091 net tons, 20.2 per cent over the corresponding period in 1940 and 15.3 per cent over 11 months in 1929. Estimated total production for the full year is 56,500,714 net tons.

Regulatory measures stemmed out from the Office of Production Management, which had been established in December, 1940, as a broader facility than the National Defense Advisory Commission, which had been created in May.

Office of Production Management functioned through the entire year and as new problems arose it was expanded to meet the emergency. Office of Price Administration and Civilian Supply was created to administer price regulation and aid non-defense users in obtaining steel. Later this agency was restricted to

price control as Office of Price Administration. Defense Supplies Rating Plan was established in May to aid in control of materials essential to defense production. This was followed in June by a general steel preference delivery order, designed to aid further in equitable distribution. At the beginning of December Production Requirements Plan was established, a streamlined substitute for Defense Supplies Rating Plan. This provides priority ratings for producers finding it necessary to schedule production in advance of receiving orders.

All these efforts to provide best distribution for defense needs and at the same time work a minimum of hardship on manufacturers of non-defense products brought an immense flood of paper work for suppliers, but compliance was complete and in general effects were salutary.

At the end of November the Priorities Division extended all general preference orders on pig iron, steel, steel warehouses and special types of iron and steel to Dec. 31, 1942, from the prior expiration, Nov. 30, 1941. Preference rating order on certain materials for foundry equipment manufacture and repair was extended to May 30, 1942.

First price control announcement was made April 3 by Leon Henderson, commissioner of price stabilization for the National Defense Advisory Commission. This related to scrap and was based on a quotation of $20 per gross ton at Pittsburgh for No. 1 heavy melting steel, with differentials for other grades and also for other consuming centers. This action was followed within a few days by formation of Office of Price Administration and Civilian Supply, under direction of Mr. Henderson, which absorbed the National Advisory Defense Commission price division.

Ceiling prices on scrap were claimed inequitable by various interests and after hearings several revisions were ordered in the effort to induce larger supplies. Among these changes were several applying to single localities which complained of dwindling supply because of better markets elsewhere. Provision was also made for absorbing freight on scrap from remote locations, too far from consuming centers to make collection profitable at the ceiling price.

Scrap Scarcity Restricted Steel Output

During the late summer ceiling prices were being openly violated by various means and Mr. Henderson called a conference of producers and consumers and warned that penalties would be applied if prices were not observed, setting Sept. 2 as the deadline. Subsequent to that date the order was well observed, a few instances coming to notice being settled by agreement of brokers to refund excess charges.

Scarcity prevailed through the entire year, becoming more acute from month to month until stringency caused numerous open hearths to be shut down in November. This was followed in December by further restriction, a Chicago producer cutting his output by 10 per cent because of depleted scrap supply. Outlook for 1942 seems serious, inasmuch as supply from other than industrial and railroad sources has been well combed and will yield less tonnage than during 1941. The fact seems to be that intensified steel production has outrun scrap supply and the country does not yield sufficient to supply the need. Institute of Scrap Iron and Steel Inc. has announced figures showing consumption practically 33 per cent larger than in 1940 and estimated scrap consumption for 1941 as 52,000,000 gross tons, far and away greater than any previous year.

Effective Oct. 11 steel and iron scrap was placed under full priority control by Priorities Division of Office of Production Management. Under this order director of priorities was given authority to issue specific directions for delivery of scrap to alleviate shortages. Producers, dealers, brokers and consumers of scrap were ordered to make full monthly reports of inventories, production, sales, receipts and consumption. With this information in hand the division expected to obtain a birdseye view of the entire situation and to direct distribution of available supplies to best advantage. Gathering and tabulating of these statistics was turned over to the Bureau of Mines, which had been making a quarterly and later a monthly survey of the scrap situation. While some orders were issued for diversion of scrap supply to meet emergencies the division has not yet been able to take over the entire distribution, awaiting codification of information as to supply and demand.

Steel and Pig Iron Prices Frozen

At mid-December a plan was announced for coordinating scrap and pig iron allocations under the raw materials group of OPM. This was undertaken to bring into one control products largely complementary, to avoid duplication and give better distribution to both.

Office of Price Administration issued an order effective April 16, freezing prices of steel and iron products at the level prevailing March 31, 1941. This was revised June 30 by change of regulation on basing points to allow use of the basing point nearest the mill instead of the basing point which gave lowest price. A ceiling was also put on prices for export.

On presentation of data covering its costs Phoenix Iron Co., Phoenixville, Pa., was given permission to accept prices on shapes and bars $4 per ton higher than the ceiling. Central Iron & Steel Co., Harrisburg, Pa., was allowed to charge $5 per ton above the base price on plates. This established a spread in plate prices at Claymont, Del., Coatesville, Pa., and Sparrows Point, Md., basing points for much of its plate tonnage.

Pig iron prices were frozen June 24 at levels prevailing in second quarter, 1941. In general these were prices which had been in effect the entire first half, and no protest was heard. Priorities Division issued a general preference order Aug. 1, putting pig iron under full priority control from that date. Reports of inventory and requirements were to be filed by all consumers by the middle of the month preceding shipment. From this information the division made up a schedule by which producers made shipments. In this way additional iron was withheld from melters with large inventory and more even distribution was attained. In addition all producers were required to set aside a portion of their output, as directed by the priorities board, to form a pool from which emergency

shipments could be made. The plan worked well from the start and melters were assured sufficient iron for their defense work, though they were not allowed to accumulate stocks. In this way best result from available tonnage was obtained.

The cycle of price fixing was completed as far as the steel industry was concerned by a priority order issued Sept. 18, effective Oct. 1, which established maximum prices on by-product blast furnace and foundry coke. The prices were 75 cents per net ton above weighted average f.o.b. oven prices in first quarter. For the most part the fixed prices were those which were in effect at the time of the order.

Prices for the most part were unchanged during 1941, except on scrap, which for the first four months was a free market. Fixed prices on steel, pig iron and coke were established at the levels which had prevailed from the first of the year. Only minor changes from these levels were made after the several freezing orders.

Restrictions on Non-Defense Production

To make available larger proportion of steel for defense purposes orders were issued during latter part of the year restricting production of automobiles and trucks, mechanical refrigerators, domestic laundry equipment, domestic ice refrigerators, metal office furniture, vacuum cleaners and other articles.

Considerable difference of opinion developed as to needed steelmaking capacity of the United States to meet the emergency. A report to the President by Gano Dunn of the Office of Production Management in March stated existing capacity was adequate but recommended some expansion to cover expected increase in demand. In June Office of Production Management started a campaign for expansion of steel ingot capacity by 10,000,000 tons. This was approved by the Supply Priorities and Allocations Board in October and immediate steps were taken to provide financing by federal agencies. Some objection to this plan arose, one argument being that steel needed for the construction of blast furnaces and steel plants would be at the cost of material for direct defense.

Capacity was increased 2,000,000 tons during the first six months of 1941, to 86,148,700 net tons. This followed a somewhat larger increase during 1940, the total being nearly 4,500,000 tons for 18 months preceding June 30, 1941.

Labor interruptions cost thousands of tons of steel production, a succession of strikes interfering with output. In addition to numerous small strikes four major interruptions took toll of tonnage in an important degree. First of these in point of time was a strike Oct. 4 of soaking pit crane operators at Gary works of Carnegie-Illinois Steel Corp., forcing practically the entire plant to suspend. The strike was unauthorized and after two days the men were persuaded by their union officers to return to work. This followed almost immediately a smaller interruption at the Gary plant of the American Bridge Co., a result of a dues picketing campaign. At least 30,000 tons of steel production was lost by the Gary stoppages.

An unauthorized strike at the plant of Great Lakes Steel Corp., Detroit, Oct. 17, cut production in that district to one-third its former rate. The tieup lasted eight days and loss of tonnage is estimated at 5000 gross tons of ingots, 2000 tons of pig iron and 1400 tons of coke daily.

At the end of October dues picketing at Irvin Works of Carnegie-Illinois Steel Corp. caused a shutdown of that plant and dropping of 16 open hearths at Homestead Works, cutting the production rate for the week in the Pittsburgh district from 99 to 90 per cent.

This was followed almost immediately by closing of captive coal mines in an effort to establish the closed shop, which prevails in the commercial mines. Coke production was cut seriously in the Pittsburgh district and numerous blast furnaces were banked, the production loss being estimated at 21,000 tons of steel, 20,000 tons of pig iron and 10,000 tons of coke.

Plate demand was increasingly heavy as the year progressed, shipbuilding, tank building and freight car construction calling for unprecedented quantities. To relieve mills from this pressure numerous sheet mills equipped to roll light plates were diverted to that product, at the expense of sheets. This relieved the situation somewhat but pressure for plates was such that mills late in the year were loaded with orders bearing top priority ratings, among which steelmakers were unable to choose those most needed. Under these circumstances allocations were applied to plate orders before the Supply Priorities and Allocations Board had asked OPM for a general allocation system. This system was not applied to all products at once, the board apparently desiring to use this authority only as need developed in various products.

Industry Set To Meet War Demands

A feature of the plate situation was denial of priority by SPAB for an oil pipe line from Texas to the Atlantic seaboard to meet a reputed shortage of oil in the East because of diversion of tankers to British service. This line was estimated to require about 180,000 tons of plates. First denial, in September, left the door open for use of seamless tubes but in November this also was denied and the project was dropped.

Tin plate production was practically at capacity through the year, usual seasonal slackening not being in evidence, heavy demand for containers for army food supply and large tonnages allocated for export to British Empire countries putting a heavy load on mills. As has been the case for some time, cold-reduced plate constituted by far the larger portion of output.

In other products defense needs were met with comparatively little difficulty though civilian users were increasingly deprived of supplies.

Entering 1942 the steel industry recognizes its obligations to meet requirements of a much wider program of production in view of actual war requirements, added to necessity for supplying other countries opposing the Axis armies. Past performance indicates cheerful co-operation with every measure tending to victory and the present year seems destined to bring new records in every line. Programs in the making by the administration call for vastly expanded production, which will call for adjustment of distribution to war at the cost of civilian use. The industry is ready to do its utmost in the cause of liberty.

Pig Iron and Steel Ingot Production

Steel Ingot Figures by American Iron and Steel Institute. Coke Pig Iron by STEEL

Pig Iron Production

Net Tons

	Stacks		Output		Stacks		Output		Stacks		Output		Stacks		Output	
	No.	In	Total	Av. daily	No.	In	Total	Av. daily	No.	In	Total	Av. daily	No.	In	Total	Av. daily
			1929				1935				1936				1937	
Jan.	328	202	3,844,991	124,031	281	89	1,655,856	53,415	267	118	2,272,820	73,316	243	169	3,606,110	116,327
Feb.	326	208	3,604,581	128,735	281	96	1,808,694	64,596	266	120	2,059,604	71,020	242	176	3,382,407	120,800
March	326	213	4,154,660	134,021	280	97	1,983,509	63,974	265	126	2,291,656	73,924	242	182	3,886,926	125,385
April	326	216	4,102,747	136,759	278	97	1,872,143	62,405	265	143	2,698,611	89,954	241	186	3,808,712	126,956
May	325	220	4,366,145	140,843	275	96	1,943,846	62,704	253	145	2,978,800	96,096	240	170	3,970,602	128,083
June	325	220	4,160,917	138,697	272	91	1,745,479	58,183	253	144	2,908,111	96,937	240	182	3,489,138	116,304
July	325	217	4,236,412	136,658	270	92	1,702,781	54,928	252	146	2,907,286	93,783	237	192	3,921,522	126,501
Aug.	325	209	4,195,742	135,346	270	98	1,970,956	63,579	248	148	3,037,133	97,972	237	191	4,050,989	130,677
Sept.	323	204	3,916,029	130,534	270	104	1,982,690	66,090	247	154	3,055,648	101,855	237	181	3,828,115	127,604
Oct.	318	203	4,018,724	129,637	269	116	2,215,784	71,476	245	161	3,350,809	108,090	237	151	3,237,949	104,450
Nov.	317	176	3,564,310	118,811	268	122	2,314,248	77,141	245	165	3,303,935	110,131	237	114	2,247,875	74,929
Dec.	316	156	3,177,347	102,495	268	120	2,369,355	76,431	245	170	3,500,215	112,911	237	93	1,683,891	54,319
Total			47,342,605	*129,705			23,565,341	*64,617			34,364,628	*93,892			41,114,236	*112,642
			1938				1939				1940				1941	
Jan.	236	91	1,618,245	52,201	237	118	2,436,474	78,596	233	177	4,024,556	129,825	229	205	4,666,233	150,524
Feb.	236	91	1,463,093	52,254	237	121	2,307,405	82,407	233	157	3,304,368	113,943	229	202	4,206,826	150,244
March	236	90	1,646,636	53,117	237	123	2,680,446	86,465	233	152	3,270,575	105,502	229	205	4,702,905	151,707
April	236	79	1,554,569	51,819	236	102	2,301,965	76,732	233	155	3,139,043	104,635	229	191	4,340,555	144,685
May	236	73	1,412,249	45,556	236	106	1,923,625	62,052	233	171	3,497,157	112,811	229	206	4,596,113	148,262
June	236	67	1,188,037	39,601	235	117	2,373,753	79,125	232	181	3,813,092	127,103	229	211	4,551,040	151,701
July	236	77	1,358,645	43,827	235	129	2,638,760	85,121	231	187	4,060,513	130,984	229	212	4,766,216	153,749
Aug.	237	88	1,674,976	54,031	235	138	2,979,774	96,122	231	190	4,234,576	136,599	229	215	4,784,639	154,343
Sept.	237	97	1,885,069	62,835	235	169	3,218,940	107,298	231	192	4,172,551	139,085	230	219	4,721,337	157,378
Oct.	237	114	2,315,599	74,697	235	188	4,062,670	131,053	231	196	4,437,725	143,152	230	216	4,860,033	156,775
Nov.	236	121	2,561,060	85,369	235	191	4,166,512	138,883	231	202	4,397,656	146,589	231	217	4,707,194	156,906
Dec.	236	115	2,478,244	79,943	233	191	4,219,718	136,119	231	202	4,542,864	146,544	...	...	.....	.....
Total			21,156,422	*57,962			35,310,042	*96,740			46,894,676	*128,128			‡50,903,091	*152,404

*Average. ‡Eleven months.

Steel Ingot Production and Operating Rates

Net Tons

	1929		% of	1935		% of	1936		% of	1937		% of
	Total	Weekly Av.	Capacity	Total	Weekly Av.	Capacity	Total	Weekly Av.	Capacity	Total	Weekly Av.	Capacity
Jan.	5,040,147	1,137,731	86.84	3,214,580	725,639	49.06	3,404,581	768,528	52.39	5,284,648	1,192,923	81.32
Feb.	4,848,159	1,212,039	92.51	3,107,184	776,796	52.52	3,311,718	799,932	54.53	4,944,463	1,236,116	84.27
March	5,676,357	1,281,345	97.80	3,209,127	724,408	48.98	3,733,915	842,871	57.46	5,844,525	1,319,306	89.94
April	5,544,059	1,292,322	98.64	2,957,474	689,388	46.61	4,404,518	1,024,344	69.99	5,679,371	1,323,862	90.25
May	5,920,596	1,336,478	102.01	2,949,700	665,847	45.02	4,521,860	1,020,736	69.58	5,770,138	1,302,514	88.79
June	5,491,310	1,280,026	97.70	2,529,704	589,674	39.87	4,452,637	1,037,911	70.75	4,686,890	1,092,515	74.48
July	5,432,653	1,229,107	93.82	2,539,966	574,653	38.86	4,384,094	991,876	67.61	5,103,060	1,154,539	78.48
Aug.	5,531,776	1,247,708	95.31	3,265,842	737,210	49.85	4,686,401	1,057,878	72.11	5,463,165	1,233,220	83.83
Sept.	5,071,233	1,184,868	90.44	3,164,004	739,254	49.99	4,649,555	1,086,344	74.05	4,804,248	1,122,488	76.30
Oct.	5,078,445	1,146,376	87.50	3,519,890	794,557	53.72	5,078,356	1,146,356	78.15	3,800,075	857,805	58.31
Nov.	3,943,644	919,265	70.17	3,528,458	822,484	55.61	4,841,788	1,128,622	76.94	2,412,889	562,445	38.23
Dec.	3,251,373	735,605	56.15	3,442,214	778,781	52.66	4,955,291	1,121,107	76.42	1,649,784	373,255	25.37
Total	60,829,752	1,166,661	89.05	37,428,143	717,839	48.54	52,424,714	1,002,768	68.36	55,443,256	1,063,354	72.38
	1938		% of	1939		% of	1940		% of	1941		% of
	Total	Weekly Av.	Capacity	Total	Weekly Av.	Capacity	Total	Weekly Av.	Capacity	Total	Weekly Av.	Capacity
Jan.	1,942,265	438,434	29.17	3,578,863	807,870	52.83	5,764,723	1,301,292	83.4	6,928,085	1,563,902	96.9
Feb.	1,901,146	475,287	31.63	3,368,915	842,229	55.07	4,525,797	1,093,188	70.0	6,237,900	1,559,475	96.6
March	2,244,708	506,706	33.72	3,839,127	866,620	56.67	4,389,183	990,786	63.5	7,131,641	1,609,851	99.7
April	2,149,327	501,008	33.34	3,352,774	781,532	51.11	4,100,474	955,821	61.2	6,756,949	1,575,046	97.6
May	2,016,982	455,301	30.30	3,295,164	743,829	48.64	4,967,782	1,121,395	71.8	7,053,238	1,592,153	98.7
June	1,828,784	426,290	28.36	3,523,880	821,417	53.71	5,657,443	1,318,751	84.5	6,800,730	1,585,252	98.2
July	2,211,235	500,279	33.29	3,564,827	806,522	52.74	5,724,625	1,295,164	83.0	6,821,682	1,543,367	93.4
Aug.	2,841,554	641,434	42.68	4,241,994	957,561	62.62	6,186,383	1,396,475	89.5	7,000,957	1,580,351	95.7
Sept.	2,964,785	692,707	46.09	4,769,468	1,114,362	72.87	6,056,246	1,415,011	90.6	6,819,706	1,593,389	96.4
Oct.	3,478,703	785,260	52.25	6,080,177	1,372,500	89.75	6,644,542	1,499,897	96.1	7,242,683	1,634,917	99.0
Nov.	3,985,367	928,990	61.81	6,147,783	1,433,050	93.71	6,469,107	1,507,950	96.6	6,969,987	1,624,706	98.3
Dec.	3,506,436	793,312	52.79	5,822,014	1,317,198	86.13	6,495,357	1,469,538	94.1	.....	.....	....
Total	31,071,292	595,921	39.65	51,584,986	989,355	64.70	**66,981,662	1,281,210	82.1	‡75,763,558	*1,587,491	97.3

Compiled by American Iron and Steel Institute. †Beginning with 1927 the Institute excludes crucible and electric ingots, which totaled 756,138 net tons in 1927, 907,232 tons in 1928, 1,073,045 tons in 1929, 688,634 tons in 1930, 461,987 tons in 1931, 270,766 tons in 1932, 47,510 tons in 1933, 405,246 tons in 1934, 607,190 tons in 1935, 866,063 tons in 1936, 913,073 tons in 1937, 524,850 tons in 1938, 952,453 tons in 1939. **Includes electric steel ingots and steel castings. Crucible steel in 1940 was 1024 tons. ‡Eleven months. *Average.

Average Monthly Quotations in 1941

Base or Furnace, Unless Otherwise Specified; Scrap, Delivered to Consumers

PITTSBURGH

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Structural Shapes	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
Plates	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Bars	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
Cold-Finished Steel Bars	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65
Strip, Hot-Rolled	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Strip, Cold-Rolled	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
Standard Spikes	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Plain Wire	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
Structural Rivets	3.40	3.40	3.40	3.40	3.50	3.75	3.75	3.75	3.75	3.75	3.75	3.75
Hot Rolled Sheets	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
No. 24 Galvanized Sheets	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Tin Plate, base box	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00
Wire Nails	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55
Steel Pipe, 1 to 3-inch, % discount (base $200 per ton)	68½%	68½%	68½%	68½%	68½%	68½%	68½%	68½%	68½%	68½%	68½%	68½%
Bessemer Pig Iron, Neville Island base	$24.50	$24.50	$24.50	$24.50	$24.50	$24.50	$24.50	$24.50	$24.50	$24.50	$24.50	$24.50
Basic Pig Iron, Neville Island base	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
No. 2 Foundry Pig Iron, Neville Island Base	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
Malleable Pig Iron, Neville Island Base	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
Bessemer Ferrosilicon, 10 per cent (Jackson co. base)	34.00	34.00	34.00	34.00	34.00	34.00	37.50	37.50	37.50	37.50	37.50	37.50
Billets, Bessemer and Open-Hearth	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
Sheet Bars, Bessemer and Open-Hearth	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
Wire Rods	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Furnace Coke, spot	$5.50	$5.50	$5.50	$5.50	$5.70	$6.25	$6.25	$6.25	$6.25	$6.25	$6.25	$6.25
Foundry Coke, spot	6.00	6.00	6.00	6.00	6.30	7.25	7.25	7.25	7.25	7.25	7.25	7.25
Heavy Melting Steel Scrap	22.15	20.75	20.75	20.20	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Low Phosphorus Scrap	27.25	27.00	27.00	25.50	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
No. 1 Cast Scrap	21.75	22.00	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50

CHICAGO

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bars	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c
Plates	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Structural Shapes	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Rail Steel Bars	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
Cold Rolled Sheets	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
No. 2 Foundry and Malleable Pig Iron	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00
Southern No. 2 Pig Iron, Delivered	24.02	24.22	24.22	24.22	24.22	24.22	24.22	24.22	24.22	24.22	24.22	24.22
Lake Superior Charcoal Iron, Delivered, Chicago	30.34	30.34	30.34	30.34	31.09	31.34	31.34	31.34	31.34	31.34	31.34	31.34
Heavy Melting Steel Scrap	$20.15	$19.25	$19.45	$18.80	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75
Steel Specialties, Chicago	23.95	23.56	23.56	23.75	(Listing eliminated)							
Rails for Rolling	24.40	23.75	24.00	22.65	22.25	22.25	22.25	22.25	22.25	22.25	22.25	22.25
Car Wheels, Iron	21.45	20.50	20.75	20.75	(Listing eliminated)							
No. 1 Machinery Cast Scrap	19.35	19.875	20.25	22.31	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50

EASTERN PENNSYLVANIA

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Tank Plates, delivered Philadelphia	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c
Structural Shapes, delivered Philadelphia	2.21½	2.21½	2.21½	2.21½	2.21½	2.21½	2.21½	2.21½	2.21½	2.21½	2.21½	2.21½
Steel Bars, delivered Philadelphia	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47
Bar Iron, common, delivered Philadelphia	2.37	2.37	2.37	2.37	2.37	2.37	3.05	3.28	3.28	3.28	3.28	3.28
Hot Rolled Sheets, delivered Philadelphia	2.27	2.27	2.27	2.12	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27
Basic Pig Iron, delivered	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34
No. 2X Foundry Pig Iron, delivered Philadelphia	26.215	26.215	26.215	26.215	26.215	26.215	26.215	26.215	26.215	26.215	26.215	26.215
Standard Low Phosphorus Pig Iron, delivered	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74
No. 1 Heavy Melting Scrap	$20.56	20.00	20.00	19.06	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75
No. 1 Railroad Wrought Scrap	20.63	20.75	20.75	20.75	(Listing eliminated)							
No. 1 Cupola Cast Scrap	24.25	24.25	25.10	25.10	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
Spiegeleisen, 20%	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
Ferromanganese, delivered Pittsburgh	125.33	125.33	125.33	125.33	125.33	125.33	125.33	125.33	125.33	125.33	125.33	125.33

COAL TAR PRODUCTS

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Benzol, per gallon producers' plants, tank lots	14.00c	14.00c	14.00c	14.00c	14.00c	14.00c	14.00c	14.00c	14.00c	14.00c	14.00c	14.00c
Toluol, two degree, per gallon producers' plants, tank lots	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
Solvent naphtha, per gallon producers' plants, tank lots	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
Xylol, per gallon producers' plants, tank lots	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
Naphthalene, flakes and balls, per pound, producers' plants	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Phenol, per pound producers' plants, 1000 pounds or less	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	14.75	14.75	14.75
Sulphate of ammonia, per ton bulk f.o.b. Atlantic seaboard	$30.00	$30.00	$30.00	$30.00	$30.00	$29.00	$29.00	$29.00	$29.00	$29.00	$29.00	$29.00

NONFERROUS METALS

Prompt wholesale prices in cents per pound

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Tin, Straits, spot, New York	50.148	51.449	52.057	51.965	52.160	52.696	53.519	52.390	52.000	52.000	52.000	52.000
Copper, electrolytic, delivered, Connecticut	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000
Zinc, prime western, East St. Louis	7.250	7.250	7.250	7.250	7.250	7.250	7.250	7.250	7.250	7.991	8.250	8.250
Lead, open market, East St. Louis	5.350	5.454	5.615	5.700	5.700	5.700	5.700	5.700	5.700	5.700	5.700	5.700
Lead, open market, New York	5.500	5.604	5.765	5.850	5.850	5.850	5.850	5.850	5.850	5.850	5.850	5.850
Aluminum, ninety-nine per cent plus	17.000	17.000	17.000	17.000	17.000	17.000	17.000	17.000	17.000	15.000	15.000	15.000
Antimony, American, spot, New York	16.500	16.500	16.500	16.500	16.500	16.500	16.500	16.500	16.500	16.500	16.500	16.500
Nickel, cathodes	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000

Monthly Price Averages for Twelve Years

Prices Averages for Years Prior to 1931 may be found in STEEL for January 7, 1935

ORES AND ALLOYS

Per Gross Ton

Iron Ore Prices at Date of Buying Movement, Delivered Lower Lake Ports

Season	Date buying movement	Old range Bessemer Ton	Old range Bessemer Cents per unit	Old range Nonbessemer Ton	Old range Nonbessemer Cents per unit	Mesabi Bessemer Ton	Mesabi Bessemer Cents per unit	Mesabi Nonbessemer Ton	Mesabi Nonbessemer Cents per unit	Iron prices, Valley Bessemer	Iron prices, Valley No. 2 Foundry
1941	Apr. 17, 1941	$4.75	9.223	$4.60	8.932	$4.60	8.932	$4.45	8.641	$24.00	$24.50
1940	Apr. 17, 1940*	4.75	9.223	4.60	8.932	4.60	8.932	4.45	8.641	23.50	23.00
1940	Jan. 2, 1940	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	23.50	23.00
1939	May 3, 1939	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	21.50	21.00
1938	May 23, 1938	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	24.50	24.00
1937	Mar. 12, 1937	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	24.50	24.00
1936	Apr. 3, 1936	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	20.00	19.50
1935	May 4, 1935	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	19.00	18.50
1934	May 19, 1934	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	19.00	18.50
1933	June 12, 1933	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	16.00	15.50
1932	June 3, 1932	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	14.50	14.50
1931	Apr. 15, 1931	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	17.00	17.00
1929	Mar. 22, 1929	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	18.50	18.00

*Price reduced.

Manganese Ore

Dollars Per Gross Ton, Duty Paid, Northern Atlantic Ports, on Basis of 50 Per Cent Ore

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$33.03	$34.85	$35.60	$40.10	$40.10	$41.60	$41.60	$41.60	$40.85	$40.10	$40.10	$40.10
1940	30.10	30.10	30.10	30.10	30.10	33.60	34.10	35.60	34.35	32.85	32.85	32.85
1939	20.85	20.85	20.35	20.10	20.10	20.10	20.10	20.10	Nom.	29.32	30.52	30.66
1938	28.10	28.10	28.10	28.10	28.10	28.10	25.60	25.60	25.60	22.60	21.10	21.60
1937	21.10	22.60	22.85	27.60	27.60	27.85	31.85	31.85	31.85	30.60	28.60	28.10
1936*	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	19.10	19.10	20.60
1935	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70
1934	21.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	23.20	23.70	23.70	23.70
1933	19.95	19.95	19.95	19.95	19.95	20.20	20.45	21.45	21.45	21.70	21.70	21.70
1932	22.70	22.70	22.70	22.70	21.70	21.70	21.70	21.70	21.20	21.20	21.20	20.70
1931	24.20	24.20	23.70	23.70	23.70	23.70	23.70	23.70	23.70	22.70	22.70	22.70
1929	27.70	27.70	27.70	27.70	27.70	27.70	26.70	26.70	26.70	25.70	25.70	25.70

*Effective Jan. 1, duty ½c per pound metallic content; $5.60 gross ton on 50 per cent ore.

Bessemer Ferrosilicon, 10 Per Cent

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$37.50	$37.50	$37.50	$37.50	$37.50	$37.50
1940	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00
1939	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	31.00	32.00	32.00	33.00
1938	33.00	33.00	33.00	33.00	33.00	33.00	29.00	29.00	29.00	30.00	30.00	30.00
1937	29.00	29.00	31.80	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00
1936	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	29.00
1935	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75
1934	27.25	27.25	27.25	27.25	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75
1933	20.50	20.50	20.50	20.50	20.50	20.75	22.40	24.65	27.00	27.75	27.75	27.75
1932	23.00	22.00	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50
1931	25.00	25.00	25.00	25.00	25.00	25.00	25.00	24.00	23.00	23.00	23.00	23.00
1929	31.00	31.00	31.00	31.00	31.00	31.00	31.00	30.20	30.00	30.00	30.00	30.00

Ferrosilicon, 50 Per Cent

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$74.50	$74.50	$74.50	$74.50	$74.50	$74.50	$74.50	$74.50	$74.50	$74.50	$74.50	$74.50
1940	69.50	69.50	69.50	69.50	69.50	70.50	74.50	74.50	74.50	74.50	74.50	74.50
1939	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
1938	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
1937	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
1936	77.50	77.50	77.50	77.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
1935	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50
1934	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50
1933	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50
1932	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	76.30
1931	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	77.50
1929	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50

Spiegeleisen, 20 Per Cent

At Producers' Furnaces

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00
1940	32.00	32.00	32.00	32.00	32.00	34.40	36.00	36.00	36.00	36.00	36.00	36.00
1939	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	32.00	32.00	32.00
1938	33.00	33.00	33.00	33.00	33.00	33.00	28.00	28.00	28.00	28.00	28.00	28.00
1937	26.00	26.00	28.00	30.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00
1936	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1935	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1934	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1933	24.00	24.00	24.00	24.00	24.00	24.00	27.00	27.00	27.00	27.00	27.00	27.00
1932	27.00	27.00	27.00	27.00	27.00	26.50	25.00	25.00	25.00	25.00	24.25	24.00
1931	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	27.00
1929	34.00	34.00	34.00	34.00	34.00	34.00	34.00	33.20	33.50	34.00	34.00	34.00

Ferromanganese, 80 Per Cent, del. Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$125.33	$125.33	$125.33	$125.33	$125.33	$125.33	$125.33	$125.33	$125.33	$125.33	$125.33	$125.33
1940	105.33	105.33	105.33	105.33	105.33	105.33	125.33	125.33	125.33	125.33	125.33	125.33
1939	91.58	85.33	85.33	85.33	85.33	85.33	85.33	85.33	95.33	105.33	105.33	105.33
1938	107.49	107.49	107.49	107.49	107.77	107.77	97.77	97.77	97.77	97.77	97.83	97.83
1937	84.79	84.79	92.29	99.79	107.29	107.29	107.29	107.29	107.29	107.29	107.39	107.49
1936*	90.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	82.65
1935	89.79	89.79	89.79	89.85	90.13	90.13	90.13	90.13	90.13	90.13	90.13	90.13
1934	90.24	90.24	90.24	90.24	90.24	90.00	89.79	89.79	89.79	89.79	89.79	89.79
1933	73.24	73.24	73.24	73.24	73.24	73.24	84.44	87.24	87.24	87.24	87.24	87.24
1932	79.85	80.24	80.24	80.24	80.24	74.99	73.24	73.24	73.24	73.24	73.24	73.24
1931	89.79	89.79	89.79	89.79	89.79	89.79	89.79	89.79	89.79	89.79	89.79	79.79
1929	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	104.79

*Duty of 1 cent per pound contained manganese became effective on ferromanganese Jan. 1, 1936.

PIG IRON

Per Gross Ton

Basic, Valley

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50
1940	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	23.00
1939	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50	21.50	22.50	22.50	22.50
1938	23.50	23.50	23.50	23.50	23.50	23.50	19.50	19.50	19.50	20.50	20.50	20.50
1937	20.50	20.50	23.10	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
1936	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.25	20.00
1935	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	19.00	19.00
1934	17.00	17.00	17.00	17.60	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
1933	14.00	14.00	14.00	14.00	14.40	15.00	15.60	16.00	17.00	17.00	17.00	17.00
1932	15.00	15.00	15.00	15.00	15.00	14.50	14.00	14.00	14.00	14.00	14.00	14.00
1931	17.00	16.75	16.75	17.00	17.00	17.00	17.00	17.00	17.00	16.60	15.00	15.00
1929	17.50	17.50	17.60	18.00	18.30	18.50	18.50	18.50	18.50	18.50	18.50	18.50

Basic, delivered Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34
1940	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.84
1939	22.34	22.34	22.34	22.34	22.34	22.34	22.34	22.34	23.54	24.34	24.34	24.34
1938	25.34	25.34	25.34	25.34	25.34	24.69	21.34	21.34	21.34	22.34	22.34	22.34
1937	22.26	22.51	24.76	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26
1936	20.81	20.81	20.81	20.81	20.81	20.81	20.81	20.81	20.81	20.81	21.06	21.81
1935	19.76	19.76	19.76	19.76	19.81	19.81	19.81	19.81	19.81	19.81	20.81	20.81
1934	18.76	18.76	18.76	19.51	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.76
1933	13.50	13.50	13.50	14.19	15.99	18.19	16.79	17.20	17.76	17.76	17.76	18.76
1932	16.00	15.75	15.75	15.00	15.00	14.50	14.35	13.90	13.75	13.60	13.50	13.50
1931	17.25	17.25	17.25	17.25	17.00	17.00	16.75	16.75	16.00	16.00	16.00	16.00
1929	20.15	20.50	20.25	20.25	20.50	20.25	19.85	19.85	19.85	19.75	19.75	19.75

No. 2 Foundry, f.o.b. Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00
1940	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.50
1939	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	22.20	23.00	23.00	23.00
1938	24.00	24.00	24.00	24.00	24.00	24.00	20.00	20.00	20.00	21.00	21.00	21.00
1937	21.00	21.00	23.20	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1936	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.75	20.50
1935	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.75	19.50	19.50
1934	17.50	17.50	17.50	18.25	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50
1933	15.50	15.50	15.50	15.50	15.90	16.00	16.75	17.00	17.50	17.50	17.50	17.50
1932	16.50	16.50	16.50	16.00	15.60	16.00	15.50	15.50	15.50	15.50	15.50	15.50
1931	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.20	17.00	16.60
1929	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00

No. 2X Foundry, delivered Philadelphia

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$26.21	$26.21	$26.21	$26.21	$26.21	$26.21	$26.21	$26.21	$26.21	$26.21	$26.21	$26.21
1940	25.21	25.21	25.21	25.21	25.21	25.21	25.21	25.21	25.21	25.21	25.21	25.71
1939	23.21	23.21	23.21	23.21	23.21	23.21	23.21	23.21	24.41	25.21	25.21	25.21
1938	26.21	26.21	26.21	26.21	26.21	26.21	22.21	22.21	22.21	23.21	23.21	23.21
1937	23.14	23.39	25.64	26.14	26.14	26.14	26.14	26.14	26.14	26.14	26.14	26.14
1936	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.93	22.68
1935	20.63	20.63	20.63	20.63	20.68	20.68	20.68	20.68	20.68	20.68	21.68	21.68
1934	19.63	19.63	19.63	20.38	20.63	20.63	20.63	20.63	20.63	20.63	20.63	20.63
1933	13.76	13.76	13.76	14.51	15.91	16.76	17.28	17.88	18.63	18.63	18.63	19.63
1932	15.76	15.76	15.76	15.66	15.13	14.76	14.76	14.51	14.26	14.16	13.95	13.88
1931	18.26	18.26	18.26	18.26	17.76	17.76	17.76	17.51	17.01	16.01	16.01	15.76
1929	22.26	22.01	22.26	22.26	22.76	22.76	22.76	22.26	22.26	22.26	22.26	21.76

No. 2X Foundry, f.o.b. Buffalo

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00
1940	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.50
1939	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	22.50	23.00	23.00	23.00
1938	24.00	24.00	24.00	24.00	24.00	24.00	20.00	20.00	20.00	21.00	21.00	21.00
1937	21.00	21.25	23.50	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1936	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.75	19.75
1935	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	19.50	19.50
1934	17.50	17.50	17.50	18.25	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50
1933	16.50	16.50	16.50	16.50	16.50	16.50	17.10	17.75	17.50	17.50	17.50	17.50
1932	16.50	16.50	16.50	16.50	16.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50
1931	18.00	18.00	18.00	18.00	17.60	19.00	19.00	18.75	19.00	18.40	18.00	18.00
1929	19.00	19.00	19.25	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00

Southern No. 2, f.o.b. Birmingham

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38
1940	19.38	19.38	19.38	19.38	19.38	19.38	19.38	19.38	19.38	19.38	19.38	19.88
1939	17.38	17.38	17.38	17.38	17.38	17.38	17.38	17.38	18.58	19.38	19.38	19.38
1938	20.38	20.38	20.38	20.38	20.38	20.38	16.38	16.38	16.38	17.38	17.38	17.38
1937	17.38	17.63	19.88	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38
1936	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.84	15.75
1935	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.75	15.50
1934	13.50	13.50	13.50	14.25	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50
1933	11.00	11.00	11.00	11.40	12.00	12.00	12.60	13.00	13.50	13.50	13.50	13.50
1932	12.00	11.20	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00
1931	14.00	13.00	13.00	13.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
1929	16.50	16.50	16.50	15.50	15.50	15.25	14.00	14.00	14.00	14.00	14.00	14.00

Malleable, f.o.b. Valley

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00
1940	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.50
1939	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	22.00	23.00	23.00	23.00
1938	24.00	24.00	24.00	24.00	24.00	24.00	20.00	20.00	20.00	21.00	21.00	21.00
1937	21.00	21.00	23.60	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1936	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.75	20.50
1935	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	19.50	19.50
1934	17.50	17.50	17.50	18.10	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50
1933	14.50	14.50	14.50	14.50	14.90	15.50	16.10	16.50	17.50	17.50	17.50	17.50
1932	16.00	15.50	15.50	15.50	15.00	14.50	14.50	14.50	14.50	14.50	14.50	14.50
1931	17.50	17.25	17.00	17.00	17.00	17.00	17.00	17.00	17.00	16.90	16.50	16.00
1929	18.00	18.00	18.10	18.50	18.80	19.00	19.00	19.00	19.00	19.00	19.00	19.00

Standard Low Phosphorus, delivered Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74
1940	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	30.24
1939	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	28.94	29.74	29.74	29.74
1938	29.63	29.63	29.63	29.70	29.74	29.74	26.74	26.74	26.74	27.74	27.74	27.74
1937	26.63	26.88	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63
1936	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.38	26.13
1935	24.63	24.63	24.63	24.63	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68
1934	24.13	24.13	24.13	24.13	24.63	24.63	24.63	24.63	24.63	24.63	24.63	24.63
1933	20.75	20.50	20.50	20.50	21.68	22.00	22.80	23.50	23.13	23.13	23.13	24.13
1932	23.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76
1931	24.76	24.76	24.76	24.76	24.76	23.76	23.76	23.76	23.76	23.76	23.76	23.76
1929	24.26	24.26	24.26	24.26	24.26	24.26	24.26	24.26	24.76	24.76	24.76	24.76

Lake Superior Charcoal, delivered Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$30.34	$30.34	$30.34	$30.34	$31.09	$31.34	$31.34	$31.34	$31.34	$31.34	$31.34	$31.34
1940	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.84
1939	28.34	28.34	28.34	28.34	28.34	28.34	28.34	29.54	30.34	30.34	30.34	30.34
1938	30.24	30.24	30.24	30.34	30.34	30.34	28.34	28.34	28.34	28.34	28.34	28.34
1937	26.54	26.54	28.95	30.04	30.04	30.04	30.04	30.04	30.04	30.04	30.14	30.24
1936	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.50	26.25
1935	24.04	24.04	24.04	24.15	24.25	24.25	24.25	24.25	24.25	24.90	25.25	25.25
1934	23.54	23.54	23.54	23.66	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04
1933	23.04	23.04	23.04	23.06	23.04	23.04	23.04	23.04	23.54	23.54	23.54	23.54
1932	22.29	23.04	23.04	23.04	23.04	23.04	23.04	23.04	23.04	23.04	24.04	23.04
1931	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	25.54	25.04	25.04	20.79
1929	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04

SEMIFINISHED STEEL

Per Gross Ton f. o. b.

Open-Hearth and Bessemer Billets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00
1940	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1939	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1938	37.00	37.00	37.00	37.00	37.00	37.00	34.00	34.00	34.00	34.00	34.00	34.00
1937	34.00	34.00	36.40	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00
1936	29.00	29.00	28.40	28.00	28.00	28.00	30.00	30.00	30.00	32.00	32.00	32.00
1935	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	28.50	29.00
1934	26.00	26.00	26.00	27.80	29.00	29.00	27.40	27.00	27.00	27.00	27.00	27.00
1933	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1932	27.50	27.00	27.00	27.00	27.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1931	30.00	30.00	30.00	30.00	30.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00
1929	33.00	34.25	34.00	34.50	36.00	35.75	35.00	35.00	35.00	35.00	35.00	34.75

Open-Hearth and Bessemer Sheet Bars, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00
1940	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1939	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1938	37.00	37.00	37.00	37.00	37.00	37.00	34.00	34.00	34.00	34.00	34.00	34.00
1937	34.00	34.00	36.40	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00
1936	30.00	30.00	28.50	28.00	28.00	28.00	30.00	30.00	30.00	32.00	32.00	32.00
1935	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	29.50	30.00
1934	26.00	26.00	26.00	28.40	30.00	30.00	28.40	28.00	28.00	28.00	28.00	28.00
1933	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1932	27.50	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1931	30.00	30.00	30.00	30.00	29.75	29.00	29.00	29.00	29.00	29.00	29.00	29.00
1929	34.00	33.25	35.00	35.25	26.00	35.75	35.00	35.00	35.00	35.00	35.00	34.75

Wire Rods, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00
1940*	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
1939	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
1938	47.00	47.00	47.00	47.00	47.00	47.00	43.00	43.00	43.00	43.00	43.00	43.00
1937	43.00	43.00	46.20	47.00	47.00	47.00	47.00	47.00	47.00	47.00	47.00	47.00
1936	40.00	40.00	40.00	40.00	40.00	38.80	38.00	38.00	38.00	40.00	40.00	40.00
1935	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.50	40.00
1934	36.00	36.00	36.00	37.20	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00
1933	36.20	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	36.00
1932	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00
1931	35.00	35.00	36.00	36.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
1929	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	40.00	40.00

*Per 100 lbs.

BEEHIVE COKE

Net Ton

Foundry, Spot, Connellsville

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$6.00	$6.00	$6.00	$6.00	$6.30	$7.25	$7.25	$7.25	$7.25	$7.25	$7.25	$7.25
1940	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	6.00
1939	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.80	6.00	5.75
1938	5.25	5.25	5.25	5.25	5.25	5.05	5.00	5.00	5.00	5.00	5.00	5.05
1937	4.25	4.25	4.25	5.05	5.30	5.30	5.30	5.30	5.30	5.30	5.30	5.30
1936	4.00	4.20	4.10	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
1935	4.60	4.60	4.60	4.60	4.60	4.60	4.25	4.00	4.00	4.35	4.35	4.25
1934	4.25	4.25	4.25	4.55	4.60	4.60	4.60	4.60	4.60	4.60	4.60	4.60
1933	2.50	2.50	2.25	2.25	2.25	2.40	2.80	3.10	3.15	3.85	4.25	4.25
1932	3.25	3.25	3.25	3.25	3.15	3.00	3.00	2.90	2.75	2.75	2.65	2.50
1931	3.30	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25
1929	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.55	3.50

Furnace, Spot, Connellsville

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$5.50	$5.50	$5.50	$5.50	$5.70	$6.25	$6.25	$6.25	$6.25	$6.25	$6.25	$6.25
1940	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	5.00
1939	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	4.75	5.00	5.00
1938	4.25	4.25	4.25	4.25	4.25	3.90	3.75	3.75	3.75	3.75	3.75	3.75
1937	4.00	4.00	4.05	4.50	4.85	4.65	4.50	4.50	4.45	4.40	4.37	4.37
1936	3.50	3.50	3.50	3.50	3.50	3.50	3.45	3.45	3.90	4.00	4.00	4.00
1935	3.60	3.60	3.60	3.60	3.60	3.50	3.30	3.25	3.25	3.55	3.55	3.65
1934	3.60	3.50	3.35	3.30	3.45	3.60	3.60	3.60	3.60	3.60	3.60	3.60
1933	1.75	1.75	1.75	1.75	1.75	1.80	2.40	2.75	2.50	3.25	3.75	3.75
1932	2.25	2.25	2.25	2.25	2.15	2.00	2.00	2.00	2.00	2.00	1.80	1.80
1931	2.50	2.50	2.50	2.50	2.45	2.40	2.40	2.40	2.40	2.40	2.35	2.30
1929	2.75	2.90	2.95	2.75	2.75	2.75	2.75	2.65	2.65	2.65	2.65	2.65

STEEL AND IRON SCRAP

Per Gross Ton, Delivered

Heavy Melting Steel, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$22.15	$20.75	$20.75	$20.20	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00
1940	18.15	17.75	17.05	16.45	18.00	19.90	19.55	18.75	20.15	21.30	21.50	22.50
1939	15.60	15.65	15.75	15.50	14.55	15.00	15.55	16.15	18.75	23.15	21.85	18.50
1938	14.05	14.15	13.65	12.79	11.55	11.40	13.75	15.20	15.25	14.95	14.85	15.75
1937	18.95	19.65	22.40	22.75	19.00	18.40	19.40	21.85	20.40	17.15	14.10	12.75
1936	14.50	14.80	15.75	15.75	14.75	13.80	14.15	16.00	17.75	18.15	17.25	18.50
1935	13.50	13.25	12.40	11.70	12.00	12.25	12.30	13.25	13.45	13.65	13.65	14.05
1934	13.05	13.90	14.35	14.15	12.80	11.90	12.00	11.45	10.75	10.50	11.15	12.95
1933	8.35	8.25	8.75	9.90	11.65	11.65	12.70	13.75	13.00	12.45	11.65	11.50
1932	10.25	10.25	10.25	10.20	9.75	9.00	8.35	8.55	9.50	9.50	9.15	8.75
1931	13.00	12.75	12.90	12.50	11.25	10.30	10.50	10.70	10.80	10.45	10.25	10.25
1929	19.00	18.60	18.50	18.60	17.83	18.30	18.45	18.90	18.45	17.30	16.30	15.10

Heavy Melting Steel, Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$20.15	$19.25	$19.45	$18.80	$18.75	$18.75	$18.75	$18.74	$18.75	$18.75	$18.75	$18.75
1940	16.45	15.75	15.50	15.25	16.65	18.00	17.45	18.15	19.30	19.85	20.25	20.60
1939	13.75	14.00	14.25	13.35	12.75	13.38	13.55	13.75	16.05	19.25	17.45	16.25
1938	13.25	12.15	12.20	11.45	11.05	10.25	12.05	14.00	13.60	13.05	14.20	13.75
1937	18.25	19.50	20.90	20.75	17.55	16.00	17.75	19.75	17.85	13.95	12.55	11.50
1936	13.40	14.30	14.75	14.35	13.05	12.75	13.25	15.45	16.15	16.25	16.50	16.50
1935	12.15	11.65	10.45	10.05	10.20	10.25	10.40	12.35	12.55	12.50	13.20	13.75
1934	10.44	10.87	12.00	11.75	11.13	9.75	9.55	9.25	8.65	8.75	9.00	10.15
1933	5.25	5.25	5.25	6.55	8.70	8.80	10.45	10.40	9.95	9.35	8.35	8.75
1932	7.25	6.80	6.75	6.55	6.20	5.60	4.50	5.40	5.75	6.00	5.75	5.50
1931	10.00	9.85	9.75	9.60	8.65	8.50	8.50	8.25	7.95	7.75	7.65	7.50
1929	16.50	16.00	15.55	15.95	15.45	14.95	14.75	15.05	15.05	14.45	13.05	12.50

Heavy Melting Steel, Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$20.56	$20.00	$20.00	$19.06	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75
1940	18.15	17.50	17.15	16.75	17.40	19.65	19.05	19.75	20.70	20.75	20.75	20.75
1939	15.25	15.25	15.37	15.65	15.25	15.44	15.60	16.44	18.95	22.12	20.70	18.85
1938	14.95	14.75	14.44	13.45	12.25	11.85	13.72	14.50	14.25	14.65	14.75	15.20
1937	17.50	18.75	19.75	20.44	18.40	17.03	18.40	19.75	19.22	16.55	14.00	14.00
1936	12.37	13.15	13.46	13.75	12.65	11.70	12.25	13.85	15.37	15.65	14.81	15.63
1935	11.40	11.25	10.60	10.15	10.45	10.45	10.30	11.40	12.20	12.00	12.05	12.25
1934	11.63	11.73	11.70	11.50	11.00	10.40	10.25	9.85	9.60	9.50	9.95	10.85
1933	6.50	6.50	6.50	6.90	9.00	9.50	10.55	12.00	10.70	10.20	9.55	10.50
1932	7.50	7.35	7.35	7.20	6.50	6.25	6.25	6.40	7.25	7.25	7.25	6.50
1931	10.50	10.50	10.50	10.00	9.50	8.75	8.25	8.55	8.75	8.20	7.95	7.50
1929	16.50	16.30	16.25	17.00	16.25	16.25	16.50	16.75	16.37	15.80	15.15	14.50

Compressed Sheets, Detroit (Dealers)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$19.20	$17.90	$17.70	$17.85	$17.85	$17.85	$17.85	$17.85	$17.85	$17.85	$17.85	$17.85
1940	13.90	13.65	13.25	13.75	15.65	17.70	16.60	17.25	17.90	18.40	18.15	18.50
1939	11.95	12.00	12.10	11.50	10.55	11.05	11.95	12.75	14.80	18.25	17.40	14.45
1938	10.50	10.50	9.95	8.45	7.60	7.30	10.20	11.45	11.85	11.65	11.80	11.90
1937	15.75	16.10	18.25	19.15	16.55	15.50	17.00	18.25	17.95	14.15	10.40	10.30
1936	10.45	11.55	12.50	12.10	10.85	10.50	11.05	12.75	14.25	14.40	13.60	13.95
1935	10.00	9.60	7.95	7.75	7.95	8.50	8.75	9.80	10.05	10.05	9.75	9.90
1934	8.50	9.40	10.30	9.70	8.90	7.90	8.00	7.80	7.75	7.50	7.75	9.00
1933	4.00	4.00	4.06	5.15	7.50	7.80	8.85	9.50	8.55	7.35	7.00	7.45
1932	5.55	5.75	5.75	5.70	5.10	4.75	3.75	3.80	5.00	5.50	5.05	4.06
1931	8.92	9.45	9.00	9.00	7.75	6.95	6.95	6.80	6.50	6.15	6.00	6.00
1929	14.65	14.45	14.00	14.00	14.00	13.65	14.00	14.00	14.00	13.40	12.15	11.50

No. 1 Cast, Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$24.25	$24.25	$25.10	$25.10	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00	$23.00
1940	20.75	19.75	19.70	19.70	20.40	21.65	21.50	21.65	22.25	22.50	22.95	23.25
1939	16.75	16.75	16.75	16.50	16.25	16.25	16.35	16.90	19.75	23.50	22.25	20.95
1938	16.25	16.20	15.75	15.30	14.75	14.75	15.85	16.75	16.75	16.75	16.75	16.75
1937	18.85	19.00	20.69	22.50	20.35	18.81	19.55	21.65	20.50	18.95	16.75	16.25
1936	12.75	13.45	17.00	14.88	14.15	13.75	14.31	15.55	16.62	16.65	16.25	17.75
1935	11.60	11.95	11.75	11.55	11.50	11.50	11.50	11.60	12.25	12.25	12.75	12.75
1934	11.50	11.65	12.30	12.50	12.15	12.00	11.25	11.00	11.00	11.00	11.00	12.25
1933	9.00	9.00	9.00	9.10	10.25	10.35	11.20	11.75	12.40	12.00	11.95	12.00
1932	11.20	10.00	10.00	9.50	9.25	9.00	9.00	9.25	9.25	9.00	9.00	9.00
1931	12.80	13.00	13.00	13.00	12.75	12.50	12.50	12.50	12.50	12.50	11.70	11.50
1929	16.75	16.75	16.50	16.50	16.50	16.50	16.50	16.50	16.25	16.25	16.00	16.00

Cast Borings, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$15.40	$15.50	$16.80	$15.90	$15.30	$15.25	$15.25	$15.25	$15.25	$15.25	$15.25	$15.25
1940	12.00	9.65	8.50	8.85	9.65	10.75	11.40	12.50	13.40	14.00	14.25	15.50
1939	8.25	8.25	8.55	8.75	7.35	6.75	8.10	8.95	10.00	12.50	13.80	12.35
1938	7.25	7.25	6.75	6.25	6.25	5.90	7.05	7.75	8.15	8.65	8.50	8.50
1937	14.40	14.00	14.40	14.50	14.10	14.00	14.65	15.20	14.90	12.95	8.75	7.25
1936	8.30	8.75	8.70	8.75	8.75	8.05	7.90	10.90	11.95	11.65	11.50	13.00
1935	6.50	6.90	7.00	6.10	6.00	6.65	6.50	7.00	7.30	8.15	8.15	8.00
1934	7.30	8.15	8.70	8.50	8.25	7.75	7.25	7.05	6.25	5.50	5.90	6.00
1933	5.70	5.70	5.55	5.70	6.90	7.65	9.05	9.80	9.05	8.30	7.60	7.50
1932	6.75	6.50	6.75	6.65	6.40	5.50	4.75	5.15	5.95	6.25	6.50	5.90
1931	7.70	7.70	7.65	7.60	7.50	7.75	7.05	7.50	7.45	7.50	7.10	6.80
1929	12.55	12.25	11.50	12.15	11.55	11.85	12.10	12.50	12.40	11.80	11.15	10.75

Machine Shop Turnings, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$15.25	$15.25	$15.70	$15.65	$15.50	$15.50	$15.50	$15.50	$15.50	$15.50	$15.50	$15.50
1940	12.50	10.90	10.45	10.10	11.65	13.50	14.10	14.00	15.40	15.50	15.50	16.25
1939	9.50	9.50	9.65	9.75	8.50	8.25	9.15	10.15	11.65	14.60	14.75	13.15
1938	8.00	8.85	7.75	7.05	6.75	6.30	7.85	9.25	9.45	9.65	9.70	10.00
1937	14.15	14.25	15.55	15.25	14.80	14.00	14.05	15.05	14.75	11.75	8.55	7.25
1936	9.75	10.20	10.50	10.50	9.75	9.40	9.50	10.70	12.40	12.45	11.75	12.90
1935	8.95	8.80	7.40	7.40	8.15	8.25	8.15	8.80	9.55	9.70	9.45	9.65
1934	9.05	10.00	10.75	10.15	8.20	7.45	7.50	8.00	7.30	7.00	7.20	8.50
1933	6.25	6.25	6.30	6.75	8.00	8.40	9.35	10.45	9.75	9.30	8.00	8.00
1932	6.95	7.10	7.25	6.75	6.30	5.25	5.00	5.25	5.95	6.00	6.25	6.00
1931	6.00	6.80	7.80	7.30	6.75	6.50	6.70	7.30	7.50	7.20	7.00	7.00
1929	12.50	11.25	10.65	11.05	11.00	11.35	11.85	12.40	12.00	11.40	10.75	10.25

FINISHED STEEL

Per Pound f. o. b.

Steel Bars, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c
1940	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
1939	2.25	2.25	2.25	2.25	2.20	2.15	2.15	2.15	2.15	2.15	2.15	2.15
1938	2.45	2.45	2.45	2.45	2.45	2.45	2.25	2.25	2.25	2.25	2.25	2.25
1937	2.20	2.20	2.40	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45
1936	1.85	1.85	1.85	1.85	1.85	1.85	1.95	1.95	1.95	2.05	2.05	2.05
1935	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.85	1.85	1.85	1.85
1934	1.75	1.75	1.75	1.85	1.90	1.90	1.80	1.80	1.80	1.80	1.80	1.80
1933	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.75	1.75	1.75
1932	1.55	1.50	1.55	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1931	1.65	1.65	1.65	1.65	1.65	1.65	1.60	1.60	1.60	1.60	1.60	1.60
1929	1.90	1.90	1.90	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.90

Tank Plates, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1940	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1939	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1938	2.25	2.25	2.25	2.25	2.25	2.25	2.10	2.10	2.10	2.10	2.10	2.10
1937	2.05	2.05	2.20	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
1936	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1935	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
1934	1.70	1.70	1.70	1.80	1.85	1.85	1.80	1.80	1.80	1.80	1.80	1.80
1933	1.60	1.60	1.60	1.55	1.50	1.55	1.60	1.60	1.60	1.70	1.70	1.70
1932	1.55	1.50	1.55	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1931	1.65	1.65	1.65	1.65	1.65	1.65	1.60	1.60	1.60	1.60	1.60	1.50
1929	1.90	1.90	1.90	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90

Structural Shapes, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1940	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1939	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1938	2.25	2.25	2.25	2.25	2.25	2.25	2.10	2.10	2.10	2.10	2.10	2.10
1937	2.05	2.05	2.20	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
1936	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1935	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
1934	1.70	1.70	1.70	1.80	1.85	1.85	1.80	1.80	1.80	1.80	1.80	1.80
1933	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.70
1932	1.55	1.50	1.55	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1931	1.60	1.60	1.60	1.65	1.65	1.65	1.60	1.60	1.60	1.60	1.60	1.50
1929	1.90	1.90	1.90	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90

Hot Rolled Sheets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1940	2.10	2.10	2.10	1.98	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1939	2.15	2.15	2.15	2.15	2.05	2.00	2.00	2.00	2.00	2.00	2.00	2.10
1938	2.40	2.40	2.40	2.40	2.40	2.40	*2.15	2.15	2.15	2.10	2.15	2.15
1937	2.15	2.15	2.35	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
1936	1.85	1.85	1.85	1.85	1.85	1.85	1.95	1.95	1.95	1.95	1.95	2.10
1935	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
1934	1.75	1.75	1.75	1.90	2.00	2.00	1.85	1.85	1.85	1.85	1.85	1.85
1933	1.65	1.60	1.55	1.55	1.55	1.65	1.75	1.65	1.70	1.75	1.75	1.75
1932	1.75	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
1931	1.90	1.90	1.90	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
1929	2.10	2.10	2.10	2.15	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.15

*Succeeded No. 10 blue annealed June 24, 1938.

Cold Rolled Sheets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c
1940	3.05	3.05	3.05	2.93	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
1939	3.20	3.20	3.20	3.20	3.10	3.05	3.05	3.05	3.05	3.05	3.05	3.05
1938	3.55	3.45	3.45	3.45	3.45	3.45	3.20	3.20	3.20	3.20	3.20	3.20
1937	3.25	3.25	3.50	3.55	2.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55
1936	2.95	2.95	2.95	2.95	2.95	2.95	3.05	3.05	3.05	3.05	3.05	3.05
1935	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95
1934	2.75	2.75	2.75	3.05	3.15	3.10	2.95	2.95	2.95	2.95	2.95	2.95
1933	2.40	2.45	2.45	2.55	2.55	2.55	2.55	2.60	2.75	2.75	2.75	2.75
1932	2.90	2.85	2.85	2.80	2.80	2.80	2.80	2.70	2.75	2.65	2.60	2.60
1931	3.30	3.30	3.30	3.15	3.05	3.10	3.10	3.10	3.10	3.10	3.10	3.00
1929	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.05	4.00	4.00

No. 24 Galvanized Sheets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c
1940	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1939	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1938	3.80	3.80	3.80	3.80	3.80	3.75	3.50	3.50	3.50	3.50	3.50	3.50
1937	3.40	3.40	3.70	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80
1936	3.10	3.10	3.10	3.10	3.10	3.10	3.20	3.20	3.20	3.20	3.20	3.35
1935	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10
1934	2.85	2.85	2.85	3.10	3.25	3.25	3.10	3.10	3.10	3.10	3.10	3.10
1933	2.70	2.50	2.60	2.65	2.70	2.70	2.85	2.85	2.85	2.85	2.85	2.85
1932	2.80	2.75	2.80	2.85	2.85	2.85	2.85	2.80	2.75	2.80	2.85	2.85
1931	2.90	2.90	2.90	2.85	2.80	2.80	2.90	2.90	2.90	2.90	2.90	2.90
1929	3.60	3.60	3.60	3.65	3.70	3.65	3.60	3.55	3.50	3.50	3.45	3.40

Cold Finished Steel Bars, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.62c	2.65c	2.65c
1940	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65
1939	2.70	2.70	2.70	2.70	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65
1938	2.90	2.90	2.90	2.90	2.90	2.90	2 70	2.70	2.70	2.70	2.70	2.70
1937	2.55	2.55	2.85	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
1936	2.10	2.10	2.10	2.10	2.10	2.15	2.25	2.25	2.25	2.35	2.35	2.55
1935	2.10	2.10	2.10	2.00	1.95	1.95	1.95	1.95	1.95	1.95	1.95	2.05
1934	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1933	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.95	1.95	1.95	1.95	1.95
1932	2.00	2.00	1.90	1.90	1.75	1.70	1.70	1.70	1.70	1.70	1.70	1.70
1931	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.00
1929	2.20	2.20	2.25	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.20	2.20

Tin Plate, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00
1940	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1939	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1938	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	*5.10	5.00
1937	4.85	4.85	4.85	5.25	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35
1936	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
1935	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
1934	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
1933	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.65	4.65	4.65	5.25
1932	4.75	4 75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.50	4.25
1931	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.75	4.75	4.75
1929	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35

*Refund of 25 cents per box on all contracts Jan. 1 to Nov. 10, 1938.

