Manpower remains critical factor as overall scrap inventories decline. Page 65

STEEL

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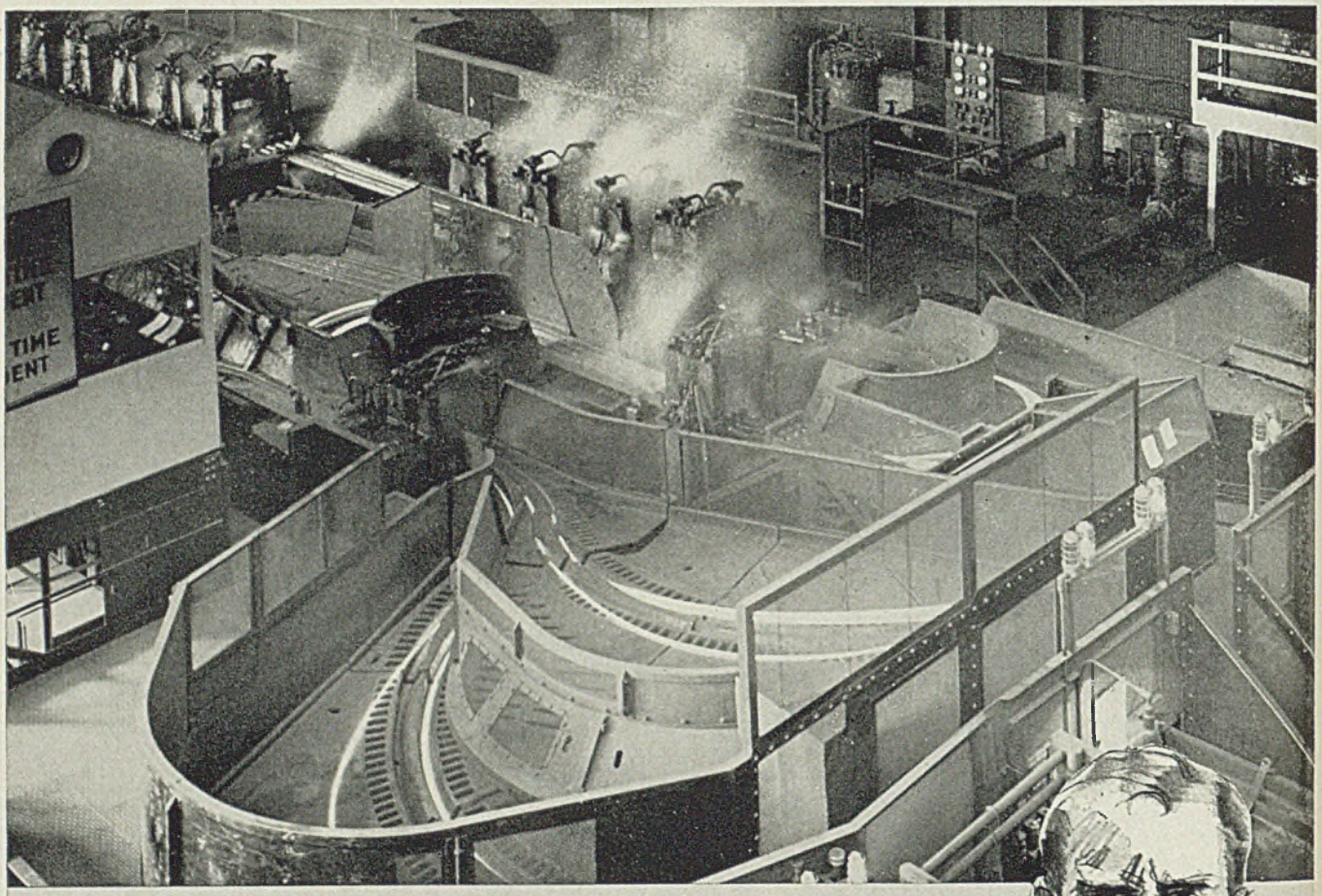
NEWS

TECHNICAL

FEATURES

MARKETS



We're producing rod at the rate of over 4,000 fpm with four Morgan Repeaters in this compact mill.

Two of them are 180° overfeed repeaters, and two are of the combination take-up and overfeed types, supplying two double-strand finishing trains.

We never did any hand looping, but it's a cinch that without Morgan Repeaters we couldn't get out the steel we do today.

MORGAN REPEATERS

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MORGAN CONSTRUCTION COMPANY, WORCESTER, MASS.

STEEL
July 26, 1943

Who's Running the War?

Speaking before the Sales Executives Club in New York, Secretary of the Interior Harold Ickes last week declared that if the war program has broken down at any point, it hasn't been chargeable to the brain trusters, to the new dealers or to the bureaucrats. "It isn't the new dealers who have been running this war. If I know anything about Washington," continued the peppery secretary, "it is that business men who have been drafted have been running the war—men like Knudsen, Nelson, Stettinius and many others. . . ."

Coming from Ickes, this attempt to whitewash brain trusters, new dealers and bureaucrats is ridiculous. Ickes knows—probably as well as anybody—that the war is being run by the government administration which is assisted by drafted business men, professional men and others. He knows too that the real authority is vested in the President, who operates through an invisible cabinet of trusted new dealers, and that the business men and others who are carrying the major burden of administration must conform to the policies of the President and his behind-the-scenes advisers.

Probably there isn't a good "knowhow" business man in Washington who is doing his job the way he would like to do it. He is doing the best he can within the limitations imposed by brain trusters, new dealers and bureaucrats.

Strangely enough, Ickes himself unwittingly gave testimony to this fact in his appearance before the sales executives. Asked about the conflicting reports recently issued by various agencies concerning the gasoline situation, Mr. Ickes replied that as fuel administrator he should give out all announcements pertaining to gasoline. "Then," he said, "you would not have one thing today and another tomorrow."

Here Ickes is proving our point from his own experience. He is implying that there is confusion on fuel because there is conflicting authority. He is pleading—with good reason, we believe—for complete authority on matters concerning fuel, for which he is responsible.

The same confusion in authority which irks Mr. Ickes as fuel administrator also irks and hampers the work of drafted business men. If the war program is breaking down at any point, it is because of this confusion in authority. This confusion, by Mr. Ickes' own inference, is chargeable to the organizers of the war program, who are the President and his brain trusters, new dealers and bureaucrats.

Mr. Ickes, the irked fuel administrator, has made a laughing stock of Mr. Ickes, the apologist for brain trusters, new dealers and bureaucrats.

WAR-BORN VERSATILITY: Sellers of machine tools, equipment and accessories are noticing a marked change in the character of inquiries and orders from war contractors. Not long ago the bulk of demand was for tools to expand production. Now an increasing number of inquiries and orders is for facilities which will increase the efficiency of production.

This shift in emphasis is gratifying from two standpoints. When a shop installs equipment for more efficient production, it benefits first from the fact that it can contribute more effectively to the war

(OVER)

effort and secondly, that in most cases it acquires an additional versatility in manufacturing operations which may prove to be highly important in the handling of postwar work.

Guy Hubbard sees in this war-born versatility an opportunity for machine tool builders (p. 70) to extend the scope of their activities into fields of repetitive manufacture which were closed to them prior to the war. Scores of machine tool builders already are manufacturing parts for ordnance on a mass production basis—a feat few of them could have performed with their prewar facilities.

What does this newly acquired versatility portend in postwar activities?

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HEADACHES FOR HITLER: The quarterly report from our British correspondent throws interesting light upon the effect of the Tunisian victory upon continental Europe. The enemy lost great quantities of equipment and supplies in North Africa (p. 39), which will be difficult, if not impossible, to replace because production in Germany and in Nazi-controlled territory is on the wane.

Reports to England from the continent indicate that Hitler's industrial production is menaced in three ways. First, the attacks on steelworks and manufacturing plants by the British and American air forces are increasingly effective. Secondly, the air attacks upon the enemy's transport system have seriously impaired industrial output. Third, sabotage by the patriots in occupied countries has been so extensive as to cause the Germans to attempt to move plants from occupied to home territory.

Industrially, the sun is rising for the Allies and setting for the Axis.

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NO TIME FOR LETDOWN: Much of the hard work performed by many thousands of persons in and outside of industry in connection with the various scrap drives has been effective. Recently scrap inventories were at the highest levels recorded since Pearl Harbor.

Naturally the fairly comfortable cushion of scrap supply is gratifying to everybody concerned (p. 65), but the situation is not such to warrant complacency or over-confidence. The coal strike cut into scrap stocks appreciably. Scrap dealers are harassed by price and manpower problems. Many of the nonrecurring sources of scrap have been exhausted. Shipments from the battle zones have been small.

Steelmakers and foundrymen will need all the scrap that can be procured to insure going into the winter with a safe backlog. The drive for scrap should continue with unabated vigor.

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BACKED-UP DEMAND: Two figures from the survey on potential markets for steel made by George W. Wolf, president, United States Steel Export Co. (p. 52) indicate the vast backed-up demand attributable to the war. By 1944, he estimates, there will be an unsatisfied demand for 12,000,000 automotive vehicles. In the export field, he estimates that a demand for from 15,000,000 to 20,000,000 tons of steel has accumulated during the past two years.

When one adds to these impressive figures the tremendous dammed-up demand for steel for housing, highways, railroads, containers, oil and gas and other markets more or less frozen for the duration of the war, it is evident that there will be plenty of work to do when the fighting stops.

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ALL "TAKE"; NO "GIVE": Most of us believe that we are fighting this war in order that the world may become a place in which our children can live in freedom, comfort and security. We are realistic enough to know that the extent to which freedom, comfort and security can be accorded to individuals will depend in no small measure upon the degree in which all elements of society co-operate for the benefit of all. In short, a liberal spirit of give-and-take must prevail.

Many persons in Washington are jittery (p. 50) because they cannot reconcile the present attitude of strong minority blocs with this necessary give-and-take spirit. They see in the recent actions of the silver, farm, labor and other blocs a stubborn determination to "take" as much as possible and "give" as little as possible. If this attitude is carried over into the postwar period, much of the terrific cost of this war and much of the effort of postwar planning will have gone for naught.

How to teach individuals, groups and nations to live, work and play together harmoniously in a wholesome spirit of give-and-take still remains the world's No. 1 unsolved problem.

E. C. Shaner

EDITOR-IN-CHIEF

CONCERNING WARTIME VACATIONS

The terrific pace of war production continues—and with metals still on the critical list—men who buy are under greatest pressure. But brief periods of mental relaxation are still essential to health and efficiency. So, in the interest of your country, your company, your family and yourself—you should take some time off this summer.

True, travel is restricted. The boys in the Service have priority on transportation and God bless them. But a happy vacation really doesn't depend on distance—so plan ahead—leave your worries behind and soak up some good old sunshine.

And—as far as steel is concerned—tell your men to depend on Ryerson. Our stocks are still the most complete. And where war requirements have created some shortages, we can usually offer substitutes that will do the job as well.

So go ahead—enjoy yourself.

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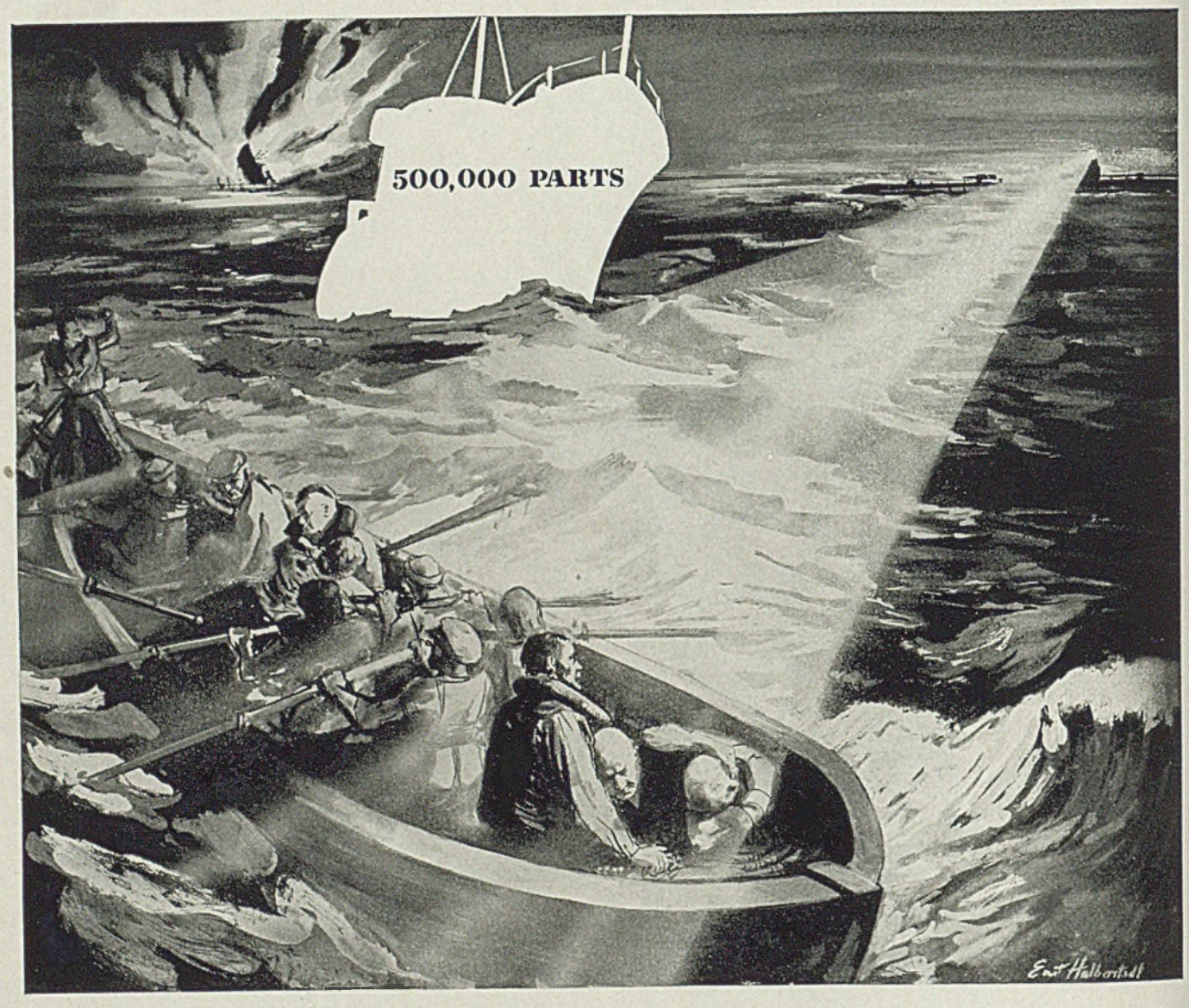


THE SUB-BUSTER THAT WASN'T THERE

"We didn't have a chance. That murderous Nazi's fire whiplashed our open boat. Helpless, we ducked, and those who could, rowed on. Out in a ghostly glare, our ship went down.

"'By God, we'll make them pay for this,' said First Mate Stone, clenching his fist. Just then, a bullet got him in the throat.

"Your mind plays funny tricks at times like that. As those devils strafed us bow to stern, I seemed to see a DE Ship lunging in to pay them back a bit. Whenever I looked close, it wasn't there, and I kept wondering why."

* * *

Thousands of tiny parts make ships, planes, tanks, trucks, guns. In many cases, men's lives depend on *when* and *how* those parts are made.

Here, at R B & W, making millions of bolts and nuts every day, we have pledged ourselves to the realization that every part, even the smallest, counts. To special bolt-and-nut-making processes insuring flawless strength and accurate fit . . . we are adding, each one of us, the personal care and extra effort needed for world-wide victory.

Perhaps the workers in your plant would benefit from a clearer idea of what our soldiers and sailors are enduring. How important *each* one's part is . . . is the basic theme of a series of posters based on ads like this one—posters freely available to every "bits and parts" manufacturer. Write us. Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N. Y.

RB&W *Making strong the things that make America strong*

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

AXIS INDUSTRY REELS

United Nations' bombing of Ruhr and other highly industrialized areas of Nazi-dominated continent wreaks widespread destruction of vital transport and production facilities. . . Considerable plant moved

By J. A. HORTON
British Correspondent, Steel

BIRMINGHAM, ENG.

WITH completion of the North African campaign, results of which are difficult to estimate but which will certainly be far-reaching, the position in Europe has undergone a material change. The enemy has left behind vast quantities of equipment which he will find it more and more difficult to replace, particularly now that his production is on the wane.

Heavy blows at Germany's transport have been struck by the R.A.F. by night and by American bombers in daylight. A spokesman of the Ministry of Economic Warfare recently stated Germany's locomotive building program had been singled out for air attack with very signal success, and the mass attack going on in the Ruhr will retard output.

In addition, engines have been attacked while operating and repair shops have been seriously damaged or completely destroyed both in Germany and in western Europe.

Daylight raids on enemy transports are likely to deprive the Germans more and more of the possibility of farming out their repairs, and maintenance and production programs in western districts. Some industries are being dispersed towards southeast Europe, and these daylight raids on the same type of industry in the west seem to be accelerating that process, particularly in the aircraft and motor industries.

The heavy bombing of the Ruhr is causing widespread damage, though to what extent blast furnaces and steelworks have been affected is not yet known. In Dortmund, which recently had a very heavy attack there are nine blast furnaces and five steelworks of the Dortmund-Hoerder Huttenverein, and six blast furnaces and the associated steelworks and rolling mills of the Hoesch-Kohn-Neuessen A.G. fur Bergbau und Huttenbetrieb.

The importance of the Ruhr as an iron and steel producing center is shown by the fact that Renish-Westphalia in 1937 produced no less than 11,204,500 tons of steel ingots and castings, and 9,281,850 tons of finished steel.

Italy, while also suffering from the visits of the R.A.F., is almost certain to be affected by the disasters in the Ruhr, since it is hardly likely that Germany will now be able to implement fully her obligation to deliver a million tons of coal a month to Italian industry.

These 500 pound bombs from Flying Fortresses pour downward on an important oil refinery at Leghorn, Italy. Sights were trained on the cracking and refining plants. NEA photo

Meanwhile the position of industry in the occupied countries of France and Belgium becomes more difficult. In consequence of the scarcity of coke several blast furnaces have been damped down in Belgium.

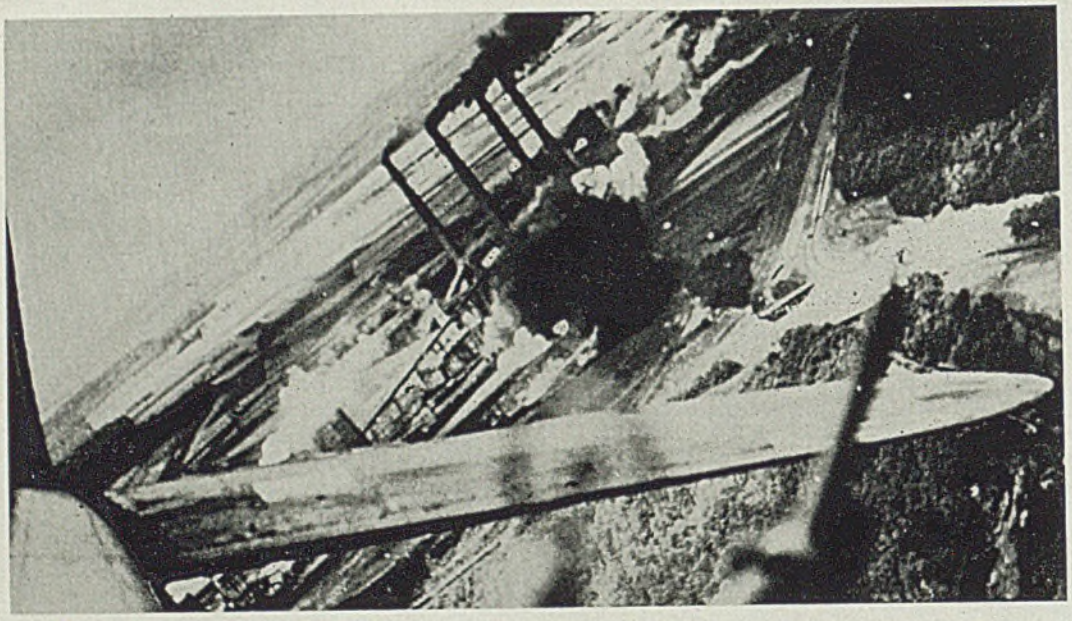
According to information received in London it seems probable that, in the face of their inability to prevent acts of sabotage, the Germans have now decided to close all, save perhaps two or three, factories in the Liege industrial area. Much of the plant facilities have already been sent to Germany. During the course of recent months sabotage resulted in destruction of locomotives, trains, ammunition trucks, power houses, electrical installations and transformers.

In France, the iron and steel distributor recently recommended that industrial undertakings be approached to insure the most economical use of iron and steel. Only the most indispensable repairs may in future be made to mechanical installations, and in view of the tight position of iron and steel supplies any question of new plant must be deferred.

This development is a very serious one for the French iron and steel industry which has hitherto enjoyed preferential treatment as regards raw materials with the result they have to a considerable extent escaped the effects of the present difficult situation, from which other industries have suffered.

One of the immediate effects of the victory in Tunisia is the resumption of shipments of iron ore to Britain. Up to the end of April about 100,000 tons from French North Africa had been shipped to Britain. Details are lacking as to developments since that date.

The financial aspect of the British steel industry since the commencement of the war has recently been dealt with in a White Paper issued by the government regarding sums granted for services and the ministry of supply. After introduction of protective duties in 1932 the industry was reorganized with the assistance of the Import Duties Advisory Committee. A policy of stable prices was adopted, framed to give a reasonable profit at a normal average rate of production somewhat below full working capacity. The committee was in process of extending price regulation to the lighter products when the war began. The prices approved by the committee were generally accepted for government



Darting down out of the clouds to within 100 feet of the ground, planes of the RAF bombing command drop deadly bombs on a vital power plant at Cologne, Germany. This scene is typical of the havoc and destruction wreaked on German Industries. NEA photo

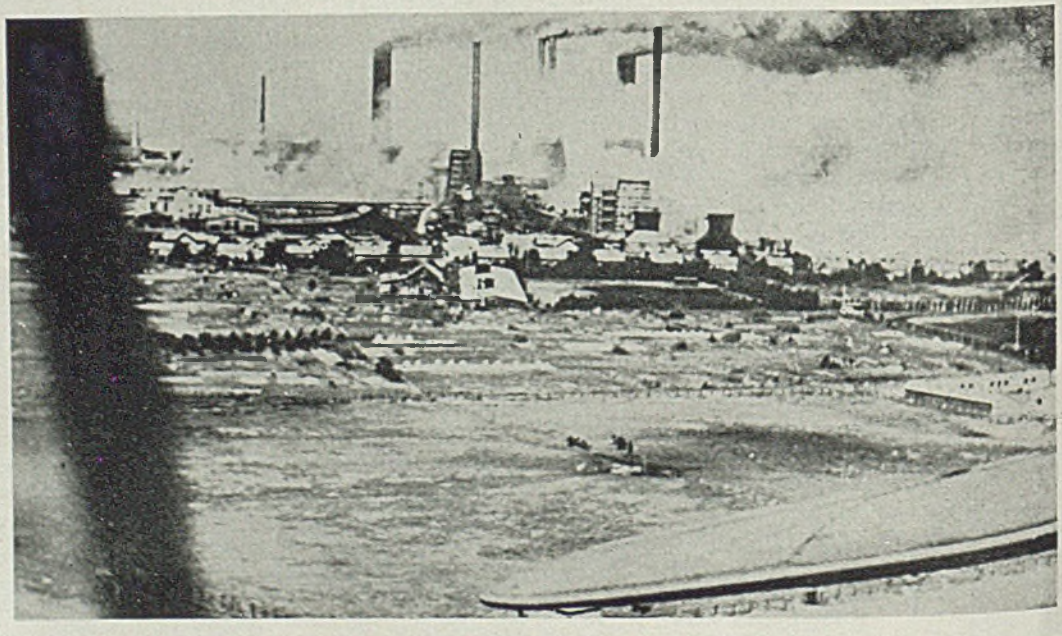
contracts, but in September 1939 the position was changed by the statutory control of the industry with the minister of supply fixing maximum prices for many products.

The latest arrangements stabilized controlled prices as of Nov. 1, 1940, in the face of rising costs, and to maintain in production high-cost essential firms. Grants are made to these high-cost producers; these grants do not affect the control prices paid by the consumer. Government contracting departments accepted in prewar days 10 per cent on the capital employed as a general guide for fixing a profit rate on normal contracts, but with the progress of the war the tendency was to bring the rate down towards seven and a half per cent per year. In certain cases the ministry is arranging to effect reductions in profits where the return on capital is considered to be excessive. Firms manufacturing heavy products, such as pig iron, billets, plates, rails and sheets are subject to a continuous investigation of costs by the investigating accountant.

More Capital Employed

The return on capital for the heavy steel industry (including sheets) was 10.5 per cent in the prewar standard period 1936-37, and 9.6 per cent after allowing for grants from the prices fund in the war year investigated, which covered broadly a period before the stabilization policy had affected the position. The corresponding figures for the industry as a whole are 12 per cent and 13.4 per cent. The capital employed in the war period is 50 per cent higher than in the prewar standard period. The prices fund, established to maintain essential firms in production, receives allocations from the central fund. Total payments from the fund to March 31, 1942, amounted to £2,827,450. From these investigations and their conclusions, it is clear that the government maintains a close scrutiny on iron and steel costs. It is generally agreed among producers and consumers that the price stabilization scheme has worked satisfactorily.

The supply position generally remains satisfactory. Demand has shifted somewhat owing to changing needs of the various government departments, admiralty, ministry of supply, etc., but the need for raw material and finished products is just as urgent. An improvement in the flow of semifinished steel has relieved the anxiety of rerollers who a few months back were becoming concerned at the inroads into stocks. The change has been brought about by larger outputs from British works and the welcome ar-



This is a view of the great Knapsack Power Station at Cologne, photographed from an RAF Blenheim bomber as it banked to race to the target in a daylight raid. Planes flew at height of 100 feet to make the bombing more accurate. NEA photo

rival of small but useful tonnages from the United States. Heavy pressure for plates comes primarily from the shipbuilding industry. Added to this is the increasing tonnage wanted for armaments and locomotive building. Contracts placed now for plates will probably not be delivered before last quarter.

In addition to direct war needs the steel industry is supplying much material for mining, where increased output means closer attention to maintenance and replacements and the speeding up of the mechanization process. Distribution of pig iron continues under the strict supervision of the Control but supplies are being maintained for all essential work. Many of the foundries are engaged 100 per cent on war work. The concentration scheme having been abandoned, foundrymen who are in a position to take on government contracts are adding to their orders, and the outlook for the light castings trade is brighter than it was a few months ago. The steel scrap position is satisfactory. At the inauguration of a London salvage drive recently, Lord Portal stated that iron and steel scrap was being collected at the rate of 110,000 tons a week or nearly five and three quarter million tons a year.

Discussions with the Board of Trade are taking place in regard to the reorganization of the Welsh tin plate industry. A redundancy scheme has been proposed, but has not been accepted by the trade as a whole, and the feeling among makers is that the government should be pressed to give all possible assistance to insure that the industry gets back into its stride as soon as possible after the end of the war, especially as the present unsatisfactory state of the trade has been brought about by the virtual prohibition of exports and by the controls and restrictions which have been found necessary. It is therefore hoped that the government will be able to take an active part in reaching agreement with United States authorities for postwar trade, whereby the Welsh and American tin plate producers come to some satisfactory arrangement over their export trades.

Present, Past and Pending

■ PLANS TO STUDY BRITISH WARTIME ECONOMY

WASHINGTON—Eric A. Johnston, president, United States Chamber of Commerce, will visit England early in August at the invitation of the British government and the British National Committee of the International Chamber of Commerce to study British economic processes as they operate under wartime pressures.

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■ RELEASE 4500 SOLDIERS TO MINE COPPER AND ZINC

WASHINGTON—The War Department at the direction of the Office of War Mobilization authorized release from active military service of 4500 men whose previous experience qualifies them for employment in mining copper, zinc, and molybdenum. Success of the military supply programs for 1943 and 1944 is jeopardized by growing shortage of these metals.

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■ LEND-LEASE TOTALS $1,030,000,000 IN JUNE

WASHINGTON—Lend-Lease aid during June totaled $1,030,000,000, E. R. Stettinius Jr., Lend-Lease administrator, announced. Munitions transfer totaled $570,000,000, industrial items $237,000,000, foodstuffs $147,000,000, and services $76,000,000.

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■ IRON AND STEEL DIVISION, WPB, REORGANIZED

WASHINGTON—Production section of the Steel Division, War Production Board, has been reorganized and now consists of eleven branches under Jesse V. Honeycutt, assistant director for production. Three branches under the former Production Section have been abolished while the other old branch has been merged into ten new branches.

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■ BYRNES SAYS INCREASE IN CIVILIAN GOODS POSSIBLE

WASHINGTON—War Mobilization Director James F. Byrnes last week expressed the opinion that the possibility of releasing more supplies for civilian goods exists. He tempered the statement by adding that the chance for an increased flow of goods to the home front was "a hope and not a prediction."

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■ CHANGING WAR NEEDS CLOSE ORDNANCE PLANTS

WASHINGTON—Eight ordnance plants of the Army in various sections of the country have been placed in standby condition, closed, or their completion cancelled, because of changing war and lend-lease needs, the war department has informed the House Military Affairs Committee.

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■ GOVERNMENT PLANT HOLDINGS HUGE

WASHINGTON—Secretary of Commerce Jones last week revealed the government owns industrial facilities representing an investment of $25,000,000,000, and said these industries would aid rebuilding the national economy if effectively allocated to private industry after the war. Government capacity in aluminum is greater than total private capacity; in magnesium it owns about 8 per cent of total facilities. Its largest investment is in aviation.

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■ MACHINE GUN USES PLASTIC BULLETS

CHICAGO—A machine gun for training purposes, which uses low-cost plastic pellets instead of regular bullets, has been developed by the Edison General Electric Appliance Co.

Complete Maintenance Shop At Geneva Steel Works

The maintenance shop at the Geneva Steel works near Provo, Utah, has been completed, the Columbia Steel Co., United States Steel Corp. subsidiary, announced.

Artificial lighting is employed in the building which is 600 feet long and does not have windows. Seven overhead cranes and two rows of "fixit" machinery are located on each side of a concrete aisle. A combination air-cooling and heating system has been installed.

Class I Railroads List 1024 Locomotives on Order

Class I railroads on July 1, 1943, had 31,744 new freight cars on order and 1024 new locomotives, which included 506 steam locomotives, 5 electric, and 413 diesel, the Association of American Railroads reported last week.

On the same date last year 39,530 freight cars and 917 locomotives were on order. During the first six months of 1943, the class I railroads placed 9415 new freight cars into service, compared with 48,769 in the like period last year. They also put 293 new locomotives in service in the first half of this year, compared with 365 in the like period in 1942.

Early Government Action Expected As Supply Problem Looms for 1944

Current year's requirements thought likely to be satisfied but close squeeze seen next spring. . . Steel Division, WPB, analyzing reports from producers to determine procedure over coming months

PITTSBURGH

STEEL producers here are anticipating early action by the War Production Board on questions involved in providing an adequate supply of metallics for the critical year—1944.

It is hoped that the present year's supply of metallics in the form of ore, scrap, sinter and minor materials will hold out through the season. A close squeeze is seen next spring, however, inasmuch as it will be necessary to melt some stock late in 1943 which should be held in reserve for 1944.

The question of weather is involved to a great degree since this will be the controlling factor on ore tonnage brought down the lakes during the remainder of 1943.

Producers have submitted reports on their situation to the Steel Division, WPB, and when this information is assembled, some decision will have to be made regarding programs for supplying additional metallics.

Included is a question of possible sintering capacity to make use of vast stores of blast furnace flue dust which have accumulated over the years and which are available for use as charging material if it can be properly prepared.

The problem of beneficiation of ores at the source is also tied up in this situation to a great degree. Programs for beneficiation of eastern ores are making satisfactory progress, but the volume involved is small and the ores are specialized and will be used primarily in the production of highest grade steels.

Reserves and Waste Surveyed

Mining companies in the Lake Superior region have made extensive studies of the fines, the ore reserves and the discarded waste from previous operations with the idea in mind of establishing a possible maximum tonnage flow figure based on beneficiation of all available material.

The future practices of the industry are concerned to a considerable degree. For example, if Lake Superior ores are beneficiated at the source, this will cut down considerably the volume of flue dust produced; in some cases might eliminate it entirely. This means that any sintering plants built to process blast furnace flue dust would ultimately be left with little or no material.

While some companies have been using this material consistently, others have used very little of it. Total stocks available now in the country may run as high as seven million tons. Obviously it is not economically sound to build expensive sintering plants using critical steel to process this volume of flue dust if there is a question as to the usefulness of such equipment after present stocks of this material have been exhausted.

Program Completion Uncertain

Furthermore, the entire question of metallic supplies must be considered by WPB in its determination of whether to use critical steel for the construction of such plants at this time. If by so doing the apparent shortage in steel supply of two million tons during the last half of 1943 can be eliminated, the sintering program may well be carried to completion. Authorities here, however, feel that the projected program could not possibly be completed in 1943 and full scale operations probably would not be possible until spring of 1944.

On the other hand, the spring of 1944 is expected to bring the heaviest pinch of all in the iron ore supply program as a result of the late spring this year. The heavy consumption, as mentioned above, is expected to result in the use of some 1944 stocks in the final months of 1943.

The millions of tons of blast furnace flue dust which are piled at blast furnace centers throughout the country are readily available. They would require little transportation to bring them to the point of consumption and the mining operation consists simply of a power shovel moving into the pile in an operation very similar to open pit mining.

Analyses of flue dust which has accumulated over long periods of time show that only minor chemical changes have taken place as a result of atmospheric conditions and weathering. Some samples have shown a lowering of the carbon content and a tendency toward reversion of the dust to its original form of ore.

Total Tin, Terne Plate Output Dropped in 1942

Production of tin and terne plate in 1942 is estimated by American Bureau of Metal Statistics at 2,658,000 short tons, representing a drop of over 25 per cent from the preceding year. These totals do not include production figures for long terne plate which were 144,568 tons in 1942 and 236,331 in 1941.

Of the 1942 total, tin plate accounted for 2,487,500 tons and terne plate for 144,568 tons. Tin plate output included 2,400,600 tons as hot dipped and 86,900 as electroplate.

Republic Steel Corp. executives examine a Stinson airframe at the company's "Production for Victory" exhibit at Canton, O. Left to right are C. M. White, vice president in charge of operations; R. J. Wysor, president, and T. M. Girdler, chairman of the board

Share the Steel Campaign Gains

Cancellations now total 320,000 tons and may range up to 700,000. Ingot output increasing

FURTHER substantial tonnages of steel on mill order books have been canceled in the "Share the Steel" campaign, the War Production Board reported last week as the "Steel for Victory" drive picked up momentum.

Latest official reports indicate 320,000 tons of steel on order books have been canceled by consumers. Of this amount about 80 per cent is for third quarter and the remainder for fourth quarter.

Also it is understood about 80 per cent of the total is carbon steel and 20 per cent alloy steel.

War Production Board Steel Division officials in charge of the "Share the Steel" campaign believe cancellations amount to much larger tonnage than officially reported because available figures are two weeks late.

Actually, there is uncertainty as to just what tonnage of steel on mill books has been canceled to date. One important official of the Steel Division stated last week that, nationally, 700,000 tons have been canceled so far. It is difficult, however, to reconcile this figure with information obtained from the mills. One important producer, for instance, is unable to point to any cancellations known to result so far from the "Share the Steel" campaign.

On the other hand, a second producer reports it has had some cancellations and expects more. Still another interest has received many cancellations, but none that can be attributed directly to the "Share the Steel" program. One leading producer reports heavy cancellations, but is unable to break them down to determine whether or not they are due to the "Share the Steel" plan.

The War Production Board has investigators in the field seeking out excess inventories and it is felt that some war contractors are canceling as a matter of self-protection and at the same time are unwilling to give their reason for wiping tonnage off mill books.

Steel industry executives and officials of the Steel Division, War Production Board, estimate between 200,000 and 250,000 ingot tons of production were lost because of the recent coal strike.

Ingot production has recovered at Pittsburgh following the return of the striking coal miners to the pits. The steel operating rate at Pittsburgh rose five points to 98 per cent of capacity. Several idle blast furnaces resumed blowing, but necessity for furnace repair is causing delay in return of several stacks to production.

The coal situation has returned to approximate normality although discontent still simmers.

Coal operators are watching with considerable interest two developments: One, the grand jury investigation in Pittsburgh as to violations of the Connally-Smith Antistrike law and the other, a legal effort on the part of former Senator Burke, counsel for southern coal operators, to determine the legality of portal-to-portal pay for the members of the United Mine Workers. The grand jury indicated it means business last week indicting a man and his wife on charges of attempting to intimidate a witness.

Practically all beehive coke ovens which have been idle as a result of strikes have now returned to production.

John L. Lewis, United Mine Workers' chief, gave the coal dispute a new twist last week when he reached an agreement with Illinois operators to give the miners an additional $2.75 per day—$1.25 for underground travel pay and $1.50 for an extra hour of work at an overtime rate. The contract is contingent upon War Labor Board approval and a coal price adjustment by the Office of Price Administration. The wage increases would necessitate a price rise of 35 cents per ton.

United States attorneys have opened proceedings in a grand jury investigation of the coal strike difficulties in the Pittsburgh district. Left to right, Henry Schweinhaut, Irving Hill, both special assistants to Attorney General Francis Biddle, and Charles F. Uhl, federal district attorney. NEA photo

Coal Production Must Be Pressed

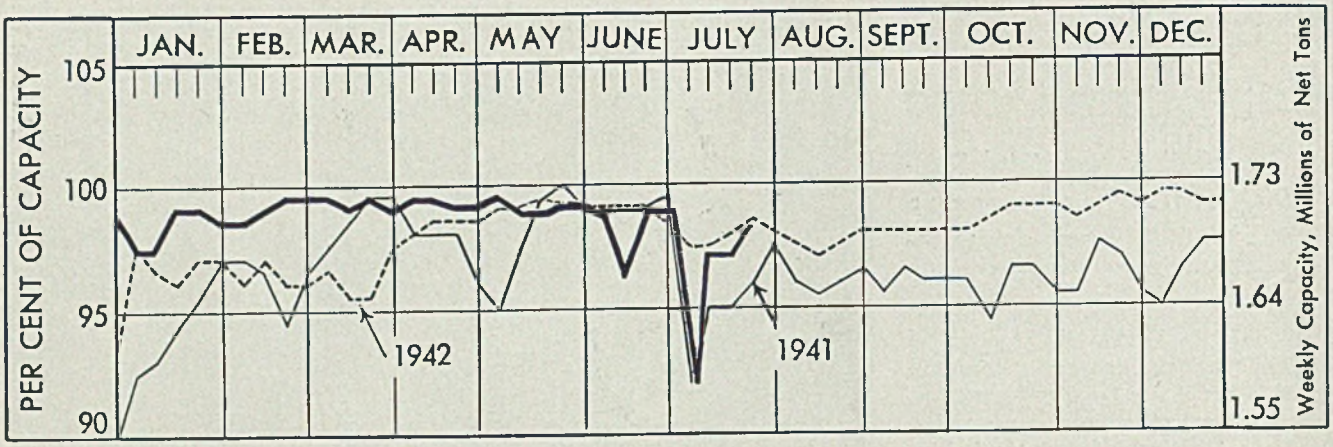
"PRODUCTION is the No. 1 task of the coal industry during the remainder of 1943," declared Thomas J. Thomas, director of production, Coal Mines Administration, last week, addressing the coal mine war conference of the American Mining Congress in Cincinnati.

He pointed out that 1943 coal production through July 3 totaled 320,445,000 tons, and that production requirements this year were earlier estimated at 600,000,000 tons of bituminous coal and 65,000,000 tons of anthracite.

"We cannot for a moment forget that this is a total war—involving all of us—all of our resources, all of our strength, all of our talents," said Charles M. Hay, counsel, War Manpower Commission.

Mr. Hay outlined the problems confronted in securing men for essential war industries, and stressed that successful distribution of labor would depend on the solution to the problems of price control.

He estimated that we must have 11,300,000 persons in the military service by July 1944, and that the latest estimates with respect to the manpower needs were: munitions industries, 11,600,000; other non-agricultural industries, 30,000,000; agriculture, 12,000,000; making the total estimated manpower requirements by July 1944, 64,900,000.



STEEL INGOT PRODUCTION BY MONTHS

Net Tons, 000 omitted

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1943	7,424	6,826	7,670	7,374	7,545	7,027	....	....	....	....	....	....
1942	7,112	6,512	7,392	7,122	7,382	7,022	7,148	7,233	7,067	7,584	7,184	7,303
1941	6,922	6,230	7,124	6,754	7,044	6,792	6,812	6,997	6,811	7,236	6,960	7,150
PIG IRON PRODUCTION												
1943	5,194	4,766	5,314	5,035	5,178	4,836	....	....	....	....	....	....
1942	4,983	4,500	5,055	4,896	5,073	4,935	5,051	5,009	4,937	5,236	5,083	5,201
1941	4,666	4,206	4,702	4,340	4,596	4,551	4,766	4,784	4,721	4,860	4,707	5,014

June Pig Iron Sags

Coal strike and relining factors in reduced tonnage. First half total sets record

PIG IRON production in June was at the lowest rate during 1943 or 1942, according to the American Iron and Steel Institute. Percentage of capacity engaged in June was 92.8, compared with 96.2 in May and an average of 96.5 for the year to July 1.

Total production in June was 4,836,283 net tons, compared with 5,177,728 tons in May and the peak of 5,314,201 tons in March. The June output was composed of 4,786,944 tons of pig iron and 49,339 tons of ferromanganese and spiegeleisen.

First half production totaled 30,343,443 tons, which exceeds the comparable period in 1942 when 29,445,945 tons were produced, and sets a new record for that period.

Two factors are involved in the falling off in tonnage in June, the effect of coal stoppage, which caused numerous blast furnaces to be banked, and necessity for relining stacks which had been pushed heavily for many months. The June tonnage was only slightly larger than February tonnage.

District	Pig iron	Ferro, spiegel	Total June	Total Year to date	Per cent capacity
Eastern	931,825	14,830	946,655	5,709,411	89.4
Pittsburgh-Youngstown	1,909,493	17,952	1,927,445	12,565,643	91.0
Cleveland-Detroit	501,336	....	501,336	3,061,107	99.5
Chicago	1,071,283	....	1,071,283	6,452,409	99.5
Southern	308,039	12,359	320,398	2,112,282	88.0
Western	64,968	4,198	69,166	442,591	74.1
Total	4,786,944	49,339	4,836,283	30,343,443	92.8

DISTRICT STEEL RATES

Percentage of Ingot Capacity Engaged in Leading Districts

	Week Ended July 24	Change	Same Week 1942	Same Week 1941
Pittsburgh	98	+5	94.5	100
Chicago	99.5	None	102.5	100
Eastern Pa.	93	None	96	95.5
Youngstown	95	—2	95	98
Wheeling	89	—1	80.5	93
Cleveland	96	+2	96.5	96
Buffalo	93	None	93	93
Birmingham	95	None	95	90
New England	95	None	93	85
Cincinnati	85	—7	92	85.5
St. Louis	92	—5	95.5	98
Detroit	90	None	85	88
Average	98	+1	°98.5	°96.0

°Based on steelmaking capacities as of these dates.

Bearing Output Reported 25 Per Cent Below Capacity

Production of bearings used in all types of machines where friction is developed can be increased 25 per cent without extending manufacturing facilities, members of the Bearing and Bushing Industry Advisory committee report to the War Production Board.

They point out that the increase could only be assured contingent upon steel requirements of the industry being met by steel mills.

Ingot Rate 98%

Operations gain as strike effects fade. More blast furnaces are blown in

PRODUCTION of open-hearth, bessemer and electric furnace ingots last week advanced 1 point to 98 per cent of capacity. Two districts gained, four declined and six were unchanged. A year ago the rate was 98½ per cent; two years ago it was 96 per cent, both based on capacities as of those dates.

Greatest factor in the advance was a gain of 5 points at Pittsburgh, where effects of the coal stoppage had been most keenly felt. Necessity for furnace repairs caused small declines at several other centers.

Carnegie-Illinois Steel Corp. last week blew in a new 1300-ton blast furnace at its Edgar Thomson works and also relighted its No. 3 furnace at Clairton, Pa., after relining. Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., has blown out its No. 1 furnace for relining after a campaign of six years and three months on foundry iron.

Granite City Steel Co. Increases Ingot Capacity

Steel ingot capacity of Granite City Steel Co., Granite City, Ill., will be increased by approximately 70 per cent by the new $12,000,000 plant being constructed for the Defense Plant Corp. The plant, which is nearing completion, will roll the bulk of the additional ingots into plates for the shipbuilding program.

All Branches of Steel Industry May Adopt War Hours Aug. 1

General Order No. 8 requires that employes released through the increased work hours shall be available by Aug. 1, and WMC anticipates about 50,000 such workers. Temporary exemptions becoming harder to secure

EXPECTATIONS are that all branches of the steel industry will go on the 48-hour work week, effective Aug. 1. Further modification of the regulations by Manpower Commissioner McNutt now is not expected.

Under general order No. 8, plants which could not obtain a minimum wartime work week of 48 hours by July 1 were required to submit by that date a release schedule indicating when workers made available by increased work hours could be released. Instructions now before the industry, and which become effective Aug. 1, require that workers released under the provision must be so released by this date, other than exceptional cases requiring special approval.

Regional directors may grant temporary exemptions only for reasons beyond control of the employer, and only as long as the circumstances on which the exception was granted continue to exist. The effect of the order, according to the War Manpower Commission, will be to make available the equivalent of 50,000 additional workers to the labor force on Aug. 1. Text of the instructions follows:

"Applications for approval of proposed hirings shall be so submitted and the consultation thereon shall be conducted as to assure that the filling of essential employment needs will not be delayed. Approval of proposed hirings under section 5 of the order may be for groups of workers. In granting such approval under section 5 of the order, the regional director shall require full information as to the specific jobs and departments for which the hirings are to be made, and shall satisfy himself that the employment needs for such jobs and departments could not be satisfied by the utilization of other workers in the establishment who are not working on the basis of the minimum wartime work week."

MAPI Research Staff To Study Economic Problems

Funds for establishment of a research staff to study the economic problems of the capital goods industries and economic policies, public and private, have been contributed by member companies of the Machinery and Allied Products Institute, William J. Kelly, president of the group, recently announced.

The research staff is under direction of George Terborgh. Bulletins of the findings of the staff will be prepared and issued under the direction of the secretary, Oscar Kiessling. They will be published at irregular intervals, depending on the progress of the work of the research staff.

SMALL PLANTS

Approximately 60 per cent of all small manufacturing plants are engaged in war production and about 40 per cent of their combined output represents war materiel, the Commerce Department estimated after a survey of small industries throughout the nation.

Value of war output in January, 1943, was 16 per cent greater than it was two years ago. About 71 per cent of the firms interviewed reported they could increase output while about one-third of them said that they could double production.

Some 60 per cent of the firms said they were plagued with manpower and material shortages. The survey revealed that 27 per cent of the small plants, employing from one to 125 workers, hoped 1943 business prospects would be better and an equal number had a pessimistic outlook, whereas, 24 per cent said the picture would be unchanged.

ACTIVITIES . . .

Farris Engineering Co., Ridgefield, N. J., announces formation of a new division to handle valve repairs. Facilities include complete testing apparatus.

—o—

Ohio Crankshaft Co., Cleveland, announces appointment of five machine tool dealers as special sales agents. They are: Strong, Carlisle & Hammond Co., Cleveland; Syracuse Supply Co., Syracuse, N. Y.; William K. Stamets Co., Pittsburgh; E. A. Kinsey Co., Cincinnati; R. R. Stephens Co., St. Louis.

—o—

Willys-Overland Motors Inc., Toledo, O., announces that in less than two years monthly production of aluminum aircraft forgings at its plant climbed from nothing to 1,000,000 pounds. Total output since Pearl Harbor is more than 7,000,000 pounds.

Coke Producers May File For Price Adjustments

Coke producers were granted relief last week through OPA authorization to file for adjustment in maximum prices when receipts from entire production at ceiling prices fall short of production costs. This was provided in amendment No. 20 to price regulation No. 121.

Certain Frozen Inventories Of Metal Parts Released

Certain frozen inventories of fabricated metal parts were released last week by WPB to preclude putting corresponding quantities of similar items in new production for replacement purposes. Inventories affected are those made of copper, copper-base alloys, steel and other metals which were held prior to May 31.

Woodward Iron Has First Half Net of $552,098

First half net income of Woodward Iron Co. totaled $552,098, or $1.64 per share on capital stock. This compares with $330,784, equal to 98 cents per share, in like 1942 period.

Based on first quarter report indicated earnings for the June quarter amounted to $300,283, in sharp contrast with indicated deficit of $66,553 for comparable period a year ago.

Continental Steel Earns $334,338 in First Half

Continental Steel Corp., Kokomo, Ind., reports first half net profit of $334,338, equal to $1.49 per share on capital stock. In like 1942 period the company earned $403,747, or $1.70 a share.

Second quarter profit amounted to $216,179, compared with $118,159 in the preceding period and $234,410 in corresponding quarter a year ago.

Net sales for the first half year aggregated $11,042,426, against $12,081,454 in comparable 1942 period.

Cease and Desist Order Against Cement Industry Issued by FTC

Ruling viewed as possibly holding implications for other industries in which basing point pricing systems are in vogue. . . Delivered price plan held discrimination among trade's respective customers

FURTHER use of the multiple-basing-point system in the cement industry was barred last week by the Federal Trade Commission in a cease and desist order against the Cement Institute and 75 cement manufacturers.

The order, No. 3167, grew out of a complaint originally filed against the Castalia Portland Cement Co., Pittsburgh.

While the cease and desist order specifically applies to cement, it is viewed in some quarters as holding implications for other industries in which basing point pricing systems are in vogue.

In the cement case, the FTC order states about 150 cement mills are in operation in the United States under ownership of approximately 80 companies.

The commission's order instructs the Cement Institute and its member companies to cease "engaging in or continuing any combination or conspiracy to sell cement at prices arrived at by use of their multiple-basing-point delivered-price system. The commission finds the respondents' practices constitute unfair methods of competition, in violation of the Federal Trade Commission act, and their delivered-price system results in discrimination in price among their respective customers, in violation of the Robinson-Patman Act."

Claims Two Prices in Effect

About half of the cement mills have base prices and are termed base mills; the rest are known as non-base mills. The non-base mill sells at the lowest combination of base price plus freight from the base mill. The respondent mills, the commission holds, have maintained certain arbitrary variations as to basing points, and in some cases have two base prices in effect simultaneously, each applicable in different territory.

Identical delivered prices at any given location by all sellers are the inevitable result of the formula's operation, provided the same freight factor be used by each seller. The FTC findings show that for many years various regional cement associations published special freight-rate books so their members might avoid using different rate factors and thus quoting varying prices. Also, when quoting on a government agency order where land-grant freight rates apply, bidders filed an identical "Government Destination Cost" form which required the government to subtract the actual land-grant rate thus avoiding an appearance of identical bidding.

The commission summarizes what it terms harmful effects of these alleged unfair practices about as follows: They have restrained and suppressed competition in sale and distribution of cement; deprived purchasers of the price benefits of competition; systematically maintained artificial and monopolistic prices; prevented purchasers from obtaining benefits which might accrue from use of trucks, water carriers, and other transportation agencies.

STEEL Index Ready

The index to Volume 112, STEEL, *for the first six months of* 1943, *is ready for distribution. Copies will be sent to all subscribers requesting them.*

The FTC orders cessation of these practices by the Cement Institute, its member companies, and the officers and agents of either or both, in a list of "desists." Respondents are ordered to abandon the following practices:

1. Quoting or selling cement at prices calculated or determined pursuant to or in accordance with the multiple basing-point delivered-price system; or quoting or selling cement pursuant to or in accordance with any other plan or system which results in identical price quotations or prices for cement at points of quotation or sale or to particular purchasers by respondents using such plan or system, or which prevents purchasers from finding any advantage in price in dealing with one or more of the respondents against any of the other respondents.

2. In connection with or in aid or support of any plan, system, acts, or practices prohibited in paragraph 1 above

(a) Refusing or declining to quote or sell cement at the location of the producing mill at a price effective at such location.

(b) Refusing or declining, when quoting or selling cement at a price effective at the location of the producing mill, to allow purchasers to provide transportation by any means, at any cost, or to any place they may desire.

(c) Quoting or selling cement at f.o.b. mill prices calculated by deducting actual common-carrier transportation charges from delivered-price quotations or delivered prices which are equivalent to the sum of the base price at, plus common-carrier transportation charges from, any point other than the actual shipping point.

(d) Quoting or selling cement ostensibly at f.o.b. mill prices, but which prices, plus common-carrier transportation charges to purchasers' destinations, are systematically equivalent to identical delivered costs to such purchasers from differently located mills.

(e) Quoting or selling cement at delivered prices calculated as or systematically equivalent to the sum of the base price in effect at, plus common-carrier transportation charges from, any point other than the actual shipping point.

(f) Quoting or selling cement at delivered prices which systematically include a common-carrier transportation factor greater or less than the actual cost of such common-carrier transportation from the point of shipment to destination.

(g) Quoting or selling cement at delivered prices which systematically include a freight factor representing transportation by a common carrier having higher rates than the means of transportation actually employed.

(h) Quoting or selling cement at destination-cost figures accompanied by a requirement that for invoicing purposes the f.o.b. mill price shall be determined by making specified deductions from said destination cost figures.

(i) Quoting or selling cement to any instrumentality of the federal government in a manner or upon terms which deprive the government of all or any part of the benefits of land-grant or other special common-carrier rates to which it may be lawfully entitled.

Bans Use of Rate Information

(j) Collecting, compiling, circulating, or exchanging information concerning common-carrier transportation charges for cement used or to be used as a factor in the price of cement, or using, directly or indirectly, any such information so compiled or received as a factor in the price of cement.

(k) Controlling or attempting to control the destination or use of cement after the acquisition of title thereto by the purchaser.

(l) Determining upon any basis for the selection or classification of customers,

or using any basis so determined for selecting or classifying customers.

(m) Determining upon the projects or types of projects for which, or the purchasers or classes of purchasers to whom, sales of cement will or will not be made directly by respondents.

(n) Collecting, compiling and circulating, or exchanging statistical data which reveal the individual production, stocks, sales, or shipments of cement of any corporate respondent to other corporate respondents.

(o) Maintaining any form of espionage for the purpose of determining whether or not their customers purchase or deal in imported cement; or discontinuing or threatening to discontinue sales of cement to customers because they purchase or deal in imported cement.

(p) Determining upon any discounts, package charges or refunds thereon, or other terms or conditions of sale, or using any discounts, package charges or refunds thereon, or other terms or conditions of sale so determined.

3. Discriminating in price between or among their respective customers by systematically charging and accepting mill net prices which differ by the amounts necessary to produce delivered costs to purchasers identical with delivered costs available to such purchasers through purchases from other respondents.

4. Using any means substantially similar to those specifically set out in this order with the purpose or effect of accomplishing any of the things prohibited by this order.

Full Import Not Yet Clear

While the cement order is viewed as possibly setting a precedent in the matter of basing point pricing practices the full import of the decision remains to be determined.

In the case of the steel industry its pricing practices have been under attack at various times in the past but in the last year or two little complaint has been heard against the pricing system now in vogue.

"Pittsburgh plus" practice of pricing was discontinued in the steel industry in the 1920's. This practice calculated delivered prices on the basis of the quoted f.o.b. Pittsburgh price with the addition of railroad freight from Pittsburgh to the buyer's location regardless of where the steel was produced.

Since abandonment of Pittsburgh plus, for that matter even before then, other basing points at the various producing centers have been established by the industry and since then pricing practices have been further modified through elimination of differentials between basing points and other factors which gave Pittsburgh alleged advantages in pricing.

New Procedures Governing Sales of Steel and Copper Issued by WPB

SUBSTANTIAL changes in procedures governing sales of steel and copper by warehouses and distributors were effected last week by a revision of Controlled Materials Plan regulation No. 4.

A distributor now may refuse any order for steel, including an authorized controlled materials order, which does not call for immediate delivery. Orders calling for immediate delivery which must be filled include authorized controlled materials orders, orders from farmers under provisions of Priorities Regulation No. 19 and orders bearing preference ratings of AAA.

Small orders for steel may be filled without authorization, provided delivery will not cause any one customer to receive at all points and from all sources in any one quarter more than 10 tons of carbon steel, 1000 pounds of stainless steel and 2 tons of other alloy steel.

A distributor may now deliver up to 56,000 pounds of steel rails to any one person at any one destination. The original limitation of 40,000 pounds of all other steel products which may be so delivered remains in effect. Definition of "individual items" in this connection has been tightened to provide that a product, to be considered different from another product, must differ in specified quality or cross section.

All deliveries of brass and wire mill products are banned after Sept. 30, except to fill authorized controlled materials orders. Until that time, a warehouse may fill from stock orders for these products bearing preference ratings of AA-5 or higher, up to 2 per cent of the total quantity of products shipped during the second quarter of 1943.

Previous prohibition against ordering from warehouse stocks brass mill products aggregating more than 2000 pounds of copper content remains but wire mill products now may be accepted up to 3000 pounds monthly.

Wider Use of Electrolytic Tin Plate Ordered by WPB

Can manufacturers are directed by War Production Board to use electrolytic tin plate, with a maximum coating weight of 0.50 pounds per single base box, exclusively in manufacture of cans for a large number of food products beginning Sept. 30 and thereafter. A saving of approximately 6000 tons of tin a year is anticipated.

Increased canning of specified foods is made possible under an amendment to conservation order M-81 but this will be offset by reduced packs of other fruits and food products.

Can manufacturers were permitted previously to use 1.25 pounds hot dipped tin plate, if 0.50 pound electrolytic tin plate were unavoidable. Within a few months the production of 0.50 electrolytic tin plate is expected to have increased to a point where all requirements can be met, as several new mills will be in production by that time.

Another requirement, effective Sept. 30, provides for the use of 0.75 electrolytic tin plate instead of 1.25 hot dipped tin plate in manufacture of cans used for condensed and evaporated milk, goat's milk, soybean milk and milk formulas.

Effective immediately, manufacturers are directed to use 0.50 electrolytic tin plate or chemically treated black plate to the greatest extent available, instead of 1.25 hot dipped tin plate in manufacturing cans for some additional products including cherries and soups.

Restrictions Relaxed on Output of Household Items

Restrictions on production of certain household articles contained in order L-30-d have been eased by the War Production Board. Whether production reaches the specified top limits, however, depends upon the amount of critical material available after the war programs have received their necessary requirements.

Clarifies Ruling on Special Controlled Materials Sales

List A attached to Priorities Regulation 13 has been altered so as to provide that special sales of aluminum, copper and steel in controlled material forms may be made only to a person who could place an authorized controlled materials order for the item. This does not apply to steel reported as idle and excessive to the Steel Recovery Corp.

In this connection, the WPB Redistribution Division points out that because of the nature of the stocks of idle and excessive steel listed at SRC and because of the need to supplement quarterly allotments of steel, the WPB is prepared to permit the purchase of such material without requiring the buyer to count the steel bought against his current CMP allotment.

WINDOWS of WASHINGTON

Feud Not Ended

DESPITE earlier indications that the last had been heard in the Wallace-Jones feud in which Vice President Henry Wallace blamed Jesse Jones for delays in purchasing strategic minerals and other materials, it now is believed likely that the controversy may come up for at least some airing in Congress after the summer recess.

In relieving Wallace of the post of chairman of the Board of Economic Warfare, President Roosevelt returned Wallace to the sole status of vice president.

On the other hand, while Jesse Jones has been stripped of the United States Commercial Co., the Rubber Development Corp., the Petroleum Reserve Corp. and the Export-Import Bank of Washington, he still is Secretary of Commerce, is a member of the War Production Board and the Office of Economic Stabilization; he is chairman of the Defense Plant Corp., War Damage Corp., Defense Supplies Corp.; he remains head of the RFC Mortgage Co., Reconstruction Finance Corp., Federal Mortgage Association, Disaster Loan Corp.; and he goes on as a member of a dozen or so other boards and agencies.

In other words, whereas Henry Wallace loses his authority in the executive branch of the government, Jesse Jones continues a king pin in government circles and in war activities. A lot of Wallace's new deal friends resent this.

Stature Rises Rapidly

Inside report is that revelations so far made by the Truman Committee of alleged war frauds and of inefficiency and waste on the home front are as nothing compared with what is to come out in its hearings in coming months. From a slow start, this committee has come to be one of the outstanding ones in Congress. It has an active staff of investigators and able legal counsel and the accumulation and digestion of facts now is on a mass production basis. Hence the committee has an active schedule for development after Congress reconvenes on Sept. 14. Many politicians, particularly fourth term proponents, fear the committee's disclosures may become a major factor of campaign speeches in the 1944 election.

Another Rumor

Latest unfounded rumor going the rounds is that the Army is buying huge tonnages of rails and rolling stock for the rehabilitation of civilian facilities in French North Africa; also that it is procuring steel and other materials to rebuild bridges, power plants, water systems and so on. The rumor goes on to explain that by this method the administration is dodging bad publicity that probably would result if the Lend-Lease Administration were to handle procurement for such rehabilitation.

Careful check reveals the Army exports only such materials and equipment as are required for strictly military purposes.

GETS ACTION

Immediately after Gov. J. Melville Broughton of North Carolina requested the Boykin Committee (STEEL of May 31, p. 42) to encourage development of an iron and steel industry in that state, the entire congressional delegation from North Carolina called at the Bureau of Mines and asked that the bureau launch a statewide iron ore exploration program.

Result: Such a program is definitely on the bureau's schedule for the fiscal year 1943-1944. Results will be watched with interest for the reason that it is proposed to establish the North Carolina iron and steel industry on Herman Brassert's process for direct reduction of iron ore, "using," as Governor Broughton put it, "hydrogen gas or other low-cost fuel instead of coking coal."

According to state geologists North Carolina has upwards of 100,000,000 tons of suitable ore. Official report of the Bureau of Mines is wanted in order effectively to attract the necessary private capital.

Tin in Alaska

How much tin ore is available in Alaska? Nobody knows exactly, although it is known that territory does have a considerable tonnage. No efforts are being made to explore and develop these deposits during the emergency, the first and most important reason being the shortage of ships due to military requirements in the Pacific area. The second is the short summers and the long, cold winter seasons which set up special mining problems.

WPB officials point out that the tin situation continues as critical as ever, due in some measure to the fact that the labor situation in Bolivia raises questions over continuity of tin shipments from that country to the new smelter in Texas.

Really Severe

Senator William R. Langer states that he will introduce a bill after Congress reconvenes which will make it a treasonable offense, punishable by death, for contractors deliberately to defraud the government on vital military construction projects.

He is preparing such legislation, he said, because he has received reliable information that fraud and extravagance are costing the government millions of dollars on a certain Army project. Whereas cost of this project originally was estimated at $56,000,000, he said, actual cost is coming to $126,000,000.

"Hundreds of thousands of dollars worth of pipeline (were) laid defectively over unfit and untamped fills," he said, so that "gangs of workmen could dig them up again for relaying at additional cost." The contractor, he said, was doing the work on a cost-plus basis. Furthermore, he said, he had been advised that the contractor spent $5,000,000 for dirt removal which should have cost only $625,000 on the basis of prevailing rates in the area; purchased 1,000,000 pencils at nine cents each although their retail value was two for a nickel, and paid $41,000 for relaying a 24-inch water main after rejecting a $15,000 bid for the same job.

Anti-Racketeering

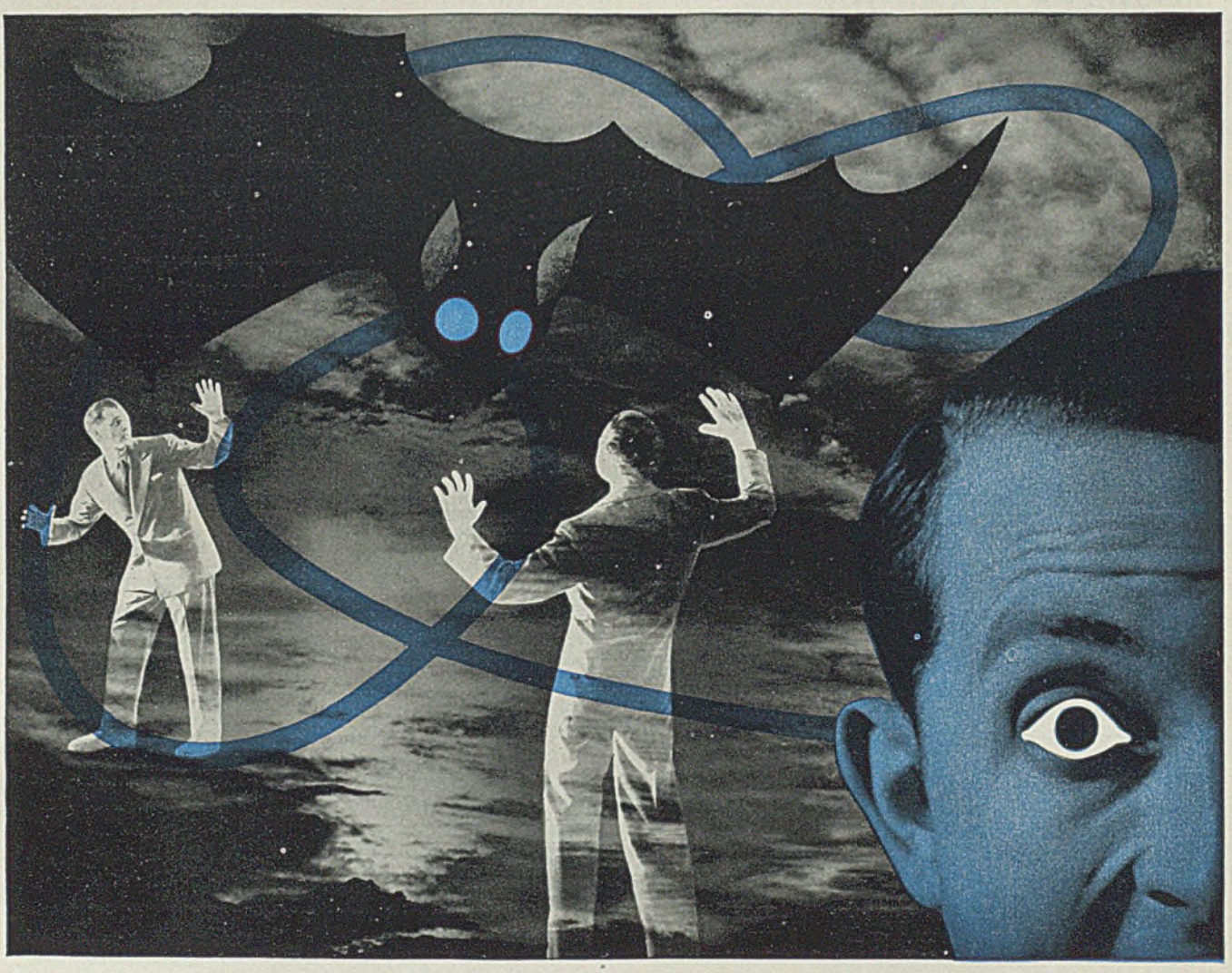
The Hobbs anti-racketeering bill, providing penalties of $10,000 fine and 20 years imprisonment for interference with interstate commerce by robbery and extortion, is far from dead. Passed by the House 270 to 107, the bill was delayed in the Senate by illness on the part of a Senate Judiciary subcommittee, chairman, Senator O'Mahoney (D. Wyo.).

Senator O'Mahoney now says that hearings will be begun on the proposed bill soon after Congress reconvenes on Sept. 14.

While the Hobbs bill makes no mention of labor, Representative Hobbs (D. Ala.) said he intended it as a counter to a Supreme Court decision last March 2 that labor organizations were not covered by the Anti-Racketeering Act of 1934. House approval of the bill was registered in the face of strong opposition by organized labor.

Air Travel Center

Washington rapidly is tending to become the country's leading air travel center, according to the Civil Aeronautics Board which says "more air-passenger traffic is being produced there than at any other city excepting New York and Chicago."



The creature no one knows...

IN THE HALF-WORLD between day and night, an eerie, sinister creature emerges from hiding. Its ancestry is unknown. It is the bat, the only mammal which flies. Of all the creatures known to man, bats are the most mysterious. They do not mate when other animals do. And no one knows where they go at migration time.

Yet bats are the most highly specialized mammals on earth. If we had the intricate ears of bats, we could hear an ant walking. If we had their incredible coordination, we could fly at the speed of a locomotive toward a telephone wire...at dusk...yet miss it! Or dash blindfold around hundreds of objects and not touch one!

But if you think that's specialization, listen to this: The production giant of the machine tool industry—Cone's multiple spindle automatic lathe—can do as many as 8 different jobs simultaneously...in a matter of seconds...or perform as many as 17 different operations on a part—more than one every two seconds—with the deftness of a master craftsman!

The prime task of Cone Automatic Machines today is to help speed war production. In the future, by making possible increased production, they will increase purchasing power...and so increase employment. As a result, Cone Automatics will make major contributions to social and economic gains of the future.

CONE Automatic Machine Company, Inc., Windsor, Vermont

Influence of Pressure Blocs on Government Policy Causes Concern

Increasing success of minority groups in obtaining special benefits from Congress and the administration serving to create atmosphere of gloom in some circles with respect to the shaping of peacetime course of action

WASHINGTON

MANY postwar planners, particularly those affiliated with planning groups and with trade and business associations concerned over government postwar policies, are in a deep state of gloom as a result of developments on the government front in recent months.

One of them remarks: "From the way things now are shaping up, it looks as though when the war is over it will be a case of every man for himself and the devil take the hindmost."

This atmosphere of gloom results from the increasing success of pressure blocs, both in Congress and the administration, in obtaining benefits for the minority groups with which they are identified. This contrasts with the view of most postwar planners that pressure blocs must give way to a unified drive to benefit the overall economy and thus improve the position of the farmer, labor, industry and the consumer, rather than of just one or more special groups.

Ask any member of Congress or the administration how he feels and he will reply that of course he is in favor of submerging pressure groups and of encouraging an approach that will help the public as a whole. Then question him a little further and you find that he has genuine reasons why the particular group with which he is affiliated deserves special consideration of one kind or another.

Silver-Bloc Successful

The recent success of the silver bloc in raising the legal price of Treasury-held "free" silver from 48.69 cents an ounce to 71.11 cents, thus forcing collection of more taxes to pay for this vital war metal is but one of the latest instances of legislative action that helps inflation. The combined effects of the pressures exerted by the farm bloc in Congress, the Department of Agriculture and the Food Administration have become apparent in many ways in the form of higher prices on food, particularly on garden products which now are commanding hothouse prices in the grocery stores. The Scrugham bill, which would force postwar stockpiling of minerals by government purchases of the output of all marginal and submarginal mines at the top prices paid for these minerals during the war is still another manifestation of Congressional tendencies to seek advantages for their particular constituents at the expense of the people at large. Still another example of pressure politics is the demand by a good many members of Congress that the iron and steel "monopoly" be broken up and smaller units be located in states not now having such industries.

Trend Toward Inflation

These are but a few of the many indications that Congress, at least at the time of adjourning over the remainder of the summer, has not yet awakened to the relationship between the demands of pressure blocs and the trend toward inflation.

The only tangible action of Congress which is aimed directly at postwar planning was the appointment of the Senate Committee on Postwar Economic Policy and Planning, with Senator George (D. Ga.) as chairman. Just before Congress recessed—the only action taken by this committee since its appointment four months before— Senator George appointed a special subcommittee to "blueprint" a plan for industrial reorganization after the war

A scrutiny of this subcommittee has led some observers to wonder just what can be expected of it, and to question whether this subcommittee, as well as its parent committee, will prove to be some sort of a Senate "front" behind which politics will go on as usual.

Chairman of the new subcommittee is Senator O'Mahoney (D. Wyo.), famous for his direction of the Temporary National Economic Committee which amassed many volumes of testimony that tended to prove, among other things, that the American patent system leads to monopoly and that bigness in business constitutes badness—a contention that the war production experience has rudely shattered.