Cold Rolled Strip, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c
1940	2.80	2.80	2.80	2.68	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
1939	2.95	2.95	2.95	2.95	2.85	2.80	2.80	2.80	2.80	2.80	2.80	2.80
1938	3.20	3.20	3.20	3.20	3.20	3.10	2.95	2.95	2.95	2.90	2.90	2.90
1937	2.85	2.85	3.15	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
1936	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.80
1935	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1934	2.40	2.40	2.40	2.65	2.80	2.80	2.60	2.60	2.60	2.60	2.60	2.60
1933	1.95	1.80	1.85	1.80	1.90	2.00	2.25	2.25	2.30	2.40	2.40	2.40
1932	2.00	1.90	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.95	2.00	2.00
1931	2.25	2.25	2.25	2.20	2.15	2.15	2.15	2.15	2.15	2.15	2.10	2.05
1929	2.85	2.85	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75

Hot Rolled Strip, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1940	2.10	2.10	2.10	1.98	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1939	2.15	2.15	2.15	2.15	2.05	2.00	2.00	2.00	2.00	2.00	2.00	2.10
1938	2.40	2.40	2.40	2.40	2.40	2.40	2.15	2.15	2.15	2.10	2.10	2.10
1937	2.15	2.15	2.35	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
1936	1.85	1.85	1.85	1.85	1.85	1.85	1.95	1.95	1.95	1.95	1.95	2.10
1935	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
1934	1.75	1.75	1.75	1.95	2.00	2.00	1.85	1.85	1.85	1.85	1.85	1.85
1933	1.45	1.45	1.45	1.45	1.55	1.55	1.60	1.65	1.70	1.75	1.75	1.75
1932	1.40	1.40	1.40	1.45	1.50	1.50	1.45	1.45	1.45	1.45	1.45	1.45
1931	1.55	1.55	1.55	1.55	1.50	1.50	1.55	1.55	1.55	1.55	1.50	1.45
1929	1.80	1.85	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90

Plain Wire, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c
1940	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1939	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1938	2.90	2.90	2.90	2.90	2.90	2.90	2.60	2.60	2.60	2.60	2.60	2.60
1937	2.60	2.60	2.85	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
1936	2.30	2.30	2.30	2.40	2.40	2.40	2.40	2.40	2.40	2.50	2.50	2.60
1935	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
1934	2.20	2.20	2.20	2.25	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
1933	2.15	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.20
1932	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20
1931	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20
1929	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.45	2.40	2.40	2.40

Wire Nails, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
1941	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c
1940	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55
1939	2.45	2.45	2.45	2.45	2.45	2.45	2.40	2.40	2.40	2.50	2.55	2.55
1938	2.75	2.75	2.75	2.75	2.75	2.75	2.45	2.45	2.45	2.45	2.45	2.45
1937	2.25	2.25	2.70	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75
1936	2.40	2.40	2.15	2.10	2.10	2.10	2.10	2.10	1.95	2.05	2.05	2.20
1935	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.55	2.40	2.40	2.40	2.40
1934	2.35	2.35	2.35	2.50	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1933	1.90	1.85	1.85	1.85	1.85	1.85	2.05	2.10	2.10	2.10	2.10	2.35
1932	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
1931	1.90	1.90	1.90	1.90	1.90	1.80	1.85	1.90	1.90	1.90	1.90	1.90
1929	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.50	2.45	2.40	2.40

Rail Steel Bars, Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c
1940	2.15	2.15	2.10	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.10	2.10
1939	2.10	2.10	2.10	2.10	2.05	2.00	2.00	2.00	2.03	2.15	2.15	2.15
1938	2.35	2.35	2.35	2.35	2.35	2.35	2.15	2.10	2.10	2.10	2.10	2.10
1937	2.10	2.10	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
1936	1.75	1.75	1.75	1.75	1.75	1.75	1.85	1.85	1.85	1.95	1.95	1.95
1935	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
1934	1.70	1.70	1.70	1.79	1.85	1.85	1.77	1.75	1.75	1.75	1.75	1.75
1933	1.50	1.45	1.45	1.45	1.50	1.50	1.50	1.50	1.60	1.70	1.70	1.70
1932	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
1931	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.50	1.50	1.50
1929	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.95	1.90

Structural Rivets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	3.40c	3.40c	3.40c	3.40c	3.50c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c
1940	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
1939	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
1938	3.60	3.60	3.60	3.60	3.60	3.60	3.40	3.40	3.40	3.40	3.40	3.40
1937	3.25	3.25	3.45	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60
1936	2.90	2.90	2.90	2.90	2.90	2.95	3.05	3.05	3.05	3.05	3.05	3.20
1935	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
1934	2.75	2.75	2.75	2.90	3.00	3.00	2.95	2.90	2.90	2.90	2.90	2.90
1933	2.25	2.25	2.25	2.25	2.25	2.35	2.50	2.50	2.50	2.60	2.75	2.75
1932	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
1931	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.55	2.30	2.25	2.25
1929	2.85	2.90	2.95	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10

Cast Iron Pipe, Birmingham

6-Inch and larger, per net ton

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1941	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00
1940	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00
1939	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	45.00	45.00	45.00
1938	46.00	46.00	46.00	46.00	46.00	46.00	42.60	42.00	42.00	42.00	42.00	42.00
1937	41.00	41.00	44.75	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00
1936	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	41.00
1935	38.00	38.00	38.00	38.50	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00
1934	36.00	36.00	36.00	36.00	36.00	36.40	38.00	38.00	38.00	38.00	38.00	38.00
1933	32.00	32.00	32.00	32.00	32.00	34.25	35.00	35.00	35.00	35.00	35.25	36.00
1932	33.00	32.20	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00
1931	37.00	37.00	36.50	35.00	35.00	35.00	35.00	35.00	33.00	33.00	33.00	33.00
1929	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00

Steel, Iron and Scrap Price Composites

Compiled by STEEL

Finished Steel Price Composite

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yr's Av.
1941	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73
1940	56.73	56.73	56.73	56.08	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.68
1939	57.36	57.36	57.36	57.36	56.74	56.36	56.29	56.27	56.27	56.49	56.54	56.73	56.76
1938	62.18	62.05	62.00	62.00	62.00	61.45	58.00	58.00	58.00	57.78	57.52	57.36	59.86
1937	55.18	55.18	60.14	61.95	62.18	62.18	62.18	62.18	62.18	62.18	62.18	62.18	60.82

Average of industry-wide prices on sheet, strip, bars, plates, shapes, wire, nails, tin plate, standard and line pipe.

Semifinished Steel Price Composite

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yr's Av.
1941	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00
1940	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
1939	36.60	36.60	36.60	36.60	36.60	36.60	36.60	36.60	36.60	36.60	36.60	36.15	36.56
1938	40.00	40.00	40.00	40.00	40.00	40.00	36.60	36.60	36.60	36.60	36.60	36.60	38.30
1937	36.20	36.20	39.24	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	39.30

Average of industry-wide prices on billets, slabs, sheet bars, skelp and wire rods.

Steelmaking Pig Iron Price Composite

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yr's Av.
1941	$22.80	$22.95	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05
1940	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.32	22.07
1939	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	21.05	22.05	22.05	22.05	20.63
1938	22.92	22.92	22.92	23.02	23.05	23.05	19.05	19.05	19.05	20.05	20.05	20.05	21.26
1937	19.96	19.98	22.10	22.84	22.84	22.84	22.84	22.84	22.84	22.84	22.84	22.90	22.31

Average of basic pig iron prices at Bethlehem, Birmingham, Buffalo, Chicago, Cleveland, Neville Island, Granite City and Youngstown.

Steelmaking Scrap Price Composite

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yr's Av.
1941	$21.00	$20.05	$20.15	$19.17	$19.17	$19.17	$19.17	$19.17	$19.17	$19.17	$19.17	$19.17	$19.50
1940	17.60	17.10	16.55	16.19	17.30	19.15	18.65	18.80	20.20	20.70	20.80	21.40	18.70
1939	14.90	14.95	15.15	14.80	14.10	14.60	14.90	15.35	18.15	21.55	20.15	17.95	16.40
1938	14.10	13.70	13.40	12.60	11.60	11.10	13.30	14.55	14.35	14.15	14.70	14.90	13.55
1937	18.45	19.40	21.25	21.40	18.50	17.05	18.70	20.50	19.15	16.00	13.50	13.40	18.10

Average of No. 1 heavy melting steel scrap at Pittsburgh, Chicago and eastern Pennsylvania.

Raw Materials Output, Consumption Increase to Record Levels in 1941

(*Concluded from Page* 269)

sels continued on after close of the regular season. Last ore vessel in operation left the head of the lakes with a cargo Dec. 8.

Estimates of shipments from mines this year indicate the total lake movement will be greater than in 1941. Five ore carriers are reported being built for Pittsburgh Steamship Co., Great Lakes shipping subsidiary of United States Steel Corp. Two, it is said, will be commissioned and ready for operation before the season is over this year and the other three are to be placed in service early in 1943.

Maritime Commission, in a long-range program to increase the lake ore fleet, has contracted for 16 more vessels, to be completed as early as is practicable. Fulfillment of the proposed program would add about 11,000,000 tons to the ore vessels' combined annual capacity STEEL reports.

52,000,000 Tons Scrap Consumed

Domestic scrap consumption in the year increased to a new high of about 52,000,000 gross tons, up nearly 25 per cent from 41,687,000 tons in 1940, the previous peak, and compared with 26,800,000 tons in 1917, record year of the first World war. Indications are the total would have been considerably higher were ample supplies of scrap available. Reports in December were that the proportion of scrap in steelmaking had declined, due to shortage, and percentage of pig iron was higher, as much as 51.5 per cent iron in open hearths. STEEL points out that no increase in scrap supply is anticipated in the near future, and many expect only higher prices will serve to bring out supplies currently unavailable.

Scrap exports in the first nine months last year were 621,700 gross tons, against 2,678,759 tons in the first ten months of 1940, and 3,098,369 tons in the ten months in 1939. Great Britain was virtually the sole purchaser, although small tonnages went also to Canada. Imports of scrap into the United States totaled 42,716 tons in the first eight months, compared with 1726 tons in the first ten months in 1940 and 27,388 tons through October, 1939.

Strong activity, marked by brief interruptions, featured coke production throughout the entire year. Estimated production for the year, based on ten months' known output, was 65,000,000 net tons. This compared with 57,072,134 tons in 1940, and 59,883,000 tons in 1929, the previous peak year. By-product output is estimated at 58,500,000 tons, or 90 per cent of the total, against about 6,500,000 tons beehive.

Combined coke capacity at the year's end was more than 72,000,000 net tons and comprised 62,388,633 tons by-product and 9,684,980 tons beehive. At the end of 1940, total capacity was reported at slightly more than 69,000,000 tons. New facilities completed in 1941 comprised more than 2,855,000 tons capacity, and ovens totaling more than 1,425,000 net tons were reported in process of construction.

Bituminous coal loadings from lower lake ports by Dec. 1 aggregated 48,536,093 net tons, against 45,997,022 tons in the corresponding period in 1940, and surpassed any year for which records have been kept.

Lake shipments of limestone in 1941 are estimated at 17,500,000 net tons, against 15,500,000 tons in the previous year, and 12,208,000 tons in 1939. These figures include all limestone transported on the lakes, not solely that for steelmaking the magazine concludes.

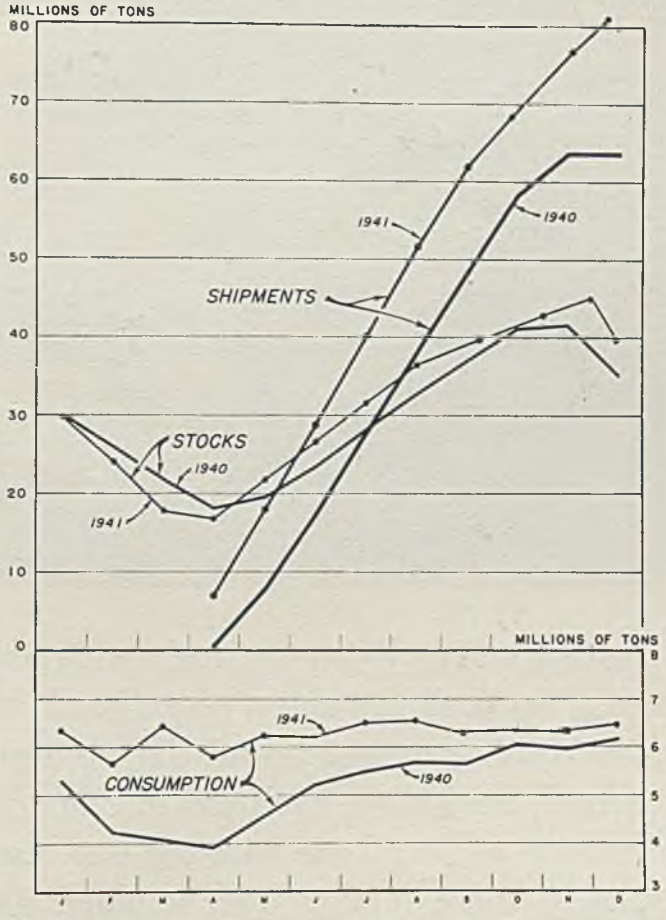
Ore, Scrap, Coke, Limestone Statistics

(Unit: 1000 tons)

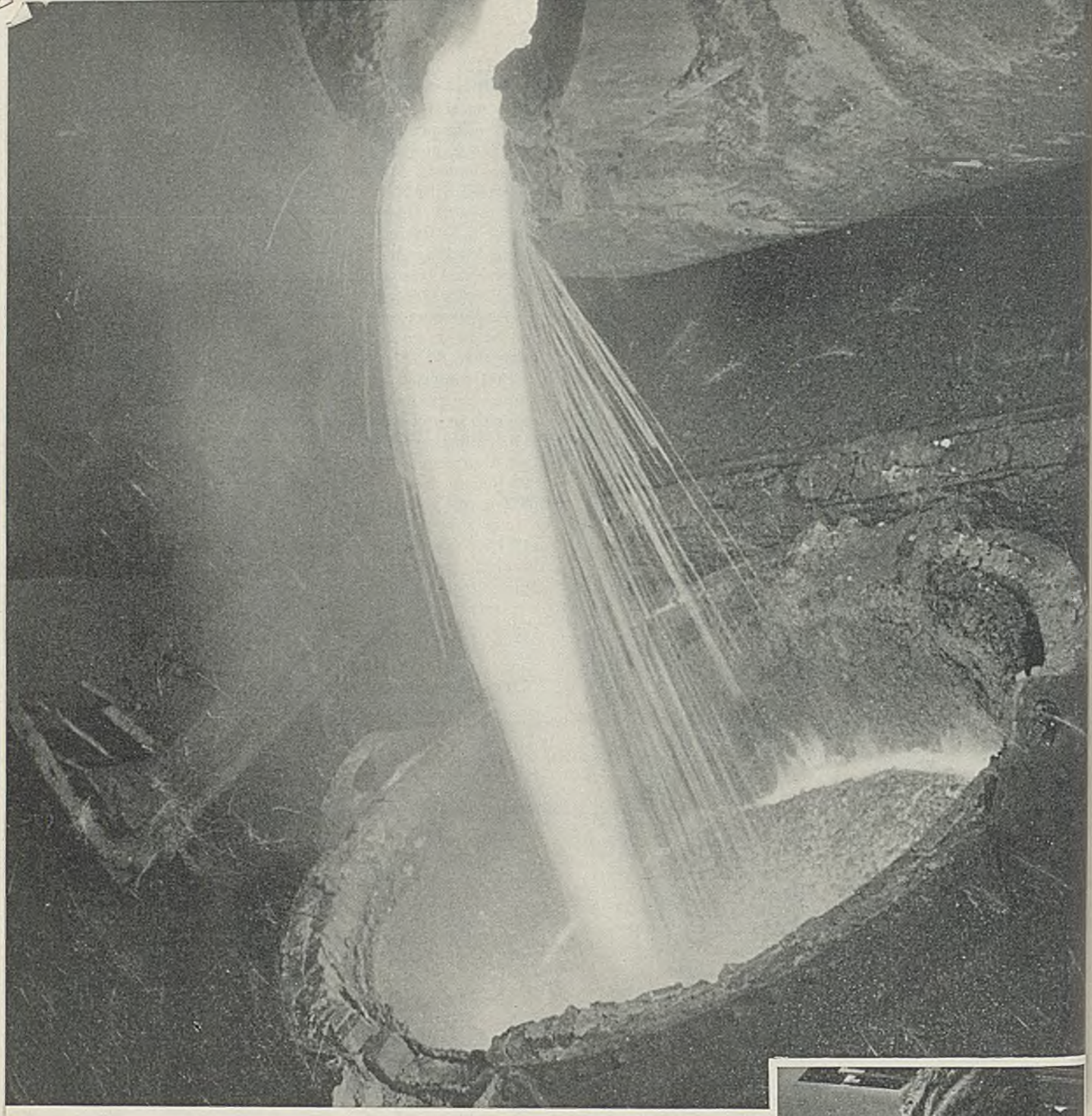
	Lake Superior Ore Consumed	Shipped by vessel	Domestic scrap consumption	Total coke production	Lake shipments limestone
1941	75,000*	80,116	52,000*	65,000*	17,500*
1940	62,500	63,713	41,687	57,072	15,500
1939	44,361	45,072	32,434	44,425	12,208
1938	25,703	19,263	21,528	32,496	8,240
1937	53,996	62,598	38,006	52,375	14,429
1936	44,639	44,822	36,358	46,275	12,080
1935	30,789	28,362	26,415	35,141	9,082
1934	22,113	22,249	18,800	31,821	7,392
1933	18,115	21,623	17,400	27,589	6,664
1932	10,283	3,567	10,000	21,788	3,928
1931	24,114	23,467	18,300	33,728	7,208
1930	45,192	46,582	26,600	48,302	12,432
1929	63,645	65,196	37,600	59,883	16,269

Iron ore and scrap, gross tons; coke and limestone, net tons.
*Estimated.

Ore Movement, Stocks, Consumption



■ Figures in the chart, prepared by the Commerce Department's Bureau of Foreign and Domestic Commerce from statistics compiled by the Lake Superior Iron Ore Association, are presented in gross tons



Steel comes first... Without Steel there can be no plowing, no harvesting, no food; no ships, no railroad cars—no transportation; no clothing; no guns, no shells, no airplanes. Steel is the raw material. Steel is the tools and machinery of production... The demands of war have widened our research—and given us results of value now as well as when the victory is won.

ALAN WOOD STEEL COMPANY

MAIN OFFICE AND MILLS: CONSHOHOCKEN, PA. District Offices and Representatives: Philadelphia, New York, Boston, Atlanta, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, St. Paul, New Orleans, Pittsburgh, Roanoke, Sanford, N.C., St. Louis, Los Angeles, San Francisco, Seattle, Montreal.

Steel Greets New Year

Ready for All Demands

Bends every effort to supply war needs.
Scrap shortage main obstacle to production.
Civilian needs subordinated to defense.

MARKET IN TABLOID ★

Demand
War needs dominate.

Prices
Hold at ceilings.

Production
Up 4 points to 97½ per cent.

■ ENTERING the new year the steel industry is prepared to bear its share, a heavy one, in providing the nation with sufficient material to meet the challenge of war. Steel is the basis of warfare and leaders of the industry insist demands will be met.

Capacity is deemed sufficient to provide as much tonnage as can be fashioned into implements of war, with additional production to be brought into action as these needs increase. After the interruption of the Christmas holiday output rebounded at once to 97½ per cent of capacity and will be held as close to maximum as possible in view of conditions in the raw materials market.

Above all the spirit of the industry is all that can be desired, from management to labor, and nothing will be allowed to interfere with production of the maximum tonnage other factors will allow. Manufacturers of civilian goods are taking their share of the burden by accepting reductions in output to the end that needed war supplies may be increased.

In the usual rebound from Christmas week the national operating rate rose 4 points to 97½ per cent, the same as the week preceding Christmas. Pittsburgh advanced 6 points to 96 per cent, Youngstown 9 points to 92, Eastern Pennsylvania 6 points to 89, Cincinnati 9 points to 91½, Detroit 4 points to 90, New England 15 points to 100, Cleveland 3½ points to 94 and Wheeling 1 point to 91. Chicago dropped 3 points to 101½ per cent, unable to maintain the record production of the preceding week. Buffalo was unchanged at 81½ per cent, St. Louis at 76 and Birmingham at 90.

Widening application of allocations in the steel market tends to a more orderly distribution and the industry definitely will be able to produce a vastly greater quantity of steel in 1942 than can be fabricated and otherwise consumed for war purposes. In addition, enough steel will be available for other essential uses, such as freight car building, as well as tonnage for export to countries dependent on the United States for their main supply. As a result of the supreme effort of 1941 much demand already met will not recur, such as for munitions plants.

Railroads have a large number of freight cars on order which builders have been unable to deliver, because of slow supply of steel, but in spite of this the carriers plan to buy 115,000 cars and 974 locomotives in 1942. During 1941 they received delivery on 80,000 cars and about 600 locomotives and at the end of the year had about 75,000 cars and 600 locomotives on order. To build the projected program will put a heavy burden on steel suppliers, but it will be distributed through the year rather than imposed in a short period.

While full effect of the new schedule of scrap prices by OPA has not been felt and some uncertainties remain general opinion is that it will help bring out larger tonnages. Placing all open-hearth grades on one level has the effect of increasing price on the inferior grades. It allows payment at full price for material not grading as No. 1 heavy melting steel, in effect making legal what has been done previously in overgrading. On the other hand, by allowing no higher price to be paid for any scrap melted in open hearths the new rules prevent buying of low phos and similar scrap for that purpose. Previously scrap which should have gone to legitimate users of low phos has been diverted to open hearths. Some time will be required to work out the effects of the radical change in making prices on cast scrap. In some cases the change will cause a marked alteration in distribution, aiding one area at the expense of another.

Forecasts as to the probable supply of steelmaking raw materials for 1942 indicate there will not be enough to keep all steelmaking facilities fully engaged, at least during the early months, until additional blast furnace capacity provides pig iron to fill the gap.

Canadian ships carried 705,572 gross tons of American iron ore to American ports during the 1941 season, 90 cargoes in 21 ships attaining this total. Special permission granted early in the season allowed this participation. In addition to this assistance Canada contributed 449,492 tons of ore from Canadian mines during the season.

Continuance of price ceilings into the new year holds all composites at the level of the past few months. Finished steel composite is $56.73; semifinished steel $36; steelmaking pig iron $23.05; steelmaking scrap $19.17.

COMPOSITE MARKET AVERAGES

	Jan. 3	Dec. 27	Dec. 20	One Month Ago Dec., 1941	Three Months Ago Oct., 1941	One Year Ago Jan., 1941	Five Years Ago Jan., 1937
Finished Steel	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$55.18
Semifinished Steel	36.00	36.00	36.00	36.00	36.00	36.00	36.20
Steelmaking Pig Iron	23.05	23.05	23.05	23.05	23.05	22.80	19.96
Steelmaking Scrap	19.17	19.17	19.17	19.17	19.17	21.00	18.45

Finished Steel Composite:—Average of industry-wide prices on sheets, strip, bars, plates, shapes, wire, nails, tin plate, standard and line pipe. Semifinished Steel Composite:—Average of industry-wide prices on billets, slabs, sheet bars, skelp and wire rods. Steelmaking Pig Iron Composite:—Average of basic pig iron prices at Bethlehem, Birmingham, Buffalo, Chicago, Cleveland, Neville Island, Granite City and Youngstown. Steelworks Scrap Composite:—Average of No. 1 heavy melting steel prices at Pittsburgh, Chicago and eastern Pennsylvania.

COMPARISON OF PRICES

Representative Market Figures for Current Week; Average for Last Month, Three Months and One Year Ago

Finished Material

	Jan. 3, 1942	Dec. 1941	Oct. 1941	Jan. 1941
Steel bars, Pittsburgh	2.15c	2.15c	2.15c	2.15c
Steel bars, Chicago	2.15	2.15	2.15	2.15
Steel bars, Philadelphia	2.47	2.47	2.47	2.47
Shapes, Pittsburgh	2.10	2.10	2.10	2.10
Shapes, Philadelphia	2.215	2.215	2.215	2.215
Shapes, Chicago	2.10	2.10	2.10	2.10
Plates, Pittsburgh	2.10	2.10	2.10	2.10
Plates, Philadelphia	2.15	2.15	2.15	2.17
Plates, Chicago	2.10	2.10	2.10	2.10
Sheets, hot-rolled, Pittsburgh	2.10	2.10	2.10	2.10
Sheets, cold-rolled, Pittsburgh	3.05	3.05	3.05	3.05
Sheets, No. 24 galv., Pittsburgh	3.50	3.50	3.50	3.50
Sheets, hot-rolled, Gary	2.10	2.10	2.10	2.10
Sheets, cold-rolled, Gary	3.05	3.05	3.05	3.05
Sheets, No. 24 galv. Gary	3.50	3.50	3.50	3.50
Bright bess., basic wire, Pitts.	2.60	2.60	2.60	2.60
Tin plate, per base box, Pitts.	$5.00	$5.00	$5.00	$5.00
Wire nails, Pittsburgh	2.55	2.55	2.55	2.55

Semifinished Material

Sheet bars, Pittsburgh, Chicago	$34.00	$34.00	$34.00	$34.00
Slabs, Pittsburgh, Chicago	34.00	34.00	34.00	34.00
Rerolling billets, Pittsburgh	54.00	34.00	34.00	34.00
Wire rods No. 5 to ⅜-inch, Pitts.	2.60	2.00	2.00	2.00

Pig Iron

	Jan. 3, 1942	Dec. 1941	Oct. 1941	Jan. 1941
Bessemer, del. Pittsburgh	$25.34	$25.34	$25.34	$25.34
Basic, Valley	23.50	23.50	23.50	23.50
Basic, eastern, del. Philadelphia	25.34	25.34	25.34	25.34
No. 2 fdry., del. Pgh., N.&S. Sides	24.69	24.69	24.69	24.69
No. 2 foundry, Chicago	24.00	24.00	24.00	24.00
Southern No. 2, Birmingham	20.38	20.38	20.38	19.38
Southern No. 2, del. Cincinnati	24.06	24.06	24.06	23.06
No. 2X, del. Phila. (differ. av.)	26.215	26.215	26.215	26.215
Malleable, Valley	24.00	24.00	24.00	24.00
Malleable, Chicago	24.00	24.00	24.00	24.00
Lake Sup., charcoal, del. Chicago	31.34	31.34	31.34	30.34
Gray forge, del. Pittsburgh	24.19	24.19	24.19	24.17
Ferromanganese, del. Pittsburgh	125.33	125.33	125.33	125.33

Scrap

Heavy melting steel, Pitts.	$20.00	$20.00	$20.00	$22.15
Heavy melt. steel, No. 2, E. Pa.	17.75	17.87	17.75	19.31
Heavy melting steel, Chicago	18.75	18.75	18.75	20.15
Rails for rolling, Chicago	22.25	22.25	22.25	24.40
No. 1 cast, Chicago	20.00	21.33	21.50	19.35

Coke

Connellsville, furnace, ovens	$6.25	$6.25	$6.25	$5.50
Connellsville, foundry, ovens	7.25	7.25	7.25	6.00
Chicago, by-product fdry., del.	12.25	12.25	12.25	11.75

STEEL, IRON, RAW MATERIAL, FUEL AND METALS PRICES

Except when otherwise designated, prices are base, f.o.b. mill, carloads.

Sheets, Strip

Hot-Rolled Sheets

Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Buffalo, Youngstown, Sparrows Point, Middletown, base 2.10c
Granite City base 2.20c
Detroit, del. 2.20c
Pacific ports 2.65c

Cold-Rolled Sheets

Pittsburgh, Chicago, Cleveland, Gary, Buffalo, Youngstown, Middletown, B'ham., base .. 3.05c
Granite City, base 3.15c
Detroit, del. 3.15c
Other Mich. pts., del. ... 2.25c
Pacific ports 3.70c

Galvanized Sheets, No. 24

Pittsburgh, Gary, Birmingham, Buffalo, Youngstown, Sparrows Point, Middletown, base 3.50c
Granite City, base 3.60c
Pacific ports 4.05c

Corrugated Galv. Sheets

Pittsburgh, Chicago, Gary, Birmingham, Buffalo, Youngstown, Sparrows Point, Middletown, 29 gage, per square 3.31c
Granite City 3.38c
Pacific Ports 3.73c

Culvert Sheets

Pittsburgh, Gary, Birmingham, 16-gage, not corrugated, copper steel 3.60c, copper iron 3.90c, pure iron 3.95c.
Pittsburgh, 24-gage, zinc-coated, hot-dipped, heat-treated 4.25c.
Granite City, copper steel 3.70c, copper iron 4.00c, pure iron 4.05c.
Pacific ports, copper steel 4.25c, copper iron 4.55c, pure iron 4.60c.

Enameling Sheets

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Middletown, 10 gage, base 2.75c
Granite City, base 2.85c
Pacific ports 3.40c
Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Middletown, 20 gage, base 3.35c
Granite City, base 3.45c
Pacific ports 4.00c

Electrical Sheets, No. 24

	Pittsburgh Base	Pacific Ports	Granite City
Field gr.	3.20c	3.95c	3.30c
Armat.	3.55c	4.30c	3.65c
Elect.	4.05c	4.80c	4.15c

Motor	4.95c	5.70c	5.05c
Dynamo	5.65c	6.40c	5.75c
Transformer			
72	6.15c	6.90c	.....
65	7.15c	7.90c	.....
58	7.65c	8.40c	.....
52	8.45c	9.20c	.....

Hot-Rolled Strip

Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Youngstown, Middletown, base, 1 ton and over, 12 inches wide and less 2.10c
Detroit, del. 2.20c
Other Mich. pts. del. ... 2.25c
Pacific ports 2.75c

Cold-Rolled Strip

Pittsburgh, Cleveland, Youngstown, 0.25 carbon and less 2.80c
Chicago, base 2.90c
Worcester, base 3.00c
Detroit, del. 2.90c
Other Mich. pts. del. ... 2.95c

Commodity C.R. Strip

Pittsburgh, Cleveland, Youngstown, base 3 tons and over 2.95c
Worcester, base 3.35c
Detroit, del. 3.05c
Other Mich. pts. del. ... 3.10c

Cold-Finished Spring Steel

Pittsburgh, Cleveland, base; add 20 cents for Worcester.
.26-.50 Carbon 2.80c
.51-.75 Carbon 4.30c
.76-1.00 Carbon 6.15c
Over 1.00 Carbon 8.35c

Stainless Steels

Base, Cents per lb.—f.o.b. Pittsburgh

TYPE	BARS	PLATES	SHEETS	H. R. STRIP	C. R. STRIP
302	24.00c	27.00c	34.00c	21.50c	28.00c
303	26.00	29.00	36.00	27.00	33.00
304	25.00	29.00	36.00	23.50	30.00
304-20% clad	.....	*18.00	19.00	.....	.....
308	29.00	34.00	41.00	28.50	35.00
309	36.00	40.00	47.00	37.00	47.00
310	49.00	52.00	53.00	48.75	56.00
311	49.00	52.00	53.00	48.75	56.00
312	36.00	40.00	49.00	.....	.....
316	40.00	44.00	48.00	40.00	48.00
317	50.00	54.00	58.00	50.00	58.00
347	33.00	38.00	45.00	33.00	42.00
403	21.50	24.50	29.50	21.25	27.00
410	18.50	21.50	26.50	17.00	22.00
416	19.00	22.00	27.00	18.25	23.50
420	24.00	28.50	33.50	23.75	36.50
430	19.00	22.00	29.00	17.50	22.50
430F	19.50	22.50	29.50	18.75	24.50
431	19.00	22.00	29.00	17.50	22.50
442	22.50	25.50	32.50	24.00	32.00
446	27.50	30.50	36.50	35.00	52.00
501	8.00	13.00	15.75	12.00	17.00
502	9.00	13.00	16.75	13.00	18.00

*Includes annealing and pickling.

Tin, Terne Plate

Tin Plate

Pittsburgh, Chicago, Gary, 100-lb. base box $5.00
Granite City $5.10
Pacific ports, f.o.b. $5.75½

Tin Mill Black Plate

Pittsburgh, Chicago, Gary, base 29 gage and lighter 3.05c
Granite City 3.15c
Pacific ports, boxed 4.27½c

Long Ternes

Pittsburgh, Gary No. 24 unassorted 3.80c
Pacific Ports 4.55c

Special Coated Mfg. Ternes

Pittsburgh, Chicago, Gary, 100-base box $4.30
Granite City $4.40

Roofing Ternes

Pittsburgh base per package 112 sheets 20 x 28 in., coating I.C.

8-lb.	$12.00	25-lb.	$16.00
15-lb.	14.00	30-lb.	17.25
20-lb.	15.00	40-lb.	19.50

Steel Plate

Pittsburgh, Chicago, Gary, Cleveland, Birmingham,

Youngstown 2.10c
Coatesville, Sparrows Point, Claymont 2.10c
Gulf ports 2.45c
Pacific Coast ports 2.65c

Steel Floor Plates

Pittsburgh 3.35c
Chicago 3.35c
Gulf ports 3.70c
Pacific Coast ports 4.00c

Structural Shapes

Pittsburgh, Bethlehem, Chicago, Buffalo, Birmingham 2.10c
St. Louis, del. 2.34c
Pacific Coast ports 2.75c

Bars

Hot-Rolled Carbon Bars

Pittsburgh, Chicago, Gary, Cleve., Birm., base 20 tons one size 2.15c
Detroit, del. 2.25c
New York, del. 2.49c
Duluth, base 2.25c
Philadelphia, del. 2.47c
Gulf ports, dock 2.50c
All-rail, Houston from Birmingham 2.59c
Pac. ports, dock 2.80c
All-rail from Chicago.. 3.25c

Rail Steel Bars

Pitts., Chicago, Gary, Cleveland, Birm., base 5 tons 2.15c
Detroit, del. 2.25c
New York, del. 2.49c
Philadelphia, del. 2.47c
Gulf ports, dock 2.50c
All-rail, Houston from Birmingham 2.59c
Pac. ports, dock 2.80c
All-rail from Chicago.. 3.25c

Hot-Rolled Alloy Bars

Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem, base 20 tons one size 2.70c
Detroit 2.80c

Alloy	Diff.	Alloy	Diff.
S.A.E.		S.A.E.	
2000.....	0.35	3100.....	0.70
2100.....	0.75	3200.....	1.35
2300.....	1.70	3300.....	3.80
2500.....	2.55	3400.....	3.20

4100 .15-25 Mo. 0.55
4600 0.20-0.30 Mo.; 1.50-2.00 Ni. 1.20
5100 80-1.10 Cr. 0.45
5100 Spr. flats 0.15
6100 Bars 1.20
6100 Spr. flats 0.85
Carb., Van. 0.85
9200 Spr. flats 0.15
9200 Spr. rounds, squares 0.40
T 1300, Mn, mean 1.51-2.00 0.10
Do., carbon under 0.20 max. 0.35

Cold-Finished Carbon Bars

Pitts., Chicago, Gary, Cleveland, Buffalo, base 20,000-39,999 lbs. 2.65c
Detroit 2.70c

Cold-Finished Alloy Bars

Pitts., Chicago, Gary, Cleveland, Buffalo, base 3.35c
Detroit 3.45c
Galveston, add $0.25; Pacific Coast, $0.50.

Turned, Ground Shafting

Pitts., Chicago, Gary, Cleveland, Buffalo, base (not including turning, grinding, polishing extras) 2.65c
Detroit 2.70c

Reinforcing Bars (*New Billet*)

Pitts., Chicago, Gary, Cleveland, Birm., Sparrows Point, Buffalo, Youngstown, base 2.15c
Gulf ports, dock 2.50c
All-rail, Houston from Birmingham 2.59c
Pacific ports, dock 2.80c
Detroit, del. 2.25c

Reinforcing Bars (*Rail Steel*)

Pitts., Chicago, Gary Cleveland, Birm., base. 2.15c
Gulf ports, dock 2.50c
All-rail, Houston from Birmingham 2.59c
Pacific ports, dock 2.80c
Detroit, del. 2.25c

Iron Bars

Philadelphia, com. del. 3.06-3.50c
Pittsburgh, muck bar ... 5.00c
Pittsburgh, staybolt 8.00c
Terre Haute com., f.o.b. mill 2.15c

Wire Products

Pitts.-Cleve.-Chicago-Birm. base per 100 lb. keg in carloads

Standard and cement coated wire nails $2.55

(Per Pound)

Polished fence staples .. 2.55c
Annealed fence wire 3.05c
Galv. fence wire 3.40c
Woven wire fencing (base C. L. column) 67
Single loop bale ties, (base C. L. column) .. 59
Galv. barbed wire, 80-rod spools, base column .. 70
Twisted barbless wire, column 70

To Manufacturing Trade

Base, Pitts. - Cleve. - Chicago Birmingham (except spring wire at Birmingham)

Bright bess., basic wire. 2.60c
Galvanized wire 2.60c
Spring wire 3.20c
Worcester, Mass., 10c higher on bright basic and spring wire.

Cut Nails

Carload, Pittsburgh, keg. $3.85

Alloy Plates (Hot)

Pitts., Chicago, Coatesville, Pa. 3.50c

Rails, Fastenings

(Gross Tons)

Standard rails, mill $40.00
Relay rails, base, 35 lbs. and over.....28.00-30.00
Light rails, billet qual., Pitts., Chicago, Bham. $40.00
Do., rerolling quality.. 39.00

Cents per pound

Angle bars, billet, mills. 2.70c
Do., axle steel 2.35c
Spikes, R. R. base 3.00c
Track bolts, base 4.75c
Do., heat treated 5.00c
Car axles forged, Pitts., Chicago, Birmingham.. 3.15c
Tie plates, base 2.15c
Base, light rails 25 to 60 lbs., 20 lbs., up $2; 16 lbs. up $4; 12 lbs. up $8; 8 lbs. up $10. Base railroad spikes 200 kegs or more; base plates 20 tons.

Bolts and Nuts

F.o.b. Pittsburgh, Cleveland, Birmingham, Chicago. Discounts for carloads additional 5%, full containers, add 10%.

Carriage and Machine

½ x 6 and smaller.....65½ off
Do., ⅛ and ⅜ x 6-in, and shorter .....63½ off
Do., ¾ to 1 x 6-in. and shorter .....61 off
1⅛ and larger, all lengths 59 off
All diameters, over 6-in. long .....59 off
Tire bolts .....50 off

Stove Bolts

In packages with nuts separate 71-10 off; with nuts attached 71 off; bulk 80 off on 15,000 of 3-inch and shorter, or 5000 over 3-in.

Step bolts .....56 off
Plow bolts .....65 off

Nuts

Semifinished hex.	U.S.S.	S.A.E.
½-inch and less.	62	64
⅝-1-inch	59	60
1⅛-1½-inch	57	58
1⅝ and larger..	56	

Hexagon Cap Screws

Upset 1-in., smaller .....60 off

Square Head Set Screws

Upset, 1-in., smaller ... 68 off
Headless, ¼-in., larger ..55 off
No. 10, smaller .....60 off

Piling

Pitts., Chgo., Buffalo .. 2.40c

Rivets, Washers

F.o.b. Pitts., Cleve., Chgo., Bham.

Structural 3.75c
½-inch and under .....65-5 off
Wrought washers, Pitts., Chi., Phila., to jobbers and large nut, bolt mfrs. l.c.l .....$3.50 off

Tool Steels

Pittsburgh, Bethlehem, Syracuse, base, cents per lb.

Carb. Reg. 14.00 Oil-hardening .. 24.00
Carb. Ext. 18.00
Carb. Spec. 22.00 High car.-chr. 43.00

High Speed Tool Steels

Tung.	Chr.	Van.	Moly.	
18.00	4	1	...	67.00
18.00	4	2	1	77.00
18.00	4	3	1	87.00
1.50	4	1	8.50	54.00
....	4	2	8	54.00
5.50	4	1.50	4	57.50
5.50	4.50	4	4.50	70.00

Boiler Tubes

Carloads minimum wall seamless steel boiler tubes, cut-lengths 4 to 24 feet; f.o.b. Pittsburgh, base price per 100 feet subject to usual extras.

Lap Welded

Sizes	Gage	Steel	Charcoal Iron
1½"O.D.	13	$ 9.72	$23.71
1¾"O.D.	13	11.06	22.93
2" O.D.	13	12.38	19.35
2¼"O.D.	13	13.79	21.68
2¼"O.D.	12	15.16	....
2½"O.D.	12	16.58	26.57
2¾"O.D.	12	17.54	29.00
3" O.D.	12	18.35	31.36
3½"O.D.	11	23.15	39.81
4" O.D.	10	28.66	49.90
5" O.D.	9	44.25	73.93
6" O.D.	7	68.14	....

Seamless

Sizes	Gage	Hot Rolled	Cold Drawn
1" O.D.	13	$ 7.82	$ 9.01
1¼"O.D.	13	9.26	10.67
1½"O.D.	13	10.23	11.79
1¾"O.D.	13	11.64	13.42
2" O.D.	13	13.04	15.03
2¼"O.D.	13	14.54	16.76
2¼"O.D.	12	16.01	18.45
2½"O.D.	12	17.54	20.21
2¾"O.D.	12	18.59	21.42
3" O.D.	12	19.50	22.48
3½"O.D.	11	24.62	28.37
4" O.D.	10	30.54	35.20
4½"O.D.	10	37.35	43.04
5" O.D.	9	46.87	54.01
6" O.D.	7	71.96	82.93

Welded Iron, Steel, Pipe

Base discounts on steel pipe, Pitts., Lorain, O., to consumers in carloads. Gary, Ind., 2 points less on lap weld, 1 point less on butt weld. Chicago delivery 2½ and 1½ less, respectively. Wrought pipe, Pittsburgh base.

Butt Weld

In.	Blk.	Galv.
Steel		
½	63½	51
¾	66½	55
1—3	68½	57½
Iron		
¾	30	10
1—1¼	34	16
1½	38	18½
2	37½	18

Lap Weld

Steel		
2	61	49½
2½—3	64	52½
3½—6	66	54½
7 and 8	65	52½
Iron		
2	30½	12
2½—3½	31½	14½
4	33½	18
4½—8	32½	17
9—12	28½	12

Line Pipe, Plain Ends

Steel	
1 to 3, butt weld.....	68½
2, lap weld	63
2½ to 3, lap weld	66
3½ to 6, lap weld	65
7 and 8, lap weld	64

Seamless, 3 pts. lower discount.

Cast Iron Pipe

Class B Pipe—Per Net Ton

6-in., & over, Birm..$45.00-46.00
4-in., Birmingham .. 48.00-49.00
4-in., Chicago 56.80-57.80
6-in. & over, Chicago 53.80-54.80
6-in. & over, east fdy. 49.00
Do., 4-in. 52.00
Class A Pipe $3 over Class B
Stnd. fittgs., Birm., base $100.00.

Semifinished Steel

Rerolling Billets, Slabs

(Gross Tons)

Pittsburgh, Chicago, Gary, Cleve., Buffalo, Youngs., Birm., Sparrows Point..$34.00
Duluth (billets) 36.00
Detroit, delivered 36.00

Forging Quality Billets

Pitts., Chi., Gary, Cleve., Young., Buffalo, Birm.. 40.00
Duluth 42.00

Sheet Bars

Pitts., Cleveland, Young., Sparrows Point, Buffalo, Canton, Chicago. 34.00
Detroit, delivered 36.00

Wire Rods

Pitts., Cleveland, Chicago, Birmingham No. 5 to ⅜-inch incl. (per 100 lbs.) $2.00
Do., over ⅜ to 41/64-in. incl. 2.15
Worcester up $0.10, Galveston up $0.25 and Pacific Coast up $0.50 on water shipments.

Skelp

Pitts., Chi., Youngstown, Coatesville, Sparrows Pt. 1.90c

Shell Steel

Pittsburgh, Chicago, base, 1000 tons of one size, open hearth

3-12-inch $52.00
12-18-inch 54.00
18-inch and over 56.00

Coke

Price Per Net Ton

Beehive Ovens

Connellsville, fur... $6.00- 6.25
Connellsville, fdry.. 7.00- 7.50
Connell. prem. fdry. 7.25- 7.60
New River fdry. .. 8.00- 8.25
Wise county fdry. .. 7.50
Wise county fur. .. 6.50

By-Product Foundry

Newark, N. J., del... 12.60-13.05
Chicago, outside del. 11.50
Chicago, delivered .. 12.25
Terre Haute, del. .. 12.00
Milwaukee, ovens... 12.25
New England, del. .. 13.75
St. Louis, del. 12.02
Birmingham, ovens. 8.50
Indianapolis, del. .. 12.00
Cincinnati, del. 11.75
Cleveland, del. 12.30
Buffalo, del. 12.50
Detroit, del. 12.25
Philadelphia, del. .. 12.38

Coke By-Products

Spot, gal., freight allowed east of Omaha

Pure and 90% benzol.... 14.00c
Toluol, two degree 27.00c
Solvent naphtha 26.00c
Industrial xylol 26.00c

Per lb. f.o.b. Frankford and St. Louis

Phenol (less than 1000 lbs.) 14.75
Do. (1000 lbs. or over) 13.00

Eastern Plants, per lb.

Naphthalene flakes, balls, bbls. to jobbers 7.00c

Per ton, bulk, f.o.b. port

Sulphate of ammonia $29.00

Pig Iron

No. 2 foundry is 1.75-2.25 sil.; 50c diff. for each 0.25 sil. above 2.25 sil. Gross tons.

Basing Points:	No. 2 Fdry.	Malleable	Basic	Bessemer
Bethlehem, Pa.	$25.00	$25.50	$24.50	$26.00
Birmingham, Ala.§	20.38	.....	19.38	25.00
Birdsboro, Pa.	25.00	25.50	24.50	26.00
Buffalo	24.00	24.50	23.00	25.00
Chicago	24.00	24.00	23.50	24.50
Cleveland	24.00	24.00	23.50	24.50
Detroit	24.00	24.00	23.50	24.50
Duluth	24.50	24.50	.....	25.00
Erie, Pa.	24.00	24.50	23.50	25.00
Everett, Mass.	25.00	25.50	24.50	26.00
Granite City, Ill.	24.00	24.00	23.50	24.50
Hamilton, O.	24.00	24.00	23.50	.....
Neville Island, Pa.	24.00	24.00	23.50	24.50
Provo, Utah	22.00	.....	.....	.....
Sharpsville, Pa.	$24.00–24.50	24.00–24.50	23.50–24.50	24.50–25.00
Sparrow's Point, Md.	25.00	.....	24.50	.....
Swedeland, Pa.	25.00	25.50	24.50	26.00
Toledo, O.	24.00	24.00	23.50	24.50
Youngstown, O.	$24.00–24.50	24.00–24.50	23.50–24.50	24.50–25.00
Delivered from Basing Points:				
Akron, O., from Cleveland	25.39	25.39	24.89	25.89
Baltimore from Birmingham†	25.61	.....	25.11	.....
Boston from Birmingham†	25.12	.....	.....	.....
Boston from Everett, Mass.	25.50	26.00	25.00	26.50
Boston from Buffalo	25.50	26.00	25.00	26.50
Brooklyn, N. Y., from Bethlehem	27.50	28.00	.....	.....
Canton, O. from Cleveland	25.39	25.39	24.89	25.89
Chicago from Birmingham	†24.22	.....	.....	.....
Cincinnati from Hamilton, O.	24.44	25.11	24.61	.....
Cincinnati from Birmingham†	24.06	.....	23.06	.....
Cleveland from Birmingham†	24.12	.....	23.12	.....
Mansfield, O., from Toledo, O.	25.94	25.94	25.44	.....
Milwaukee from Chicago	25.10	25.10	24.60	25.60
Muskegon, Mich., from Chicago, Toledo or Detroit	27.19	27.19	.....	.....
Newark, N. J., from Birmingham†	26.15	.....	.....	.....
Newark, N. J., from Bethlehem	26.53	27.03	.....	.....
Philadelphia from Birmingham†	25.46	.....	24.96	.....
Philadelphia from Swedeland, Pa.	25.84	26.34	25.34	.....

Pittsburgh dist.: Add to Neville Island base, North and South Sides, 69c; McKees Rocks, 55c; Lawrenceville, Homestead, McKeesport, Ambridge, Monaca, Aliquippa, 84c; Monessen, Monongahela City, $1.07; Oakmont, Verona, $1.11; Brackenridge, $1.24.

§Subject to 38 cents deduction for 0.70 per cent phosphorus or higher.

	No. 2 Fdry.	Malleable	Basic	Bessemer
Saginaw, Mich., from Detroit	26.31	26.31	25.81	26.81
St. Louis, northern	24.50	24.50	24.00	.....
St. Louis from Birmingham	†24.50	.....	23.62	.....
St. Paul from Duluth	26.63	26.63	.....	27.13

†Over 0.70 phos.

Low Phos.

Basing Points: Birdsboro and Steelton, Pa., and Buffalo, N. Y., $29.50, base; $30.74 delivered Philadelphia.

Gray Forge		Charcoal	
Valley furnace	$23.50	Lake Superior fur.	$28.00
Pitts. dist. fur.	23.50	do., del. Chicago	31.34
		Lyles, Tenn., high phos.	28.50

Silvery

Jackson county, O., base, 6.00 to 6.50 per cent $29.50. Add 50 cents for each additional 0.25 per cent of silicon. Buffalo base $1.25 higher.

Bessemer Ferrosilicon†

Jackson county, O., base; Prices are the same as for silveries, plus $1 a ton.

Manganese differentials in silvery iron and ferrosilicon not to exceed 50 cents per 0.50 per cent manganese in excess of 1 per cent.

Refractories

Per 1000 f.o.b. Works, Net Prices

Fire Clay Brick

Super Quality

Pa., Mo., Ky.	$64.60

First Quality

Pa., Ill., Md., Mo., Ky.	51.30
Alabama, Georgia	51.30
New Jersey	56.00

Second Quality

Pa., Ill., Ky., Md., Mo.	46.55
Georgia, Alabama	38.00
New Jersey	49.00

Ohio

First quality	43.00
Intermediate	36.10
Second quality	36.00

Malleable Bung Brick

All bases	$59.85

Silica Brick

Pennsylvania	$51.30
Joliet, E. Chicago	58.90
Birmingham, Ala.	51.30

Ladle Brick

(Pa., O., W. Va., Mo.)

Dry press	$31.00
Wire cut	29.00

Magnesite

Domestic dead-burned grains, net ton f.o.b. Chewelah, Wash., net ton, bulk	22.00
net ton, bags	26.00

Basic Brick

Net ton, f.o.b. Baltimore, Plymouth Meeting, Chester, Pa.

Chrome brick	$54.00
Chem. bonded chrome	54.00
Magnesite brick	76.00
Chem. bonded magnesite	65.00

Fluorspar

Washed gravel, duty pd., tide, net ton	nominal
Washed gravel, f.o.b. Ill., Ky., net ton, carloads, all rail	$23.00
Do., barge	23.00
No. 2 lump	23.00

Ferroalloy Prices

Ferromanganese, 78-82%,

Carlots, duty pd., seab'd.	$120.00
Carlots, del. Pittsburgh	125.33
Carlots, f.o.b. So. f'ces	140.00

Add $10 for ton, $13.50 for less ton, $18 for less than 200-lb. lots.

Spiegeleisen, 19-21%, gross ton, Palmerton $36.00

Manganese Briquets, Contract carloads, bulk freight allowed, per lb.

	5.50c
Packed	5.75c
Ton lots	6.00c
Less-ton lots	6.25c
Less 200-lb. lots	6.50c

Spot ¼c higher.

Manganese Electro, 99.9+%, less car lots 42.00c

Chromium Metal, per lb. contained chromium

	Contract	Spot
98% Cr. ton lots	80.00c	85.00c
88% Cr. ton lots	79.00c	84.00c

Ferrocolumbium, 50-60% f.o.b. Niagara Falls, per lb. contained Cb on contract $2.25

Less-ton lots	2.30

(Spot 10c higher)

Chromium Briquets, per lb., freight allowed

	Contract	Spot
Carlots	8.25c	8.50c
Packed	8.50c	8.75c
Ton lots	8.75c	9.00c
Less-ton lots	9.00c	9.25c
Less 200 lbs.	9.25c	9.50c

Ferrochrome, 66-70%, freight allowed, 4-6% carbon, per pound contained (chrome)

Carloads	13.00c
Ton lots	13.75c
Less-ton lots	14.00c
Less than 200-lb. lots	14.25c

67-72%, low carbon, cts. per pound:

	Car loads	Ton lots	Less ton	Less 200 lbs.
2% C.	19.50	20.25	20.75	21.00
1% C.	20.50	21.25	21.75	22.00
0.20% C.	21.50	22.25	22.75	23.00
0.10% C.	22.50	23.25	23.75	24.00

Spot is ¼c higher.

Ferromolybdenum, 55-75%, per lb. contained molybdenum, f.o.b. furnace 95.00c

Calcium Molybdate (Molyte), 40-45% Mo., per lb. contracts, f.o.b. producers plant 80.00c

Molybdic Oxide Briquets, 48-52% Mo. per lb. contained, f.o.b. producers plant 30.00c

Molybdenum Oxide, (In 5 and 20 lb. mo. contained cans) 53-63 mo. per lb. contained f.o.b. producers' plants 80.00c

Molybdenum Powder, 99%, f.o.b. York, Pa., per lb. in 200-lb. kegs $2.60

Do., 100-200 lb. lots	2.75
Do., under 100-lb. lots	3.00

Ferrophosphorus, 17-19%, gross ton carloads, f.o.b. sellers' works, $3 unitage, freight equalized with Rockdale, Tenn. for 18% phos.

Contract	$58.50
Spot	62.25

23-26%, $3 unitage, freight equalized with Mt. Pleasant, Tenn., for 24% phos.

Contract	75.00
Spot	80.00

Ferrosilicon, Gross tons, freight allowed, bulk

	Carloads	Ton lots
50%	$ 74.50	$ 87.00
Unitage	1.50	1.75
75%	135.00	151.00
Unitage	1.80	2.00
85%	170.00	188.00
Unitage	2.00	2.20
90-95%	10.25c	11.25c

(Above for contracts; spot ¼c higher)

Silicon Metal, Spot ¼-cent higher (Per Lb., Contracts):

	1% Iron	2% Iron
Carlots	14.50c	13.00c
Ton lots	15.00c	13.50c
Less-ton lots	15.25c	13.75c
Less 200 lbs.	15.50c	14.00c

Silicon Briquets, Contract carloads, bulk freight allowed, per ton $74.50

Packed	80.50
Ton lots	84.50
Less-ton lots, per lb.	4.00c
Less 200-lb. lots	4.25c

Spot ¼c higher on less ton lots; $5 higher on ton lots and over.

Silicomanganese,

Carbon	1½%	2½%
Carloads (contract)	$128.00	$118.00
Ton Lots (contract)	140.50	130.50

Freight allowed spot $5 above contract

Ferrotungsten, (All prices nominal) Carlots, per lb. contained tungsten $1.90

Tungsten Metal Powder, (Prices Nominal) 98-99 per cent, per pound, depending upon quantity $2.60-$2.65

Ferrotitanium, 40-45%, f.o.b. Niagara Falls, per lb. contained in ton lots $1.23

Less ton lots	1.25

20-25%, C. 0.10 max., in ton lots per lb. contained Ti 1.35

Less-ton lots	1.40

(Spot 5c higher)

Ferro-Carbon-Titanium, 15-20% Titanium,

	6-8% C	3-5% C
Carlots, contract, f.o.b. Niagara Falls, freight allowed to destinations east of Mississippi and north of Baltimore and St. Louis	$142.50	$157.50

Ferrovanadium, 35-40%, contract per pound contained vanadium $2.70-$2.80-$2.90

(Spot 10c higher)

Vanadium Pentoxide, Per lb. contained, contracts $1.10

Do., spot	1.15

Zirconium Alloy, 12-15%, carloads, contract, bulk $102.50

Packed	107.50
Ton lots	108.00
Less ton lots	112.50

Spot $5 a ton higher

35-40%, contract, carloads, bulk or package, per lb. alloy 14.00c

Do., ton lots	15.00c
Do., less-ton lots	16.00c

Spot is ¼-cent higher

Alsifer, Per lb., f.o.b. Niagara Falls.

	Contract	Spot
Carlots	7.50c	8.00c
Ton lots	8.00c	8.50c

Simanal, Per lb. of alloy, contracts, freight allowed (approx. 20% Si, 20% Mn, 20% Al)

Carlots	Ton Lots	Ton Lots
10.50c	11.00c	11.50c

WAREHOUSE STEEL PRICES

Base Prices in Cents Per Pound, Delivered Locally, Subject to Prevailing Differentials. As of April 16, 1941

	Soft Bars	Bands	Hoops	Plates ¼-in. & Over	Structural Shapes	Floor Plates	Sheets: Hot Rolled	Sheets: Cold Rolled	Sheets: Galv. No. 24	Cold Rolled Strip	Cold Drawn Bars: Carbon	Cold Drawn Bars: S.A.E. 2300	Cold Drawn Bars: S.A.E. 3100
Boston	3.98	4.06	5.06	3.85	3.85	5.66	3.71	4.48	5.11	3.46	4.13	8.88	7.23
New York (Met.)	3.84	3.96	3.96	3.76	3.75	5.56	3.58	4.60	5.00	3.51	4.09	8.84	7.19
Philadelphia	3.85	3.95	4.45	3.55	3.55	5.25	3.55	4.05	4.65	3.31	4.06	8.56	7.16
Baltimore	3.85	4.00	4.35	3.70	3.70	5.25	3.50	....	5.05	....	4.05	....	....
Norfolk, Va.	4.00	4.10	....	4.05	4.05	5.45	3.85	....	5.40	....	4.15	....	....
Buffalo	3.35	3.82	3.82	3.62	3.40	5.25	3.25	4.30	4.75	3.52	3.75	8.40	6.75
Pittsburgh	3.35	3.60	3.60	3.40	3.40	5.00	3.35	....	4.65	....	3.65	8.40	6.75
Cleveland	3.25	3.50	3.50	3.40	3.58	5.18	3.35	4.05	4.62	3.20	3.75	8.40	6.75
Detroit	3.43	3.43	3.68	3.60	3.65	5.27	3.43	4.30	4.84	3.40	3.80	8.70	7.05
Omaha	4.10	4.20	4.20	4.15	4.15	5.75	3.85	5.32	5.50	....	4.42	....	....
Cincinnati	3.60	3.67	3.67	3.65	3.68	5.28	3.42	4.00	4.92	3.47	4.00	8.75	7.10
Chicago	3.50	3.60	3.60	3.55	3.55	5.15	3.25	4.10	4.85	3.50	3.75	8.40	6.75
Twin Cities	3.75	3.85	3.85	3.80	3.80	5.40	3.50	4.35	5.00	3.83	4.34	9.09	7.44
Milwaukee	3.63	3.53	3.53	3.68	3.68	5.28	3.18	4.23	4.73	3.54	3.88	8.38	6.98
St. Louis	3.64	3.74	3.74	3.69	3.69	5.29	3.39	4.24	4.99	3.61	4.02	8.77	7.12
Kansas City	4.05	4.15	4.15	4.00	4.00	5.60	3.90	....	5.00	....	4.30	....	....
Indianapolis	3.60	3.75	3.75	3.70	3.70	5.30	3.45	....	5.01	....	3.97	....	....
Memphis	3.90	4.10	4.10	3.95	3.95	5.71	3.85	....	5.25	....	4.31	....	....
Chattanooga	3.80	4.00	4.00	3.85	3.85	5.68	3.75	....	4.50	....	4.39	....	....
Tulsa, Okla.	4.44	4.34	4.34	4.49	4.49	6.09	4.19	....	5.54	....	4.69	....	....
Birmingham	3.50	3.70	3.70	3.55	3.55	5.93	3.45	....	4.75	....	4.43	....	....
New Orleans	4.00	4.10	4.10	3.80	3.80	5.75	3.85	....	4.80	5.00	4.60	....	....
Houston, Tex.	3.75	5.95	5.95	3.85	3.85	5.50	4.20	....	5.25	....	6.90	....	....
Seattle	4.00	4.00	5.20	4.00	4.00	5.75	4.00	6.50	5.25	....	5.75	....	....
Portland, Oreg.	4.25	4.50	6.10	4.00	4.00	5.75	3.95	6.50	5.00	....	5.75	....	....
Los Angeles	4.50	5.00	6.80	4.50	4.50	6.75	4.65	6.50	5.85	....	6.60	10.55	9.55
San Francisco	4.10	4.60	6.35	4.25	4.25	5.95	4.25	6.40	6.00	....	6.80	10.80	9.80

	S.A.E. Hot-rolled Bars (Unannealed): 1035-1050	2300 Series	3100 Series	4100 Series	6100 Series
Boston	4.28	7.75	6.05	5.80	7.90
New York (Met.)	4.04	7.60	5.90	5.65	....
Philadelphia	4.10	7.56	5.86	5.61	8.56
Baltimore	4.45	....	....	....	....
Norfolk, Va.	....	....	....	....	....
Buffalo	3.55	7.35	5.65	5.40	7.50
Pittsburgh	3.40	7.45	5.75	5.50	7.60
Cleveland	3.30	7.55	5.85	5.85	7.70
Detroit	3.48	7.67	5.97	5.72	7.19
Cincinnati	3.65	7.69	5.99	5.74	7.84
Chicago	3.70	7.35	5.65	5.40	7.50
Twin Cities	3.95	7.70	6.00	6.09	8.19
Milwaukee	3.83	7.33	5.88	5.63	7.73
St. Louis	3.84	7.72	6.02	5.77	7.87
Seattle	5.85	....	8.00	7.85	8.65
Portland, Oreg.	5.70	8.85	8.00	7.85	8.65
Los Angeles	4.80	9.55	8.55	8.40	9.05
San Francisco	5.60	9.80	8.80	8.65	9.05

BASE QUANTITIES

Soft Bars, Bands, Hoops, Plates, Shapes, Floor Plates, Hot Rolled Sheets and SAE 1035-1050 Bars: Base, 400-1999 pounds; 300-1999 pounds in Los Angeles; 400-39,999 (hoops, 0-299) in San Francisco; 300-4999 pounds in Portland; 300-9999 Seattle; 400-14,999 pounds in Twin Cities; 400-3999 pounds in B'ham., Memphis.