Senator O'Mahoney told reporters that his subcommittee was starting with "no preconceived notions except one—that our economy like our government must be governed by all of the constituent members of it" and that the problem is largely one of "adjusting the postwar ambitions and desires of all the various groups—agriculture, labor, business, finance and consumer."

The high degree of economic concentration uncovered by the TNEC studies, he said, have been accentuated by the war's need for "an even greater concentration of political as well as economic power." Estimating that the government has constructed about 20 per cent of the present industrial capacity, the question to be answered, he said, is: "How is this going to be used after the war?" He suggested one of the tasks of the subcommittee would be a "reappraisal of the position of the federal and state governments, and the postwar part they will play in the preservation of the democratic economic system."

Other members of the O'Mahoney subcommittee are Senator Lucas (D. Ill.) and Senate Minority Leader McNary (R. Oreg.).

Some postwar planners are in a state of confusion over the announcement by the Brookings Institution that it had accepted an invitation to assist Senator George's committee in study of postwar economic problems. This is because the Brookings Institution has specialized in studying and analyzing past trends rather than in trying to set up future programs. Another reason for this confusion is because the Brookings Institution research studies are not the joint product of direct representatives of agriculture, labor, industry and other segments of our economy. In other words, it is not an arena in which direct representatives of these economic segments iron out their differences and achieve unity of approach.

Scope of Investigation Unknown

"We have agreed to accept the invitation, but as yet there has been no opportunity to discuss with the committee the precise scope and character of the investigations that may be made," says a statement by the institution. "We conceive our task to be not merely to present to the committee our own recommendations with respect to postwar reconstruction, but also to keep the committee informed of significant studies being made by other agencies, both public and private."

Too, the administration's attempts at postwar planning, particularly now that the National Resources Planning Board has been legislated out of existence, are nothing that can be counted on. Every government department and agency has plans of its own, and in this connection the old adage that "nothing is more immortal than a government bureau" well may be borne in mind. There is no such thing as a unified administration postwar plan. There are plans, many

of them, but they are scattered all over the place. Members of Congress often have complained about this; they have tried on numerous occasions to study the overall administration postwar planning. But they find it comes out here and there in such a way as to make no general sense. It lacks balance and coherency.

Superimposed on this absence of any sort of a unified administration plan is the ineptitude of many government agencies. Many of them continue to be manned by theorists rather than by practical, experienced men who know what it is all about. The result is the formulation of policies that, by causing dislocations and helping inflation during the war, seem bound to make the solution of postwar economic problems that much more difficult.

It is true that Congress provided legislation prior to its recessing which will result in dislodging some of these men but the surface in this direction has only been scratched.

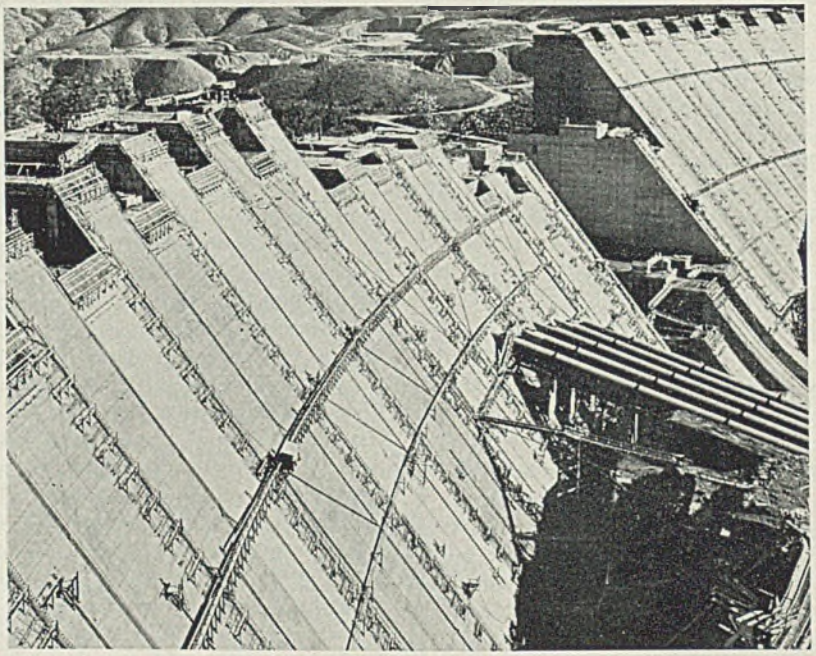
About the only favorable sign of intelligent, unified postwar planning is the reconversion program of the postwar planning group of the War Production Board—and nothing much is being said about what this group has in mind. This group has plans for reconverting industry from war to peacetime production, either after the war, or at such time when progress of the war reaches a stage at which reconversion can be commenced without harming the war effort.

But not too much reliance can be placed on the plans of this group for the reason that its continuance after the emergency is over is not at all assured. The administration might eliminate or curb the War Production Board, or it might organize a new agency to handle the postwar changeover—and nobody now could form any impression whatever about the political complexion of the new agency. On the other hand, Congress might designate an agency to handle the postwar changeover—and again nobody now could know what to expect from such an agency.

Perhaps the only really favorable factor at this time with respect to the postwar economy is the determination everywhere that we must provide full employment and have a high plane of living after the war. Everyone insists that jobs must be provided for all the returning members of our armed forces and for all war workers who want peacetime employment. The very fact that there is so much determination with regard to this objective is encouraging for, as long has been said, "where there is a will there is a way."

Those bills that have to do with the postwar period which now appear slated for favorable consideration by Congress are H. R. 2795 and H. R. 2959. The House already has passed H. R. 2795. Both bills are expected to become law. Under H. R. 2795 (STEEL of July 19, p. 84) surplus property in the hands of the armed forces is to be liquidated in a controlled manner after the war, in a way that will prevent shocks to the economy. H. R. 2959 would make the Civil Aeronautics Board the government agency for disposing of surplus aircraft in an orderly manner.

With the enactment of these bills the postwar planning surface, as far as legislation is concerned, will have been merely scratched. Sound postwar planners know that if we are to have full employment we will have to have healthy industries. We will have to have a good climate for industry. That means that our whole tax system must be overhauled in order that the profit incentive to industrial capital will prove attractive. It means that we will need realistic and fair labor laws that will not penalize employers. A great deal remains to be done by Congress before we can be assured of having a legal framework within which industry can prosper permanently.



POWER FOR WAR: Nearing completion by the Bureau of Reclamation in California to regulate the treacherous Sacramento river and provide irrigation and power for war plants, Shasta Dam soon will take its place in the triumvirate of "tallest and largest" dams in the world. Boulder Dam is the tallest, the Grand Coulee the most massive, but Shasta is taller than the Grand Coulee and more massive than Boulder. NEA photo

Liberalize Means To Obtain Licenses on Enemy Patents

In view of the steadily growing demand for licenses under patents seized from enemy owners, Leo T. Crowley, Alien Property Custodian, has announced recently liberalized terms for the issuance of licenses to all American business firms.

Beginning Aug. 1, the fee for obtaining a license to use enemy owned patents held by the alien property custodian will be a flat $15 for each patent. Hitherto, licenses have been issued for a fee of $50 for a single patent plus $5 for each related patent included in the same license.

Substitution of Cast Iron For Steel Increasing

A total of 904,800 short tons of cast iron for construction, machinery and equipment will be required in this country during 1943, according to estimates made by War Production Board. Requirements for industrial facilities are divided into the following quarterly estimates: first, 329,600; second, 257,100; third, 184,100; and fourth, 134,000. Of the total, 770,900 tons will be required for machinery and equipment; 133,900 short tons are estimated for construction.

Demand Outlook Found Favorable

Huge potential consuming markets in peacetime indicated by United States Steel survey. . . Study inquires into postwar possibilities in 13 consuming industries representing four-fifths of corporation's normal business volume

THAT the potential market for steel in the postwar world will be large is indicated by a survey recently conducted by George W. Wolf, president, United States Steel Export Co., subsidiary, United States Steel Corp., New York.

Mr. Wolf's survey inquired into the demand prospects for steel in thirteen consuming industries representing in a normal year about four-fifths of United States Steel Corp.'s normal business.

Mr. Wolf found that among the industries surveyed the demand outlook in the automobile field was especially promising.

He estimates that by the end of 1943 there will be a backed-up demand for two million trucks and six million passenger cars which, added to the estimated normal requirements of one million trucks and three million passenger cars per year, means that by 1944 there will be a demand for 12 million automotive vehicles. Thus for the first several years after the war it will be a seller's market for the automotive industry.

As for housing, Mr. Wolf reports the outlook also very favorable, with national requirements for the first ten years after the war estimated at up to one and one-half million dwelling units a year.

He sees a golden opportunity for the fabricated house in the postwar market.

The mechanical problem of prefabrication should hold no obstacle, since a house is much less intricate than an automobile. Difficulty with respect to floor plans and exterior appearance should be easily overcome, and he predicts that within five years after the war one-half of the single-family detached houses will be of the prefabricated type.

Quoting from the July issue of *United States Steel News*, organ of the United States Steel Corp., Mr. Wolf's survey shows the tremendous market for steel in prospect in other consuming fields:

"On the farms too a trend toward greater use of steel is indicated. Steel frames are forecast for barns and sheds, and there will be accumulated demands for fencing and for tractors and other mechanized equipment.

"The nation's highway system, in the post-war period, will provide another large outlet for steel. Delayed maintenance has built up an enormous backlog for reinforcing steel for existing highways. In addition, many thousands of new highways are needed and are being planned. These are expected to embrace more superhighways like the Pennsylvania Turnpike, not merely in a few spots but an entire network for the whole country. And they will doubtless include more metropolitan express arteries like the West Side elevated highway in New York.

"The demand for steel for construction should also benefit from the development of new industries after the war, as well as from changes in established industries that may make it preferable to build new plants rather than convert old ones.

"In the railroad industry, catching up on deferred maintenance and changes in track and rolling stock to meet increasing speeds of passenger and freight trains will offer the principal opportunities. In addition to the need of more block signals and longer block sections, high-speed trains will require heavier rails, greater banking of curves, and longer curves and turnouts.

"Thousands of cars and locomotives for both freight and passenger service will have to be replaced. In the construction of this equipment, particularly gondola cars, there will be wider application of rust and corrosion-resisting steels. The higher speed of trains will favor increased use of rolled steel wheels and hollow axles.

"No large program of passenger station and terminal construction is foreseen, and further electrification is expected to be restricted to special purposes and short sections of line. Grade crossing separation is likely to continue in congested areas.

"In the container industry, steel has felt the encroachment of other materials because of wartime restrictions. For large containers no serious competitive material has appeared, but in the tin plate field competitors have been working feverishly to establish themselves.

"However, processors of foods, such as milk and meat packers, show a strong preference for tin plate, and an accelerated demand from these sources is expected after the war.

"Thus the general concensus is that the use of steel for containers following the war is destined for further expansion. Though this country is known for 'living out of a tin can,' canners have taken only 10 per cent of the total food market and it is considered entirely possible that this proportion can be doubled. Potential growth of the domestic market, plus the expected much greater usage in export resulting from the consumer educational effect of lend-lease tinned food shipments, could conceivably run into millions of additional tons of tin plate demand.

"In the oil and gas industry, refining facilities seem adequate and pipe line construction will yield to the more economical tanker. There will, however, be an increase in the drilling of wells, especially deep wells, and there will be delayed repairs and maintenance of equipment. In addition, extensive rehabilitation will be required for the oil fields and refineries in Europe and the Far East, and storage facilities will be needed for many commercial and military air fields scattered around the globe.

"The postwar status of the manufacture of synthetic rubber from oil is uncertain, but should production be continued steel would be required.

"In the machinery and tool industry, the brightest prospect is the automotive industry, which in a normal year absorbs one-third of machine tool production and which will require complete retooling at the war's end. Besides, it may be possible to export a considerable amount of used machine tools to rehabilitate devastated countries, as well as to supply others planning increased industrialization.

"The forging industry does not produce its own trends, but follows those

BONDING STEEL

A process for bonding light alloys and steel to each other or to wood by use of synthetic resin adhesives has been developed by an aeronautical research group in the United Kingdom, according to trade reports reaching the Department of Commerce. Details concerning the process are available only to firms engaged in war work.

It is claimed use of the process provides joints which are aerodynamically smooth and gasoline-tight.

The process is reported employed satisfactorily with such metals as aluminum, chromium, iron, and steel.

of its customer industries, principally the automotive industry and manufacturers of engines, turbines, generators, ship machinery, machine tools, etc.

"The pressing, forming and stamping industry expects to benefit from an expansion in the use of steel office furniture and equipment. In the housing industry, a prefabricated one-unit kitchen and bathroom heating combination may become a volume factor.

"The bolt, nut and rivet industry seems assured a continued large volume of business. The extent to which it will feel the inroads of welding will depend, it is believed, on its own research and promotional efforts.

"The wire-drawing industry, owing to wartime restrictions on the use of steel, will face the problem of recovering the market for wire used in innerspring mattresses. It expects, however, to capitalize on technological advances such as the development of wire for the carcasses of heavy-duty truck tires, and it sees enlarging opportunities for the use of wire mesh in building construction.

"The aircraft and shipbuilding industries, which have expanded so rapidly during the war, will face drastic curtailment in the postwar era. As against the aircraft industry's expected production of 100,000 planes in 1943, a normal peace year's requirements, according to the Aeronautical Chamber of Commerce, would be 6000 planes for private use plus 500 for commercial air lines. Global air transport, however, will result in demands for steel of no mean proportions for the building of global air transport service and fueling stations.

Unsatisfied Demand Accumulating

"This, in brief, summarizes the outlook among the main domestic consumers of steel. In the export field it is estimated that 15 million to 20 million tons of unsatisfied demand has accumulated in the past two years. This demand will build up at an accelerated rate as the war continues.

"Consequently steel exports should provide a substantial outlet immediately after the war ends and for several years thereafter."

It is understood the over-all survey of the postwar prospects of steel consuming industries is being supplemented by further detailed studies by the various subsidiaries of the United States Steel Corp.

For example, Carnegie-Illinois Steel Corp.'s survey will apply to products supplied by it to each industry before the war and currently, and to possible new products that may be required by it after the war. It embraces such factors as the growth of the industry and its future prospects; the changes it has undergone because of the war and their effects on methods and markets; methods of production used; treatments or processes to which the company's products are subjected; competition from other steel companies and from substitute products; ability to meet the industry's changing needs; costs involved in serving the industry and their relation to profits; capacities and locations of mills.

Study Customers Intensely

"In fact," states the article in *United States Steel News*, "no point believed to be pertinent to the relationship of Carnegie-Illinois to the industry is overlooked. The types of products made by the industry, the character and distribution of the industry's customers, the industry's domestic and export markets, the volume of production of the industry's plants and shifts in such volume, temporary or permanent—these and many other points are being given careful scrutiny.

"Competition, moreover, will be complicated after the war by the presence in the market of aluminum and its alloys, magnesium, plastics, and improved plywoods, which, under the stress of war demands, have been produced in greatly increased quantity.

"These materials, however, are not cheaper than steel and also must justify their use, after the war, on the basis of their engineering adaptability and their physical characteristics as compared with steel. It should be remembered too that these competitive materials will attempt to displace products other than steel, such as the nonferrous metals and alloys.

"Aside from steel's advantage in cost over these competitive materials, it will have at its disposal the benefit of improved processes developed during the war, some of which must remain confidential for the duration.

"Among those which have been made public is electrolytic tin plating, which produces a satisfactory product with only about one-third the pre-war weight of tin coating. Another development which will improve the competitive position of steel has been the trend, enforced by the necessities of war, away from 'tailor-made' steels to standard steels serving multiple purposes.

"As a part of this standardization program, specifications for low-alloy National Emergency Steels were adopted and put into use as a means of conserving scarce alloys. These steels, now employed for many purposes for which more expensive high-alloy steels had formerly been used, have probably won markets from which they will not easily be displaced.

GEORGE W. WOLF

"This and other developments make it certain that steel will prove its utility against the pressures of competitive products. In a word, steel is ready so far as cost and quality of products are concerned to play its full part in making the postwar period prosperous.

"What is true of steel may be said of all American industries. Each one is straining at the bit to show its mettle in the race for business that will start after the war. It is the release of this pent-up competitive energy, ready to utilize to the full the technological advances made during the war, that offers the best hope of keeping the nation employed at a satisfactory level.

Favor Upsurge of Enterprise

"The whole temper of the American people will be favorable to a sweeping upsurge of enterprise. Not only industry, but war workers and war veterans as well, will welcome the removal of wartime restraints and discipline and the opportunity to demonstrate what they can do in a world of peace.

"The chief threat to such an economic climate is the possible retention by government of wartime controls over industry.

"Freedom for business from unnecessary government controls is therefore a postwar 'must,' ranking in importance with the other freedoms for which we are fighting. Without it, America would lose the priceless asset to which it owes its outstanding position in the world of technology and production, i.e., experienced managers who manage."

PRIORITIES-ALLOCATIONS-PRICES

Weekly summaries of orders and regulations, together with official interpretations and directives, issued by War Production Board and Office of Price Administration

INSTRUCTIONS

MACHINE TOOLS: WPB has simplified procedures for review of purchase orders of capital equipment and machine tools by the Army, Navy and other government agencies. Principal changes brought about by an amendment to Directive 23 follow: (1) It restricts requirements for review to those cases where items included in the purchase order were not listed in the preference rating certificate which assigned the rating; (2) definition of "command construction" now includes any project such as air fields, military housing, depots, proving grounds and other passive defense projects which are built at the direction of the Chief of Staff, U. S. Army, or the Chief of Naval Operations, U. S. Navy; (3) capital equipment, including machine tools, purchased for administrative use is exempt from review requirement; (4) those provisions which in the previous Directive 23 exempted from review certain PD-3A certificates are now, where appropriate, applied to exempt certain purchase orders also.

CMP REGULATIONS

REPAIR MATERIALS: Products or materials for repairs or replacements may not be obtained under CMP regulation No. 5 if they are capitalized on the purchaser's books, except insofar as this is expressly permitted with respect to minor capital additions, War Production Board says. (CMP No. 5)

SPECIAL ALLOTMENTS for Class A Products: During third and fourth quarters Class A product manufacturers who are unable to obtain allotments from customers in time to use them, may make application directly to WPB for an allotment of controlled materials. To apply for a special allotment, a manufacturer must: (1) File form CMP-4B with WPB; (2) spell out in a letter of transmittal covering the CMP-4B application the extraordinary circumstances and urgency of need for the allotment, showing that failure to receive it will cause an interruption of production to the detriment of the war effort.

Use of special allotments will be subject to special conditions. These will be set out in a letter of transmittal, accompanying form CMPL-150, the instrument on which special allotments will be made.

To avoid production delays a manufacturer may use an allotment to replace in inventory controlled materials used to manufacture the product for which the allotment was originally made.

The quarter for which an allotment is made and the quarter in which delivery of a Class A product is to be made need not be the same, making it possible for a manufacturer to use an earlier or a later quarterly allotment to fit in with production needs.

However, a manufacturer of Class A products may refuse an order unless his customer makes an allotment of enough controlled materials to fill it, even though he may have sufficient in inventory. The manufacturer must, however, accept such an order if he has enough material in excess inventory to fill the order. (CMP No. 1)

HOUSING RATINGS: Preference ratings and symbols assigned by CMP regulation No. 5A may not be used by any local housing authority. These authorities may use the ratings and symbols assigned by the Federal Public Housing Authority to obtain maintenance, repair and operating supplies to the extent that such use is specifically authorized. (CMP No. 5A)

L ORDERS

OFFICE MACHINERY: Manufacturers are limited now in their production of office machinery and parts to a quantity sufficient to meet orders on hand authorized on forms WPB-1688 and WPB-2798. In any case, they are allowed to maintain inventories not to exceed total dollar value of sales of machinery to their customers on approved orders plus exports of sets of parts during the preceding three calendar months. In addition, they are limited in total production of parts and machinery during the 19-month period ending Dec. 31, 1943, to specified quota percentages. Amendment to the order also makes a general increase in maximum production quotas; requires manufacturers to schedule shipments in accordance with delivery dates specified on authorization certificates; adds to the list of banned machinery: currency counting machines, perforating machines (marking and canceling), post office canceling machines, and shorthand writing machines. (L-54-c)

INDEX OF ORDER REVISIONS

Subject	Designations
Allotments, Special	CMP No. 1
Chains, Tire	L-201
Containers	P-140
Equipment, Railroad	L-97
Files	L-216
Furniture, Surgical	L-214
Graphite	M-61
Heaters, Space	L-173
Hoes, Eye	L-157
Housing Ratings	CMP No. 5A
Machinery, Farm	L-257
Machinery, Food	L-292
Machinery, Office	L-54-c
Motors, Small	L-123
Repair Materials	CMP No. 5
Steel Drums	L-197, M-255
Zinc Dust	M-11-L

PRICE REGULATIONS

Adjustable Pricing	GMPR
Castings, Steel	No. 41
Equipment, Farm	No. 246
Ferrochromium and Chromium	No. 258
Hinges	No. 413
Iron and Steel Products	No. 49
Machining	No. 214
Price Modifications	GMPR

RAILROAD EQUIPMENT: Transportation Equipment Division, WPB, will undertake scheduling of all locomotives of 20 tons or under, which are to be used in above-ground mining operations. (L-97)

SMALL MOTORS: Sales of a fractional horsepower motor to replace one broken down is considered a maintenance and repair transaction, where the broken one is taken in by the repairer. (L-123)

EYE HOES: Hand eye hoes manufactured for export under license issued by Office of Economic Warfare or to fill Lend-Lease orders are exempt from restrictions on patterns, sizes and weight established by Schedule V of the hand tool simplification order. Use of alloy steel, however, still is prohibited and the finish must be natural except for lower half of hoe which may be polished. (L-157)

SPACE HEATERS: Space heaters using fuel oil may be manufactured without restriction under order L-173 but must comply with limitations provided in L-28-c. They still may be produced in unlimited volume for the armed services and for use in a building or project authorized under P-55-b, P-55, or any order in the P-19 series. Manufacture for other purposes is limited to 32 per cent of the amount of iron and steel consumed during the year ended June 30, 1941. No heater may be made for civilian use with a capacity in excess of 30,000 B.t.u. per hour. All wall and floor furnaces may be produced in unlimited quantities for housing as well as for the armed services which had been permitted unrestricted quantities under the original order. (L-173)

STEEL DRUMS: Restrictions which prohibited use of steel drums for packing 16 chemical products have been removed. Use of new or used steel drums for packing corn syrup, molasses or fruit juices is prohibited for the first time. Most of the products formerly on List B can be packed in used drums without regard to date on which they were purchased, List A and B products now being consolidated into one Schedule A. (L-197)

TIRE CHAINS: Manufacturers of automotive tire chains now are permitted to produce the quantity allowed by order L-201 without regard for any other orders bearing higher preference ratings. However, manufacturers must fill AAA orders and must not permit tire chain production to delay any order for the Army, Navy, Maritime Commission, or War Shipping Administration more than 30 days beyond its required delivery date. Manufacturers of farm tractor chains may use 50% of total weight of metal contained in all farm tractor tire chains and parts sold during the two-year period ended March 31, 1942. Bans manufacture after Aug. 1 of chains for 6.00-16 sized passenger tires except in the "light car special" type. (L-201)

SURGICAL FURNITURE: Simplified practices and controls have been established with regard to medical and surgical furniture. Use of critical metals is prohibited in manufacture of items other than those named on List A and limits number of models of each item that may be produced. No limitation is placed on manufacture of any number of models where the only metals used are iron and carbon steel and the weight of iron and steel is not more than 25% of total weight of the article. Manufacturers must file with WPB photographs or catalog cuts of the models of items named in List A which they elect to produce. (L-214)

FILES: Schedule V of order L-216 establishes standardization and simplification for production of files. It provides for maximum thickness of the rectangular cross-section of files and a reduction of the number of sizes and types which may be manufactured. (L-216)

FARM MACHINERY: Fabrication of items of farm machinery for which critical material is allotted during the period up to June 30, 1944, does not have to be completed until Sept. 30, 1944. Eleven items of equipment have been removed from Schedule A. (L-257)

FOOD MACHINERY: Definition of "approved orders" for food machinery has been revised to include orders bearing a rating of AA-3 or higher on form WPB-837 (formerly PD-408). (L-292)

M ORDERS

ZINC DUST: Any producer or dealer may deliver zinc dust to any other person without an allocation certificate provided the person receiving the shipment certifies in writing to the shipper at time of delivery: (1) That total amount of zinc dust delivered to such person from all sources has not exceeded 75 lb. in the month in which delivery is being made; (2) that no allocation certificate for zinc dust has been issued to such person for the month in which shipment is being made; (3) the end use to which the zinc dust is being put. (M-11-L)

GRAPHITES: Certain types of graphites have been freed by WPB for use in manufacture of strategic graphite articles other than crucibles. (M-61)

STEEL DRUMS: Manufacturers are now prohibited from selling or delivering to anyone except the Army, Navy, Maritime Commission or War Shipping Administration, any rejected new steel drums or seconds in excess of 0.75% of monthly production without express authorization of WPB. Where a sale of rejects or

seconds in excess of the restricting percentage is made to a user, it is necessary for the user to file form PD-835; where the sale is made to a reconditioner, the manufacturer applies to WPB Containers Division by letter for the authorization to sell. (M-255)

P ORDERS

CONTAINERS: Following preference ratings are assigned to deliveries of shipping containers or parts for uses indicated: AA-1 for uses specified in List 1: AA-2X, in List 2; AA-3, in List 3; AA-4, in List 4; and AA-5 in List 5. Apply on PD-802 for special rating. (P-140)

PRICE REGULATIONS

PRICE MODIFICATIONS: Revision of Supplementary Regulation No. 14, serving as a "catch-all" for miscellaneous modifications of ceiling prices established by the General Maximum Price Regulation has been issued by OPA. It groups the pricing provisions in articles according to classes of commodities or services, eliminating obsolete provisions. (GMPR)

ADJUSTABLE PRICING: Any person may agree to sell at a price which can be increased up to the maximum price in effect at time of delivery; but no person may, unless specifically authorized by OPA, deliver or agree to deliver at prices to be adjusted upward in accordance with action taken by OPA after delivery. Such authorization may be given under certain circumstances by OPA when a request for a change in the applicable maximum price is pending. (GMPR)

STEEL CASTINGS: Quantity differentials applicable to maximum prices for steel castings have been revised by OPA. Please turn to the Market News section in this issue for details. (No. 41)

IRON AND STEEL PRODUCTS: Warehousemen and jobbers on sales of iron and steel products, when the buyer has specified special delivery service, may pass on to the buyer actual special delivery service charges less normal freight from shipping point to destination. Amendment No. 17 also authorizes them to use freight rates applicable to less-than-carload shipments in computing freight charges on mixed carload shipments of iron and steel products within their normal marketing areas. Please turn to the Market News section in this issue for details. (No. 49)

FARM EQUIPMENT PARTS: Manufacturers may add emergency service charges to their ceiling prices. These "emergency service charges" are limited to the extra costs incurred to make delivery at the request of the purchaser on a date which would not have been possible without these extra costs. Provision is applicable only in sales to manufacturers who incorporate the part into a completed item of farm equipment or into farm equipment parts produced by them. Emergency service charge must be billed and invoiced separately and the purchaser must sign a statement showing why the condition is an emergency and stating that he will not ask for an increase in his maximum prices because of the additional service charge. If the charge is added to the maximum price, the part producer must file within 7 days after delivery a statement with OPA showing: name and address of purchaser; quantity of each part or parts sold; price received; amount of emergency service charge added to each maximum price; reasons why the addition was necessary; and method by which amount of emergency service charge was computed. (No. 246)

FERROCHROMIUM AND CHROMIUM METAL: Buyers of chrome ores may be charged transportation from ship unloading docks to users' plants in basing point cities but not in excess of switching charges from dock to plant. (No. 258)

HINGES AND BUTT HINGES: Manufacturers' shipments into Kansas, Nebraska, North Dakota and South Dakota are to be priced on an f.o.b. and not a free freight basis. (No. 413)

MACHINING: Maximum charges for machining which may be made in connection with sale of high-alloy castings by producers have been established on a March 31, 1942, basis. Charges previously were on a Oct. 1-15, 1941, basis. (No. 214)

Drum Makers Urged Not To Apply For Supplemental Supply of Steel

MANUFACTURERS have been advised of the allocation procedure for steel needed in fabrication of steel drums, and have been urged not to make applications for additional allotments for the quarter for which they already have received an allotment, even though they may have received additional orders for drums.

A letter from the Containers Division, WPB, points out that a misunderstanding existed on the part of some manufacturers concerning the policy followed in allocating steel under CMP for manufacture of drums, which were transferred on May 15, from the class B products list to class A.

"As a result of this reclassification" the letter states, "steel drums are now sometimes considered to be a class A product and sometimes to be a class B product. They are considered to be class A product whenever the claimant agencies, the War Department, Navy Department, Air Resources Control Office, Martime Commission, and Office of Lend-Lease Administration, order steel drums directly from the manufacturer, and request the manufacturer to submit his application directly to such claimant agency on form CMP 4-A for his steel requirements for the drums so ordered.

Class B Ruling

"In all other cases, either where the procuring claimant agency does not elect to treat the drums as a class A product by not requesting the drum manufacturer to make application for an allotment of steel directly to it, or where the drums are to be sold to purchasers other than one of these claimant agencies, then the manufacturer makes his application for his steel requirements to the Containers Division on form CMP-4B, and these drums are treated as a class B product.

"There may be instances where the manufacturer will submit an application for a steel allotment to a claimant agency on form CMP-4A when requested to do so by the claimant agency, and where he will also submit an application to the Containers Division on form CMP-4B for the balance of his requirements.

"The Containers Division receives an allotment of steel from the WPB Requirements committee based upon the applications filed with it and it distributes the entire allotment among the supplying manufacturers retaining none for future distribution during that quarter. The Containers Division, therefore, has no steel left and no way of getting more to meet supplementary requests. In view of this situation, manufacturers are asked to refrain from submitting applications for additional allotments for the quarter for which they have already received allotments, even though they have received additional orders for drums.

"Many manufacturers and users of steel drums have made the error of interpreting an authorization on form PD-835 to purchase drums to mean that steel must be forthcoming to fill all orders accompanied by such an authorization. This is not so, as an authorization on PD-835 is only a permission to purchase and receive drums from any manufacturer who has steel available to make them."

Aluminum Castings Supply Continues To Tighten

Review of military programs for the next 18 months shows procurement of aluminum castings will become more difficult, says Frederick Ayer II, chief, Castings Section, Aluminum and Magnesium Division, WPB.

This section has offered concrete assistance to all users of aluminum castings who encounter difficulty in finding suitable sources of supply. It is advised at all times as to open capacity which may be used.

Mr. Ayer also has warned aluminum foundries and die casting plants that unless they submit future reports on forms WPB-2530 (formerly CMP-19) and WPB-2685 (formerly CMP-24) regularly, accurately and on time, their authorization numbers to purchase aluminum ingot for authorized production without prior approval will be revoked.

Appointments-Resignations

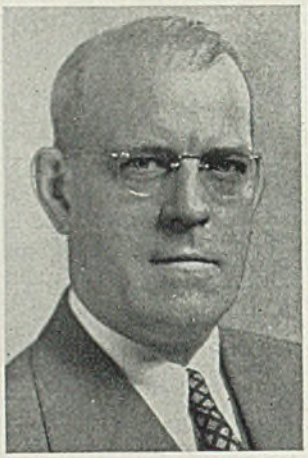
Paul Cabot, director of the Salvage Division, War Production Board, has tendered his resignation to Donald Nelson, effective not later than Sept. 1 due to poor health. Mr. Cabot, who is president of State Street Investment Trust of Boston, came to Washington early in January of this year.

* * *

Chester Bowles, New York advertising executive and OPA director for Connecticut, has been appointed general manager of Office of Price Administration. Elliott Marple, former chief of the OPA News Branch, was appointed deputy administrator in charge of information, succeeding Lou Maxon who recently resigned.

MEN of INDUSTRY

WALTER E. WATSON



G. V. DUTNEY

W. F. SEWART

Walter E. Watson, vice president in charge of sales, Youngstown Sheet & Tube Co., Youngstown, O., has been made first vice president, a newly-created position. He continues in charge of sales.

—o—

Eugene P. Harter, former sales manager, grinding wheel division, Electro Refractories & Alloys Corp., Buffalo, has been made general sales manager. Mr. Harter takes over the duties of **Grant S. Diamond,** vice president, who has assumed broader executive and management responsibilities since the recent death of the company's president, Luke U. Milward.

—o—

Frederick W. McIntyre, vice president and general manager, Reed-Prentice Corp., Worcester, Mass., has returned to the United States to resume active management of the company after spending three months in Australia as a machine tool consultant for a Lend-Lease mission.

—o—

Alexander Konkle, former treasurer and assistant to the president, Kelly O'Leary Steel Works, Chicago, has been named executive vice president.

—o—

Harvey McKenney has been appointed manager of alloy steel sales, a new post for the Fol'ansbee Steel Corp., Pittsburgh.

—o—

Russell B. Gunia was recently appointed manager of the stainless steel bureau, metallurgical division, Chicago district, Carnegie-Illinois Steel Corp.

—o—

Dewey C. Harvey has been named chief plant engineer, Osborn Mfg. Co., Cleveland. Prior to joining the Osborn Co. in 1935, Mr. Harvey served in the engineering departments of C. O. Bartlett & Snow Co., and Bender Body Co., both of Cleveland.

—o—

Lee B. Green has been appointed executive vice president and general manager, Designers For Industry Inc., Cleveland. Previously, Mr. Green had been manager of Firestone Rubber & Metal Products Co., Wyandotte, Mich.

—o—

Harold S. Falk, president, Fa'k Corp., Milwaukee, has been elected a director of the Wisconsin Telephone Co., Milwaukee.

—o—

Elmer Gammeter has joined Globe Steel Tubes Co., Milwaukee, Wis., as chief metallurgist. Formerly, Mr. Gammeter was manager of the stainless steel bureau, Chicago district metallurgical division, Carnegie-Illinois Steel Corp. **C. A. Schroeder,** previously manager of the Wisconsin-Minnesota district for Globe Steel Tubes Co. has been named manager at Cleveland.

—o—

G. V. Dutney, recently appointed assistant manager, industrial department, Johns-Manville Corp., New York, has also been named manager of the newly-formed steel industry section of the industrial department.

—o—

John Olin, vice president of Western Cartridge Co., East Alton, Ill., has been elected to the board of National Bearing Metals Corp., St. Louis. **Thomas W. Pettus,** formerly sales manager, was named vice president in charge of sales for National Bearing Metals Corp.

—o—

Henry K. Beebe, former chief plant engineer at Brewster Aeronautical Corp., Long Island City, N. Y., has joined Wales-Strippit Corp., North Tonawanda, N. Y., as works manager.

—o—

Milo McCammon has been appointed assistant general production manager, Bendix Products Division, Bendix Aviation Corp., South Bend, Ind. Before joining Bendix Products in 1941, Mr. McCammon was supervisor of production planning, Hudson Motor Car Co., Detroit.

—o—

H. F. Hebley, for the past four years product control manager in charge of coal quality for Pittsburgh Coal Co., Pittsburgh, has been appointed director of research.

—o—

Lee B. Thomas, former vice president and general manager, Edward Katzinger Co., Chicago, has been elected president, succeeding **Arthur Keating,** who was made board chairman. **M. K. Schrager,** previously secretary, has been appointed first vice president and secretary, and **Robert Burns,** controller, has been named assistant secretary as well.

—o—

W. F. Sewart has been appointed assistant sales manager of the hardware products division, Wickwire Spencer Steel Co., New York. Mr. Sewart, associated with the company since 1923, was sales correspondent in the export department for about 10 years, and later was active in the domestic sale of hardware items.

—o—

Dr. Eugene M. Baroody, physicist, has been named to the technical staff of Battelle Memorial Institute, Columbus, O.

—o—

T. W. Shook has been appointed director of sales development and service, Basic Refractories Inc., Cleveland. **A. M. Weaning,** assistant since 1940 to **Gordon Adams,** works manager, Maple Grove and Bettsville, O., plants has been named superintendent of production at Maple Grove and Bettsville.

—o—

J. S. Walters, former service manager, Diesel Engine Division, General Motors Sales Corp., Cleveland, has been made manager of plant 3, and **B. H. Gomel** has been named to succeed Mr. Walters as service manager.

—o—

W. J. Parker has been elected secretary-treasurer, Steel Heating Boiler Institute, New York.

—o—

Charles S. Powell, Boston district manager, Graybar Electric Co., New York, will become manager of the communications and merchandising department Aug. 15. **W. H. MacCrellish** will succeed Mr. Powell as district manager in Boston, and **A. D. Hammond,** Birmingham manager, will become Cincinnati district manager, succeeding Mr. MacCrellish. Effective Sept. 1, **Douglas**

Wallace, sales manager, communications and merchandising departments at New York headquarters, will become Pittsburgh district manager. **A. R. Loughborough,** present Pittsburgh manager, will act in a consulting capacity at Pittsburgh until his retirement Dec. 31 after 39 years service.

—o—

Frank C. Mahnke Jr. has joined All-Steel-Equip Co. Inc., Aurora, Ill., as advertising manager.

—o—

M. Frank Dresmal, manager of machinery sales since December, 1942, United States Steel Supply Co., Chicago, has been appointed Chicago office manager.

—o—

Roy L. Stone has been appointed flow meter representative for Cochrane Corp., Philadelphia, with offices in the Commerce building, Rochester, 4, N. Y., and at 295 Hartford avenue, Kenmore, 17, Buffalo.

—o—

Herman H. Gradman, formerly affiliated with Price Iron & Steel Co., Chicago, is now associated with the S. R. Steinberg Co., Chicago.

—o—

W. J. Buttfield, president of Vulcan Detinning Co., Sewaren, N. J., has been elected to the board of directors, Continental Can Co. Inc., New York.

—o—

Philip S. Auten, associated with South Works, Carnegie-Illinois Steel Corp., Chicago, for the past seven years as special engineer in the maintenance division, has joined the production and industrial engineering division of Fry, Lawson & Co., Chicago.

—o—

W. F. Dashiell, formerly representative in Richmond, Va., of the Boston Woven Hose & Rubber Co., Boston, will become southern district sales manager on Aug. 1.

—o—

Walter H. Walker has resigned as vice president and director of Standard Shipbuilding Corp., Los Angeles.

—o—

Norman R. Frame, previously assistant secretary, Western Electric Co., New York, has been elected secretary, succeeding **Harry B. Gilmore,** who will retire in September after 41 years of service with the company.

—o—

William B. Hurley, assistant chief of the Detroit Ordnance district since March 1940, has resigned to resume his duties with Detroit Edison Co., Detroit.

—o—

J. B. Peake, formerly New York district sales manager, Mathieson Alkali Works Inc., New York, has been appointed assistant general sales manager.

—o—

C. T. Hansen, president, C. T. Hansen & Co., has taken personal charge of the company's new offices in Los Angeles, San Francisco and Seattle, representing Lukens Steel Co., Coatesville, Pa.

—o—

H. B. Harrison has been appointed general sales manager, Ferracute Machine Co., Bridgeton, N. J. Mr. Harrison's business experience includes association with the Bucyrus Co. of Milwaukee.

E. W. KEMPTON

Who has been appointed assistant vice president, industrial relations, United States Steel Corp. of Deleware, New York, as reported in STEEL, July 12, p. 86.

L. J. ROHL

Who has been appointed manager, Chicago district metallurgical department, Carnegie-Illinois Steel Corp., noted in STEEL, July 19

OBITUARIES . . .

Emeric R. Leonard, 65, Washington district sales manager, Bethlehem Steel Co., Bethlehem, Pa., died July 13 in Los Angeles. Mr. Leonard had been associated with Bethlehem Steel for 33 years.

—o—

William C. Baker, founder, Baker Foundry & Machine Co., Amesbury, Mass., died June 22. Mr. Baker retired from business several years ago.

—o—

Standish Backus, 68, retired president, Burroughs Adding Machine Co., Detroit, died July 13 in White Plains, N. Y.

—o—

Charles A. Hager, 73, president, C. Hager & Sons Hinge Mfg. Co., St. Louis, died recently in that city.

—o—

Charles E. Malley, 42, sales manager of the Springfield Plant, Ohio Steel Foundry Co., Lima, O., died July 11 in Springfield, O.

—o—

Henry H. Springhorn, 51, sales manager since 1937 of Industrial Tool Co., Racine Wis., died July 12.

—o—

Charles W. Baer, vice president, Kallmerton & Baer Co., Mansfield, O., died July 5 in that city.

—o—

Francis J. Blum, 76, vice president and treasurer, Armstrong-Blum Mfg. Co., Chicago, died July 19 in Oak Park, Ill.

—o—

Harry Payne, vice president, Youngstown Welding & Engineering Co., Youngstown, O., died July 3 in that city.

—o—

Frank Herbert Sampson, 74, retired engineer, Stone & Webster Engineering Corp., New York, died July 12 in White Plains, N. Y.

Carl Ingebretsen, 39, electrical engineer, Otis Elevator Co., New York, died July 11 in that city.

—o—

Herman A. Tepel, 60, vice president, Adalet Mfg. Co., Cleveland, died recently in that city.

—o—

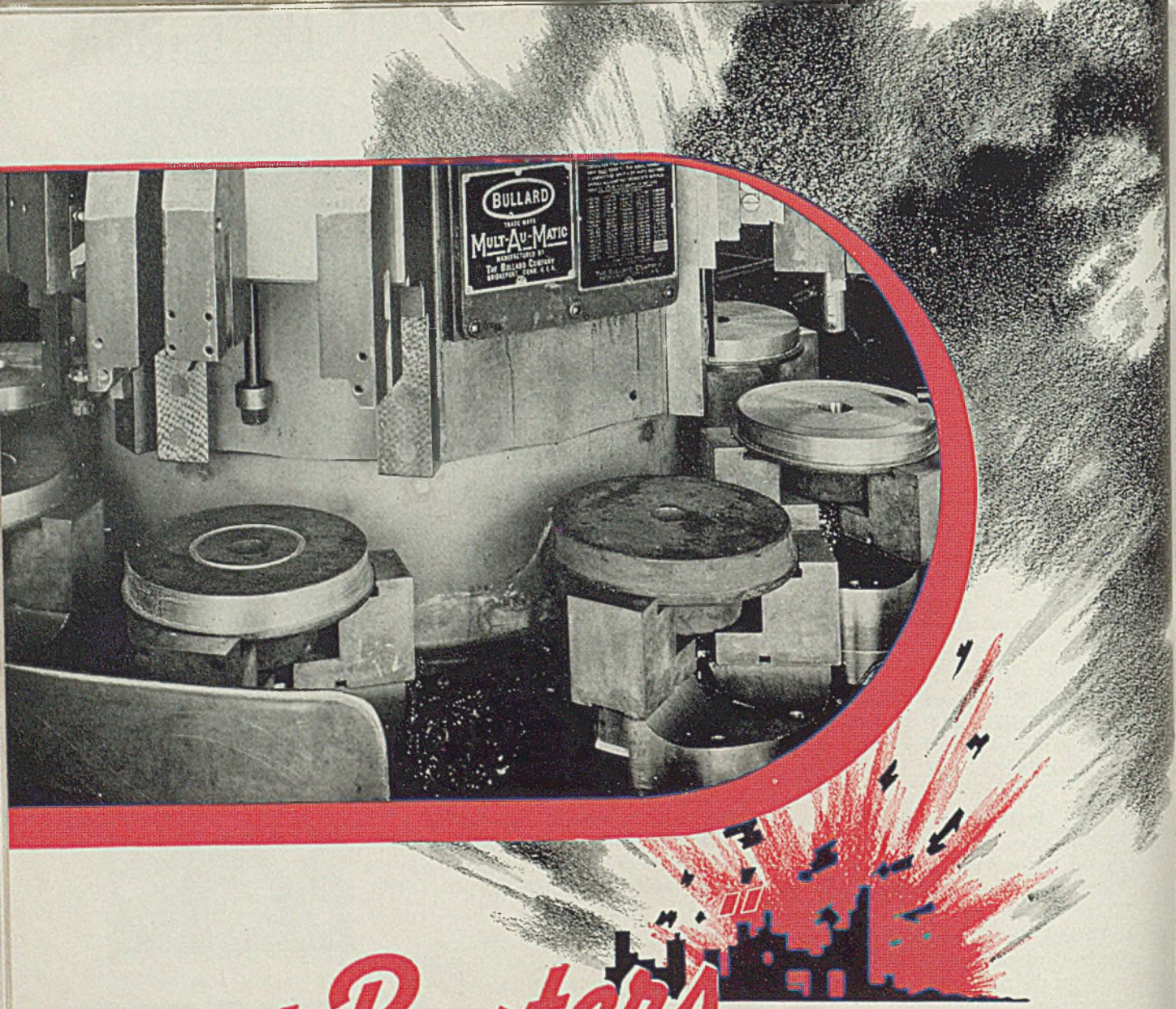
Karl King, 63, superintendent, Palmer, Mass, plant, Wickwire Spencer Steel Co. since 1925, died in that city June 26.

—o—

Charles L. Bransford, 56, Birmingham district manager, Republic Steel Corp., Cleveland, from 1938 to 1941, died recently in Birmingham, Ala.

—o—

William F. Clark, 68, retired executive of the administration department, Phelps Dodge Corp., New York, died in Maplewood, N. J., recently.



Block Busters

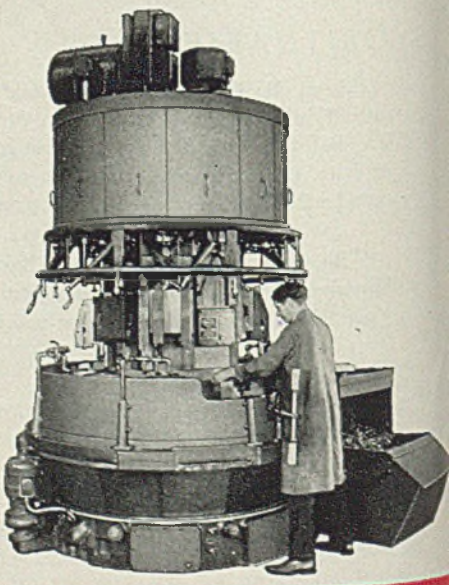
2 Mult-Au-Matics Turn out One Set of Bomb Caps Every 133 Seconds

• Where older methods block production, the Mult-Au-Matic often proves a "block buster". To speed output of caps for a 1000 lb. bomb, a manufacturer installed two 12" 8-spindle Type "D" Mult-Au-Matics. Now he gets 27 bomb caps every hour.

The reason the Mult-Au-Matic licks such jobs is plain. Your operator loses no time. While he is loading the work, the 7 working stations get 7 operations done on 7 other pieces. Each station has independent speeds and feeds.

Perhaps you have a job that needs a "block buster"—a Mult-Au-Matic for your urgent production. Our engineering department will welcome your inquiry.

Close-up of 12" 8-spindle Type "D" Mult-Au-Matic machining rear cap for 1000 lb. bomb.



THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

By A. H. ALLEN Detroit Editor, STEEL

MIRRORS of MOTORDOM

Transition to war production entailed one of the greatest mass movements of machine tools in and out of any automobile plant at Chevrolet's Buffalo operations. . . Conversion completely effected within period of nine months

BUFFALO

ONE of the greatest mass movements of machine tools in and out of any automobile plant during the process of conversion to war production was that occurring at the Chevrolet plants here where, in the space of nine months from the signing of a contract, facilities were rearranged, new tools brought in and subcontracting scheduled, materials purchased and the first Pratt & Whitney 1200-horsepower aircraft engine produced.

The first unit was completed in March, 1942, and the plants are now in what is called the fourth "buy", the term used to cover a specified lot of engines ordered by the government. Each successive buy has been stepped up appreciably, necessitating a constant reshuffling of production facilities which even now are in process of another regrouping to handle greater output.

Three plants are included in Chevrolet Buffalo operations—aviation engine plant No. 2, comprising a former assembly plant, a Fisher Body plant, and a General Motors parts plant; the motor and axle plant at Tonawanda, completed only in 1937 to build motors and axles for cars and trucks assembled in Buffalo and three other eastern assembly plants, and now producing most of the heavier P&W engine parts; and a new Defense Plant Corp. building known as aviation plant No. 1, designed exclusively for the assembly and testing of P&W engines. The latter began operations just a year ago.

These three plants in Buffalo have been co-ordinated with nine Chevrolet plants in other parts of the country and with hundreds of subcontractors to develop a smooth flow of parts and subassemblies to the final assembly line at Tonawanda.

Converted to Aircraft Engine Parts

The former Chevrolet assembly plant once turned out cars at a rate of 45 an hour and has now been entirely converted to aircraft engine parts production, all machinery and even the plant buildings themselves being the property of Defense Plant Corp. Originally, its only machine tool equipment was that required for maintenance operations; now the plant manufactures some 140 precision parts such as pistons, master rods, articulating rods, and gears.

Conversion of this plant started before the last automobile was assembled on July 30, 1941. As assembly plant machinery was being dismantled, studies and layouts were made to determine what new machinery could best fit the location. Other Chevrolet plants were combed for equipment and a lot of it was shipped to Buffalo. One example is a group of 25-ton broaching machines formerly used at the gear and axle plant in Detroit to broach steering knuckles. These were routed off to Buffalo and are now broaching connecting rods and caps.

Specifications called for removal of conveyors, ovens and spray booths at the Buffalo assembly plant, filling in conveyor pits, installation of new lightning and wood block flooring, and the complete redesign of the electrical system from 25 to 60 cycle. Underground enamel storage tanks were converted into a storage and cooling system for heat treat quenching oil. Even a former enamel oven penthouse was utilized—as a pistol range for training plant protection police. Doorways were enlarged to admit heavy machines. New stairways were provided for increased usage of the second floor areas and other changes effected to permit the three disconnected plant buildings to function as a whole.

The problem of supervision was complicated by the fact that former assembly supervisors had been transferred to the new aircraft engine assembly plant, while former Fisher Body supervision had been removed to other plants. The remaining supervisory staff was supplemented with personnel brought in from Chevrolet operations elsewhere and with former assembly line operators trained for new supervisory jobs. Some of the supervisors were trained at the home grounds of Pratt & Whitney in Hartford, Conn., but since Chevrolet was planning to make many engine parts not made in Hartford, complete outside training on all precision parts was not possible.

Shipment of the first set of parts required from this plant was completed March 29, 1942, about four months after the first machine was moved into the revamped plant. On March 30, the first engine was assembled at the motor and axle plant just eleven months and six days after Chevrolet was asked to bid on the project, and six months ahead of the contract schedule.

Originally, plant No. 2 was scheduled to produce 300 different parts for the 14-cylinder radial engine. As mentioned

One section of aircraft engine assembly line at new Buffalo plant. Engines are mounted on special dollies moved along by floor chain. Fixture permits turning engine to any angle for ease of operators

before, contract increases have made it necessary to revise this schedule, transferring a number of parts to other Chevrolet plants and to subcontractors. Thus, after the increase on the second "buy", 89 parts were moved to the company's plant at Indianapolis, and after another schedule stepup on the third buy, additional parts were moved to Saginaw, Muncie and Indianapolis. Last December, with the fourth buy under way and still further contract increases planned, master mechanics from the Buffalo plants went scurrying out across the nation to line up subcontractors.

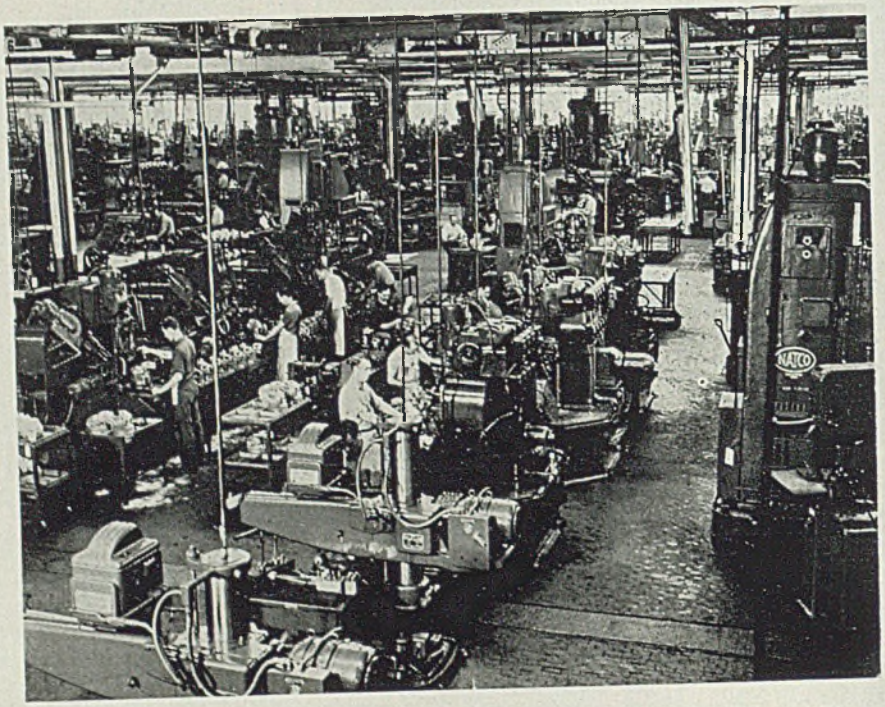
Several innovations in machining practice have been worked out at the No. 2 plant, under direction of master mechanic Russell Schultz, whose father is master mechanic at Chevrolet's gear and axle plant in Detroit. One is the extensive use of broaching on connecting rod ends and caps. These parts are of S. A. E. 4140 steel and in early work the wear on broaching tools was a discouraging difficulty. But by a slow process of cut and try, the method has been improved to the point where broaches now give 24 hours of constant service before requiring resharpening.

To avoid any warping in the finished rods as a result of built-up internal stresses, the parts are given a stress relief heat treatment of 30 minutes at 350 degrees Fahr. before the finish grinding operation. Extremely close fits are required in the rod and cap assembly, tolerance being only 0.001-inch. To make sure of Army acceptance, Chevrolet has halved this and produces the pieces to 0.0005-inch tolerance.

Twelve Cincinnati Hydrotel profiling machines, costing about $30,000 each, have been installed at the Buffalo plants, one typical setup being for contouring the outsides of connecting rods. The machines are four-spindle units, travel of the cutting spindles being controlled by movement of a guide pin inside a template.

Another interesting machine setup is a "baying" operation on the connecting rod. The machine is a vertical spindle type of planetary miller. Still another unusual process is a skiving operation in a crankshaft gear. The latter was developed out of pure necessity because of the failure of some lathes with Keller attachments to arrive in time to get out required production. The part is a circular, stepped piece, with an external gear on the large diameter and an internal gear cut on the small diameter. It is first rough turned on Bullard automatics and then transferred to a lathe equipped with a special skiving tool mounted on a slide and contacting the part on its underside. The tool is the full width of the part and as the latter revolves the tool is fed into the cut, finishing the full width at one operation and producing 20 blanks an hour.

A novel change has been worked out in the method of localized carburizing of gears. Former practice was to finish machine the surfaces of a gear which were to be hard in the final piece and leave stock on the portions to be soft, then to carburize all over and machine off the hard surfaces where necessary. This was a costly and time-consuming procedure so now the gears are coated with red lacquer on areas to be carburized, leaving bare those portions which are not to be carburized. Then the piece is copper plated and naturally the plate will not adhere to the lacquer. Next the lacquer is stripped off by means of hot water and the gear is then carburized.



Former motor and axle plant is now crammed with new machinery, this section machining aluminum alloy cylinder heads. Arrangement here is in contrast to other plants which dispose machining operations along both sides of a single continuous line

Former motor car assembly plant now re-equipped for small parts manufacture this area housing batteries of turret lathes. Provocative question is: What happens to all this beautiful new Defense Plant Corp. machinery when reconversion to peacetime production becomes practicable?

Helping to "BRING 'EM BACK ALIVE"

Nothing in this war is more heartening than the large number of pilots and plane crews who come back alive from missions of extreme hazard.

Case after case has occurred where planes suffered terrific punishment, yet the pilots managed to bring them home. It is a tribute to the splendid skill of our pilots and the remarkable quality of our planes.

Vickers Hydromotive Controls are an important factor in the exceptional quality of many American combat planes. These high pressure oil hydraulic controls are dependable, accurate, easy to operate, easily adjusted, insensitive to shock and vibration . . . reliable no matter how tough the going.

Vickers Hydraulic Equipment is also used to advantage for the control of many types of production machines . . . machines that are helping win the war . . . machines that will help win the peace.

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WING TIPS

There will be plenty of work for the aircraft industry after the war in the opinion of Harry Woodhead, president, Consolidated Vultee. . . Holds military planes will prove to be unsuited to commercial competition

THAT there will be plenty of work for the aircraft industry after the war is the opinion of Harry Woodhead, president, Consolidated Vultee Aircraft Corp., San Diego, Calif.

The usual wartime talk of budding manufacturers branching out into new peacetime lines "fortunately" ends mostly in them "sticking" to the product they know the most about, Mr. Woodhead said last week commenting to newspaper reporters in New York city.

The aircraft industry executive took the occasion to debunk prevalent rumors in response to queries about whether Consolidated Vultee was planning on entering the automotive field after the war.

"Consolidated Vultee thinks it will stay in the aircraft business and be one of the best in the business," said Mr. Woodhead.

He feels that there will be plenty of work for the aircraft people to do after the war. Military ships that stress speed, armor and other wartime needs, he said, are far from suited to commercial competition after the war. They are too expensive to operate and too difficult to pilot to make them any threat even if they are disposed of cheaply.

"The only competition from aircraft as it exists now is from little primary trainers," he said. "After the war we will have to shoot for performance and economy."

Mr. Woodhead indicated that if some form of auto-airplane evolved from airplane experiments, something "logical" for an aircraft builder, his company might branch out, but he gave no hint that such a composite product is definitely planned.

"We are doing all the thinking and planning that can be done at this time, providing it doesn't interfere with our war work. That comes first," he said.

Arrange To Buy "Family Plane"

Nearly a thousand persons in the United States, Canada, and Latin America, realizing the importance of the "family" plane in the postwar transportation picture, already are arranging for delivery after victory of their own private airplanes, according to Dwane L. Wallace, president, Cessna Aircraft Co., Wichita, Kans.

These people, he said, have "earmarked" more than three-quarters of a million dollars in War Savings bonds under the unique priority delivery plan announced by Cessna last March.

"Ever since we first announced our plans for producing a post-Victory 'Family Car of the Air' more than a year ago," Wallace said, "we have been swamped with requests from persons wishing to reserve one of the first models to be delivered. Last March we announced our priority delivery plan under which we assigned a temporary priority number to anyone listing with us the serial number of as little as a $25 bond. A permanent number is assigned when the listing of serial numbers and denominations of war bonds reaches $500. So far the average initial registration has been $800."

While several aircraft companies have announced they will build a private plane after the war, Cessna has described the plane which it is ready to build at the cessation of hostilities as one the average person, without any previous experience in flying, will be able to buy, fly and use.

At present Cessna is engaged entirely in military production, turning out twin-engined "Bobcat" bomber-pilot training planes and UC-78 personnel transport planes for the U.S. Army Air Forces.

Boeing Aircraft Co., Seattle, maintains two identical photo template laboratories, one at its Seattle Plant 2 and the other at Renton.

These laboratories are a series of darkrooms for taking, developing and printing photographs of engineering drawings on large sheets of steel up to 5 feet by ten feet in surface.

Thus the science of photography is enabling the aircraft industry to turn out templates on a mass production basis.

Before photography was brought in, it often took 100 hours of layout time for a single template. Now the majority of templates are ready-made on the sheets of steel rather than laid out from blueprints, and it takes only a few minutes apiece to make them.

The story is told in *Boeing News*. The sheets are coated with white paint, and the drawings as photographed on them show up as black lines. They are used as the base for jigs on which parts are fabricated and assembled; they are used for construction of all types of dies. They serve, too, as drill templates, enabling a drill operator simply to set them over the part to be drilled. Drill holes are marked in the template, leaving no chance for error. In the same way, they are used as patterns for router operators.

Checking templates are furnished inspectors who apply them to airplane parts and can tell in a minute whether the part is accurate. Thousands of tem-

UNLOADING SUPPLIES: Air Transport Commando cargo planes are flying supplies to every theatre of action on the globe. Engine parts and tires, among other equipment, are being unloaded in this scene which might be similar to one in Sicily, North Africa, or the Solomons. OWI photo

plates are sent from Boeing to sub-contractors and to other aircraft companies that are building Fortresses.

Quoting *Boeing News*. "A template is born as an idea on a drafting board in the project design unit. From there it goes to master layout, where draftsmen draw all details, full size, on a steel sheet painted pale green. That's the sheet the photo template people take pictures of.

"The steel plate is set on a big easel that looks like the grid of an overdeveloped waffle iron. The plate is held in place by a vacuum, the suction being applied through holes in the grid.

"In the next room, peering through a hole in the wall, is one of the largest cameras that ever snapped a picture. It was built especially for making photo templates and weighs six tons, including the easel.

"The entire camera assembly is suspended from steel beams. It hangs on springs, so if one of the elements of the assembly moves ever so slightly, the whole business moves exactly the same distance in exactly the same direction.

"The negatives, reduced to one-fifth size, are made on special glass plates rather than the usual celluloid, so there will be no shrinkage to throw the whole drawing out of proportion.

"Before photographic enlargements are made from the glass negatives, the steel sheets—soon to become templates—are prepared on an assembly line basis.

"In the red-tinted dark of one of the lab's big rooms, they are run through a pair of wringer-like rollers that squeeze onto them a paper which already is covered with photographic emulsion. A cement makes the emulsion adhere to the steel, and when the sheet emerges from the machine it is covered with emulsion and a layer of protective paper.

"Pausing in a curing room two hours for the emulsion to dry, the sheets are put into storage racks until they are used. The base paper serves the dual purpose of protecting the sheets from scratching and holding the thin emulsion on their surface. When it's time to feed the sheet to the camera, the paper is ripped off.

"The template-to-be is exposed the same as any ordinary photographic enlargement, only in a much larger manner. Again it goes on the easel, with the glass negative on a much smaller rack behind the lens in an adjoining room. The same camera is used both for taking the photo negative and shooting the photo template.

"The enlargements are, in most cases, made the actual size of the B-17 parts which they represent. Some of them, to be used for construction of Kirksite dies, are made slightly over-size to allow for the shrinkage of the die after it is poured in the foundry.

"After exposure, the process continues to be a huge carbon copy of what goes on in a photographic laboratory. Swinging from an overhead trolley, the sheet is lowered into a tank of developer fluid, then into the rinse or "shortstop," which stops all development. From shortstop it goes, not to third base, but on to the hypo, which dissolves any undeveloped silver that remains on the steel. Next is the water that gives it a final wash, and then its travels are ended in a steam-heated drying cabinet."

AIDING WAR EFFORT: School teachers usually enjoy a long summer vacation, but these two decided to do their share in the war program. The one on the left teaches science and mathematics at a Kent, O., high school and the other is a professor of education at Kent State University, Kent, O. They form an efficient riveting-bucking team at the Firestone Aircraft Co., Akron, O. NEA photo

"Within a year of the month ground was first broken at the plant site in Chicago, we have built our first ship and officially inaugurated production," states John D. Weaver, plant manager of the new $33,000,000 Chicago plant of the Douglas Aircraft Co.

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Develops New Leaf Spring Landing Gear

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WING TIPS

There will be plenty of work for the aircraft industry after the war in the opinion of Harry Woodhead, president, Consolidated Vultee. . . Holds military planes will prove to be unsuited to commercial competition

THAT there will be plenty of work for the aircraft industry after the war is the opinion of Harry Woodhead, president, Consolidated Vultee Aircraft Corp., San Diego, Calif.

The usual wartime talk of budding manufacturers branching out into new peacetime lines "fortunately" ends mostly in them "sticking" to the product they know the most about, Mr. Woodhead said last week commenting to newspaper reporters in New York city.

The aircraft industry executive took the occasion to debunk prevalent rumors in response to queries about whether Consolidated Vultee was planning on entering the automotive field after the war.

"Consolidated Vultee thinks it will stay in the aircraft business and be one of the best in the business," said Mr. Woodhead.

He feels that there will be plenty of work for the aircraft people to do after the war. Military ships that stress speed, armor and other wartime needs, he said, are far from suited to commercial competition after the war. They are too expensive to operate and too difficult to pilot to make them any threat even if they are disposed of cheaply.

"The only competition from aircraft as it exists now is from little primary trainers," he said. "After the war we will have to shoot for performance and economy."

Mr. Woodhead indicated that if some form of auto-airplane evolved from airplane experiments, something "logical" for an aircraft builder, his company might branch out, but he gave no hint that such a composite product is definitely planned.

"We are doing all the thinking and planning that can be done at this time, providing it doesn't interfere with our war work. That comes first," he said.

Arrange To Buy "Family Plane"

Nearly a thousand persons in the United States, Canada, and Latin America, realizing the importance of the "family" plane in the postwar transportation picture, already are arranging for delivery after victory of their own private airplanes, according to Dwane L. Wallace, president, Cessna Aircraft Co., Wichita, Kans.

These people, he said, have "earmarked" more than three-quarters of a million dollars in War Savings bonds under the unique priority delivery plan announced by Cessna last March.

"Ever since we first announced our plans for producing a post-Victory 'Family Car of the Air' more than a year ago," Wallace said, "we have been swamped with requests from persons wishing to reserve one of the first models to be delivered. Last March we announced our priority delivery plan under which we assigned a temporary priority number to anyone listing with us the serial number of as little as a $25 bond. A permanent number is assigned when the listing of serial numbers and denominations of war bonds reaches $500. So far the average initial registration has been $800."

While several aircraft companies have announced they will build a private plane after the war, Cessna has described the plane which it is ready to build at the cessation of hostilities as one the average person, without any previous experience in flying, will be able to buy, fly and use.

At present Cessna is engaged entirely in military production, turning out twin-engined "Bobcat" bomber-pilot training planes and UC-78 personnel transport planes for the U.S. Army Air Forces.

Boeing Aircraft Co., Seattle, maintains two identical photo template laboratories, one at its Seattle Plant 2 and the other at Renton.

These laboratories are a series of darkrooms for taking, developing and printing photographs of engineering drawings on large sheets of steel up to 5 feet by ten feet in surface.

Thus the science of photography is enabling the aircraft industry to turn out templates on a mass production basis.

Before photography was brought in, it often took 100 hours of layout time for a single template. Now the majority of templates are ready-made on the sheets of steel rather than laid out from blueprints, and it takes only a few minutes apiece to make them.

The story is told in *Boeing News*. The sheets are coated with white paint, and the drawings as photographed on them show up as black lines. They are used as the base for jigs on which parts are fabricated and assembled; they are used for construction of all types of dies. They serve, too, as drill templates, enabling a drill operator simply to set them over the part to be drilled. Drill holes are marked in the template, leaving no chance for error. In the same way, they are used as patterns for router operators.

Checking templates are furnished inspectors who apply them to airplane parts and can tell in a minute whether the part is accurate. Thousands of tem-

UNLOADING SUPPLIES: Air Transport Commando cargo planes are flying supplies to every theatre of action on the globe. Engine parts and tires, among other equipment, are being unloaded in this scene which might be similar to one in Sicily, North Africa, or the Solomons. OWI photo

plates are sent from Boeing to sub-contractors and to other aircraft companies that are building Fortresses.

Quoting *Boeing News*. "A template is born as an idea on a drafting board in the project design unit. From there it goes to master layout, where draftsmen draw all details, full size, on a steel sheet painted pale green. That's the sheet the photo template people take pictures of.

"The steel plate is set on a big easel that looks like the grid of an overdeveloped waffle iron. The plate is held in place by a vacuum, the suction being applied through holes in the grid.

"In the next room, peering through a hole in the wall, is one of the largest cameras that ever snapped a picture. It was built especially for making photo templates and weighs six tons, including the easel.

"The entire camera assembly is suspended from steel beams. It hangs on springs, so if one of the elements of the assembly moves ever so slightly, the whole business moves exactly the same distance in exactly the same direction.

"The negatives, reduced to one-fifth size, are made on special glass plates rather than the usual celluloid, so there will be no shrinkage to throw the whole drawing out of proportion.

"Before photographic enlargements are made from the glass negatives, the steel sheets—soon to become templates—are prepared on an assembly line basis.

"In the red-tinted dark of one of the lab's big rooms, they are run through a pair of wringer-like rollers that squeeze onto them a paper which already is covered with photographic emulsion. A cement makes the emulsion adhere to the steel, and when the sheet emerges from the machine it is covered with emulsion and a layer of protective paper.

"Pausing in a curing room two hours for the emulsion to dry, the sheets are put into storage racks until they are used. The base paper serves the dual purpose of protecting the sheets from scratching and holding the thin emulsion on their surface. When it's time to feed the sheet to the camera, the paper is ripped off.

"The template-to-be is exposed the same as any ordinary photographic enlargement, only in a much larger manner. Again it goes on the easel, with the glass negative on a much smaller rack behind the lens in an adjoining room. The same camera is used both for taking the photo negative and shooting the photo template.

"The enlargements are, in most cases, made the actual size of the B-17 parts which they represent. Some of them, to be used for construction of Kirksite dies, are made slightly over-size to allow for the shrinkage of the die after it is poured in the foundry.

"After exposure, the process continues to be a huge carbon copy of what goes on in a photographic laboratory. Swinging from an overhead trolley, the sheet is lowered into a tank of developer fluid, then into the rinse or "shortstop," which stops all development. From shortstop it goes, not to third base, but on to the hypo, which dissolves any undeveloped silver that remains on the steel. Next is the water that gives it a final wash, and then its travels are ended in a steam-heated drying cabinet."

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New Stack Blown In at Sydney, N. S.

Completion of furnace rounds out Dominion Steel & Coal's expansion program. Labor shortage hits metal mines

TORONTO, ONT.

DOMINION Steel & Coal Corp. has blown in its new 1000 ton blast furnace at Sydney, N. S. This stack was started about a year ago, when the company moved the shell from Ojibway, acquired with other plant and equipment from United States Steel Corp., several years ago. It gives the company a total of four furnaces, and lifts its pig iron capacity from 490,560 to approximately 850,000 tons annually.

Completion of this furnace practically rounds out the company's expansion program. The only units now to be completed are an ore beneficiation plant and a 700-ton mixer, representing expenditure of some $2,000,000. Completion of the latter units will add some 60,000 tons of steel ingots, bringing the company's rated capacity for ingots to over 775,000 tons a year, a total wartime expansion of some 300,000 tons.

Operations have been resumed at the Wabana, Newfoundland, iron mines of Dominion Steel. During the time shipments from Newfoundland were suspended the company experienced an ore shortage. Dominion Steel re-opened an old iron property near Bathurst, N. B.

Contract awards and commitments by the Department of Munitions and Supply, in the first half were approximately $3,000,000,000, to bring total on Canadian, United Kingdom and other account, to about $9,000,000,000 as of June 30.

Preliminary figures show the grand total for the period, July 14, 1939 to June 30, 1943, was $8,914,359,567, a figure which would be increased by hundreds of millions of dollars by the inclusion of letters of intention and unvalued acceptance of tender.

The Wartime Prices and Trade Board has issued a new farm machinery order which provides for substantially increased quotas for the manufacture and import of farm equipment over the next 12 months. The order provides for a supply of farm equipment equal to approximately 77 per cent of average of 1940-41 output.

National Selective Service officials are endeavoring to overcome the labor shortage in Canada's base metal mines. Many suggestions have been made but so far results have been unsatisfactory. Some months ago 700 workers were shipped from the gold mines of Kirkland Lake and Porcupine to fill vacancies in the working forces of International Nickel Co., at Sudbury. Actually less than 200 of these workers remained in the nickel mines, the remainder having scattered.

One of the troubles with the present situation in the base metal mines is that while theoretically the workers are supposed to be frozen to their jobs and not subject to call ups, they are actually being called up for military service and not enough men are forthcoming.

NEED FLUORSPAR

Faced with a serious shortage of fluorspar and with only limited supplies available from the United States, the Canadian government is making special efforts to stimulate fluorspar mining. Through government financial assistance several small producers have started operations in the Madoc section of Ontario.