Cold Rolled Sheets: Base, 400-1499 pounds in Chicago, Cincinnati, Cleveland, Detroit, New York, Omaha, Kansas City, St. Louis; 450-3749 in Boston; 500-1499 in Buffalo; 1000-1999 in Philadelphia, Baltimore; 750-4999 in San Francisco; 300-4999 in Portland, Seattle; any quantity in Twin Cities; 300-1999 Los Angeles.

Galvanized Sheets: Base, 150-1499 pounds, New York; 150-1499 in Cleveland, Pittsburgh, Baltimore, Norfolk; 150-1049 in Los Angeles; 300-4999 in Portland, Seattle; 450-3749 in Boston; 500-1499 in Birmingham, Buffalo, Chicago, Cincinnati, Detroit, Indianapolis, Milwaukee, Omaha, St. Louis, Tulsa; 3500 and over in Chattanooga; any quantity in Twin Cities; 750-1500 in Kansas City; 150 and over in Memphis; 25 to 49 bundles in Philadelphia; 750-4999 in San Francisco.

Cold Rolled Strip: No base quantity; extras apply on lots of all size.

Cold Finished Bars: Base, 1500 pounds and over on carbon, except 0-299 in San Francisco, 1000 and over in Portland, Seattle; 1000 pounds and over on alloy, except 0-4999 in San Francisco.

SAE Hot Rolled Alloy Bars: Base, 1000 pounds and over, except 0-4999, San Francisco; 0-1999, Portland, Seattle.

EUROPEAN IRON, STEEL PRICES

Dollars at $4.02½ per Pound Sterling

Export Prices f.o.b. Port of Dispatch—

By Cable or Radio

	BRITISH Gross Tons f.o.b. U.K. Ports	£	s	d
Merchant bars, 3-inch and over	$66.50	16	10	0
Merchant bars, small, under 3-inch, re-rolled	3.60c	20	0	0
Structural shapes	2.95c	15	10	0
Ship plates	2.90c	16	2	6
Boiler plates	3.17c	17	12	6
Sheets, black, 24 gage	4.00c	22	5	0
Sheets, galvanized, corrugated, 24 gage	4.61c	25	12	6
Tin plate, base box, 20 x 14, 108 pounds	$ 6.20	1	10	9

British ferromanganese $120.00 delivered Atlantic seaboard duty-paid.

Domestic Prices Delivered at Works or Furnace—

		£	s	d
Foundry No. 3 Pig Iron, Silicon 2.50—3.00	$25.79	6	8	0(a)
Basic pig iron	24.28	6	0	6(a)
Furnace coke, f.o.t. ovens	7.40	1	16	9
Billets, basic soft, 100-ton lots and over	49.37	12	5	0
Standard rails, 60 lbs. per yard, 500-ton lots & over	2.61c	14	10	6
Merchant bars, rounds and squares, under 3-inch	3.17c	17	12	0††
Shapes	2.77c	15	8	0††
Ship plates	2.91c	16	3	0††
Boiler plates	3.06c	17	0	6††
Sheets, black, 24 gage, 4-ton lots and over	4.10c	22	15	0
Sheets, galvanized 24 gage, corrugated, 4-ton lots & over	4.70c	26	2	6
Plain wire, mild drawn, catch weight coils, 2-ton lots and over	4.28c	23	15	0
Bands and strips, hot-rolled	3.30c	18	7	0

(a) del. Middlesbrough 5s rebate to approved customers. ††Rebate 15s on certain conditions.

Ores

Lake Superior Iron Ore

Gross ton, 51½%

Lower Lake Ports

Old range bessemer	$4.75
Mesabi nonbessemer	4.45
High phosphorus	4.35
Mesabi bessemer	4.60
Old range nonbessemer	4.60

Eastern Local Ore

Cents. unit, del. E. Pa.

Foundry and basic 56-63%, contract.	12.00

Foreign Ore

Cents per unit, c.i.f. Atlantic ports

Manganiferous ore, 45-55% Fe., 6-10% Mang.	Nom.
N. African low phos.	Nom.
Spanish, No. African basic, 50 to 60%	Nom.
Chinese wolframite, net ton, duty pd.	$24.00
Brazil iron ore, 68-69%, ord.	7.50c
Low phos. (.02 max.)	8.00c

F.O.B. Rio Janeiro.

Scheelite, imp.	23.50-24.00
Chrome ore, Indian, 48% gross ton	.....

Manganese Ore

Including war risk but not duty, cents per unit cargo lots

Caucasian, 50-52%	.....
So. African, 50%	68.00-70.00
Indian, 50%	68.00-70.00
Brazilian, 46%	68.00-70.00
Chilean, 47%	68.00-70.00
Cuban, 50-51%, duty free	.....

Molybdenum

Sulphide conc., lb., Mo. cont., mines	$0.75

LOGEMANN
Presses for Sheet Scrap

THE NATION NEEDS YOUR SHEET SCRAP!

In mills, industrial plants and scrap yards, LOGEMANN SCRAP PRESSES are working day and night to prepare sheet scrap for the furnaces.

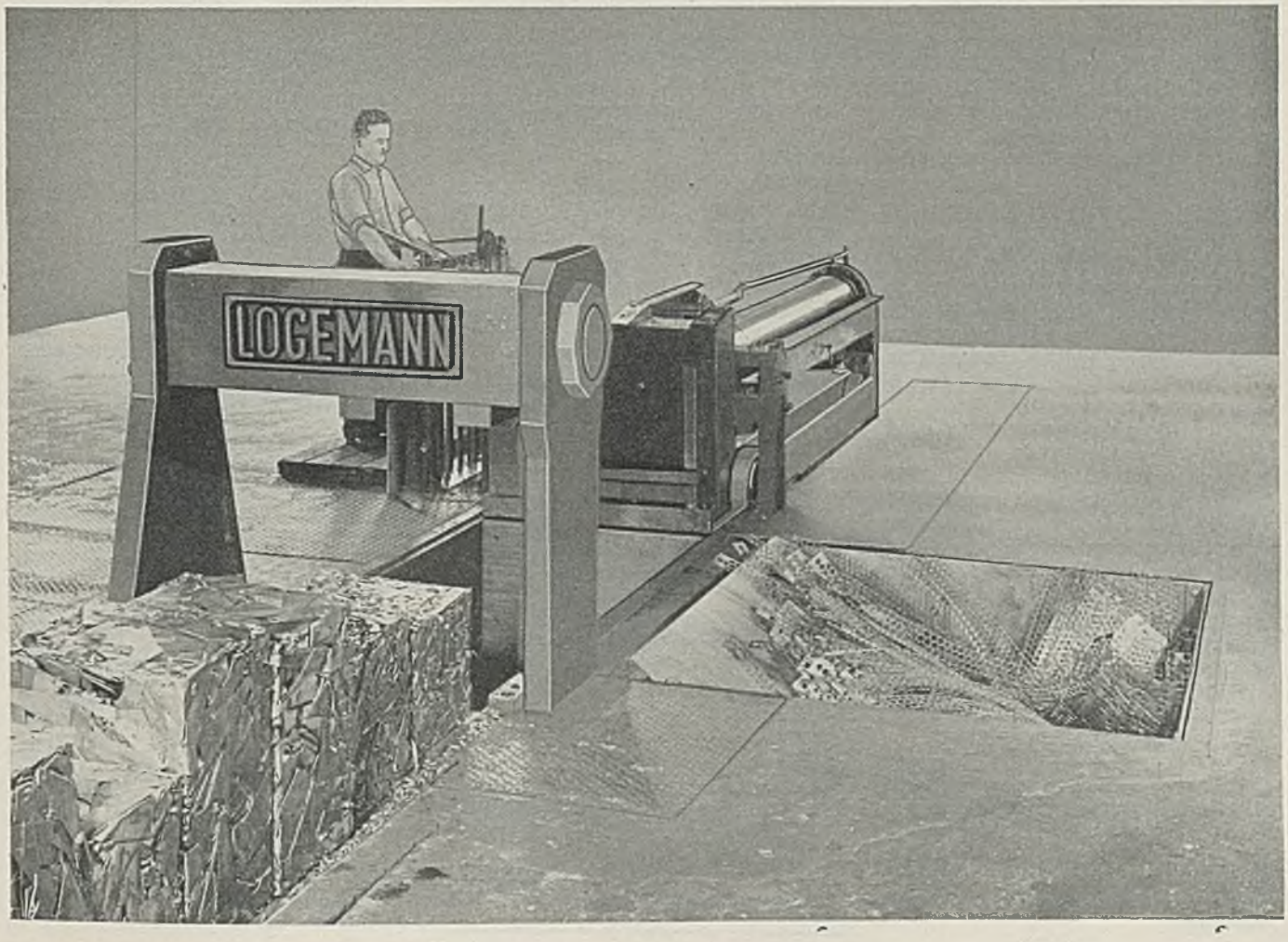
Sheet mills particularly recognize the value of the years of experience and the performance records which back up LOGEMANN designs and workmanship.

The line includes scrap presses *designed for mill service,* presses *designed for automobile plant conditions,* presses *designed for general plant applications.*

Write for details.

The scrap press illustrated operates in one of the largest industrial plants. Compresses scrap from three directions to produce high-density mill size bundles. Built in various capacities.

LOGEMANN BROTHERS COMPANY
3126 W. Burleigh St., Milwaukee, Wisconsin



Steel Planning Group Slated

WASHINGTON

■ STEEL Industry Advisory Committee met here last week with OPM officials, under the chairmanship of Charles E. Adams, new chief of OPM's Iron and Steel Branch. This was the first time in two months that the committee was in Washington.

Two main topics were discussed, including a discussion of the possibility of the expansion of plate production under existing facilities, and the whole question of steel expansion.

It was reported that Mr. Adams, under a proposed Iron and Steel Branch reorganization, intends to set up a new planning division. Also, the allocation of the expansion of the steel industry has been substantially completed by OPM steel experts.

It is the opinion of those in charge of this work that within ten days the last of the steel expansion projects will have been forwarded to the Defense Plant Corp. for financing.

Under the proposed Iron and Steel Branch reorganization, it is reported R. C. Allen, now chief of the raw materials section, will become deputy chief, under Mr. Adams. Robert Ridgeway, who has been scrap expert of the branch, is expected to take Mr. Allen's position. Don Watkins will become chief of the Iron and Steel Branch plant construction unit and will continue as head of the refractories and fluxes unit.

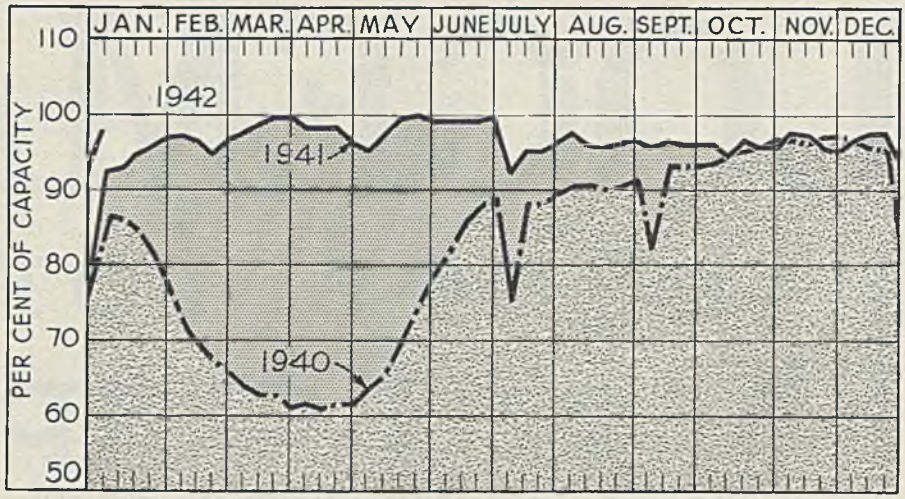
Propose Reduction in Tin Used for Cans

■ Program providing for reduction in the amount of tin used by can manufacturers was proposed to OPM last week by the conservation subcommittee of the industry's advisory committee.

Under the plan the quantity used by can manufacturers would be reduced from 36,950 tons in 1941 to 31,900 tons in 1942 and 28,750 tons in 1943. Amount available for packers' cans would be cut from 28,000 tons in 1941 to 26,400 tons in 1942 and 24,300 tons in 1943. For general line cans the reduction would be to 5500 tons in 1942 and 4450 tons in 1943.

OPM representatives warned the amount of steel allocated to the can manufacturers may be reduced.

■ Factory building costs at year end were 19 per cent above the average of a year ago, according to index compiled by the Austin Co., Cleveland engineers and builders. Further advances during 1942 are anticipated.



PRODUCTION . . . . Up

■ PRODUCTION of open-hearth, bessemer and electric furnace ingots last week rose 4 points to 97.5 per cent. Eight districts advanced, one declined and three were unchanged. A year ago the rate was 92½ per cent; two years ago it was 86½ per cent.

Chicago—Down 3 points from the revised all-time high of 104.5 per cent the previous week. Carnegie-Illinois Steel Corp. was unable to maintain its rate of 109 per cent and Inland Steel Co. cut production slightly because of scrap shortage. All plants operated through New Years.

New England — Increased 15 points to 100 per cent, with no loss for the holiday.

Central eastern seaboard—Better supply of pig iron and scrap caused production to rise 6 points to 89 per cent.

St. Louis—Rate held unchanged at 76 per cent, the holiday having no effect.

Cincinnati—Advanced 9 points to 91½ per cent, nearly recovering the Christmas loss. New Years was not observed.

Buffalo—Unchanged at 81½ per cent, lack of scrap holding production below the rate of summer and fall.

Detroit — Rose 4 points to 90 per cent, the rate prevailing before the Christmas season.

Pittsburgh — Rebounded 6 points to 96 per cent as New Years day caused no interruption.

Wheeling — Gained 1 point to 91 per cent.

Youngstown, O. — Advanced 9 points to 92 per cent with 71 open hearths and three bessemers active.

Birmingham, Ala. — Unchanged at 90 per cent, all plants continuing through the holiday.

Cleveland — With one producer enlarging production the rate rose 3½ points to 94 per cent.

District Steel Rates

Percentage of Ingot Capacity Engaged In Leading Districts

	Week ended Jan. 3	Change	Same week 1941	Same week 1940
Pittsburgh	96	+ 6	95.5	89
Chicago	101.5	— 3	99.5	90.5
Eastern Pa. ...	89	+ 6	95	82
Youngstown ...	92	+ 9	92	85
Wheeling	91	+ 1	96	89
Cleveland	94	+ 3.5	91	85
Buffalo	81.5	None	93	67
Birmingham ..	90	None	100	94
New England ..	100	+15	85	83
Cincinnati	91.5	+ 9	87	91
St. Louis	76	None	87.5	78.5
Detroit	90	+ 4	90	90
Average	97.5	+ 4	92.5	86.5

Carnegie-Illinois Sets New Production Records

■ Plants of Carnegie-Illinois Steel Corp. in the Chicago district in establishing a new all-time record for steel ingot production during Christmas week exceeded their scheduled rate. On the basis of preliminary figures, these plants produced at the rate of 109 per cent of capacity, compared with the anticipated 108 per cent. Gary, Ind., works achieved a new daily record on Christmas Day, pouring 116 heats, against the previous high of 115 on Nov. 29. South Chicago, Ill., works achieved a new weekly record.

Of the company's 22,000 employes, 16,000 gave up their Christmas holiday to maintain the flow of steel to armament makers. It was the first time since 1917, in World War I, that the company's plants had operated on Christmas day.

Sheets, Strip

Sheet & Strip Prices, Page 370

Decline in automobile tonnage as a result of mandatory curtailment in that industry has eased temporarily the supply of sheets. However, sellers are booking first quarter tonnage cautiously and while it appears that most regular customers, whether engaged in war work or not, will receive at least a limited tonnage during January, the outlook for the months beyond is less promising. Some sellers are booking commercial tonnage for February tentatively on the same ratio as for January. They are hoping to be able to do the same in March, but refuse to commit themselves that far ahead on tonnage that does not carry priority.

While such civilian tonnages as are now being booked are limited, in most cases to a percentage of what was taken by sellers last year, actual demand on the part of certain important groups of consumers is not as heavy as last year, due to mandatory curtailment orders from Washington. However, it appears that tonnage booked is not sufficient to maintain the latter's operations at even the maximum levels now permitted.

Bars

Bar Prices, Page 371

Some leading sellers of carbon bars are tentatively figuring on supplying their commercial customers with a certain amount of tonnage in the first quarter. Some tonnage is very definitely scheduled to go through in January, it appears, and sellers at least hope to be able to supply a limited amount in the succeeding two months. However, the situation generally is tight and some leading interests, apparently, are making no promises whatsoever unless orders carry a priority rating.

Carbon bar deliveries depend greatly on priority and type of steel but in general flats and rounds within the priority group can be obtained within two to three months, although some producers can not do as well.

Heavier releases are being filed against forward coverage on defense contracts. High ratings on alloy bars, hot-rolled carbon and cold-finished account for most of the volume. New buying is off except for rated tonnage but total deliveries to consumers are above normal, including textile equipment manufacturers, most of whom have obtained defense work to 65 or 70 per cent of capacity.

Pipe

Pipe Prices, Page 371

Pipe distributors generally are meeting all rated demand. Buying by consumers is active with mills keeping reseller inventories down, but turnover by jobbers holds well above normal. Markups on slower

moving and extra heavy sizes is less under the new price ceiling.

Cast pipe buying is limited mainly to maintenance, although one contractor has bought 400 tons for a defense project near Chattanooga, Tenn. Numerous municipalities which had planned water extensions have withdrawn and will limit buying to repair needs. Considerable cast pipe tonnage is on order for munition plants and for housing in connection with defense plants.

CAST PIPE PENDING

250 tons, 2 to 8 inch, bell and spigot, for Bremerton, Wash.; bids in.

Plates

Plate Prices, Page 370

With OPM now having set up allocations for January, it appears that relatively little plate tonnage will be available for consumers in the lower priority brackets, practically none for those with no priorities. As a matter of fact, most January plate production will go to shipyards. However, there will probably be further changes in rolling schedules, if past experiences can be taken as a criterion.

Plate mills in the East are producing more tonnage than at any time since early fall, reflecting better steel ingot output. Completion of repairs on at least two mills, one producer recently starting up its universal mill after suspension during most of December.

Rails, Cars

Track Material Prices, Page 371

Award of 1000 fifty-ton box cars by the Great Northern to its own shops brought total domestic freight car bookings for 1941 up to approximately 117,000 cars, against 66,889 in 1940, 57,775 in 1939, and 16,303 in 1938. Meanwhile, the Louisville & Nashville plans purchase of 3250 freight cars comprising 2100 hopper, 1000 box and 150 flat cars. One hundred of the hopper cars will be covered.

Recent car awards include 22 for the navy, with 12 forty-ton flat cars going to Haffner Thrall Co. and 10 forty-ton steel-sheathed box cars to the General American Transportation Corp. Birmingham Southern has closed on 10 seventy-ton hopper cars to General American Transportation Corp.

Chicago, Rock Island & Pacific has been granted permission by the district court to purchase 850 freight cars and 17 diesel-electric engines, including 12 switchers. The Navy will open bids Jan. 13 on two 35-ton diesel locomotives.

Locomotive awards include two 1000-horsepower diesel-electric switch engines for Northern Pacific, placed with American Locomotive Co.; four 400-horsepower diesel-electric engines for Carnegie-Illinois Steel Corp., to General Electric Co.; and one 660-horsepower diesel-electric switch engine for Akron & Barberton Belt, to Baldwin Locomotive Works, Eddystone, Pa.

The Treasury Department has placed twenty-four 190-horsepower diesel-mechanical switch engines with Davenport-Besler Corp., Davenport, Iowa, for export to Iran.

Year end left railroad car orders on carbuilders' books at around 70,000 units, about as many as were delivered during the year. Unless some drastic change in the war situation occurs suddenly to eliminate or minimize need for ships, carbuilders will be unable to get as much tonnage in light plates and carbuilding shapes as they did last year. The tightest situation is in structural shapes. Plates are practically impossible to get, yet the carbuilders are more worried about the much needed special carbuilding shapes.

Rail programs, also, are being held in abeyance pending some clarification of the shell round situation. Also in this picture is the lend-lease program, which commands a higher rating and which has tentative orders for heavy rail tonnages from South America and other countries.

Certain domestic rail tonnage will undoubtedly get high enough ratings to insure delivery, including new spurs being laid to defense plants. Rails for replacement, however, will be tight and rail programs will have to be curtailed drastically.

CAR ORDERS PLACED

Birmingham Southern, 10 seventy-ton hopper cars, to General American Transportation Corp., Chicago.

Chesapeake & Ohio, 1000 fifty-ton all-steel hoppers, to American Car & Foundry Co., to be built at Huntington, W. Va., shops.

Navy, 22 freight cars, with 12 forty-ton flat cars going to Haffner-Thrall Co., and 10 forty-ton steel-sheathed box cars to the General American Transportation Corp., Chicago.

CAR ORDERS PENDING

Chicago, Rock Island & Pacific, 850 freight cars, permission to purchase, granted by district court.

Louisville & Nashville, 3250 freight cars, reported contemplated; list includes 2000 hopper, 1000 box, 150 flat and 100 covered hopper cars.

LOCOMOTIVES PLACED

Akron & Barberton Belt, one 660-horsepower diesel-electric switch engine, to the Baldwin Locomotive Works, Eddystone, Pa.

Carnegie-Illinois Steel Corp., four 400-horsepower diesel-electric switch engines, to the General Electric Co., Schenectady, N. Y.

Northern Pacific, two 1000-horsepower diesel-electric switch engines to American Locomotive Co., New York.

Treasury Department, twenty-four 190-horsepower diesel-mechanical switch engines, to Davenport Besler Corp., Davenport, Ia.; locomotives are for export to Iran.

LOCOMOTIVES PENDING

Chicago, Rock Island & Pacific, 17 diesel-electric engines, including 12 switchers, permission to purchase granted by district court.

Navy, two 35-ton Diesel locomotives, bids Jan. 13.

Will Place 115,000 Freight Cars for 1942 Delivery

Railroads plan to order 115,000 new freight cars and 974 locomotives for the year closing Oct. 1, 1942, according to J. J. Pelley, president, Association of American Railroads. This estimate is based on a resurvey of equipment needs by the carriers to furnish defense officials with information as to the extent car and locomotive plants will be required to take care of the railroads' needs this coming year.

"During the past year the railroads installed about 80,000 new freight cars and about 600 locomotives. They will enter 1942 with about 75,000 new freight cars and 600 locomotives on order with deliveries being constantly made. Number and percentage of freight cars now in need of repairs are less than ever before.

"Carriers handled, without congestion or car shortage, the greatest volume of freight in their history during 1941.

"They are confident of their ability to meet transportation demands in 1942 if materials for adequate maintenance and for new construction are made available," he added.

"Measured in revenue ton-miles the freight volume transported in 1941 amounted to approximately 470 billion ton-miles, or an increase of 5.1 per cent above the previous record made in 1929. It also was an increase of 25.9 per cent above 1940. This record traffic took place despite the fact that carloadings of revenue freight were 20 per cent less than in 1929.

"In 1941, freight loadings totaled 42,250,000 cars, an increase of 16.2 per cent above 1940.

"This volume of freight traffic was handled, however, with an ownership of nearly 600,000 fewer cars, or 26 per cent, than in 1929. It was accomplished because of a continuous improvement in cars, locomotives and facilities, and in operating methods and efficiency, that started 20 years ago and has kept growing despite the ups and downs of the railroads in more recent years. The result has been that the railroads in 1941 hauled more freight per train than ever before and moved each train over the road nearly 1½ times as fast compared with 20 years ago.

"Class I railroads in 1941 are expected to have a net railway operating income of about $980,000,000, or 3.72 per cent on their property investment. For the first time since 1930, a period of 11 years, this rate of return exceeded 3 per cent. During the ten intervening years,

1931 to 1940, the rate ranged from a low of 1.24 per cent in 1932 to a high of 2.59 per cent in 1940. In 1940, their net railway operating income was $682,000,000.

After fixed charges, the Class I railroads, according to preliminary estimates, will have a net income in 1941 of $485,000,000, compared with $189,000,000 in 1940.

Tin Plate

Tin Plate Prices, Page 370

Definite reduction in the quantity of tin to be available to tin plate manufacturers will result from conferences between OPM officials and representatives of the industry. A program has been submitted looking to a reduction from 36,950 tons used in 1941 to 31,900 tons for 1942 and 28,750 tons for 1943. Under this plan tin available for packers' cans would be reduced from 28,000 tons in 1941 to 26,400 tons in 1942 and 24,300 tons in 1943. General line can allotment would be reduced from 89,050 tons in 1941 to 5500 tons in 1942 and 4450 tons in 1943. It is also thought likely the allowance of steel plate for tinning might be cut down. Up to this time the can manufacturing industry has not been affected.

Government pressure for shipments of tin plate is heavy but supply of tin will be a limiting factor. Unless allocations are made on black plate for tinning production will be reduced and the steel will be diverted to other products, including plates.

Structural Shapes

Structural Shape Prices, Page 371

With good backlogs of structural steel mills are receiving heavy demand for steel piling, a condition heightened by recent purchases for shipment to Hawaii for repairs at Pearl Harbor. Two mills at Chicago shared substantially in Navy orders placed immediately after the Japanese attack. Most of this has been shipped. One mill at Chicago has orders for additional piling for shipment on a 60-day schedule, sufficient to keep its rolling facilities busy until February.

At the moment there is considerable easing in shape demands in the East, with shipments available on high priority tonnage within eight weeks. Considerable new emergency demand is acmumulating and extension of deliveries is expected soon. Meanwhile, some fabricators have reduced backlogs by five to six weeks to about two months.

SHAPE CONTRACTS PLACED

14,000 tons, armor plate plant, General Steel Castings Corp., Granite City, Ill., to Mississippi Valley Structural Steel Co., Decatur, Ill.

2640 tons, airplane repair shop, unit 2, Hill Field, Utah, for War Department, to Minneapolis-Moline Power Implement Co., Minneapolis; Robert McKee, El Paso, Tex., contractor, bids Dec. 10.

2000 tons or more, traveling cranes for Puget Sound navy yard, to Washington Iron Works, Seattle, at $222,000.

1940 tons, four Pennsylvania state bridges: 865 tons, Snyder county, to Phoenix Bridge Co., Phoenixville, Pa.; 735 tons, Tioga county, to American Bridge Co., Pittsburgh; 210 tons, Monroe county, to Bethlehem Steel Co., Bethlehem, Pa.; 130 tons, Montgomery county, to Phoenix Bridge Co.

500 tons or more, Longview-Rainier transmission line for Bonneville Power Administration, to Bethlehem Steel Co., San Francisco, low at $98,228.

464 tons, power house extension, Minnesota Power & Light Co., Duluth, Minn., to Worden-Allen Co., Milwaukee.

187 tons, sheet piling, shore intake, south district filtration plant, Chicago, for city, to Carnegie-Illinois Steel Corp.; Fitzsimons & Connell Dredge & Dock Co. contractor, bids Nov. 5.

150 tons, addition, American Steel Castings Co., Newark, N. J., to Dayton Iron

SHAPE AWARDS COMPARED

	Tons
Period ended Dec. 31	21,986
Week ended Dec. 27	10,918
Week ended Dec. 20	35,993
This week, 1940	55,382
Weekly average, 1941	27,373
Weekly average, 1940	28,414
Weekly average, Nov., 1941	20,935
Total, 1940	1,532,920
Total, 1941	1,437,096

Includes awards of 100 tons or more.

Works, Newark, N. J.

105 tons, turbine room extension, New Orleans Public Service Inc., New Orleans, La., to Kansas City Structural Steel Co.

Unstated, second Grand Coulee dam power plant; materials furnished by Reclamation Bureau, general contract to Consolidated Builders, Inc.

SHAPE CONTRACTS PENDING

1225 tons, Spokane street state viaduct, Seattle; MacRae Bros., Seattle, contractors.

831 tons, East Eighty-third street subway improvement, Chicago, for department of public works; bids Jan. 16.

Unstated, substations at Ampere and Longview, Wash., for Bonneville Power Administration; Pacific Car & Foundry Co., low at $18,745 for delivery on job.

Unstated, shipfitting shop fabricating bays, Puget Sound navy yard, Washington; bids to Public Works Officer, yard, Jan. 21.

Unstated, hangar for Westward Project, Alaska; bids in to United States engineer, Seattle, Jan. 5.

Unstated, 115-kw switch structure for Bonneville powerhouse; bids to U. S. engineer, Portland, Jan. 14.

Reinforcing Bars

Reinforcing Bar Prices, Page 371

REINFORCING STEEL AWARDS

500 tons, Ashton viaduct, Lincoln-Cumberland, R. I., to Concrete Steel Co., through Frank T. Westcott, North Attleboro, Mass., contractor.

276 tons, building 87, packing plant, Morrell & Co., Ottumwa, Iowa, to Laclede Steel Co., St. Louis; Stark Building Co., contractor, bids Dec. 9.

185 tons mesh, state highway project, route 28, sections 24A and 25A, Hunterton county, New Jersey, Jos. T. Ryerson & Son Inc., through Franklin Contracting Co., Newark, N. J., contractor.

160 tons, coal dock, Minneapolis, for city, to Carnegie-Illinois Steel Corp.

REINFORCING STEEL PENDING

2000 tons, defense projects, Puget Sound area; bids in.

1500 tons, Spokane street viaduct, Seattle; MacRae Bros., Seattle, contractor.

Unstated, foundations for extension to shipfitting shop bays, Puget Sound navy yard; bids to public works officer, Jan. 21.

Unstated, three water storage tanks, 150,000 to 250,000-gallons each, Pierce county, Washington, fire district; award to C. F. Davidson, Tacoma, by Federal Works Agency.

Pig Iron

Pig Iron Prices, Page 372

January pig iron allocations show about the same general distribution as in December and few changes of significance have been made. Ad-

CONCRETE BARS COMPARED

	Tons
Period ended Dec. 31	1,121
Week ended Dec. 27	2,070
Week ended Dec. 20	14,754
This week, 1940	5,406
Weekly average, 1941	13,609
Weekly average, 1940	9,661
Weekly average, Nov., 1941	11,379
Total, 1940	507,762
Total, 1941	714,501

Includes awards of 100 tons or more.

justments will be necessary in some areas to provide iron for users depending on blast furnaces blown out for relining. An instance is found in blowing out of Mary furnace of Sharon Steel Corp. at Lowellville, O. Iron for the company's open hearths must be supplied from some other source during relining.

In New England a similar situation is expected to develop when Everett, Mass., blast furnace is blown out for relining. This stack will have been in continuous production two years in April. Efforts have been made to build up some stocks to meet the situation and relieve outside furnaces which might have to ship in 20,000 tons or more during the relining process. No definite date has been set for going out of blast.

Only a few foundries in the textile machinery trade have been given iron for several months, though they are operating at about 60 per cent on defense work. One recently was given 50 tons as a token shipment against a requisition for five times that tonnage. Of 17,000 tons allocated for December delivery in New England 13,000 tons was rated A-10 or better. On annual basis 125,000 tons of the current melt of an estimated 225,000 tons is coming out of inventories, a situation about to affect substantially allocations of coming months.

Scrap

Scrap Prices, Page 374

While the new scrap price schedule will eliminate some difficulties and make some practices legal which were formerly illegal, there will still be considerable difficulty in some quarters.

For example, overgrading on open hearth material has been partially met by eliminating separate prices for inferior grades. However, this does not stop the practice of overgrading above No. 1 heavy melting steel, which had been practiced in many cases. Material was billed as low phos scrap, commanding the higher price. Mills, in order to obtain supplies, bought low phos scrap and paid the high price, merely checking the tonnage.

Under the new code, mills are now forbidden to pay above a maximum price for any material used in the open hearth. This cuts into scrap flow to those mills which have been paying higher prices, and tends to divert material to steel foundries and electric furnace shops, which alone are permitted to pay premium prices.

Scrap brokers have been assured by OPA officials that a modification of the new price schedule with regard to specifications on low phos material will be forthcoming shortly. Under the present setup, no material lighter than ¼-inch thick can be considered low phos, but must be graded as No. 1 heavy melting steel without regard to phosphorus content. This puts certain electric furnace operators at a disadvantage, inasmuch as they have been buying lighter material of guaranteed phos content and paying the required price for it. Under the new setup, they are prohibited from paying low phos prices for this material, and thus it goes to other consumers with a more favorable freight rate for open-hearth consumption.

Actually, there has been no change in the volume of scrap moving. Since the initial price control was established, virtually all open-hearth grades have been billed as No. 1 heavy melting steel, regardless of their content, and since the new schedule does not reflect a change from that standpoint, actual billings will probably show little change.

Most cast grades to Eastern Massachusetts foundries will be lower and the effect of the new schedule on these is likely to increase the ratio of tonnage shipped to Pennsylvania and New Jersey consumers.

Under the new schedule consumers in the St. Louis area will benefit by a better supply from Iowa and Arkansas, scrap from these states having been sent elsewhere under former regulations. St. Louis dealers now have a $2 springboard for Arkansas scrap, which has been moving east through Memphis and the Ohio river. Numerous other shipping points now offer $1 more for scrap for St. Louis. Effects of these advantages have not yet been apparent and supply is light.

Irrespective of the unfilled orders

or outstanding contracts no payments against deliveries of steel and iron scrap made on and after Dec. 23 may be made at prices in excess of those set by the extensive amendment to the price schedule issued on that date. This statement by OPA is made in response to numerous inquiries.

Warehouse

Warehouse Prices, Page 373

Little change can be observed in the warehouse situation, stocks barely holding their own or declining as mill shipments fail to come through. Some satisfaction is gained by the knowledge that plans have been made for distributors to receive 9,000,000 tons of steel in 1942, but there is no assurance this program can be carried out, in spite of good intentions.

Warehouses enter the new year with inventories badly depleted, in contrast to the situation a year ago. December shipments to consumers were near the level of November, a feature being moderate tonnages or plates. Few jobbers expect shipments of plates in any tonnage, and possibly there will be none, in January. The sheet market also tends tighter.

Pacific Coast

Seattle — Capacity activity prevails, army and navy projects developing rapidly, shipyards and airplane plants under rush orders, rolling mills making every effort to reduce huge backlogs.

Defense Plant Corp. has authorized Bonneville Power Administration to build a $1,000,000 substation near Tacoma, the improvement to serve the 40,000,000-pound aluminum reduction plant to be built at Tacoma and to tie in with the Tacoma municipal system. A second Bonneville-Covington power line is scheduled for early construction. The aluminum reduction plant at Hillyard, near Spokane, is laid out for two lines but can be easily expanded, if required, to an eight-line plant.

Consolidated Builders Inc. will erect a $4,000,000 second power plant at Coulee dam, tonnages unstated, supplied by the Reclamation Bureau. Puget Sound navy yard will receive bids Jan. 21 for fabricating bays involving unstated tonnages of concrete bars and shapes. U. S. engineers' projects at both Seattle and Portland offices, call for unstated but sizeable tonnages of steel. Washington Iron Works, Seattle, has the contract to fabricate traveling cranes for Puget Sound navy yard involving 1000 tons or more of shapes and castings.

While rolling mills have sufficient supplies of scrap for immediate needs, a long range program of activity is faced with indications of a shortage. The OPA new ruling places No. 2 scrap on a parity with No. 1 in this territory, the price for both grades being $14.50. Buyers expect this adjustment will ease the situation and serve to attract larger tonnages to tidewater. Foundries find it a serious problem to obtain sufficient cast iron. Washington Toll Bridge Authority will receive bids at Olympia Jan. 22 for steel scrap salvaged from the Narrows bridge. This includes 1040 tons of used steel in 91 plate girders, 17,600 ft. of suspension cable, 175 tons of floor plates, girders, etc. and other items.

Canada

Toronto, Ont.—To make available the ever increasing quantities of steel for Canada's war program, new government restrictions have been put into effect which will greatly curtail production of civilian goods. Practically all lines of civilian production will be sharply reduced at the beginning of the year and restrictions on output of this type of goods will continue for the duration, according to the minister of munitions and supply. The new orders cover all line of manufacture in which steel or metal are the principal components. While these restrictions will result in larger supply of steel and metals to war industry, they will not entirely take care of Canadian requirements. At present rate of production only slightly more than 60 per cent of Canada's prospective steel require-

ments for 1942 will be met out of production in the Dominion, for the remainder we are looking to the United States.

While iron and steel production in Canada during November fell slightly under the all time monthly record made in October, the decline was entirely due to the shorter month. Pig iron production totaled 133,735 gross tons, an all time peak average of 4458 tons per day, and compares with 137,114 tons or daily average of 4423 tons in October, and 109,576 tons in November, 1940.

For the eleven months, cumulative production of pig iron was an all time record of 1,215,957 gross tons, a gain of 14.8 per cent over the 1,058,417 gross tons produced in the

Nonferrous Metal Prices

	Copper										
Dec.	Electro, del. Conn.	Lake, del. Midwest	Casting, refinery	Straits Tin, New York Spot	Straits Tin, New York Futures	Lead N. Y.	Lead East St. L.	Zinc St. L.	Aluminum 99%	Antimony Amer. Spot, N.Y.	Nickel Cathodes
1-31	12.00	12.12½	11.75	52.00	52.00	5.85	5.70	8.25	15.00	14.00	35.00

F.o.b. mill base, cents per lb. except as specified. Copper brass products based on 12.00c Conn. copper

Sheets

Yellow brass (high)	19.48
Copper, hot rolled	20.87
Lead, cut to jobbers	9.10
Zinc, 100 lb. base	13.15

Tubes

High yellow brass	22.23
Seamless copper	21.37

Rods

High yellow brass	15.01
Copper, hot rolled	17.37

Anodes

Copper, untrimmed	18.12

Wire

Yellow brass (high)	19.73

OLD METALS

Dealers' Buying Prices

No. 1 Composition Red Brass

New York	10.12½-10.25
Cleveland	10.25-10.50
Chicago	10.25-10.50
St. Louis	10.50

Heavy Copper and Wire

New York, No. 1	10.00
Cleveland, No. 1	10.00
Chicago, No. 1	10.00
St. Louis	10.00

Composition Brass Turnings

New York	9.37½-9.75

Light Copper

New York	8.00
Cleveland	8.00
Chicago	8.00
St. Louis	8.00

Light Brass

Cleveland	6.00
Chicago	6.00-6.25
St. Louis	6.25

Lead

New York	5.25-5.50
Cleveland	5.00-5.25
Chicago	4.75-5.00
St. Louis	4.75-5.00

Old Zinc

New York	5.00-5.25
Cleveland	4.00-4.12½
St. Louis	4.50-5.00

Aluminum

Mis., cast	11.00
Borings, No. 12	9.50
Other than No. 12	10.00
Clips, pure	13.00

SECONDARY METALS

Brass ingot, 85-5-5-5, l. c. l.	13.25
Standard No. 12 aluminum	14.50

corresponding period of 1940 and was 83.6 per cent over the 661,562 tons produced in the 1939 period.

Output of ferroalloys in November rose to 17,078 gross tons from 16,809 tons in October and compares with 11,654 tons in November, 1940. For 11 months production of ferroalloys totaled 173,530 gross tons, a gain of 50 per cent over the 117,015 tons produced in the same period last year and 168 per cent over the 1939 output of 64,740 gross tons.

Production of steel ingots and castings during November amounted to 221,367 gross tons a record average of 7379 gross tons per day, and compares with 222,853 gross tons or 7189 tons per day in October and 176,113 tons in November, 1940.

Cumulative production of steel in eleven months totaled the record figure of 2,193,276 gross tons, a gain of 20 per cent over the 1,825,752 tons reported for the same period last year and was 77.6 per cent over the 1,234,765 gross tons made in the eleven-month period of 1939. Of the eleven months' total, steel ingots accounted for 2,094,041 gross tons and steel castings, 99,235 gross tons, both totals showing all-time peak records for Canada.

Steel in Europe

Foreign Steel Prices, Page 373

London—(*By Cable*)—Iron and steel output and raw materials and semifinished steel supply at the year end in Great Britain is satisfactory. However, the strictest control will continue, reserving production for essential war purposes to balance reduction in American supplies. Imported high grade ores and hematite iron have been reduced to a minimum and reserved for essential purposes. Otherwise, the domestic situation is mainly favorable.

Ferroalloys

Ferroalloy Prices, Page 372

The Tennessee producer of ferromanganese has been permitted by Washington to quote $140, furnace, after having its price cut from $145 to $135 at the time books were opened recently for first quarter.

Nonferrous Metals

New York—OPM tightened its controls over nonferrous metals further last week through its General Imports Order M-63. This order provides that unless otherwise authorized by OPM, all future contracts for imports of designated materials, now including antimony, cadmium, chromium, copper, graphite, kyanite, lead, mercury, rutile, tungsten, vanadium, zinc and zirconium, will be handled by Metals Reserve Co. or other governmental agency. It is expected a greater flow of these imports from present war zones may be made possible as the MRC can take risks on delivery which a private importer might not want to face; can work more closely with the Maritime Commission in securing the shipping space, and is in a better position to negotiate with foreign governments.

Copper—OPA amended its price schedule No. 12 to the effect that the import duty on brass mill scrap brought into this country from any foreign country may be added to the selling price, even though this brings total cost to the buyer above the maximum price established in the order.

Zinc—Consumers' stocks held at plants declined less than 1 per cent during October to a month-end total of 57,793 tons from 57,950 tons as of Sept. 30, according to the latest report issued by the Bureau of Mines.

Tin—The important producing district north of Ipoh in Malaya has fallen to the Japanese and the large Penang smelter has been destroyed. The war in this district has disrupted completely the tin mining, smelting and shipping industry and likely will have an adverse effect on the domestic market for a long time. In the meantime, the government has taken over control of stocks, imports and other market details.

OPA To Study Export "Hardship" Cases

WASHINGTON

■ Special machinery to expedite decisions on "hardship cases" where exporters are making deliveries of iron and steel products in compliance with the ceiling prices established in Price Schedule No. 49, Resales of Iron and Steel Products, is being set up by the OPA.

OPA emphasized that all deliveries of iron and steel products by exporters must be made at or below the ceiling prices. Price Schedule No. 49 became effective on Dec. 15, and made no provision to permit the completion of outstanding contracts, domestic or export, at higher-than-ceiling prices.

This omission was deliberate on the part of OPA and was considered necessary because of the highly unsatisfactory price situation in the export markets. Purchasers in export markets have complained bitterly and with reason about excessive prices being charged for steel and steel products, the administrator said.

However, since exporters are free to apply to OPA under the general hardship clause for relief in any transactions wherein undue hardship or inequity can be shown because of the schedule's provisions, officials urged exporters to complete deliveries on all outstanding contracts.

Toluene Made Subject To Complete Allocation

All toluene in the United States will be subject to allocation beginning Feb. 1, in accordance with the terms of an amendment to General Preference Order M-34. The order will apply to stocks on hand as well as toluene produced after that.

On or before Jan. 15, 1942, and each succeeding month, every producer of toluene is required to file with the Chemicals Branch of the OPM his estimated production and scheduled deliveries of commercial grade toluene for the following month. No deliveries may be made after Feb. 1 without authorization from the director of priorities, except that deliveries may be made according to the schedule as filed if no word to the contrary is received from the director of priorities before the 25th of the month before which the scheduled deliveries are to be made.

Beginning Feb. 1, at least 70 per cent of the total production of all producers of toluene must be of nitration grade, meeting the requirements of Grade A in United States Army specifications. Deliveries of nitration grade toluene are to be made only as authorized by the Director of Priorities.

Toluene is used in the manufacture of TNT, dyes, airplane "dopes," food preservatives, medicinals and drugs, oil additives, as a solvent in quick-drying protective coatings, and for other purposes. The supply of toluene at present is sufficient for war and essential civilian requirements, but today's order is made necessary by an anticipated shortage as a result of increasing war requirements in 1942. The Chemicals Branch of OPM is engaged in making arrangements for an increase in toluene production.

The order as amended provides the following ratings for civilian uses of toluene:

Use	Rating
Medicinals and drugs	B-1
Petroleum additives	B-2
Dyes and intermediates	B-3
Rubber accelerators	B-4
Miscellaneous organic chemicals	B-5
Solvents	B-6

Use of toluene as a diluent for protective coatings will be entirely prohibited after Feb. 1, since substitutes are available. Effective immediately, no toluene is to be exported without authorization from the Director of Priorities.

MEN of INDUSTRY

■ **A. D. CHISHOLM,** Duluth, **Herbert C. Jackson** and **George W. Striebing,** Cleveland, have become partners in Pickands, Mather & Co., Cleveland.

Mr. Chisholm has been general manager of the company's ore properties since 1937, and he will continue in Duluth. Mr. Jackson's entire business career has been with Pickands, Mather and for several years he has been secretary of most of the companies managed by the iron ore and coal mining firm. Mr. Striebing, associated with the company since 1911, has been identified mainly with pig iron and coke sales and the traffic department.

These additions, with **John Sherwin Jr.,** whose partnership was noted in STEEL, Dec. 29, page 26, give the firm eight partners.

♦

John H. Davey, associated with

A. D. Chisholm

Herbert C. Jackson

George W. Striebing

the Chicago office of Brown & Sharpe Co. for a number of years, retired Jan. 1 after 46 years of active service in various capacities with Brown & Sharpe Mfg. Co. and its subsidiary, Brown & Sharpe Co.

♦

Joseph D. Sherman has resigned as vice president and general manager, Reynolds Spring Co., Jackson, Mich.

♦

John H. Lawrence has been appointed manager, coal department, Cleveland-Cliffs Iron Co., Cleveland, succeeding the late Albert D. Carlton. Mr. Lawrence has been associated with Cleveland-Cliffs 29 years the past 16 in the coal department.

♦

William G. Crook has been appointed sales manager, Buffalo district office, Carnegie-Illinois Steel Corp. Mr. Crook has been in Buffalo since September, 1941, as assistant manager of sales. Prior to that Carnegie-Illinois' interests were under direction of **C. E. McIntyre** and earlier they were directed by **W. S. Saylor.**

The territory comprising the new Buffalo sales district embraces all of western New York, including Utica, Syracuse, Binghamton, Elmira, Rochester and Jamestown. Several counties in northern Pennsylvania will also be included.

♦

Martin V. Kehoe, associated with Hall Mfg. Co., Cedar Rapids, Iowa, over 40 years, has retired from active work. He had served as general manager and secretary-treasurer, and also as purchasing agent a number of years.

♦

R. E. Bingman has been appointed district manager in the Indiana territory by Jessop Steel Co., Washington, Pa. His headquarters are at

R. E. Bingman

617 Architects and Builders building, Indianapolis. Mr. Bingman has sold Jessop steels in the Indiana area since 1939.

♦

James M. Nicholson, general assistant, mechanical department, Atchison, Topeka & Santa Fe railroad, Chicago, has been made assistant to the operating vice president, succeeding **John Purcell,** who has retired after 57 years with the road.

♦

John G. Kura has been named to the technical staff of Battelle Memorial Institute, Columbus, O., where he has been assigned to metallurgical research. He formerly was associated with the Carnegie-Illinois Steel Corp. at Duquesne, Pa.

♦

E. L. Reed has joined Foote Mineral Co., Philadelphia, as project engineer, and will do research and development work on milling and concentration problems. He formerly was with the United States Gypsum Co. as quality supervisor and research chemist, and also

spent some time doing exploration and underground mining of lead and zinc ores for Eagle-Picher Mining & Smelting Co.

♦

Jesse P. Walton, assistant engineer of bridges and buildings in the central region for the Pennsylvania railroad, has been promoted to engineer of bridges and buildings in the western region, with headquarters in Chicago. **Edward W. Preintiss,** designing engineer, Chicago, has been advanced to Mr. Walton's former post.

♦

H. L. Harrison, for many years sales engineer, Darwin & Milner Inc., Cleveland, has resigned to devote his entire time to the Harrison Tool & Die Co., Elyria, O., of which he has become proprietor.

C. Carnahan, Cleveland, will represent the interests of Darwin & Milner in Ohio, and **Taylor H. Beech,** Wilkinsburg, Pa., will take over the district of western Pennsylvania and adjacent districts in West Virginia.

♦

R. Howard Webster and **Richard J. Buck,** New York; **Warren W. York,** Allentown, Pa.; and **W. Campbell Shaw** and **W. Colin Webster,** Montreal, Canada, have acquired an interest in the National Roll & Foundry Co., Avonmore, Pa., and now constitute with **William H. Seaman** and **F. J. Kaib** the board of directors of the company.

R. H. Webster is chairman of the board, while Mr. Seaman remains president and general manager. Mr. York and Mr. Buck are vice presidents, and Mr. Kaib continues as secretary-treasurer.

♦

Eugene J. Reardon has been made assistant chief engineer, American Steel & Wire Co., with headquarters in Cleveland, and is succeeded as general superintendent of the New Haven, Conn., and Trenton, N. J., works by **Stephen B. Metcalfe. Alexander J. King** has been named superintendent at Trenton works, succeeding Mr. Metcalfe, and in turn is replaced by **Bernard N. Carlson** as chief rope engineer, with headquarters at New Haven.

♦

H. E. Grout has been appointed superintendent, small motor division, Westinghouse Electric & Mfg. Co., Lima, O. Joining the East Springfield, Mass., works in 1925, he was transferred to Lima in 1937 as an inspection foreman, and subsequently became manufacturing foreman and general foreman.

Elevator Manufacturers Granted A-2 Rating

WASHINGTON

■ Manufacturers of elevators, escalators and dumbwaiters have been granted an A-2 preference rating by the Division of Priorities, OPM, to fill defense orders.

The assistance is granted under Order P-91 but is not available for civilian requirements. Application of the rating is possible only upon authorization by the Division of Priorities. Authorization will be made upon submission of form PD-25a which is being sent to 83 known producers of this equipment. Other producers will be furnished copies upon application to OPM.

To prevent use of critical materials for decorative purposes, no metals except iron and steel may be used in the interior of an elevator, hatchway doors or landing thresholds. Form PD-25a will list the kinds and quantities of materials permitted to be used, and will cover requirements for first quarter of 1942. A second application will be required to use the rating for second quarter needs of these items.

Oppose Textile Shutdowns To Transfer Machinery

■ Commenting on export of old or used textile machinery, Frank Walton, Chief of the Textile and Fiber Branch of OPM, states that his office would oppose any move to shut down any textile plants in the country and ship the machinery elsewhere.

Production of these textile plants is badly needed at this time in this country largely for defense and essential civilian demands. Particularly is this true of cotton textile plants.

"The shutdown and movement of a plant not only throws labor out of work but sometimes upsets the economy of an entire community," Mr. Walton said. "A loss of production results for several months while the machinery is being packed, transported and set up elsewhere. At this time this production is needed and it should not be lost."

Luncheon To Celebrate Lake Shipping Record

■ In recognition of the all-time record in Great Lakes shipping during the past season, the Lake Carriers Association in co-operation with the Cleveland Chamber of Commerce will sponsor a civic luncheon at the Hotel Statler in Cleveland Jan. 6.

Capt. Howard L. Vickery, who is on a special leave from the United States Navy to serve on the Maritime Commission, will be the principal speaker. Guests of honor will include Ralph Budd, advisor on transportation to the National Defense Council, lake vessel operators, masters and chief engineers of lake freighters.

DIED:

■ **John H. Roberts,** 62, for 20 years branch manager at Indianapolis for American Radiator Co., New York, recently.

♦

Robert B. Hall, 46, traffic manager, Massey-Harris Co., Racine, Wis., Dec. 26, in that city.

♦

Victor A. Hanson, 69, retired superintendent of tools, dies and plant maintenance, Crane Co., Chicago, in Oak Park, Ill., Dec. 24.

♦

Charles S. Johnson, 57, field engineer, Mattison Machine Works, Rockford, Ill., the past 22 years, in that city, Dec. 24.

♦

Henry B. Manton, 74, one of the founders and a director, Goodyear Tire & Rubber Co., Akron, O., in that city, Dec. 19.

1941 Federal Payroll Taxes
12 Per Cent of All Collections

WASHINGTON

■ FEDERAL payroll tax collections in the fiscal year 1942, based on present rates, are expected to aggregate more than $1,167,000,000, according to the Tax Foundation, New York. This compares with total payroll collections of more than $925,000,000 in fiscal year 1941, when these taxes yielded about 12 per cent of all federal tax collections.

Constituting one of the newer accretions to the nation's tax structure, the federal payroll taxes have developed at a comparatively rapid pace, the foundation reports in its publication *The Tax Review*. Aggregate collections from this source in the fiscal year ended June, 1937, totaled about $252,500,000. This increased to $754,500,000 in 1938, was $740,400,000 in 1939, and $833,100,000 in 1940.

Recent proposals to increase substantially the social security tax rates would result in collection of an amount considerably greater than that estimated by the foundation. Proponents of the plan feel a rate increase would not only provide additional revenue but would also halt or restrain inflationary tendencies. The latter result is to be accomplished by extension of coverage over certain groups previously exempt from social security impositions, as well as by increasing rates.

Largest category of the payroll taxes comprises levies imposed by the Social Security Act of 1935. Two are designed to finance the old-age insurance system, and the third is a compulsory unemployment contribution levied upon employers of eight or more persons.

Social security taxes constitute the greater portion of payroll taxes, accounting for 85.2 per cent of the total in 1941. Aggregating almost $800,000,000, they were up 30 per cent over the total in 1938. Old age and survivors insurance contributions yielded $690,000,000 in the fiscal year 1941, and the unemployment insurance taxes in the period totaled about $98,000,000.

Approves Trebling Country's Synthetic Rubber Capacity

Supply Priorities and Allocations Board has approved tripling of America's present synthetic rubber production program, subject to detailed examination of the program by the Division of Priorities to make certain that sufficient materials can be provided for construction and operation of the new plants.

Action was taken after presentation to SPAB by Jesse Jones, federal loan administrator, of a program being worked out by him with the industry and designed to give the nation an annual production of 120,000 tons of synthetic rubber. Productive facilities for synthetic rubber now under construction will have a capacity of 40,000 tons per year.

Mr. Jones explained that if the program were approved immediately construction of the increased facilities could begin promptly. It is expected the new plants can be in production early in 1943.

Meanwhile, an amendment to the order restricting rubber consumption and sales of certain rubber products was issued last week. It permits processing of rubber for manufacture of fire hose and other fire fighting equipment. The order, however, specifies production must be limited to the November, 1941, rate.

2,500,000 Enrolled for War Industry Training in 18 Months

WASHINGTON

■ TWO and one-half million persons have been enrolled for training for war industry work in the last 18 months, according to Associate Director General Sidney Hillman. Training will be stepped up rapidly.

One of the most useful contributions a young man or woman can make now is to enroll for war industry training, Mr. Hillman said. The public vocational schools or the public employment office in every city will give young people advice and direct them to the courses of training which will be most needed and to which they may be adapted, he added. The most useful training courses leading to war industry employment at this time are: Welding, aircraft riveting, sheet metal working, machine shop work and ship-fitting.

A shortage of equipment, especially machine tools, has hindered the expansion of training in vocational and other public schools, but Mr. Hillman expressed confidence that a great enlargement is possible with present facilities.

He called on public vocational schools to expand their courses to permit the use of all their shop and training machinery on a 24-hour day and seven-day week basis. "The outbreak of war makes it as imperative to use our training machinery to the utmost, as it does to use our production machinery full-time" he said. He pointed out that more than 600 such schools are working already "around the clock."

"Training programs, financed by the federal government, are now being conducted by public educational authorities in every state for the development of qualified workers for war industries," he said.

"A total of 2,477,400 persons have received specific instruction through these programs since their inception July 1, 1940. Twelve hundred public vocational and trade schools, 155 colleges and universities, and 10,000 public school shops, are assisting in these programs.

"These figures do not include the more than 2,000,000 workers in war contract factories who receive inplant training from employers through arrangements made by the Training-Within-Industry Branch of the OPM Labor Division.

"In addition, the NYA and CCC programs have provided training and work experience useful to war industry to hundreds of thousands of youthful workers. The NYA now has 77,400 enrolled in its new Youth Work Defense Program, in addition to 51,400 participating in regular NYA work projects tied into war production, and 334,000 who have completed general training in defense training courses since July 1, 1940."

Mr. Hillman said the war's demands would require an expansion of training for farm workers during 1942. Under the current program financed by Congress, training in farm operations, with special emphasis on mechanized tools, is being conducted in school shops in 2500 rural communities.

Understudies Advised for Men Eligible for Draft

PITTSBURGH

The expanding Army is taking its toll of defense workers. Employers are being notified that deferments will continue to be granted to key employes who are otherwise

eligible for the draft, but that understudies should now be trained for all these men inasmuch as additional deferments may not be granted. It is further indicated that as far as possible, these understudies should be women.

Furthermore, each new crisis sends men to the recruiting stations to enlist, some of them vital links in the chain of war production. In a number of recent cases, the companies have persuaded men to return to work, and have received some co-operation from Army recruiting officers on this score.

The supply of labor in the district is growing shorter and shorter. One company, preparing to open a new ordnance plant, is having considerable difficulty finding men although the pay is union scale, beginning at 72½ cents per hour, and no experience is necessary. Conferences have been held with state employment services with a view toward moving workers from other parts of the state where industries have been forced into idleness by lack of materials.

Most companies here have relaxed all but the most extreme requirements for labor. Age and health bars have been let down, experience no longer is a necessity, and in this same connection lies one reason for industry's fight against the closed shop, inasmuch as it is felt that union membership is neither desirable nor necessary under such conditions.

Some firms are greatly increasing their proportion of women employes, putting them into as many jobs as possible despite the fact that men might be more efficient, merely because it is impossible to hire men.

Globe Steel Now Offers Welded Stainless Tubing

■ Stainless steel tubing produced by a closely controlled electric welding process is now ready for production at Globe Steel Tubes Co., Milwaukee. To be marketed under the trade name of Gloweld, this new welded stainless steel tubing is said to provide a high degree of corrosion resistance, strength with minimum weight, and uniformity of structure.

The method of welding the stainless strip, according to the company, is such as to result in a tube with very little "flash". The structure of the weld metal very closely approximates the structure of the tube itself. In addition, the new tubing can be readily bent, coiled, swaged and formed. This development, it is said, will be available shortly in a wide range of diameters and wall sizes, and in practically all the stainless analyses.

Government Takes Control Over All Imports of 13 Materials

WASHINGTON

■ FEDERAL government has taken control of all imports of 13 designated materials and may add others to the list later.

Materials listed are antimony, cadmium, chromium, copper, graphite, kyanite, lead, mercury, rutile, tungsten, vanadium, zinc and zircon.

General Imports Order M-6 provides that, unless otherwise authorized by OPM, all future contracts for imports of these materials will be handled by the Metals Reserve Co., RFC subsidiary, or other governmental agency. No private person or concern can make arrangements for imports, except in certain cases, such as imports for processing and immediate re-export. The Director of Priorities may grant specific exception to the order.

It was announced, also, that the Metals Reserve Co. plans to use existing channels to make its foreign purchases and will work through established brokers and dealers.

The order does not disturb existing contracts or commitments, except that future shipments or goods now in transit may not be sold except to the Metals Reserve Co., unless under written authorization of the Director of Priorities. Persons seeking such authorization or other action by the Director of Priorities are instructed to use Form PD-222-A in all instances.

Collectors of customs at all ports of entry in the United States will assist the OPM in clearing shipments affected by the order. The consignee will file a report with the collector in each instance and then may move his shipment to the point of first destination in this country. There it must be held for disposition as outlined in the order.

Clearance May Be Arranged

In many instances, clearance of goods in transit is possible, and importers are urged to get in touch with the appropriate branch of the OPM to avoid delay after shipments have arrived. Materials going directly into plants with war contracts are in that category and automatic clearance for such shipments may be arranged.

The Metals Reserve Co. is prepared to negotiate with holders of open commitments and will take over their contracts where that is feasible. All material purchased by the company will be held for allocation by the Director of Priorities.

Order provides that all persons who have made arrangements for imports affected by the order shall report the facts immediately to the Metals Reserve Co.

Civilian Use of High-Grade Chromium Steel Restricted

Civilian use of all high grade chromium steel, except in fabricated articles, has been restricted by the Priorities Division.

Supplementary Order M-21-d provides that no person shall consume, use, fabricate or deliver corrosion or heat-resistant alloy iron or steel containing more than 4 per cent chromium, except on ratings of A-10 or higher.

The order further provides for a report by Jan. 15 of all chrome iron or steel subject to the order on hand. Form PD-221 is provided for these reports.

It was emphasized that the order does not apply to fully fabricated chrome steel articles, but to such material in any stage of fabrication.

"Innumerable Problems" for War Needs Solved by Electrical Industry

■ ELECTRICAL industry's first consideration throughout 1941 was the production of urgently needed war equipment, with essential electrical products being turned out in increasing quantities as the year ended, it was reported last week by General Electric Co., Schenectady, N. Y. In many instances, the blueprint and tooling up stage is completed, and full production has begun.

Innumerable problems had to be solved before large-scale war output became a reality. Redesign of products was required in some cases; expanded manufacturing facilities were needed; and many new tools, difficult to obtain, were demanded. New employes had to be trained and expanded raw materials sources located and developed.

In addition to its large direct contributions to the war program, the electrical industry was also called upon to help all other industries in gearing their facilities for war manufacture. It was asked to supply more power-generating equipment, more motors, more controls, new electric-heating devices and processes, new welding techniques, special electronic-tube devices, and equipments and methods for increasing the power-carrying capacity of distribution systems already carrying full loads.