Recently announcements were made of plans for development of fluorspar properties on a more extensive scale. Detomac Mines Ltd. is arranging for development of a property in the Madoc area, where engineers estimate there are approximately 200,000 tons to a depth of 400 feet.

The Canadian government has given special priorities on equipment, supplies and labor. Price of fluorspar in Canada is approximately $40 net ton f.o.b. Madoc.

Munitions Output Behind Army Schedule in June

Despite the national trend in which munitions output is below scheduled needs, war production in the automotive industry in June continued to climb and reached a total of $725,000,000, compared with $705,600,000 in May, $672,000,000 in April and $383,800,000 in June, 1942.

Yet in the nation's industries as a whole production for the Army fell behind schedule for the second consecutive month. The Commerce Department attributes the leveling off in arms output to the fact that there have been changes in the types of war materials needed.

Robert P. Patterson, Under Secretary of War, reported that the supply program for the Army ground forces increased in June 1.1 per cent over May, but was 4.9 per cent below forecasts for June.

They Say:

"Security and freedom from want should come from the individual's efforts rather than in the form of government guarantees. Industry cannot flawlessly provide the opportunity for individuals to earn security and freedom from want, but it can do a better job under the free enterprise system than under binding government regulations."—**Clifford F. Hood**, president, American Steel & Wire Co., Cleveland.

° ° °

"The whole machinery of orderly and non-competitive liquidation must be made ready during the war, and the vast work of directing the country from a war to a peace economy must start as suddenly as war itself usually starts."—**Senator Tydings** of Maryland.

° ° °

"The job of controlling prices and rationing scarce commodities under the tremendous stress of global war is vast enough without the infusion of any efforts to remake the American economy at the same time."—**Lou R. Maxon**, chief information officer, Office of Price Administration, resigned.

° ° °

"The record indicates almost without exception that the length of time required by the national office of the OPA to correct an error is increased as the need for such action becomes more obvious."—**George J. Seedman**, president, American Business Congress.

° ° °

"The government should make use of women's brains in their specialized fields. Because this is not being done, I charge that the war is being slowed down here in America."—**Dr. Minnie L. Maffett**, president, National Federation of Business and Professional Women's Clubs, speaking at the group's annual board of directors' meeting.

WHAT ABOUT SCRAP ?

This workman is cutting a large steel tank with a torch before it is shipped for melting as scrap. The manpower shortage is one of the scrap industry's most troublesome problems at present and has interfered with collections and preparation of material

Fairly comfortable current supply position provides no cause for complacency for the future . . . Heavy consumption cuts into stockpile. Collections must be pressed

By JOSEPH M. KURTZ
Assistant Editor, STEEL

ALTHOUGH current iron and steel scrap supply is more comfortable today than at any period since the war began, steel industry officials and the Industrial Salvage Division, War Production Board, warn against any complacency inasmuch as any single factor may upset the situation to a considerable degree and cause a critical shortage in this vital war material.

The strikes in the nation's coal fields caused abnormal inroads into scrap inventories. With mining resumed, except for localized outbreaks, the drain on scrap, created by the interruption in production of a number of blast furnaces, has practically ended. Loss in ingot production as a result of the coal strike is estimated at more than 200,000 tons.

Executives familiar with the scrap market declare that though the supply on hand is plentiful, there is no reason whatever to become overconfident about conditions.

The Industrial Salvage Division, WPB, has set a scrap collection goal of 15,000,000 tons for the second half of 1943. This compares with a total collection of 13,000,000 tons during the first half.

At present there appears to be no oversupply on hand for several purchasers said they are buying everything offered and taking all tonnage allocated to them. Attempts are being made to increase inventories of the steel mills which now average about 60 days' supply. The amount in some mills varies from a six weeks' supply to a five months' supply.

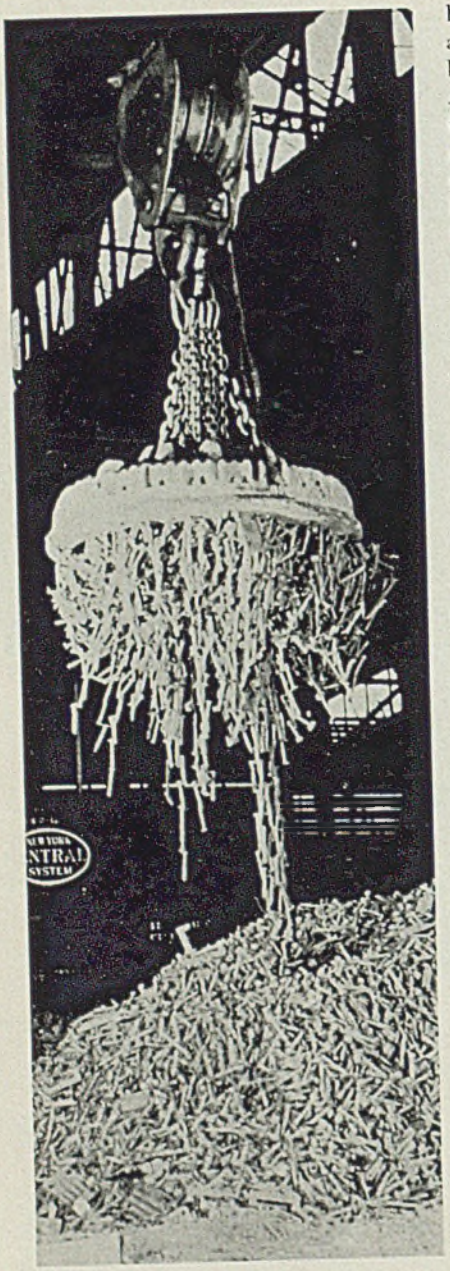
Small Dealers Hard Pressed

A number of small scrap dealers virtually have been forced out of business due to the lack of manpower. Another factor in this connection is that automobile parts have been frozen, thus cutting off an important source of non-recurrent scrap. Dealers in smaller towns have been dealt a severe blow since they, unlike those in the metropolitan areas, cannot rely on the continual flow of industrial scrap but depend almost entirely on scrap collected by peddlers.

Manpower difficulties in the scrap industry have been further aggravated by the fact rates paid to labor are considerably below those paid by war industries. This has tended to draw away the workers from scrap yards. Peddlers who once found collecting scrap a lucrative business now have gone into war plants. They complain that they are unable to market their scrap profitably under existing conditions.

Increased blast furnace capacity as a result of the steel expansion program does not warrant the assumption less scrap will be needed. Blast furnace production is being pushed with the use of turnings and borings.

Although scrap inventories are at the highest level since Pearl Harbor, with a total of 6,500,000 tons as of June 30, 1943, this has not alleviated the concern of steelmakers for scrap shipments are not being maintained at a steady level. The WPB's campaign to collect heavy scrap on farms throughout the country has not



been successful up this point. This is attributed to the fact that farmers have been much too busy with spring planting. Another influencing point is that collectors find that in traveling to the farms to gather the scrap, the cost has been increased to such an extent that it is no longer profitable. Scrap dealers believe that the government should subsidize them for collections in order to insure a continual flow of the heavy and better grades.

Some metal is being imported from South America and the West Indies with the aid of subsidies. Various estimates place the actual cost of this imported material at about $40 per ton.

Household scrap collected last year to a certain extent has been a "drug" on the market. A considerable tonnage still remains in scrap yards. But it is being used by the steel mills in light portions, mixed with the heavier grades in charging open hearths.

American Iron and Steel Institute reports steel mills are prepared to absorb all scrap that may be offered to them. This overcomes the psychological barrier set up recently by the view in some quarters that supply was assured. The result is that dealers are encouraged to aggressively seek out unprepared material.

One large steel producer has managed to accumulate a large stockpile but this will be cut into deeply inasmuch as two blast furnaces are preparing to shut down for repairs. Therefore, in this one case a heavy burden will fall on the scrap stockpile since open hearths will not be able to rely on the usual tonnage of pig iron. Present proportion of scrap in the open hearth melt ranges between 40 and 50 per cent.

"Early 1943 figures reveal a reduction in overall inventories every month," E. F. Mulligan, head, promotion unit, Industrial Salvage Branch, WPB, said. "The trend could well be termed unfavorable. Many normal sources have dried up or have been replaced by supplies of less desirable grades. Much non-recurrent scrap has been moved. A large amount of steel has been exported in billets or semi-finished form from which there was no resultant production scrap."

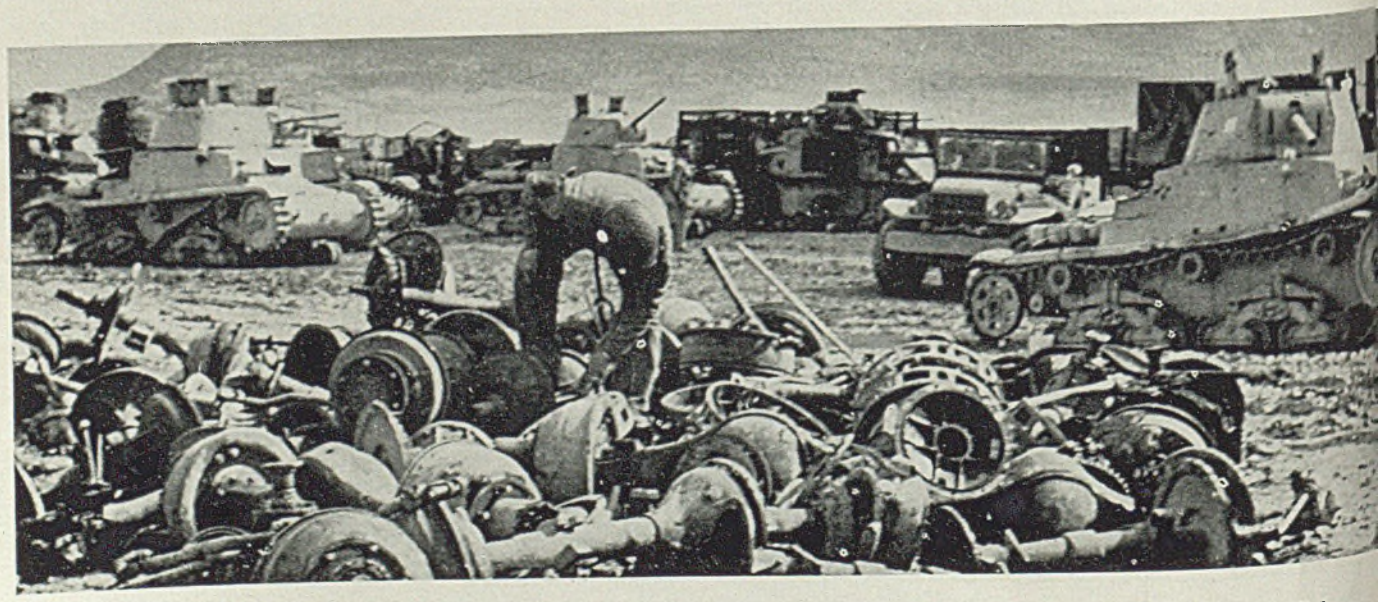
Battlefield Scrap Shipped Here

Questioned on battlefield scrap the Salvage Division is able to throw little light on the picture other than the fact that there have been shipments both to the east and west coasts, but not in any great quantities. Considerable tonnages of battlefield scrap reportedly are available in various theatres of war. Little of it has been brought back even as ballast because of the loss of time in ship turnabout which would result from loading and unloading. Another controlling factor is that equipment necessary for loading the scrap is lacking in the battle areas.

Virtually none of the scrap which is reaching the country from the battle areas is being shipped far inland. It is being allocated almost in its entirety to steel plants located in the coastal areas.

Many rumors are emanating from Washington concerning the disposal of

Hundreds of thousands of the plates and rail spikes are gathered by the railroads. Above at left they are shown being lifted into a gondola by a magnet crane at a reclamation plant. Below, soldier mechanics are sorting salvaged parts of battlefield scrap to make damaged vehicles "good as new." Some battlefield scrap has been shipped to the United States from North Africa



the vast quantities of battlefield scrap which has been collected in Tunisia and other sections of North Africa. Several reports indicate that this scrap will be retained there, decision as to its disposal to be made later.

"Considering only the visible supply, the iron and steel scrap situation today is the most comfortable of the entire defense and war period," Edwin C. Barringer, president and executive secretary, Institute of Scrap Iron and Steel, states. "Currently, the consumption of purchased scrap is running at about 2,000,000 gross tons per month and of home scrap about 2,000,000 gross tons. Since home scrap is constantly produced and bears a relation to total steel output, the best gage of the length of inventories is to divide the stocks of purchased scrap by consumption of purchased scrap, which indicates that an 11-weeks' supply is on hand on the average."

He adds that although the short-term outlook is good, nobody can afford to be categorical on the long-term outlook. What in the early summer appears to be a most comfortable situation can by fall be transformed into a troublesome one.

Mr. Barringer expressed a great deal of concern over the fact that the scrap peddler and collector virtually have been driven out of business by OPA regulations and the lure of more remunerative employment in other war industries. Hence, he added, the national safety demands that there is no letup in the effort to get out scrap.

"It has been months since any steel production has been lost due to a shortage of scrap," he said. "As a matter of fact, had the scrap industry been permitted by the government to pay the labor charge to get out dormant scrap and the freight to haul it to market, not one furnace would ever have gone down for lack of scrap. Inventories of both suppliers and consumers have been expanding until they are at the highest level of the war period.

"But the flow of scrap cannot be turned off and on like a spigot. National safety requires that this flow be maintained," he cautioned.

At a recent press conference, Benjamin F. Fairless, president, United States Steel Corp., said that up until the time of the coal strike scrap supplies were very comfortable but that the coal strike had changed the picture very radically.

Bureau of Mines figures on iron and steel scrap supplies bear out the contention that the picture has improved tremendously over 1942. Consumers' stocks in January, 1943, totaled 6,233,000 tons as compared with 3,503,000 tons in the like month of 1942. In February, 1943, the supply declined slightly over the previous month to 6,209,000 tons in comparison to 3,455,000 tons in February, 1942. A marked increase was made in scrap stocks in March to 6,850,000 tons and in April, 1943, to 6,918,000. In 1942 the March total was 3,460,000 tons and in April, 3,582,000. The April figure is the latest reported by the Bureau of Mines for this year.

WPB Urging Conservation Of Tool, High-Speed Steels

A campaign to widen appreciation in industry of the necessity for conserving tool and high-speed steels is being prepared by the Conservation Division of the War Production Board. These steels contain tungsten, molybdenum, chrome, vanadium, and cobalt, all carrying the highest priorities and all relatively rare and difficult to obtain. Conservation is best accomplished through proper care and use of tools.

The great number of new workers, using these tools for the first time complicates the effort, as they must be taught the technique of proper use and their care when not in use.

Use Burmese "Speiss" To Produce Steel Strengthener

Using raw material which was brought from Burma as the Japanese army overran that country, Ferro Enamel Supply Co., subsidiary of the Ferro Enamel Corp., Cleveland, is producing cobalt oxide, nickel oxide, calcium arsenate and copper oxide.

Only enough of the raw material, known as "speiss," has been brought from Burma to keep the plant in operation for a year. Cobalt ore is being stored in North Africa for shipment here when needed and the St. Louis Smelting & Refining Co. reportedly is developing a sizable source of cobalt "somewhere in Missouri."

Product of the company will be used to strengthen steel for plates and for other valuable war purposes. Robert B. Schall, Ferro Enamel chemical engineer, is credited with developing the complicated process by which the speiss is crushed and treated hydrometallurgically to produce copper, calcium arsenate, cobalt oxides, and nickel.

"Speiss" is not found in a natural state but instead is a residue in the manufacture of antimonial lead and is a term describing the combination of any other metal with arsenic.

Abrasives Output Sets New Records in 1942

Total value of products of the natural abrasives industries in 1942 increased about 9 per cent compared with 1941. Gains in value of products were made in all classes of abrasives except tripoli, millstones, garnet and grindstones, according to the Bureau of Mines.

Values of sales of quartz and sandstone were at a high level, ground sand and sandstone establishing a new record. Value of pumice and pumicite sales also was the highest yet recorded.

Paced by enormously increased demand for abrasives, production of crude manufactured abrasives for the third successive year surpassed all prior records by substantial margins.

Combined total output reached by aluminum oxide, silicon carbide and metallic abrasive in 1942 rose to 370,578 net tons, valued at $23,856,488, which was 33 per cent more in tonnage and 45 per cent more in value than for the previous record year, 1941.

Silicon carbide increased 37 per cent, aluminum oxide 24 per cent and metallic abrasives 45 per cent.

Mine Corundum in U. S. To Save Shipping Space

In order to conserve shipping space used to carry corundum, the War Production Board revealed recently that a new corundum mining operation has started at a reopened deposit in South Carolina, consisting of three veins of the mineral.

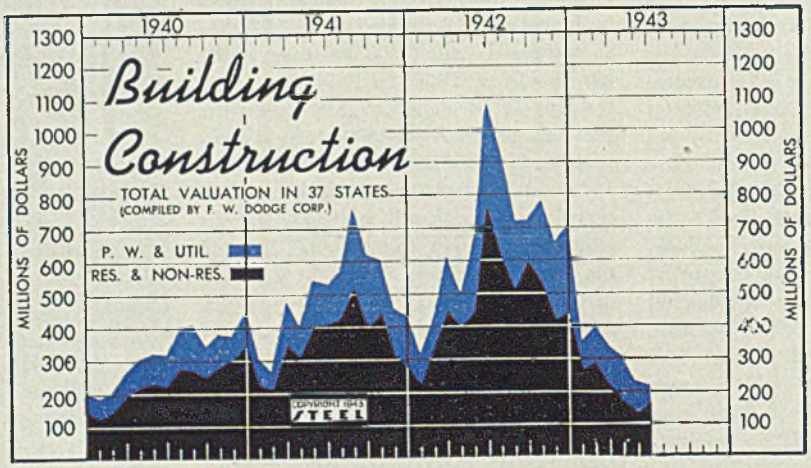
Used principally as an abrasive, corundum now is being mined in the United States for the first time since the last war. Supply mined is expected to amount to approximately a fourth of the country's total current consumption.

Withers Inc. is mining corundum through a contract signed with the Metals Reserve Corp.

Increase Pressure To Step Up War Output Schedules

INCREASED pressure is being exerted to accelerate the war production tempo in an all-out effort to overcome the lag in output recorded during the first half of this year. About three-fifths of the 1943 army requirements, including aircraft, must be met in the second half. This means output of war materiel over the balance of the year will have to exceed the huge first half volume by 50 per cent. However, despite the failure to meet projected war production schedules, industry is now out-producing the Axis nations two to one. Combined output of the Allies is triple that of the Axis powers.

Added to the military demands in the near future are expected to be large new requirements for industrial equipment needed in conquered areas. These rehabilitation orders will include tractors, trucks and locomotives in addition to those already scheduled for the armed forces. There will also be needed large quantities of medical supplies, soap, cotton and woolen cloth, seed, and food. Preliminary schedules covering these orders are reported to have already been submitted to Herbert H. Lehman, chief of the Office of Foreign Relief and Rehabilitation Operations in Washington.



WAR EXPENDITURES—The steady upward trend in production of war materiel is primarily due to the enormous increase in the daily rate of United States war expenditures. During June these disbursements recorded the sixth consecutive monthly increase to $295.7 million, WPB states. This is in sharp contrast with the daily rate of $7.7 million in July, 1940. Total expenditures for June of $7.7 billion represented an increase of 4 per cent over the May total. Government disbursements for war purposes during the fiscal year ended June 30 aggregated $75.1 billion, or 2.7 times the $28.3 billion reported for the preceding fiscal year; and was 11 times greater than that spent in the 1941 fiscal year. The above figures cover war expenditures by the Treasury and the Reconstruction Finance Corp. and its subsidiaries.

CONSTRUCTION—Further curtailment in government expenditures for war plants is reflected in the fourth consecutive monthly decline in construction awards reported by F. W. Dodge Corp. June building contracts totaled $229.6 million; off 2 per cent from the May volume and equal to only one-fifth of the all-time record of $1.2 billion established in June, 1942. Since the June peak a year ago when war construction was in full swing, utilities building awards have declined 84 per cent; nonresidential construction 83; and public works 82 per cent.

Residential awards last month were up slightly, but were the lowest for June since 1935; and were 73 per cent below the most recent high for the group reached in August, 1941.

Total construction declined 50 per cent in the first half this year, compared with that recorded in the like 1942 period.

CIVILIAN NEEDS—Threatened serious shortage of civilian goods supplies is currently being given more consideration than earlier in the war effort when the dominating need was to convert industry to a war production basis. Retail goods inventories are estimated by WPB at 20 per cent or more below a year ago, with a further slump foreseen in the coming months. Shortage in consumer services is believed to have an adverse effect on war production as reflected in absenteeism and lowered efficiency. Lack of manpower is the chief factor limiting activity among the service industries.

FIGURES THIS WEEK

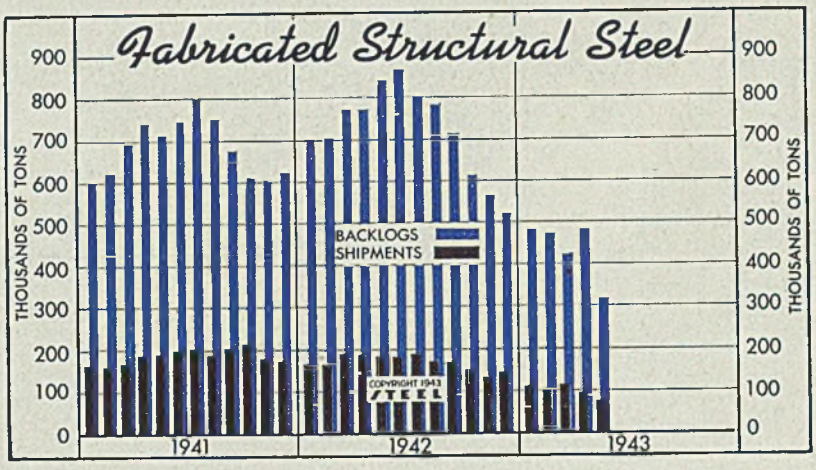
	Latest Period*	Prior Week	Month Ago	Year Ago
INDUSTRY				
Steel Ingot Output (per cent of capacity)	97.0	97.0	98.5	98.0
Electric Power Distributed (million kilowatt hours)	4,184	3,919	4,098	3,565
Bituminous Coal Production (daily av.—1000 tons)	1,850	1,725	1,954	1,793
Petroleum Production (daily av.—1000 bbls.)	4,103	4,090	3,966	3,713
Construction Volume (ENR—unit $1,000,000)	104.0	42.0	44.2	174.1
Automobile and Truck Output (Ward's, number)	19,485	19,435	19,080	17,870
TRADE				
Freight Car Loadings (unit—1000 cars)†	870†	809	817	857
Business Failures (Dun & Bradstreet, number)	33	66	54	159
Money in Circulation (in millions of dollars)	$17,658	$17,607	$17,189	$12,502
Department Store Sales (change from like week year ago)	+39%	+19%	+2%	−2%

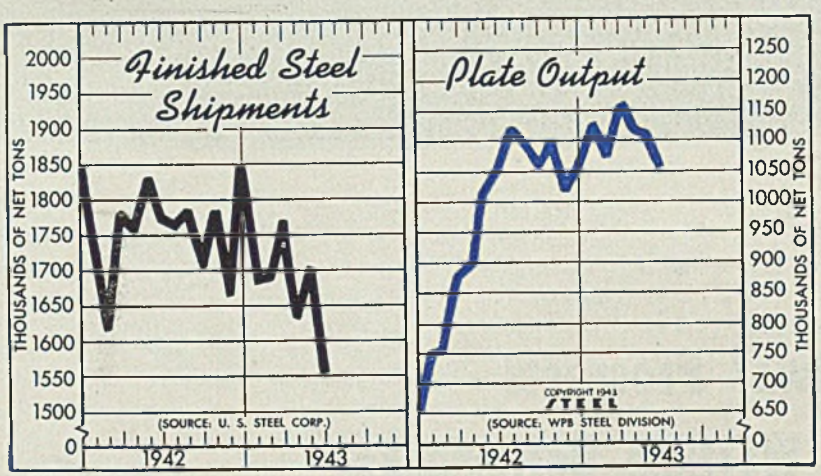
*Dates on request.
†Preliminary.

Fabricated Structural Steel

(1000 tons)

	Shipments			Backlogs		
	1943	1942	1941	1943	1942	1941
Jan.	109.9	167.8	164.6	489.3	704.4	601.5
Feb.	109.1	164.6	161.4	475.6	706.7	624.2
Mar.	113.3	191.3	170.2	424.4	777.7	697.2
Apr.	96.5	187.2	189.8	385.3	772.4	741.9
May	86.5	184.2	191.9	306.6	843.8	718.9
June		182.7	200.5		869.8	747.4
July		189.9	203.0		808.6	802.7
Aug.		173.9	189.3		783.5	754.5
Sept.		169.8	204.1		716.0	678.5
Oct.		152.9	217.7		617.7	614.4
Nov.		130.4	182.6		566.6	602.9
Dec.		145.3	176.1		523.5	626.0





Steel Shipments†—Plate Production‡

(Unit 1000 Net Tons)

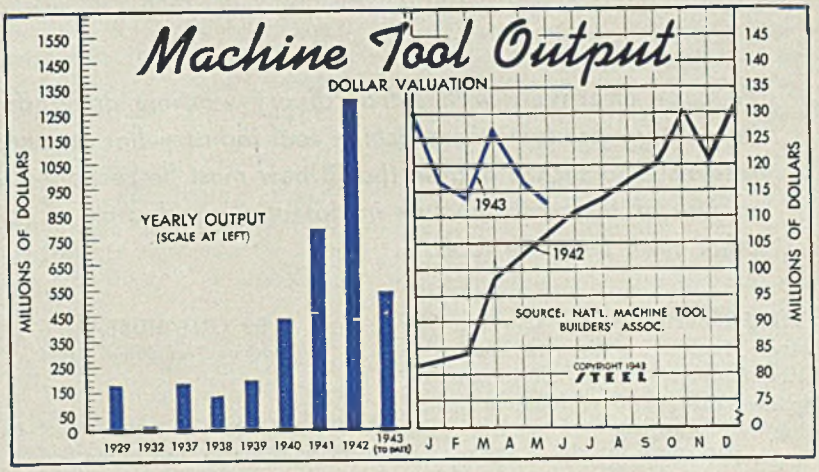
	Shipments		Plate Output	
	1943	1942	1943	1942
Jan.	1685.9	1738.9	1135.4	754.5
Feb.	1691.6	1616.6	1072.0	758.7
Mar.	1772.4	1780.9	1167.7	878.7
Apr.	1630.8	1758.9	1121.0	895.9
May	1706.5	1834.1	1114.9	1012.2
June	1552.7	1774.1	1056.1	1050.9
July		1765.7		1124.1
Aug.		1788.6		1097.9
Sept.		1703.6		1061.8
Oct.		1787.5		1101.4
Nov.		1665.5		1013.6
Dec.		1849.6		1060.0
Total		21,064.2		11,809.7

†U. S. Steel Corp. ‡War Production Board.

Machine Tool Output

(000 omitted)

	1943	1942	1941
Jan.	$117,384	$83,547	$50,700
Feb.	114,593	84,432	54,000
Mar.	125,445	98,358	57,400
Apr.	118,031	103,364	60,300
May	113,710	107,297	60,800
June		111,090	69,070
July		113,596	63,019
Aug.		117,342	70,069
Sept.		119,883	74,906
Oct.		130,008	84,178
Nov.		120,871	81,320
Dec.		131,960	81,435
Year			
1942			1,321,862
1941			812,462
1940			450,000
1939			210,000



FINANCE

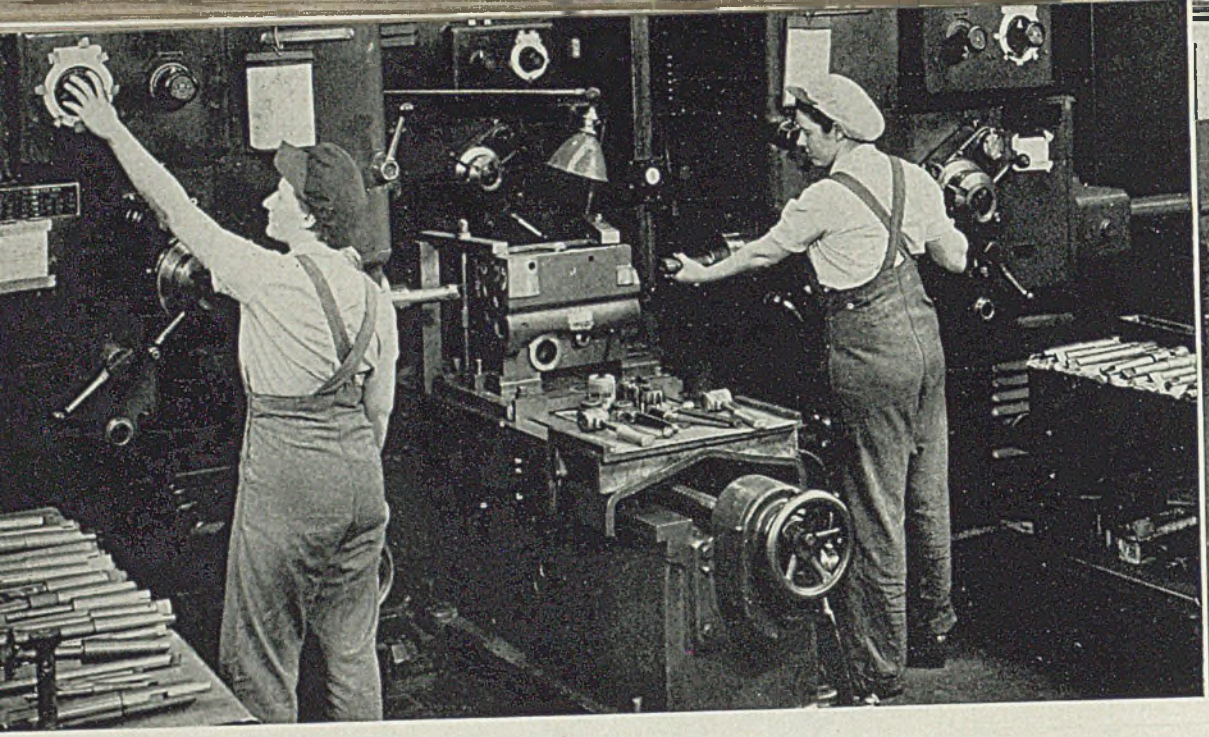
	Latest Period°	Prior Week	Month Ago	Year Ago
Bank Clearings (Dun & Bradstreet, total in billions)	$8,906	$7,558	$8,594	$6,848
Federal Gross Debt (in billions of dollars)	$141.1	$141.3	$140.9	$80.5
Bond Volume NYSE (millions of dollars)	$63.7	$52.0	$53.4	$21.7
Stock Sales, NYSE (thousands of shares)	6,788	4,163	4,966	1,685
Loans and Investments (in millions)†	$45,563	$45,843	$46,808	$32,366
United States Gov't. Obligations Held†	$31,095	$31,414	$32,249	$16,280

†Member banks, Federal Reserve System.

PRICES

STEEL's composite finished steel price average	$56.73	$56.73	$56.73	$56.73
Spot Commodity Index (Moody's, 15 items)†	243.6	243.1	243.8	236.6
Industrial Raw Materials (Bureau of Labor index)†	114.0	114.0	114.8	99.8
Manufactured Products (Bureau of Labor index)†	90.6	99.7	100.7	98.9

†1931 = 100; Friday seriese. ‡1926 = 100.



TOOL BUILDERS

Broaden Postwar Prospects In Smashing Wartime Bottlenecks

To cope effectively with extraordinary wartime demands for its primary product, the machine tool industry has revolutionized itself to such a degree that it now must be reckoned with as one of the major factors in potential production of things other than machine tools

By GUY HUBBARD
Machine Tool Editor, STEEL

THOSE WHO see no very hopeful postwar future for the machine tool plants of America or who are inclined to disparage the ability of these plants to swing over effectively to other war work if and when such a shift is desirable, are not well acquainted with the big changes which have swept over these plants as a result of the present war.

Time was—it is true—when the average machine tool plant was more in the nature of a jobbing shop than a manufacturing machine shop in the American sense of the word. Lots were small, seldom more than 50 machines being put through at one time, and in many cases only one at a time was scheduled. Under such conditions it is natural that general purpose machine tools operated by all-around mechanics were employed to a large extent. That sort of equipment then was justified, and criticisms subsequently leveled against the industry for having so much of that kind of equipment were harsh and unjustified.

However, following the outbreak of war fever in Europe—with attending rising demand for American machine tools—conditions changed and changed fast in our machine tool plants. First, designs were "frozen," then lots of increasing size began to be scheduled, and eventually when we got into the war which inevitably grew out of the earlier war fever, general overhauling of the equipment and manpower facilities became necessary.

As a result, many of our machine tool plants today are no more like those of pre-Axis days than black is like white. Their equipment compares favorably with that of the most exacting of the mass production industries—aircraft engine plants for example—and many of their most capable machine operators, assemblers and inspectors are women. Prewar skeptics said flatly that it couldn't be done. They were wrong. It has been done and it works.

In my travels throughout the American machine tool industry I have personally observed literally hundreds of cases demonstrating the radical changes in manufacturing techniques which place machine tool plants in a new and wholly different category so far as their "post crisis" and post war manufacturing capabilities are concerned. Whether they continue to concentrate on machine tool production or whether eventually they devote their capacity wholly or in part to other lines of manufacturing, they now are staffed and equipped to stand shoulder to shoulder with any metalworking plants in this country.

As a matter of fact many of them already are demonstrating this on work ranging all the way from small parts for aircraft engines to frames of big marine diesel engines—while still working "right around the clock" getting out machine tools still vitally needed unrelenting to support the general war production

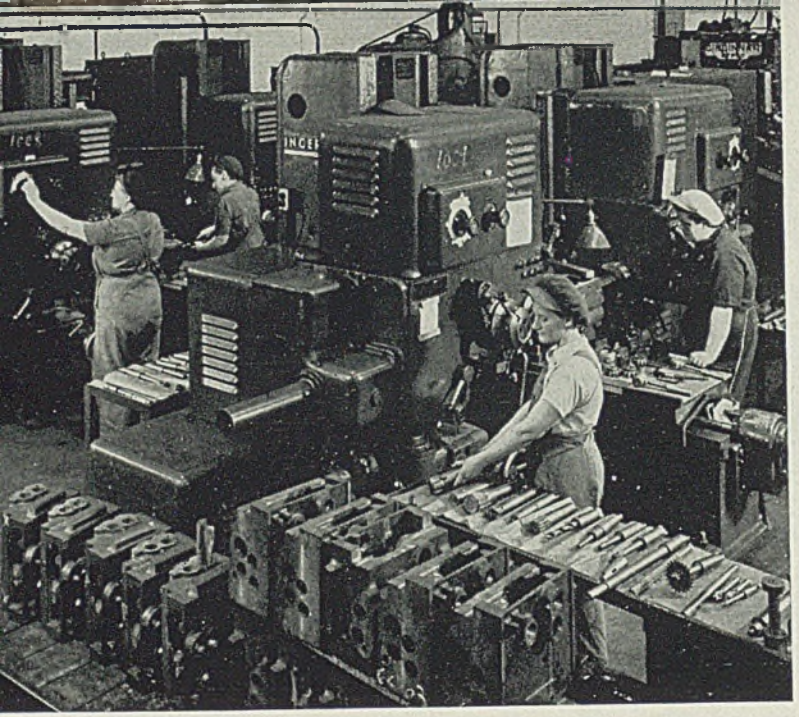


Fig. 1. (Left, opposite page)—Operator at right is making one of the several quick tool changes involved in this system, while one at the left is setting rheostat to give correct spindle speed for tool already in place. Paper dials around rheostat knobs have been specially calibrated to give exact series of speeds required on this particular job

Fig. 2. (Immediate left)—"Manned" entirely by teams of women, these dual head machines, which represent a marked departure from traditional machine tool shop practice, put the precision machining of Warner & Swasey turret lathe aprons (shown stacked in foreground) on a manufacturing basis to keep pace with wartime demands

program in its constantly changing phases.

Out of numerous examples of this "revolution in machine tool shop practice" which lately have come to my attention, I have chosen a typical one as the subject of this article. It is the department at the Warner & Swasey Co., devoted to boring of turret lathe aprons. These aprons themselves are typical of details common in various lines of machine tool building. They are precision parts of alloy cast iron which by the time they are finished are almost as full of holes as the proverbial Swiss cheese. Pound for pound, there probably are more precision-located and precision-finished holes in these aprons than in almost any other standard machine tool part. This claim is borne out by study of the machined aprons stacked on pallets in the foreground of Fig. 2.

Back in the days when machine tools were built a few at a time, these aprons were machined by one-at-a-time methods similar to those used on jig and fixture work of comparable size and shape. At various times, in various shops, I have seen them being bored on standard boring machines, milling machines, radial drills and even in lathes. Seldom was any very elaborate jig or fixture equipment provided for them, their machining more often being of the tool room variety —involving careful "laying out" on a surface plate and considerable individual skill and ingenuity.

Although to keep pace with improved methods employed on other parts of their turret lathes, Warner & Swasey production specialists long ago improved the machining setup of their aprons on conventional boring machines, it was some time before they broke away entirely from the idea of using so-called standard machines on this job. When finally they did break away it was a complete break—involving not only the type of equipment but also the method of handling the work and the kind of operators employed. As a matter of fact a newly equipped, highly specialized department "manned by women" was what eventually developed, as is clearly indicated by Fig. 2.

Older production thinking on this job had been along the lines of "machining through" from one end. Analysis in the light of mass production revealed that while not entirely identical at the two ends, these aprons did involve a considerable amount of identical or very similar machining at each end. Thus a double head machine, capable of operating on the two ends at once, was indicated.

Having decided on simultaneous machining of the two ends, or rather from the two ends, Warner & Swasey took up the problem with engineers of the Ingersoll Milling Machine Co. The result was a rugged and powerful dual head boring, drilling and milling machine of horizontal spindle type, designed to be operated by a team made up of two operators—one on the left hand head and one on the right hand head. Each head is entirely independent of the other in spindle speed and feed and in vertical positioning of spindle but the work is held on a single table with longitudinal feed and adjustment. This table is located between the two heads, as in the case of a duplex milling machine.

The partially machined apron castings are fixture-located on this central worktable—either by stop and spline as illustrated in Fig. 3, or in the case of certain other models, by pins which fit into attachment holes drilled and sized in a prior setup. The tools, however, are not jig-guided. Instead, the machine itself is the "positioner" as well as the driver of the tools. Exact tool settings are made

(*Please turn to Page* 108)

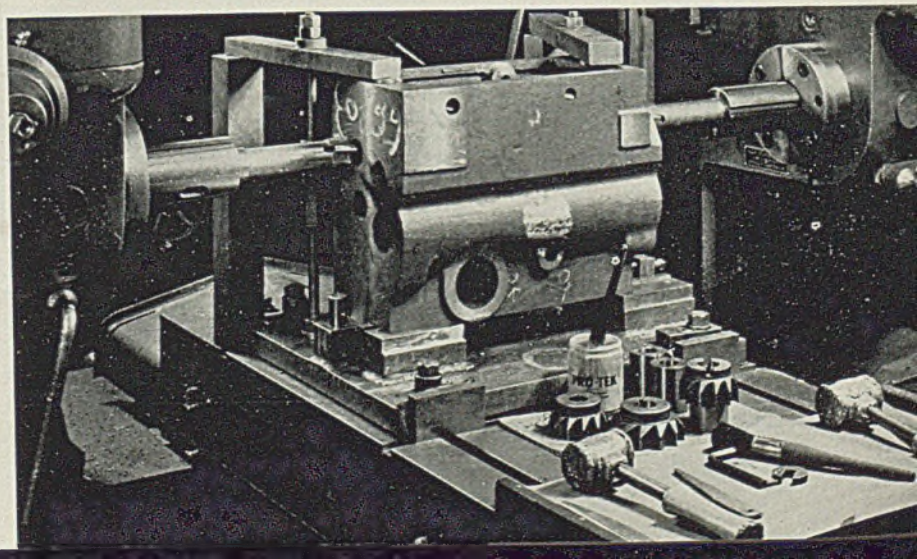
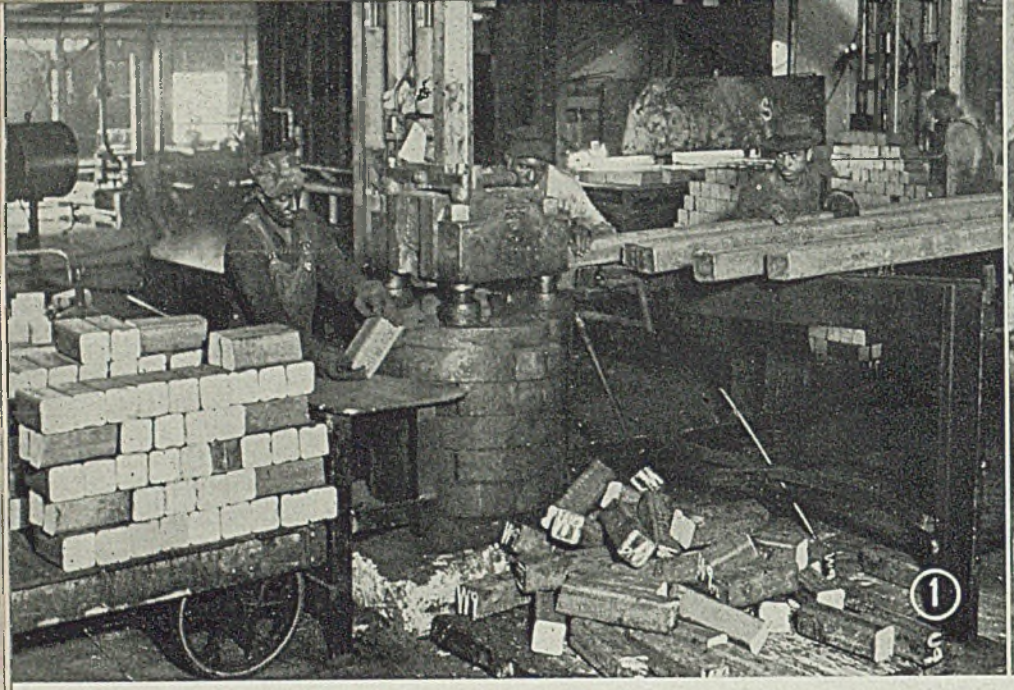
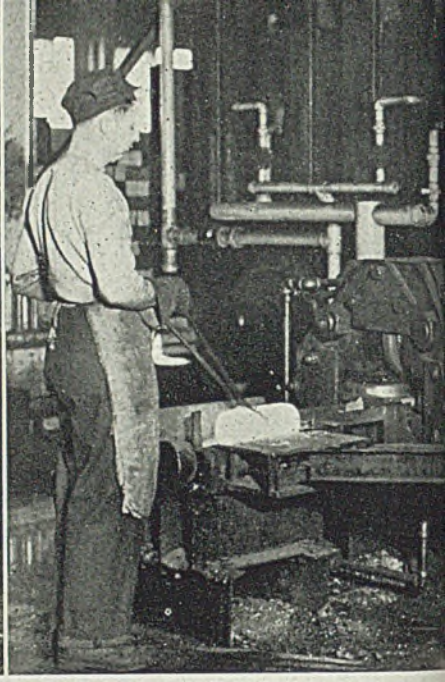


Fig. 3.—Located on the worktable by means of a stop and spline fixture, this apron is about to be operated on by two core drills — the operations in this instance being identical from each of the two heads. One of the built-in dial gages for accurate tool setting can be seen on the slide behind the work





How Army Ordnance Forges 105-mm. High-Explosive Shell at . . . .

GADSDEN ORDNANCE PLANT

SINCE describing shell production in these columns early in 1942, much information concerning the various techniques has been accumulated—including data on billet separation, heating, descaling, forging, drawing, nosing and the like. Hence, for purposes of comparison and analysis, we propose to describe latest practices employed by some of the most efficient and successful organizations working in this field.

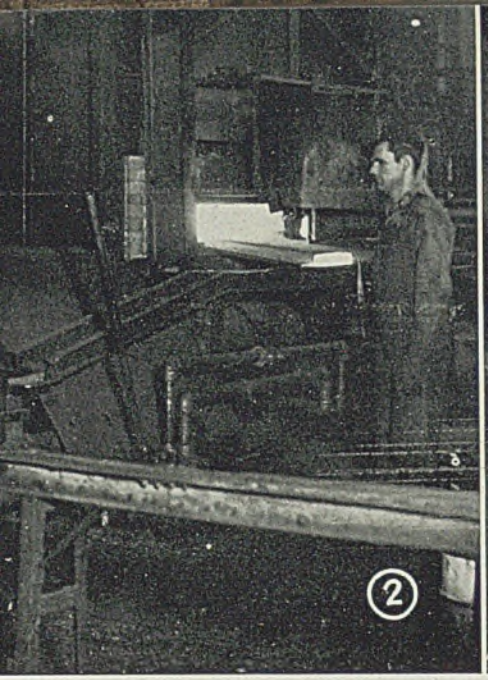
The Gadsden, Ala., plant of Lansdowne Iron & Steel Co. is featured in this article in this new series because the "pierce and draw" is both the oldest and still the most widely used method of forming a shell from a billet. For their most cordial co-operation, we are indebted to Walter N. Howley, president of Lansdowne, as well as to Dr. M. D. Stone, chairman, and other members of the shell forging research committee of the American Society of Mechanical Engineers.

It may be of interest to note that within a year after producing its first shell forging, the Gadsden Ordnance Plant was flying the coveted Army and Navy production award burgee, thanks in large measure to the counsel and active co-operation of Major-General Levin H. Campbell Jr., Chief of Ordnance, and members of his staff, backed by the will efforts of plant personnel.

FOLLOWING chemical and metallurgical examination of each lot of billet steel at the Gadsden plant, heat treating and drawing temperature specifications are set up which will insure attainment of required physical properties and uniform machinability in the carcass. The rolled bars as they come from the mill are nominally 4 inches square with rounded corners, but these may run as low as 3 15/16 inches, the bars being purchased on the basis of a whole number of equal weight slugs per bar. The nominal length of each slug is 9.19 inches for the high-explosive 105-millimeter (as opposed to the chemical shell of this caliber which is somewhat lighter) and weighs 40 pounds. The bars are first nicked with the oxyacetylene torch and then broken on the machine shown pictorially in Fig. 1 and in cross-section in Fig. 4.

While nicking, the operator sits on a cushion mounted on a board provided with casters and having a movement equal to the width of three bars. After each nick he moves forward. In some cases the nicks are made all the way across but, in general, the nicks are in the center only and vary in length from 1¾ to 2 inches. In width they run from 1/16 to 3/32 inch and are fairly deep (⅜ to ½-inch) in order to facilitate breaking and avoid injury to the upper crosshead of the somewhat light breaking press.

In general the nicking operation is more successful when the steel is cold (down around 40 degrees Fahr.) since the ductility rapidly rises with increase in temperature. Some ¾-inch cubic foot of oxygen and 0.19-cubic foot of acetylene are consumed per nick. To obtain slugs of the length required to give the de-



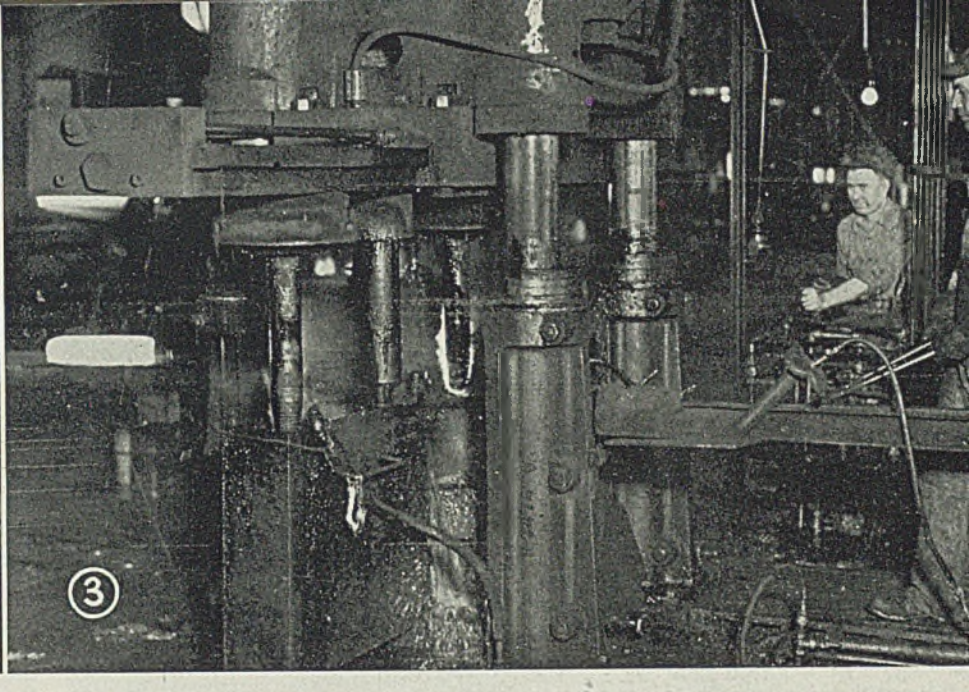


Fig. 1—Billet breaking press designed by Lansdowne Iron & Steel Co. Hydraulic ram exerts pressure of 110 tons of force breaking tool upward against bar directly below the nick. Bearing blocks are mounted in rotatable pressure head at double slug length pitch. If done properly, breaking is most economical method of billet separation as far as saving steel is concerned. All illustrations courtesy Lansdowne Iron & Steel Co.

Fig. 2—Corner rolling mill not only sizes plug so its dimensions permit easy entry into die pot but also cracks scale, facilitating its removal in descaling process that follows

Fig. 3—Vertical 280-ton Birdsboro piercing press fitted with sliding tool carrier and fixed die assembly by Lansdowne. Main ram is 24 inches diameter; two pull-back cylinders are 7-inches diameter; total stroke is 40 inches. Slugging tool is located in center; one punch on either side, used alternately. Knockout rod operated by hydraulic cylinder

Fig. 4—Cross-section and side view of breaker press. No pull-backs are required—lead core and counterweights quickly lower the ram after working stroke

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sired weight, a gage is used consisting essentially of an adjustable pin. This pin is set against the end of the bar for the first nick and thereafter in the previously burned nick in order to locate the cutting tip for the next nick, and so on.

Six of the 130-ton breaking presses shown in Figs. 1 and 4 are available. These are all of Lansdowne design. Each is provided with a 14-inch diameter ram, which carries the breaking tool upward under a pressure of 1675 pounds per square inch, the return stroke being accomplished by means of counterweights. In order to bear evenly on the bar as fracture takes place, the upper crosshead is rotatable about the trunnion axis.

In action, the bar is rolled into the press with the nick topside, the nick being located directly over the breaking tool by lining up the next nick in the bar with a chalk mark. This procedure works well enough when carefully applied, but careless operation results in oblique breaks. The stroke of the press varies from 1⅝ to 2 inches. Average time required per break is 6 seconds.

Each breaker press requires the services of one operator and two helpers. One of these as shown in the accompanying illustration, moves the bars from the rails on to the roller conveyor and then helps the operator to feed them into the press. The other helper, stationed at the delivery end of the breaker, inspects the fracture and stacks the slugs on the hand truck ready for transfer to the heating furnace. Before being placed on the hearth, Ordnance Department in-

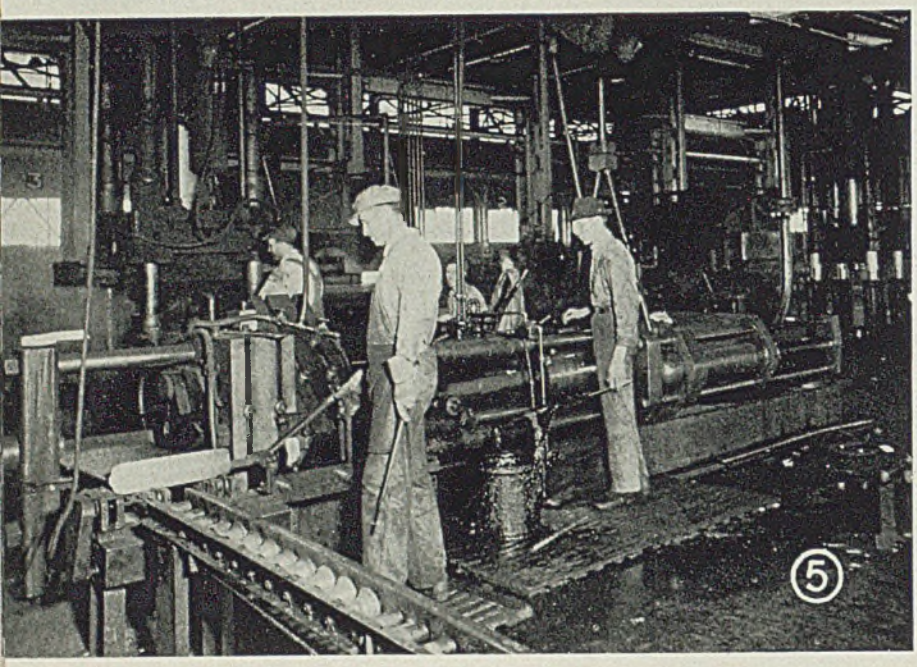


Fig. 5—Lansdowne designed and built, this horizontal two-stage roller drawbench has combination air and water drive, quick-acting compressed air drive being used for nonworking parts of stroke. High pressure water does actual drawing. Shell bodies are checked for concentricity and length immediately on emerging from draw

spectors examine both ends of each slug for pipe or other defects.

Heating: Each forging line has one gas-fired furnace of the roll-down type, fired with natural gas of 1000 B.t.u. per cubic foot. There are four burners, two on each side, but offset so as to avoid blasting against each other. The hearth is 10½ feet long and 7 feet 3 inches wide, giving about 76 square feet of area. A luminous flame is used, combustion being so regulated as to produce a hard dry scale, relatively easy to remove prior to the piercing operation, while the slug is still hot.

The billets are charged in six rows. One man and an alternate, load the furnace and advance the slugs about half way along the hearth, whence they are pulled out on to an apron by the crew at the discharge end. As the slugs are advanced through the furnace, they are carefully turned through half a revolution, in order to secure even heating—a matter of considerable importance to the subsequent piercing operation, since even a small variation in temperature between one side of the billet and the other may cause the punch of the piercing press to run offside, producing an eccentric cup.

The furnace accommodates 192 slugs on the hearth and about 30 additional slugs can be piled on the upper apron extending outward from the hearth, so that a total of 222 slugs constitutes a furnace charge. It takes 2 hours and 15 minutes to heat the billets through, the furnace temperature at the hot end being maintained at just over 2300 degrees Fahr. The slugs are drawn at 2200 to 2250 degrees Fahr. In case of delays of short duration, the hot steel is pulled from the furnace and the remainder worked after repairs have been completed. If major breakdowns occur, the crew moves to another press line and the steel is used elsewhere.

Corner Rolling: From the furnace, the slugs pass through a corner rolling mill illustrated in Fig. 2. The function of this mill is to size the slug so that it drops readily into the die pot. It also serves to crack the scale, thus facilitating its removal in the subsequent de-

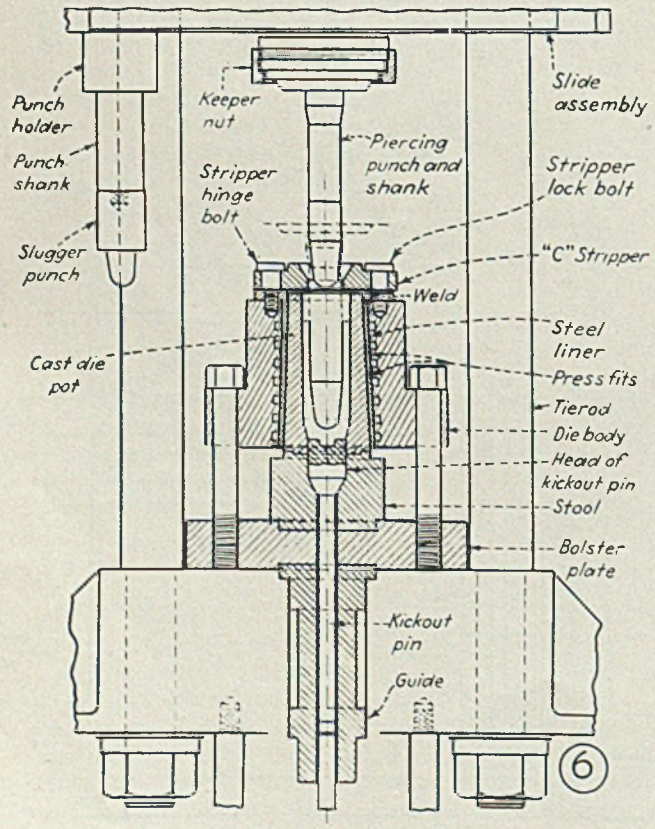
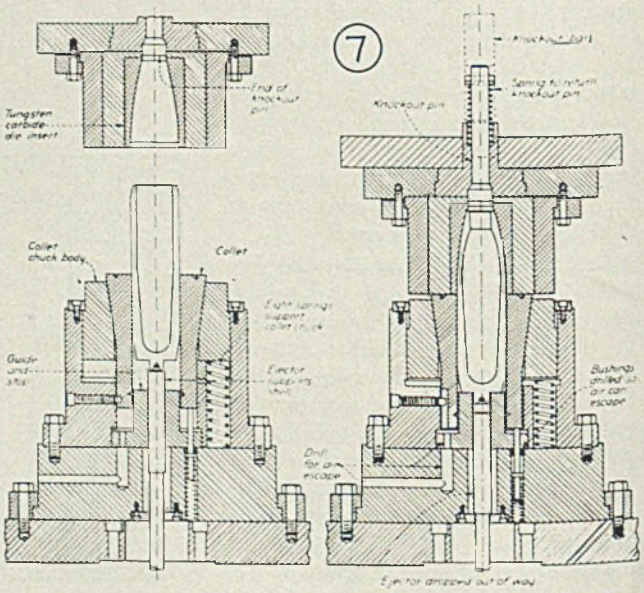


Fig. 6—Cross-section of piercing press. Slugging tool is at left. In center, piercing punch has just been withdrawn from the forged bottle. Best punches are made of a chromium-molybdenum steel, but alloy cast iron answers for the die pot

Fig. 7—Nosing tools: Tungsten carbide inserts in nosing die have proved very satisfactory. Some have a record of over a million operations. Shell elongates ⅜-inch during the nosing operation



scaling operation. But there is a definite risk of scale being rolled into the steel in this operation.

In practice, the four single-stage 12-inch diameter concave rolls are set to reduce the slug diagonals to 4 11/16 inches and form a ¾-inch radius. Since the pot has an inside diameter of 4 15/16 inches, the slug drops in easily, no matter what the original dimensions of the billet were (and these may vary considerably, especially if the billets were rolled on a blooming mill).

In action, the operator of the corner roller hooks the hot slugs off the discharge apron of the furnace on to the roller conveyor in evidence in Fig. 2 which discharges them on to the adjustable tray at the loading end of the mill. A hydraulic ram, developing a total thrust of 75 tons, then pushes the slug through the free-running rolls of the mill in such wise that the corners are under the rolls.

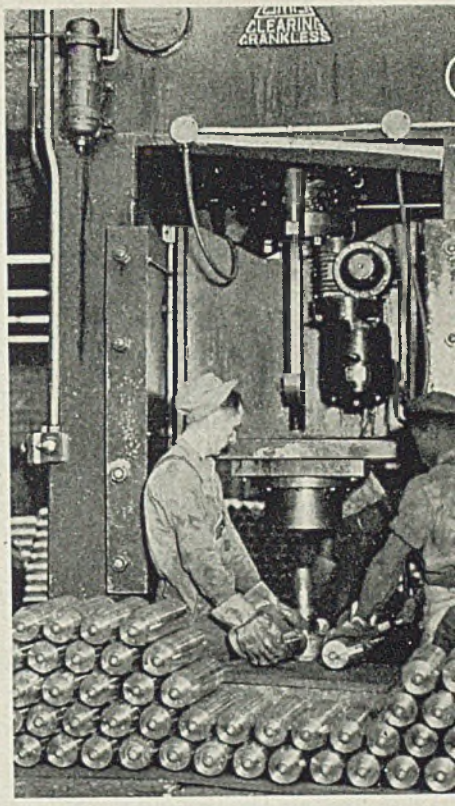
De-scaling: From the corner roller, the slug drops into the descaler, a device embodying two corrugated rollers, one of which rotates at 44 and the other at 49 revolutions per minute. These rollers are 3½ to 4 inches in diameter and lie on centers 6 inches apart. When the scale is in proper condition, the end result is satisfactory but, as might be anticipated, a sticky scale is less easily removed by this means. No positive attempt is made to descale the ends of the slug, but this tends to drop off in any event.

As may be observed from the illustration, one operator is required for the corner rolling mill and another for the descaler. The latter's job is to place the slug on the 20-foot conveyor leading to the press and push it within reach of the press crew. It takes on the average 5.3 seconds for the slug to pass from the furnace to the corner rolling mill; 1.3 seconds through the latter; 8.1 seconds for descaling; and 20.3 seconds from the descaler to the forging press. Thus some 35 seconds elapse between leaving the furnace and arriving at the piercing press.

Piercing: On the end of the conveyor leading to the forging press, a spring loaded charging device is mounted, with the object of tilting the slug so that it can drop into the pot; but more often than not, a little help with the tongs is necessary. The hot slug now being in position in the die, the slugging punch seen on the left in Fig. 6, is indexed into position, the press being fitted with a sliding head carrying the slugging tool in the center and a punch on either side, as may readily be observed in Fig. 6.

On the first down stroke, the slugger punch, closely guided by the mouth of the pot, squeezes the slug into the die, leveling the upper face and impressing a centering cavity 3¾ inches deep there-

Fig. 8—After preliminary turning, shell bodies are cold nosed on this 400-ton Clearing crankless press. Shell is held in collet chuck which "floats" on heavy springs



in. At the same time the boat-tail and centering tit are formed on the base. The slugging stroke is 13 inches and is carried out with the total force of the 280-ton ram.

On completion of the slugging stroke, the slugging tool is withdrawn and one of the piercing punches is moved to the center of the press. A carefully measured half-teaspoonful of pulverized coal is now dropped into the cavity in order to provide a gaseous, sooty film around the punch during its descent and thus protect it, in some measure, from too intimate contact with the hot forging.

Further, all the forging tools are swabbed with Bunker-C oil before each operation. From Fig. 3 we may note that as any one of the three tools mounted in the sliding head descends in a working stroke, the other two are immersed in water tanks, one of which is in evidence in the foreground. These tanks are kept supplied with cool water. When slugging, both punches descend into their respective tanks, immersion in this case being limited by the shorter slugging stroke. One punch is now used for the pierce and the other, together with the slugging tool, dip deeply into the water.

Since there is only one slugging tool and a slugging operation alternates with a pierce, the piercing tools are dipped three times between applications. The die pot liner is also cooled with water circulating in a spiral about it; and the knock-out pin is exchanged every so often for one which has been cooling in a water trough.

After slugging, the carcass has shortened about ⅛-inch, its diameter is around 4⅞ inches, for about 5½ inches, whence it tapers along the boat-tail to 4 inches, the original corners of the billet being still in evidence at the base. It has a cavity 3 inches in diameter and 3⅝ inches deep.

After piercing, the bottle is about 14 inches long and 4 15/16 inches in diameter, with a cavity 12½ inches deep and 3 7/16 inches in diameter.

The crew required for the forging operation consists of one press operator, one kick-in helper who does the swabbing, and a man who removes the bottle after ejection by the hydraulically actuated knock-out rod which lifts the forging out of the die to a position where it can be removed by tongs to the roller conveyor. The last mentioned member of the crew also blows out the scale with compressed air and feeds the pulverized coal between slugging and piercing. The average time in seconds required for the various elements of the forging operation are as follows:

In piercing pot before slugging	2.3
Slugging stroke	1.5
Slugging return stroke to piercing stroke	3.5
Full down stroke to pierce	3.1
Actual piercing stroke	1.2
Return stroke	2.4
Complete cycle	24.1

The temperature of the forging, as it is now ready for the draw, has fallen at this point to about 1800 to 1850 degrees Fahr.

A word about the types of steel found most serviceable for the forging tools and the length of life to be expected in each case, may be of interest here. For the piercing slugger "Thermold A" has been used. This gives a total life of about 4500 shell cases with some 900 per machining. The slugger fails eventually by heavy scoring and washing along the taper.

For the piercing punch, good results have been secured with Carpenter No. 822. This steel breaks down by cracking along the taper where it meets the radius. Heat checking also develops and there is some scoring, extending all the way to the tip. Before being put in service the punch is preheated by laying it on the furnace apron where it remains for about 15 minutes—the time required to change the die pot.

By and large perhaps the best results have been obtained with steel containing 0.45 per cent carbon, 5.0 chromium

and 1.5 molybdenum for both the operating tools and the knock-out pin, although Halcomb 218 steel appears to have been used with good results for the last mentioned item. Total life figures of 10,000 to 12,000 for the slugging punch, up to 2000 for the piercing punch and 1300 between redressings for the knock-out pin, with chromium-molybdenum steel have been given. Tungsten steels, normally thought of as highly heat resistant, cannot be used because they crack as a result of alternate heating and cooling.

The piercing pot liners are made by the American Cast Iron Pipe Co., according to the following analysis: carbon, 3.00 to 3.25 per cent; manganese, 0.70 to 0.90; nickel, 1.55 to 1.50; chromium, 0.30 to 0.50; silicon, 1.16 to 1.50; molybdenum, 0.40 to 0.55; sulphur, under 0.15; phosphor, under 0.15.

Considerable care is exercised in casting these pots to insure sound metal which will offer effective resistance to heat and wear. As may be noted in Fig. 6, the pot is press fitted into a tapered steel liner for support. The assembly is then forced into the cast steel die container and welded in position. No redressing of the die pot is attempted. Its total life is about 1100 shell cases.

Wear here consists mostly in washing near the level of the punch radius and extending upward for about 7 inches. The worst conditions are found in the lower half of the washing, indicating that pressure and wear increase as the punch penetrates the slug. Vertical scores resulting from cracks occasionally open up and the pot breaks in two, despite the support of the steel liner and die container. After assembly, the die pot is preheated by placing a hot slug in it.

Drawing: The drawing of the forged bottle is carried out in a draw bench of Lansdowne design, shown pictorially in Fig. 5 and in cross-section in Fig. 9. A study of these will show that the bench has a combination air and water drive, consisting of an outer main ram, exerting a total pressure of over 80 tons, and an inner air-actuated ram whose job it is to deliver the forging to the first (of two) sets of four concave rolls forming a complete circle.

This done, the air plunger is locked in position and the main ram comes into action to do the actual drawing. When new, the diameters of the roughing and finishing passes are identical, the final pass merely serving to correct the flash and secure a perfectly round shell. However, the roughing rolls wear faster than the finishing set and eventually the latter effect a slight reduction in shell diameter.

The mandrel is hinged and dips into a water trough for cooling. An air driven lifting device, carrying a roller on the end, lifts the mandrel into position before drawing. Before entering the pierced bottle, the mandrel is well lubricated with Bunker-C fuel oil. The rollers are water cooled with fine sprays which emerge from ring-formed perforated tubes.

As the forging leaves the second set of rolls, it shoots forward against a spring loaded stop under the impulse of the air plunger. The stop stamps the heat and code number into the base of the shell. The stripper operates automatically and closes by its own weight.

One man is required for the operation of the draw bench proper; while a second checks every shell for concentricity and base thickness. Average time in seconds for the various elements of the drawing operation are as follows:—

Mandrel stroke by air to draw rollers	4.5
Ditto by main ram through rollers	3.3
Return stroke	1.8
Complete cycle	21.5

Actually the operating cycle of the draw bench is dependent on the speed of the piercing press, most of the time being spent in waiting for the pierced bottle and cooling the tools. The average production is around 90 shell cases per hour. During a record 10-hour run this figure reached 143 per hour. The outside temperature of the finished forging has now dropped to about 1760 degrees Fahr.

Fig. 9—Cross-section of Lansdowne drawbench. Two sets of four concave rollers form a complete circle. First stage is roughing; second does some reducing but serves mainly to correct flash and insure a round carcass. Mandrel moves forward until contact is made with first set of rolls at which point it is locked and main ram started. Mandrel is hinged so it may be dropped into water trough for cooling

The draw bench mandrel has an average life of 1500 to 1800 shells with three redressings. Formerly the steel used was Carpenter 883 modified, or Halcomb 218 modified, but SAE-4140, at a fraction of the price, is now used with equal or better results. The mandrel tends to heat check, cracks sometimes developing, but no scoring is apparent, nor is there any trouble from breakages.

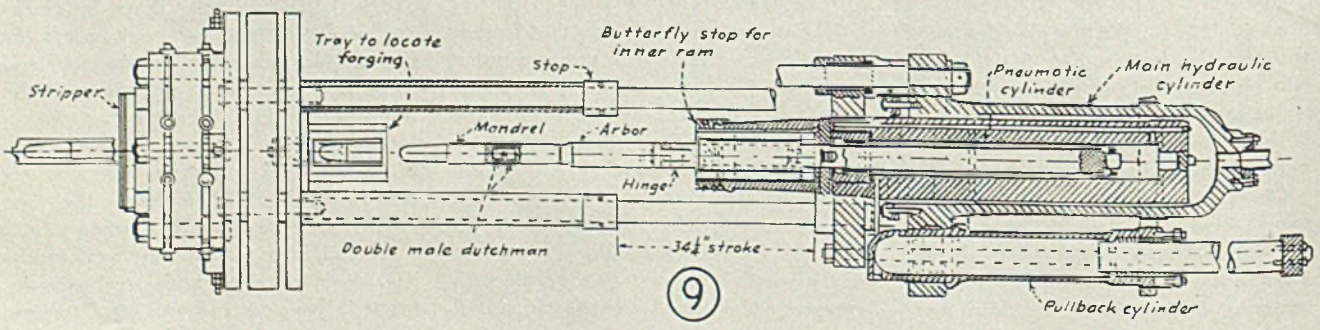
The mandrel is preheated by placing it in the saddle of the lifting device and threading upon it a hot slug which is allowed to remain for 15 minutes. Six mandrels are normally in use and are changed every 50 to 100 shells. Burning of the swabbing oil gives notice of excessive temperature. Each mandrel stays in service about an hour and then is laid aside for 3 or 4 hours to cool.

The life of the roller dies is about 150,000 shells per unit of eight rollers. These are redressed every 30,000 forgings. AISI steel C-1045 is employed; also cast iron and Meehanite. Wear is the prime cause of failure, but there is some heat checking, especially toward the center where the cooling water strikes.

Inspection: The finished shell is inspected for eccentricity, length and base thickness just as soon as it leaves the draw bench; in other words there is an inspector for each line. A chief inspector is responsible for all the production lines. Two government inspectors are also normally on duty, inspecting breaks and finished forgings. The crew foreman is charged with the duty of making a thorough inspection after any tool changes.

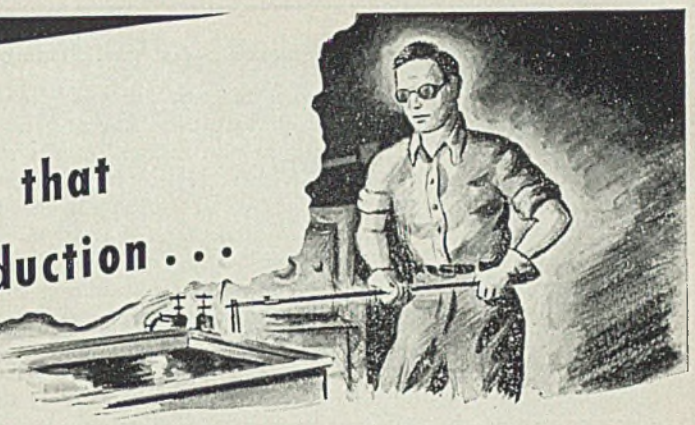
The principal reasons for rejections are short shells, bad cavities, short boss, and eccentricity, in the order given. Many shell forgings which are too short for high explosives, are salvaged and used for chemical shell, which are 1 inch shorter than the H.E.