Two Thirds for War

General Electric Co., before the year's end, was reported devoting about two-thirds of its production facilities to war items. Some of its plants were engaged almost entirely in war work. Fourteen new building projects plus numerous buildings were completed before extensions and additions to existing Dec. 31, comprising about 3,500,000 square feet of floor space. Expenditures totaling more than $100,000,000 will be required for the erection and equipment of the added manufacturing facilities.

To maintain the schedule set for it, the industry has set up an extensive subcontracting system. Hundreds of subcontractors have been employed by General Electric alone, and additional concerns able to handle precision work of the type required are being sought. Simultaneously, electrical products manufacturers have been doing subcontract work for other essential industries.

Not only electrical items for war, but many products outside its regular sphere are being produced by the industry. General Electric, for example, is manufacturing 75 millimeter pack howitzers in its Erie, Pa., plant. The work is being largely done on machines formerly used in making electric motors for street cars and locomotives.

Engineering emphasis in the industry in 1941 was placed on the design and output of materials to help eliminate disturbances resulting from shortages in key materials. In all products, especial endeavors were made to find and apply alternate materials where critical supplies were involved. Substantial progress was reported, and redesign of equipment in line with need for conserving the critical materials continues.

Numerous instances are reported of new products completed, so far as design is concerned, but not placed into productioon as they would have required essential materials or extensive retooling. However new products were introduced whenever they were not in conflict

with defense demands; many more were redesigned for added efficiency in operation, for improved appearance and for simpler construction.

Production of power-generating equipment in the year established a new record. About 2,500,000 kilowatts of large turbine generator sets were under construction for utilities and industries; more than 1,000,000 kilovolt amperes of hydroelectric generators were being produced; and about 9,000,000 horsepower in turbines for propulsion equipment of ships were being supplied.

Six large transformers were built mounted on individual railway cars as a highly mobile reserve for an utility. A new single-circuit substation unit was developed to provide, in one co-ordinated and factory-built assembly, a complete outdoor type substation with one outgoing feeder. Capacity of testing both low and high-current rated meters, with the light weight and small size of the best low-capacity standard, was incorporated in a new portable watt-hour meter standard.

Four portable, shockproof, 1,000,000-volt, industrial X-ray units went into service in the year. Several more were under construction for manufacturers engaged in war production. Range of analytical service provided industry and research laboratories was materially widened by the introduction of a small portable unit for X-ray diffraction and microradiography.

Contributions of the electrical industry in the year to aviation and airplane manufacturers were many and important. Turbosuperchargers, propeller feathering control devices and radio transmitters, among other products, were completed in large numbers. A remote-control liquid level indicating instrument was developed to give pilots complete knowledge of fuel in from one to four tanks. Simplified armament controls were effected in co-operation with engineers of aircraft, optical and other industries and with government services.

Meets Navy's Demands

The industry's response to needs of the Navy for all types of electrical equipment for the greatly expanded ship-building program was prompt and complete. Much of the material was delivered well ahead of schedule. Included were turbines and gears, service turbine-generators, switchboards and other electrical equipment for battleships, some commissioned and others launched.

Several destroyers, with propulsion turbines and turbine-generator sets, went into service in the year. In that period General Electric alone had on order turbines for 310 propeller shafts, aggregating approximately 8,800,000 horsepower.

Diesel-electric drive, it is also reported, can be considered one of the major methods of ship propulsion. Sixty-seven vessels, exclusive of submarines, with a total of more than 300,000 horsepower are being thus equipped.

Cincinnati Bickford Tool Co. Expanding

■ Cincinnati Bickford Tool Co., Cincinnati, has awarded contracts for new buildings which will add 75,000 square feet to the company's manufacturing space, according to an announcement by August H. Tuechter, president.

Work on the expansion is underway by the Austin Co., Cleveland, holder of the construction contract, and equipment is being purchased.

Substantial additions were completed by the company during 1941.

Company's volume of business last year, Mr. Tuechter said, was 75 per cent greater than in 1940, which in turn was twice as great as in any previous year.

British Refinery Granted High Priority Rating

WASHINGTON

■ Materials to be used in the operation of a British refinery for aviation gasoline located in the Caribbean area have been assigned a high preference rating by a special order issued by the director of priorities.

The Anglo-American Purchasing Co., 70 Pine street, New York, has been granted use of the rating to obtain a specified list of materials.

Since the requirements of the refinery include a large number of diverse items, a single order has been issued giving a priority rating for all of them, to avoid the necessity of handling many individual applications.

Pamphlet Describes Source And Uses of Dolomite

Increased importance of dolomite in the national defense program as a source of magnesium metal for aircraft industry and of furnace linings in great demand by the steel industry, has resulted in publication of a pamphlet and map by the Bureau of Mines on sources and uses of dolomite, Dr. R. R. Sayers, Director of the Bureau, has advised Secretary of the Interior H. L. Ickes.

Construction of plants to utilize ground dolomite in combination with other ores and chemicals in the manufacture of magnesium metal has been authorized by the Defense Plant Corp.

Ferro Enamel Corp. Reports on Progress

■ Ferro Enamel Corp., Cleveland, manufacturers of porcelain and synthetic enamels, has distributed to customers a booklet entitled Report of Progress. Topics discussed include: Physical resources, financial position, raw material situation, foreign subsidiaries and prospects for the future.

In a preface, Robert A. Weaver, president of the company, says: "It has always seemed to me that those plants which supply you with fabricated parts or with raw materials are really a part of your plant. The sum total of the efficiency and economy of your operations depend on the efficiency and ability of your supplier."

■ The January lead pool will remain unchanged at 15 per cent of November production, the Division of Priorities announced last week. Producers will be required to set aside this percentage for allocation which, it is estimated, will amount to 6500 to 7000 tons.

Subcontract Opportunities . . .

Data on subcontract work are issued by local offices of the Contract Distribution Division, OPM. Contact either the office issuing the data or your nearest district office. Data on prime contracts also are issued by Contract Distribution offices, which usually have drawings and specifications, but bids should be submitted directly to contracting officers as indicated.

Chicago office, Division of Contract Distribution, OPM, 20 North Wacker Drive, is seeking contractors for the following:

AEC-A-1216: Automatic screw machines, preferably No. 6 Brown & Sharpes, required for making parts for sound power telephone. Material, tools, and detailed information will be furnished by the prime contractor. Due to the nature of the work, only firms in the Chicago area can be considered. Blue prints available at this office.

CWC-N-1218: An Eastern manufacturing company is in urgent need of subcontractors for the production of five sizes of hexagon head shoulder bolts made from hexagon steel bars, requiring various sizes of hexagon collets, from $\frac{5}{8}$ to $1\frac{1}{4}$ inches. Bolts vary in length from 2 to about $6\frac{3}{4}$ inches. 1500 of each size required per month. Hand screw machines required on account of excess length. Also, parts for assembly of hydraulic hand pumps, of which 400 units per month are required. Blueprints available at this office.

PPC-N-1215: Facilities for precision work of the finest type are urgently required for making parts for aviation instruments. Only jewelers lathes or special equipment capable of turning bessemer steel to .022 diameter can be considered. Quantities very large. Blueprints are available at this office for examination. Material to be supplied by the prime contractor.

NEW-A-1212: A large manufacturer of precision timing equipment requires 250 special machines to be built in 19 types. Work is suited for precision machine and tool shops accustomed to small and medium-size work. Priority rating is A-1-a. Contact this office for information and examination of prints.

CAT-N-1202: A prime contractor desires to subcontract long screws in substantial quantities. Equipment required includes automatic screw machine to turn lengths starting at $7\frac{3}{8}$-inch over-all, through a step range to approximately 12 inches; drill press with $\frac{1}{2}$-inch capacity in steel, and Landis bolt threader or equivalent. Heat treating equipment desirable but not essential. Average stock requirements $\frac{3}{4}$-inch square SAE 1045.

OWM-A-1211: Wanted, screw machines for production of bullets and magazines. Magazine production required is 35,000 to 50,000 per day starting 45 to 60 days from receipt of order. Requires 1-inch multiple spindle automatics with threading attachment. .30 caliber bullet cores: Production required, 9,000,000 in January, 18,000,000 in February and increased in March. Takes B. & S. multiple spindle automatics. .50 caliber bullet cores: Production required, 3,000,000 in January, 6,000,000 in February and increased in March. Takes B. & S. and multiple spindle automatics.

CCG-A-1120: Out-of-state prime contractor needs 78,544 C.D. steel plugs, $1\frac{5}{8}$-inch hexagon by 0.65-inch long, 1.5-12 N.FI thread under head; tolerances .03. Requires automatic screw machines or similar $2\frac{1}{4}$-inch capacity.

GMO-A-1224: Facilities for precision milling and surface grinding 20 mm. gun parts. Steel forgings will be supplied by prime contractor. Quantities required: 5000 each of four parts, to be delivered at rate of 50 per day. Blueprints available, for inspection only, at this office.

RTDC-A-1124: Facilities required to machine forgings of SAE 4640 steel ranging up to 24-inches diameter. Work can best be done on 36-inch vertical boring mills, lathes with 24-inch swing, gear shapers up to $20\frac{5}{8}$-inch diameter, and gear hobber for 4-inch diameter. Quantities at present from 1000 to 2000 of each part. Material to be furnished by prime contractor. Blueprints available for inspection at this office.

Standard Oil Opens New Research Laboratory

■ Standard Oil Co. of Ohio's new research laboratory, adjacent to Western Reserve University in Cleveland, was formally opened last week and immediately devoted to vital research problems linked to the war.

Five separate laboratories, a large engine testing room and cold room provided in the building combine practically every known facility for the development of higher octane gasolines, diesel oils and other fuels, new lubricating oils and greases, better asphalt products, and new byproducts of the refining process.

The research staff will be concerned with the development of improved manufacturing processes as well as the improvement of petroleum products and their more efficient use. For this reason one lofty room, two stories high, with a large hatch in the roof, has been provided to accommodate any refinery setup that may be erected. A completely equipped machine shop has been installed and will enable the laboratory to build any required experimental equipment.

Transfer War Agencies To Central Location

■ Consolidation of most regional rearmament agency offices in the Chanin building, 122 East Forty-second street, New York, has been completed, according to the Regional Office for Emergency Management.

At the new headquarters, the following agencies may be reached at Murray Hill 3-6805: Office of Price Administration, Room 714; Contract Distribution Division, OPM, sixth floor; Priorities Field Service, OPM, Room 818; Division of Defense Housing Co-ordination, Room 702; Consumers' Division, OPA, Room 724; Central Administrative Services, OEM, Room 802; and Regional Information Office and Radio Section, Division of Information, OEM, Room 704.

Certain essential production agencies, however, such as Training Within Industry Branch, Labor Division, 11 West Forty-second street, and Export Control at 500 Fifth avenue, have not yet moved to the new headquarters.

Institute Bulk Packaging To Save Paper, Wood

■ To conserve the supply of wood and paper, Lamson & Sessions Co., Cleveland, is abandoning as far as possible shipment of bolts, nuts and cotter pins in cartons and small containers. Instead, it is shipping in bulk containers which include both boxes and kegs made of wood or corrugated paper and fibre board.

In many cases, it is wrapping small shipments in ordinary paper, using several sheets per package. In addition, thickness of box sections, of paper and of keg walls has been reduced. Although the company has not yet calculated what the saving in wood and paper will be, it is expected to be substantial. The program has been facilitated by co-operation on the part of customers.

Steel Industry Accomplished "Extraordinary Feat"

By WALTER S. TOWER

President, American Iron and Steel Institute

■ FOR the steel industry, 1941 was a year of historic accomplishment.

Under the impetus of the approaching war emergency, American steel companies produced over 82,800,000 net tons of steel, or approximately 25 per cent more than had ever before been made in one year. The previous record was 67,000,000 tons in 1940.

The record achieved in 1941 stands out in its full stature against the background of recurring strikes and slow-downs in coal mines and steel plants, and of shortages which developed in certain raw materials, such as scrap steel. Those developments beyond any doubt caused a loss in production running toward, if not beyond, a million tons of steel.

In the face of these handicaps it may fairly be said that the steel industry accomplished an extraordinary feat of production.

The outbreak of the war with the Axis countries found the steel industry fully prepared, and ready to do whatever is necessary to assure ultimate victory.

The industry had been functioning for many months on the basis of a 24-hour day and a seven-day week. Its leaders long ago had accepted as their primary task the fulfillment of all defense needs. For those reasons, the steel industry has quickly and smoothly placed itself on a wartime basis.

Metals Conservation Essential

The war of the Pacific is of direct concern to the steel industry because of the threat to lines of supply of strategic metals, such as tin, chrome ore and tungsten, from the Far East. Developments in these areas make necessary the strictest conservation of strategic metals.

By assuring enough steel for the manufacture of military and defense equipment during 1941, the steel industry made one of the most essential of all contributions by industry to national security, and the war effort which the United States now faces.

Exactly what the war needs for steel have been or will be cannot be answered by any data available today. In the closing months of 1941, reports from steel companies indicated that somewhat less than one-third of all their shipments were going under A-priority rating to the Army, the Navy, to other government agencies and to Lend-Lease. Another one-third of total shipments went to nongovernment consumers holding A-priority ratings.

While two-thirds of the steel shipped to consumers at the end of 1941 bore an A-priority, it wc be correct to assume the needs represented that larg of the tonnage shipped. Ma ular, peacetime buyers of steel, such as the railroad industry, the steel warehouses, farm equipment and others have been assigned an A-priority rating although a large part of their steel requirements are primarily for common civilian uses.

It had been estimated in some official quarters prior to the declaration of war that the 1942 steel consumption of the Army, Navy, Maritime Commission and the Lend-Lease Administration would be in

the neighborhood of 17,000,000 tons. Our productive capacity, at the beginning of 1942, stands at approximately 88,000,000 net tons. That would certainly leave a large tonnage available for indirect defense and civilian needs, but how greatly the total will be affected by active warfare is still not clear.

The foresight of leaders of the steel industry in expanding steelmaking capacity by 15,000,000 tons, or 20 per cent, since 1929 has proved invaluable during the defense emergency and will have incalculable importance as the war progresses.

According to plans already accepted, steel capacity is currently being expanded still further to over 90,000,000 tons annually. It is apparent, however, that such an amount of steel capacity cannot be fully employed until some time in 1944, because of shortage of scrap steel, need for more blast furnaces to compensate for that shortage, and for facilities for transporting from mines to blast furnaces the greatly increased tonnages of iron ore that will be required.

New blast furnace capacity now under way was designed to supply pig iron for steel capacity now existing or planned. It would not provide pig iron for any substantial further addition to steelmaking capacity beyond what is now in pros-

Full co-operation with the defense program since its inception has been the basic policy of the steel industry. From the middle of 1940 until the summer of 1941, it voluntarily gave priority to defense orders. Then a system of mandatory priorities was established by the Office of Production Management. All present indications are that specific allocations of materials will replace priorities. This would place distribution on a more effective basis, with no more chances for the accumulation of "priorities inventories."

More Normal Status Expected

As buying and inventories are brought under better control in 1942, it seems logical to expect a more normal condition in supplies and deliveries. If carefully controlled allocations replace blanket priorities, swollen inventories may diminish and duplication of orders may be discouraged.

Furthermore, it is likely that as long as the war lasts, a progressive let-down may be expected from the heavy buying of consumers' goods which prevailed during much of 1941. Higher taxes will be a factor in such curtailment, and in addition it is unlikely that the output of many consumers' goods could be greatly expanded owing to shortages, created by defense needs, in nonferrous metals, chemicals, machine tools, and skilled labor.

Despite the heavy demands, first of the defense program and later for war, steel available for some leading nondefense uses in 1941 probably came close to record levels, reflecting heavy production of automobiles, refrigerators and similar consumers' goods, particularly during the first nine months.

While sacrifices and substitutions among nondefense steel consumers may be necessary in 1942, particularly in alloy steels, the industry in 1942 will make millions of tons above the maximum of all defense or war needs.

Declares 1941 Scrap Supply Was Adequate

■ NOTWITHSTANDING many fears and alarms, supply of iron and steel scrap in 1941 was adequate to support steel mills and foundries at practical capacity. Little actual production was lost due to a shortage of scrap, and in most cases where capacity was lost other factors were equally responsible, according to Edwin C. Barringer, executive secretary, Institute of Scrap Iron and Steel Inc., Washington.

Including home and purchased

scrap, total consumption in 1941, with December estimated at the same level as November, was approximately 59,600,000 net tons. This compared with 46,600,000 tons consumed in 1940. In 1917, record year of the first World war, a total of 30,900,000 tons of scrap was melted.

Inventories of suppliers and consumers in 1941 decreased 1,841,000 tons, but at the end of the year were still close to 6,000,000 tons, Mr. Barringer declared.

Of 59,600,000 tons melted in 1941, purchased scrap totaled 27,400,000 tons. Railroads supplied about 4,500,000 tons; by-product of converting finished steel into commodities, called prompt industrial steel scrap, was 8,300,000 tons; prompt scrap from finishing castings was about 2,400,000 tons. Remaining was about 12,000,000 tons, ascribed to "maintenance and obsolescence." This category includes auto wrecker, farm, peddler, shipbreaking, and general run of yard scrap.

"It is a serious question for the entire defense program whether there will be enough scrap to keep steel mills and foundries operating at the desired capacity rate in 1942," said Mr. Barringer. "Undoubtedly, the melt of scrap in 1941 included much nonrecurring material. Until new blast furnaces are built, and the blast furnace program will not mature for a year, scrap must assume the burden not only of holding steel production at its present level but also of making possible any increase."

Railroad Offering To Be Lower

Survey of railroads indicates their offering this year will be 5 to 10 per cent below 1941. Prompt industrial steel scrap, however, may be expected to increase. "Not only will the production of steel ingots be at least as high as, if not higher than, in 1941, but it is also reasonable to expect that the conversion loss will be greater than the 16 per cent attributed to 1941."

Supply of scrap from finishing castings should be about the same in 1942.

This leaves "maintenance and obsolescence" scrap as the unknown factor. The peddler or collector has virtually been driven out of business both by the low prices placed upon his product by the government and the lure of more attractive alternate employment.

"Opinions vary widely because of the extreme difficulty in gaging the supply of unprepared material, but there is no little opinion that scrap adequate to keep steel mills and foundries operating at the requisite high rate is present in this country. If the scrap industry is permitted to function efficiently and comprehensively, it can get this scrap out."

Two-Billion Curtailment in Nondefense Spending Proposed

WASHINGTON

■ POSSIBILITIES of reducing federal nondefense expenditures by more than two billion dollars without encroaching on essential social services are set forth in a study by the Brookings Institution. Rather than presenting expenditures merely by departments and agencies, or by broad general classes, the study shows the specific purposes for which the outlays are made and thus provides an adequate basis for determining those which can be eliminated in the emergency.

Study was conducted by Henry P. Seidemann, and was financed by a grant from the Maurice and Laura Falk Foundation, Pittsburgh.

Report of the study states that the nation is faced with a clear alternative. It may proceed without concern over the mounting public indebtedness, on the theory that the enormous increase in the public debt is of no real significance; or it may resolutely strive to limit the growth of the debt in order to preserve the national credit and justify the faith of all who are asked to participate in financing the war program. So far, the government has not really come to grips with the situation. Yet, if the will to do so exists, the proposed curtailment can be made without great difficulty.

Large-scale spending to alleviate distress and promote economic recovery began in 1935. Despite the fact that the national income for the current fiscal year has risen to an estimated $95,000,000,000, compared with a $60,000,000,000 average for the fiscal years 1935-36-37, nondefense expenditures are $200,000,000 greater than the average for the earlier period. It is estimated that $6,464,000,000 will be spent this year for nondefense activities, which is three times the amount so spent in 1929, although per capita income is somewhat greater than in 1929 and is more widely distributed. The report points out that, in addition to expenditures for 1942 for which definite appropriations have been made, a rivers and harbors bill is pending in Congress which would authorize construction of nondefense public works costing nearly $1,000,000,000.

Agriculture's Reduction Largest

Study suggests the following curtailments (in millions):

Flood control, rivers and harbors, other water projects	$ 350
Agriculture	625
Public domain	19
Public welfare	615
Highway development	171
Executive, general activities	5
Transfer of costs to state and local governments	300
Total	$2,085

Proposed curtailment in expenditures for agriculture is made possible by the fact that the goal of parity has been achieved, and farm income has risen approximately $3,000,000,000 in the past two years. Transfers of costs to states and local governments is feasible because of the improvement in their fiscal situation, particularly in respect to states. Other reductions have been made possible by improvement in economic conditions and at the same time have been made necessary by the demand for men and materials in the war program.

It is apparent that the full amount of the savings recommended cannot be realized during the present fiscal year, as it is already half over. These reductions, however, should be fully achieved in the ensuing fis-

cal year; and there is reason for believing it will be possible as the war program intensifies, to make still further reductions in federal expenditures not directly related to the war.

The government can set an example for the people in this critical hour by practicing the rigid economies which the national situation imperatively requires, says the report. Although nonessential private construction which is already underway is being abandoned so that men and materials will be available for the war effort, much federal nondefense construction is still proceeding. Government expenditures for nonessential activities should not be permitted to compete with the government's war program any more than private expenditures for nonessential purposes should be allowed to do so.

To carry out a systematic program of retrenchment in nondefense expenditures so as to obtain maximum reductions with minimum disturbances to economic life will require continuous scrutiny by the Congress. To this end, it is recommended that a permanent bipartisan committee of the Senate and the House be vested with continuing responsibility for analyzing expenditures—for both nondefense and war purposes—with a view to achieving all possible economies consistent with present national objectives.

Uses Four Crews for Continuous Operation

■ Four crews are employed by Timken Roller Bearing Co., Canton, O., to achieve 168-hour-week operations. The antiblackout schedule, which was started months ago and which has been extended to one department after another as needs for production increased, calls for three 8-hour shifts per day up to 40 hours a week. By having four crews instead of three to handle the three shifts, the company is able to rotate the working time for each crew so that it works 40 hours a week, or a total of 160 hours for the four crews.

By an ingenious scheduling arrangement of shifts and crews, each crew works five extra shifts over each period of 20 weeks, for which overtime is paid. These five extra shifts for each of the four crews are all that is necessary to bring the "equipment work-week" up to 168 hours.

The schedule has been worked out so that every man works five days in a row and then is off at least 48 hours, after which he changes shifts. Over each period of 20 weeks, each man has five Sundays off; after 20 weeks the schedule is repeated without change.

Canadian Ships Helped In Record Ore Movement

■ Canadian participation in the American movement of Lake Superior ore in the 1941 season represented a total of 705,572 gross tons, of American ore transported to American ports in Canadian vessels. In addition, 461,575 tons of Canadian ore from Michipicoten was moved.

The Canadian share was less than 1 per cent of the total season movement of 80,116,360 tons, and included 90 cargoes in 21 ships.

The largest tonnage was carried by the 500-foot BERRYTON, of the Colonial Steamships fleet, operated by Sarnia Steamships Ltd. In ten cargoes she transported 88,972 tons. MANTADOC, 430-foot carrier of the Paterson Steamship Co. Ltd., brought nine cargoes with a total of 62,144 tons. CAPT. C. D. SECORD, Mohawk Navigation Co., Montreal, made eight trips for a total of 78,270 tons and ALGOSTEEL, of Algoma Central Steamship Line, made eight trips with a total of 70,295 tons of ore. Other Canadian shipper in the ore trade were WINDOC of the Paterson fleet and H. L. SHAW of Upper Lakes Transportation Co., Toronto.

U. S. Outproduced Axis In 1941, Says Witherow

■ American industry produced as much or more essential war material in 1941 than Germany and the Axis countries combined, declared William P. Witherow last week when he became president, National Association of Manufacturers, New York.

This production, he said, included all essentials for a successful military campaign—machine tools, steel, petroleum products, electric power, automobiles and trucks, airplanes and aluminum.

Mr. Witherow, president, Blaw-Knox Corp., Pittsburgh, explained output of these vital wartime services and products was accomplished during one of the most critical periods in the industrial history of this country. It was done while factories were switching from peacetime to war manufacture, and while industry and government were spending more than $2,900,000,000 for expansion of facilities. Meanwhile, hundreds of thousands of green workers had to be taught new trades and skills.

Another gage by which war production can be judged is employment at industrial plants in the past year and a comparison of payrolls. The increase has been large in all industries contributing to the program, the aircraft industry showing the largest. Between June, 1940, and July, 1941, its payrolls increased 152 per cent, and indications are the percentage has been greater the last several months.

Shipyards in the same period increased payrolls from 159,400 to 348,000 men, up 188 per cent; plants making ordnance have added 71 per cent to their payrolls. Average increase of employment at war plants is approximately 60 per cent.

War Risk Insurance For Inland Waterways

NEW YORK

■ Possibility of enemy attacks on inland shipping in the United States was acknowledged by marine underwriters here recently with the announcement of a schedule of war risk insurance rates.

A premium of 15 cents per $100 of cargo value will be charged to cover shipments while in domestic harbors, bays, sounds, rivers and other inland water ways west of Rocky Mountains. Inland shipments east of the Rockies will be given war risk covering at the rate of 10 cents per $100.

Carbide Tool Handbook

■ Firth-Sterling Steel Co., McKeesport, Pa., announces a 64-page users' handbook dealing in an unusually complete way with the making, use and maintenance of single point, form, and fluted cutting tools having sintered carbide tips.

This ring-bound, pocket size book is divided into five sections, covering: Nature and selection of the cutting material itself; specifications and suggested uses of standard general purpose carbide-tipped tools; tipping and grinding of tools made by the user—including complete instructions in recessing, cleaning and brazing; proper operation of the tools—including suggestions as to cutting fluids and their application; and eight pages of data—including a speed and feed chart.

Every standard, every tool making operation and every suggested setup is illustrated either by a line drawing or photograph. With the help of this book any good tool maker or machinist can undertake the responsibility of making up and machining with carbide tools with every possibility of success.

Copies of this handbook will be sent by Firth-Sterling to those who furnish satisfactory evidence that they are in responsible positions in war industries in connection with which carbide tooling is a vital factor.

Bethlehem's Incentive, Bonus System Upheld

■ Bethlehem Steel Corp.'s bonus and incentive compensation system recently was upheld in New York by Supreme Court Justice Louis A. Valente, ruling in a minority stockholders' suit against present and former directors of the corporation. However, Justice Valente held that directors must return to the corporation sums estimated at $1,100,000 paid out of corporate funds in settlement of earlier stockholder actions based on similar charges.

He held the incentive compensation system was reasonable and the payments not excessive, and exonerated the defendants on charges of fraud. But, he ruled directors had allocated improperly to the company expenses and payment in settlement of the earlier action.

ACF Insures 15,000

■ Triple security has been provided by the American Car & Foundry Co. for its more than 15,000 employes by adopting a group program providing life insurance, weekly benefits in case of sickness or non-occupational injuries and hospital expense benefits. Life insurance and hospital expense benefits are underwritten by Metropolitan Life Insurance Co., weekly benefits by Travelers Insurance Co. The plan is on a co-operative basis, employes contributing fixed amounts and the employer bearing the balance.

Now Offers High Frequency Capacitors

■ Two high-frequency capacitors, rated at the same kilovolt-ampere, differ greatly if one is for 1250-volt and the other for 300-volt service. Lower voltage means higher currents—limitations in terminal size and excessive heating of current-carrying parts have heretofore prevented the design of capacitors for low voltages.

This bottleneck according to the Westinghouse East Pittsburgh works, is no more, and it is possible to build a 230-kilovolt-ampere, 300-volt capacitor for continuous service at 11,520 cycles. Earlier increases of kilovolt-ampere rating of capacitors had been possible through the development of efficient internal water cooling.

Further increase in the current-carrying ability of the capacitor is now possible by water-cooling not only the working elements, but also the case and the terminals. Higher frequency rating is achieved through metallic shields that prevent magnetic fields from inducing eddy currents in the housing and spread the heat over a larger area.

Machine Tool Output May Exceed Billion

(*Concluded from Page 235*)

second and third shifts. Just as soon as adequate supervisory staffs can be provided for these without weakening the vital first shift, this situation will be remedied. Upgrading out of the first shifts personnel is the most hopeful source of foremen for these extra shifts.

Another possibility which may develop in 1942 is the construction of certain big machines with reinforced concrete beds. Planers and long lathes were successfully constructed on this plan during the first World war. Plans for such machines are now being revised.

Tools, Dies in Mass Production

WHILE not as widely publicized as the machine tool industry, the tool and die industry runs it a close second in importance as far as the defense program is concerned. As a matter of fact, it is hard to draw a line of demarcation between the two industries. Each one without the other would be incomplete and useless—much as would a knife without a handle or a handle without its blade.

The importance of the tool and die industry and of tool engineering was driven home forcibly in March, 1941, by the Machine Tool and Progress Exhibition staged in Detroit by the American Society of Tool Engineers. No national exposition ever was staged at a more difficult time, yet more than 70,000 tool makers and tool designers who somehow found time to attend—coming from all parts of the United States and the Dominion of Canada. They received a liberal education in how to apply production technique to the tool industry itself.

Hitherto essentially a handicraft industry dealing primarily with single items or small lots of exceedingly accurate work, the tool industry proceeded to revolutionize itself by applying to the suddenly increased orders for tools, jigs, fixtures and gages, the same manufacturing equipment and the same manufacturing technique that its own customers long had been applying—with the help of tool engineers—to mass production of consumer goods.

Mass Production Technique

It is not at all uncommon now to find turret lathes and even automatics operating on large runs of gage blanks. It is not at all uncommon to find other standard machine tools—including milling machines and grinders—operating on tool work for which special machines formerly would have been required. Tedious handwork, including layout and hole spacing, is being handled directly in the machines which do the cutting. Rugged and accurate jig borers and profiling milling machines of recent origin have contributed heavily to this toolroom technique.

An indirect result of this mechanization of tool making has been that the skill of the limited number of fully trained tool and die makers has been spread out over a much greater field than would have been possible before. At the same time the industry has been able to make effective use of thousands of semi-skilled and even unskilled workers who have had to be called in to meet the emergency. It still takes at least four years to turn out a reasonably skilled all-around tool maker, but under the systems now employed and with the machines now used it is possible to train workmen in four months to handle effectively the less exacting and

routine work with which every tool maker used to be saddled and which took up the greater part of his time. Women also are beginning to work in successfully on certain phases of this departmentalized tool work—particularly inspection and checking.

The tool industry by no means is out of the woods yet and it will continue to be under tremendous pressure throughout 1942 and just as long thereafter as the emergency may last. However, it is no longer looked upon as a "hopeless case" as many pessimists did look upon it a year ago when it was announced that $16,000,000 worth of gages would be needed within 12 months by defense agencies and that "it simply couldn't be done". The fact that it was done answers that.

Just as the machine tool industry lost its Clifford Stilwell, so also did the tool engineering profession lose its equally dynamic Ford Lamb. Moving spirit of the American Society of Tool Engineers since its inception and widely known as its executive secretary, Mr. Lamb died Oct. 26, 1941 — a victim of overwork involved in the defense program.

The tool industry faces a rising tide of work in 1942 with far more assurance than it had in itself—or that the public had in it—at the beginning of 1941. For instance, there no longer is any question as to the willingness and ability of automotive tool shops to swing over effectively to defense tool work. That historic appeal in behalf of democracy, "Give us the tools and we will finish the job", has been accepted literally by the tool and die makers of America and is being met in full measure with typical American resourcefulness.

Hyatt Celebrates Fiftieth Anniversary

■ Hyatt Bearings Division of General Motors Corp., Harrison, N. J., this year reaches its fiftieth anniversary.

When the Hyatt Roller Bearing Co. was founded in 1892, industry was running chiefly on axle grease and plain bearings. Invention of the roller bearing and later developments by other antifriction bearing builders ushered in a new machine age.

During its half-century growth from a one-man machine shop to its present size, Hyatt has contributed to major advances in the motor car and in the mining, railroading, agriculture, textile, aviation and other industries.

The big Hyatt plant in New Jersey is celebrating its golden anniversary this year by working three shifts, helping to build the millions of roller bearings needed for the machines of war.

1942 Best Year In Shipbuilding

■ SHIP construction, both combat and merchant, is entering the most active year in history. While work progresses on the two-ocean navy, merchant vessels will be sliding down the ways at a rate of one a day during the first quarter and two a day by the fourth quarter. A total of more than 6,000,000 tons of merchant ships will be completed during the next 12 months, easily exceeding the previous peak output in 1919.

This rate of construction will continue and possibly be accelerated through 1943.

The merchant ship construction program, instituted by the United States Maritime Commission in 1937, has been steadily expanded since the national emergency was declared. Originally the commission sought to rehabilitate the merchant marine by building 500 speedy cargo and passenger-cargo vessels over a period of ten years. With the outbreak of war and the withdrawal of British and other

foreign bottoms from normal world commerce, the commission's program was accelerated to help take care of the United States' foreign trade.

Toll taken from British shipping by Axis submarines and the difficulty of building ships on the island — under aerial bombardment — caused the British government to place 60 cargo vessels in this country late in 1940.

In January of last year the need for additional bottoms became so acute that the President asked for an emergency fleet of 200 ships. These were to be standardized, slow cargo vessels, dubbed "ugly ducklings," which could be built more rapidly and at lower cost than the fast cargo vessels in the Maritime Commission's regular program. Rechristened as the "Liberty" fleet, the emergency ships can be built in four to six months, cost only $1,500,000 to $1,700,000, compared with $2,000,000 to $3,000,000 for the faster C-type vessels.

In April, after the lend-lease act was passed, the President called for an additional 227 cargo ships.

In July, 541 cargo vessels and tankers and 25 sea-going tugs were added to the program. An undetermined number of the cargo ships will be of the emergency type.

Thus a shipbuilding industry which from 1922 to 1935 had built not a single cargo vessel for overseas or foreign trade was asked to build more than 1500 major vessels —and in a hurry. In addition, a number of small vessels have been contracted for.

When the United States actually became involved in the war, the probability that the already gigantic shipbuilding program would be further enlarged, provided facilities could be constructed and materials made available, was apparent.

How rapidly facilities were expanded may be judged by the deliveries now scheduled. During the first quarter of this year, 90 ships, aggregating 1,000,000 tons, will be launched. In the second quarter, 146 vessels, totaling 1,400,000 tons will go into service, and in the third quarter, 154 ships, of 1,646,000 tons, are scheduled. During the fourth period, the two-a-day goal will be reached and 184 vessels, totaling 2,000,000 tons, will hit the water. For the first quarter of 1943, 2,270,000 tons are to be launched, and this rate will be maintained or accelerated as necessary.

Two-Ocean Navy Building

But merchant vessel construction is only one side of the picture. While expanding the cargo ship program, private yards were helping the Navy yards build the most powerful naval force in the world. The two-ocean navy was contracted for in 1940 but much of the construction was not underway until the past year.

The year 1941 will go down as one of the most notable in the Navy's history.

America's strength in naval ships on Dec. 1—including 942 built and 936 building or converting—totaled 1878 vessels.

Including smaller vessels the Navy has placed a total of 5334 ships since Jan. 1, 1940, at a cost of $7,351,497,905.

Coincidence of the huge merchant and combat shipbuilding programs early caused a dearth of facilities and ways, of skilled labor and of materials.

Both private and Navy yards were expanded as rapidly as equipment could be installed. Prior to the emergency there were only 21 active private yards engaged in the construction of seagoing vessels. They had available 83 ways of 300 feet or more in length. At present there are 65 yards with 383 ways of 300 feet or more.

The private yards now are employing more than 250,000 workers, compared with 65,000 before the emergency. By September this

year it is estimated total shipyard employment will be 750,000. Many of these will have to be trained.

The OPM early granted high priorities for materials required for ships. For those scheduled for completion in 1941, a rating of A-1-a was ordered; for vessels to be completed in 1942, a rating of A-1-b, and for those to be finished in 1943, a rating of A-1-c. After the war started some ship ratings were raised.

Even these high ratings, however, did not enable delivery of all the materials needed, especially steel plates. In June, the defense agency allocated almost 500,000 tons of plates, shapes, bars and sheets for shipbuilding among various steel mills. Plate capacity proved to be one of the choke-points in the program. Expansion of plate capacity is now underway.

Labor difficulties slowed the program in numerous instances and work stoppages were frequent. The Federal Shipbuilding & Dry Dock Co. yards at Kearny, N. J., were taken over by the Navy after the company refused to accede to a union demand for a "maintenance of membership" agreement.

On the Great Lakes at least 16 large new ore carriers will be built as part of the 10,000,000-ton steel expansion program. OPM approved a recommendation for building 25 new freighters at a cost of approximately $50,000,000, but it appears doubtful if more than the 16 can be placed.

Pittsburgh Steamship Co., United States Steel Corp. subsidiary, has five 640-foot freighters under construction.

Install Second Grand Coulee Generator

■ The second of 18 water wheel generators that will eventually be installed at Grand Coulee dam, Oregon, is in process of installation and will be in operation early this month. Built by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., the second unit will deliver 108,000 kilowatts.

For the present, it is said, Grand Coulee power will all be used for industrial purposes, much of it in defense industries of Washington and Oregon. Part of the power will eventually be used to operate twelve 65,000 horsepower synchronous motors to pump water for irrigation to a nearby natural reservoir 280 feet above the lake.

Work has been started by Westinghouse on three more identical 108,000 kilowatt units, to be installed in 1943. When all 18 machines are running, the company reported, Grand Coulee will produce 1,944,000 kilowatts.

Active Year For Railroads

■ ENTRY of the United States into war and acceleration of the arms production program, which will be attended by increased freight traffic and higher revenues, is expected to continue American railroads in a favorable position to purchase new equipment materials and supplies in 1942. Throughout 1941, the carriers were heavy buyers by virtue of their higher volume of business and improved earnings. Late in the year sizable wage increases to workers retroactive to Sept. 1, threatened net operating income, but this likely will be offset by higher freight, passenger rates.

Advent of the rearmament program in early 1940 found the railroads well prepared to meet demands placed upon them. As the program expanded in scope, the carriers purchased new cars and locomotives in heavy volume and speeded the rehabilitation of bad order equipment, and with much of this equipment placed in service no severe shortage of facilities developed.

As last year closed, the freight

car building program was appreciably behind schedule because of the difficulties which car shops experienced in obtaining steel. Plates were a principal stumbling block, with all standard plate mills producing the heavier sizes almost exclusively to meet the high priority ratings of navy and maritime requirements. An A-3 rating granted to railroad equipment manufacturers in midyear failed to provide adequate quantities of steel. In an effort to overcome this difficulty, OPM arranged for continuous sheet mills to roll lighter gage plates suitable for freight car requirements, but only a fraction of potential capacity had been converted by year end. When this conversion is completed and new plate capacity is installed late in the year, the steel supply situation for car builders should be improved.

In early December, OPM extended from Nov. 30 to Dec. 31 general preference orders incorporating the A-3 priority ratings. Since the extension was for only 30 days, it appeared that the priorities division expected this system to be temporary for the industry and to serve only pending development of some system of providing for the builder of rail equipment a guarantee, through preference rating or direct allocations, of set percentages of raw materials tonnages sufficient to permit construction of minimum equipment required throughout the coming year.

At a meeting of the executives from the railroads, equipment manufacturers and steel producers with the Office of Production Management in Washington Dec. 13 it was agreed that the railroads are the nation's No. 1 civilian industry and their requirements for materials entering new equipment must be filled immediately after Army, Navy and Maritime Commission requirements. OPM had already placed before SPAB a tentative program to obtain allocation of materials to meet expanded production quotas for the first quarter of 1942.

Another move to conserve metal supplies in the interest of national defense was made in late November when the Association of American Railroads announced that roads hereafter will limit new construction to certain designs now in use. This would facilitate allocation of steel and other materials. Major points in the program called for substitution of other materials for scarce materials wherever possible, use of carbon rather than alloy steel in locomotives, and use of smaller-sized steel plates.

Manufacturing Ordnance

In addition to direct railroad production, equipment makers have assumed an important role in the manufacture of ordnance. A number of the country's locomotive and car building shops have converted or expanded their facilities to make tanks, guns, gun carriages, bombs, shells and similar items.

The railroad industry is an important consumer of iron, steel and other metals. According to reliable statistics, compiled from shipments reported by steel manufacturers, the railroads and equipment industries in 1940 took 8.2 per cent of all finished steel produced in the United States; in 1939, the figure was 9.29 per cent. Under average conditions, the carriers estimate they utilize approximately 17 per cent of the total iron and steel output of the country. This, of course, includes gray iron, malleable and steel castings, as well as finished steel.

Domestic freight car orders in 1941 were sharply upward under impetus of the armament program. For ten months they aggregated 110,871, which far exceeded the 66,889 in all of 1940. Incidentally, this is the first year since 1929 with 106,105 units that orders have exceeded 100,000. All-time peak was 180,154 cars in 1922. For the first six months of 1941, awards averaged 15,796 units monthly with a

top of 32,749 in June, but the average fell to only 4024 for the succeeding four months.

Reflecting the heavy purchases of freight cars, starting in mid-1940 and continuing at an accelerated rate through the first six months of last year, Class 1 railroads put 64,680 new units into service in the first ten months of 1941, compared with 54,791 in the corresponding 1940 period. That the number was not substantially larger is due to difficulties car builders experienced in obtaining steel in the last half of last year. On Nov. 1, carriers had on order 80,504 cars, against 27,459 on the same date a year ago.

Railroad Statistics

	Net railway operating income (000 omitted)	Freight car-loadings (000 omitted)	Freight cars ordered	Steel rail production (net tons)
1930.....	$869,000	45,878	46,356	2,098,021
1931.....	526,000	37,151	10,884	1,296,681
1932.....	326,000	38,180	1,968	450,874
1933.....	474,000	29,220	1,680	466,252
1934.....	463,000	30,846	24,602	1,131,451
1935.....	500,000	31,504	19,308	796,921
1936.....	667,000	36,109	64,523	1,366,228
1937.....	590,000	37,670	51,611	1,619,228
1938.....	373,000	30,457	16,303	697,642
1939.....	589,000	33,911	57,775	1,312,647
1940.....	682,000	36,354	66,889	1,678,986
1941.....	*846,824	†39,251	*110,871	*1,624,239

*10 months; †11 months.

During the same ten months, the roads installed 493 locomotives, of which 117 were steam and 376 were electric and diesel, compared with 320 new units in first ten months of 1940, of which 84 were steam and 236 were electric and diesel. A total of 611 locomotives, comprising 284 steam and 237 electric and diesel, were on order Nov. 1, against 196 units on Nov. 1, 1940, of which 131 were steam and 65 electric and diesel.

Under pressure of rapidly rising freight traffic, the carriers speeded up the rehabilitation of damaged equipment. With 108,972 cars, or 6.8 per cent of the total, awaiting repairs on Dec. 31, 1940, only 68,128, or 4.1 per cent, were in this category on Nov. 1. Incidentally, this was the lowest percentage on record; as far back as 1917 the figure had not fallen below 5 per cent. Bad order locomotives on Dec. 31, 1940, numbered 5914, or 14.9 per cent of the total. By Nov. 1 last, the figure had been reduced to 3778, or only 9.6 per cent.

During the first ten months of 1941, freight cars permanently withdrawn for sale or demolition because of obsolescence totaled 42,877, against 54,846 in all of 1940. Locomotives retired for the same reason numbered 968, compared with 1260 in the year before.

Early in December, J. J. Pelley, president, Association of American Railroads, announced that first line roads had decided to order 26,000 new freight cars and 304 new locomotives, mostly diesel powered, for delivery by Oct. 1, 1942. In view of the fact the railroads had 80,504 cars on order on Nov. 1, a considerable number of these held up because of the plate situation, and further in view of the rising demand for steel now that the nation is at war, steel men regard the proposed purchase as impossible of fulfillment.

Increased freight traffic and building of many huge ordnance plants, army cantonments, warehouses, and the like, created a heavy demand for rails. Production of rails in the first ten months of 1941 totaled 1,624,239 tons, as compared with 1,678,986 tons in the full year 1940. Of this production, 114,977 tons was exported. Exports in all 1940 amounted to 282,109 tons. On the basis of the ten months' performance, it seems likely that 1941 rail production will aggregate about 2,000,000 tons, and will be the best since 1930 with 2,098,021 tons. This figure would have been surpassed substantially had not steel short-

age during the last half of the year inflicted restrictions on output.

Earnings of Class 1 railroads, which are the important regulator of carrier spending, were considerably improved in 1941 over recent years. For ten months they totaled $846,824,141, against $682,000,000 in all of 1940. The ten-month total was an increase of 59.2 per cent over the corresponding period of 1940. Every month of last year showed a marked gain over the corresponding month of 1940, with the best showings in July, August and September. What will happen to earnings in the two closing months of the year cannot be estimated safely, inasmuch as the full import of the recently granted $325,000,000 annual wage increases retroactive to Sept. 1 is not known.

Freight carloadings followed a pattern similar to that of earnings, although the improvement was more moderate, and the total was the best since 1930. For 11 months, loadings aggregated 39,251,000, a gain of 16.6 per cent over the corresponding period of 1940, and compared with 36,354,000 in all of 1940. The trend exactly followed that of a typical good year. Loadings in 1930 totaled 45,878,000.

War To Spur New Building

■ INCREASED arms production necessitated by the Unites States' involvement in actual war will develop heavier demand for fabricated structural steel for new industrial plants, bases, repairs and general requirements of the times.

Nonessential tonnage will decline to the vanishing point.

Structural mills will be relatively heavier engaged than structural fabricating shops, due to the probable demand on mills for other than structural products — shell steel, for example.

Recession in immediate demand and backlogs, manifest in the last quarter of 1941, probably will continue for the next two or three months, or until details of the supplemental program brought forth by the war can be learned.

Structural Statistics

(American Institute of Steel Construction)

	—BOOKINGS— 1941	1940
January	281,235	81,689
February	173,559	98,882
March	206,072	128,321
April	218,018	73,780
May	179,884	126,815
June	246,910	109,744
July	214,756	194,940
August	158,658	122,468
September	158,782	225,494
October	126,488	240,942
November	*125,000	141,945
December	*150,000	203,124
Total	*2,239,362	1,748,144

	—SHIPMENTS— 1941	1940
January	164,590	110,919
February	161,354	97,157
March	170,161	95,915
April	189,751	116,317
May	191,905	115,617
June	200,505	119,087
July	203,026	127,120
August	189,251	134,858
September	204,085	142,834
October	210,639	153,201
November	*200,000	146,992
December	*196,000	155,526
Total	*2,281,271	1,515,543

*Estimated.

Another sharp upturn in strictly defense tonnage may then be expected.

Much of the construction started under the program to make America the "arsenal of democracy" is well along; the storage and warehouse phase is advancing and most defense construction is nearing completion, under contract or nearly ready for estimates.

While the supplemental program

Total Value of Construction Contracts

(F. W. Dodge Corp. Reports—37 Eastern States)

Classification	1940 Act. Millions of Dollars	—1941 Estimate— Millions of Dollars	% Change From '40	—1942 Estimate— Millions of Dollars	% Change From 1941 Est.
Commercial Buildings	318	490	+ 54	330	—33
Manufacturing Buildings	442	1,175	+166	1,175	0
Miscellaneous	534	715	+ 34	355	—50
Total Non-Residential	1,294	2,380	+ 84	1,860	—22
Apartments, Hotels, Dorms.	331	255	— 23	100	—61
1 and 2-Family Houses	1,155	1,625	+ 41	1,075	—34
Other Shelter	111	160	+ 44	50	—69
Residential	1,597	2,040	+ 28	1,225	—40
Total Building	2,891	4,420	+ 53	3,085	—30
Total Pub. Works and Utilities	1,112	1,710	+ 54	1,100	—36
Total Construction	4,003	6,130	+ 53	4,185	—32

is yet to be revealed, it is doubted that the dollar value of 1942 construction will equal that of 1941.

Recession in structural rolling mill production will not be so relatively pronounced as in the fabricating industry. Volume of plain material entering into consumption and by-passing structural shops is increasing.

Ship construction, car building, crane erecting, bearing piles for numerous defense and engineering projects, coastwise gun protection shelters, export, warehouse and miscellaneous outlets requiring little or no shop fabrication partially account for the widening difference between structural mill output and fabricating shop totals.

Structural mills rolled approximately 4,602,278 tons last year which, based on a capacity of 5,248,400 tons, was approximately 88 per cent of capacity. Therefore, less than half of the output of structural mills actually passed through fabricating shops, an unusual and little-realized situation.

The fabricating industry is doing a remarkable job, completed plants being erected in record time, four months being possible on even the largest projects and even better on many jobs.

Unfilled orders of fabricators have been steadily declining since early September, shipments substantially exceeding bookings.

Tonnage under contract or available for fabrication and early delivery at the start of the year is smaller than last, about 475,000 tons. On the other hand, steel mills had defense orders for structural shapes and piling for rerolling later than November approximating 1,101,358 tons or 74 per cent of all ordered tonnage for that period. Rollings of those products for defense during November, the last figures available, totaled 281,263 tons or 76.8 per cent of all scheduled rolled orders.

Therefore, starting last quarter, analysis of total bookings and shipments discloses pressure for defense requirements on both the fabricating industry and structural mills is becoming progressively less, notably with the former. Actually substantial capacity is now available for civilian work, since the industry as a whole was placed on a priority basis Sept. 1, when mills were restrained from accepting orders without priority rating.

The 10,000,000-ton steel ingot expansion has been estimated to require 1,500,000 tons of ingots, with an allowance of 50 per cent as a safety factor, making a possible requirement of 2,500,000 tons over a two-year period. Only a part of this would be structurals, of course.

If the expansion program is en-

larged, as has been suggested, to 15,000,000 tons, a total of 3,750,000 tons might be required. On a two-year basis this would require 2.1 per cent of the industry's present capacity.

Highway bridges took approximately 11 per cent of the fabricated output in 1941, compared with 22.2 per cent in 1940. For 1942 the outlook is uncertain, but 400 defense areas have been certified which may readily involve more bridge construction under priority ratings.

Curtailment in number of structural steel sizes, starting Feb. 1, is not likely to reduce total tonnage rolled or fabricated. Such is not the intent, but rather increased efficiency by elimination of 50 per cent of angle shapes, reductions in beams, channels and other shapes being almost as drastic. Both mills and fabricating shops will benefit by fewer odd-sized rollings, which tend to slow down production.

Failure of the fabricating industry to share to a greater extent in the shipbuilding program has been a major disappointment. High hopes were entertained earlier in the defense drive that structural fabricators would assist substantially in the production of ship parts through subcontracts. This has not materialized and a minimum of tonnage has been given shops, due to opposition of the Maritime Commission, seeking to avoid another Hog Island experience.

The SPAB order of Oct. 9 sets no limitation on construction for defense or building not requiring critical materials. In effect, however, the order will practically bring nondefense activity to a halt. This will be partially offset by defense construction.

The going will be difficult for many members of the construction industry this year. Controls instituted by defense planning agencies are directing this year's construction activity into specialized types of projects and at specially designated locations. Impacts of defense needs and nondefense curtailment are unevenly distributed. Although defense areas, where construction volume will be large, are well distributed regionally, nondefense areas are also numerous and will apparently have little construction except maintenance and repair work.

Army, Navy and defense plant construction projects are likely to consist of large unit operations employing a relatively small number of construction organizations. Manufacturers of building products will have varying problems, according to whether they turn out nonmetallic products, metal products used in defense construction, or metal specialties not rated as essential to defense.

Find Data on Elastic Properties of Alloy Iron

■ Tests recently concluded at the National Bureau of Standards have developed much needed data on the elastic properties of three types of alloy cast iron, according to the Department of Commerce.

The tests, conducted by Col. A. I. Krynitsky and C. M. Saeger Jr., were made in the bureau's experimental foundry.

Transverse strength, deflection, resilience and hardness measurements were made on test bars from iron which had been melted in a high-frequency induction furnace. Before pouring, the metals were heated to various temperatures above the point at which the iron liquefied.

Maximum heating was shown to be of greater benefit in the case of plain carbon irons than alloy irons, while the effect of pouring temperature on plain carbon and alloy irons was about the same, both kinds showing a tendency to become weaker and less elastic as the temperature was raised.

Farm Income To Reach New Peak

WAR conditions are leaving indelible imprints upon American agriculture. These influences gave farming and the farm equipment industry the best year in history in 1941, but for 1942 the situation is confused and less promising as shortages of steel and other metals seem certain to force readjustments in many directions.

An anticipated rise of 10 per cent in business of the farm equipment industry in 1941 expanded to 20 per cent under the stimulus of the drive for increased farm production and the accelerating arms output late in the year. Except for the specter of growing shortages in critical materials, this trend probably would continue this year, but even the most optimistic estimates forecast a 15 to 25 per cent decrease from 1941, to place the total business at about 80 per cent of the volume in 1940.

Domestic farm equipment sales, estimated at $600,000,000 for 1941, compared with $488,322,100 in 1940, and were the largest in history. Prior peak was in 1937 with $507,000,000. Sales in 1941 included armament production, for the industry has converted a sizeable proportion of its facilities to the manufacture of tanks, guns, gun carriages and shells, for which these facilities are admirably suited. Exports in 1940 amounted to $74,221,000, and were expected to remain at approximately the same level in 1941. For the first nine months of 1941, according to the Department of Commerce, exports of farm implements and machinery totaled $61,825,171, compared with $61,842,549 in the corresponding period of 1940.

For 1942, it is expected that domestic sales of farm equipment may drop to between $450,000,000 and $500,000,000 because of restrictions which the arms building program will impose on production of new machinery. The total will be influenced to a considerable extent by the volume of repair and maintenance output, which probably will be free of restriction. Exports in 1942 will about hold their own with last year, possibly decreasing slightly. Crawler-type tractors and some other machines increased in export volume in 1941 to approximately offset a decline in other types of equipment, and this trend is expected to continue in 1942.

Crop situation improved measurably in 1942 and production compared favorably with 1937, the record year. This was due both to increase in acreage and to higher productivity. On top of this, dairy production, and poultry and livestock raising expanded sharply under spur of efforts of the Department of Agriculture to increase farm output.

Cash farm income in 1941 was estimated at $11,200,000,000, and was

Farm Cash Income and Buying Power

(Millions of Dollars)

	From Marketings	From Government Payments	Buying Power of Cash Income*
1929	$11,221	....	$7,330
1930	8,883	....	6,120
1931	6,283	....	5,070
1932	4,682	....	4,370
1933	5,278	$131	4,950
1934	6,273	447	5,460
1935	6,969	573	6,030
1936	8,212	287	6,850
1937	8,744	367	7,000
1938	7,599	482	6,630
1939	7,711	807	7,040
1940	8,354	766	7,400
1941** ..	10,700	500	8,750

*Includes government payments.
**Preliminary estimate.

the best for any year since 1929 with $11,221,000,000. This income, which was evenly distributed over the country, was $2,080,000,000 higher than the 1940 figures of $9,120,000,000. Government payments, which were a comparatively important factor in 1939 and 1940, were estimated at only $500,000,000 in 1941. They aggregated $766,000,000 in 1940.

Agricultural experts cite as reasons for 1941 cash income reaching $11,200,000,000 the facts that increased consumer buying, government support of prices, actual and prospective purchases under the lease-lend act, curtailment of imports of competitive agricultural products, provision on loans on certain products at 85 to 100 per cent of parity, and the increment in prices of holdover supplies, have enhanced farm income prospects. In face of current trends, it seems likely that cash farm income will reach an all-time peak of $13,000,000,000 in 1942.

At the request of Washington officials, the Farm Equipment Institute Priorities Committee recently completed a tabulation of materials requirements of the farm equipment industry. These data, covering 1940, 1941 and 1942, and the first of their kind ever to have been compiled, are as follows:

	Net Tons		
	1940	1941	1942
Steel	1,269,892	1,553,841	1,804,794
Cast Iron	824,879	954,287	1,089,846
Chromium	1,354	1,673	1,921
Nickel	435	516	580
Zinc	15,867	20,505	21,205
Copper	11,908	14,799	17,968
Lead	4,606	6,445	7,444
Tin	1,539	1,770	2,155
Aluminum	1,601	2,145	2,567
Antimony	186	249	279
Molybdenum	165	194	225
Cobalt	18	22	25
Rubber	21,396	26,492	28,661

Figures for 1940 are based on production; 1941 is based on some experience during the year and on estimates of 250 people with 150 companies in the industry; and 1942 is based on estimates provided by a similar number of individuals. To obtain the summary, each machine was broken down into its weight of each material required. Then by multiplying the individual items of materials by total estimates of machines wanted in 1941 and 1942, the total weight of each material was arrived at.

Output May Be Limited

Perhaps it should be pointed out that the figures were compiled at a time before it was known to what extent materials shortages or requirements of the defense program might prove to be limiting influences in equipment production. Since neither of these influences exerted much effect until late last year, it is probable that materials consumption in 1941 closely approximated the estimate. If, as now seems likely, production of new equipment in 1942 is restricted to 80 per cent of 1940, then materials requirements will be only about 56 per cent of the estimate.

Until these estimates were prepared, the only key to use of steel in agriculture, including farm machinery and all other farm uses, has been the distribution figures compiled over a long period of years up to 1939 by STEEL and in 1940 by the American Iron and Steel Institute. In 1940, all agriculture consumed 919,502 net tons of steel, or 2 per cent of the country's output of finished steel. Of this steel, 50 per cent was carbon and alloy bars, and about 25 per cent was hot-rolled, cold-rolled, galvanized and other forms of sheet and strip. Thus, all other forms of steel, including wire and wire products, which are used widely on farms, and pipe, accounted for only 25 per cent.

From a study of the Priorities Committee steel tabulation for 1940 and the 1940 steel consumption figures compiled by the American Iron and Steel Institute, it will be observed that the former are higher by approximately 38 per cent. The answer to this probably lies in the fact that steelmakers in reporting

shipments to the institute are not sure of the ultimate destination of their products. Probably a large portion of steel reported as going to "Jobbers" and to "All Other" ultimately went to agriculture.

The farm equipment industry operated in 1941 without the benefit of an advantageous preference rating for its principal production. Preference rating order P-33, issued Aug. 20, assigned the highest civilian rating, B-1, to materials for new farm machinery, but this was not sufficiently high to provide adequate supplies. An A-10 rating was issued for materials for production of parts for repairs and maintenance of existing farm equipment. This rating operated reasonably well.

Throughout the closing months of 1941, a plan was considered by SPAB for making a "guinea pig" of the farm equipment industry and providing materials for its needs by allocation. This was abandoned, however, in favor of a program of higher priority ratings designed to insure delivery of set percentages of various materials estimated as necessary to turn out definite quotas of certain types of new machinery.

Early in December, Priorities Division of OPM extended the farm equipment priority order from Nov. 30 to Feb. 14. In extending the order, the division also assigned a higher rating for the acquisition of material needed to produce farm machinery. The new rating is A-8, compared with B-1 previously. The new order was described by the division as "an interim measure," since it is making an exhaustive study to work out a plan to allocate materials to the industry. After the United States entered the war, however, steelmakers indicated a definite feeling that the industry may not fare so well on allocations, because of the suddenly increased requirements for steel for direct war needs.

The Department of Agriculture has requested a 15 per cent increase in food production in 1942. This is equivalent to 340,000 man-years, and with farm labor supply already short due to losses of men to industry and to the armed forces, the increase in farm production can be obtained only with some increase in land and considerable increase in machinery. The growing diversification of crops also requires more machinery, as does larger feeding of livestock. As a matter of fact, any move toward efficiency produces demand for mechanical equipment.

Tractors continue to increase their importance considerably. Other types of farm machinery appear to be holding their relative positions. Demand for grain binders has been heavy and sales of corn pickers would have been very high could they have been manufactured.

Tin Plate Output At New Peak

■ ACCOMPANIED by a 28 per cent increase in packer and general line cans, tin plate mill production broke all records in 1941 with approximately 3,500,000 tons rolled and coated. Sustained lend-lease requirements, substantially heavier food packs, with greater use of tin and terne plate in general war items, assures near-capacity output for 1942. Facilities will be taxed to meet all requirements.

Productive capacity will be somewhat heavier this year, considerable hot mill equipment having been revived in the last half of 1941. With some overhauling, which will require time, cold-reduction output could be stepped up materially. As the time element is important, such a move is not likely until a distinct lull in demand appears. No such lull appears likely in the near future.

At the outbreak of the war with Japan, the United States had more tin on hand or in sight than ever

before. While reduction in Straits imports may threaten, and total requirements can hardly be met at once by Bolivia, no immediate tin shortage is likely.

Normally the country uses close to 85,000 tons, producing none.

Imports last year approximated 145,000 long tons, 25 per cent more than 1940 and 50 per cent more than normal year imports. Thus after 28 months of world conflict, when the United States then entered the war, supplies are ample for nearby needs.

For every ton of hot-rolled now being produced, nine tons of cold processed tin plate is going into consumption. Theoretical capacity for both grades is 4,057,660 tons, but this includes 515,620 tons of hot-rolled, which before the abnormal demand growing out of the world conditions which removes Great Britain from competition, was rapidly being removed. Hot-rolled capacity in 1940 was 1,201,960 tons and 1,710,643 tons in 1939. Indications are this removal of hot-rolled capacity has halted, but the ratio in favor of cold-rolled grows rapidly greater. Latter was at capacity at the start of last year, and in August had reached 110 per cent of the industry's theoretical capacity.

While mill backlogs are heavy, inventories are low and the carryover of canned goods into 1942 is below normal, as in 1941. Proposed increases in vegetable packs this year for greater domestic defense needs and ample assistance to numerous nations under lend-lease are staggering. Growers and can-makers are advised 44,000,000 cases of tomatoes will be required against 31,500,000 cases in 1941; 14,000,000 cases snap beans, compared with 10,000,000; and 42,000,000 cases of peas against 29,500,000 in 1941. Other vegetable packs will be in proportion.

While tin plate exports last year were about equal to 1940 or slightly under, shipments abroad are likely to be heavier in the next 12 months. Bulk of the world trade formerly supplied by Great Britain is getting tin plate from the United States in increasing volume. With the end of the emergency, the British may experience difficulty in recapturing these markets. Some foreign customers are using cold-reduced plate for the first time. Great Britain has little cold-reduced capacity and to meet later competition may have to re-equip materially.

Allocation of 218,600 metric tons of tin plate for Latin-America this year has been made by SPAB and recommendations of Central and South American nations have been asked as a guide for essential uses and consignees to whom the plate is to be exported. A system is being developed whereby prospective importers apply to their governments for certificates indicating proposed deliveries have government approval. These certificates will be transferred to American exporters and submitted by them with export license applications.

Having tacitly accepted the fact most tin plate production is automatically essential in defense, the industry has been operating on a nonpriority basis. Fully 93 per

Tin Mill Operations

Net tons

	Annual Capacity	Production	Per Cent of Capacity	Tin Plate Exports
1934.....	2,987,774	1,692,131	56.7	203,800
1935.....	2,829,407	1,856,908	65.6	148,077
1936.....	2,975,504	2,361,986	79.4	263,853
1937.....	3,317,216	2,758,294	83.2	396,860
1938.....	a1,827,791	675,745	37.0	†231,170
	b2,047,472	142,572	46.0	
1939.....	a1,710,643	645,301	37.7	†369,443
	b2,168,544	1,916,159	88.4	
1940.....	a1,201,960	422,028	35.1	†400,629
	b2,970,360	2,267,828	77.4	
1941*.....	a 515,620	294,118	68.5	†299,219
	b3,542,040	2,582,343	87.5	

*Ten months; a—hot rolled; b—cold rolled; †both grades.

Three Major Vegetable Packs

(In millions of cases)

	*1942	1941	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931
Tomatoes	44.0	31.5	29.6	18.5	23.0	20.5	24.0	15.7	13.1	12.0	16.0	9.6
Peas	42.0	29.5	25.5	16.3	24.5	23.3	16.0	24.6	15.7	12.9	10.4	13.3
Corn	25.0	23.1	16.3	15.3	20.8	24.3	14.0	21.0	11.3	10.2	9.4	19.4

*Estimated.

cent of tin plate tonnage goes into containers or cans in some form, 76 per cent domestic cans and 17 per cent export.

Bottle crowns and screw caps consume close to 5 per cent of the output, leaving the remainder for miscellaneous uses, gas masks, kitchen ware and other items. For gas masks, the ratio will be heavier this year. Cans now in use for some products might be dispensed with, but to disrupt numerous small industries to save a few thousand tons of steel has not been considered worth while.

Beer, canning of which has stepped up greatly in recent years, might be placed in this category, but closer analysis raises doubt as to feasibility of such a curtailment. Troops in Africa, for instance, will not drink the water available or consume salt tablets urged upon them. They insist on beer. The move would not be popular with U. S. armed forces, canteens selling canned beer, but not hard liquors. Also scores of breweries have replaced bottling equipment with canning machinery and any change would prove a hardship.

In numerous other instances where suggestions are heard as to curtailment in the use of cans, closer study reveals many of these are indirectly connected with defense. Disinfectant in cans by the carload, for example, is going to army cantonments and naval depots.

Milk Leading Pack

Milk continues to be the leading pack and current schedules call for 85,000,000 cases of canned milk this year, each of 48 cans, 14½-ounce capacity. This means more than four billion cans, and output of dairies alone will probably ultimately fix the total volume of milk to be canned. The pack in 1941 was approximately 35,000,000 cases. Outstanding gains are being made in meat products, cranberries, mushrooms, apple sauce and apple juice —in fact, all fruit and vegetable juices, while increase is noted in orange juice.

Reduction of tin consumption by lighter coating of plate entering into many cans from 1.5 pounds per base box to 1.35 pounds has been satisfactorily accomplished by the industry voluntarily, the thinner coating being satisfactory for the bulk of packs. Total production of tin cans last year was about 28 per cent greater than in 1940, and the gain will be larger in 1942. Tin plate is taking nearly half of the tin now being consumed in this country.

Approximately 80 per cent of tin plate for containers goes into so-called packers' cans for the conservation of food, remaining 20 per cent being consumed in general line cans required for thousands of specialties.

Considerable tin plate is being fabricated into gas mask parts, while needs for ammunition cases and containers is mounting. For gas masks, a sharp upward demand is likely with a program to supply civilians as well as the military under consideration. Purchases by arsenals, notably Picatinny, N. J., and Edgewater, Md., are substantially higher.

Government estimates of requirements indicate total over-all pack

of 445,000,000 cases will be required this year, against 400,000,000 in 1941. Canners claim canning equipment out of service for a year or more in plants in various parts of the country represents a theoretical production capacity equal to the additional 45,000,000 cases called for in the Department of Agriculture's estimates. They warn, however, that much equipment is obsolete or in such disrepair that the cost of putting it back into operation might be greater than that of erecting new plants.

No definite estimates as to the industry's new equipment needs can be made until the government indicates its requirements more exactly, both as to quantities and types of canned goods desired.

To aid the small canner in getting his share of Army business, the Chicago Quartermaster Depot, through which most of the Army's canned vegetables are purchased, is now sending "buying teams" into the field to deal directly with canners at their plants. So far these field buyers have gone into Illinois, Indiana, Ohio, Wisconsin and Minnesota to purchase thousands of cases of corn, peas, tomatoes and tomato juice.

Throughout 1941 there was no shortage of tin, though the Metals Reserve in August began to sell small tonnages out of its stockpile to consumers needing spot tin. Public stocks of tin at the end of 1941 were over 45,000 tons and privately held stocks were equally as large. Defense Plant Corp's tin smelter at Texas City, Tex., which is to refine 18,000 tons per year, goes into operation in February, 1942, with the output to be sold to the Metals Reserve Co. Substantial tonnages of Bolivian and Netherlands East Indies ore already are in store at the smelter. Tin conservation was instituted in 1941 but substitution of tin for alumiunm and for lead actually increased consumption of tin from 5000 tons per month in normal times to around 9000 tons.

Shortages Hit Appliances

■ SUBSTITUTES and production ceilings will be the two most vital factors confronting appliance manufacturers during 1942. These manufacturers will be fighting it out in the narrow confines of an arena whose limitation on one side is an L-order, on the other side an M-order. Some of them may gain a certain assistance from P-orders, but at best the P-orders will be only slight relief.

Already some of the rules of the game are visible. Look at L-5, restricting production of domestic refrigerators; L-6, the same for laundry equipment; L-7, cutting steel supplies going to refrigerator manufacturers; L-13, metal office furniture and equipment; L-18, vacuum cleaners—all these are merely harbingers of an entire family which will establish production ceilings throughout the appliance industry.

Pressure of the defense program has already eliminated major metals used in appliance manufacture and restricted quantities on other materials through the operation of M-orders so that in some cases even the allowable ceilings will be impossible of achievement. Thus 1942 production is already pretty well limited, and will show a sharp decline from 1941 output, which reached new highs for many appliances. Gas ranges, for example, reached 2,400,000 units; a gain of nearly 40 per cent over 1940 output. Electric ranges touched 725,000 units for a gain of nearly 70 per cent. Practically all items in this classification show the same general trend—a steady gain through the early months of 1941, piling up substantial margins over 1940 production.

and then with the incidence of priorities, a gradual decline due to material shortages until the tag end of 1941 production in most cases dropped below 1940 levels.

During 1942, application of substitutes will enable production to reach ceiling levels without the difficulties so apparent now. Output of new chemical plants, plus development of new base materials, will increase availability of both structural and ornamental plastics, while increasing steel production toward the end of the year may ease the tightness in that category. There is not yet any appreciable relief in sight on zinc, copper or aluminum because defense uses for these metals are increasing faster than new production can be made ready. Reapplication of these must be reserved until the war ends.

Naturally most manufacturers have turned to war work, either as prime contractors or on subcontract work, to fill in their idle plant time. This activity is due for expansion during 1942, both from the standpoint of new orders and from expansion of quantities under contract on present orders.

While many appliance makers have substantial government contracts for their regular items, they have also gone in for war material manufacture.

From Refrigerators to Fire Controls

For example, an air conditioning equipment maker has started ordnance work, a refrigerator manufacturer now is turning out fire control equipment, a vacuum cleaner plant has numerous subcontracts for a wide variety of small parts, and the larger manufacturers, such as Westinghouse Electric & Mfg., Frigidaire, and General Electric Co., have taken on major defense prime contracts in almost every branch from aircraft to submarines.

Those manufacturers, and there are still some, who have not yet ventured into defense business will find the pickings somewhat leaner this year in the way of good subcontracts which can be made with a minimum of changes in their plant layouts and equipment. However, there will still be plenty of available jobs, and if the manufacturer expects to run at more than 50 per cent of capacity, he will have to investigate these possibilities thoroughly with a view toward augmenting his regular line with defense work. Obviously war requirements will take an increasing portion of industrial capacity, and the probable 1942 averwill be less than 50 per cent, enforced by limitation orders, allocation of materials and price ceilings. As a result, material allocation will be made as war conditions and needs dictate.

Nonferrous Capacity Up

■ NONFERROUS metal producing and fabricating capacity was raised in 1941 to a new high, partly by private and considerably by government capital.

Never before has the federal government dominated all aspects of nonferrous metal production, distribution, sales, fabrication and use as in 1941, and because of long term commitments the government will be the biggest factor in the metal business for years.

These are the significant aspects of the nonferrous metal business at the end of 1941:

Metals Reserve Co.: Set up originally to buy for stockpile only 75,000 tons of tin and various other materials, the MRC has bought nearly one *billion* dollars worth of strategic materials of all kinds, many of which have been sold, free of customary duty, to domestic consumers.

This government agency, now a super metal brokerage agency grown to a size beyond the wildest

imagination of any private interest, imports and sells practically every defense commodity. MRC will be in the metal business, particularly tin, long after the war is over.

Production: Through loans and subsidies, government capital has stimulated output of copper, lead, zinc, tin and other metals in mines and mills that could not be operated at maximum prices set by OPA. Private capital has increased output substantially, particularly in aluminum.

Distribution and Sales: OPM control of distribution and OPA control of prices in 1941 practically ended for the duration of the war of the "free" metal market, largely centered in New York.

Fabrication: No figures are available, but perhaps $100,000,000 has been spent to increase facilities to produce semifinished material, including about $50,000,000 for copper and brass capacity alone.

Use: OPM by the end of 1941 was concerned with the ultimate, or "end use" to which raw materials were being put. Users of metals in civilian products have been the first and hardest hit by the severe limitations on the use of copper, aluminum, magnesium, lead, zinc and tin.

Nonferrous metal producing capacity at the end of 1941 and to be effective early in 1942:

COPPER: United States electrolytic copper refining capacity is 1,550,000 tons per year, or about 129,000 tons per month, but will go up to 1,625,000 tons in 1942 when Phelps Dodge Corp. brings in its mine and refinery capacity of 75,000 tons per year.

Shifts to Middle West

Copper and brass mill capacity, once centered mainly in the Connecticut valley, will be largest in the Middle West as soon as a number of big government-owned plants for munitions go into operation in 1942. American Brass, Chase, Bridgeport, Revere, Scovill, Western Cartridge and others will have spent better than $50,000,000, mostly for the Defense Plant Corp. account.

Revere alone is accounting for a $10,000,000 plant for production of 15,000,000 pounds of cartridge brass monthly, along with a $3,000,000 marine condenser tube plant to turn out 1,000,000 pounds monthly.

ALUMINUM: Ingot producing capacity in 1942 will be raised to 716,000 tons per year, or close to 60,000 tons per month. Best peacetime output was 163,000 tons in 1939.

Aluminum Company of America since the start of the war has spent $215,000,000 of its own money for new capacity to raise ALCOA's capacity to 380,000 tons per year. ALCOA is building for the Defense Plant Corp. five ingot plants costing $90,000,000 to produce some 256,000 tons per year.

Reynolds Metals Co., mortgaging its own plants for $35,000,000 to the RFC, will have an ingot capacity in 1942 of 80,000 tons per year.

MAGNESIUM: The United States has a goal of 185,000 tons capacity per year by the end of 1942. Production of 3200 tons in 1938 was ample for all needs and output was a mere 6200 tons in 1940.

Of this 185,000 ton annual output goal capacity now in operation or definitely scheduled includes: Dow Chemical with 45,000 tons; Basic Magnesium with 56,000 Permenente 36,000; Mathiesen Alkali 18,000; Diamond Alkali 18,000; and Union Potash 12,000 tons.

ZINC: Including two government owned smelters to be completed in 1942 and privately financed improvements in 10 smelters zinc smelting capacity in 1942 is to be some 960,000 tons per year, or 80,000 tons per month.

This is a 20 per cent increase over theoretical capacity of 814,000 tons in 1940, but actually an increase

of about 30 per cent over previous effective capacity.

TIN: For the first time since 1923 tin will be smelted in the United States, at the $4,000,000, government-owned smelter in Texas City, Tex. Plant's annual capacity will be 18,000 tons. Bolivian and Netherlands East Indies ores are on hand. Operations will start in February.

Strong Demand For Castings

■ AS the United States prepared for war during 1941, foundry operations reached the highest point in history. An ever accelerating need for all types of castings to be used in every ramification of the nation's war effort, and a civilian market limited only by the available supply of metals, combined to produce an enormous demand for steel, gray iron, malleable iron, and nonferrous castings. Demands made on the industry during the year, both military and civil, prove once again that castings are indispensable to the maintenance of our highly industrialized civilization and the protection of our national existence.

Perhaps the greatest developments in the production of cast war *materiel* have taken place in the steel castings branch of the foundry industry. Recent substitution of cast steel hulls and turrets for riveted structures on tanks, use of steel castings as bombs, shells and other ordnance products, and the heavy requirements of the navy, the ship building industry, car builders, and numerous other war projects, have placed requirements for steel castings considerably in excess of the capacity to produce. Total production for the year will reach approximately 1,350,000 tons as compared with 797,947 tons in 1940.

New Plants Needed

While sizeable additions have been made to a substantial number of steel foundries, and several entirely new plants have been built, deliveries of steel castings cannot keep up with requirements. It appears now that all-out war will place an additional burden upon the steel foundry industry that can be met only through the construction of new steel castings plants, the conversion of some gray iron capacity to the production of steel castings, or the greater use of pearlitic malleable iron, malleable iron or gray iron as substitutes for steel castings, where these products could meet the service requirements satisfactorily.

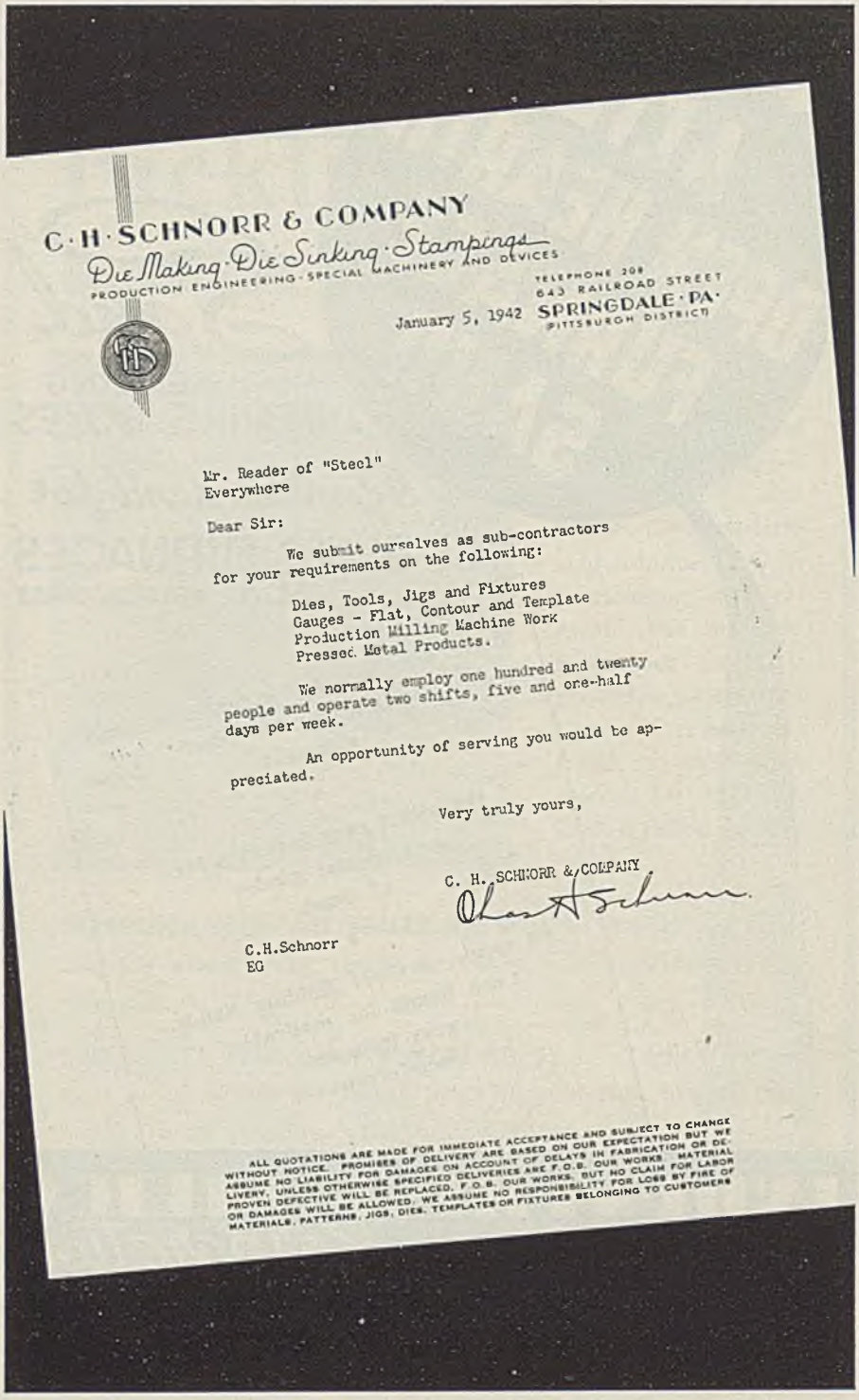
Production of castings for all types of machinery constitutes one of the greatest contributions of the gray iron foundry industry to the nation's war program. The tremendous expansion in the machine tool industry during 1941, where the value of machines produced approached $800,000,000, was reflected directly in the demand for gray iron castings. This resulted in the construction of several new machine tool foundries and capacity operation of jobbing foundries producing that type of work. Present sources of supply for machine tool castings seem inadequate, and undoubtedly additional capacity for that work must be provided, preferably among foundries now producing gray iron castings not so completely essential to war. At present many gray iron foundries have been unable to obtain work falling into the defense classification. Unless these plants can find direct or indirect government work, or revamp equipment and practice in order to produce those types of castings where shortages of capacity exist, scarcity of pig iron and scrap will limit future operations.

The malleable iron industry has been active in developing new war uses for that type of casting and at present most malleable iron foundries are busy on direct or indirect war work, or for the production of castings for such essential materials

as trucks, farm equipment, etc. Capacity of the industry should be sufficient to meet future needs. Other branches of the iron foundry industry, including cast iron pipe and chilled car wheels have been extremely active and production at a high rate will continue as war demands mount. Present reports of additional cantonments will require considerably more cast iron pipe.

The nonferrous field is confronted with a feast or famine situation. Those foundries making government work are operating at full capacity, while others, not as yet equipped to do war work, or not able to land subcontracts, are faced with the problem of obtaining metals. During the past year a number of new foundries have been built for the production of aluminum and magnesium aircraft castings, and probably additional capacity for that type of work must be found.

Foundry equipment producers set all-time records during the past year, and probably will repeat this record in 1942. New foundries must be built. Also, because the repair and maintenance problem in foundries is greater than perhaps in any other industry, much replacement equipment must be produced.



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January 5, 1942

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Need 25% More Workers For Full-Time Operations

WASHINGTON

■ Federalization of the United States Employment Service, as recently directed by President Roosevelt, will be accomplished with a minimum disturbance of existing personnel and methods of operation, Paul V. McNutt, federal security administrator, declared last week.

Simultaneously he requested maximum efficiency from the 20,000 men and women who operate 1500 employment offices throughout the country. To attain 24-hour, 7-day week war production, he explained, the nation's labor force must be increased at least 25 per cent.

Only those changes in organization necessary to bring about increased speed and co-ordination required in wartime will be made. Social Security Board, responsible for administration of the United States Employment Service, will co-operate with state governments in working out plans to safeguard pension rights built up by employment service personnel.

It is hoped, said Mr. McNutt, to meet labor needs of war industries through a 3-point program: Transfer of workers, displaced because of priorities, to war production; increased utilization of existing and potential labor reserves including women, older workers, Negroes and minority groups against whom there is frequent discrimination; and by making more effective use of those already employed through upgrading workers and transfer of needed workers to war production from less essential jobs.

Unemployment compensation systems in each state, Mr. McNutt pointed out, will remain state-operated. Federally-operated public employment offices where unemployed claiming benefit payments are required to register, will continue to serve state agencies administering unemployment compensation laws.

Students' Bridge Contest

■ American Institute of Steel Construction, New York, last week reported appointment of a jury to select prize winning designs in the Students' Annual Bridge Design Competition. The contest has been held annually for 13 years.

Designs judged to be first, second and third best will be awarded prizes of $200, $100 and $50, respectively. Certificates signed by the jury of award and by officers of the institute will be presented prize winners and those whose designs are given honorable mention.

Steelworks Expansion

(*Concluded from Page 266*)

boiler house to permit improvements to 9, 12, and 18-inch bar mills, improvements in continuous hardening and tempering facilities for cold-rolled strip.

U. S. STEEL CORP. SUBSIDIARIES

Homestead Works: Installing armor plate plant.

Clairton Works: Installing heat treating plant.

Joliet Works: New facilities for wire production, heat treating equipment.

Waukegan Works: Replacement of patenting, heat treating straightening, cutting and tinning equipment. Improvements to spring mill.

Pittsburg, Calif. Works: Rebuilding four open hearths, installing rod mill, adding wire drawing equipment and nail machines.

MISCELLANEOUS

Bopp Steel Corp., Detroit: Installed 3 cranes, 2 annealing furnaces and extended annealing and pickling buildings.

Braeburn Alloy Steel Corp., Braeburn, Pa.: Installed 2 car-type annealing furnaces, 1 gas preheating furnace and 3 air compressors.

Central Iron & Steel Co., Harrisburg, Pa.: Work started on an oil-fired automatic temperature controlled heat treating and annealing furnace, and straightening rolls for processing alloy and standard plates.

Connors Steel Co., Birmingham, Ala.: Electric furnace with annual capacity of 36,000 tons to be completed by spring.

Copperweld Steel Co., Warren, O.: Ten annealing and one ingot heating furnace.

Electro Metallurgical Co., Portland, Oreg.: Electric furnace plant for production of alloy metals.

Empire Sheet & Tin Plate Co., Mansfield, O.: Open-flame annealing furnace replaced push-pull type.

Hanna Furnace Corp., Buffalo, N. Y.: Two diesel locomotive cranes for pig iron, track scale, turbogenerator set, five 600-h.p. Stirling boilers, and rebuilt pan-type sintering plant. Installing double strand pig machine.

Hind Steel Co. Inc., Union, N. J.: Small annealing furnace is being installed.

Interlake Iron Corp., Chicago: Two 72-inch sintering plants being installed one at the Toledo, O. plant, and the other at the Federal Furnace plant, Chicago.

Judson Steel Corp., Oakland, Calif.: Finishing capacity increased 20 per cent by new conveyor lines and relocation of shears, transfer tables, pushers, etc. Rearrangement of scrap storage facilities, new electrical installations, etc. are underway to prepare for enlargement of present 30-ton open hearths.

Laclede Steel Co., Alton, Ill.: Installed new boiler, wire annealing department, billet yard and additional wire drawing equipment. Adding hot bed at billet mill, 2 cupolas for scrap reduction and scrap handling equipment. Two boilers installed at Madison works.

Lukens Steel Co., Coatesville, Pa.: Extending and strengthening heating and shearing buildings to handle heavier material. Installing 4 heating furnaces, cranes and ingot chariot.

Otis Steel Co., Cleveland: Completed at Riverside plant 6 annealing furnaces for sheets and cold strip, alterations to heating furnaces for fuel oil, 10,000 cubic foot per hour DX generating unit, turboblower, high-pressure boiler, four 60-ton hot metal ladles and cars for blast furnaces, motor-generator set for ore dock, hydroblast equipment at open-hearth foundry cleaning room, motor-operated air compressor, X-ray equipment for open-hearth castings, 10 hopper and 18 gondola cars, one 30-ton locomotive crane, 80,000 barrel fuel oil storage tank.

Rustless Iron & Steel Corp., Baltimore.: Melt shop extended three bays, 25-ton electric furnace, building to house 2 high and 1 low-temperature car-type annealing furnaces, and 10 pickling tanks, wire mill extension for additional pickling and lead-coating pots and facilities for cold drawing wire, hot roll inspection building for straightening, rough turning, sawing, inspection, shipping and stock storage equipment.

Scullin Steel Co., St. Louis: Plans expansion and facilities costing about $2,000,000 for armor tank plate production, including special heat treating equipment and open-hearth furnace.

Sloss-Sheffield Steel & Iron Co., Birmingham, Ala.: Air conditioning two blast furnaces.

Stanley Works, Bridgeport, Conn.: Completed 2 cupolas with capacity of 10 tons per hour, which when used with open-hearth furnaces, will increase annual steel capacity by 15,000 tons.

Texas Steel Co., Fort Worth, Tex.: Remodeling 18"—10" mill.

Timken Steel & Tube Co., Canton, O.: Installed 1000-ton forging press at Gambrinus, O. works. New stripping shed and large elevated water tank at Canton, O. works.

United Engineering & Foundry Co., Vandergrift, Pa.: 60-ton gas-fired open-hearth furnace being installed.

United States Naval Ordnance Plant, S. Charleston, W. Va.: Two 14,000-ton forging presses installed and substantial additions to heat treating and handling facilities.

Wheeling Steel Corp., Wheeling, W. Va.: Expenditures for plant additions totaled $4,500,000. Installed fabric welding equipment, 14 portable annealing furnaces, new lithographing building and equipment.

Wisconsin Steel Co., S. Chicago, Ill.: New 220-ton ladle crane, open-hearth charging machine, and one 2-hole soaking pit installed.

Worcester Pressed Steel Co., Worcester, Mass.: New equipment installed in press departments.

Worth Steel Co., Claymont, Del.: Installing one battery of three soaking pits.

Windows of Washington

(*Concluded from Page* 242)

Congress regardless of policital complexion co-operating in the war effort. Consequently the President was able to get any legislative action he wanted in December. In fact, up to the time this is written the Chief Executive has more powers than were ever given to President Wilson during the first World war.

This situation may change somewhat in course of the war, particularly if things do not work out as the country expects. However, there will not be the type of conflict that has existed between the White House and Congress at times in the present administration.

Under the exceptional war powers granted him, the President now can treat with industry almost as he chooses. In this connection there is no question but what the tax situation will go into a tail spin. Representative Doughton, chairman of the house ways and means committee, has announced his committee will begin hearings on the new tax bill about the middle of January, although the exact date has not yet been set.

There is some talk joint hearings will be held between the Doughton committee and the comparable senate committee on finance. There has been talk, many times, of joint tax or tariff hearings, but they never worked out because of jealousy between the two bodies. Also, members of the Senate frequently like to question those concerned after the bill has actually passed the house as to just what effect certain provisions may have on their industries.

However, there have been some conferences between Doughton and Senator George, of Georgia, chairman of the finance committee, regarding possible joint session. Since Mr. Doughton's announcement that hearings will begin about Jan. 15, the Secretary of the Treasury has reiterated that any new tax bill will not be retroactive on 1941 taxes. However, in the present war situation there is always the chance such an opinion might be changed.

Industries Speeding Up

(*Concluded from Page* 225)

representing more than 83 per cent of the industry's ingot capacity, in the first nine months was at the annual rate of about 7.6 per cent on their aggregate capitalization, and was approximately equal to the rate earned in the entire year 1940 by 23 companies, representing 90 per cent of ingot capacity.

Most companies last fall reported total tax provisions for both the third quarter and nine months were substantially greater than the net income after all charges had been met. One large independent reported that its total tax bill for the first nine months amounted to 72.4 per cent of all earnings before taxes, with income and excess profits taxes alone representing 65.7 per cent for the period.

During the past year two tax bills were enacted—one, "Excess Profits Tax of 1941," signed last March, and the other, "Revenue Act of 1941," signed in September. The latter, a $3.5 billion tax bill, was the largest in the country's history. But even it stands to be eclipsed by measures now in the making. Treasury officials and fiscal experts of Congress are at work on new tax legislation, which, it is said may boost federal tax collections to $20 billions annually. Congressional hearings are tentatively scheduled for later this month.

The amount will likely top the $5 billion proposal by the Treasury Department of only a few weeks ago. Among measures suggested at that time was the imposition of a 15 per cent tax on all incomes, after

personal exemptions, to be deducted at the source; also an increase in social security taxes with an additional 3 per cent deducted from the first $3000 of salary wage.

The 15 per cent supertax came in for widespread opposition from the first, and it is now predicted that any withholding tax will not exceed 5 per cent on the gross income of individuals. Among later proposals made in administrative circles was one program calling for higher levies on corporation income; excise taxes to curb use of durable goods; and increases in income taxes and in social security payroll levies. There has seemed to be no talk whatsoever of retroactive tax legislation.

Taxes at this time are being considered with a two-fold purpose: (1) to raise money to offset mounting deficits (a deficit of at least $12 billions is expected for the 1942 fiscal year) and (2) to help curb inflation. Only recently Leon Henderson, price administrator, predicted that the cost of living by April would be 20 per cent higher than at the outbreak of the war in Europe in 1939, and added that it already had risen 11 per cent and was continuing at the rate of 1.5 per cent a month.

Price Control Bill Studied

An anti-inflation price control bill has been undergoing hearings in the Senate, after having passed the house late in November. The major provisions, as approved by the lower chamber, called for the appointment of a price administrator to control prices during the emergency; establishment of a 5-man board of review with power to override the administrator; and price ceilings to be set by the administrator on commodities threatened by inflation prices. The bill placed no limitation on wages and provided even greater latitude on agricultural prices than did the original administration bill introduced in Congress early last August. The original bill called for no ceiling on such products below 110 per cent of the official parity figure, a provision which critics said would insure high farm prices.

The same week the house adopted its bill, it had previously voted down by 218 to 63 the proposal of Congressman Gore, calling for the placing of ceilings on all prices, rents, wages and salaries, in line with the suggestion of Bernard M. Baruch, chairman of the War Industries Board during the first World war. However, the house bill was not considered satisfactory to the Senate or the administration and no further action on it has been taken.

Thus far ceilings have been applied on various products through voluntary co-operation of manufacturers and producers; and in this, Price Administrator Henderson recently said no group had co-operated more fully than the basic steel producers. In fact, steel prices have been held virtually unchanged since the outbreak of the war in Europe. This is in sharp contrast to the rule in most other commodities and holds despite an increase of about 16 per cent in the hourly wage rates of steelworkers.

Other anti-inflationary steps taken or in process include the selling of defense bonds and stamps, not only to raise funds for defense, but to divert excess funds from inflationary channels; the raising by the Federal Reserve Board of the bank reserve requirements to the legal limit last November, in an effort to check the banks' power to lend; and curtailment by OPM of production in several industries, primarily to conserve raw materials for war purposes.

While there will be increasing pressure for steel at home, it is evident that an effort will be made to extend, if anything, shipments abroad of lease-lend supplies—steel and ordnance of various types made largely of steel. This is based on the administration's apparent firm

conviction that the lines of this country's Allies are still this country's first lines of defense. However, it is believed in some quarters that more steel will be sent to the Central and South American countries, in view of the present threat to the Western Hemisphere. However, availability of ships may be a deciding factor.

The President, in his recent quarterly report to Congress on lease-lend aid, said that defenses of 32 countries and the British Empire have now been declared vital to the defenses of the United States, and are eligible for lease-lend aid.

During the first nine months authorizations amounted to almost $13 billion, of which $9,186,000,000 had been allocated, $5,243,000,000 let in actual contracts and only $1,202,000,000 actually spent.

Torpedo Drawing Helps Visualize Work Progress

■ To help create a spirit of watchful and willing time saving among machine shop employes, Porter-Cable Machine Co., Syracuse, N. Y., has erected an outline drawing of a torpedo, for which it is making many parts, on the plant wall.

The drawing is black, 7 feet long, and is divided vertically into sections, each section representing a different part the company is making. Each vertical section is subdivided into the number of operations required for each part. When any operation on a part is completed, the section is painted red, and eventually the whole part is shown as finished. This is kept up to date each day and everyone in the machine shop can visually keep informed of the progress of the contract and, as each part is numbered, see how his work is coming along in comparison with others.

Some parts have as many as 32 different operations, on any one of which a mistake would mean scrapping the entire part. The drawing reminds the men not only to get their jobs finished, but to do them right to avoid scrapping.

Automotive Engineers Nominate 1942 Officers

■ A. W. S. Herrington, president, Marmon-Herrington Co. Inc., Indianapolis, has been nominated president for 1942 of the Society of Automotive Engineers Inc., New York, it was reported last week. David Beecroft, Bendix Products Division, Bendix Aviation Corp., South Bend, Ind., was nominated treasurer.

Nominees for vice presidents: Aircraft, Peter Altman, director, manufacturing research department, Vultee Aircraft Inc., Downey, Calif.; aircraft engine, C. F. Bachle, vice president in charge of research, Continental Aviation & Engineering Corp., Detroit; diesel engine, H. L. Knudsen, chief engineer, Cummins Engine Co., Columbus, Ind.; fuels and lubricants, C. M. Larson, chief consulting engineer, Sinclair Refining Co., New York; passenger car, Ernest E. Wilson, director, General Motors Proving Ground, Detroit; passenger car body, E. L. Allen Jr., sales engineer, Reid Products Division, Standard Products Co., Cleveland; production, Joseph Geschelin, Detroit technical editor, Chilton Co. Inc., Philadelphia; tractor and industrial, L. S. Pfost, chief engineer, Tractor Division, Massey-Harris Co., Racine, Wis., transportation and maintenance, J. Y. Ray, supervisor automotive equipment, Virginia Electric & Power Co., Richmond, Va.; and truck and bus, F. B. Lautzenhiser, chief transportation engineer, International Harvester Co., Chicago.

Membership on the SAE council, term of 1942-43: W. S. James, chief engineer, Studebaker Corp., South Bend, Ind.; T. P. Wright, assistant chief, Aircraft Section, OPM; and J. V. Savage, superintendent, municipal shops and motor vehicle inspection station, Portland, Oreg.

Elected for a two-year term at the beginning of 1941 and continuing on the council for 1942: N. C. Millman, product service manager, General Motors of Canada Ltd., Oshawa, Ont.; H. O. Mathews, automotive engineer, Public Utility Engineering & Service Corp.; and D. A. Fales, associate professor of automotive engineering, Massachusetts Institute of Technology, Cambridge, Mass.

Serving on the council as past presidents: A. T. Colwell, vice president, Thompson Products Inc., Cleveland; and Arthur Nutt, vice president of engineering, Wright Aeronautical Corp., Paterson, N. J.

Canada's Industrial Growth in '41 Above Any Earlier 10-Year Period

TORONTO, ONT.

■ MORE was accomplished by Canada in 1941, from an industrial viewpoint, than in any previous 10-year period, with all-time records established in new plant construction and production of materials. This striking achievement, however, was directly due to the war and introduction of new war industries.

Canada's war expenditure in the year totaled approximately $2,300,000,000, more than double that in 1940 and compared with $1,025,000,000 spent in the four years of the first World war. The Dominion has assisted Great Britain in financing war materials purchases on a "lease-lend" basis to a total of approximately $1,500,000,000. To finance their own war program, the Canadian people have loaned the government nearly $1,500,000,000 since outbreak of hostilities in return for war bonds and saving certificates.

Tax Payments Trebled

Canadians now pay three times as much in taxes of all kinds as they did before the war; five times as many pay income taxes. Taxes on goods and services have been increased and extended to cover a wide variety of commodities. Business income is subject to a minimum tax of 40 per cent and 79½ per cent of all "excess profits" are taken by the government. Of every dollar earned in Canada, 40 cents is taken to support the war.

Supply of many essential materials is rigidly controlled and in 1942 much greater curtailment in production of civilian goods will become effective, particularly those in which steel or other metals comprise the chief component.

With record taxation facing the public, the government in turn has taken steps to control inflation. Maximum and minimum wages have been established and a cost-of-living bonus made compulsory for employes in the lower wage brackets. A price ceiling was placed on all goods and many foodstuffs, Dec. 1, 1941, with the top price that may be charged for any commodity set at the peak that prevailed between Sept. 15 and Oct. 11 last year. Thus Canadians now have a fair idea of what their living costs will be for the duration of the war, as well as maximum earning power.

At the close of the year Canada's army, voluntarily enlisted for service anywhere, totaled about 400,000, with an additional reserve army for home defense of about 200,000.

Two years ago Canada was incapable of equipping an infantry division but can do it completely now in six weeks. Two years ago Canada imported most of what little war equipment she had, and today exports war equipment to almost every battlefield in the world.

In the first 10 months of 1941, Canada's exports to certain friendly countries totaled $1,323,332,000, compared with $647,373,000 in the corresponding period of 1939. Exports for the period included: Great Britain, $548,985,000; United States, $477,593,000; British empire countries, $177,438,000; Egypt, $55,639,000; India and Burma, $34,023,000; Newfoundland, $22,243,000; China, $6,126,000; Russia, $1,285,000. Sharp gain in exports was entirely due to war supplies.

On Canada's industrial front

more than $750,000,000 has been spent in the past two years for new plants, plant extensions and equipment for war production.

Bulk of the expenditure has been for increase in output of shells, guns, gun mountings, tanks, iron and steel, chemicals and explosives and raw materials. At the end of the year, Canada had reached its stride and was very close to maximum production with available equipment.

The primary iron and steel industry in Canada increased production to record levels last year. This sharply increased output, however, was almost entirely due to new equipment. Rated pig iron capacity was boosted from 1,505,625 tons per year at the end of 1940 to 1,816,075 tons at the close of 1941. Steel ingots and castings capacity was increased from 2,097,000 gross tons to upwards of 2,700,000.

Pig iron production in 1941 topped all previous records with 1,356,440 gross tons, 16 per cent more than in the year preceding, and was 27 per cent above the peak of the first World war when 1,068,000 gross tons was reported for 1918. Steel ingot production at 2,304,860 gross tons was 18 per cent above the previous year's record, and 40 per cent in excess of the 1918 total; steel castings in the year jumped 60 per cent to 110,759 gross tons and ferroalloys rose 40 per cent to 189,000 tons.

Following table presents a statistical review of Canada's iron and steel production from 1923 to 1941 inclusive, with figures for December last year, estimated:

	Pig iron	Ferro-alloys	Steel ingots	Steel castings
1923	880,018	29,951	839,710	45,060
1924	593,024	26,450	625,175	25,515
1925	570,397	25,709	783,855	18,840
1926	737,503	57,416	745,550	33,338
1927	707,697	56,230	867,928	39,710
1928	1,037,727	44,882	1,190,001	44,718
1929	1,090,244	80,010	1,309,543	70,145
1930	747,178	65,223	957,430	54,313
1931	420,038	46,764	664,826	37,055
1932	144,130	16,161	312,360	22,915
1933	227,315	30,123	394,059	15,920
1934	406,955	33,085	738,430	20,640
1935	605,627	55,520	907,870	31,360
1936	678,231	76,284	1,081,549	34,230
1937	898,855	75,288	1,334,164	66,847
1938	705,427	55,926	1,103,004	50,568
1939	755,731	76,375	1,330,408	54,462
1940	1,168,894	135,412	1,941,619	69,553
1941	1,356,440	189,050	2,304,860	110,759

Dominion War Orders $16,369,021 in Week

TORONTO, ONT.

Department of Munitions and Supply for the week ending Dec. 16, placed 4272 contracts having total value of $16,369,021, of which orders valued at $1,128,017 were placed with United States companies.

Aircraft: Canadian Vickers, Ltd., Montreal, $1,258,652; Canadian Associated Aircraft, Ltd., Montreal, $21,592; Canadian Car & Foundry Co., Ltd., Montreal, $5903; Noorduyn Aviation, Ltd., Montreal,

$28,856; Railway & Power Engineering Corp., Montreal, $26,950; Overseas Requisition, London, Eng., $216,800; Canadian Westinghouse Co., Ltd., Ottawa, $53,428; Standard Tube Co., Ltd., Ottawa, $6194; B. Greening Wire Co., Ltd., Hamilton, $5515; Smith & Stone, Ltd., Georgetown, $25,338; Amalgamated Electric Corp., Ltd., Toronto, $47,320; Dill Mfg. Co. of Canada, Ltd., Toronto, $54,710; Dunlop Tire & Rubber Goods Co., Ltd., Toronto, $67,777.

Land transport: Gutta Percha & Rubber, Ltd., Toronto, Ont., $18,501; Firestone Tire & Rubber Co. of Canada, Ltd., Hamilton, $94,658; Chrysler Corp. of Canada Ltd., Windsor, $5271; Ford Motor Co. of Canada, Ltd., Windsor, $21,168; Cotfredson Ltd., Windsor, $50,957.

Shipbuilding: Foundation Maritime, Ltd., Halifax, N. S., $16,935.

Dockyard supplies: C. O. Monat & Co., Ltd., Montreal, $9040; Superheater Co., Ltd., Montreal, $5790; Dominion Bridge Co., Ltd., Lachine, Que., $9800; Page-Hersey Tubes, Ltd., Toronto, Ont., $22,124; Belfast Rope Works, Vancouver, B. C., $6650.

Instruments: Canadian General Electric Co., Ltd., Ottawa, $36,660; Instruments Limited, Ottawa, $49,573; Ontario Hughes-Owens Co., Ltd., Ottawa, $24,428.

Electrical equipment: General Supply Co. of Canada, Ltd., Ottawa, Ont., $16,840; Canadian Telephones & Supplies, Ltd., Toronto, $6720; LaFrance Fire Engine & Foamite, Ltd., Toronto, $5172; Willard Storage Battery Co. of Canada, Ltd., Toronto, $16,257; Stewart-Warner-Alemite Corp. of Canada, Ltd., Belleville, $6480.

Machinery: Overseas Requisition, London, England, $5000; Canadian Ingersoll-Rand of Canada, Ltd., Montreal, $366,993; T. E. Ryder Machinery Co., Montreal, $10,550; A. R. Williams Machinery Co., Ltd., Toronto, $8915; Smith Burners & Heaters, Ltd., Toronto, $11,475; Brunner Corp. (Canada), Ltd., Toronto, $15,173; W. L. Ballentine Co., Ltd., Toronto, $45,929.

Hardware: General Steel Wares, Ltd., Ottawa, $5639; Eastern Steel Products, Ltd., Preston, Ont., $6750.

Metals: Algoma Steel Corp., Ltd., Montreal, $35,811.

Ordnance: Canadian Locomotive Co., Ltd., Kingston, Ont., $149,600; George White & Sons, Ltd., London, Ont., $9000.

Munitions: Overseas Requisition, London, Eng., $283,500; Canadian Industries, Ltd., Montreal, Que., $82,993; General Steel Wares, Ltd., Toronto, $117,467; Fairgrieve & Son, Ltd., Toronto, $8102.

War construction projects: Canadian National Railway Co., Ltd., Montreal, $4,000,000; Consolidated Construction Co., Montreal, $88,000; Standard Construction Co., Halifax, N. S., $61,000; W. C. Brennan Contracting Co., Hamilton, Ont., $57,000.

Miscellaneous: Enterprise Foundry Co., Sackville, N. B., $9967; Enamel & Heating Products, Ltd., Sackville, N. B., $28,301; Metropolitan Electric Co., Quebec, $22,498; Wilson Boxes, Ltd., St. John, N. B., $7277; Neptune Meters, Ltd., Toronto, $14,405; General Steel Wares, Ltd., Toronto, $151,340; Aluminum Co. of Canada, Ltd., Montreal, $38,917; Safety Supply Co., Ltd., Toronto, $6653; Viceroy Mfg. Co., Ltd., Toronto, $27,855; B. F. Goodrich Rubber Co. of Canada, Ltd., Kitchener, Ont., $79,199; Canadian General Rubber Co., Toronto, $19,764; Canadian Ice Machine Co., Montreal, $5000; Howard Automatic Heat & Air Conditioning Co., Montreal, $5000; Bennett & White Construction Co., Calgary, Alta., $45,000; M. H. McManus, Ltd., Halifax, N. S., $13,000; Canadian Fairbanks-Morse Co., Ltd., Montreal, Que., $7000; Moncton Electric & Gas Co., Ltd., Moncton, N. B., $35,000; M. F. Schurman Co., Ltd., Summerside, P. E. I., $44,000; Cotter Bros., Ltd., Winnipeg, Man., $19,000.

Olds Asks Maximum War Materials Output

■ Maximum production of the essential instruments of modern warfare for the complete defeat of America's enemies was called for by Irving S. Olds, chairman, United States Steel Corp., last week.

"That can be brought about only by real unity and co-operation at home; by a willingness on the part of all segments of our society wholeheartedly to accept such restrictions and to undergo such sacrifices as will contribute to victory; by a readiness on the part of the government to deal fairly and uniformly with both industry and labor and with all of our citizens; and by a deep-rooted determination on the part of everyone that the winning of the war is all important . . .

"In spite of some loss of production resulting from shortages of scrap and from strikes and work stoppages in coal mines and steel mills, production of the United States Steel Corp. during the past year established an all-time high record, approximately 29,000,000 tons of steel ingots having been produced, as compared with approximately 23,000,000 tons in 1940. A large part of this production went into defense. Work is now underway on the erection of new facilities by various subsidiaries to increase their steelmaking and finishing capacities, as a part of the government's steel expansion program. Existing facilities of subsidiaries for the production of such war materials as heavy and light armor plate, shell forgings, unloaded shells and bombs, are now in full operation.

"Although no one should minimize the grave responsibilities which war has placed upon the members of the steel industry, United States Steel Corp. faces this trying period with courage and with confidence in its ability to do its part in the fight for victory."

Sheet & Tube Building Ore Sintering Plant

■ Youngstown Sheet & Tube Co. is constructing a sintering and ore-treating plant at Campbell works, designed to produce 60,000 tons of sinter monthly. It is scheduled for operation in the spring. Rust Engineering Co., Pittsburgh, is in charge of construction. Financing is being done without government aid.

Flue dust will be sintered and wet ore will be dried, increasing efficiency of blast furnaces and thus better production of steel.

Allocation and Preference Orders

Allocation, Priority, Limitation and Suspension orders issued by the Office of Production Management, New Social Security Building, Washington, D. C. On specific problems, contact local Priorities Field Service Office

"M" Orders

An order identified by an "M" serial number—for example, M-3, M-10, etc.—is designed to regulate the distribution and flow of a given material into defense and essential civilian channels.

The "M" order (M for material) differs completely from the limited blanket-rating orders in the "P" series. An "M" order, for example, tells how a given material may be distributed; a "P" order helps the company or companies holding it to get the material. Thus an "M" order regulates distribution of steel, while a "P" order has been granted to freight car builders to help them get steel.

M-1: Aluminum, effective March 22, 1941; M-1-a, schedule of preference ratings, effective March 22, 1941; M-1-b, modifies M-1 and M-1-a with respect to deliveries of low-grade aluminum, effective April 11, 1941; M-1, M-1-a and M-1-b extended to Dec. 31, 1941; M-1-c directs distribution of aluminum scrap and secondary aluminum, effective June 10, 1941; revokes M-1-b.

Deliveries of virgin and secondary aluminum must be made in accordance with preference ratings. Deliveries under B ratings are limited to specific percentages of 1940 average shipments. Aluminum producers must file PD-26-a by the 20th of each month showing shipping schedules. Purchasers file PD-40-a quarterly, listing consumption and inventory. Scrap deliveries require A-10 rating or higher. Persons requiring scrap file PD-1 for rating.

M-2: Magnesium, effective March 24, 1941: M-2-a, supplementary order, effective March 24, 1941; M-2-b, supplementary order, effective Nov. 14, 1941.

Applies to all materials and products, including scrap, principal ingredient of which is magnesium. Deliveries are subject to monthly allocation by Director of Priorities. Magnesium products may be used only on orders carrying a rating of A-1-j or higher. Alloying any material with magnesium without authorization of the Director of Priorities is prohibited. All material, in whatever form, not being used to fill orders with ratings of A-1-j or higher, must be disposed of to a producer or approved smelter.

Producers, fabricators, secondary smelters must file PD-26-m monthly by the 20th with Aluminum and Magnesium branch, giving shipping schedules. Users report inventories by the 15th on PD-40-m.

M-3, M-3-a: Tungsten, revoked by M-29.

M-4: Neoprene, effective March 28, 1941. Note: Superseded by M-13.

M-5, M-5-a, M-5-b: Nickel-bearing Steel, revoked by M-21-a.

M-6: Nickel, effective May 15, 1941; Revoked by General Preference Order M-6-a, effective Sept. 30, 1941. Deliveries to be made by producers and distributors only as authorized by Director of Priorities. Buyers must file Form PD-27 with Division of Priorities and with supplier not later than 20th day of each month, listing requirements for next month, stocks and customers' names.

M-8: Cork, effective May 31, 1941. Use Forms PD-28, PD-29. **M-8-a:** Cork End Products, effective Oct. 1, 1941. Interpretation Oct. 16, 1941. Use Form PD-51.

M-9: Copper, effective May 29, 1941; Superseded by M-9-a, as amended, effective Aug. 2, 1941. Refiners can deliver no metal except as specifically authorized by the Director of Priorities. Persons may obtain copper from dealers without allocation certificates but not from both dealers and refiners.

Orders for copper placed with dealers and for copper alloys and products with any person are to be filled according to preference ratings. Defense orders must be accepted. Individual deliveries not exceeding 50 pounds may be made without preference ratings, provided such deliveries for a month do not aggregate more than 1 per cent of total shipments during the first three months of 1941. Deliveries are restricted to consumers' actual requirements. Details regarding toll agreements must be filed by refiners with the Copper Commodity Branch, OPM.

Fabricators must file by the 20th of each month with OPM Copper Commodity Branch Form PD-59-a applying for the next month's supply for domestic consumption and PD-60-b reporting requirements for various classifications. Refiners file Form PD-61 monthly, listing output and shipments of duty free copper.

M-9-b: Copper and Copper-Base Alloy Scrap, effective Sept. 30, 1941. All brass mill scrap must be delivered back to brass mills, either directly or through dealers. Other copper and copper base alloy scrap may be delivered only to dealers or in cases (including foundries) where a preference rating of A-10 or higher has been assigned.

No copper or brass mill scrap may be delivered under future conversion of toll agreements, unless approved by Director of Priorities. Dealers are prohibited from melting any scrap without

authorization and from accepting scrap unless they have turned over their inventories within the preceding 60 days. Foundries must apply for rating on Form PD-1.

M-9-c: Use of copper or copper base alloy in manufacture of any one of more than 100 civilian articles prohibited after Jan. 1, 1942. Between Oct. 15 and Dec. 31, 1941, consumption for that purpose limited to one-half the total amount used by a manufacturer of such item during the last three months of 1940 or one-eighth the total amount consumed during 1940.

Amendment, effective Dec. 8, 1941, exempts certain industrial items. Also permits, until March 31, 1942, limited use of inventories of partially fabricated metal in making specified civilian articles, extending original Jan. 1 deadline. Consumers must file PD-189 with OPM by Dec. 31, 1941, PD-175 with each order to supplier.

M-10: Polyvinyl Chloride, effective June 9, 1941. Use Forms PD-7, PD-36.

M-11: Zinc, effective July 11, 1941; Supplementary orders M-11-a-b-c-d-e fix monthly zinc pool requirements.

All deliveries to be made in accordance with preference ratings. Shipments must not cause buyer's inventory to exceed actual requirements for any calendar month. Receipts must be used for the purpose for which rating was assigned. Producers are to set aside from their production each month a quantity specified by Director of Priorities and to be delivered at his direction. Material produced under toll agreements is exempted from this pool. Consumers must file Form PD-94 by the 10th of each month with Copper, Zinc Branch, OPM, applying for allocation in next month and reporting consumption and inventory. Producers must file PD-50a by 10th of each month listing orders.

M-12: Cotton linters, effective Aug. 10, 1941. Use Forms PD-110, 112, 122, 122a.

M-13: Synthetic Rubber (includes Neoprene), effective June 9, 1941. Use Forms PD-7, 33, 36.

M-14: Tungsten High-Speed Tool Steel, effective June 11, 1941; amended, effective Dec. 3, 1941. No orders to be placed or filled for tungsten-type steel if molybdenum type will fill buyer's requirements. Total deliveries of tungsten-type steel shall not exceed by weight one-third of deliveries of molybdenum-type steel in the same quarter. Producers must report quarterly to Iron and Steel Branch, OPM, on orders and shipments. Use Form PD-101. Shipments must not cause buyer's inventory to exceed actual needs. Defense orders have preference in allocations of tungsten-type steel by Director of Priorities.

M-15: Rubber, effective June 20, 1941. Use Form PD-49. **M-15-a:** Supplementary Order, effective June 27, 1941. (Amendment), effective Aug. 4, 1941. (Amendment)—White Sidewall Tires, effective Aug. 8, 1941. **M-15-b:** Prohibits sale of new tires.

M-16: Tricresyl and Triphenyl Phosphates, effective Aug. 30, 1941.

M-17: Pig Iron, effective Aug. 1; amended, effective Oct. 14, 1941. Customers submit their monthly requirements by filing with producers by the 5th of the month on Form PD-69. By the 12th of each month customers must file Form PD-70 with Iron and Steel Branch, OPM, showing stocks, consumption and requirements for following month. Producers must file by the same date Form PD-71, covering proposed shipments for coming month. Such shipments may not be made until approved by Director of Priorities. Defense orders must be given priority over other orders. Producers must set aside each month a portion of their output, the percentage to be spcified by Director of Priorities, who will make allocations from this pool for the following month to meet emergency needs. Order expires Dec. 31, 1942, extended Nov. 25, 1941.

M-18: Chromium, effective July 7, 1941; amended, effective Aug. 22, 1941; revoked by M-18-a, effective Nov. 29, 1941. Applies to all processors, dealers, producers and purchasers. Includes ores or concentrates, ferro-chromium and combinations with other elements, chromium refractory material and scrap or secondary material. All deliveries are allocated by Director of Priorities. Monthly use of chromium oxide for manufacture of chromium chemicals from ores or concentrates must not exceed monthly average consumption during period July 1, 1940, through July 30, 1941. Monthly requests for chromium, ferrochromium and other combinations used in making steel or for other metallurgical purposes must be made to sellers by the 25th of each month on Form PD-53-b. Copy must be sent Director of Priorities, together with Form PD-53-a in duplicate.

M-19: Chlorine, effective July 26, 1941. Use Forms PD-158, b, c; PD-159, a, b, c.

M-20: Calcium-Silicon, effective July 29, 1941; revoked by M-20-a, effective, Nov. 29, 1941. All shipments are under direct allocation by Director of Priorities. Customers must file Form PD-72 by the 25th with suppliers to obtain shipment the following

month, also filing one copy with OPM.

M-21: Steel, effective Aug. 9, 1941; amended effective Sept. 9, 1941. Applies to carbon and alloy iron and steel. Orders are to be filled according to preference ratings. Accumulation of inventories beyond buyers' current needs is prohibited. Customers must file Form PD-73 with each order, summarizing contents of the order by group and product. Material obtained under allocation or preference rating must be used for purpose specified. Director of Priorities may direct producers to make deliveries for particular purposes without regard to preference ratings. Producers must file Forms PD-99 and PD-100 by the 6th of each month with Iron and Steel Branch, OPM, summarizing proposed production, distribution and capacity, also reports covering shipments and backlogs. Extended to Dec. 31, 1942, effective Nov. 25, 1941.

M-21-a: Alloy Iron, Alloy Steel, Wrought Iron, effective Sept. 16, 1941, revoking M-5, M-5-a, M-5-b, as amended. Amendments effective Nov. 25, Dec. 20, 1941. All provisions of Order M-21 are part of this order. Director of Priorities may specify quantities and forms of alloys in alloy iron or steel. Deliveries under toll agreements must be approved by the Director. Alloy iron or steel is defined as containing manganese in excess of 1.65%, or silicon in excess of 0.60% (5% for iron), or copper in excess of 0.60% or any other element added to obtain a desired alloying effect. Except on orders of A-10 or higher, melting—also delivery after Jan. 1, 1942—of alloy iron or steel containing more than 1.65% Mn; 0.60% Cu., Cr. Mo, Ni; or any Co, W or V added for alloying effect is prohibited.

M-21-b: Steel Warehouses, effective Sept. 3, 1941. Amended, effective Jan. 1, 1942. Receipts by a warehouse are limited by a quota established by the Director of Priorities and based on stock shipments during the first quarter of 1941. Quotas for merchant products based on receipts from producers in corresponding 1940 quarter or on one-fourth total 1940 receipts. Preference rating of warehouses is A-9. Warehouses must file Form PD-83-a by the 15th of each month with Iron and Steel Branch, OPM, detailing stock additions, shipments and inventories. Warehouses are forbidden to sell alloy steel for other than defense purposes, except for essential maintenance and repairs limited to 10 per cent of total deliveries in first quarter of 1941. Plate sales after Jan. 1, 1942 limited to defense orders. Merchant products, termed "Schedule B Products," include concrete bars, pipe, tubes, wire and products, tin and terne plate, galvanized sheets and strip. Distributors of these products exclusively file no monthly reports.

M-21-d: High-Grade Chromium Steel, effective Jan. 6, 1942. Restricts civilian use. No person shall deliver or consume corrosion or heat-resistant alloy irons or steel containing more than 4 per cent chromium except on ratings of A-10 or higher. Report inventory on Form PD-221.

M-22: Silk, effective July 26, 1941. Use Forms PD-77, 78, 78a.

M-23: Vanadium, effective Aug. 14, 1941, Revoked by M-23-a, Dec. 20, 1941. Includes ores or concentrates, ferrovanadium and combinations with other elements, chemical combinations, and scrap or secondary material containing commercially vanadium as well as pure vanadium. Establishes full allocation, requiring deliveries to be authorized by Director of Priorities. Buyers must file Form PD-84 with Vanadium Branch, OPM, and supplier by 20th of month to obtain delivery following month. Monthly deliveries up to 50 pounds contained vanadium do not require this report.

M-24: Scrap Iron and Steel, effective Oct. 11, 1941. Defense orders must be accepted and given pref-

erential treatment. On or before 15th of each month, producers who during preceding month produced 20 gross tons or more of scrap must report to Bureau of Mines, Pittsburgh, on Form PD-149, listing scrap inventory, production and sales. Dealers and brokers must file Form PD-151 by same date showing scrap inventory, purchases and sales. Consumers must report monthly on Form PD-150 their inventory, production, receipts and consumption. Director of Priorities has broad powers to control deliveries of scrap at his discretion.

M-25: Formaldehyde, Paraformaldehyde, Hexamethylenetetramine and Synthetic Resins, effective Aug. 23, 1941. (Amendment), effective Aug. 28, 1941.

M-26: Silk Waste, effective Aug. 8, 1941. Use Form PD-91.

M-27: Phenols, effective Aug. 30, 1941. Amended Nov. 10, 1941, to provide complete allocation. Use Forms PD-1; 178a, b; 180.

M-28: Chlorinated Hydrocarbon Refrigerants, effective Aug. 22, 1941.

M-29: Tungsten, effective Aug. 31; Supplementary order M-29-a effective Oct. 13, 1941. M-3 and M-3-a revoked by M-29. Applies to distribution of tungsten in all forms, including secondary material containing commercially recoverable tungsten. Producers are required to accept defense orders, deliveries to be made in accordance with priority rating. Shipments are limited to buyers' actual requirements. Buyers' requests for deliveries must be made by 10th of month to Division of Priorities on Form PD-9 by those using 100 pounds or more of contained tungsten monthly, filing one copy with supplier and one with Division of Priorities.

Distribution of ferrotungsten, tungsten metal powder and tungsten chemicals going into metal powder is to be made only with the specific authority of the Director of Priorities. Processors of tungsten in chemical form, other than those forms going into tungsten metal powder, are generally limited in their processing or purchasing to 90 per cent of amounts processed or purchased during the 12 months ended June 20, 1941.

M-30: Ethyl Alcohol and Related Compounds, effective Aug. 28, 1941.

M-31: Methyl Alcohol, effective Aug. 28, 1941. Amendment, Nov. 12, 1941.

M-32: Potassium Perchlorate, effective Aug. 28, 1941.

M-33: Potassium Permanganate, effective Aug. 28, 1941.

M-34: Toluene, effective Aug. 28, 1941. Use Form PD-1.

M-35: Phosphorus Oxychloride, effective Aug. 30, 1941.

M-36: Manila Fiber and Manila Cordage, effective Aug. 29, 1941. Amendment, Oct. 14, 1941. Use Forms PD-128, 129.

M-37: Rayon Yarn, effective Sept. 13, 1941. Supplementary Orders 37a, b, Oct. 1, 1941. Use Forms PD-102a, 103a, 106, 112, 113.

M-38: Lead, effective Oct. 4, 1941. Refiners and dealers must file Form PD-124 with Director of Priorities by the 20th of each month, detailing proposed shipments for the following month. Each refiner must set aside in December a pool tonnage equal to 15% of October production, as fixed by Director of Priorities, to be allocated directly for emergency needs. Refiners must ship balance according to preference ratings. Lead released by Metals Reserve Co. is allocated by Director of Priorities. Consumers must file Form PD-66-a by the 15th of each month with OPM Lead Commodity Branch, applying for allocation in the following month and detailing inventories. Producers file Form PD-124 by the 20th, giving proposed shipping schedules.

M-39: Cobalt, effective Nov. 3, 1941. Includes ores, chemical compounds and scrap. All shipments are under direct allocation. Buyers (over 50 lbs.) file PD-152 and PD-153, with Division of Priorities by 20th of each month, listing stocks and requesting deliveries for following month. Monthly production and shipments of cobalt chemical compounds to be used for other than manufacturing cobalt metal must not exceed 90 per cent of monthly average shipments during first six months of 1941.