Nosing: Shell, after preliminary machining, were formerly hot nosed after induction heating. This process was somewhat dirty and rather slow, a production rate obtained was only 170 per hour as



9

Here's Help to Avoid Tool Hardening Troubles that Interfere with War Production . . .



Getting hardening results that assure the kind of tools that give longer uninterrupted production is largely a matter of two things. First, having the right steel. Second, having complete heat treating data. And on each of these points, Carpenter is prepared to help you.

The Carpenter Matched Set Method of tool steel selection provides you with a system for selecting the *one* steel that is best for each tool you make.

For help in heat treating the Carpenter Matched Tool Steels, your nearby Carpenter representative will be glad to give you the benefit of his long practical experience. He can render on-the-spot service—keep you in touch with our Metallurgical Department—and supply you with literature packed with helpful information. Here, for example, is basic information on the laws of quenching.

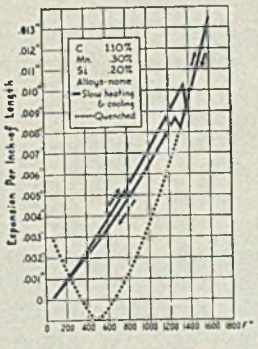
The Four Fundamental Laws of Quenching

LAW NO. 1—Steel is stronger cold than hot. Everyone knows that steel is easier to bend, shape or deform when it is cold. Therefore, when hot steel comes into conflict with cold steel, the cold steel always wins. *(This law explains why a steel rod quenched horizontally will warp upward at the ends.)*

LAW NO. 2—Steel expands when heated and contracts when cooled. This is illustrated by the solid curve in the chart, which shows the behavior of a piece of high carbon tool steel heated and cooled slowly in a furnace. Starting at room temperature, the steel gradually expands up to about 1350°F. when it will be about .010" longer per inch than it was when it started. Here, it reaches the critical point, and while going through the critical, it shrinks somewhat. Above the critical, it continues to expand at a more rapid rate.

On cooling slowly, it shrinks until it reaches about 1310°F., expands while going through the critical and then shrinks back to its original size as room temperature is reached. *(The importance of this law is obvious—since, if different parts of a tool are not cooling at the same rate, stresses will be set up in proportion to the difference in cooling rates.)*

LAW NO. 3—Some tool steels increase in volume when hardened. This is particularly true of water-hardening tool steels. The dotted line in the chart shows the approximate course through which carbon tool steel would travel if it were quenched instead of being cooled slowly. It would continue to shrink (without any critical point interruption) to some temperature in the neighborhood of 500°F. As it cooled below this temperature, it would expand until it would finally be about .003" per inch longer than it was when it started in the annealed condition. *(This law explains why some tools change size in hardening and why some break in the quenching bath. Size change as such is not necessarily disastrous, but if the volume change in part of the tool differs greatly from that in an adjacent part, cracking may result.)*



LAW NO. 4—All steels when stressed under the elastic limit have the same elastic properties—regardless of composition or heat treatment. This may seem impossible, but it is true nevertheless. All steel, regardless of its analysis or heat treatment will stretch exactly .001" per inch under a load of 30,000 lbs. per sq. in. *(This law makes possible the measurement of internal stresses in a piece of quenched tool steel, by simply measuring the amount of distortion. By such a study, it is possible to obtain information to control the quenching operation so as to minimize warpage and breakage.)*

Much helpful information on quenching, like that above, is contained in "Tool Steel Simplified". It is only a small part of the practical information on tool making given in the book. You can put all its useful facts to work in your tool room by making copies available to your tool room men. "Tool Steel Simplified" is available *at cost*, $1.00, in the U. S. A.—$3.50 elsewhere.

THE CARPENTER STEEL COMPANY
139 Bern Street, Reading, Pennsylvania

Carpenter MATCHED TOOL STEELS

United States Army Ordnance Backs Shell Forging Research

FROM the moment the order to cease fire was given on the Western Front in 1918 until the impact of the present war was felt in our industrial plants in 1940, meager financial support of our arsenals stifled progress in the art of forging high-explosive shell. However, some progress had been made. In particular, the forge-finished cavity had eliminated much laborious machining. Nevertheless the relative merits of the various practical methods of forging shell, of billet separation, heating, descaling, drawing, nosing, etc., together with the inherent possibilities of manufacturing improvements, production step-ups, machinery specifications, steel conservation, etc., had to wait for the threat or actual stress of war.

Very early in the shell program, Dr. M. D. Stone, United Engineering & Foundry Co., Pittsburgh, in consultation with others keenly alive to the necessity of putting the technique of shell manufacture on a firm scientific and engineering basis, initiated discussion with officials of the American Society of Mechanical Engineers and, later, with members of the United States Army Ordnance Department. Following these discussions a canvass of the shell forging industry indicated a cordial attitude toward proposals to conduct field studies, supplemented by laboratory research and analysis; and an interchange of information between shell forgers in this country and Canada. Accordingly, in the summer of 1941, a meeting was held with Major General Barnes, then Assistant Chief of Industrial Service, who approved the financial activation of a committee constituted under the authority of the American Society of Mechanical Engineers.

The members of this committee were chosen for their breadth of experience in the various techniques of shell forging as well as for their familiarity with the theory of the flow of metals, metal heating, tool metallurgy, etc., rather than on a representative basis of the industry at large. Associate members were, however, appointed to act in a liaison capacity with the field representatives of the committee; and a work program formally established in June, 1942, following approval by the Ordnance Department. Subcontracts were later let to the Case School of Applied Science in Cleveland and to the Westinghouse Research Laboratories in East Pittsburgh for experimental studies in shell drawing and nosing.

The work of the committee, ably supported by its projects director, Professor W. Trinks of the Carnegie Institute of Technology and field staff, has included all the various phases of shell forging, billet separation, heating, descaling, forging proper, cooling, salvage of slightly defective forgings, together with studies of tool life, production, process economies, forces developed during forging, drawing, nosing, metal flow and so forth, all of the information being secured from shop records and direct observation. It is the aim of the committee eventually to present a comprehensive treatise on shell forging, which will serve as a basis of orientation and decision, as future occasion may demand, as well as exercise an important influence on the development and modification of our existing program.

Members of the committee include: Dr. M. D. Stone, chairman, United Engineering & Foundry Co., Pittsburgh; J. J. Dierbeck, International Harvester Co., Chicago; D. W. Fletcher, National Tube Co., Pittsburgh; W. M. Frame, National Supply Co., Ambridge; W. N. Howley, Lansdowne Steel & Iron Co., Gadsden, Ala.; A. F. Macconochie, University of Virginia, University Sta., Va.; W. P. Muir, Dominion Engineering Co. Ltd., Montreal; A. Nadai, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; A. R. Nettenstrom, American Forge Division, American Brake Shoe & Foundry Co., Chicago; Dr. G. Sachs, Case School of Applied Science, Cleveland; W. Trinks, Carnegie Institute of Technology, Pittsburgh; A. E. Van Cleve, Crucible Steel Co. of America, Harrison, N. J.

Advisory members include: Major General G. M. Barnes and assistants; Brig. General R. Hardy and assistants; Lieut. Commodore A. H. Bateman, United States Navy Bureau of Ordnance; C. D. Howe and assistants, Department of Munitions & Supply, Ontario, Canada.

against 400 per hour by the present cold nosing method. Two 400-ton Clearing crankless presses, shown in Figs. 7 and 8, are employed. In action, the collet chuck closes around the lower part of the shell body as the die descends and is forced over the nose as the shell bottoms on the base. The chuck body, it may be observed, is free to float on heavy duty springs.

An interesting feature of the assembly is the use of Vascalloy Ramet tungsten carbide inserts in the nosing die. These cost $3500, but since they are guaranteed for 350,000 operations the die cost of each operation on this basis is exactly one penny. Actually one die was used 652,252 times without redressing and one die has a total life record of over a million shell forgings. The average life, however, is much less than this, many dies failing soon after being put in service. These are replaced under the guarantee.

Defective dies tend to show their weaknesses within the first 25,000 pieces. If they survive this far, they generally are good for a very long life. An ejector plug, passing through the nose of the die, is brought into play if the shell sticks.

Substitutes Fiber Tape For Steel Strapping

A laminated fiber substitute for steel or wire strapping which can be used for strapping all types of packages weighing 90 pounds or less is reported by A. J. Gerrard & Co., 2700 Belmont avenue, Chicago. It is said to have unusual strength.

The development is water repellant, and has only 1 per cent elongation which allows for a selective tensioning. In actual tests, it indicated a tensile strength of 13,500 pounds per square inch.

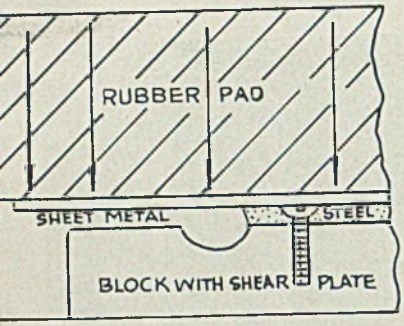
Called Stur-D-Strap, the substitute may be used in all types of steel strapping tools, it is said. It is being made in 700-foot rolls, ¾ inch wide.

Manual for Training In Foremanship Duties

Foremanship Training, edited by Capt. Richard B. Starr; cloth, 191 pages, 5 x 7 inches; published by Prentice-Hall Inc., 70 Fifth avenue, New York, for $2.65.

To meet the pressing problem of maintaining and increasing production by bettering the efficiency of personnel this volume has been compiled. With a high percentage of workers and foremen new to their duties there is need for quick but careful supervision and training. The authors seek to meet this problem by presenting the fundamental principles of training needed by foreman, with instruction material and problems based on modern practice in leading industrial organizations.

The foreman must understand how to deal with human relations in industry so that there will be a minimum of friction and a maximum of goodwill. To attain this end the contributing authors have given of their experience. All are practical men attached to important industrial organizations and their advice is based on actual experience.

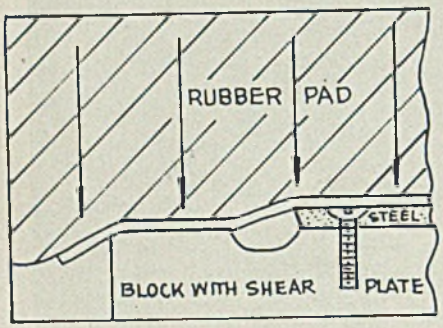


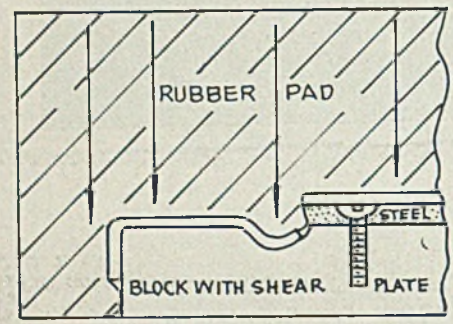
PROPERTIES of RUBBER

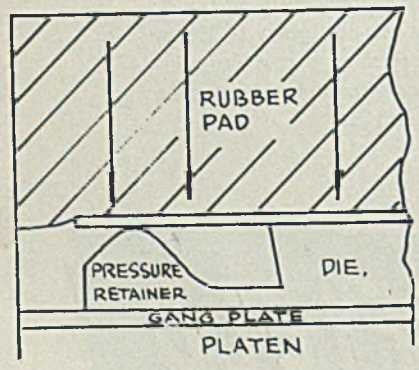
as used in

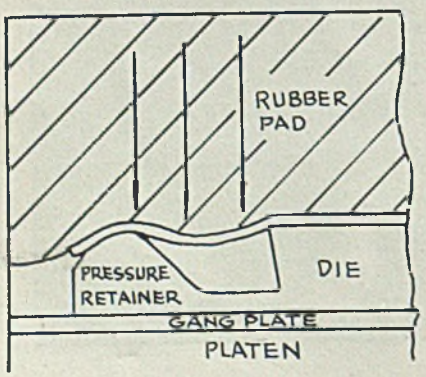
METAL DRAWING and PRESSING

By L. J. BROWN
Avon Rubber Co. Ltd.









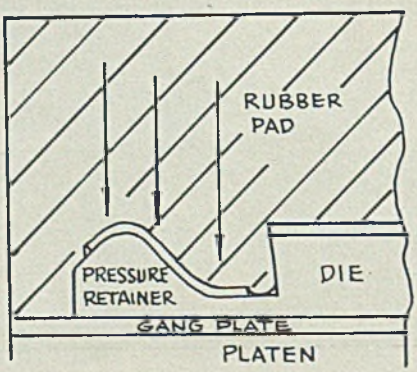


Fig. 4. (Upper three views, left) —Combined shearing and forming. Note flanging by forcing work around at unsupported surface. Diagrams show three stages of one operation that combines both cutting and forming. Shearing die is case-hardened steel plate fastened to wood block

Fig. 5. (Lower views)—Three stages in blanking. Note action of deformation and clamping of metal at outer edge as pressure continues, resulting in final shear

(Concluded From Last Week)

Hydraulic Presses: Much has been written on the hydraulic press process, and much useful information has been circulated in various private and public documents. The larger presses vary between 2000 and 5000-ton ram pressures. The user's choice of rubber on such presses is small indeed. The box contains a solid pad of rubber built raw into the cavity and then vulcanized there. The rubber hardness of this particular type of equipment is arranged about 70 to 75 degrees Shore.

Any margin of error in hardness for the peculiarities of any particular job is taken care of in the high pressures available, but this is not conducive to the best work. As soon as the rubber touches metal it acts as a pressure pad and starts to cling to and hold the metal from flowing evenly forward. For drawing operations, therefore, excess pressure will not cure this difficulty, and the engineer will readily recognize many of his troubles in this simple statement. *The metal to be formed should be free to flow forward to the deeper parts where it is needed.* The alleviation of this condition can only be correct correlation of tool design and rubber hardness and on such a press this is not by any means a simple matter.

In the "vulcanized in place" type—to which most of the above observations apply, it will be assumed that the rubber face is ready for repair or renewal.

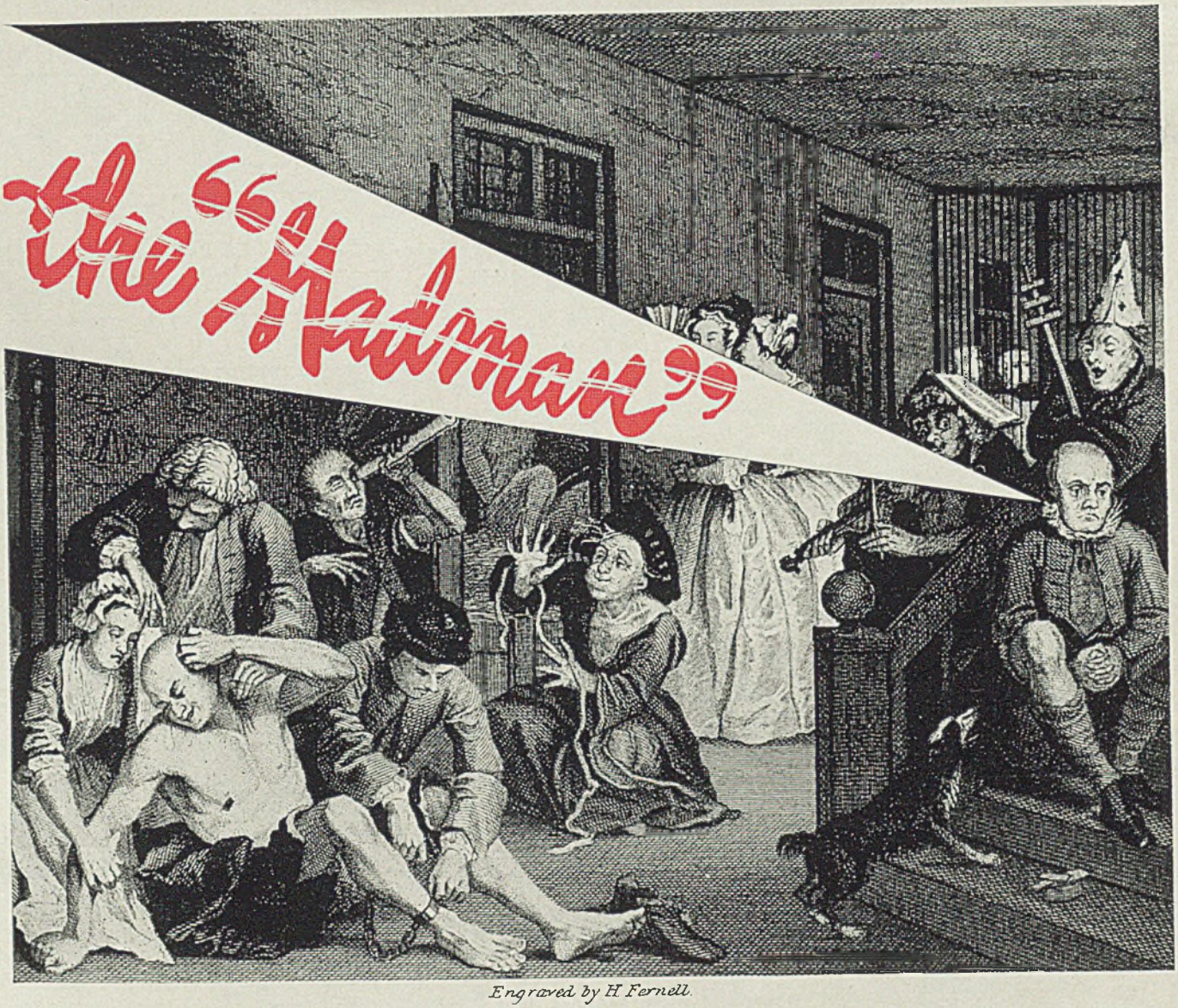
The worn part has to be ground away. The surface is then built up again by adding unvulcanized rubber compound, a dead inelastic dough-like substance, and the press is then closed until the surface of the rubber lies on the lower metal bed.

Heat is then applied through the provision made in the construction of the press and, after due time, the new surface becomes vulcanized and elastic. If complete renewal is required, the process is the same except that it may be better to remove the box and pad for greater ease of repair, although this in itself is a major operation resulting in the loss of considerable working time.

A difficult feature of this process from the rubber point of view, which must be reflected in the press products, is as follows: Raw rubber, before it is compounded, is a natural vegetable substance which acts as a base material. It is masticated on a horizontal mill, becomes heated, plastic and fully mobile. At this stage, selected powders or "fillers" best suited to the ultimate known duty of the material are milled into it, in predetermined order, to give a thoroughly mixed and homogeneous mass. When cold, this mass looks "rubbery", stiffens up a good deal, but it is dead and lifeless until it is "vulcanized", when for the first time it becomes elastic and develops a "recovery" power.

This vulcanization is a heat treatment better described by the popular term of "curing". The rubber is confined to whatever shape is ultimately desirable while still in the uncured condition;

From *Sheet Metal Industries*, London.



Engraved by H Fernell.

THIS man had a vision. He saw a world in which men would fly through space, and voices could be heard thousands of miles away. A world in which buildings would be many houses high, lighted without lamps, and ascended without recourse to stairs. A world in which machines would do most of the work. . . . And he saw all this made possible as a result of water being heated in a closed container. Standing at the threshold of the age of steam, he had a vision of the future.

Now this man lived in a sane and sensible world, so they beat him with brooms and pelted him with pots, and his final reward for this demented woolgathering was one of the less sanitary cells in Bedlam.

We haven't yet reached the millennium, of course. But we've learned the value of vision. We've learned that it is a divine sort of madness, to be searched for rather than hunted, to be used rather than destroyed.

Today, we're on the threshold of a new age of power — the new Age of Air Transportation — and a handful of visionary men are already telling us what they see in the future beyond this war.

A vision? Yes, but no pipe dream, for the day of world air transport is already in the planning stage.

We in the field of machine tool engineering have had a hand in bringing about the vision of this new age. We helped to make possible the "impossible" mass production of aircraft and engines through an entirely new assembly line technique, known as "fluid production." And today, we're already at work on production plans for the future.

There is no tool that we cannot build, no job that we cannot do, given the necessity. . . . War was a necessity. So, too, will be peace. . . . We invite you to call upon us now, as the leaders of American industry have been doing for more than a century.

Universal Turret Lathes . Fay Automatic Lathes . Automatic Thread Grinders . Optical Comparators . Automatic Opening Threading Dies

JONES & LAMSON MACHINE CO., SPRINGFIELD, VERMONT, U.S.A.

Profit-producing Machine Tools

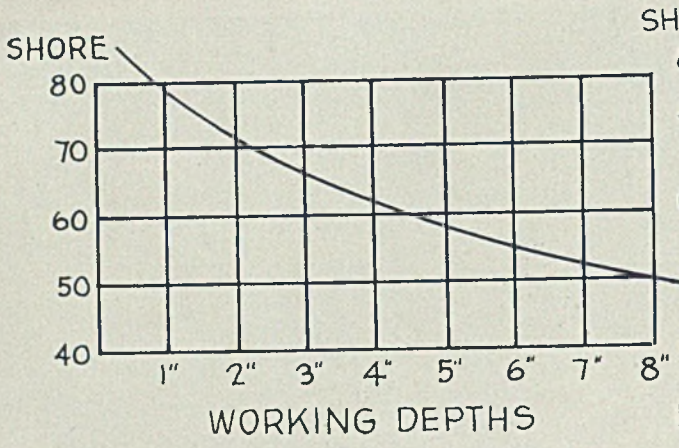


Fig. 6. (Left, above)—Working depths of rubber pad plotted against hardness of rubber

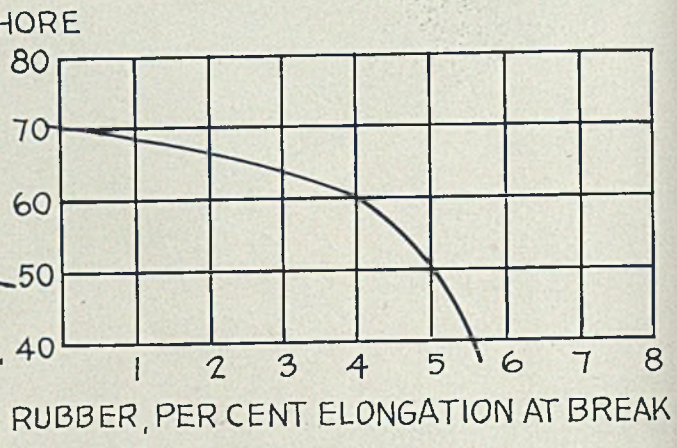


Fig. 7. (Right)—Per cent elongation of rubber at break plotted against hardness of the rubber

after curing, this shape is permanently retained. The heat treatment used for sheet or flat rubber shapes is usually applied between steel plates, the medium being piped steam to give approximately 300 degrees Fahr. on the plate faces.

Once cured, the rubber cannot regain its "raw" properties (although with special plant a portion of it can be reclaimed for use as a rubbery filler).

If heat is applied beyond the vulcanizing maximum, either at the time of original "cure" or at any time thereafter, the material begins to lose valuable physical properties and is termed "overcured". It loses elasticity, its deformability is impaired progressively, and (according to the peculiarities of the mix employed) becomes brittle and "short", surface cracks and blemishes becoming apparent. If there is a sufficiency of free sulphur in the mixing, it will harden rapidly. If there is no sufficiency of free sulphur to do this, then the material will soften slightly and the same loss of physical characteristics will become progressively apparent.

How, then, can this system of repair or surface renewal be desirable when one considers the requirements of the press process? The top skin may be normal cure but below this the physical characteristics may be anything and will have wider variations as successive repairs have to be carried out.

Taking the long view of complete replacement of the whole 10 inches of pad thickness, it must follow that if the engineer wants consistent work then he must face this cost long before it should be necessary. It comes down again to "costs" and in this and many other ways these presses are seldom economic, although they might have been so designed.

Mechanical Presses: Some authorities say that it is wrong to advocate adapting mechanical power presses to the rubber process. This advice is based upon the fact that constrained, boxed rubber pads will build up such pressure from the accumulated flywheel energy that there is a danger of the crankshaft suffering should the press stall. Also that the return stroke might fly up and cause head damage.

It is enough to say that there are many individual and proprietary devices already in existence, and there is no need for such happenings. *If such damage did occur, it would be due largely to careless experiments and a poor choice of operation detail.* Such conversions must, therefore, be included along with hydraulic units as the writer has seen many such conversions working quite happily. The top box then is assumed to be already provided and this is filled with rubber according to needs. Such a box can be almost any size and either rectangular or circular.

A standard offer in sheet rubber which not only seems to be a popular size for the pressman to cut up himself, as required, but also is a convenient and economical size for the rubber company to make, is 5 or 5½ feet by 3 feet. It is a great advantage to fill the box with sheets of rubber and not a solid pad.

Some confusion has arisen in the literature by the use of the word "laminated" pad. It should be clearly defined that where the word laminated is used it means that the sheets are not stuck together, but *are quite separate and free to move one on another.* In the past, attempts have been made, in some instances, to avoid the necessity of vulcanizing a new pad in place by sticking together, by means of solution, a number of slabs of vulcanized rubber. This attempt to open up the supply position is well understood but it can never be good.

Another idea consisted of a heavy

(*Please turn to Page* 105)

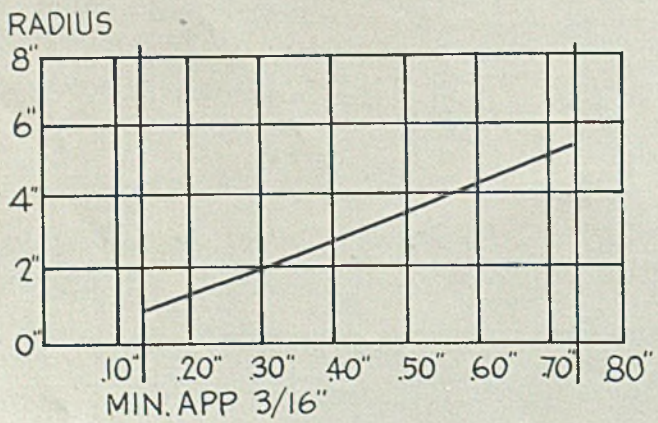


Fig. 8. (Left, below)—Data for 90 per cent concave flanging. Minimum flange width for curves as shown, 18-gage Duralumin

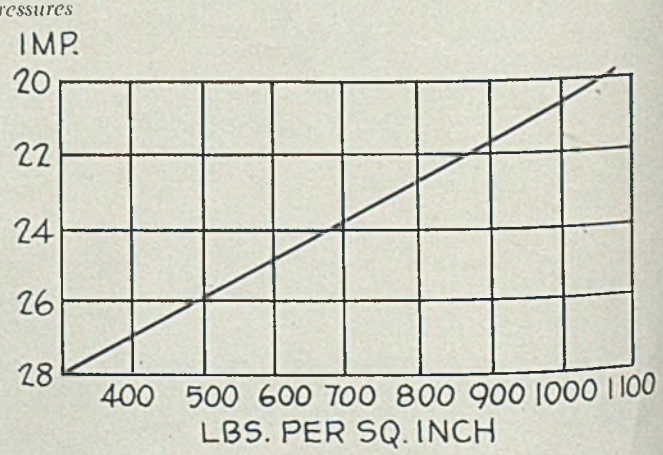
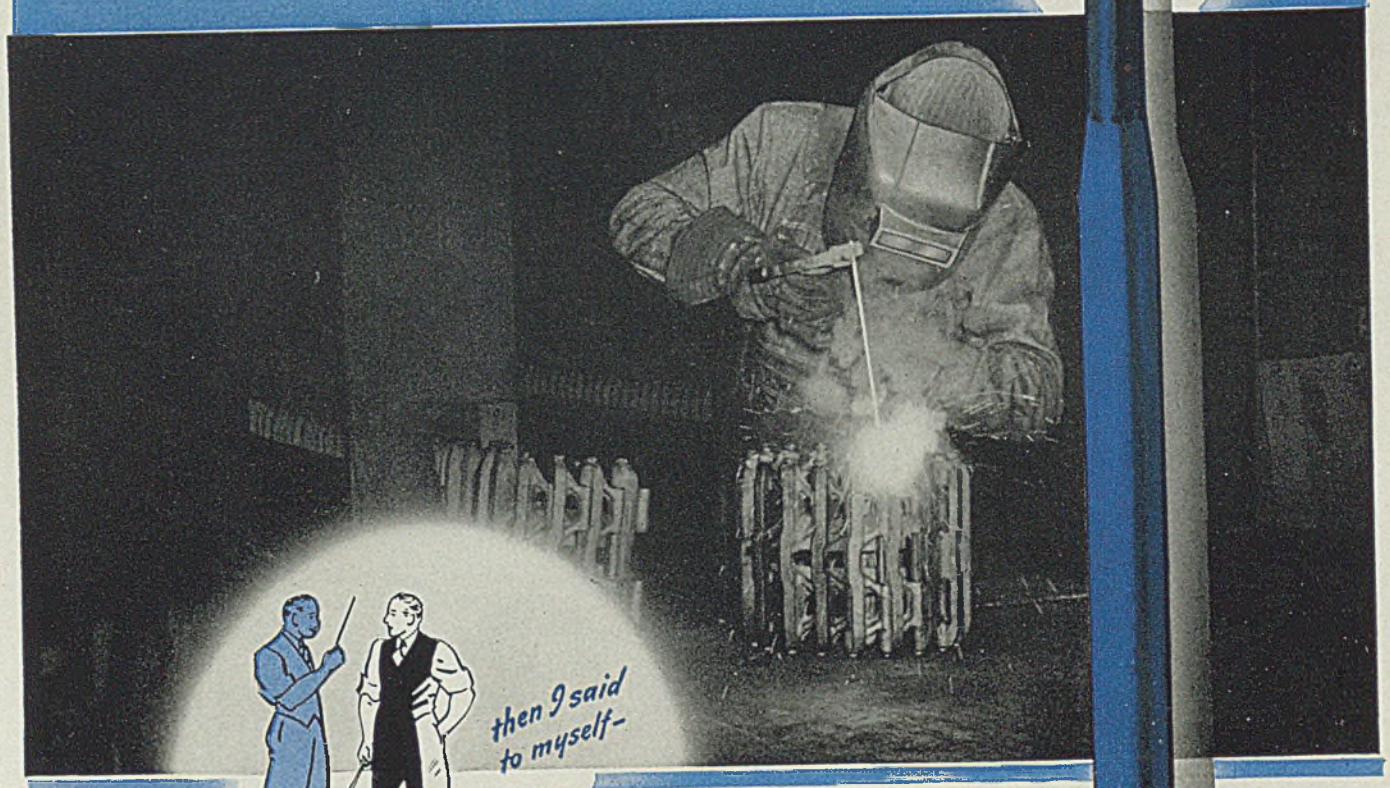


Fig. 9. (Right)—Duralumin shearing pressures



then I said to myself-

This "BIG STICK Policy" ups production 140%

Teddy Roosevelt had a good idea in 1901 when he advised, "carry a big stick, and you'll go far."

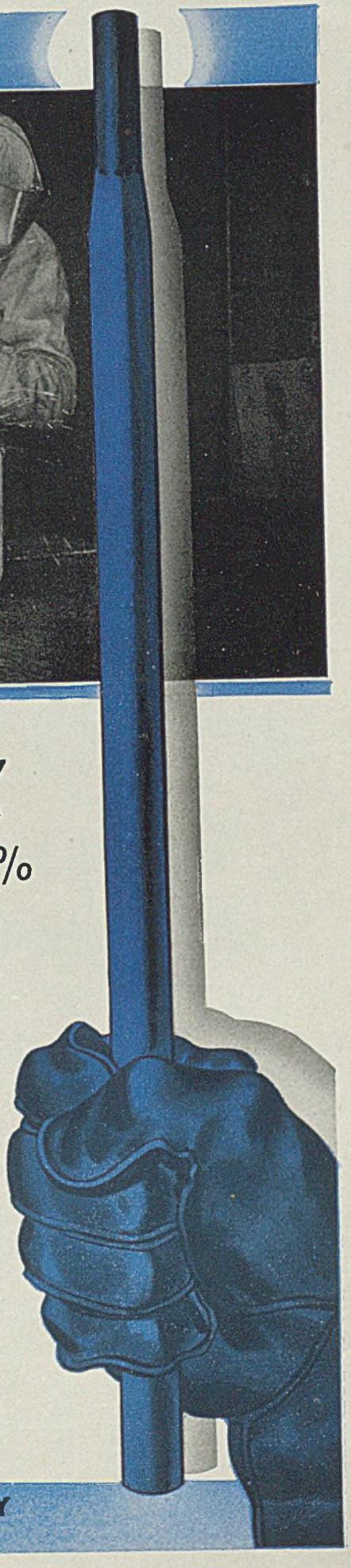
Yes, by today's arc welding standards that "Big Stick Policy" is still good.

Right! USE THE BIGGEST POSSIBLE STICK OF ELECTRODE, AND YOU'LL GO FAR.

Look what they're doing in this shop. By boosting electrode size, output of tank track sections was increased like this:

Size "Fleetweld" Electrode	Parts Welded Per Hr.
1/8"	10
5/32"	17
3/16"	24

Swell! 3/16" electrode may not be a giant but it got "big stick" results here . . . an output increase of 140%. Some shops are boosting electrode size up to 3/8". It all depends on the nature of your work. You can get "big stick" advice from Lincoln.



THE LINCOLN ELECTRIC COMPANY
Cleveland, Ohio

Factors Affecting open hearth Design

By DR. A. H. LECKIE
Industrial Research Council
Iron and Steel Institute
London, England

DESIGNERS of open-hearth furnaces have been mainly concerned with structural principles, and treating the furnace as a building rather than as a piece of technological plant. The internal design of the passages, ports, and valves has been based more on practical experience than on fundamental theory. While it is of first importance that designs should be based on a plant which has worked well in the past, it is equally important to consider fundamental theory so that maximum efficiency may be attained. This treatise refers chiefly to the furnace considered as a melting unit. Although the melting aspect is not so important in Lincolnshire as in some other areas, owing to the high proportion of hot metal charged in this district, the melting process is so important that no apology is necessary for concentrating on this.

Some of the most useful papers and books on the general principles on which furnace passages should be designed are listed at the end of this paper, Nos. 1 to 10. In some of the earlier publications the methods of calculation are set out in a rather lengthy and complex way; perhaps the most simple and straightforward system is that advocated by Etherington.[9]

If a furnace is performing badly the accompanying chart illustrates a convenient way in which the fault may be traced. This refers to permanent faults in design; the chart is not intended to cover causes of slow melting attributable to bad operation, such as the use of excessive air, gas, or draft, or to temporary troubles such as choked checkers or slag pockets.

Two of the faults, bad gas and low pressure, are not attributable to the furnace itself. In mixed or coke oven-gas fired furnaces, gas is generally of good, consistent analysis, and it is simply a matter of getting the necessary luminosity through preheat or tar addition. Where producers are used, there is greater variation in gas quality, but this is a matter for the producer operator. Again, low pressure, being usually due to inadequate producer capacity or to badly laid out mains, must be attended to apart from the question of furnace design. If the trouble is due to large external heat losses (radiation, gas leaks, etc.), the condition in which this factor would be large enough seriously to affect performance would be obvious.

All the other points in the chart, with the exception of port design (to be mentioned later) are covered by an examination of the pressure balance of the furnace. Pressure calculations demand a knowledge of the volumes of gas flowing and of the gas temperature. Methods of making these measurements are discussed in the published literature; the salient points are as follows:

For measuring the flow of gas and air to the furnace, reliance is usually placed on the conventional orifice method. This offers no difficulty where air or clean gas such as mixed or coke-oven gas is concerned. The measurement of crude producer gas is a little more difficult, but may be done by using a firebrick orifice, which stands the week-end burnout, steam-blown occasionally for cleaning purposes. This method was developed by the meter manufacturers in conjunction with the gas producer subcommittee of the Iron and Steel Industrial Research Council; any failure of this method is almost invariably due to a badly designed producer main causing the gas temperature to fall below 400 to 450 degrees Cent. before passing the orifice. In all producer main installations the gas should be kept above this temperature to prevent deposition of tar. Some works successfully use a metal orifice for producer gas[11], withdrawing it when the mains are burned out.