M-40: Sperm Oil, effective Oct. 16, 1941.

M-41: Chlorinated solvents, placed under full priority, effective Oct. 15, 1941. Use Form PD-127.

M-43: Tin, effective Dec. 18, 1941. All shipments and uses must be authorized by Director of Priorities. Distributor may deliver less than 5-ton lots to regular customers, subject to Priorities Regulation No. 1. Imports must be sold to Metals Reserve Co.

M-44: Titanium Dioxide, effective Jan. 1, 1942. Applies to distribution of titanium dioxide for use as pigment. Sets up defense pool of a certain percentage (20% for December) of daily production to fill mandatory purchase orders. Remaining production is to be prorated on an equitable basis to all customers. Use Forms PD-145, 146.

M-45: Sheet steel inventory for Steel Drums, effective Nov. 17, 1941. See P-76.

M-46: Chlorinated Rubber, effective Nov. 1, 1941. Use Forms PD-143, 144.

M-47: Burlap, effective Dec. 21, 1941, placed under complete allocation. Importers and bag manufacturers use PD-186.

M-49: Iridium, effective Dec. 12, 1941. Forbids use of iridium and alloys in jewelry manufacture.

M-51: Pigs' and Hogs' Bristles, effective Dec. 13, 1941.

"P" Orders

A limited blanket rating, which can usually be identified by a "P" serial number—for example, P-17, P-22, etc.—is a rating granted to a company or group of companies to facilitate the acquisition of scarce material needed by these companies for defense or essential civilian production.

P-1: Cranes and Hoists, effective March 12, 1941; revoked by P-5, effective May 26, 1941; revoked by P-5-a, effective Aug. 1, 1941; superseded by P-5-b, effective Nov. 1, 1941. Assigns A-10 rating or higher on deliveries of materials required to fill defense orders. Rating may be applied only to: Motors and other electrical accessories; alloy and carbon steel bars, forgings, castings, plates, sheets, shapes and tubes; ferrous and nonferrous castings; machine parts and accessories; cutting tools; abrasives; measuring instruments and gages; brass, copper and steel tubing and fittings; oil resisting hose; hydraulic bridge brakes; gasoline and diesel engines and accessories; paints, lacquers and finishing materials; maintenance and shop supplies; foundry supplies, including scrap, pig iron, coke, and alloys.

P-2: Metalworking Equipment, effective March 28, 1941; revoked by P-11, effective July 1, 1941; revoked by P-11-a, Sept. 30, 1941.

P-3: Material Entering into the Production of Airframes, effective April 29, 1941, rating A-1-d. Use Form PD-13.

P-4: Material Entering into the

Production of Airplane Engines and Propellers, effective April 29, 1941, rating A-1-c. Use Form PD-14.

P-5-b: Cranes and Hoists. See P-1.

P-6: Defense Supplies Rating Plan, effective May 31, 1941. Assigns A-10 rating to deliveries of materials certified to by the Division of Priorities. Replaced by Production Requirements Plan (P-90), applicable starting first quarter, 1942.

P-6-a: Civil Aircraft, Repair Parts and Accessories, effective July 21, 1941, rating A-10. Amendment No. 1, effective Oct. 27, 1941. Use Forms PD-25-d, PD-25-c.

P-7: Material and Equipment Entering into the Production of **Merchant Ship Construction,** effective June 12, 1941, ratings A-1-a (1941), A-1-b (1942), A-1-c (1943). Use Forms PD-30, PD-30-a.

P-8: Material Entering into **Freight Car** Construction, effective June 18, 1941, rating A-3. Use Forms PD-38, PD-38-a. Extended to Dec. 31, 1941, effective Nov. 29.

P-9-a-b-c-d-e-f: Heavy Bombers, effective June 26, 30, 1941. Assigns A-1-b rating to materials entering into production of airframes, engines, propellers, gun turrets, gun sights and turbo superchargers, respectively, for heavy bombers. Use forms PD-43-44-45-46-47-48.

P-10: Material and Equipment Entering into the **Conversion of Ships,** effective June 19, 1941, rating AA. Use Forms PD-41, PD-41-a.

P-11-a: Metalworking Equipment, effective Sept. 30, 1941; revoking P-11, P-2. Ratings as assigned by Priorities Division are applicable to deliveries of same materials included in P-5-b (See P-1: Cranes, Hoists) except brakes and engines. Rating may be extended by supplier. PD-81 used to report monthly assignments of rating.

P-12: Aluminum Scrap, effective June 26, 1941. Assigns A-10 rating to processors of aluminum scrap entering into production of material for defense orders. User must furnish photostatic copy of the order to supplier in buying scrap and must keep records of all uses of preference rating.
PD-40 used to report inventory and consumption.

P-13: Material Entering into the Production of **Airframes,** effective July 3, 1941, rating A-1-b. Use Forms PD-52, PD-52-a. Applies to Columbus, O., plant Curtiss-Wright Corp.

P-14-a-b: Material and equipment Entering into the Construction of **Ship Ways,** effective July 12, 1941, rating A-1-a (1941), A-1-b (1942-43). Use Forms PD-56, PD-56-a.

P-15: Material for **Electrical Relays** and Solenoid Assemblies, effective July 11, 1941, rating A-1-d. Use Forms PD-57, PD-57-a.

P-16: Material for **Radio Receiving,** Transmitting and Directional Equipment, effective July 11, 1941, rating A-1-c. Use Forms PD-58, PD-58-a.

P-17: Canning Machinery, expired Aug. 31, 1941. See P-42.

P-18: Cutting Tool Equipment, effective July 31, 1941; revoked by P-18-a, effective Aug. 28, 1941. Assigns A-1-a rating to deliveries of materials required in producing following tools for defense orders: Drills, reamers, countersinks, counterbores, spotfacers, taps, chasers for self-opening die heads, chasers for collapsing taps, milling cutters, form tools, gear cutting and finishing tools, hobs, boring bars and tools, metal cutting shear knives, metal cutting circular saws and machine broaches. Rating also may be used by suppliers of the producer. Materials affected include high-speed, carbon tool and alloy steel bars, sheets, rods, shapes, forgings and castings; cutting tools, abrasives; measuring instruments, maintenance and shop supplies.
PD-81 used to report monthly assignments of rating. Extended to Feb. 28, 1942, effective Nov. 29, 1941.

P-19: Material Entering into the Construction of Defense Projects, effective July 18, 1941, rating as assigned. Use Forms PD-63, PD-63-a.

P-19-a: Material Entering into the

Construction of Defense Projects (limited to the Priorities Critical List), effective July 18, 1941, rating as assigned. Use Forms PD-68, PD-68-a.

P-19-b: Material Entering into the Construction of Certain Defense Projects with Protected Delivery Dates effective July 30, 1941, rating as assigned. Use Forms PD-68, PD-68-a.

P-19-c: Material entering into construction of publicly financed defense housing, effective as issued, rating as assigned.

P-19-d: Material entering into construction of privately financed defense housing, effective Sept. 9, 1941, rating as assigned.

P-19-e: Material entering into construction of road projects, effective Oct. 18, 1941, rating as assigned.

P-20: Material Entering into the Construction of Specified Locomotives, effective July 21, 1941, rating A-3. Use Forms PD-64, PD-64-a. Extended to Dec. 31, 1941, effective Nov. 29.

P-21: Material Entering into the Repair and Rebuilding of Steam, Electric or Diesel Locomotives Whether for Railroad, Mining or Industrial Use, effective July 21, 1941, rating A-3. Use Forms PD-65, PD-65-a.
Extended to Dec. 31, 1941, effective Nov. 29.

P-22: Repairs, effective Sept. 9, 1941; superseded by P-22-Amended: **Repairs, Maintenance and Supplies,** effective Oct. 16, 1941. Revoked by P-100.

P-23: Materials for the Production of **Mining Machinery** and Equipment, effective July 29, 1941. Assigns A-3 rating to deliveries of material to mining machinery and equipment manufacturers. Materials limited to critical list. Rating may be extended to subcontractors. Use Form PD-117. Order extended Nov. 29 to Dec. 31, 1941.

P-24: Experimental, Research Work, effective Aug. 5, 1941. Assigns A-1-b rating to deliveries of material entering directly or indirectly into experimental work. Applies only to material included under current priorities critical list. PD-74 used to report orders to which rating assigned.

P-25, P-26 series: Tanks. Light tanks covered by P-25-a-b-c-d, effective Aug. 11, 1941, P-25-e effective Oct. 9, 1941. Medium tanks covered by P-26-a-b-c-d, effective Aug. 11, 1941, P-26-e effective Oct. 9, 1941. Preference rating A-1-f assigned materials for light tanks, A-1-d for medium tanks. In both cases orders "a" refer to accessories and equipment, "b" to spare parts and accessories, "c" to 30-caliber and 37-mm. guns for light tanks and 37-mm. and 75-mm. guns for medium tanks, "c" to gasoline and diesel engines and "e" to material entering into production of the tanks.

P-29: Health Supplies Rating Plan, effective Aug. 25, 1941, rating A-10. Use Forms PD-79, PD-80. Amendment, Sept. 30, 1941.

P-31: Foundry Equipment, effective Sept. 5, 1941. Extended to May 30, 1942. Assigns A-1-b rating to deliveries of certain material entering into manufacture of following types of equipment when required to fill defense orders: Molding and core machines; blast cleaning equipment, dust arrestors, sand preparing and handling equipment and briquetting equipment. Materials involved include castings; forgings; sheets, bars, shapes, plates and tubing of ferrous, nonferrous and nonmetallic materials; electrical equipment and accessories; mechanical equipment and accessories; cutting tools; maintenance and shop supplies. PD-81 used to report monthly assignments of rating.

P-32: Farm Equipment Parts, effective Aug. 20, 1941. Revoked Dec. 27, 1941. See P-95, L-26.

P-33: Farm Machinery and Equipment, effective Aug. 20, 1941. Revoked Dec. 27, 1941. See P-95, L-26.

P-35: Half-Track Vehicles, effective Dec. 5. Assigns A-1-f rating to delivery of materials required. Rating may be extended. Use Form PD-81.

P-38: Material Entering into the Production of **Radio Sondes,** effective Aug. 26, 1941, rating A-1-d.

Use Form PD-6, 6a.

P-39: Welding Machines, effective Sept. 12, 1941. Assigns A-1-c rating to deliveries of certain material entering into manufacture of arc welding and resistance welding equipment (excluding electrodes), provided the equipment is required to fill defense orders. Materials affected are: Ferrous and nonferrous forgings, castings, sheets, bars, rods, plates and wire; insulation materials, motors, and other electrical accessories; gasoline and diesel engines and accessories; machine parts and accessories; brass, copper and steel tubing and fittings; maintenance and shop supplies. PD-81 used to report monthly assignments of rating.

P-40: Industrial Lift Trucks, effective Sept. 12, 1941. Assigns A-1-g rating to deliveries of certain materials entering into production of power-driven trucks required to fill defense orders. Materials affected include: Iron or steel castings, and steel forgings; motors and other electrical accessories; ferrous, nonferrous and nonmetallic bars, sheets, plates, shapes and sections; finished or semifinished parts and accessories, including wheels and tires; gasoline engines and accessories. Use Form PD-81.

P-41: Material Entering into the Construction, Maintenance and Operation of **Defense Projects,** effective Aug. 27, 1941, rating A-1-a. Applies to Pan American Airways Inc. only. Form PD-6.

P-42: Material entering into maintenance and repair of **Canning Machinery** and Equipment, effective Aug. 21, 1941, rating A-7. Use Forms PD-88, 93. **P-42-a:** Applies only to American Can Co. Expired Dec. 1, 1941.

P-43: Laboratory Supplies, Equipment, effective Aug. 28, 1941. Assigns A-2 rating to deliveries of materials to be used for scientific research conducted by the laboratory, or which will enter into production of such materials. PD-93 used to report orders to which rating assigned, PD-88 for application for rating.

P-45: Fire Apparatus, effective Oct. 31, 1941. Assigns A-2 rating to deliveries of material to producer and to any supplier of material incorporated into motorized fire apparatus required to fill defense orders. P-45-a, effective Nov. 22, 1941, gives A-8 rating to purchases of fire fighting equipment by U. S. Forest Service.

P-46: Utilities, effective Sept. 17, 1941. Assigns A-10 rating to materials furnished a utility as operating supplies or for the maintenance or repair of its facilities. Also applies to deliveries to any supplier of such material. Covers electric power, gas, water, central heating and public sanitation plants. PD-118 used to report withdrawals from inventory. Quarterly receipts and stock withdrawals must not exceed average quarterly inventory withdrawals of 1940. Receipts also limited by 1940 volume.

P-47: Material Entering into the Maintenance and Repair of **Air Transportation Facilities,** effective Sept. 6, 1941, rating A-3. Use Form PD-96.

P-51: Material Entering into the Production of **Canning Machinery** and Equipment, effective Sept. 22, 1941, rating A-3. Applies to Food Machinery Corp.

P-52: Aircraft Accessories, effective Sept. 15, 1941. Assigns A-1-d rating to deliveries of materials and to any supplier of material to be incorporated into aircraft accessories. Such accessories include all parts and instruments which will be installed in a finished aircraft for which delivery schedule has been approved by the Joint Aircraft Committee. Also covers auxiliary products necessary for maintenance or operation of such finished aircraft. PD-108 used to apply for preference rating, PD-81 to report monthly assignments of rating.

P-53: Textile Machinery Parts, effective Sept. 13, 1941. Assigns A-10 rating to deliveries of material for production of parts for maintenance and repair of textile machinery and equipment. Supplier of material also may extend rating assigned him by producer.

PD-81 used to report monthly assignments of rating.

P-54: Trucks, Trailers, Busses, effective Sept. 12, 1941. Assigns A-3 rating to deliveries of materials to builders of trucks 1½-ton capacity or more, trailers 5 tons or more and busses seating 15 or more persons. Also may be extended to deliveries to any supplier of such materials.

P-55: Defense Housing Projects, effective when issued. Applies rating as determined by Division of Priorities to certain authorized materials required in connection with privately financed defense housing projects. Application for rating to be filed on Form PD-105, 105a, b.

P-56: Mines, effective Sept. 22, 1941; amended, effective Dec. 2, 1941. Assigns A-1-a rating to material deliveries for repairs in event of breakdown; A-1-c to material up to minimum required to avert breakdown; A-3 to material for other repairs to selected list of machinery and equipment; A-3 to delivery of completed items on this list; A-8 to repair material and machinery and equipment not listed. Deliveries to supplier take A-3 for listed, A-8 for unlisted machinery and equipment. Approval of Director of Priorities necessary before application of A-1-a, A-1-c or A-3 ratings for machinery and equipment. Inventories of operating supplies in relation to production must not exceed average ratio of 1938, 1939, 1940. Operators report on PD-119 to designated state agency by 10th of each month on purchases. Suppliers report on same date to OPM on deliveries and purchases under A-3 or higher rating.

P-57: Automobile Repair Parts, effective Sept. 18, 1941. Assigns A-10 rating to deliveries either to a producer or to his supplier of material required for production of replacement parts for passenger cars, and trucks of less than 1½ tons capacity.

P-58: Supplies for specified South American mines, rating A-3, effective Oct. 8, 1941. Includes Cerro de Pasco Copper Corp., Andes Copper Mining Co., Chile Exploration Co., Braden Copper Co.

P-61: Copper Scrap, effective Oct. 13, 1941. Assigns A-10 rating to deliveries of scrap, other than brass mill scrap, entering into material for delivery on defense orders. Dealers apply for listing on PD-126.

P-62: Material for production of **Laboratory Equipment,** Reagent Chemicals, rating A-5, effective Nov. 15, 1941.

P-65: Marine Paints, effective Dec. 5. A-3 rating assigned for raw materials upon filing PD-82 with Priorities Division.

P-68: Steel Plant Maintenance, effective, Oct. 31, 1941. Assigns A-1-a rating to deliveries of materials for repair of iron or steel plant facilities in event of actual breakdown when parts are not otherwise available; A-1-c to material to make reasonable advance provision to avert breakdown; A-3 to deliveries for ordinary maintenance, repair or operating supplies. Deliveries not permitted if inventories exceed 125 per cent of dollar volume on Dec. 31, 1940. Withdrawals from inventory must not exceed those of corresponding 1940 quarter or one-half those of first six months of 1941. PD-148 used to apply for preference rating.

P-72: Elevator, Escalator Repair Parts, effective Nov. 10, 1941. Assigns A-3 rating to deliveries of materials to be used in production of parts for repair or maintenance of passenger or freight elevators or escalators, such materials to be only those included in current priorities critical list. PD-81 used to report monthly assignments of rating.

P-73: Smelters, Refiners of Copper, Lead, Zinc, Antimony, Mercury, Cobalt, issued Dec. 22, 1941. Assigns A-1-a rating to material for repair of actual breakdown; A-1-c for material to avert breakdown; A-3 to other material for repair maintenance or operation, also for deliveries to suppliers. Producers must file PD-212 with OPM before applying rating.

P-74: Heat Treating Furnaces, effective Nov. 22, 1941. Assigns

A-1-c rating to deliveries of certain materials to manufacturers of furnaces used in heat treatment of metals, when such furnaces are used to fill defense orders. Materials affected include rolled steel bars, plates, sheets, shapes and tubes; ferrous and nonferrous forgings and castings; abrasives; indicating instruments; refractories and insulation; controlled atmosphere generators; burners and accessories; finishing materials; maintenance and shop supplies; foundry supplies, including scrap, pig iron, coke and alloys.

P-75: Material for production of **Tackle Blocks,** rating A-1-c, effective Oct. 24, 1941.

P-76: Steel sheets, 16 and 18 gage, for manufacture of **Drums,** rating A-4, effective Nov. 17, 1941. Use Form PD-81 to report monthly assignments of rating, PD-156 to apply for rating.

P-77: Rebuilt Machine Tools, effective Nov. 10, 1941. Assigns A-1-c rating to deliveries to rebuilder of machine tools of the following materials required for this purpose: Motors and other electrical accessories; iron, steel, brass and bronze castings; alloy and carbon steel bars, forgings, castings, shapes and tubes; cutting tools and abrasives; measuring instruments; brass, copper and steel tubing and fittings; oil resisting hose; bearing metals, antifriction bearings; machine parts and accessories. Tools rebuilt from material so obtained must be guaranteed for 30 days and must be used to fill defense orders. Use Forms PD-157, 179.

P-78: Conveyor Machinery, effective Nov. 10, 1941. Assigns A-3 rating to deliveries of materials to be used in production of stationary and portable conveying and elevating equipment designed for handling industrial material, also auxiliary equipment. Materials affected are the same as covered by Order P-31 (Foundry Equipment). PD-81 used to report monthly assignments of rating.

P-79: Non-Metal Containers, effective Nov. 14, 1941. Assigns A-8 rating on deliveries of steel wire and A-5 on other ferrous materials to producers of cooperage and wooden packages, such as boxes, crates, etc. Rating may be applied only to quantities and kinds of material authorized by Director of Priorities on Form PD-82.

P-90: Production Requirements Plan, issued Dec. 3, 1941, effective first quarter of 1942. Replaces Defense Supplies Rating Plan (P-6). Ratings covering materials needed for defense or essential civilian production during that quarter assigned by Director of Priorities after applicant has filed Form PD-25A. One or more ratings may be assigned to cover all or any specified part of applicant's requirements. Where deliveries must be scheduled beyond March 31, 1942, an additional Form PD-25A may be submitted. Capital items may not be obtained by rating assigned by this order. Forms submitted after Jan. 1, 1942, restrict priority assistance to remainder of first quarter. No ratings other than those authorized in PD-25A may be used by those operating under the plan.

P-95: Farm Machinery and Parts, effective Dec. 27, 1941. Assigns A-3 rating to deliveries of material for production of new machinery and parts limited by Order L-26.

P-100: Repairs, Maintenance, Supplies, effective Dec. 18, 1941, revoking P-22, rating A-10. Limits stocks of materials for these purposes to 110 per cent of purchases in corresponding 1940 quarter. Withdrawals from inventory similarly limited. Does not apply if purchases or withdrawals are $5000 or less per quarter. May not be used for material required for plant expansion or improvements. Plants working overtime get extra allowances. Operating supplies include ferrous parts used to make containers. Application for rating not required. Does not apply to mines.

"E" Orders

"E" stands for equipment. So far, only machine tools and cutting tools have been covered by these orders. An "E" order is simi-

lar to an "M" order in that it affects the distributor of the item covered, so that defense needs can be filled first.

E-1: Machine Tools, effective March 28, 1941. Supplementary Order No. 1, effective July 7, 1941. Note: Revokes E-1.

E-2: Cutting Tools, effective July 17, 1941. (Amendment), effective July 25, 1941; superseded by E-2-a, effective Aug. 28, 1941; extended to Feb. 28, 1942, effective Nov. 29, 1941.

"L" Orders

The "L" orders are limitation orders, setting limits on production of the materials or items covered. Orders issued so far in this series are:

L-1: To Restrict the Production of Motor Truck and Public Passenger Carriers, effective Aug 30, 1941. Note: Amended by L-1-a.

L-1-a: To Restrict the Production of Medium Trucks, Truck Trailers, Passenger Carriers and Replacement Parts, effective Sept. 12, 1941. Note: Amends L-1. Extension No. 1 issued Oct. 13, 1941. Use Form PD-95. Extended Nov. 6 to Jan. 31, 1942. Truck trailers removed from all restrictions, effective Dec 4, 1941.

L-2, L-2-a: To Restrict the Production of Passenger Automobiles, effective Sept. 13, 1941.

L-2-b, L-2-c: To eliminate "bright work" from passenger cars, effective Dec. 15, 1941. Issued Oct. 27, 1941. Amended Dec. 10, 1941, extending deadline to Dec. 31, 1941, and exempting ventilator latches, external locks and caps, windshield wiper arms and blade holders, body trim screws.

L-2-c: Setting maximum passenger car output for January, issued Nov. 7.

L-3: To Restrict the Production of Light Motor Trucks, effective Sept. 13, 1941. L-3-a issued Oct. 24, L-3-b Nov. 14, 1941.

L-4: To Restrict the Production of Replacement Parts used in the Repair of Passenger Automobiles and Light Trucks, effective Sept. 18, 1941. Amended Nov. 22, 1941.

L-4-a: Extends L-4 through Jan. 31, 1942. Issued Nov. 14, 1941.

L-5: To Restrict the Production of Domestic Mechanical Refrigerators, effective Sept. 30, 1941. Revised Dec. 4, 1941.

L-6: To Restrict Production of Domestic Laundry Equipment, effective Oct. 29, 1941. Restrictions more than doubled, Dec. 12, 1841.

L-6-a: Extends L-6 to Jan. 31, 1942 and imposes further restrictions in February, 1942.

L-7: To Restrict steel consumption by makers of domestic ice refrigerators, effective Oct. 28, 1941.

L-8: To Restrict distribution of motor fuel in Atlantic coast area, effective Sept. 30, 1941. Revoked Oct. 24, 1941.

L-11: To Restrict use of chlorine in manufacture of Pulp and Paper Board, effective Nov. 15, 1941.

L-13: To Restrict Production of Metal Office Furniture and Equipment, effective Nov. 7.

L-15: To Restrict consumption of waste paper by eastern paper board and roofing mill plants, effective Oct. 25, 1941.

L-16: To Restrict Electric Power consumption in Southeast, effective Oct. 30, 1941. Modified Dec. 5, 1941.

L-18: To Restrict production of Domestic Vacuum Cleaners effective Nov. 27, 1941.

L-20: To limit use of Cellophane and similar Transparent Materials derived from Cellulose, effective Nov. 8, 1941.

L-21: To Restrict production of Automatic Phonographs, Weighing, Amusement and Gaming Machines, effective Dec. 10, 1941.

L-23: To Restrict production of Domestic Cooking Appliances, effective Dec. 13, 1941. Use Forms PD-192, 203.

L-25: To limit use of Tin Foil and Lead Foil, effective Nov. 24, 1941. Deferred 30 days, Nov. 28, 1941.

L-26: To Restrict materials for production of new Farm Machinery to 83 per cent of 1940 consumption and materials for repair parts to about 150 per cent of 1940.

Allocation Orders

No. 1: Steel Plates, effective Nov. 29. Covers flat products, except slabs, over 6-inches wide, ¼-inch or more thick, or over 48 inches wide, 3/16-inch or more thick. All shipments to be as instructed by Director of Priorities. Producers

must report proposed monthly production and shipments by 15th of preceding month to Iron and Steel Branch, OPM.

"S" Orders

The "S" orders are suspension orders, issued in event of willful violation of preference orders. Issued to date are:

S-1: Central Pattern & Foundry Co., Chicago, to suspend aluminum operations until March 31, 1942. Issued Oct. 15, 1941.

S-2: Lieb & Buchalter Inc., Brooklyn, N. Y., to be deprived of preference ratings on deliveries until March 1, 1942. Issued Dec. 20, 1941.

S-7: State Metals & Steel Co., Canton, O., to be deprived of priority assistance and forbidden aluminum receipts and deliveries.

Miscellaneous Orders

Priorities Regulation No. 1. Defense orders must be accepted unless impossible because of previous defense orders, or if buyer will not conform to established prices, or if orders specify delivery within 15 days and such delivery would require termination before completion of an existing production schedule. Delivery under defense orders must be made before other orders, but no earlier delivery date shall be specified in any defense order than required by the schedule of the person placing the order. Material obtained under allocation or preference rating may be used only for the purpose specified. Inventories must not be increased beyond current needs. Records must be kept for not less than two years of inventories of material covered by preference orders and details of all transactions in such materials. Records are subject to inspection by OPM. Effective Aug. 27, 1941.

Amendment effective Dec. 23, 1941, requires acceptance of B rated orders before unrated orders. Inventory restrictions tightened further. All defense orders not otherwise rated take A-10 rating.

Priorities Regulation No. 2, effective Sept. 9, 1941.

General Metals Order No. 1, Note: Terminated Sept. 23, 1941. Restrictions imposed covered by Regulation No. 1.

Wisconsin Roadbuilders To Collect Scrap Free

■ Wisconsin highway contractors who recently offered to conduct an iron and steel scrap collection campaign in connection with the defense program have received orders from OPM to proceed with the plan. Pointing out that the offer to collect this material free of cost was the first of the kind to be received by its Iron and Steel Branch, OPM asked to be kept advised of results so that it can seek similar co-operation in other states.

Construction and Enterprise

Michigan

ANN ARBOR, MICH. — American Broach & Machine Co., Ann Arbor, has let contract to Cunningham-Rudy Co., Detroit, for an addition to its plant.

BELDING, MICH.—Metal-Glass Products Co. will build a 51 x 54-foot addition to its present plant to be used in manufacture of stainless steel tanks and equipment.

DEARBORN, MICH.—Dearborn Electric Co. has been organized to manufacture electrical devices; John F. Gillespie, 1010 Mason street, correspondent.

DETROIT—Motor Products Corp. will erect a 118 x 200-foot addition to its factory. Smith, Hinchman & Grylls, Detroit, architects.

DETROIT—Standard Die Cast Co. has let contract to Campbell Construction Co., Detroit, for an addition to its factory.

DETROIT—Standard Tool & Mfg., Detroit, has let contract to Stibbard Construction Co., Detroit, for an addition to its shop.

DETROIT—W. J. C. Kaufmann Co., Detroit, has been awarded contract for an addition to the factory of Federal Mogul Corp., Detroit, and also for an addition

to the shop of Commonwealth Industries, Detroit.

DETROIT—Falcon Tool Co. has been incorporated with $75,000 capital to manufacture cutting and grinding tools; Ralph A. Edens, 12502 Greiner avenue, correspondent.

MONROE, MICH.—Monroe Auto Equipment Co. is having Reed M. Dunbar, Monroe, architect, prepare sketches for construction of an addition to its factory.

MUSKEGON, MICH.—Strom & Strom Construction Co., Muskegon, has contract for rehabilitation of the former Austin Machinery plant here for Norge Division of Borg-Warner Corp.

ROYAL OAK, MICH.—Lyman Gauge Co. has been incorporated to deal in dies, tools and gauges. Harry J. Lyman, 400 West Hudson avenue, correspondent.

WYANDOTTE, MICH.—O. W. Burke Co., Detroit, has been awarded contract for construction of a manufacturing building here for Air Reduction Sales Corp.

WYANDOTTE, MICH.—E. I. Du Pont de Nemours & Co. Inc., Wilmington, Del., has awarded general contract to O. W. Burke Co., Detroit, for superstructure of the trichlorethylene building for the solvents plant to be erected here. (Noted Dec. 8).

Ohio

CINCINNATI — Cincinnati Bickford Tool Co., 3220 Forrer street, Oakley, O., has awarded contract to Austin Co., Cleveland, for erection of one-story building, 120 x 400 feet, containing 72,000 square feet of floor space.

DEFIANCE, O.—Modern Equipment Corp. has started construction of a factory addition, 60 x 344 feet, to contain 20,000 feet of floor space.

Indiana

EVANSVILLE, IND.—Excel Mfg. Co., West Third street, A. Moore, will take bids in January for enlarging plant. Cost $40,000 or more.

EVANSVILLE, IND.—Hoosier Lamp & Stamping Co. Inc., J. Morton Jr., president, 601 West Eichel avenue, plans plant addition. Cost $200,000 or more with equipment.

HAGERSTOWN, IND.—Perfect Circle Corp. will erect testing laboratory at cost of $125,000 or more with equipment.

Wisconsin

BELOIT, WIS.—Fairbanks-Morse & Co. has let contract for one-story 30 x 187-foot shop addition to Cunningham Bros., 359 East Grand avenue. W. Fred Dolke, 2204 Merchandise Mart, Chicago, architect. (Noted Nov. 10).

GENOA, WIS.—Tri-State Power Cooperative, J. N. Gundershaug, manager, plans additional facilities in connection with generating plant, for which it has $48,000 REA allotment.

WALWORTH, WIS.—Gillett Canning Co., Gillett, Wis., will erect canning plant here to cost about $100,000.

Texas

DALLAS, TEX.—Dallas Power & Light Co., George L. MacGregor, president, has asked for approval of $2,260,000 expansion program.

EDINBURG, TEX.—City, A. A. Aldrich, mayor, will vote Jan. 15 on issuance of $500,000 bonds for electric system, $250,000 bonds for water system.

GOOSE CREEK, TEX.—City will soon let contracts for $255,000 sewer and water improvements.

HOUSTON, TEX.—Stokeley Bros. & Co. Inc., 951 North Meridian street, Indianapolis, will build food canning and packing plant here to cost $100,000, including equipment.

PASADENA, TEX.— Garret Engineering Co., 3504 Audubon street, Houston, Tex., is engineer for additions and extensions to water supply and distribution system for city. Delbert L. Atkinson, mayor. Approximate cost $532,699.

Kansas

LINDSBORG, KANS.—City voters approved purchase of an engine-generator and the issuance of bonds to finance same for power plant. Estimated cost $51,000. E. W. Jernberg, mayor. (Noted Dec. 8.)

WICHITA, KANS.—Watkins Inc. is preparing preliminary plans for construction of a steel and foundry plant with about 250,000 square feet of floor space, to cost approximately $200,000. Forsblom & Parks, Beacon building, Wichita, architects.

California

LOS ANGELES—Wire & Metal Mfg. Co., 5965 Alcoa avenue, is erecting an addition to its plant, 60 x 120 feet.

Washington

EPHRATA, WASH. — Grant County P. U. D. No. 2 has been allocated $600,000 by REA for 526 miles of power transmission lines at Soap Lake and Coulee City.

RITZVILLE, WASH.—Big Bend Electric Co-operative has been allotted $170,000 for additional power line extensions.

SEATTLE—Atlas Engine Co., 1512 Thurman avenue, plans plant addition, 30 x 60 feet for machine shop and offices. W. C. Jackson, architect.

WHERE-TO-BUY

A classified list of advertisers according to products. ¶Index to advertisements gives page number of any advertiser.

ABRASIVES (Blast Cleaning)
American Foundry Equipment Co., The, 509 So. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., 4839 Harrison St., Pittsburgh, Pa.

ABRASIVES (Polishing)
Abrasive Co., Tacony & Fraley Sts., Philadelphia, Pa.
Carborundum Co., The, Niagara Falls, N. Y.
Norton Co., Worcester, Mass.

ABRASIVES (Wheels)
Bay State Abrasive Products Co., Westboro, Mass.

ABRASIVES (Wire Cleaning)
Industrial Silica Corp., 602 Stambaugh Bldg., Youngstown, O.

ACCUMULATORS
Elmes, Chas. F., Engineering Wks., 243 N. Morgan St., Chicago, Ill.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Morgan Engineering Co., The, Alliance, O.
Schioemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

ACETYLENE
Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., The, 30 E. 42nd St., New York City.
National Cylinder Gas Co., 205 W. Wacker Dr., Chicago, Ill.

ACID-PROOF LININGS
Cellcote Co., 750 Rockefeller Bldg., Cleveland, O.
Heil & Co., 12901 Elmwood Ave., Cleveland, O.
Pennsylvania Salt Mfg. Co., Dept. S, Pennsalt Cleaner Div., Philadelphia, Pa.
Quigley Co., 56 W. 45th St., New York City.

ACIDS (Pickling)
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Ampco Metal, Inc., Dept. S-142, 3830 W. Burnham St., Milwaukee, Wis.
Pennsylvania Salt Mfg. Co., Dept. S, Pennsalt Cleaner Div., Philadelphia, Pa.

AIR COMPRESSORS—See COMPRESSORS (Air)

AIR CONDITIONING EQUIPMENT
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

AIRLESS BLAST CLEANING EQUIPMENT
American Foundry Equipment Co., The, 509 So. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

ALKALI CLEANING COMPOUNDS
Pennsylvania Salt Mfg. Co., Dept. S, Pennsalt Cleaner Div., Philadelphia, Pa.

ALLOYS (Corrosion & Abrasive Resistant)
Wall-Colmonoy Corp., 637 Buhl Bldg., Detroit, Mich.

ALLOYS (Hard Surfacing)
Stoody Co., Whittier, Calif.

ALLOYS—See FERROALLOYS

ALLOYS (Magnesium)
Dow Chemical Co., Midland, Mich.

ANGLES, CHANNELS—See BEAMS, CHANNELS, ANGLES

ANNEALING BOXES—See BOXES (Annealing)

ANNEALING COVERS
General American Transportation Corp., 135 So. LaSalle St., Chicago, Ill.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.

ANODES (All Types)
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

ANODES (Nickel)
Seymour Manufacturing Co., The, Seymour, Conn.

ANVILS
Swedish-American Steel Corp., 430 Kent Ave., Brooklyn, N. Y.

ARCHES (Suspended)
Standard Arch Co., Keedysville, Md.

ARCHES AND WALLS
Standard Arch Co., Keedysville, Md.

AXLES
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Republic Steel Corp., Dept. ST, Cleveland, O.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

BABBITT METAL
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.

BALANCING MACHINES
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.

BALING PRESSES
Galland-Henning Manufacturing Co., 2747 So. 31st St., Milwaukee, Wis.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Standard Machinery Co., Providence, R. I.

BALL TRANSFERS
Mathews Conveyer Co., 142 Tenth St., Ellwood City, Pa.

BALLS (Brass or Bronze)
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Strom Steel Ball Co., 1850 S. 54th Ave., Cicero, Ill.

BALLS (Special Alloy Metals)
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

BALLS (Steel)
***Also Stainless**
*Strom Steel Ball Co., 1850 S. 54th Ave., Cicero, Ill.

BAND FILES (Metal)
Continental Machines, Inc., 1324 So. Washington Ave., Minneapolis, Minn.

BAND SAWS (Metal Cutting)
Continental Machines, Inc., 1324 So. Washington Ave., Minneapolis, Minn.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Walker-Turner Co., Inc., 5012 Berckman St., Plainfield, N. J.

BANDS—See HOOPS AND BANDS

BANDS (Iron and Steel)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

BAR BENDERS
Kardong Bros. Inc., 346 Buchanan St., Minneapolis, Minn.

BARGE MOVERS
Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.

BARGES (Steel)
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Dravo Corp. (Engin'r'g Works Div.) Neville Island, Pittsburgh, Pa.
Federal Shipbuilding & Dry Dock Co., Kearney, N. J.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Maryland Dry Dock Co., Baltimore, Md.
Treadwell Construction Co., Midland, Pa.

BARRELS (Plating)
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

BARRELS (Steel)
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.

BARS (Alloy)
Ampco Metal, Inc., Dept. S-142, 3830 W. Burnham St., Milwaukee, Wis.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Copperweld Steel Co., Warren, O.
Firth-Sterling Steel Co., McKeesport, Pa.
International Nickel Co. Inc., The, 67 Wall Street, New York City.
LaSalle Steel Co., Chicago, Ill.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.

BARS (Brass, Bronze or Copper)
American Brass Co., The, Waterbury, Conn.
Copperweld Steel Co., Warren, O.
Johnson Bronze Co., 550 So. Mill St., New Castle, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.

BARS (Concrete Reinforcing)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Northwest Steel Rolling Mills, 4315 Ninth Ave., Seattle, Wash.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BARS (Iron)—See IRON (Bar)

BARS (Steel)
(*Also Stainless)
*Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
*Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
*Copperweld Steel Co., Warren, O.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
*Midvale Co., The, Nicetown, Philadelphia, Pa.
*Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
*Rustless Iron & Steel Corp., 3400 E. Chase St., Baltimore, Md.
*Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Sutton Engineering Co., Park Bldg., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Canton, O.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BATHS (Heat Treating-High Speed)
A. F. Holden Co., The, 200 Winchester Ave., New Haven, Conn.

BATTERIES (Storage)
Edison Storage Battery Div. of Edison, Thomas A., Inc., West Orange, N. J.
Electric Storage Battery Co., The, 19th St. and Allegheny Ave., Philadelphia, Pa.

BATTERY CHARGING APPARATUS
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
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BEAMS, CHANNELS, ANGLES, ETC.
(*Also Stainless)
Bethlehem Steel Co., Bethlehem, Pa.

BEAMS, CHANNELS, ANGLES, ETC.—Con.
(*Also Stainless)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Dow Chemical Co., Midland, Mich.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Levinson Steel Co., 33 Pride St., Pittsburgh, Pa.
*Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BEARINGS (Ball)
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Bantam Bearings Corp., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
New Departure Div., General Motors Corp., Bristol, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Torrington Co., The, Torrington, Conn.

BEARINGS (Babbitt)
Johnson Bronze Co., 550 So. Mill St., New Castle, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.

BEARINGS (Brass, Bronze)
3830 W. Burnham St., Milwaukee, Wis.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Johnson Bronze Co., 550 So. Mill St., New Castle, Pa.
Lawrence Copper & Bronze, Bessemer Bldg., Pittsburgh, Pa.
Moraine Products Division, General Motors Corporation, Dayton, Ohio.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Shenango-Penn Mold Co., Dover, O.

BEARINGS (Graphite)
United States Graphite Co., The, Saginaw, Mich.
Ampco Metal, Inc., Dept. S-142,

BEARINGS (Journal)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
Bantam Bearings Corp., South Bend, Ind.
Bower Roller Bearing Co., 3040 Hart St., Detroit, Mich.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Division, General Motors Sales Corp., Harrison, N. J.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS (Needle)
Torrington Co., The, Torrington, Conn.

BEARINGS (Non-Metallic)
Moraine Products Division, General Motors Corporation, Dayton, Ohio.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.

BEARINGS (Oilless)
Moraine Products Division, General Motors Corporation, Dayton, Ohio.
Rhondes, R. W., Metalline Co., P. O. Box 1, Long Island City, N. Y.

BEARINGS (Quill)
Bantam Bearings Corp., South Bend, Ind.

BEARINGS (Radial)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
American Roller Bearing Co., 416 Melwood St., Pittsburgh, Pa.
Bantam Bearings Corp., South Bend, Ind.
Bower Roller Bearing Co., 3040 Hart St., Detroit, Mich.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Link-Belt Co., 519 No. Holmes Ave., Indianapolis, Ind.
New Departure Div., General Motors Corp., Bristol, Conn.
Rollway Bearing Co., Inc., 541 Seymour Ave., Syracuse, N. Y.
SKF Industries, Inc., Front St., and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The Canton, O.

BEARINGS (Roll Neck)
Bantam Bearings Corp., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn. Harrison, N. J.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Morgan Construction Co., Worcester, Mass.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS (Roller)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
American Roller Bearing Co., 416 Melwood St., Pittsburgh, Pa.
Bantam Bearings Corp., South Bend, Ind.
Bower Roller Bearing Co., 3040 Hart St., Detroit, Mich.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., 541 Seymour Ave., Syracuse, N. Y.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Standard Machinery Co., Providence, R. I.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS (Roller Tapered)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.

BEARINGS (Rolling Mill)
American Roller Bearing Co., 416 Melwood St., Pittsburgh, Pa.
Bantam Bearings Corp., South Bend, Ind.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Morgan Construction Co., Worcester, Mass.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS (Shaft Hangers)
Rollway Bearing Co., Inc., 541 Seymour Ave., Syracuse, N. Y.

BEARINGS (Thrust)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
Bantam Bearings Corp., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., 519 No. Holmes Ave., Indianapolis, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., 541 Seymour Ave., Syracuse, N. Y.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The, Canton, O.

BELLS (Furnace)
Pittsburgh Steel Foundry Corp., Glassport, Pa.

BELTING (Chain and Link)
Link-Belt Co., 220 So. Belmont Ave., Indianapolis, Ind.

BELTING (Metal, Conveyor, High and Low Temperature)
Cyclone Fence Co., Waukegan, Ill.

BENCH PLATES
Challenge Machinery Co., Grand Haven, Mich.

BENCHES
Challenge Machinery Co., Grand Haven, Mich.
Lyon Metal Products, Inc., 7211 Madison Ave., Aurora, Ill.

BENDING AND STRAIGHTENING MACHINES
Alliance Machine Co., The, Alliance, O.
Buffalo Forge Co., 446 Broadway, Buffalo, N. Y.
Cleveland Crane & Engineering Co., Steelweld Machinery Div., The, 1125 E. 283rd St., Wickliffe, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Kane & Roach, Inc., Niagara & Shonnard Sts., Syracuse, N. Y.
Kardong Bros., Inc., 346 Buchanan St., Minneapolis, Minn.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Morgan Engineering Co., The, Alliance, O.
Thomas Machine Mfg. Co., Elna Branch P. O., Pittsburgh, Pa.

BENZOL AND TOLUOL RECOVERY PLANTS
Koppers Co., Engineering and Construction Div., 300 Koppers Bldg., Pittsburgh, Pa.
Koppers Co., Tar & Chemical Div., 901 Koppers Bldg., Pittsburgh, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BILLETS (Alloys and Carbon Steel)
Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Firth-Sterling Steel Co., McKeesport, Pa.
Keystone Steel & Wire Co., Dept. AC, Peoria, Ill.
Northwest Steel Rolling Mills, 4315 Ninth Ave., Seattle, Wash.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Washburn Wire Co., Phillipsdale, R. I.

BILLETS (Forging)
Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Copperweld Steel Co., Warren, O.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.

BILLETS AND BLOOMS (*Also Stainless)
*Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
*Copperweld Steel Co., Warren, O.
*Firth-Sterling Steel Co., McKeesport, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
*Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BINS (Storage)
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.
Lyon Metal Products, Inc., 7211 Madison Ave., Aurora, Ill.

BLACKING (Graphite)
United States Graphite Co., The, Saginaw, Mich.

BLAST CLEANING EQUIPMENT (Sand)
American Foundry Equipment Co., The, 509 So. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

BLAST FURNACE CLEANING (Gas)
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.

BLAST FURNACE LINING & RELINING
Anderson, A. E., Construction Corp., Prudential Bldg., Buffalo, N. Y.

BLAST FURNACE HOT BLAST STOVES
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.

BLAST FURNACE SPECIALTIES
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brassert, H. A., & Co., First National Bk. Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.

BLAST FURNACE STOCK HOUSES
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.

BLAST FURNACES—See FURNACES (Blast)

BLOCKS (Chain)
Reading Chain & Block Co., Dept. 313, Reading, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

BLOWERS
General Electric Co., Schenectady, N. Y.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Mahr Mfg. Co., Div. of Diamond Iron Works, Inc., Minneapolis, Minn.
Stewart Furnace Div., Chicago Flexible Shaft Co., Dept. 112, 5600 Roosevelt Rd., Chicago, Ill.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

BLOWPIPES (Oxy-Acetylene)
Linde Air Products Co., The, 30 E. 42nd St., New York City.

BOILER HEADS
Bethlehem Steel Co., Bethlehem, Pa.

BOILER TUBES—See TUBES (Boiler)

BOILERS
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Oil Well Supply Co., Dallas, Texas

BOLT AND NUT MACHINERY
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., The, Tiffin, O.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.

BOLT & RIVET CUTTERS
Helwig Mfg. Co., Locust & 7th Sts., St. Paul, Minn.

BOLTS (*Also Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
*Erie Bolt & Nut Co., Liberty Ave., at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Oliver Iron & Steel Corp., So. 10th & Muriel Sts., Pittsburgh, Pa.
*Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
*Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Triplex Screw Co., The, 5317 Grant Ave., Cleveland, O.

BOLTS (Carriage and Machine)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Oliver Iron & Steel Corp., So. 10th & Muriel Sts., Pittsburgh, Pa.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Triplex Screw Co., The, 5317 Grant Ave., Cleveland, O.

BOLTS (Non-Ferrous and Stainless)
Harper, H. M., Co., The, 2646 Fletcher St., Chicago, Ill.

BOLTS (Special)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOLTS (Stove)
Central Screw Co., 3517 Shields Ave., Chicago, Ill.
Cleveland Cap Screw Co., 2934 E. 79th St., Cleveland, O.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.

BOLTS (Stove, Recessed Head)
American Screw Co., Providence, R. I.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.

BOLTS (Track)—See TRACK BOLTS

BORING MACHINES (Precision)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Heald Machine Co., Worcester, Mass.

BOXES (Annealing)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
General American Transportation Corp., 135 So. LaSalle St., Chicago, Ill.
National-Erie Corp., Erie, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Treadwell Construction Co., Midland, Pa.
Union Steel Casting Div. of Blaw-Knox Co., 62nd & Butler Sts., Pittsburgh, Pa.
United Engineering & Foundry Co., First National Bank Bldg., Pittsburgh, Pa.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

BOXES (Open Hearth Charging)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Morgan Engineering Co., The, Alliance, O.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Treadwell Construction Co., Midland, Pa.

BRAKE LININGS
Johns-Manville Corp., 22 E. 40th St., New York City.

BRAKES (Electric)
Clark Controller Co., The, 1146 E. 152nd St., Cleveland, O.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.

BRAKES (Press)
Cincinnati Shaper Co., Elam and Garrard Sts., Cincinnati, O.
Cleveland Crane & Engineering Co., The, Steelweld Machinery Div., 1125 E. 283rd St., Wickliffe, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.

BRICK—(Insulating)—See INSULATING BRICK

BRICK (Acid Resisting)
Nukem Products Corp., 70 Niagara St., Buffalo, N. Y.

BRICK (Chrome)
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh, Pa.

BRICK (Ladle)
Globe Brick Co., The, East Liverpool, O.

BRICK (Refractory)—See REFRACTORIES, CEMENT, ETC.

BRICK (Silica)
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh, Pa.

BRICK (Silicon Carbide)
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Perth Amboy, N. J.
Norton Co., Worcester, Mass.

BRIDGE CRANES (Ore and Coal Handling)—See CRANES (Bridge)

BRIDGES, BUILDINGS, VIADUCTS, STACKS, ETC.
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Belmont Iron Works, 22nd St., and Washington Ave., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Co., Blawnox, Pa.
Columbia Steel Co., San Francisco, Calif.
General American Transportation Corp., 135 So. LaSalle St., Chicago, Ill.
Levinson Steel Co., 33 Pride St., Pittsburgh, Pa.
Robertson, H. H., Co., Farmers Bank Bldg., Pittsburgh, Pa.
Uhl Construction Co., 6001 Butler St., Pittsburgh, Pa.
Youngstown Steel Tank Co., Oak St. & Andrews Ave., Youngstown, O.

BROACHING CUTTERS
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

BROACHING MACHINES
American Broach & Machine Co., Ann Arbor, Mich.
Bullard Co., The, Bridgeport, Conn.
Cincinnati Milling Machine & Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Colonial Broach Co., 147 Jos. Campau, Detroit, Mich.

BRUSHES
Fuller Brush Co., The, Hartford, Conn.

BRUSHES (Carbon)
United States Graphite Co., The, Saginaw, Mich.

BRUSHES (Industrial)
Fuller Brush Co., The, Hartford, Conn.
Pittsburgh Plate Glass Co., Brush Div., Frederick Ave., Baltimore, Md.

BRUSHES (Steelgript)
Fuller Brush Co., The, Hartford, Conn.

BUCKETS (Clam Shell, Dragline Grab, Single Line)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Blaw-Knox Co., Blawnox, Pa.
Cullen-Friestedt Co., 1308 So. Kilbourn St., Chicago, Ill.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Osgood Co., The, Marion, O.
Owen Bucket Co., 6012 Breakwater Ave., Cleveland, O.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland, O.

BUCKETS (Single Hook, Automatic Dump, Automatic Single Line)
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland, O.

BUILDINGS (Industrial)
Austin Co., The, 16112 Euclid Ave., Cleveland, O.

BUILDINGS (Steel)—See BRIDGES, BUILDINGS, ETC.

BULLDOZERS
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.

BURNERS (Acetylene)—See TORCHES AND BURNERS

BURNERS (Automatic)
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Bloom Engineering Co., 916 Behan St., Pittsburgh, Pa.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Wean Engineering Co., Warren, O.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

BURNERS (Fuel, Oil, Gas, Combination)
American Gas Furnace Co., Elizabeth, N. J.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Bloom Engineering Co., 916 Behan St., Pittsburgh, Pa.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Maehler, Paul, Co., The, 2210 Lake St., Chicago, Ill.
Mahr Mfg. Co., Div. of Diamond Iron Works, Inc., Minneapolis, Minn.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Stewart Furnace Div., Chicago Flexible Shaft Co., Dept. 112, 5600 Roosevelt Rd., Chicago, Ill.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Wean Engineering Co., Warren, O.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

BUSHINGS (Bronze)
Ampco Metal, Inc., Dept. S-142, 3830 W. Burnham St., Milwaukee, Wis.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Johnson Bronze Co., 550 So. Mill St., New Castle, Pa.
Lawrence Copper & Bronze, Bessemer Bldg., Pittsburgh, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Shenango-Penn Mold Co., Dover, O.

BUSHINGS (Jig)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

BUSHINGS (Oilless)
Rhoades, R. W., Metaline Co., P. O. Box 1, Long Island City, N. Y.

BY-PRODUCT PLANTS
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

CABINETS (Steel)
Dahlstrom Metallic Door Co., Jamestown, N. Y.

CABLE SUPPLIES (Electric Welding)
Punch-Lok Co., 430 N. Wolcott St., Chicago, Ill.

CADMIUM
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

CADMIUM PLATING PROCESS
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

CAISSONS (Pneumatic)
Dravo Corp., (Contracting Div.), Neville Island, Pittsburgh, Pa.

CALCIUM METAL AND ALLOYS
Electro Metallurgical Co., 30 E. 42nd St., New York City.

CAP SCREWS—See SCREWS (Cap, Set, Safety-Set)

CAPSTANS (Electric, Gasoline, Diesel)
Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.

CAR DUMPERS
Alliance Machine Co., The, Alliance, Ohio.
Industrial Brownhoist Corp., Bay City, Mich.

CAR PULLERS and SPOTTERS
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
Cullen-Friestedt Co., 1308 So. Kilbourn St., Chicago, Ill.
Link-Belt Co., 2410 W. 18th St., Chicago, Ill.
Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.

CARBIDE
Linde Air Products Co., The, 30 E. 42nd St., New York City.
National Carbide Corp., 60 E. 42nd St., New York City.
National Cylinder Gas Co., 205 W. Wacker Dr., Chicago, Ill.

CARBON SPECIALTIES
United States Graphite Co., The, Saginaw, Mich.

CARBURIZING COMPOUNDS
Park Chemical Co., 8076 Military Ave., Detroit, Mich.

CARS (Charging)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Morgan Engineering Co., The, Alliance, O.
Pennsylvania Engineering Works, New Castle, Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.

CARS (Cinder Pot)
Pressed Steel Car Co., (Koppel Div.) Koppers Bldg., Pittsburgh, Pa.

CARS (Dump)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.
Easton Car & Construction Co., Easton, Pa.
Pressed Steel Car Co., (Koppel Div.) Koppers Bldg., Pittsburgh, Pa.

CARS (Industrial and Mining)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Differential Steel Car Co., Findlay, O.
Easton Car & Construction Co., Easton, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Pressed Steel Car Co., (Koppel Div.) Koppers Bldg., Pittsburgh, Pa.

CARS (Scale)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.

CASTING WASHER EQUIPMENT
Pangborn Corp., Hagerstown, Md.

CASTINGS (Acid Resisting)
Ampco Metal, Inc., Dept. S-142, 3830 W. Burnham St., Milwaukee, Wis.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
International Nickel Co., Inc., The, 67 Wall St., New York City.
Mechanite Research Institute, 311 Ross St., Pittsburgh, Pa.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Shenango-Penn Mold Co., Dover, O.

CASTINGS (Alloy Iron)
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.

CASTINGS (Alloy Steel)
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Damascus Steel Casting Co., New Brighton, Pa.
Electro Alloys Co., The, Elyria, O.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
National-Erie Corp., Erie, Pa.
Ohio Steel Foundry Co., Lima, O.-Springfield, O.
Pittsburgh Steel Foundry Corp., Glassport, Pa.

CASTINGS (Brass, Pressure)
Titan Metal Mfg. Co., Bellefonte, Pa.

CASTINGS (Brass, Bronze, Copper, Aluminum)
Ampco Metal, Inc., Dept. S-142, 3830 W. Burnham St., Milwaukee, Wis.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Homestead Valve Mfg. Co., P. O. Box 20, Coraopolis, Pa.
Lawrence Copper & Bronze, Bessemer Bldg., Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Shenango-Penn Mold Co., Dover, O.
Titan Metal Mfg. Co., Bellefonte, Pa.

CASTINGS (Corrosion Resisting)
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
Wall-Colmonoy Corp., 637 Buhl Bldg., Detroit, Mich.

CASTINGS (Die)—See DIE CASTINGS

CASTINGS (Electric Steel)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Damascus Steel Casting Co., New Brighton, Pa.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
National-Erie Corp., Erie, Pa.
Reading Steel Casting Div. of American Chain & Cable Co. Inc., Reading, Pa.
Union Spring & Mfg. Co., New Kensington, Pa.
West Steel Casting Co., 805 E. 70th St., Cleveland, O.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

CASTINGS (Gray Iron, Alloy, or Semi-Steel)
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Brown, Inc., 456 So. Main St., Lima, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Erie Foundry Co., Erie, Pa.
Etna Machine Co., The, 3400 Maplewood Ave., Toledo, O.
Ferracute Machine Co., Bridgeton, N. J.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Roll & Foundry Co., The, Avonmore, Pa.
Oil Well Supply Co., Dallas, Texas.
Shenango-Penn Mold Co., Dover, O.
Urick Foundry Co., 1416-20 Cherry St., Erie, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.

CASTINGS (Heat Resisting)
Electro Alloys Co., The, Elyria, O.
International Nickel Co. Inc., The, 67 Wall Street, New York City.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
Shenango-Penn Mold Co., Dover, O.

CASTINGS (Malleable)
American Chain & Cable Co. Inc., Bridgeport, Conn.
Lake City Malleable Co., 5026 Lakeside Ave., Cleveland, O.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CASTINGS (Manganese Steel)
Damascus Steel Casting Co., New Brighton, Pa.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Damascus Steel Casting Co., New Brighton, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
*Midvale Co., The, Nicetown, Philadelphia, Pa.
National-Erie Corp., Erie, Pa.
National Roll & Foundry Co., The, Avonmore, Pa.
Ohio Steel Fdry. Co., Lima, O.-Springfield, O.
Oil Well Supply Co., Dallas, Texas.
Pittsburgh Rolls Div. of Blaw-Knox Co., Pittsburgh, Pa.
Standard Steel Works Div. of Baldwin Locomotive Works, The Paschall P. O., Philadelphia, Pa.
Steel Founders' Society of America, 920 Midland Bldg., Cleveland, O.
Strong Steel Fdry. Co., Hertel & Norris Ave., Buffalo, N. Y.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Union Steel Casting Div. of Blaw-Knox Co., 62nd and Butler Sts., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.
West Steel Casting Co., 805 E. 70th St., Cleveland, O.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

CASTINGS (Steel) (*Also Stainless)
*Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehm, Pa.
Birdsboro Stel Fdry. & Mach. Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
Pittsburgh Rolls, Div. of Blaw-Knox Co., Pittsburgh, Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Union Steel Casting Div. of Blaw-Knox Co., 62nd and Butler Sts., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

CASTINGS (Wear Resisting)
Hagan, George J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Mechanite Research Institute, 311 Ross St., Pittsburgh, Pa.
Shenango-Penn Mold Co., Dover, O.
Wall-Colmonoy Corp., 637 Buhl Bldg., Detroit, Mich.

CASTINGS (Worm and Gear Bronze)
Ampco Metal, Inc., Dept. S-142, 3830 W. Burnham St., Milwaukee, Wis.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.

CEMENT (Acid Proof)
Nukem Products Corp., 70 Niagara St., Buffalo, N. Y.
Pennsylvania Salt Mfg. Co., Dept. S, Pennsalt Cleaner Div., Philadelphia, Pa.
Sauereisen Cements Co., 1601 Main St., Sharpsburg Station, Pittsburgh (15), Pa.

CEMENT (High Temperature)
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Perth Amboy, N. J.
Eagle-Picher Lead Co., The, Cincinnati, O.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh, Pa.
Johns-Manville Corp., 22 E. 40th St., New York City.
Norton Company, Worcester, Mass.
Quigley Company, 56 W. 45th St., New York City.

CEMENT (High Temperature Hydraulic)
Atlas Lumnite Cement Co., Dept. S, Chrysler Bldg., New York City.

CENTRAL STATION EQUIPMENT
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

CHAIN (Conveyor and Elevator)
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Draw Bench)
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Malleable)
Lake City Malleable Co., 5026 Lakeside Ave., Cleveland, O.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Power Transmission)
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Roller)
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Sling)
American Chain & Cable Co. Inc., Bridgeport, Conn.

CHAIN (Sprocket)
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Steel-Finished Roller)
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Welded or Weldless)
American Chain & Cable Co. Inc., Bridgeport, Conn.

CHARGING MACHINES (Cupola)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Morgan Engineering Co., The, Alliance, O.

CHARGING MACHINES (Open Hearth)
Morgan Engineering Co., The, Allince, O.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland, O.

CHARGING MACHINES AND MANIPULATORS (Autofloor Type)
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

CHECKER BRICK
Loftus Engineering Corp., 747 Oliver Bldg., Pittsburgh, Pa.

CHECKS (Metal)
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.

CHEMICALS (Industrial)
American Solder & Flux Co., 2153 Z. Norris St., Philadelphia, Pa.
Park Chemical Co., 8076 Military Ave., Detroit, Mich.
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.

CHISELS (Chipping)
Steel Conversion & Supply Co., P. O. Box 537 (Castle Shannon), Pittsburgh, Pa.

CHROME ORE
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

CHROMIUM METAL AND ALLOYS
Electro Metallurgical Co., 30 E. 42nd St., New York City.

CHROMIUM PLATING PROCESS
United Chromium, Inc., 51 E. 42nd St., New York City.

CHUCK OPERATING CYLINDERS
Airgrip Chuck Div., Anker-Holth Mfg. Co., Port Huron, Mich.

CHUCKING MACHINES (Multiple Spindle)
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Oster Mfg. Co., The, 2057 E. 61st St., Cleveland, O.

CHUCKS (Air or Hydraulically Operated)
Logansport Machine, Inc., 917 Payson Rd., Logansport, Ind.

CHUCKS (Automatic Closing)
Airgrip Chuck Div., Anker-Holth Mfg. Co., Port Huron, Mich.
Tomkins-Johnson Co., The, Dept. S, 611 N. Mechanic St., Jackson, Mich.

CLAMPS (Drop Forged)
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

CLEANERS (Steam)
Homestead Valve Mfg. Co., P. O. Box 20, Coraopolis, Pa.

CLEANING SPECIALTIES
American Chemical Paint Co., Dept. 310, Ambler, Pa.
MacDermid, Inc., Waterbury, Conn.
Pennsylvania Salt Mfg. Co., Dept. S, Pennsalt Cleaner Div., Philadelphia, Pa.

CLUTCHES (Friction)
Jones, W. A. Fdry. & Mach. Co., 4437 Roosevelt Rd., Chicago, Ill.

CLUTCHES (Magnetic)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

COAL OR COKE
Alan Wood Steel Co., Conshohocken, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cleveland-Cliffs Iron Co., Union Commerce Bldg., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Hanna Furnace Corp., The, Ecorse, Detroit, Mich.
Koppers Co., Gas & Coke Div., 300 Koppers Bldg., Pittsburgh, Pa.
Koppers Coal Co., 300 Koppers Bldg., Pittsburgh, Pa.
New England Coal & Coke Co., Boston, Mass.
Pickands Mather & Co., Union Commerce Bldg., Cleveland, O.
Shenango Furnace Co., Oliver Bldg., Pittsburgh, Pa.
Snyder, W. P., & Co., Oliver Bldg., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

COAL, COKE, ORE AND ASH HANDLING MACHINERY
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Easton Car & Construction Co., Easton, Pa.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Koppers Co., Engineering & Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
Koppers-Rheolaveur Co., 300 Koppers Bldg., Pittsburgh, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

COKE—See COAL OR COKE

COKE OVEN MACHINERY
Alliance Machine Co., The, Alliance, Ohio.
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Morgan Engineering Co., The, Alliance, O.

COKE OVENS (By-Product)
Koppers Co., Engineering and Construction Div., 100 Koppers Bldg., Pittsburgh, Pa.

COLUMBIUM
Electro Metallurgical Co., 30 E. 42nd St., New York City.

COMBUSTION BULBS
Norton Company, Worcester, Mass.

COMBUSTION CONTROLS
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Morgan Construction Co., Worcester, Mass.
Norton Company, Worcester, Mass.

COMPARATORS (Optical)
Jones & Lamson Machine Co., Springfield, Vt.

COMPENSATORS (Automatic)
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.

COMPOUNDS (Case Hardening, Heat Treating, Polishing)
Park Chemical Co., 8076 Military Ave., Detroit, Mich.

COMPRESSORS (Air)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Curtis Pneumatic Machinery Div. of Curtis Mfg. Co., 1996 Kienlen Ave., St. Louis, Mo.
General Electric Co., Schenectady, N. Y.

CONCRETE (Heat Resistant)
Atlas Lumnite Cement Co., Dept. S, Chrysler Bldg., New York City.

CONCRETE REINFORCING BARS —See BARS (Concrete Reinforcing)

CONDENSERS (Surface, Barometric, Multi-Jet)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Western Gas Div., Koppers Co., Fort Wayne, Ind.

CONDUITS (Electric)
Youngstown Sheet & Tube Co., The, Youngstown, O.

CONDUITS (Pressure-Treated Wood)
Wood Preserving Corp., The, 300 Koppers Bldg., Pittsburgh, Pa.

CONNECTING RODS
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
Leard, Wm., Co., Inc., 16th St. & Fifth Ave., New Brighton, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.

CONSTRUCTION (Industrial Building)
Austin Company, The, 16112 Euclid Ave., Cleveland, O.

CONTACTS & CONTACTORS (Electrical)
Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind.

CONTRACTORS—See ENGINEERS AND CONTRACTORS

CONTROL SYSTEMS (Automatic)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

CONTROLLERS (Electric)
Allen-Bradley Co., 1320 So Second St., Milwaukee, Wis.
Clark Controller Co., The, 1146 E. 152nd St., Cleveland, O.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.
General Electric Co., Schenectady, N. Y.

CONTROLS (Combustion)—See COMBUSTION CONTROLS

CONTROLS (Temperature)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

CONVEYING SYSTEMS (Steam Jet)
Hagan, George J., Co., 2400 E. Carson St., Pittsburgh, Pa.

CONVEYOR BELTS (High and Low Temperature)
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

CONVEYOR BELTS (Wire)
Cyclone Fence Co., Waukegan, Ill.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

CONVEYORS (Apron)
Link-Belt Co., 300 W. Pershing Road, Chicago, Ill.
Mathews Conveyer Co., 142 Tenth St., Ellwood City, Pa.

CONVEYORS (Chain)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Mathews Conveyer Co., 142 Tenth St., Ellwood City, Pa.

CONVEYORS (Elevating)
Link-Belt Co., 300 W. Pershing Road, Chicago, Ill.
Mathews Conveyer Co., 142 Tenth St., Ellwood City, Pa.

CONVEYORS (Overhead Trolley)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Link-Belt Co., 300 W. Pershing Road, Chicago, Ill.
Reading Chain & Block Corp., Dept. 313, Reading, Pa.

CONVEYORS (Roller—Power and Gravity)
Mathews Conveyer Co., 142 Tenth St., Ellwood City, Pa.

CONVEYORS (Vibratory)
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.

COPPER (Phosphorized)
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.

COPPERING COMPOUND
American Chemical Paint Co., Dept. 310, Ambler, Pa.

CORE WASH
United States Graphite Co., The, Saginaw, Mich.

COTTER PINS
American Chain & Cable Co., Inc., York, Pa.
Hindley Mfg. Co., Valley Falls, R. I.
Hubbard, M. D., Spring Co., 444 Central Ave., Pontiac, Mich.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.

COUNTERBORES
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

COUPLINGS (Flexible)
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Clark Controller Co., The, 1146 E. 152nd St., Cleveland, O.
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
James, D. O., Mfg. Co., 1120 W. Monroe St., Chicago, Ill.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.
Lovejoy Flexible Coupling Co., 4973 W. Lake St., Chicago, Ill.
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia, Pa.
Poole Fdy. & Mach. Co., Woodberry St., Baltimore, Md.
Waldron, John, Corp., New Brunswick, N. J.

COUPLINGS (Pipe)
Bethlehem Steel Co., Bethlehem, Pa
National Tube Co., Frick Bldg., Pittsburgh, Pa

Oil Well Supply Co., Dallas, Texas.
Republic Steel Corp., Dept. ST, Cleveland, O.
Youngstown Sheet & Tube Co., The, Youngstown, O.

CRANES, BRIDGE (Ore and Coal Handling)
Alliance Machine Co., The, Alliance, Ohio.
Dravo Corp. (Engineering Works Div.), Neville Island, Pittsburgh, Pa.
Industrial Brownhoist Corp., Bay City, Mich.

CRANES (Charging)
Alliance Machine Co., The, Alliance, Ohio.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Morgan Engineering Co., The, Alliance, O.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

CRANES (Crawler, Erection)
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Osgood Co., The, Marion, O.

CRANES (Electric)
Alliance Machine Co., The, Alliance, Ohio.
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, Ohio.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Morgan Engineering Co., The, Alliance, O.
Reading Chain & Block Corp., Dept. 313, Reading, Pa.
Shaw-Box Crane & Hoist Div., Manning, Maxwell & Moore, Inc., 406 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

CRANES (Gantry)
Alliance Machine Co., The, Alliance, Ohio.
Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Cullen-Friestedt Co., 1308 So. Kilbourn Ave., Chicago, Ill.
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, Ohio.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Reading Chain & Block Corp., Dept. 313, Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

CRANES (Gasoline and Diesel)
Cullen-Friestedt Co., 1308 So. Kilbourn Ave., Chicago, Ill.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.

CRANES (Hand)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Curtis Pneumatic Machinery Div. of Curtis Mfg. Co., 1996 Kienlen Ave., St. Louis, Mo.
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, Ohio.
Industrial Brownhoist Corp., Bay City, Mich.
Reading Chain & Block Corp., Dept. 313, Reading, Pa.
Shaw-Box Crane & Hoist Div., Manning, Maxwell & Moore, Inc., 406 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

CRANES (Jib)
Alliance Machine Co., The, Alliance, Ohio.
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, Ohio.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.
Reading Chain & Block Corp., Dept. 313, Reading, Pa.
Wright Mfg. Div. of American Chain & Cable Co. Inc., York, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

CRANES (Locomotive)
Cullen-Friestedt Co., 1308 So. Kilbourn Ave., Chicago, Ill.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Osgood Co., The, Marion, O.
Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.

CRANES (Monorail)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div., of The Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, Ohio.
Reading Chain & Block Corp., Dept. 313, Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

CRANES (Traveling)
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, Ohio.
Reading Chain & Block Corp., Dept. 313, Reading, Pa.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.

CRANK SHAFTS
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
Leard, Wm., Co., Inc., 16th St. & Fifth Ave., New Brighton, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Union Drawn Steel Div. Republic Steel Corp., Massillon, O.

CRUSHERS
American Pulverizer Co., 1539 Macklind Ave., St. Louis, Mo

CUPOLA BLOCKS
McLain Fire Brick Co., Gulf Bldg., Pittsburgh, Pa.

CUSHIONS (Pneumatic)
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.

CUT-OFF MACHINES (Abrasive)
Challenge Machinery Co., Grand Haven, Mich.

CUTTERS (Die Sinking & End Milling)
Brown & Sharpe Mfg. Co., Providence, R. I.
Tomkins-Johnson Co., The, 611 N. Mechanic St., Dept. S, Jackson, Mich.

CUTTERS (Gang Slitter)
Cowles Tool Co., 2086 W. 110th St., Cleveland, O.

CUTTERS (Keyseating)
Davis Key Seater Co., 397 Exchange St., Rochester, N. Y.

CUTTING AND WELDING—See WELDING

CUTTING OILS—See OILS (Cutting)

WHERE-TO-BUY

CUTTING-OFF MACHINES (Rotary)
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, O.
Taylor-Wilson Mfg. Co., 1200 Thomson Ave. McKees Rocks, Pa.

CYLINDERS (Air or Hydraulic)
Airgrip Chuck Div., Anker-Holth Mfg. Co., Port Huron, Mich.
Curtis Pneumatic Machinery Div. of Curtis Mfg. Co., 1996 Kienlen Ave., St. Louis, Mo.
Galland-Henning Mfg. Co., 2747 So. 31st St., Milwaukee, Wis.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Logansport Machine, Inc., 917 Payson Rd., Logansport, Ind.
Scaife Co., Ames St., Oakmont, Pa.
Tomkins-Johnson Co., The, Dept. S, 611 N. Mechanic St., Jackson, Mich.

CYLINDERS (Hydraulic)
American Hollow Boring Co., 1054 W. 20th St., Buffalo, N. Y.
Scaife Co., Ames St., Oakmont, Pa.

CYLINDERS (Pressure)
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.
Scaife Co., Ames St., Oakmont, Pa.

DEGREASERS
Magnus Chemical Co., Inc., 206 South Ave., Garwood, N. J.
Pennsylvania Salt Mfg. Co., Dept. S, Pennsalt Cleaner Div., Philadelphia, Pa.

DEOXIDIZERS
Vanadium Corp. of America, 420 Lexington Ave., New York City.

DESCALING PROCESSES
The Bullard Co., Bridgeport, Conn.

DIAMONDS (Wheel Dressing)
Diamond Tool Co., 938 E. 41st St., Chicago, Ill.

DIE BLOCKS
American Shear Knife Co., 3rd & Ann Sts., Homestead, Pa.
Ampco Metal, Inc., Dept. S-142, 3830 W. Burnham St., Milwaukee, Wis.
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Heppenstall Co., 47th and Hatfield Sts., Pittsburgh, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.

DIE CASTINGS
Titan Metal Mfg. Co., Bellefonte, Pa.

DIE CASTING MACHINES
Phoenix Machine Co., The, 2711 Church Ave., Cleveland, O.

DIE CENTERS
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

DIE HEADS
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.

DIE-SINKING MACHINES
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.

DIES (Punching, Stamping, Blanking)
Columbus Die, Tool & Mach. Co. 955 Cleveland Ave., Columbus, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Schnorr, C. H., & Co., 643 Railroad St., Springdale, Pa.
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

DIES (Steel, Embossing)
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.

DOLOMITE—FLUX AND REFRACTORIES
Basic Refractories, Inc., Hanna Bldg., Cleveland, O.

DOORS & SHUTTERS (Steel, Fire, and Rolling)
Kinnear Mfg. Co., 1780-1800 Fields Ave., Columbus, O.

DOORS & TRIM (Metal)
Dahlstrom Metallic Door Co., Jamestown, N. Y.

DRAFT GAGES (Indicating, Recording)
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.

DRAGLINES (Crawler)
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.

DRAW BENCHES
Standard Machinery Co., Providence, R. I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRESSERS (Grinding Wheel)
Diamond Tool Co., 938 E. 41st St., Chicago, Ill.

DRILL HEADS (Multiple)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

DRILL RODS—See RODS (Drill)

DRILLING MACHINERY
Buffalo Forge Co., 446 Broadway, Buffalo, N. Y.
Guibert Steel Co., 1716 Youghiogheny Ave., Pittsburgh, Pa.
Walker-Turner Co., Inc., 5012 Berckman St., Plainfield, N. J.

DRILLING MACHINES (Radial)
Cincinnati Bickford Tool Co., Oakley Sta., Cincinnati, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Walker-Turner Co., Inc., 5012 Berckman St., Plainfield, N. J.

DRILLING MACHINES (Vertical)
Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill.
Cleereman Machine Tool Co., Green Bay, Wis.
Walker-Turner Co., Inc., 5012 Berckman St., Plainfield, N. J.

DRILLS (Twist)—See TWIST DRILLS

DRIVES (Chain)
Link-Belt Co., 220 S. Belmont Ave. Indianapolis, Ind.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.

DRIVES (Cut Herringbone Gear)
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

DRIVES (Machine Tool)
Berkeley Equipment Co., First Avenue, Corry, Pa.

DRIVES (Motor)
Berkeley Equipment Co., First Avenue, Corry, Pa.

DRIVES (Multi-V-Belt)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

DRIVES (Reciprocating)
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.

DRUMS (Steel)
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.

DRYERS (Compressed Air)
Ruemelin Mfg. Co., 3860 N. Palmer St., Milwaukee, Wis.

DRYERS (Paint, Varnish, Enamel, Chemical)
Machler, Paul, Co., The, 2210 Lake St., Chicago, Ill.

DRYERS (Rotary)
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

WHERE-TO-BUY

DUST ARRESTING EQUIPMENT
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Pangborn Corp., Hagerstown, Md.
Ruemelin Mfg. Co., 3860 N. Palmer St., Milwaukee, Wis.

ECONOMIC SERVICE
Brookmire Corp., 551 Fifth Ave., New York City.

ECONOMIZERS
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.

ELECTRIC WELDING—See WELDING

ELECTRIC WIRING—See WIRE AND CABLE

ELECTRICAL EQUIPMENT
Allen-Bradley Co., 1320 So. Second St., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.
Fairbanks, Morse & Co., Dept. A75, 600 S. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.

ELECTRODES (Carbon and Graphite)
National Carbon Co., W. 117th St. at Madison Ave., Cleveland, O.

ELECTRODES (Hard Surfacing Welding)
Stoody Co., Whittier, Calif.

ELECTRODES (Resistance Welding)
Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind.

ELEVATING AND CONVEYING MACHINERY—See CONVEYORS

ENGINEERS AND CONTRACTORS
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Austin Co., The, 16112 Euclid Ave., Cleveland, O.
Brassert, H. A., & Co., First National Bank Bldg., Pittsburgh, Pa.
Hunt, C. H., 1213 1st National Bk. Bldg., Pittsburgh, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Morgan Engineering Co., The, Alliance, O.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Uhl Construction Co., 6001 Butler St., Pittsburgh, Pa.
Wean Engineering Co., Warren, O.

ENGINEERS (Consulting)
Austin Co., The, 16112 Euclid Ave., Cleveland, O.
Brassert, H. A., & Co., First National Bank Bldg., Pittsburgh, Pa.
Easton Car & Construction Co., Easton, Pa.
Hunt, C. H., 1213 1st National Bk. Bldg., Pittsburgh, Pa.
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
Loftus Engineering Corp., 747 Oliver Bldg., Pittsburgh, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Wean Engineering Co., Warren, O.

ENGINEERS (Lubricating Equipment)
Lincoln Engineering Co., 5700 Natural Bridge Ave., St. Louis, Mo.

ENGINES (Diesel)
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Fairbanks, Morse & Co., Dept. A75, 600 So. Michigan Ave., Chicago, Ill.

ENGINES (Gas, Oil)
Fairbanks, Morse & Co., Dept. A75, 600 So. Michigan Ave., Chicago, Ill.

ENGINES (Kerosene)
Fairbanks, Morse & Co., Dept. A75, 600 S. Michigan Ave., Chicago, Ill.

ENGINES (Steam)
Oil Well Supply Co., Dallas, Texas.

EXCAVATORS
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Osgood Co., The, Marion, O.

FABRICATORS (Structural)
Gilbert Steel Co., 1716 Youghiogheny Ave., Pittsburgh, Pa.

FACTORY & INDUSTRIAL BUILDINGS—See BUILDINGS (Industrial)

FANS (Crane Cab)
Perkins, B. F. & Son, Inc., Holyoke, Mass.

FANS (Exhaust Ventilating)
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Sturtevant, B. F., Co., 1316 Wabansia Ave., Chicago, Ill

FANS (Portable)
Perkins, B. F., & Son, Inc., Holyoke, Mass.

FANS (Wall)
Perkins, B. F. & Son, Inc., Holyoke, Mass.

FENCE (Chain Link)
Cyclone Fence Co., Waukegan, Ill.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.

FENCING (Wire)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

FERROALLOY (Briquets)
Electro Metallurgical Co., 30 E. 42nd St., New York City.

FERROALLOYS
Cleveland-Cliffs Iron Co., The, Union Commerce Bldg., Cleveland, O.
Electro Metallurgical Co., 30 E. 42nd St., New York City.
International Nickel Co., Inc., The, 67 Wall St., New York City.
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

FERROCHROME
Electro Metallurgical Co., 30 E. 42nd St., New York City.
Samuel, Frank & Co., Inc., Harrison Bldg., Philadelphia, Pa.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

FERROMANGANESE
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Electro Metallurgical Co., 30 E. 42nd St., New York City.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

FERROPHOSPHORUS
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

FERROSILICON
Electro Metallurgical Co., 30 E. 42nd St., New York City.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.
Southern Ferro Alloys Co., 2108 Chestnut St., Chattanooga, Tenn.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

FERROSILICON ALUMINUM
Vanadium Corp. of America,

FERROTITANIUM
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

WHERE-TO-BUY

FERROVANADIUM
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.
Vanadium Corp. of America, 420 Lexington Ave..

FILES AND RASPS
Atkins, E. C., & Co., 427 So. Illinois St., Indianapolis, Ind.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Simonds Saw & Steel Co., Fitchburg, Mass.

FILTER CLOTH (Asbestos)
Johns-Manville Corp., 22 E. 40th St., New York City.

FIRE EXTINGUISHERS
C-O-Two Fire Equipment Co., 10 Empire St., Newark, N. J.
Kidde, Walter, & Co., Inc., 132 West St., Bloomfield, N. J.

FIRE CLAY—See REFRACTORIES

FIRE DOORS & SHUTTERS—See DOORS & SHUTTERS

FITTINGS (Electric Steel)
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

FLAME HARDENING
Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., 30 E. 42nd St., New York City.
National-Erie Corp., Erie, Pa.

FLANGES (Welded Steel)
King Fifth Wheel Co., 2915 No. Second St., Philadelphia, Pa.

FLOORING (Monolithic)
Carey, Philip, Co., The, Lockland, Cincinnati, O.
Johns-Manville Corp., 22 E. 40th St., New York City.

FLOORING (Steel)
Alan Wood Steel Co., Conshohocken, Pa.
Blaw-Knox Co., Blawnox, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Dravo Corp. (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.
Robertson, H. H. Co., Farmers Bank Bldg., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Tri-Lok Co., 5515 Butler St., Pittsburgh, Pa.

FLUE DUST CONDITIONERS
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

FLUE GAS ANALYZERS
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.

FLUORSPAR
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

FLUXES (Soldering, Welding & Tinning)
American Chemical Paint Co., Dept. 310, Ambler, Pa.
American Solder & Flux Co., 2153 E. Norris St., Philadelphia, Pa.
Anti-Borax Compound Co., Inc., 1506 Wall St., Fort Wayne, Ind.
Kester Solder Co., 4222 Wrightwood Ave., Chicago, Ill.
Wayne Chemical Products Co., 9502 Copeland St., Detroit, Mich.

FORGING BILLETS—See BILLETS

FORGING MACHINERY
Alliance Machine Co., The, Alliance, Ohio.
Erie Foundry Co., Erie, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.
National Machinery Co., The, Tiffin, O.

FORGINGS (Brass, Bronze, Copper)
American Brass Co., The, Waterbury, Conn.
Ampco Metal, Inc., Dept. S-142, 3830 W. Burnham St., Milwaukee, Wis.
Bridgeport Brass Co., Bridgeport, Conn.
Titan Metal Mfg. Co., Bellefonte, Pa.

FORGINGS (Drop)
(*Also Stainless)
*Atlas Drop Forge Co., Lansing, Mich.
*Bethlehem Steel Co., Bethlehem, Pa.
Oil Well Supply Co., Dallas, Texas.
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

FORGINGS (Hollow Bored)
American Hollow Boring Co., 1054 W. 20th St., Erie, Pa.
Atlas Drop Forge Co., Lansing, Mich.
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.

FORGINGS (Iron and Steel)
(*Also Stainless)
*Atlas Drop Forge Co., Lansing, Mich.
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Erie Forge Co., W. 15th & Cascade Sts., Erie, Pa.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
Leard, Wm., Co., Inc., 16th St., & Fifth Ave., New Brighton, Pa.
McInnes Steel Co., Corry, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
*Midvale Co., The, Nicetown, Philadelphia, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Oil Well Supply Co., Dallas, Texas.
Standard Steel Works Div. of The Baldwin Locomotive Works, Paschall P. O., Philadelphia, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

FORGINGS (Upset)
Atlas Drop Forge Co., Lansing, Mich.
Bethlehem Steel Co., Bethlehem, Pa.

FROGS AND SWITCHES
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.

FURNACE BOTTOMS
Industrial Silica Corp., 602 Stambaugh Bldg., Youngstown, O.

FURNACE INSULATION—See INSULATION

FURNACES (Blast)
Brassert, H. A., & Co., First National Bank Bldg., Pittsburgh, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Pennsylvania Engineering Works, New Castle, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.

FURNACES (Brazing)
Hevi Duty Electric Co., 4100 W. Highland Blvd., Milwaukee, Wis.
Upton Electric Salt Bath Furnace Div. Commerce Pattern Fdry. & Mach. Co., 7452 Melville Ave., at Green, Detroit, Mich.

FURNACES (Electric Heating)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Electric Furnace Co., The, Salem, O.
General Electric Co., Schenectady, N. Y.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Hevi Duty Electric Co., 4100 W. Highland Blvd., Milwaukee, Wis.
Mahr Mfg. Co., Div. of Diamond Iron Works, Inc., Minneapolis, Minn.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1257, Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

WHERE-TO-BUY

FURNACES (Electric Melting)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Detroit Electric Furnace Div., Kuhlman Electric Co., Bay City, Mich.
General Electric Co., Schenectady, N. Y.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1257, Pittsburgh, Pa.

FURNACES (Enameling)
Hagan, George J., Co., 2400 E. Carson St., Pittsburgh, Pa.

FURNACES (Forging)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Electric Furnace Co., The, Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., Dept. 112, 5600 Roosevelt Rd., Chicago, Ill.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.
Wilson, Lee, Sales Corp., 1370 Blount St., Cleveland, O.

FURNACES (Galvanizing)
Salem Engineering Co., 714 So. Broadway, Salem, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., Dept. 112, 5600 Roosevelt Rd., Chicago, Ill.
Wilson, Lee, Sales Corp., 1370 Blount St., Cleveland, O.

FURNACES (Gas or Oil)
Electric Furnace Co., The, Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., Dept. 112, 5600 Roosevelt Rd., Chicago, Ill.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.
Wilson, Lee, Sales Corp., 1368 Blount St., Cleveland, O.

FURNACES (Heat Treating, Annealing, Carburizing, Hardening, Tempering)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
American Gas Furnace Co., Elizabeth, N. J.
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Carborundum Co., The, Perth Amboy, N. J.
Electric Furnace Co., The, Salem, O.
General Electric Co., Schenectady, N. Y.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Hevi Duty Electric Co., 4100 W. Highland Blvd., Milwaukee, Wis.
A. F. Holden Co., The, 200 Winchester Ave., New Haven, Conn.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
Mahr Mfg. Co., Div. of Diamond Iron Works, Inc., Minneapolis, Minn.
Ohio Crankshaft Co., The, 6600 Clement Ave., Cleveland, O.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., Dept. 112, 5600 Roosevelt Rd., Chicago, Ill.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.
Upton Electric Salt Bath Furnace Div. Commerce Pattern Fdry. & Mach. Co., 7452 Melville Ave., at Green, Detroit, Mich.
Wean Engineering Co., Warren, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.
Wilson, Lee, Sales Corp., 1370 Blount St., Cleveland, O.

FURNACES (Laboratory)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Hevi Duty Electric Co., 4100 W. Highland Blvd., Milwaukee, Wis.

FURNACES (Non-Ferrous Melting)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Detroit Electric Furnace Div., Kuhlman Electric Co., Bay City, Mich.
Wilson, Lee, Sales Corp., 1370 Blount St., Cleveland, O.

FURNACES (Open Hearth)
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Brassert, H. A., & Co., First National Bank Bldg., Pittsburgh, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Pennsylvania Engineering Works, New Castle, Pa.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.

FURNACES (Portable)
Hagan, George J., Co., 2400 E. Carson St., Pittsburgh, Pa.

FURNACES (Recuperative)
Electric Furnace Co., The, Salem, O.
Hagan, Geo. J. Co., 2400 E. Carson St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.

FURNACES (Rivet Heating)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.

FURNACES (Sheet and Tin Mill)
Electric Furnace Co., The, Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.
Wean Engineering Co., Warren, O.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

FURNACES (Steel Mill)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Electric Furnace Co., The, Salem, O.
General Electric Co., Schenectady, N. Y.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh, Pa.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland, O.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

FURNACES (Welding)
Hagan, George J., Co., 2400 E. Carson St., Pittsburgh, Pa.

GAGE BLOCKS
Dearborn Gage Co., 22036 Beech St., Dearborn, Mich.

GAGES
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.
Schnorr, C. H., & Co., 643 Railroad St., Springdale, Pa.
Sheffield Corp., The, Gage Div., Dayton, O.

GAGES (Automatic Control & Recording)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.

WHERE-TO-BUY

GAGES (Indicating and Recording)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.
Sheffield Corp., The, Gage Div., Dayton, O.

GAGES (Pressure & Vacuum Recording)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.

GALVANIZING (Hot Dip)
Acme Galvanizing, Inc., Milwaukee, Wis.
Acme Steel & Malleable Iron Works, Buffalo, N. Y.
American Hot Dip Galvanizers Assoc., Inc., 903 American Bank Bldg., Pittsburgh, Pa.
American Tinning & Galvanizing Co., Erie, Pa.
Atlantic Steel Co., Atlanta, Ga.
Buffalo Galvanizing & Tinning Works, Inc., Buffalo, N. Y.
Cattie, Jos. P., & Bros., Gaul and Liberty Sts., Philadelphia, Pa.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Enterprise Galvanizing Co., 2525 E. Cumberland St.,
Equipment Steel Products Div., of Union Asbestos & Rubber Co., Blue Island, Ill.

Galvanizers Incorporated, Portland, Ore.
Fanner Mfg. Co., The, Cleveland, O.
Finn, John, Metal Works, San Francisco, Calif.
Gregory, Thomas, Galvanizing Works, Maspeth, N. Y.
Hanlon-Gregory Galvanizing Co., 5515 Butler St., Pittsburgh, Pa.
Hill, James, Mfg. Co., Providence, R. I.
Hubbard & Co., Oakland, Calif.
Independent Galvanizing Co., Newark, N. J.
International-Stacey Corp., Columbus, O.
Isaacson Iron Works, Seattle, Wash.
Joslyn Co. of California, Los Angeles, Calif.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Koven, L. O., & Bro., Inc., Jersey City, N. J.
Lehigh Structural Steel Co., Allentown, Pa.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Missouri Rolling Mill Corp., St. Louis, Mo.
National Telephone Supply Co., The, Cleveland, O.
Penn Galvanizing Co., Philadelphia, Pa.
Riverside Foundry & Galvanizing Co., Kalamazoo, Mich.
San Francisco Galvanizing Works, San Francisco, Calif.
Sanitary Tinning Co., The, Cleveland, O.
Scaife Co., Ames St., Oakmont, Pa.
Standard Galvanizing Co., Chicago, Ill.
Wilcox, Crittenden & Co., Inc., Middletown, Conn.
Witt Cornice Co., The, Cincinnati, O.

GALVANIZING COMPOUNDS
American Solder & Flux Co., 2153 E. Norris St., Philadelphia, Pa.

GALVANIZING PLANTS FOR SHEETS
Erie Foundry Co., Erie, Pa.
Wean Engineering Co., Warren, O.

GALVANIZING PRODUCTS
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.

GAS HOLDERS
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.

GAS PRODUCER PLANTS
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

GAS RECOVERY COKE OVEN AND GAS PLANTS
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

GAS SCRUBBERS
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Brassert, H. A., & Co., First National Bank Bldg., Pittsburgh, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.

GASKETS (Asbestos, Metal or Rubber)
Johns-Manville Corp., 22 E. 40th St., New York City.

GEAR BLANKS
Ampco Metal, Inc., Dept. S-142, 3830 W. Burnham St., Milwaukee, Wis.
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
King Fifth Wheel Co., 2915 No. Second St., Philadelphia, Pa.
National-Erie Corp., Erie, Pa.
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Waldron, John, Corp., New Brunswick, N. J.

GEAR MACHINERY (Generating)
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.

GEAR MACHINERY (Lapping, Finishing, Checking)
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

GEARS (Non-Metallic)
Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill.
Pittsburgh Gear & Machine Co., 2680-2700 Smallman St., Pittsburgh, Pa.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.

GEARS (Steel Laminated)
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.
Waldron, John, Corp., New Brunswick, N. J.

GEARS (Worm)
Cleveland Worm & Gear Co., 3270 E. 80th St., Cleveland, O.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia, Pa.
Pittsburgh Gear & Machine Co., 2680-2700 Smallman St., Pittsburgh, Pa.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.

GEARS AND GEAR CUTTING
General Electric Co., Schenectady, N. Y.
Grant Gear Works, 2nd & B Sts., Boston, Mass.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
James, D. O., Mfg. Co., 1120 W. Monroe St., Chicago, Ill.
Jones, W. A., Fdry. & Mach. Co., 4437 Roosevelt Rd., Chicago, Ill.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 146, Pittsburgh, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
National-Erie Corp., Erie, Pa.
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia, Pa.
Pittsburgh Gear & Machine Co., 2680-2700 Smallman St., Pittsburgh, Pa.
Simonds Gear & Mfg. Co., 25th St., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

GENERATING SETS
Fairbanks, Morse & Co., Dept. A75, 600 So. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Reliance Electric & Eng. Co., 1081 Ivanhoe Rd., Cleveland, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

GENERATORS (Acetylene—Portable and Stationary)
Linde Air Products Co., The, 30 E. 42nd St., New York City.

WHERE-TO-BUY

GENERATORS (Electric)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Dept. A75, 600 S. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Lincoln Electric Co., The, Cleveland, O.
Reliance Electric & Eng. Co., 1081 Ivanhoe Rd., Cleveland, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

GENERATORS (Plating)
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

GRABS—FOR SHEETS, COILS, INGOTS
J-B Engineering Sales Co., 1743 Orange St., New Haven, Conn.

GRAPHITE
United States Graphite Co., The, Saginaw, Mich.

GRAPPLES (Scrap Handling)
Owen Bucket Co., 6012 Breakwater Ave., Cleveland, O.

GRATING
Blaw-Knox Co., Blawnox, Pa.
Borden Metal Products Co., P. O. Box 172, Elizabeth, N. J.
Dravo Corp., (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.
Tri-Lok Co., 5515 Butler St., Pittsburgh, Pa.

GREASE FITTINGS
Lincoln Engineering Co., 5700 Natural Bridge Ave., St. Louis, Mo.

GREASE GUNS
Lincoln Engineering Co., 5700 Natural Bridge Ave., St. Louis, Mo.

GREASE (Lubricating)—See LUBRICANTS (Industrial)

GREASE RETAINERS AND SEALS
Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill.

GRINDER CENTERS
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

GRINDER HEADS
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDERS (Circular Saw)
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, O.

GRINDERS (Foundry Core)
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.

GRINDERS (Precision Thread)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Jones & Lamson Machine Co., Springfield, Vt.

GRINDERS (Sheet Steel and Internal Tube)
Mattison Machine Works, Rockford, Ill.

GRINDERS (Single Slide Internal)
Bryant Chucking Grinder Co., Springfield, Vt.

GRINDERS (Surface)
Brown & Sharpe Mfg. Co., Providence, R. I.
Heald Machine Co., Worcester, Mass.
Mattison Machine Works, Rockford, Ill.
Norton Company, Worcester, Mass.

GRINDERS (Swing Frame)
Fox Grinders, Inc., Oliver Bldg., Pittsburgh, Pa.

GRINDING (Shear Knife)
American Shear Knife Co., 3rd & Ann Sts., Homestead, Pa.

GRINDING COMPOUNDS
Stuart, D. A., Oil Co., Ltd., 2733 S. Troy St., Chicago, Ill.
Sun Oil Co., Dept. 1, 1608 Walnut St., Philadelphia, Pa.
Wayne Chemical Products Co., 9502 Copeland St., Detroit, Mich.

GRINDING MACHINE ATTACHMENTS
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDING MACHINES (Automotive Reconditioning)
Heald Machine Co., Worcester, Mass.

GRINDING MACHINES (Centerless, Internal and External)
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Heald Machine Co., Worcester, Mass.

GRINDING MACHINES (Chucking)
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.

GRINDING MACHINES (Crank Pin, Cam, Piston & Valve Face)
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Norton Company, Worcester, Mass.

GRINDING MACHINES (Die)
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDING MACHINES (Gear)
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDING MACHINES (Oscillating)
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.

GRINDING MACHINES (Plain and Universal)
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine and Cincinnati Grinders, Inc. Oakley Sta., Cincinnati, O.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Norton Co., Worcester, Mass.

GRINDING MACHINES (Roll)
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Norton Co., Worcester, Mass.

GRINDING MACHINES (Rotary Surface)
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.
Heald Machine Co., Worcester, Mass.

GRINDING MACHINES (Segmental)
Norton Company, Worcester, Mass.

GRINDING MACHINES (Spline)
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDING MACHINES (Tool and Cutter)
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Kearney & Trecker Corp., 5926 National Ave., Milwaukee, Wis.
Norton Co., Worcester, Mass.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.
Walker-Turner Co., Inc., 5012 Berckman St., Plainfield, N. J.

GRINDING WHEELS
Abrasive Co., Tacony & Fraley Sts., Philadelphia, Pa.
Atkins, E. C., & Co., 427 So. Illinois St., Indianapolis, Ind.
Bay State Abrasive Products Co., Westboro, Mass.
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Macklin Co., The, Jackson, Mich.
Norton Co., Worcester, Mass.

GRINDING WHEELS (Segmental)
Abrasive Co., Tacony & Fraley Sts., Philadelphia, Pa.
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Norton Company, Worcester, Mass.

GUARDS (Belt, Machine & Window)
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.

WHERE-TO-BUY

GUIDE SHOES
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

GUIDES (Mill)
Ampco Metal, Inc., Dept. S-142, 3830 W. Burnham St., Milwaukee, Wis.
National-Erie Corp., Erie, Pa.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

GUNS (Blast Furnace Mud)
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

GUNS (Steam, Hydraulic, Electric)
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

HAMMER BUSHINGS
Steel Conversion & Supply Co., P. O. Box 537 (Castle Shannon), Pittsburgh, Pa.

HAMMERS (Drop)
Alliance Machine Co., The, Alliance, Ohio.
Chambersburg Engineering Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.
Standard Machinery Co., Providence, R. I.

HAMMERS (Power)
Bradley, C. C., & Son, Inc., Syracuse, N. Y.
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

HAMMERS (Steam)
Alliance Machine Co., The, Alliance, Ohio.
Chambersburg Engineering Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.

HANGERS
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
Grinnell Co., Inc., Providence, R. I.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

HANGERS (Shaft)
Bantam Bearings Corp., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Division, General Motors Sales Corp., Harrison, N. J.
New Departure Div., General Motors Corp., Bristol, Conn.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

HEADING MACHINERY
National Machinery Co., Tiffin, O.

HEAT TREATING MATERIALS
Park Chemical Co., 8076 Military Ave., Detroit, Mich.

HEATERS (Air)
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.

HEATERS (Electric Space)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

HEATERS (Unit)
Buffalo Forge Co., 446 Broadway, Buffalo, N. Y.
Dravo Corp. (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.
Grinnell Co., Inc., Providence, R. I.

HELMETS (Blast Cleaning)
Pangborn Corp., Hagerstown, Md.

HITCHINGS (Mine Car)
American Chain & Cable Co., Inc., Bridgeport, Conn.

HOBS
Brown & Sharpe Mfg. Co., Providence, R. I.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

HOISTS (Chain)
Cleveland Tramrail Div., of Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Ford Chain Block Div. of American Chain & Cable Co., Inc., 2nd & Diamond Sts., Philadelphia, Pa.
Reading Chain & Block Co., Dept. 313, Reading, Pa.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

HOISTS (Electric)
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, Ohio.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Reading Chain & Block Corp., Dept. 313, Reading, Pa.
Shaw-Box Crane & Hoist Div., Manning, Maxwell & Moore, Inc., 406 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.
Wright Mfg. Div. of American Chain & Cable Co. Inc., York, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

HOISTS (Monorail)
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Euclid Crane & Hoist Co., The, Chardon Rd., Euclid, Ohio.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Reading Chain & Block Corp., Dept. 313, Reading, Pa.
Shaw-Box Crane & Hoist Div., Manning, Maxwell & Moore, Inc., 406 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

HOISTS (Pneumatic)
Curtis Pneumatic Machinery Div. of Curtis Mfg. Co., 1996 Kienlen Ave., St. Louis, Mo.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.

HONING MACHINES
Micromatic Hone Corp., 1345 E. Milwaukee Ave., Detroit, Mich.

HOOKS (Chain)
American Chain & Cable Co., Inc., Bridgeport, Conn.

HOOPS AND BANDS
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

HOOPS (Welded Wire)
Keystone Steel & Wire Co., Dept. AC, Peoria, Ill.

HOSE CLAMPS, FITTINGS, NIPPLES AND MENDERS
Punch-Lok Co., 430 N. Wolcott St., Chicago, Ill.

HOSE REINFORCEMENT MACHINES
Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia, Pa.

HOSE (Flexible Metal)
American Metal Hose Branch of The American Brass Co., Waterbury, Conn.
Chicago Metal Hose Corp., 1315 S. Third St., Maywood, Ill.

HUMIDIFIERS (Industrial)
Grinnell Co., Inc., Providence, R. I.

HYDRAULIC MACHINERY
Alliance Machine Co., The, Alliance, Ohio.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.

WHERE-TO-BUY

HYDRAULIC MACHINERY—Con.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Morgan Engineering Co., The, Alliance, O.
National-Erie Corp., Erie, Pa.
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.
Treadwell Construction Co., Midland, Pa.
Weinman Pump & Supply Co., The, 210 Boulevard of the Allies, Pittsburgh, Pa.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

HYDRAULIC PRESSES—See PRESSES (Hydraulic)

HYDRAULIC UNITS
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Racine Tool & Machine Co., Racine, Wis.
Weinman Pump & Supply Co., The, 210 Boulevard of the Allies, Pittsburgh, Pa.

INDICATORS (Blast Furnace Stock Line)
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

INDICATORS (Temperature)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

INGOT METALS
Roessing Bronze Co., Butler Plank Rd., Etna, Pittsburgh, Pa.

INGOT MOLD WASH (Graphite)
United States Graphite Co., The, Saginaw, Mich.

INGOT MOLDS
Bethlehem Steel Co., Bethlehem, Pa.
Shenango-Penn Mold Co., Oliver Bldg., Pittsburgh, Pa.
Valley Mould & Iron Corp., Hubbard, O.

INHIBITORS
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Parkin, Wm. M., Co., The, 1005 Highland Bldg., Pittsburgh, Pa.

INSTRUMENTS (Electric-Indicating and Recording)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
General Electric Co., Schenectady, N. Y.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

INSULATING BLOCK
Armstrong Cork Co., 985 Concord St., Lancaster, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.
Ramtite Co., The, Div. of the S. Obermayer Co., 2557 W. 18th St., Chicago, Ill.

INSULATING BRICK
Armstrong Cork Co., 985 Concord St., Lancaster, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.
Quigley Co., 56 W. 45th St., New York City.
Ramtite Co., The, Div. of the S. Obermayer Co., 2557 W. 18th St., Chicago, Ill.

INSULATING CONCRETE
Atlas Lumnite Cement Co., Dept. S, Chrysler Bldg., New York City.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.

INSULATING POWDER AND CEMENT
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Armstrong Cork Co., 985 Concord St., Lancaster, Pa.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.
Ramtite Co., The, Div. of the S. Obermayer Co., 2557 W. 18th St., Chicago, Ill.

INSULATION (Building)
Carey, Philip, Co., The, Lockland, Cincinnati, O.
Johns-Manville Corp., 22 E. 40th St., New York City.

INSULATION (Furnace, Boiler Settings, Ovens, Steam Pipe, Etc.)
Armstrong Cork Co., 985 Concord St., Lancaster, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.
Quigley Co., 56 W. 45th St., New York City.

IRON (Bar)
Ryerson, Jos. T., & Son Co., 16th & Rockwell Sts., Chicago, Ill.

IRON (Swedish)
Swedish-American Steel Corp., 430 Kent Ave., Brooklyn, N. Y.

IRON ORE
Alan Wood Steel Co., Conshohocken, Pa.
Cleveland-Cliffs Iron Co., Union Commerce Bldg., Cleveland, O.
Hanna Furnace Corp., The, Ecorse, Detroit, Mich.
Pickands Mather & Co., Union Commerce Bldg., Cleveland, O.
Shenango Furnace Co., Oliver Bldg., Pittsburgh, Pa.
Snyder, W. P., & Co., Oliver Bldg., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., The, Youngstown, O.

JIG BORERS
Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill.
Cleereman Machine Tool Co., Green Bay, Wis.

JIGS AND FIXTURES
Columbus Die, Tool & Mach. Co., 955 Cleveland Ave., Columbus, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Schnorr, C. H., & Co., 643 Railroad St., Springdale, Pa.

KETTLES (Galvanizing)
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.

KEYS (Machine or Woodruff)
Leard, Wm., Co., Inc., 16th St., & Fifth Ave., New Brighton, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.

KEYSEATERS
Davis Key Seater Co., 397 Exchange St., Rochester, N. Y.

KNIVES
American Shear Knife Co., 3rd and Ann Sts., Homestead, Pa.
Atkins, E. C., & Co., 427 So. Illinois St., Indianapolis, Ind.
Cowles Tool Co., 2086 W. 110th St., Cleveland, O.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Ohio Knife Co., Dreman Ave. & B. & O. R.R., Cincinnati, O.

LABORATORY WARE
Bay State Abrasive Products Co., Westboro, Mass.
Norton Company, Worcester, Mass.

LADLES
Pennsylvania Engineering Works, New Castle, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Treadwell Construction Co., Midland, Pa.

LAMPS (Industrial)
General Electric Co., Dept. 166-S-G, Nela Park, Cleveland, O.

LAPPING MACHINES
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.
Norton Company, Worcester, Mass.

LAPPING PLATES
Challenge Machinery Co., Grand Haven, Mich.

LARRIES (Coal)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.

LATHE CENTERS
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

LATHE DOGS (Drop Forged)
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

LATHES
Axelson Manufacturing Co., 6160 So. Boyle Ave., Los Angeles, Cal.
Jones & Lamson Machine Co., Springfield, Vt.
LeBlond, R. K., Machine Tool Co., Dept. J-2, Cincinnati, O.
Lehmann Machine Co., Chouteau at Grand, St. Louis, Mo.
Monarch Machine Tool Co., Sidney, O.
Morey Machinery Co., Inc., 410 Broome St., New York City.
South Bend Lathe Works, 654 E. Madison St., South Bend, Ind.
Walker-Turner Co., Inc., 5012 Berckman St., Plainfield, N. J.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, O.

LATHES (Automatic)
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
Monarch Machine Tool Co., Sidney, O.
Sundstrand Machine Tool Co., 2571 11th St., Rockford, Ill.

LATHES (Chucking)
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.

LATHES (Engine)
Lehmann Machine Co., Chouteau at Grand, St. Louis, Mo.
Monarch Machine Tool Co., Sidney, O.
South Bend Lathe Works, 654 E. Madison St., South Bend, Ind.

LATHES (Roll Turning)
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, O.

LATHES (Turret)
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Company, The, Bridgeport, Conn.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, O.

LAYOUT SURFACE PLATES
Challenge Machinery Co., Grand Haven, Mich.

LEAD (Tellurium)
National Lead Co., 111 Broadway, New York City.

LEVELING MACHINES
Erie Foundry Co., Erie, Pa.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
McKay Machine Co., Youngstown, O.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Sutton Engineering Co., Park Bldg., Pittsburgh, Pa.
Wean Engineering Co., Warren, O.

LIFT TRUCKS—See TRUCKS (Lift)

LIFTING MAGNETS—See MAGNETS (Lifting)

LIGHTING (Industrial)
General Electric Co., Dept. 166-S-G, Nela Park, Cleveland, O.

LINERS (Pump and Cylinder)
Shenango-Penn Mold Co., Dover, O.

LOCOMOTIVE CRANES—See CRANES (Locomotive)

LOCOMOTIVES (Diesel-Electric)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Differential Steel Car Co., Findlay, O.
Plymouth Locomotive Works, Div., Fate-Root-Heath Co., Plymouth, O.
Porter, H. K., Co., Inc., 49th & Harrison Sts., Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Diesel Mechanical)
Plymouth Locomotive Works, Div., Fate-Root-Heath Co., Plymouth, O.
Porter, H. K., Co., Inc., 49th & Harrison Sts., Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Electric)
Porter, H. K., Co. Inc., 49th & Harrison Sts., Pittsburgh, Pa.

LOCOMOTIVES (Electric Trolley)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.
General Electric Co., Schenectady, N. Y.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Fireless)
Porter, H. K., Co. Inc., 49th & Harrison Sts., Pittsburgh, Pa.

LOCOMOTIVES (Gasoline-Electric)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.
General Electric Co., Schenectady, N. Y.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Gas-Mechanical)
Differential Steel Car Co., Findlay, O.

LOCOMOTIVES (Gasoline Mechanical)
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Oil-Electric)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.

LOCOMOTIVES (Steam)
Porter, H. K., Co., Inc., 49th & Harrison Sts., Pittsburgh, Pa.

LOCOMOTIVES (Storage Battery)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Switching and Transfer)
Cooper-Bessemer Corp., The, Mt. Vernon, O.

LUBRICANTS (Graphite)
Acheson Colloids Corp., Port Huron, Mich.
United States Graphite Co., The, Saginaw, Mich.

LUBRICANTS (Industrial)
Acheson Colloids Corp., Port Huron, Mich.
American Lanolin Corp., Railroad St., Lawrence, Mass.
Gulf Oil Corp. of Penna., Gulf Refining Co., 3800 Gulf Bldg., Pittsburgh, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark, N. J.
New York & New Jersey Lubricant Co., 292 Madison Ave., New York City.
Penola, Inc., 34th & Smallman Sts., Pittsburgh, Pa.
Shell Oil Co., Inc., 50 W. 50th St., New York City.
Socony-Vacuum Oil Co., Inc., 26 Broadway, New York City.
Stuart, D. A., Oil Co., Ltd., 2733 So. Troy St., Chicago, Ill.
Sun Oil Co., Dept. 1, 1608 Walnut St., Philadelphia, Pa.
Tide Water Associated Oil Co., 17 Battery Place, New York City.
Wayne Chemical Products Co., 9502 Copeland St., Detroit, Mich.

LUBRICATING SYSTEMS
Farval Corp., The, 3270 E. 80th St., Cleveland, O.
Lincoln Engineering Co., 5700 Natural Bridge Ave., St. Louis, Mo.

MACHINE WORK
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Federal Shipbuilding & Dry Dock Co., Kearney, N. J.
Fidelity Machine Co. 3908-18 Frankford Ave., Philadelphia, Pa.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Treadwell Construction Co., Midland, Pa.

MACHINERY (Drilling, Reaming, Countersinking, Portable)
Guibert Steel Company, 1716 Youghiogheny Ave., Pittsburgh, Pa.

MACHINERY (Special)
Alliance Machine Co., The, Alliance, Ohio.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Columbus Die, Tool & Mach. Co., 955 Cleveland Ave., Columbus, O.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Coulter, James, Machine Co., The, 396 Mountain Grove Ave., Bridgeport, Conn.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia, Pa.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
The James Coulter Machine Co., 386 Mountain Grove Ave., Bridgeport, Conn.
Kane & Roach, Inc., Niagara & Shonnard Sts., Syracuse, N. Y.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.
National-Erie Corp., Erie, Pa.
National Roll & Fdry. Co., The, Avonmore, Pa.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Oil Well Supply Co., Dallas, Texas.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Shuster, F. B., Co., The, New Haven, Conn.
Standard Machinery Co., Providence, R. I.
Sundstrand Machine Tool Co., 2571 11th St., Rockford, Ill.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

MACHINERY (Used & Rebuilt)
Albert, L., & Son, Whitehead Rd., Trenton, N. J.
Emerman, Louis E., & Co., 1761 Elston Ave., Chicago, Ill.
Crawbuck, John D., Co., Empire Bldg., Pittsburgh, Pa.
Galbreath Machinery Co., Empire Bldg., Pittsburgh, Pa.
General Blower Co., 404 No. Peoria St., Chicago, Ill.
Iron & Steel Products, Inc., Hegewisch Sta., Chicago, Ill.
Lang Machinery Co., 28th & A.V.R.R., Pittsburgh, Pa.
Motor Repair & Mfg. Co., 1558 Hamilton Ave., Cleveland, O.
West Penn Machinery Co., 1208 House Bldg., Pittsburgh, Pa.

MACHINES (Metal Forming)
Maplewood Machinery Co., Inc., The, 2634-38 Fullerton Ave., Chicago, Ill.

MAGNESIA (Electrically Fused)
Norton Co., Worcester, Mass.

MAGNESIUM
Dow Chemical Co., Midland, Mich.

MAGNETIC SEPARATORS—See SEPARATORS (Magnetic)

MAGNETS (Lifting)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., 2670 E. 79th St., Cleveland, O.
Ohio Electric Mfg. Co., The, 5906 Maurice Ave., Cleveland, O.

MAGNETS (Separating)
Ohio Electric Mfg. Co., The, 5906 Maurice Ave., Cleveland, O.

MANDRELS (Expanding)
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

MANGANESE METAL AND ALLOYS
Electro Metallurgical Co., 30 E. 42nd St., New York City.

MANGANESE ORE
Cuban-American Manganese Corp., 122 E. 42nd St., New York, N. Y.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

MANIPULATORS
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Morgan Engineering Co., The, Alliance, O.

MANIPULATORS (Forging)
Alliance Machine Co., The, Alliance, Ohio.

MARKING DEVICES
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.

METAL (Perforated)—See PERFORATED METAL

METAL BLAST ABRASIVES (Shot and Grit)
American Foundry Equipment Co., The, 509 So. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., 4839 Harrison St., Pittsburgh, Pa

METAL CLEANERS
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Pennsylvania Salt Mfg. Co., Dept. S. Pennsalt Cleaner Div., Philadelphia, Pa.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

METAL FINISHES
American Nickeloid Co., 1310 N. Second St., Peru, Ill.

METAL SPECIALTIES AND PARTS—See STAMPINGS

METAL STAMPINGS—See STAMPINGS

METALS (Hard Surfacing)
Stoody Co., Whittier, Calif.

METALS (Nonferrous)
American Brass Co., The, Waterbury, Conn.
International Nickel Co., Inc., The, 67 Wall St., New York City.

MICROMETERS
Brown & Sharpe Mfg. Co., Providence, R. I.

MILL BUILDINGS
Uhl Construction Co., 6001 Butler St., Pittsburgh, Pa.

MILLING CUTTERS
Atkins, E. C., & Co., 427 So. Illinois St., Indianapolis, Ind.
Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

MILLING MACHINE ATTACHMENTS
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee, Wis.

MILLING MACHINES
Bradley, C. C., & Son, Inc., Syracuse, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Kearney & Trecker Corp., 5926 National Ave., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee, Wis.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.
Sundstrand Machine Tool Co., 2571 11th St., Rockford, Ill.

WHERE-TO-BUY

MILLING MACHINES (Hob Thread)
Coulter, James, Machine Co., The, 396 Mountain Grove Ave., Bridgeport, Conn.

MILLING MACHINES (Milling and Centering Combined)
Jones & Lamson Machine Co., Springfield, Vt.
Sundstrand Machine Tool Co., 2571 11th St., Rockford, Ill.

MILLS (Blooming, Universal, Plate, Sheet, Tin, Bar, Strip, Etc.)—See ROLLING MILL EQUIPMENT

MOLDING MACHINERY (Foundry)
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.

MOLDINGS (Metal)
Dahlstrom Metallic Door Co., Jamestown, N. Y.

MOLDS (Ingot)—See INGOT MOLDS

MOLYBDENUM
Climax Molybdenum Co., 500 Fifth Ave., New York City.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

MONEL METAL (All Commercial Forms)
International Nickel Co., Inc., The, 67 Wall St., New York City.

MONORAIL SYSTEMS
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Reading Chain & Block Corp., Dept. 313, Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

MOTOR-ROLLERS
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.

MOTORS (Electric)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Dept. A75, 600 So. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Lincoln Electric Co., The, Cleveland, O.
Reliance Electric & Eng. Co., 1081 Ivanhoe Rd., Cleveland, O.
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.
Walker-Turner Co., Inc., 5012 Berckman St., Plainfield, N. J.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

MUCK BAR
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

NAILS (*Also Stainless)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Keystone Steel & Wire Co., Dept. AC, Peoria, Ill.
*Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

NAILS (Coated and Galvanized)
Wickwire Brothers, 189 Main St., Cortland, N. Y.

NICKEL (All Commercial Forms)
International Nickel Co., Inc., The, 67 Wall St., New York City.

NICKEL (Shot)
International Nickel Co., Inc., The, 67 Wall St., New York City.

NICKEL STEEL (Cold Drawn)
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Republic Steel Co., Dept. ST Cleveland, O.
Union Drawn Steel Div. Republic Steel Corp., Massillon, O.

NOZZLES (Blasting)
Pangborn Corporation, Hagerstown, Md.

NUTS (*Also Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Elastic Stop Nut Corp., 2367 Vauxhall Rd., Union, N. J.
Erie Bolt & Nut Co., Liberty Ave., at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Oliver Iron & Steel Corp., So. 10th & Muriel Sts., Pittsburgh, Pa.
*Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y
Tinnerman Products, Inc., 2039 Fulton Rd., Cleveland, O.
Triplex Screw Co., The, 5317 Grant Ave., Cleveland, O.

NUTS (Castellated)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Erie Bolt & Nut Co., Liberty Ave., at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co. Port Chester, N. Y.

NUTS (Machine Screw)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.

NUTS (Non-Ferrous and Stainless)
Harper, H. M., Co., The, 2646 Fletcher St., Chicago, Ill.

NUTS (Self Locking)
Elastic Stop Nut Corp., 2367 Vauxhall Rd., Union, N. J.

NUTS (Semi-Finished)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St. Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

NUTS (Wing)
Central Screw Company 3517 Shields Ave., Chicago, Ill.
Parker-Kalon Corp., 194-200 Varick St., New York City.

OIL RETAINERS AND SEALS
Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill.

OILS (Cutting)
Fiske Bros. Refining Co., 129 Lockwood St., Newark, N. J.
Gulf Oil Corp. of Penna., Gulf Refining Co., 3800 Gulf Bldg., Pittsburgh, Pa.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.
Penola, Inc., 34th & Smallman Sts., Pittsburgh, Pa.
Shell Oil Co., Inc., 50 W. 50th St., New York City.
Socony-Vacuum Oil Co., Inc., 26 Broadway, New York City.
Stuart, D. A., Oil Co. Ltd., 2733 So. Troy St., Chicago, Ill.
Sun Oil Co., Dept. 1, 1608 Walnut St., Philadelphia, Pa.
Tide Water Associated Oil Co., 17 Battery Place, New York City.
Wayne Chemical Products Co., 9502 Copeland St., Detroit, Mich.

OILS (Lubricating)—See LUBRICANTS (Industrial)

OILS (Quenching)
Park Chemical Co., 8076 Military Ave., Detroit, Mich.

OILS (Rust Preventive)
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Wayne Chemical Products Co., 9502 Copeland St., Detroit, Mich.

OPEN-HEARTH FURNACES—See FURNACES (Open-Hearth)

OVENS (Annealing, Japanning, Tempering)
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Maehler, Paul, Co., The, 2210 Lake St., Chicago, Ill.
Stewart Furnace Div., Chicago Flexible Shaft Co., Dept. 112, 5600 Roosevelt Rd., Chicago, Ill.

OVENS (Coke, By-Product Recovery)
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

OVENS (Core and Mold)
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.

OVENS (Gas or Oil Heat)
Maehler, Paul, Co., The, 2210 Lake St., Chicago, Ill.

OXY-ACETYLENE WELDING AND CUTTING—See WELDING

OXYGEN IN CYLINDERS
Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., The, 30 E. 42nd St., New York City
National Cylinder Gas Co., 205 W. Wacker Drive, Chicago, Ill.

PACKING (Asbestos or Rubber)
Carey, Philip, Co., The, Lockland, Cincinnati, O.
Johns-Manville Corp., 22 E. 40th St., New York City.

PACKINGS—MECHANICAL LEATHER (Cup, U-Cup, Flange and Vees)
Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill
Excelsior Leather Washer Mfg. Co., Inc., Rockford, Ill.

PAINT (Alkali Resisting)
Pennsylvania Salt Mfg. Co., Dept. S, Pennsalt Cleaner Div., Philadelphia, Pa.

PAINT (Aluminum)
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

PAINT (Heat Resisting)
American Chemical Paint Co., Dept. 310, Ambler, Pa.

PAINT (Industrial)
Carey, Philip, Co., The, Lockland, Cincinnati, O.

PAINT (Marking)
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

PAINT (Rust Preventive)
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

PARALLELS
Challenge Machinery Co., Grand Haven, Mich.

PARTS (Precision)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

PATTERN MAKERS SUPPLIES
Wellman Products Co., The, 1444 E. 49th St., Cleveland, O.

PATTERN SHOP MACHINERY
Wellman Products Co., The, 1444 E. 49th St., Cleveland, O.

PATTERNS (Wood or Metal)
Wellman Bronze & Aluminum Co., The, 6011 Superior Ave., Cleveland, O.

PENSTOCKS
Treadwell Construction Co., Midland, Pa.

PERFORATED METAL
Chicago Perforating Co., 2443 W. 24th Pl., Chicago, Ill.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Harrington & King Perforating Co., 5634 Fillmore St., Chicago, Ill.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

PHENOL RECOVERY PLANTS
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

PICKLING COMPOUNDS
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Parkin, Wm. M., Co., The, 1005 Highland Bldg., Pittsburgh, Pa.
Pennsylvania Salt Mfg. Co., Dept. S, Pennsalt Cleaner Div., Philadelphia, Pa.

PICKLING CRATES
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.

PICKLING EQUIPMENT
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.
Heil & Co., 12901 Elmwood Ave., Cleveland, O.
International Nickel Co., The, 67 Wall St., New York City.

PICKLING MACHINERY
Erie Foundry Co., Erie, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Wean Engineering Co., Warren, O.

PICKLING TANK LININGS
Cellcote Co., 750 Rockefeller Bldg., Cleveland, O.
Pennsylvania Salt Mfg. Co., Dept. S, Pennsalt Cleaner Div., Philadelphia, Pa.
Sauereisen Cements Co., 1601 Main St., Sharpsburg Station, Pittsburgh (15), Pa.

PICKLING TANKS—See TANKS (Pickling)

PIERCER POINTS
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

PIG IRON
Alan Wood Steel Co., Conshohocken, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Brooke, E. & G., Iron Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cleveland-Cliffs Iron Co., Union Commerce Bldg., Cleveland, O.
Hanna Furnace Corp., The, Ecorse, Detroit, Mich.
Jackson Iron & Steel Co., Jackson, O.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Pickands Mather & Co., Union Commerce Bldg., Cleveland, O.
Republic Steel Corp., Dept. ST, Cleveland, O.
Samuel, Frank & Co., Inc., Harrison Bldg., Philadelphia, Pa.
Shenango Furnace Co., Oliver Bldg., Pittsburgh, Pa.
Snyder, W. P., & Co., Oliver Bldg., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

PIG IRON (Charcoal)
Tennessee Products Corp., Nashville, Tenn.

PILING (Iron and Steel)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 South Dearborn St., Chicago, Ill.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.

PILING (Pressure-Treated Wood)
Wood Preserving Corp., The, 300 Koppers Bldg., Pittsburgh, Pa.

PILLOW BLOCKS (Ball)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.

PILLOW BLOCKS (Roller Bearing)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis, Ind.

PILLOW BOXES
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

PINIONS (Mill)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
National-Erie Corp., Erie, Pa.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.
United Engineering & Foundry Co., First National Bank Bldg., Pittsburgh, Pa.

PINS (Case Hardened or Heat Treated)
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.

PINS (Taper)
Leard, Wm., Co., Inc., 16th St., & Fifth Ave., New Brighton, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.

PIPE (Brass, Bronze, Copper)
American Brass Co., The, Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Shenango-Penn Mold Co., Dover, O.

PIPE (Square and Rectangular)
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown, O.

PIPE (Steel)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
American Rolling Mill Co., The, 3091 Curtis St., Middletown, O.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Crane Co., 836 So. Michigan Ave., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.
Western Gas Div., Koppers Co., Fort Wayne, Ind.

Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

PIPE (Welded Steel)
Treadwell Construction Co., Midland, Pa.

PIPE BALLS
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

PIPE BENDING
Crane Co., 836 So. Michigan Ave., Chicago, Ill.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.

PIPE CUTTING AND THREADING MACHINERY
Landis Machine Co., Waynesboro, Pa.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.

PIPE FITTINGS
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Crane Co., 836 So. Michigan Ave., Chicago, Ill.
Grinnell Co., Inc., Providence, R. I.
Oil Well Supply Co., Dallas, Texas.

PIPE LINES (Riveted and Welded)
Bethlehem Steel Co., Bethlehem, Pa.

PIPE MILL MACHINERY
Taylor-Wilson Mfg. Co., 1200 Thomson Ave., McKees Rocks, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

PIPE STRAIGHTENING MACHINERY
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Sutton Engineering Co., Park Bldg., Pittsburgh, Pa.
Taylor-Wilson Mfg. Co., 1200 Thomson Ave., McKees Rocks, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

PIPE TOOLS
Greenfield Tap & Die Corp., Greenfield, Mass.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.

PIPING (Air & Gas)
Youngstown Steel Tank Co., Oak St. & Andrews Ave., Youngstown, O.

PIPING CONTRACTORS
Grinnell Co., Inc., Providence, R. I.
Power Piping Co., Beaver and Western Ave., Pittsburgh, Pa.

PISTON RINGS
American Hammered Piston Ring Div., Koppers Co., Baltimore, Md.

PISTON RODS
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Heppenstall Co., 47th and Hatfield Sts., Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Leard, Wm., Co., Inc., 16th St., & Fifth Ave., New Brighton, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Union Drawn Steel Div., Republic Steel Corp., Massillon, O.

PLANERS AND SHAPERS
Cincinnati Shaper Co., Elam and Garrard Sts., Cincinnati, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.

PLANT DISMANTLERS
Hetz Construction Co., Warren, O.

PLATE CASTORS
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.

PLATE LIFTING GRIPS
Downs Crane & Hoist Co., 3989 S. Normandie Ave., Los Angeles, Cal.

PLATES (Sheared or Universal) (*Also Stainless)
*Alan Wood Steel Co., Conshohocken, Pa.
*Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
*American Rolling Mill Co., The, 3091 Curtis St., Middletown, O.
*Bethlehem Steel Co., Bethlehem, Pa.
*Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Levinson Steel Co., 33 Pride St., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
*Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Worth Steel Co., Claymont, Del.
Youngstown Sheet & Tube Co., The, Youngstown, O.

PLATES (Stainless Clad)
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.

PLATES (Steel—Floor)—See FLOORING (Steel)

PLATES (Terne and Tin)—See TIN PLATE

PLATING EQUIPMENT
Lasalco, Inc., 2820-38 LaSalle St., St. Louis, Mo.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

PLUGS (Expansion)
Hubbard, M. D., Spring Co., 444 Central Ave., Pontiac, Mich.

WHERE-TO-BUY

PLUGS (Rolling Mill)
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

PLUGS (Mold)
McLain Fire Brick Co., Gulf Bldg., Pittsburgh, Pa.

POLES (Tubular Steel)
National Tube Co., Frick Bldg., Pittsburgh, Pa.

POLISHING MACHINERY (Tube and Bar)
Medart Co., The, 3520 de Kalb St., St. Louis, Mo.

POTENTIOMETERS
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.

POTS (Case Hardening)
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.

POTS (Lead)
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.

POTS (Melting)
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.

POTS (Slag & Cinder)
Pittsburgh Steel Foundry Corp., Glassport, Pa.

POWER UNITS (Gasoline, Electric for Industrial Trucks)
Ready-Power Co., The, 3842 Grand River Ave., Detroit, Mich.

PREHEATERS
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.

PRESSED METAL PARTS
Dahlstrom Metallic Door Co., Jamestown, N. Y.
Schnorr, C. H., & Co., 643 Railroad St., Springdale, Pa.
Stanley Works, The, Pressed Metal Div., New Britain, Conn.
Union Spring & Mfg. Co., New Kensington, Pa.

PRESSES
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Erie Foundry Co., Erie, Pa.
Galland-Henning Manufacturing Co., 2747 So. 31st St., Milwaukee, Wis.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Standard Machinery Co., Providence, R. I.
Streine Tool & Mfg. Co., New Bremen, O.
Tomkins-Johnson Co., The, (Dept. S) 611 N. Mechanic St., Jackson, Mich.
Watson-Stillman Co., Roselle, N. J.

PRESSES (Bending)
Cleveland Crane & Engineering Co., Steelweld Machinery Div., The, 1125 E. 283rd St., Wickliffe, O.
Watson-Stillman Co., Roselle, N. J.
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

PRESSES, BRIQUETTING (Turnings & Borings)
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.

PRESSES (Extrusion)
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.
Watson-Stillman Co., Roselle, N. J.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

PRESSES (Forging)
Erie Foundry Co., Erie, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
National Machinery Co., The, Tiffin, O.
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Watson-Stillman Co., Roselle, N. J.

PRESSES (Forming and Braking)
Cincinnati Shaper Co., Elam and Garrard Sts., Cincinnati, O.
Cleveland Crane & Engineering Co., The, Steelweld Machinery Div., 1125 E. 283rd St., Wickliffe, O.
Watson-Stillman Co., Roselle, N. J.
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

PRESSES (Hydraulic)
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Denison Engineering Co., The, 113 W. Chestnut St., Columbus, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
Galland-Henning Manufacturing Co., 2747 So. 31st St., Milwaukee, Wis.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Logansport Machine, Inc., 917 Payson Rd., Logansport, Ind.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
National-Erie Corp., Erie, Pa.
Progressive Welder Co., 3050 E. Outer Drive, Detroit, Mich.
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.
Watson-Stillman Co., Roselle, N. J.
West Tire Setter Co., 397 Exchange St., Rochester, N. Y.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

PRESSES (Pneumatic)
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.

PRESSES (Punching, Drawing, Coining, Blanking, etc.)
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Progressive Welder Co., 3050 E. Outer Drive, Detroit, Mich.
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

PRESSES (Riveting)
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.

PRESSES (Scrap Bundling and Baling)
Galland-Henning Manufacturing Co., 2747 So. 31st St., Milwaukee, Wis.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.

PRESSES (Shell & Projectile Banding)
West Tire Setter Co., 397 Exchange St., Rochester, N. Y.

PRESSES (Stamping)
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

PRESSES (Welding)—See WELDERS

PRESSURE VESSELS
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Scaife Co., Ames St., Oakmont, Pa.

PRODUCER GAS SYSTEMS—See GAS PRODUCER PLANTS

PUG MILLS (For Blast Furnaces and Sintering Plants)
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.

PULLEYS (Magnetic)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

PULVERIZERS
American Pulverizer Co., 1539 Macklind Ave., St. Louis, Mo.

PUMP HOUSES
Dravo Corp. (Contracting Div.), Neville Island, Pittsburgh, Pa.

PUMPS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., 446 Broadway, Buffalo, N. Y.
Fairbanks, Morse & Co., Dept. A75, 600 S. Michigan Ave., Chicago, Ill.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Oil Well Supply Co., Dallas, Texas.
Roper, The Geo. D., Corp., Rockford, Ill.
Weinman Pump & Suply Co., The, 210 Blvd. of the Allies, Pittsburgh, Pa.

PUMPS (Boiler Feed)
Fairbanks, Morse & Co., Dept. A75, 600 S. Michigan Ave., Chicago, Ill.
Weinman Pump & Supply Co., The, 210 Blvd. of the Allies, Pittsburgh, Pa.

PUMPS (Centrifugal)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
Fairbanks, Morse & Co., Dept. A75, 600 So. Michigan Ave., Chicago, Ill.
Tomkins-Johnson Co., The, 611 N. Mechanic St., Dept. S, Jackson, Mich.
Weinman Pump & Supply Co., The, 210 Blvd. of the Allies, Pittsburgh, Pa.

PUMPS (Fuel Injection)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

PUMPS (Hydraulic)
Brown & Sharpe Mfg. Co., Providence, R. I.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Galland-Henning Manufacturing Co., 2747 So. 31st St., Milwaukee, Wis.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
National-Erie Corp., Erie, Pa.
Racine Tool & Machine Co., Racine, Wis.
Roper, The Geo. D., Corp., Rockford, Ill.
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.
Sundstrand Machine Tool Co., 2571 11th St., Rockford, Ill.,
Weinman Pump & Supply Co., The, 210 Blvd. of the Allies, Pittsburgh, Pa.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

PUMPS (Reciprocating)
Fairbanks, oMrse & Co., Dept. A75, 600 S. Michigan Ave., Chicago, Ill.
Weinman Pump & Supply Co., The, 210 Blvd. of the Allies, Pittsburgh, Pa.

PUMPS (Rotary)
Brown & Sharpe Mfg. Co.,
Fairbanks, Morse & Co., Dept. A75, Providence, R. I.
600 S. Michigan Ave., Chicago, Ill.
Roper, The Geo. D., Corp., Rockford, Ill.
Weinman Pump & Supply Co., The, 210 Blvd. of the Allies, Pittsburgh, Pa.

PUMPS (Vacuum)
Fairbanks, Morse & Co., Dept. A75, 600 S. Michigan Ave., Chicago, Ill.

PUMPS (Vertical Turbine)
Layne & Bowler, Inc., Memphis, Tenn.

PUNCHES (Multiple)
Cincinnati Shaper Co., Elam and Garrard Sts., Cincinnati, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.

PUNCHING AND SHEARING MACHINERY
Buffalo Forge Co., 446 Broadway, Buffalo, N. Y.
Chambersburg Engineering Co., Chambersburg, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

PYROMETER TUBES
Norton Company, Worcester, Mass.

PYROMETERS
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

RAIL BREAKERS
National Roll & Foundry Co., The, Avonmore, Pa.
United Engineering & Fdry Co., First National Bank Bldg., Pittsburgh, Pa.

RAILS (Light & Accessories)
Buckeye Rolling Mill Co., Wheeling, W. Va.

RAILS (New and Relaying)
Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.
Hyman-Michaels Co., 122 S. Michigan Ave., Chicago, Ill.

RAILS (Steel)
Bethlehem Steel Co., Bethlehem, Pa.
Buckeye Rolling Mill Co., Wheeling, W. Va.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Ryerson, Jos. T. & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.

REAMERS
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., The, 1242 E. 49th St., Cleveland, O.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.

REBUILT EQUIPMENT
Albert, L., & Son, Whitehead Rd., Trenton, N. J.
Crawbuck, John D., Co., Empire Bldg., Pittsburgh, Pa.
Galbreath Machinery Co., Empire Bldg., Pittsburgh, Pa.
General Blower Co., 404 N. Peoria St., Chicago, Ill.
Iron & Steel Products, Inc., Hegewisch Sta., Chicago, Ill.
Lang Machinery Co., 28th & A.V.R.R., Pittsburgh, Pa.
Motor Repair & Mfg. Co., 1558 Hamilton Ave., Cleveland, O.
West Penn Machinery Co., 1208 House Bldg., Pittsburgh, Pa.

RECEIVERS
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.
Scaife Co., Ames St., Oakmont, Pa.

RECORDERS (Combustion)
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.

RECORDERS (Pressure, Speed, Temperature, Time)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

RECTIFIERS (Dry Disc)
Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind.

REDUCERS (Speed)—See SPEED REDUCERS

REDUCTION GEARS
Horsburgn & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
National-Erie Corp., Erie, Pa.
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia, Pa.
Sturtevant, B. F., Co. Hyde Park, Boston, Mass.

REFRACTORIES (Dolomite)
Basic Refractories, Inc., Hanna Bldg., Cleveland, O.

REFRACTORIES (Fire Clay)
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Climax Fire Brick Co., Climax. (Clarion Co.) Pa.
Eureka Fire Brick Co., 1100 B. F. Jones Law Bldg., Pittsburgh, Pa.
Globe Brick Co., The, East Liverpool, O.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
McLain Fire Brick Co., Gulf Bldg., Pittsburgh, Pa.
Pope, Frank B., Co., Koppers Bldg., Pittsburgh, Pa.
Ramtite Co., The, Div. of the S. Obermayer Co., 2557 W. 18th St., Chicago, Ill.
Standard Arch Co., Keedysville, Md.
West Virginia Fire Clay Mfg. Co., Diamond Bank Bldg., Pittsburgh, Pa.

REFRACTORIES (For High Frequency Furnaces)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Carborundum Co., The, Perth Amboy, N. J.
Norton Co., Worcester, Mass.
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.

REFRACTORIES (Silicon Carbide)
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Perth Amboy, N. J.
Norton Co., Worcester, Mass.

REFRACTORY CONCRETE
Atlas Lumnite Cement Co., Dept. S, Chrysler Bldg., New York. City.
Johns-Manville Corp., 22 E. 40th St., New York City.

REGULATORS (Pressure)
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.

REGULATORS (Temperature)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

REINFORCEMENT FABRIC (Electric Welded)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

RESISTORS (Edgewound)
Clark Controller Co., The, 1146 E. 152nd St., Cleveland, O.

RESISTORS (Graphite Disc)
Allen-Bradley Co., 1320 So. 2nd St., Milwaukee, Wis.

RHEOSTATS (Plating)
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

RINGS (Steel)
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
King Fifth Wheel Co., 2915 No. Second St., Philadelphia, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.

RINGS (Weldless) (*Also Stainless)
*Midvale Co., The, Nicetown, Philadelphia, Pa.

RIVET SETS
Pittsburgh Saw & Tool Co., 78-80 Sycamore St., Etna P. O., Pittsburgh, Pa.

RIVETERS (Hydraulic—Portable and Stationary)
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.

RIVETERS (Pneumatic)
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.

RIVETING MACHINERY
Buffalo Forge Co., 446 Broadway, Buffalo, N. Y.
Chambersburg Engineering Co., Chambersburg, Pa.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Shuster, F. B., Co., The, New Haven, Conn.
Tomkins-Johnson Co., (Dept. S), 611 N. Mechanic St., Jackson, Mich.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

RIVETS (*Also Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Oliver Iron & Steel Corp., So. 10th & Muriel Sts., Pittsburgh, Pa.
*Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
*Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Triplex Screw Co., The, 5317 Grant Ave., Cleveland, O.

RIVETS (Non-Ferrous and Stainless)
Harper, H. M., Co., The 2646 Fletcher St., Chicago, Ill.

RODS (Alloy)
Ampco Metal, Inc., Dept. S-142, 3830 W. Burnham St., Milwaukee, Wis.
Bliss & Laughlin, Inc., Harvey, Ill.
Copperweld Steel Co., Warren, O.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.

RODS (Brass, Bronze, Copper, Nickel Silver, Silicon-Bronze)
American Brass Co., The, Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Roebling's, John A., Sons Co., Trenton, N. J.
Seymour Manufacturing Co., The, Seymour, Conn.
Titan Metal Mfg. Co., Bellefonte, Pa.

RODS (Drill)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc. 17 Grand St., New York City
Kidd Drawn Steel Co., Aliquippa, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.

RODS (Phosphor Bronze)
Seymour Manufacturing Co., The, Seymour, Conn.

RODS (Rounds, Flats and Shapes) (*Also Stainless)
*Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
*American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
*Copperweld Steel Co., Warren, O.
*Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
*Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Washburn Wire Co., Phillipsdale, R. I.
Youngstown Sheet & Tube Co., The, Youngstown, O.

RODS (Steel and Iron)
Firth-Sterling Steel Co., McKeesport, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

RODS (Welding)—See WELDING RODS

RODS (Wire)—See WIRE PRODUCTS

ROLLING DOORS & SHUTTERS—See DOORS AND SHUTTERS

WHERE-TO-BUY

ROLLING MILL BEARINGS—See BEARINGS (Rolling Mill)

ROLLING MILL EQUIPMENT
Alliance Machine Co., The, Alliance, Ohio
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Cold Metal Products Co., The, 2131 Wilson Ave., Youngstown, O.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Monessen Foundry & Machine Co., Monessen, Pa.
Morgan Construction Co., Worcester, Mass.
Morgan Engineering Co., The, Alliance, O.
National Roll & Foundry Co., The, Avonmore, Pa.
Streine Tool & Mfg. Co., New Bremen, O.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Wean Engineering Co., Warren, O.
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

ROLLING MILLS (Consulting, Contracting Engineers)
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.

ROLLING MILL MACHINERY (Used)
Frank B. Foster, Oliver Bldg., Pittsburgh, Pa.

ROLLING MILL TABLES
Schloemann Engineering Corp., Empire Bldg., Pittsburgh, Pa.

ROLL FORMING MACHINES
Kane & Roach, Inc., Niagara & Shonnard Sts., Syracuse, N. Y.

ROLLS (Bending and Straightening)
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.

ROLLS (Sand and Chilled)
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
National Roll & Foundry Co., The, Avonmore, Pa.
Ohio Steel Fdry. Co., Lima, O.
Springfield, O.
Pittsburgh Rolls Div. of Blaw-Knox Co., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

ROLLS (Steel and Iron)
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co. Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hyde Park Fdry. and Machine Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Roll & Fdry. Co., The, Avonmore, Pa.
Ohio Steel Fdry. Co., Lima, O.-Springfield, O.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
United Engineering & Fdry Co., First National Bank Bldg., Pittsburgh, Pa.

ROLLS (Tinning Machine)
American Shear Knife Co., 3rd & Ann Sts., Homestead, Pa.

ROOFING AND SIDING
Johns-Manville Corp., 22 E. 40th St., New York City.

ROOFING AND SIDING (Corrugated and Plain)
American Rolling Mill Co., The, 3091 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carey, Philip, Co., The, Lockland, Cincinnati, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
New Jersey Zinc Co., 160 Front St., New York City.
Republic Steel Corp., Dept. ST, Cleveland, O.
Robertson, H. H., Co., Farmers Bank Bldg., Pittsburgh, Pa.
Ryerson, Jos. T., & Sons, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

ROOFING (Plastic and Liquid)
Carey, Philip, Co., The, Lockland, Cincinnati, O.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

RUST PREVENTIVES
Alrose Chemical Co., 80 Clifford St., Providence, R. I.
American Lanolin Corp., Railroad St., Lawrence, Mass.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.
Parker Rust Proof Co., 2158 E. Milwaukee Ave., Detroit, Mich.
Smith Oil & Refining Co., Rockford, Ill.
Wayne Chemical Products Co., 9502 Copeland St., Detroit, Mich.

RUST PROOFING COMPOUNDS
Parker Rust Proof Co., 2158 E. Milwaukee Ave., Detroit, Mich.

RUST PROOFING PROCESS
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.
Parker Rust Proof Co., 2158 E. Milwaukee Ave., Detroit, Mich.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

SAFE ENDS (Boiler Tube)
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.

SAFETY DEVICES (Electric)
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.

SALT TABLETS
Fairway Laboratories, Div. The G. S. Suppiger Co., 1530 Hadley St., St. Louis Mo.
Morton Salt Co., 310 So. Michigan Ave., Chicago, Ill.

SAND-BLASTING NOZZLES (Borium)
Stoody Co., 1134 W. Slauson Ave., Whittier, Calif.

SAND CONDITIONING AND PREPARING MACHINERY
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

SANDBLAST ABRASIVES (Sand)
Industrial Silica Corp., 602 Stambaugh Bldg., Youngstown, O.

SAND (Annealing Box Sealing)
Industrial Silica Corp., 602 Stambaugh Bldg., Youngstown, O.

SAND (Molding)
Industrial Silica Corp., 602 Stambaugh Bldg., Youngstown, O.

SAND (Silica)
Industrial Silica Corp., 602 Stambaugh Bldg., Youngstown, O.

SAND (Slag Pocket)
Industrial Silica Corp., 602 Stambaugh Bldg., Youngstown, O.

SAWING MACHINES (Hot and Cold)
Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago, Ill.
Morgan Engineering Co., The, Alliance, O.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, O.
Pittsburgh Saw & Tool Co., 78-80 Sycamore St., Etna P. O., Pittsburgh, Pa.
Racine Tool & Machine Co., Racine, Wis.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

SAWING MACHINES (Contour)
Continental Machines, Inc., 1324 So. Washington Ave., Minneapolis, Minn.

SAWS (Band—Metal Cutting)
Atkins, E. C., & Co., 427 So. Illinois St., Indianapolis, Ind.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Huther Bros. Saw & Mfg. Co., 1290 University Ave., Rochester, N. Y.
Simonds Saw & Steel Co., Fitchburg, Mass.

SAWS (Hack)
Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago, Ill.
Atkins, E. C., & Co., 402 So. Illinois St., Indianapolis, Ind.
Disston, Henry & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Simonds Saw & Steel Co., Fitchburg, Mass.

SAWS (Hot and Cold)
Huther Bros. Saw & Mfg. Co., 1290 University Ave., Rochester, N. Y.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, O.

SAWS (Inserted Tooth, Cold)
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Huther Bros. Saw & Mfg. Co., 1290 University Ave., Rochester, N. Y.
Pittsburgh Saw & Tool Co., 78-80 Sycamore St., Etna P. O., Pittsburgh, Pa.
Simonds Saw & Steel Co., Fitchburg, Mass.

SAWS (Metal Cutting)
Atkins, E. C., & Co., 402 So. Illinois St., Indianapolis, Ind.
Brown & Sharpe Mfg. Co., Providence, R. I.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, O.
Pittsburgh Saw & Tool Co., 78-80 Sycamore St., Etna P. O., Pittsburgh, Pa.
Simonds Saw & Steel Co., Fitchburg, Mass.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SAWS (Segmental)
Atkins, E. C., & Co., 427 So. Illinois St., Indianapolis, Ind.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, O.
Pittsburgh Saw & Tool Co., 78-80 Sycamore St., Etna P. O., Pittsburgh, Pa.

SCAFFOLDING (Tubular)
Dravo Corp. (Machinery Div.) 300 Penn Ave., Pittsburgh, Pa.

SCALES
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Fairbanks, Morse & Co., Dept. A75, 600 So. Michigan Ave., Chicago, Ill.
Kron Co., The, Bridgeport, Conn.
Toledo Scale Co., 3216 Monroe St., Toledo, O.

SCALES (Dial & Recording)
Fairbanks, Morse & Co., Dept. A75, 600 S. Michigan Ave., Chicago, Ill.

SCALES (Laboratory)
Fairbanks, Morse & Co., Dept. A75, 600 S. Michigan Ave., Chicago, Ill.

SCALES (Monorail)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Fairbanks, Morse & Co., Dept. A75, 600 So. Michigan Ave., Chicago, Ill.
Kron Co., The, Bridgeport, Conn.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Toledo Scale Co., 3216 Monroe St., Toledo, O.

SCRAP BALING PRESSES—See BALING PRESSES

SCRAP (Iron & Steel)
Hyman-Michaels Co., 122 S. Michigan Ave., Chicago, Ill.

SCREENS AND SIEVES
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.
Chicago Perforating Co., 2443 W. 24th Pl., Chicago, Ill.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Harrington & King Perforating Co., 5634 Fillmore St., Chicago, Ill.
Koppers Co., Engineering & Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
Ludlow-Saylor Wire Co., The, Newstead Ave. & Wabash R. R., St. Louis, Mo.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

SCREENS (Vibrating)
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.

SCREW EXTRACTORS
Greenfield Tap & Die Corp., Greenfield, Mass.

SCREW MACHINE PRODUCTS
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Hindley Mfg. Co., Valley Falls, R. I.
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Titan Metal Mfg. Co., Bellefonte, Pa.

SCREW MACHINES (Automatic, Single and Multiple Spindle)
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Machine Co., Inc., Windsor, Vt.
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.

SCREW PLATES
Greenfield Tap & Die Corp., Greenfield, Mass.

SCREW STOCK—See STEEL (Screw Stock)

SCREWS
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Continental Screw Corp., New Bedford, Mass.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Cap, Set, Safety-Set)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City
Triplex Screw Co., The, 5317 Grant St., Cleveland, O.

SCREWS (Cold Headed)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.

SCREWS (Conveyor)
Lee Spring Co. Inc., 30 Main St., Brooklyn, N. Y.

SCREWS (Drive)
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Hardened Self-Tapping)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Machine)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Triplex Screw Co., The, 5317 Grant Ave., Cleveland, O.

SCREWS (Machine, Recessed Head)
American Screw Co., Providence, R. I.
Central Screw Co., Chicago, Ill.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit, Mich.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., 194-200 Varick St., New York City.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.

Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.

SCREWS (Non-Ferrous and Stainless)
Harper, H. M., Co., The 2646 Fletcher St., Chicago, Ill.

SCREWS (Self Locking)
Shakeproof Inc., 2525 N. Keeler Ave., Chicago, Ill.

SCREWS (Sheet Metal, Recessed Head)
American Screw Co., Providence, R. I.
Central Screw Co., Chicago, Ill.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Shakeproof Lock Washer Co., Chicago, Ill.

SCREWS (Socket, Cold Forged)
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Thread-Cutting)
Parker-Kalon Corp., 194-200 Varick St., New York City
Shakeproof Inc., 2525 N. Keeler Ave., Chicago, Ill.

SCREWS (Thumb)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Wood, Recessed Head)
American Screw Co., Providence, R. I.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
Parker, Charles, Co., The, Meriden, Conn.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Southington Hdwe. Mfg. Co., Pawtucket, R. I.
Whitney Screw Co., Nashua, N. H.

SEAMLESS STEEL TUBING—See TUBES

SEPARATORS (Magnetic)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.
Frantz, S. G., Co., Inc., 221-5 Centre St., New York City.
Ohio Electric Mfg. Co., The, 5906 Maurice Ave., Cleveland, O.

SHAFT HANGERS—See HANGERS (Shaft)

SHAFTING
Bliss & Laughlin, Inc., Harvey, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Union Drawn Steel Div. Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

SHAKERS
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.

SHAPERS
Automotive Maintenance Machinery Co., 2120 Commonwealth Ave., N. Chicago, Ill.
Cincinnati Shaper Co., Garrard and Elam Sts., Cincinnati, O.

SHAPES (Brass, Bronze, Nickel, Silver)
Titan Metal Mfg. Co., Bellefonte, Pa.
Dahlstrom Metallic Door Co., Jamestown, N. Y.

SHAPES (Steel)—See STEEL (Structural)

SHAPES, SPECIAL (Steel)
Bliss & Laughlin, Inc., Harvey, Ill.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Dahlstrom Metallic Door Co., Jamestown, N. Y.
Harrison Sheet Steel Co., 4718 W. 5th Ave., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Union Drawn Steel Div. Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

SHEAR BLADES
American Shear Knife Co., 3rd and Ann Sts., Homestead, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
Ohio Knife Co., Dreman Ave. & B. & O. R.R., Cincinnati, O.
Wapakoneta Machine Co., The, Wapakoneta, O.

SHEARS
Buffalo Forge Co., 446 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Garrard and Elam Sts., Cincinnati, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hallden Machine Co., The, Thomaston, Conn.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
Lewis Fdry. & Mach. Div. of Blaw-Knox Co., Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Streine Tool & Mfg. Co., New Bremen, O.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

SHEARS, ROTARY (Slitting, Beveling, Circling, Flanging)
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

WHERE-TO-BUY

SHEET BARS
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEET LIFTERS AND CARRIERS
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago, Ill.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
J-B Engineering Sales Co., 1743 Orange St., New Haven, Conn.

SHEET METAL PRODUCTS—
See STAMPINGS

SHEET METAL WORKERS MACHINES
Cincinnati Shaper Co., Elam and Garrard Sts., Cincinnati, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Streine Tool & Mfg. Co., New Bremen, O.
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

SHEET STEEL PILING (New and Used)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.

SHEETS (Acid Resisting)
International Nickel Co., Inc., The, 67 Wall St., New York City.

SHEETS (Black)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Andrews Steel Co., The, Newport, Ky.
Continental Steel Corp., Kokomo, Ind.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Superior Sheet Steel Div., Continental Steel Corp., Canton, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

SHEETS (Brass, Bronze, Copper, Nickel Silver, Silicon-Bronze)
American Brass Co., The, Waterbury, Conn.
Ampco Metal, Inc., Dept. S-142, 3830 W. Burnham St., Milwaukee, Wis.
Bridgeport Brass Co., Bridgeport, Conn.

SHEETS (Corrugated)
American Rolling Mill Co., The, 3091 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Superior Sheet Steel Div., Continental Steel Corp., Canton, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Deep Drawing and Stamping)
Alan Wood Steel Co., Conshohocken, Pa.
American Rolling Mill Co., The, 3091 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Electrical)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
American Rolling Mill Co., The, 3091 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc. Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Galvanized)
American Rolling Mill Co., The, 3091 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Superior Sheet Steel Div., Continental Steel Corp., Canton, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Hot Rolled and Hot Rolled Annealed)
Alan Wood Steel Co., Conshohocken, Pa.
American Rolling Mill Co., The, 3091 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.

SHEETS (Hot Rolled and Hot Rolled Annealed)—Con.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Levinson Steel Co., 33 Pride St., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.
Weirton Steel Co., Weirton, W. Va.
Worth Steel Co., Claymont, Del.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Lead Coated)
Superior Sheet Steel Div., Continental Steel Corp., Canton, O.

SHEETS (Long Terne)
Andrews Steel Co., The, Newport, Ky.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Steel Corp., Kokomo, Ind.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Weirton Steel Co., Weirton, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Nickel Silver)
Seymour Manufacturing Co., The, Seymour, Conn.

SHEETS (Perforated)
Harrington & King Perforating Co., 5634 Fillmore St., Chicago, Ill.

SHEETS (Phosphor Bronze)
Seymour Manufacturing Co., The, Seymour, Conn.

SHEETS (Reinforced)
Erdle Perforating Co., 171 York St., Rochester, N. Y.

SHEETS (Roofing)—See ROOFING AND SIDING

SHEETS (Stainless)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
American Rolling Mill Co., The, 3091 Curtis St., Middletown, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Republic Steel Corp., Massillon, O.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.

SHEETS (Stainless Clad)
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.

SHEETS (Tin)—See TIN PLATE

SHEETS (Tin Mill Black)
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.

SHEETS—HIGH FINISH (Automobile, Metal Furniture, Enameling)
American Rolling Mill Co., The, 3091 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHELLS (Seamless Drawn)
Crosby Co., The, 183 Pratt St., Buffalo, N. Y.

SHOT (Copper)
Roessing Bronze Co., Butler Plank Rd., Etna, Pittsburgh, Pa.

SHOVELS (Power)
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.

SIEVES—See SCREENS AND SIEVES

SILICO-MANGANESE
Electro Metallurgical Co., 30 E. 42nd St., New York City.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

SILICON METAL AND ALLOYS
Electro Metallurgical Co., 30 E. 42nd St., New York City.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.

SKELP (Steel)
Alan Wood Steel Co., Conshohocken, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

SLAG GRANULATING MACHINES (Blast Furnace and Open Hearth)
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

SLITTERS
Cowles Tool Co., 2086 W. 110th St., Cleveland, O.
Ohio Knife Co., Dreman Ave. & B. & O. R.R., Cincinnati, O.

SMALL TOOLS
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., The, 1242 E. 49th St., Cleveland, O.

SOAKING PITS
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.

SOLDER
Kester Solder Co., 4222 Wrightwood Ave., Chicago, Ill.
Wayne Chemical Products Co., 9502 Copeland St., Detroit, Mich.

SOLENOIDS (Electric)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

SOLVENT (Degreasing)
Pennsylvania Salt Mfg. Co., Dept. S, Pennsalt Cleaner Div., Philadelphia, Pa.

SPACING TABLES
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.

SPECIAL MACHINERY—See MACHINERY (Special)

SPEED REDUCERS
Cleveland Worm & Gear Co., 3270 E. 80th St., Cleveland, O.
Grant Gear Works, 2nd & B. Sts., Boston, Mass.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
James, D. O., Mfg. Co., 1120 W. Monroe St., Chicago, Ill.
Jones, W. A., Fdry. & Mach. Co., 4437 Roosevelt Rd., Chicago, Ill.
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
New Departure Div., General Motors Corp., Bristol, Conn.
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia, Pa.

SPIEGELEISEN
Electro Metallurgical Co., 30 E. 42nd St., New York City.
New Jersey Zinc Co., 160 Front St., New York City.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

SPIKES (Screw)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SPINDLES
Leard, Wm., Co., Inc., 16th St., & Fifth Ave., New Brighton, Pa.

SPINDLES (Grinding)
Bryant Chucking Grinder Co., Springfield, Vt.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Heald Machine Co., Worcester, Mass.

SPINDLES (Lathe)
American Hollow Boring Co., 1054 W. 20th St., Erie, Pa.

SPLICE BARS (Rail)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

SPRINGS (*Also Stainless)
*American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
*Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Hubbard, M. D., Spring Co., 444 Central Ave., Pontiac, Mich.
Lee Spring Co., Inc., 30 Main St., Brooklyn, N. Y.
*Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Washburn Wire Co., 118th St. & Harlem River, New York City.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

SPRINGS (Alloy)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.

SPRINGS (Coil & Elliptic)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.
Union Spring & Mfg. Co., New Kensington, Pa.

SPRINGS (Compression)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.

SPRINGS (Oil Tempered—Flat)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Davis Brake Beam Co., Laurel Ave., & P. R. R., Johnstown, Pa.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.

SPRINGS (Torsion)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.

SPRINGS (Valve)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.

SPRINKLERS (Automatic)
Grinnell Co., Inc., Providence, R. I.

SPRUE CUTTERS
Shuster, F. B., Co., The, New Haven, Conn.

STACKS (Steel)—See BRIDGES, ETC.

STAINLESS STEEL—See BARS, SHEETS, STRIP, PLATES, ETC.

STAMPINGS
American Tube & Stamping Plant, (Stanley Wks.), Bridgeport, Conn.
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Crosby Co., The, 183 Pratt St, Buffalo, N. Y.
Dahlstrom Metallic Door Co., Jamestown, N. Y.
Davis Brake Beam Co., Laurel Ave., & P. R. R., Johnstown, Pa.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Homestead Valve Mfg. Co., P. O. Box 20, Coraopolis, Pa.
Hubbard, M. D., Spring Co., 444 Central Ave., Pontiac, Mich.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Lansing Stamping Co., So. Pennsy. Ave., Lansing, Mich.
Lyon Metal Products, Inc., 7212 Madison Ave., Aurora, Ill.
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.
Scaife Co., Ames St., Oakmont, Pa.
Schnorr, C. H., & Co., 643 Railroad St., Springdale, Pa.
Shakeproof Inc., 2525 N. Keeler Ave., Chicago, Ill.
Sheet Metal Specialty Co., Third & Liberty Sts., Pittsburgh, Pa.
Stanley Works, The, Bridgeport, Conn. New Britain, Conn.
Toledo Stamping & Mfg. Co., 90 Fearing Blvd., Toledo, O.
Whitehead Stamping Co., 1667 W. Lafayette Blvd., Detroit, Mich.

STAMPS (Steel)
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.

STAPLES (Wire)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STARTERS (Electric Motor)
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.

STEEL (Alloy)
Alan Wood Steel Co., Conshohocken, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.

WHERE-TO-BUY

STEEL (Alloy)—Con.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Columbia Steel Co., San Francisco, Calif.
Copperweld Steel Co., Warren, O.
Crucible Steel Co. of America, Room 117—405 Lexington Ave., New York City.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc. 17 Grand St., New York City
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
Jessop Steel Co., 584 Green St., Washington, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Simonds Saw & Steel Co., Fitchburg, Mass.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Washburn Wire Co., Phillipsdale, R. I.

STEEL (Alloy, Cold Finished)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bliss & Laughlin, Inc., Harvey, Ill.
Copperweld Steel Co., Warren, O.
Firth-Sterling Steel Co., McKeesport, Pa.
LaSalle Steel Co., Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

STEEL (Clad—Corrosion Resisting) (*Also Stainless)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
*Copperweld Steel Co., Warren, O. Room 117—405 Lexington Ave., New York City.
*Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Jessop Steel Co., 584 Green St., Washington, Pa.
Sharon Steel Corp., Sharon, Pa.
Superior Steel Corp., Carnegie, Pa.

STEEL (Cold Drawn)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bliss & Laughlin, Inc., Harvey, Ill.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Kidd Drawn Steel Co., Aliquippa, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Roebling's, John A., Sons Co., Trenton, N. J.
Sutton Engineering Co., Park Bldg., Pittsburgh, Pa.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

STEEL (Cold Finished)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Roebling's, John A., Sons Co., Trenton, N. J.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

STEEL (Corrosion Resisting)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
American Rolling Mill Co., The, 3091 Curtis St., Middletown, O.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Andrews Steel Co., The Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Room 117—405 Lexington Ave., New York City.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc. 17 Grand St., New York City
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Rustless Iron & Steel Corp., 3400 E. Chase St., Baltimore, Md.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Sharon Steel Corp., Sharon, Pa.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Superior Steel Corp., Carnegie, Pa.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.

STEEL (Die)
Crucible Steel Co. of America, Room 117—405 Lexington Ave., New York City.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL (Drill)
Crucible Steel Co. of America, Room 117—405 Lexington Ave., New York City.

STEEL (Electric)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Copperweld Steel Co., Warren, O.
Crucible Steel Co. of America, Room 117—405 Lexington Ave., New York City.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.

STEEL (High Speed)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Room 117—405 Lexington Ave., New York City.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Jessop, Wm., & Sons Co., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL (High Tensile, Low Alloy)
Alan Wood Steel Co., Conshohocken, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cold Metal Products Co., The, 2131 Wilson Ave., Youngstown, O.
Columbia Steel Co., San Francisco, Calif.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STEEL (Nitriding)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.

STEEL (Rustless)—See STEEL (Corrosion Resisting)

STEEL (Screw Stock)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STEEL (Spring)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Cold Metal Products Co., The, Wilson Ave., Youngstown, O.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Washburn Wire Co., 118th St. & Harlem River, New York City, Phillipsdale, R. I.

STEEL (Stainless)—See STEEL (Corrosion Resisting)

STEEL (Strapping)
Atkins, E. C., & Co., 427 So. Illinois St., Indianapolis, Ind.

STEEL (Strip, Copper Coated)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Thomas Steel Co., The, Warren, O. Rockefeller Bldg., Cleveland, O.

STEEL (Strip, Hot and Cold Rolled) (*Also Stainless)
*Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
*American Rolling Mill Co., The, 3091 Curtis St., Middletown, O.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
American Tube & Stamping Plant, (Stanley Wks.), Bridgeport, Conn.
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cold Metal Products Co., The, 2131 Wilson Ave., Youngstown, O.
Columbia Steel Co., San Francisco, Calif.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
*Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc. 17 Grand St., New York City
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Harrison Sheet Steel Co., 4718 W. 5th Ave., Chicago, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
*Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Seneca Wire & Mfg. Co., Fostoria, O.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Sharon Steel Corp., Sharon, Pa.
*Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Superior Steel Corp., Carnegie, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Thomas Steel Co., The, Warren, O.
Washburn Wire Co., 118th St. & Harlem River, New York City. Phillipsdale, R. I.
Weirton Steel Co., Weirton, W. Va.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

STEEL (Strip, Tin Coated)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Thomas Steel Co., The, Warren, O.
Washburn Wire Co., 118th St. & Harlem River, New York City.

STEEL (Strip, Zinc Coated)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Thomas Steel Co., The, Warren, O.
Washburn Wire Co., 118th St. & Harlem River, New York City.

STEEL (Structural) (*Also Stainless)
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Belmont Iron Works, 22nd St. and Washington Ave., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Levinson Steel Co., 33 Pride St., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Scully Steel Products Co., 1316 Wabansia Ave., Chicago, Ill.
Standard Steel Fabricating & Boiler Works, Inc., 1640 W. Hanford St., (Harbor Island) Seattle, Wash.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Treadwell Construction Co., Midland, Pa.
Uhl Construction Co., 6001 Butler St., Pittsburgh, Pa.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STEEL (Tool)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Copperweld Steel Co., Warren, O.
Crucible Steel Co. of America, Room 117—405 Lexington Ave., New York City.
Darwin & Milner, Inc., 1260 W. 4th St., Cleveland, O.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc. 17 Grand St., New York City
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Jessop, Wm., & Sons Co., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Kidd Drawn Steel Co., Aliquippa, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Broach & Mach. Co., 5600 St. Jean, Detroit, Mich.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL BUILDINGS—See BRIDGES, BUILDINGS, ETC.

STEEL DOORS & SHUTTERS—See DOORS & SHUTTERS

STEEL FABRICATORS—See BRIDGES, BUILDINGS, ETC.

STEEL FLOATING AND TERMINAL EQUIPMENT
Dravo Corp. (Engin'r'g Works Div.), Neville Island, Pittsburgh, Pa.

STEEL PLATE CONSTRUCTION
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Belmont Iron Works, 22nd St., and Washington Ave., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Federal Shipbuilding & Dry Dock Co., Kearney, N. J.
General American Transportation Corp., 135 So. LaSalle St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Standard Steel Fabricating & Boiler Works, Inc., 1640 W. Hanford St., (Harbor Island) Seattle, Wash.
Treadwell Construction Co., Midland, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.
Youngstown Steel Tank Co., Oak St. & Andrews Ave., Youngstown, O.

STELLITE
Haynes Stellite Co., Harrison and Lindsay Sts., Kokomo, Ind.

STOKERS
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.

STONES (Honing)
Bay State Abrasive Products Co., Westboro, Mass.

STOPPERS (Cinder Notch)
Bailey, Wm. M. Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

STOPPERS (Rubber)
Rhoades, R. W., Metaline Co., P. O. Box 1, Long Island City, N. Y.

STORAGE EQUIPMENT
Lyon Metal Products, Inc., 7212 Madison Ave., Aurora, Ill.

STORAGE BATTERIES—See BATTERIES (Storage)

STRAIGHTENING MACHINERY
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Kane & Roach, Inc., Niagara & Shonnard Sts., Syracuse, N. Y.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Lewis Machine Co., 3450 E. 76th St., Cleveland, O.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Medart Co., The, 3520 de Kalb St., St. Louis, Mo.
Shuster, F. B., Co., The, New Haven, Conn.
Sutton Engineering Co., Park Bldg., Pittsburgh, Pa.

SULPHURIC ACID
Cleveland-Cliffs Iron Co., The, Union Commerce Bldg., Cleveland, O.
New Jersey Zinc Co., 160 Front St., New York City.
Pennsylvania Salt Mfg. Co., Dept. S. Pennsalt Cleaner Div., Philadelphia, Pa.

SURFACE WELDING
Wall-Colmonoy Corp., 637 Buhl Bldg., Detroit, Mich.

SWAGING MACHINES
Standard Machinery Co., Providence, R. I.

SWITCHES (Electric)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.
General Electric Co., Dept. 166-S-G. Nela Park, Cleveland, O.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

TACHOMETERS
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.

TANK LININGS
Ceilcote Co., 750 Rockefeller Bldg., Cleveland, O.
Goodyear Tire & Rubber Co., 1144 E. Market St., Akron, O.
Heil & Co., 12901 Elmwood Ave., Cleveland, O.
National Carbon Co., W. 117th St. and Madison Ave., Cleveland, O.
Nukem Products Corp., 70 Niagara St., Buffalo, N. Y.
Sauereisen Cements Co., 1601 Main St., Sharpsburg Station, Pittsburgh (15), Pa.

TANKS (Pickling)
Goodyear Tire & Rubber Co., 1144 E. Market St., Akron, O.
National Carbon Co., W. 117th St. and Madison Ave., Cleveland, O.
Nukem Products Corp., 70 Niagara St., Buffalo, N. Y.
Sauereisen Cements Co., 1601 Main St., Sharpsburg Station, Pittsburgh (15), Pa.

TANKS (Storage, Pressure, Riveted, Welded)
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.
General American Transportation Corp., 135 So. LaSalle St., Chicago, Ill.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.

WHERE-TO-BUY

TANKS (Storage, Pressure, Riveted, Welded)—Con.
Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.
Scaife Co., Ames St., Oakmont, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.
Youngstown Steel Tank Co., Oak St. & Andrews Ave., Youngstown, O.

TANKS (Wood or Steel, Rubber or Lead Lined)
Goodyear Tire & Rubber Co., 1144 E. Market St., Akron, O.
Heil & Co., 12901 Elmwood Ave., Cleveland, O.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.

TANKS and TOWERS
Treadwell Construction Co., Midland, Pa.

TANTALUM-TUNGSTEN CARBIDE
Carboloy Co., Inc., The, 11177 E. 8 Mile Rd., Detroit, Mich.
Vascoloy-Ramet Corp., No. Chicago, Ill.

TAPS AND DIES
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.

TERMINALS (Locking)
Shakeproof Inc., 2525 N. Keeler Ave., Chicago, Ill.
Thompson-Bremer & Co., 1644 W. Hubbard St., Chicago, Ill.

TERNE PLATE—See TIN PLATE

TESTING MACHINERY (Materials)
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.

THERMOMETERS
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stanton Ave., Philadelphia, Pa.

THREAD CUTTING TOOLS
Landis Machine Co., Waynesboro, Pa.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland, O.

TIE PLATES
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.

TIN PLATE
Bethlehem Steel Co. Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Washington Tin Plate Co., Washington, Pa.
Weirton Steel Co., Weirton, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TIN PLATE MACHINERY
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Wean Engineering Co., Warren, O.

TITANIUM
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

TONGS (Chain Pipe)
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

TONGS (Rail Handling)
Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago, Ill.

TOOL BITS (High Speed)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
Disston, Henry, & Sons, Inc., 1226 Tacony, Philadelphia, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Haynes Stellite Co., Harrison and Lindsay Sts., Kokomo, Ind.
Jessop Steel Co., 584 Green St., Washington, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

TOOL BITS (Tantalum Carbide)
Vascoloy-Ramet Corp., N. Chicago, Ill.

TOOL HOLDERS
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

TOOL STEELS (Hammered)
McInnes Steel Co., Corry, Pa.

TOOLS (Pneumatic)
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.

TOOLS (Precision, Lathe, Metal Cutting, etc.)
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Inc., The, 11177 E. 8 Mile Rd., Detroit, Mich.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.
Vascoloy-Ramet Corp., N. Chicago, Ill.

TOOLS (Tantalum Carbide)
Carboloy Co., Inc., The, 11177 E. 8 Mile Rd., Detroit, Mich.
Vascoloy-Ramet Corp., N. Chicago, Ill.

TOOLS (Tipped, Carbide)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

TORCHES & BURNERS (Acetylene, Blow, Oxy-Acetylene)
Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., The, 30 E. 42nd St., New York City.
National Cylinder Gas Co., 205 W. Wacker Drive, Chicago, Ill.

TOWBOATS
Dravo Corp. (Engin'r'g Works Div.) Neville Island, Pittsburgh, Pa.

TOWERS (Transmission)
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.

TOWERS (Tubular Hoisting)
Dravo Corp., (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.

TRACK ACCESSORIES
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

TRACK BOLTS
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TRAILERS
Ohio Galvanizing & Mfg. Co., Penn St., Niles, O.

TRAILERS (Arch-Girder)
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

TRAMRAILS
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

TRANSMISSIONS—VARIABLE SPEED
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.

TRAPS (Compressed Air)
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

TRAPS (High Pressure Steam)
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

TRAPS (Steam)
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

TREADS (Safety)
Alan Wood Steel Co., Conshohocken, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Dravo Corp. (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tri-Lok Co., 5515 Butler St., Pittsburgh, Pa.

TROLLEYS
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Ford Chain Block Div., American Chain & Cable Co. Inc., 2nd & Diamond Sts., Philadelphia, Pa.
Reading Chain & Block Co., Dept. 313, Reading, Pa.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

TRUCK CRANES
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Silent Hoist Winch & Crane Co., 849 63rd St., Brooklyn, N. Y.

TRUCKS AND TRACTORS (Electric Industrial)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland, O.
Easton Car & Construction Co., Easton, Pa.
Elwell-Parker Electric Co., The, 4501 St. Clair Ave., Cleveland, O.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

TRUCKS AND TRACTORS (Gasoline Diesel)
Silent Hoist Winch & Crane Co. 849 63rd St., Brooklyn, N. Y.

TRUCKS AND TRACTORS (Gasoline Industrial)
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland, O.
Clark Tructractor Div., Clark Equipment Co., 127 Springfield Pl., Battle Creek, Mich.
Elwell-Parker Electric Co., The, 4501 St. Clair Ave., Cleveland, O.

TRUCKS (Dump-Industrial)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Easton Car & Construction Co., Easton, Pa.

TRUCKS (Hydraulic Lift)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.

TRUCKS (Industrial)
Easton Car & Construction Co., Easton, Pa.
Ohio Galvanizing & Mfg. Co., Penn St., Niles, O.

TRUCKS (Lift)
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland, O.
Clark Tructractor Div., Clark Equipment Co., 127 Springfield Pl., Battle Creek, Mich.
Easton Car & Construction Co., Easton, Pa.
Elwell-Parker Electric Co., The, 4501 St. Clair Ave., Cleveland, O.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

TUBE MILL EQUIPMENT
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Taylor-Wilson Mfg. Co., 1200 Thomson Ave., McKees Rocks, Pa.

TUBES (Boiler)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TUBES (Brass, Bronze, Copper, Nickel Silver)
American Brass Co., The, Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.

TUBES (High Carbon)
Ohio Seamless Tube Co., Shelby, O.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.

TUBING (Alloy Steel) (*Also Stainless)
*Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
*National Tube Co., Frick Bldg., Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
*Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.

TUBING (Copper, Brass, Aluminum)
American Brass Co., The, Waterbury, Conn.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Shenango-Penn Mold Co., Dover, O.

TUBING (Flexible Metal)
Chicago Metal Hose Corp., 1315 S. Third St., Maywood, Ill.

TUBING (Monel)
Bundy Tubing Co., 10951 Hern Ave., Detroit, Mich.

TUBING (Seamless Flexible Metal)
American Metal Hose Branch of The American Brass Co., Waterbury, Conn.

TUBING (Seamless Steel)
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Columbia Steel Co., San Francisco, Calif.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York City
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
Pipe & Tube Products, Inc., 445 Communipaw Ave., Jersey City, N. J.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TUBING (Square, Rectangular)
Ohio Seamless Tube Co., Shelby, O.
Steel & Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.

TUBING (Welded Steel)
Bundy Tubing Co., 10951 Hern Ave., Detroit, Mich.
Frasse, Peter A., & Co. Inc., 17 Grand St., New York City
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Ohio Seamless Tube Co., Shelby, O.
Republic Steel Corp., Dept. ST, Cleveland, O.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TUBULAR PRODUCTS
Bundy Tubing Co., 10951 Hern Ave., Detroit, Mich.
Ohio Seamless Tube Co., Shelby, O.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland, O.
Tubular Service Corp., 120 44th St., Brooklyn, N. Y.

TUMBLING BARRELS (Coke Testing)
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

TUNGSTEN CARBIDE
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Haynes Stellite Co., Harrison and Lindsay Sts., Kokomo, Ind.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

TUNGSTEN CARBIDE (Tools and Dies)
Carboloy Co., Inc., The, 11177 E. 8 Mile Rd., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

TUNGSTEN METAL AND ALLOYS
Electro Metallurgical Co., 30 E. 42nd St., New York City.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

TURBINES (Steam)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

TURBO BLOWERS—See BLOWERS

TURNTABLES
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland, O.

TURRET LATHES—See LATHES (Turret)

TUYERES
Climax Fire Brick Co., Climax, (Clarion Co.) Pa.

TWIST DRILLS
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, O..
Greenfield Tap & Die Corp., Greenfield, Mass.

UNIT HEATERS
Dravo Corp. (Machinery Div.) 300 Penn Ave., Pittsburgh, Pa.

VACUUM CLEANERS
Sturtevant, B. F., Co., Hyde Park, Boston, Mass.

VALVE CONTROL (Motor Operated Units)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

VALVE CONTROLS
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia, Pa.

VALVES (Blast Furnace)
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

VALVES (Blow-off)
Homestead Valve Mfg. Co., P. O. Box 20, Coraopolis, Pa.

VALVES (Brass, Iron and Steel)
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Galland-Henning Mfg. Co., 2747 So. 31st St., Milwaukee, Wis.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

VALVES (Check)
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

VALVES (Control—Air and Hydraulic)
Airgrip Chuck Div., Anker-Holth Mfg. Co., Port Huron, Mich.
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Galland-Henning Mfg. Co., 2747 So. 31st St., Milwaukee, Wis.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Homestead Valve Mfg. Co., P. O. Box 22, Coraopolis, Pa.
Logansport Machine, Inc., 917 Payson Rd., Logansport, Ind.
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.
Racine Tool & Machine Co., Racine, Wis.

VALVES (Electrically Operated)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

VALVES (Gas and Air Reversing)
Blaw-Knox Co., Blawnox, Pa.

VALVES (Gate)
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Crane Co., The, 836 So. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.
Western Gas Div. Koppers Co., Fort Wayne, Ind.

VALVES (Globe)
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

WHERE-TO-BUY

VALVES (Hydraulic)

Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Homestead Valve Mfg. Co., P. O. Box 20, Coraopolis, Pa.
Racine Tool & Machine Co., Racine, Wis.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

VALVES (Iron & Steel)

Galland-Henning Mfg. Co., 2747 So. 31st St., Milwaukee, Wis.

VALVES (Needle)

Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

VALVES (Open Hearth Control—Oil, Tar, Steam & Air)

Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

VALVES (Plug)

Homestead Valve Mfg. Co., P. O. Box 20, Coraopolis, Pa.

VALVES (Steam and Water)

Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

VALVES AND FITTINGS—See PIPE FITTINGS

VANADIUM

Electro Metallurgical Co., 30 E. 42nd St., New York City.
Vanadium Corp. of America, 420 Lexington Ave., New York City.

VIADUCTS (Steel)—See BRIDGES, ETC.

WALKWAYS—See FLOORING—(Steel)

WASHERS (Iron and Steel)

Hubbard, M. D., Spring Co., 444 Central Ave., Pontiac, Mich.
Thompson-Bremer & Co., 1644 W. Hubbard St., Chicago, Ill.

WASHERS (Lock)

Garrett, George K., Co., 1421 Chestnut St., Philadelphia, Pa.
Shakeproof Inc., 2525 N. Keeler Ave., Chicago, Ill.
Thompson-Bremer & Co., 1644 W. Hubbard St., Chicago, Ill.

WASHERS (Non-ferrous and Stainless)

Garrett, Geo. K., Co., 1421 Chestnut St., Philadelphia, Pa.
Harper, H. M., Co., The, 2646 Fletcher St., Chicago, Ill.

WASHERS (Spring)

Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Garrett, Geo. K., Co., 1421 Chestnut St., Philadelphia, Pa.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.
Shakeproof Inc., 2525 N. Keeler Ave., Chicago, Ill.
Thompson-Bremer & Co., 1644 W. Hubbard St., Chicago, Ill.

WELDED STEEL CONSTRUCTION

Pollock, Wm. B., Co., The, 101 Andrews Ave., Youngstown, O.

WELDERS (Electric—Arc)

Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Hobart Bros., Box ST-12, Troy, O.
Lincoln Electric Co., The, Cleveland, O.
Progressive Welder Co., 3050 E. Outer Drive, Detroit, Mich.

WELDERS (Electric-Resistance)

Federal Machine & Welder Co., Dana St., Warren, O.

WELDING

Bartlett-Hayward Div. Koppers Co., Baltimore, Md.
Lincoln Electric Co., The, Cleveland, O.
Scaife Co., Ames St., Oakmont, Pa.
Western Gas Div., Koppers Co., Ft. Wayne, Ind.

WELDING (Welded Machine Steel Bases)

Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.

WELDING COMPOUNDS

Anti-Borax Compound Co., Inc., 1506 Wall St., Fort Wayne, Ind.

WELDING DIES (Flash)

Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind.

WELDING RODS (Alloys)

Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
International Nickel Co. Inc., The, 67 Wall Street, New York City.
Lincoln Electric Co., The, Cleveland, O.
Maurath, Inc., 7311 Union Ave., Cleveland, O.
Metal & Thermit Corp., 120 Broadway, New York City
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.

WELDING RODS (Bronze)

American Brass Co., The, Waterbury, Conn.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Titan Metal Mfg. Co., Bellefonte, Pa.

WELDING RODS (Hard Surfacing)

Stoody Co., Whittier, Calif.
Wall-Colmonoy Corp., 637 Buhl Bldg., Detroit, Mich. Dept. AC, Peoria, Ill.

WELDING RODS OR WIRE

Air Reduction, 60 E. 42nd St., New York City.
American Brass Co., The, Waterbury, Conn.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bridgeport Brass Co., Bridgeport, Conn.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Hobart Bros., Box ST-12, Troy, O.
Lincoln Electric Co., The, Cleveland, O.
Linde Air Products Co., The, 30 E. 42nd St., New York City.
Maurath, Inc., 7311 Union Ave., Cleveland, O.
Metal & Thermit Corp., 120 Broadway, New York City
National Cylinder Gas Co., 205 W. Wacker Drive, Chicago, Ill.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Seneca Wire & Mfg. Co., Fostoria, O.
Washburn Wire Co., Phillipsdale, R. I.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Wilson Welder & Metals Co., 60 East 42nd St., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WELDING TIPS (Spot)

Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind.

WELDING WHEELS (Seam)

Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind.

WELDING AND CUTTING APPARATUS AND SUPPLIES (Electric)

General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Hobart Bros., Box ST-12, Troy, O.
Lincoln Electric Co., The, Cleveland, O.

WHERE-TO-BUY

WELDING AND CUTTING APPARATUS AND SUPPLIES (Electric)—Con.

Mallory & Co., P. R., 3029 E. Washington Ave., Indianapolis, Ind.
National Cylinder Gas Co., 205 W. Wacker Drive, Chicago, Ill.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.
Wilson Welder & Metals Co., 60 E. 42nd St., New York City.

WELDING AND CUTTING APPARATUS AND SUPPLIES (Oxy-Acetylene)

Air Reduction, 60 E. 42nd St., New York City,
Linde Air Products Co., The, 30 E. 42nd St., New York City.
Mallory, P. R., & Co., 3029 E. Washington Ave., Indianapolis, Ind.
National Cylinder Gas Co., 205 W. Wacker Drive, Chicago, Ill.

WELL WATER SUPPLY SYSTEMS

Layne & Bowler, Inc., Memphis, Tenn.

WHEELS (Car and Locomotive)

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.

WHEELS (Track)

National-Erie Corp., Erie, Pa.

WHEELS (Trolley)

Crosby Co., The, 183 Pratt St., Buffalo, N. Y.

WINCHES (Electric)

American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

WINCHES (Electric, Gasoline, Diesel)

Silent Hoist Winch & Crane Co. 849 63rd St., Brooklyn, N. Y.

WIRE (Alloy Steel) (*Also Stainless)

*American Steel & Wire Co. Rockefeller Bldg., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Firth-Sterling Steel Co., McKeesport, Pa.
*Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
*Republic Steel Corp., Dept. ST Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

WIRE (Annealed, Bright, Galvanized)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Dept. AC, Peoria, Ill.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WIRE (Barb)

Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WIRE (Brass)

Titan Metal Mfg. Co., Bellefonte, Pa.

WIRE (Cold Drawn)

Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Washburn Wire Co., 118th St. & Harlem River, New York City.

WIRE (High Carbon)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Washburn Wire Co., 118th St. and Harlem River, New York City.

WIRE (Nickel Silver)

Seymour Manufacturing Co., The, Seymour, Conn.

WIRE (Music)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Frasse, Peter A., & Co., Inc. 17 Grand St., New York City
Roebling's, John A., Sons Co., Trenton, N. J.
Washburn Wire Co., 118th St. and Harlem River, New York City.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

WIRE (Phosphor Bronze)

Seymour Manufacturing Co., The, Seymour, Conn.

WIRE (Round, Flat, Square, Special Shapes)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Columbia Steel Co., Los Angeles, Calif.
Continental Steel Corp., Kokomo, Ind.
Page Steel & Wire Div., of American Chain & Cable Co., Inc., Monessen, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Washburn Wire Co., 118th St. and Harlem River, New York City.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WIRE (Spring)

American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Keystone Steel & Wire Co., Dept. AC, Peoria, Ill.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.

WHERE-TO-BUY

WIRE (Spring)—Con.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Washburn Wire Co., 118th St. & Harlem River, New York City.

WIRE (Stainless)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.

WIRE (Stapling)
Keystone Steel & Wire Co., Dept. AC, Peoria, Ill.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Rustless Iron & Steel Corp., 3400 E. Chase St., Baltimore, Md.

WIRE (Welding)—See WELDING RODS OR WIRE

WIRE AND CABLE (Electric)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
General Electric Co., Sec. CDW-1907, Appliance & Merchandise Dept., Bridgeport, Conn.
Roebling's, John A., Sons Co., Trenton, N. J.

WIRE CLOTH
Cyclone Fence Co., Waukegan, Ill.
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

WIRE COVERING MACHINES
Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia, Pa.

WIRE DIES
Vascoloy-Ramet Corp., N. Chicago, Ill.

WIRE FORMS, SHAPES AND SPECIALTIES
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Columbia Steel Co., San Francisco, Calif.
Firth-Sterling Steel Co., McKeesport, Pa.
Hubbard, M. D., Spring Co., 444 Central Ave., Pontiac, Mich.
Ludlow-Saylor Wire Co., The, Newstead Ave. & Wabash R. R., St. Louis, Mo.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.

WIRE FORMING MACHINERY
Nilson, A. H., Machine Co., The, Bridgeport, Conn.

WIRE MILL EQUIPMENT
Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Lewis Machine Co., 3450 E. 76th St., Cleveland, O.
Morgan Construction Co., Worcester, Mass.
Shuster, F. B., Co., The, New Haven, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

WIRE NAILS—See NAILS

WIRE PRODUCTS (*Also Stainless)
*American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.
Continental Steel Corp., Kokomo, Ind.
Hubbard, M. D., Spring Co., 444 Central Ave., Pontiac, Mich.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Keystone Steel & Wire Co., Dept. AC, Peoria, Ill.
Leschen, A., & Sons Rope Co., 5909 Kennerly Ave., St. Louis, Mo.
Ludlow-Saylor Wire Co., The, Newstead Ave. & Wabash R. R., St. Louis, Mo.
*Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Washburn Wire Co., 118th St. and Harlem River, New York City.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WIRE ROPE AND FITTINGS (*Also Stainless)
American Cable Div. of American Chain & Cable Co., Inc., Wilkes-Barre, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Broderick & Bascom Rope Co., 4203 N. Union St., St. Louis, Mo.
Hazard Wire Rope Div. of American Chain & Cable Co., Inc., Wilkes-Barre, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Leschen, A., & Sons Rope Co., 5909 Kennerly Ave., St. Louis, Mo.
Macwhyte Co., 2912 14th Ave., Kenosha, Wis.
Roebling's, John A., Sons Co., Trenton, N. J.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

WIRE ROPE SLINGS
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Broderick & Bascom Rope Co., 4203 N. Union St., St. Louis, Mo.
Leschen, A., & Sons Rope Co., 5909 Kennerly Ave., St. Louis, Mo.
Macwhyte Co., 2912 14th Ave., Kenosha, Wis.
Roebling's, John A., Sons Co., Trenton, N. J.

WIRE SPOOLING MACHINES
Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia, Pa.

WIRE STRAIGHTENING AND CUTTING MACHINERY
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Lewis Machine Co., 3450 E. 76th St., Cleveland, O
Shuster, F. B., Co., The, New Haven, Conn.

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300 amp. 40/0 volt Lincoln with 10 H.P. 220 volt, D. C. motor.

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ADVERTISING INDEX

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