Occasionally it may be desired to measure the flow of hot air or waste gas in the uptakes to examine flow conditions, partition between the uptakes, or extent of infiltration. For such experiments the water-cooled pilot tube is suitable[12].

The difficulties of gas temperature measurement were fully discussed at a symposium held by the Institute of Fuel in 1938[13]. For high temperatures a water-cooled suction pyrometer[12] is necessary, but approximate estimation of the temperature in uptakes may be made by using an optical pyrometer sighted on the hot wall.

Comparison between optical and suction pyrometer readings, as shown in Fig. 1, suggests that a fair idea of the true air or waste-gas temperature can be obtained by subtracting 200 degrees Cent. from the optical reading (sighted on the uptake wall) for ingoing air, and adding 100 degrees to the optical reading for out-going gas. The wall seems to adhere more closely to the waste-gas temperature than to the ingoing air temperature, probably because the heat transfer between waste gas and wall is

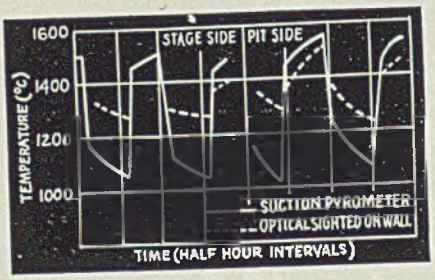
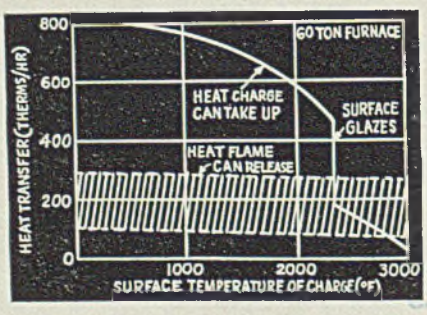


Fig. 1—Comparison of optical and suction pyrometer readings of air uptake temperature measurements, 40-ton furnace

Fig. 2—Approximate limits of heat transfer during melting period



From a paper presented before the Lincolnshire Iron and Steel Institute, Scunthorpe, England, Feb. 16, 1943, and published in *The British Steelmaker*.

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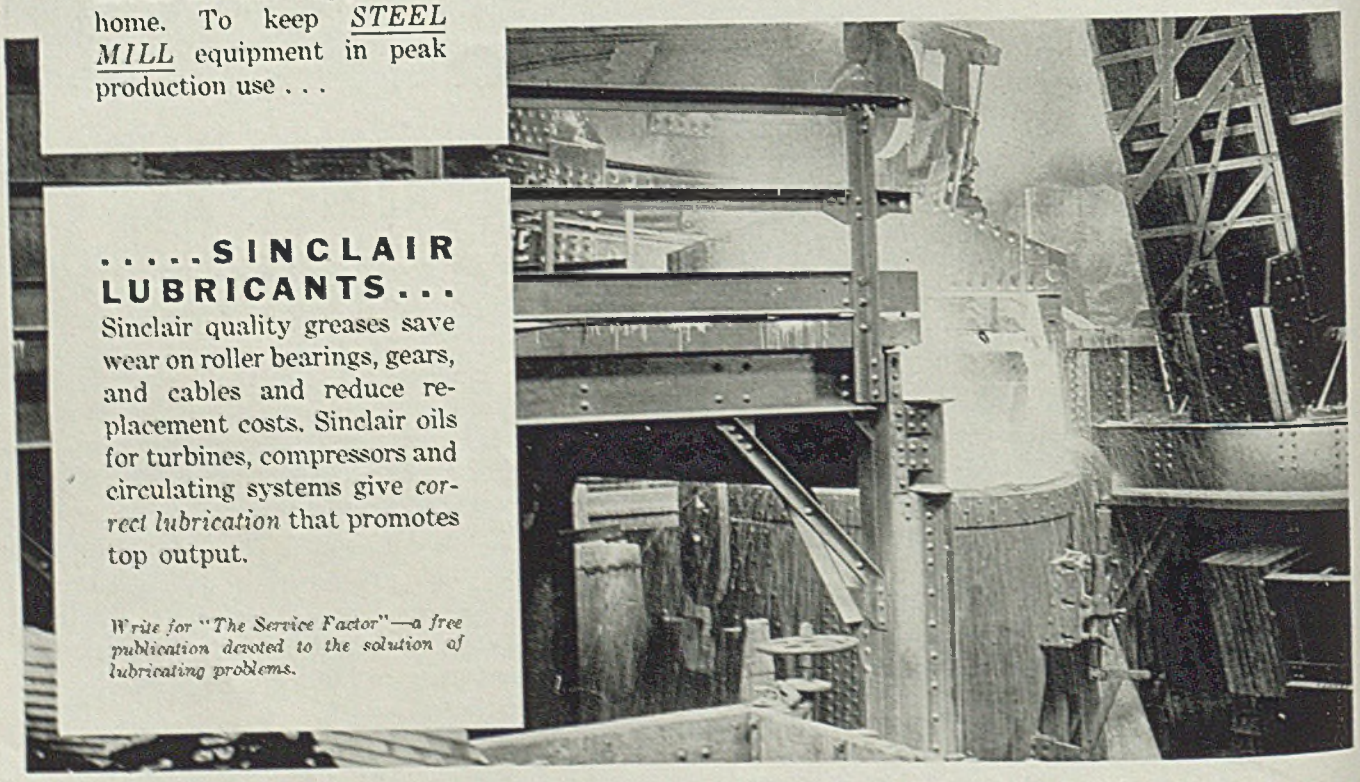

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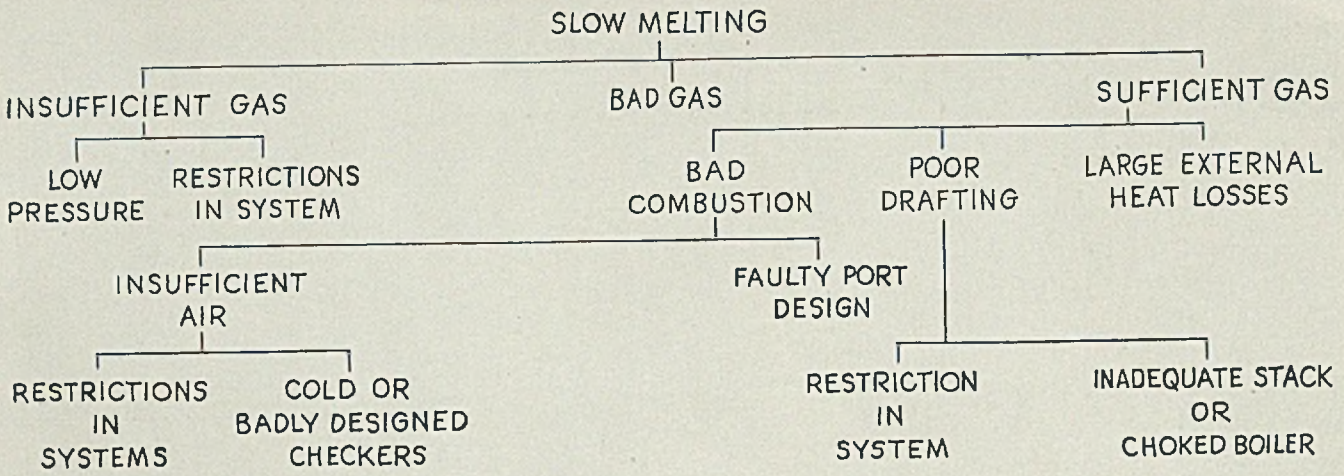


Chart showing various causes for irregular working furnace

better than between wall and ingoing air, as the waste gas contains slag and dust particles which increase its emissivity.

It has been found that in most open-hearth furnaces working on producer gas the true temperature of the ingoing gas and air is about 1100 degrees Cent. in the uptakes. If the furnace is keen, 1200 degrees for the air and 1100 degrees for the gas might be taken, while for slower furnaces the figures might be 1100 degrees and 1000 degrees Cent. These figures are irrespective of what the temperature of the checker might be, as it appears that the powerful regenerative action of hot uptakes and slag pockets is sufficient to damp out appreciably variations due to different checker types. For instance, if a furnace is relatively under-checked so that the ingoing gas and air leave the checkers relatively cold, the gas is all the more capable of taking up heat from the slag pockets and uptakes. These in turn are cooled more, so that they recover more heat on waste gas. This argument must not be carried too far, of course, otherwise one reaches the absurd conclusion that checkers are not necessary at all, but it does seem to hold to a large extent within the variations in checker capacity encountered in practice. It is rather significant that many furnaces working equally well differ widely in checker design and capacity.

The constancy of the ultimate preheats, despite varying checkers and different furnaces, is shown in Table I which gives the air preheats in five furnaces and the waste gas temperatures.

The results of Clements and of Kinney and McDermott were obtained with ordinary, not suction, thermocouples, which would give readings similar to an optical pyrometer, being exposed to the uptake wall radiation. The figures quoted against their names were obtained by applying the appropriate correction of —200 deg. (air) and + 100 deg. (waste gas) to their published figures.

While in an existing furnace the gas flow can be measured, in designing a new furnace, or in checking whether an existing furnace is receiving sufficient gas, the gas requirements must be calculated. Various methods of doing this are given in textbooks (*e.g.*, Trinks[2]). The chief point is specifying the melting rate required, and from this the required rate of heating the charge. The necessary gas rate to give this melting rate is then obtained by calculating the heat losses in waste gas and by radiation, etc. (from published heat balances), the remaining heat in the gas being usefully available for melting.

From a series of such calculations on producer-gas-fired furnaces it is suggested that the passages be designed to take the gas flows given in Table II. These are much higher than generally encountered, but it is advisable to allow for a generous maximum, as it is easier to control flow in a large passage by dampers or chokes than subsequently to enlarge a passage made slightly too small.

Allowing for the quantities of excess air generally encountered, the corresponding air volumes and waste-gas volumes will be 1.6 and 2.5 times the respective figures given in Table II. Specification of gas flow for furnaces above 100 tons capacity has not been attempted as the large furnaces are generally hot-metal tilters where little melting is done, and there is considerable chemical heat evolved. Such furnaces do not take as

(*Please turn to Page* 108)

Table I—Air Preheat and Waste Gas Temperatures

	Air preheat, (deg. C.)	Waste gas, (deg. C.)
Clements[14]	1100	1660
Kinney and McDermott[15]	1100	1510
Henry and McLoughlin[16]	1130	1450
I.S.I.R.C. Works (1)	1200	1500
I.S.I.R.C. Works (2)	1100	1500

Table II—Maximum Gas Flow for Various Furnaces

Furnace capacity, tons	Specified maximum gas flow (cub. ft. per hr. at normal temp. and press.)
40	170,000
60	230,000
80	300,000
100	350,000

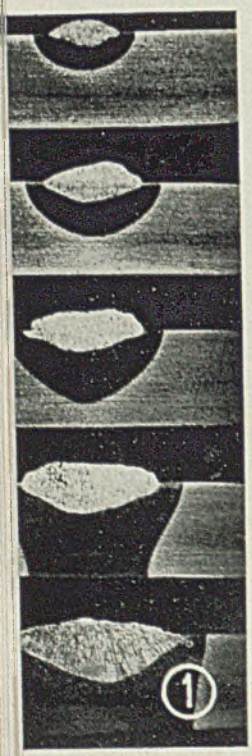
Table III—Example of a Pressure Balance for Ingoing Air
(Air flow required: 400,000 cub. ft. per hr. at normal temp. and press.)

Portion of furnace	Area sq. ft. (A)	Length ft. (L)	Perimeter ft. (P.)	Gas velocity ft. per second at N.T.P.)	Average gas temp. deg. C.	p_s in. W.G.	f_1	f_2	f_1+f_2	p_v in. W.G.
Reversing valve	16	...	...	7.0	50	0.0133	2.0	...	2.0	0.0266
Flue between reversing valve and checkers	16	10	Av. 16	7.0	100	0.0153	2.0	0.125	2.125	0.0325
	22.3 to 61.5	28	19	5.0	100	0.0078	1.0	0.298	1.298	0.0101
Flues below checkers (4)	Total 34.4	...	...	3.25	100	0.0033	2.0 (entry)	...	2.0	0.0066
Checkers, 41 courses	50	...	...	2.22	525	0.0030	12.3	...	12.3	0.0369
Bridgewall and slag pocket	80	...	...	3.70	950	0.0141	1.0	...	1.0	0.0141
Uptakes (2)	Total 24.15	25.5	15 each	4.60	1000	0.0226	2.5	0.40	2.9	0.0655
Port	14	8.5	21.8	7.94	1050	0.0700	3.54	0.16	3.7	0.2590
Total pv										0.4513
Total ps	(*a*) Buoyancy in checkers 19 ft. 1½ in. at 525 deg. = 0.1798 in.									
	(*b*) Net buoyancy in uptakes and port, 22 ft. 7½ in. at 1000 deg. = 0.2579 in.									
$= a + b$	(*c*) Buoyancy in air valve, 0.0160 in.									0.4117
$-(c + d)$	(*d*) Furnace pressure, 0.0100 in. (assumed)									
Net pressure required before reversing valve										0.0396

User Report No. 15 on Experience with . . . .

NE (National Emergency) ALLOY STEELS

A study of the weldability of NE-8339 manganese-molybdenum steel piping



By R. W. EMERSON
Metallurgist
Pittsburgh Piping & Equipment Co.
Pittsburgh

NATIONAL emergency (NE) steels consist of medium carbon, manganese-molybdenum steel, AISI series NE-8000 to 8500; and medium carbon, nickel - chromium - molybdenum steel AISI series NE-8600 to 8900, plus the newer NE-9000 group and others. The range of composition of these first two groups is given in Table I.

Realizing that increasing tonnages of these analyses are being used in fabricated parts and with some appreciation of the difficulties involved in the welding and cutting of the manganese-molybdenum type, particularly the grades which exceed 0.25-per cent carbon, it is felt that a discussion of some of the problems involved, would be of value to those having little or no previous experience with manganese-molybdenum steel.

Effects of Alloys: Manganese has a complex cubic lattice which lowers the transformation temperature of austenite and promotes the gamma phase over a wider temperature range as the manganese is increased. Molybdenum is much more effective in raising the austenite transformation temperature than is an equal quantity of manganese in lowering this temperature. The combined effects of manganese and molybdenum in the quantities listed in Table I for NE-8339, however, produce an Ae_1 temperature which is only a few degrees lower than that of plain carbon steel.

Though the Ae_1 temperature is only slightly altered, the solution of manganese and molybdenum in austenite results in a greatly retarded transformation, which in effect, *promotes hardenability; this adversely affects weldability.*

The analysis of the material used in this investigation is carbon 0.33 per cent, manganese 1.68 per cent, phosphorus 0.026 per cent, sulphur 0.020 per cent, silicon 0.28 per cent and molybdenum 0.30 per cent. Though this analysis does not exactly conform to that of NE-8339 as listed in Table I, the results obtained using the above analysis are believed to be comparable to those obtainable with NE-8339.

The average cross sectional hardness of this material as obtained by water quenching from 1600 degrees Fahr., air cooling and furnace cooling 7/16 x 7/16 x 4-inch long bars is 566 brinell from the water quench, 265 from the air cool and 192 from the furnace cool.

After sectioning the water quenched bar, a crack was observed which extended inward a distance of 5/16-inch from one edge of the bar. This, however, was not surprising in view of the subsequent hardness obtained. The microstructure was found to be fully martensitic.

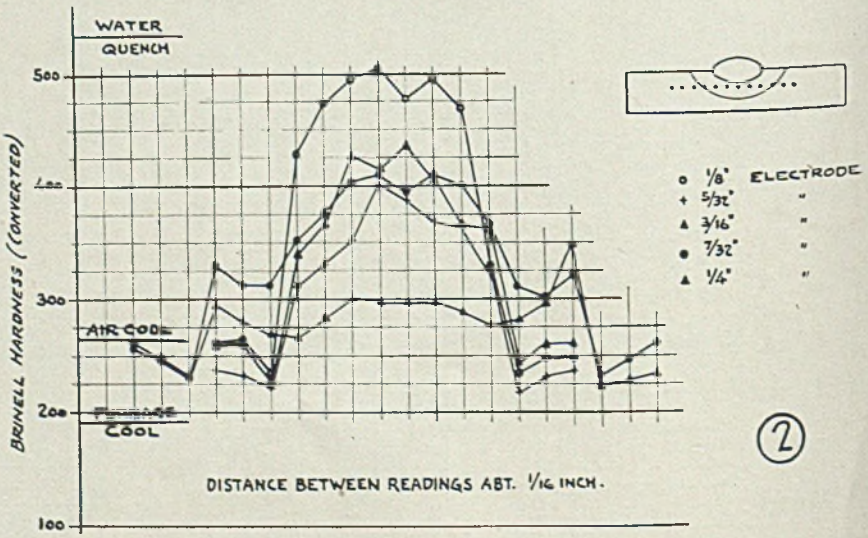
The air cooled bar was found to have a very fine uniform structure of ferrite and carbide, while the furnace cooled specimen consisted of large amounts of ferrite and poorly developed pearlite. Visual observation of the air and furnace cooled specimens after polishing and etching indicated alloy segregation (banding). The air cooled specimen cooled sufficiently fast through the two-phase region so that banding was much less noticeable than in furnace cooled specimen when observed microscopically.

Effect of Welding: Since manganese-molybdenum steel has a retarded transformation accompanied by high hardenability, it is logical to expect, with the high cooling rates obtained in metallic arc welding, that a martensitic microstructure and subsequent high hardness would develop in the heat affected zone of this material. For this reason a series of single bead weld tests were made using ⅛, 5/32, 3/16, 7/32 and ¼-inch electrodes in tests on 7/16-inch thick pipe.

The effect of increasing welding cur-

Fig. 1—Single bead deposits made with (from top to bottom) 1/8, 5/32, 3/16, 7/32 and 1/4-inch diameter mild steel electrodes. Actual size

Fig. 2—Hardness survey of single bead weld deposits in manganese-molybdenum steel



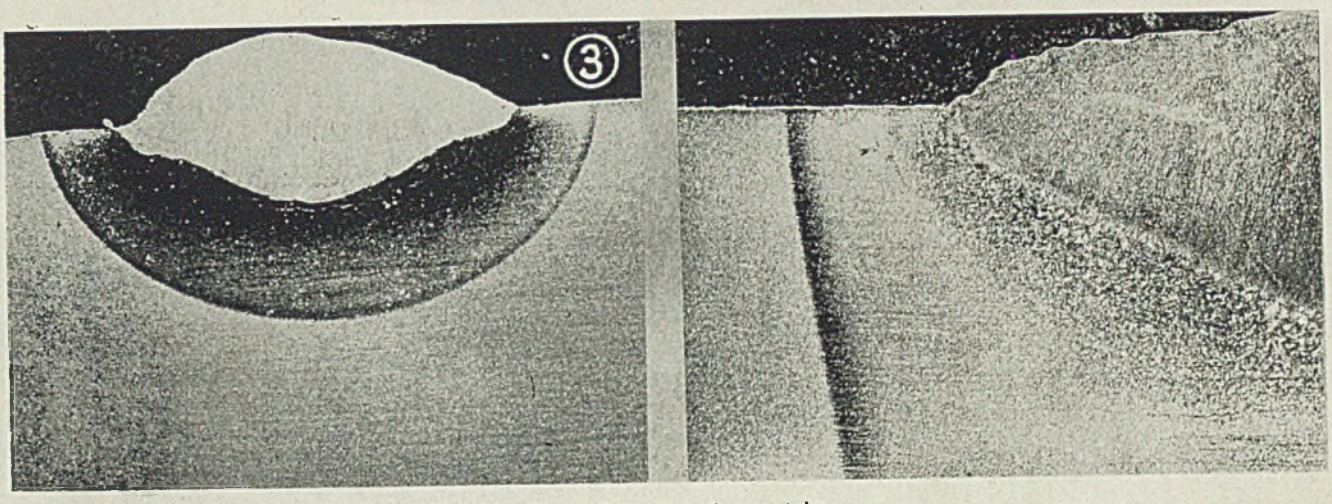
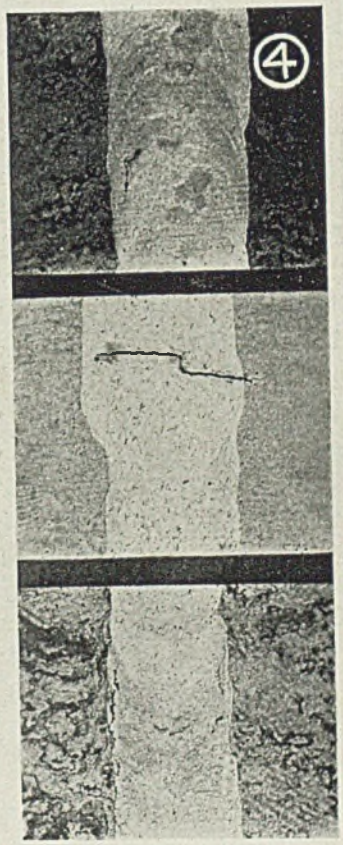


Fig. 3—Single bead deposits—⅛-inch electrode at left, ¼-inch at right—shown at 5 diameters

Fig. 4—Transverse and longitudinal root cracks in bend test specimens prior to bending. Shown at 1½ diameters



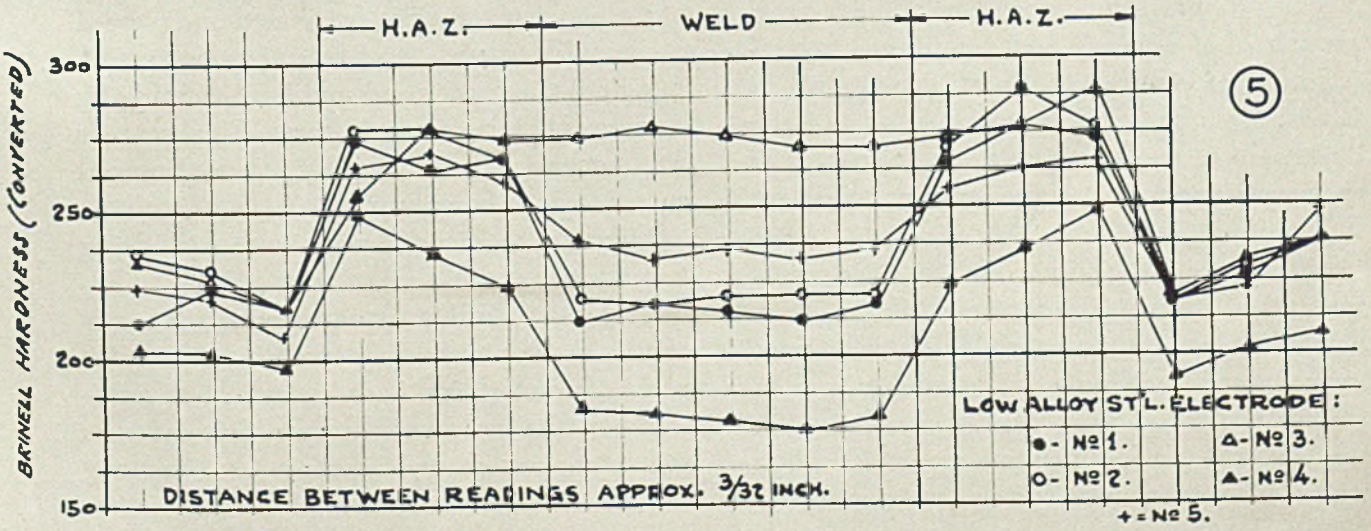
rent (electrode size) on the width of the heat affected zone is shown in Fig. 1. Two views of Fig. 3 show respectively deposits made with ⅛ and ¼-inch electrodes at a magnification of five diameters. The deposit made with ⅛-inch electrode, though not visible in Fig. 3, contained a series of cracks in the heat affected zone just below the line of fusion, as did the welds made with all other size electrodes except that made with the ¼-inch.

Fig. 7 illustrates the microstructure of the weld made with the 5/32-inch electrode, showing the weld metal, line of fusion, extent of cracking in the heat affected zone, the two-phase region and parent metal. The foregoing evidence, in addition to the brinell hardness values obtained in the heat affected zone of the five single bead deposits as shown in Fig. 2, is believed sufficient to indicate the hazard involved in welding this material with relatively small electrodes and little or no preheat.

From Fig. 2, it may be observed that the hardness produced using the ⅛-inch electrode was 500 brinell and that produced with the 5/32, 3/16 and 7/32-inch electrodes exceeded 400 brinell, the ¼-inch electrode being the only one which produced a hardness not exceeding 300 brinell. Observation of the base line hardness shown to the right, indicates that the hardness of the heat affected zone, in all cases but one, approaches that of the water quench base line. The hardness produced by the 5/32-inch electrode seems somewhat low with respect to the other data; in all probability the maximum hardness should approach 450 brinell in this case.

Physical Properties: In view of the preliminary investigation, all subsequent tests were made using a minimum preheat of 400 degrees Fahr. The tests

Fig. 5—Hardness survey through welds and adjacent areas made in manganese-molybdenum steel "as welded", using five different low alloy steel electrodes. Note wide range in hardness of weld metal



FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

NEW PRODUCTION TEAM DELIVERS THE GUNS FOR VICTORY

The new 75mm. gun, descendant of the famous French 75 of World War I, is winning victorious acclaim in this war for and by our armed forces. This powerful weapon is one of the keystones in the teamwork our armed forces are employing on the fighting front to defeat the enemy.

Likewise on the industrial front it is teamwork that is producing these 75mm. gunbarrels at a fighting pace. The steel comes from a leading alloy steel manufacturer in the form of solid rounds eight feet long. At the Jones & Laughlin seamless tube mills, where oil country pipe is normally produced, these alloy steel rounds are heated and pierced their full length. Next steps are upsetting (forging) the breech end and heat-treating by a famous bearing manufacturer. Final stage is the machining and rifling by a New England machine tool company.

Four steps — four companies — each doing for Victory the thing best suited to its experience, skill and equipment. This is another example of war cooperation taking the place of competition in industry . . . of teamwork on the production fronts that matches the teamwork on the fighting fronts among our armed forces and those of our allies.

BACKGROUND FOR BETTER LIVING

Written from material furnished Jones & Laughlin Steel Corporation by companies named.

Better living in peacetime will result from many applications of "know-how" now fast developing under the stimulation of production for War, Chairman A. W. Robertson of Westinghouse believes. "Industry's responsibility after the war," he says "will be to provide the breadth of vision needed to find ways and means to put this know-how to work to make a better civilization."

Post-war motoring and flying will benefit from new products perfected by the petroleum industry under the driving force of war. Cars and planes designed to use new fuels and lubricants to their best advantage will go many more miles per gallon and be easier and better and cheaper to drive. George H. Freyermuth, Standard Oil of New Jersey engineer, says that "Many will be the other benefits laid at our doors as a result of petroleum being at war. Plants will be producing many new peacetime products in enormous quantities. There will be cheaper chemicals, new synthetic rubbers, new plastics. Just around the corner lie new solvents, new textile fibers, new soaps, new materials of many kinds."

Famous "bubble bath" scene in Clare Boothe's play, The Women, was made dramatically possible by a new lather-sustaining detergent (cleaning agent to us) based on alkyl aryl sodium sulfonate, a petroleum derivative, Allied Chemical & Dye Corporation reports. Today the Navy is using this new latherable salt water "soapless soap" in millions of pounds. It is a product of American research to develop a substitute for palm oil, a War casualty, and will have peacetime applications as yet undreamed of, not only as a "soap" but industrially, for example, to clean steel in pickling processes, according to Analine's Lawrence H. Flett in his American Chemical Society medal address.

More economical containers for many post-war foods, and other products will be the result of war-time research looking toward stretching the tin supply, American Can Company reports. "Several thousand tons of tin will be saved during 1943 as a result of the use of electrolytic tinplate and chemically-treated black plates," the company states. "One of the principal reasons why there has been an ample supply of metal cans for essential foods during the war is because great container manufacturers have been able to utilize more readily available supplementary protective coatings, applying them to the tin-less plate or thinly plated metal developed by the steel companies. The continuous improvement in steel manufacture and treatment has been a great help in conserving supplies during the war and in laying the foundation for after-war development."

Today's "Blackout" plants, with air conditioning and refrigeration for precision manufacture of materials for war are "forerunners of the efficient, healthful plant of the future" predicts Herbert L. Laube, Director, Development Division, Carrier Corporation. "Factories so designed," he says "completely air conditioned, will be employing hundreds of thousands of workers before the war is over, and it is unthinkable that industry in the post-war period will scrap such plants or turn back to outmoded factories." Mr. Laube points out four-fold function of air conditioning to be: control of temperature, movement of air, cleanliness of air, and of humidity.

Oil men, loggers, road builders and others whose operations are in mud, sand or over rough terrain believe that they see a post-war application for one of the types of vehicles being supplied to the United States Army Ordnance Department by the White Motor Company. The wartime Half-Trac can attain high speeds on the highway as well as negotiate the most difficult terrain. It is being used on all the fighting fronts of the world as tank destroyers, scout cars and personnel carriers. The Half-Trac, with its armor plate, employs nearly 6½ tons of steel.

Steel pinions forged (instead of machine cut) is an important contribution of Timken-Detroit Axle Company to saving steel for war that will be reflected in stronger differentials in our autos, trucks, buses in peacetime, especially since complete information on the revolutionary process has been made available to other manufacturers of the same type of equipment. By forging, two high traction differential pinions can be made from approximately the same quantity steel that made only one pinion by machining, and the product is stronger.

75,000 lbs. of earth (25 cubic yards) is the morsel nipped up with every operation of a Marion Walking Dragline when it is stripping soil off the top of buried coal veins, going deeper than ever before, to meet the present demand for more and more fuel supplies for war factories. Coal stripping operations are increasing materially above the 10% they formerly represented of the nation's coal supply. Equipment such as this which digs deeper and dumps farther at less cost will tend to maintain its revolutionary effect on coal production after the war is over.

Synthetic rubber tires are at work successfully in one of country's large steel mills. The B. F. Goodrich Co. reports, "Four experimental tires, constructed entirely of synthetic rubber were built, two of the 22x16x16 and two 22x12x16. They are of the Press-On type, for use on industrial power trucks and are being operated in the plants of the Jones & Laughlin Steel Corporation at Pittsburgh. Latest reports on the tire performance is that they are holding up as well as tires made of natural rubber previously used."

TABLE I—Composition Range of Two Groups of NE Steels

Type	A.I.S.I. No.	Carbon	Manganese	P. Max.	S. Max.	Silicon	Molybdenum	Nickel	Chromium
Manganese	NE-8024	0.22-0.28	1.00-1.30	0.040	0.040	0.20-0.35	0.10-0.20	.....	.....
	NE-8339	0.35-0.42	1.30-1.60	0.040	0.040	0.20-0.35	0.20-0.30	.....	.....
Molybdenum	NE-8547	0.43-0.50	1.30-1.60	0.040	0.040	0.20-0.35	0.40-0.60	.....	.....
Nickel	NE-8620	0.18-0.23	0.70-0.95	0.040	0.040	0.20-0.35	0.15-0.25	0.40-0.60	0.40-0.60
Chromium	NE-8739	0.35-0.42	0.75-1.00	0.040	0.040	0.20-0.35	0.20-0.30	0.40-0.60	0.40-0.60
Molybdenum	NE-8949	0.45-0.52	1.00-1.30	0.040	0.040	0.20-0.35	0.30-0.40	0.40-0.60	0.40-0.60

were made on 18-inch outside diameter pipe with 7/16-inch wall. A 37½-degree bevel was used (75-degree included angle) in conjunction with a 3/16-inch free space and a 1 x 7/16-inch thick backing ring which was cut from the pipe used in the investigation.

When assembling the joint prior to welding, the backing ring was tack welded to the pipe in several places without the use of preheat. Almost without exception, a crack occurred in the pipe adjacent to the tacks. All test pieces which were machined from regions containing backing-ring tack welds were found to contain cracks.

Five electrodes were investigated. Electrodes Nos. 1, 2, 4 and 5 were low-alloy high-tensile electrodes, and No. 3 was a 2-per cent chromium electrode. All tests were made in the flat position by roll welding the pipe. Electrode No. 5 was a flat-position electrode, and No. 2 an all-position electrode. Electrodes Nos. 1, 3 and 4 could be used in all positions only with difficulty.

Hardness measurements were made on all test welds in the as-welded, normalized, and normalized-plus-stress-relieved conditions. Reduced-section tensile and jig-bend tests were made only on material in the normalized and normalized - plus - stress - relieved condition. Since low-alloy steel electrodes sometimes contain small quantities of copper, an age hardening element, stress relieving frequently increases the tensility instead of lowering it; for this reason tests were made in both the above conditions.

Hardness Tests: The results of hardness surveys on welded manganese-molybdenum steel, using these five low alloy steel electrodes in the as-welded, normalized and normalized-plus-stress-relieved conditions are shown in Figs. 5, 6 and 8. Fig. 9 shows the microstructure of welds made with No. 1 electrode in the above three mentioned conditions.

TABLE II—Reduced Section Tensile Tests Made on Mn-Mo Steel Normalized from 1600° F. After Welding

Electrode No. (base metal)	Tensile Strength psi	Elongation % in 2 in.	Remarks
	129,840	20	
	130,600	20	
1	101,500	8	
	101,070	8	
2	102,000	9.5	
	100,100	7.5	All
	104,100	9.5	
	106,100	7.0	Failed
3	119,450	4.5	In
	110,603	4.5	Weld
4	99,900	9.5	
	104,000	9.5	
5	107,350	9.5	
	99,700	7.5	

TABLE III—Reduced Section Tensile Tests Made on Mn-Mo Steel Normalized 1600° F.—Stress Relieved 1150° F.

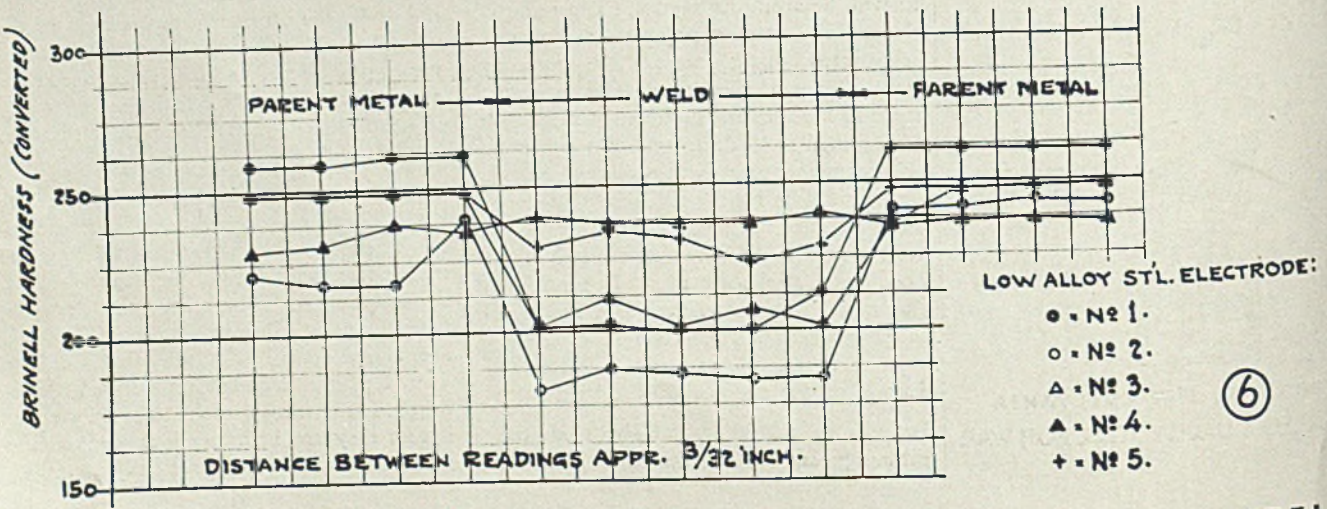
Electrode No.	Tensile Strength psi	Elongation % in 2 in.	Remarks
1	99,920	15	
	100,400	16	
2	97,260	16	All
	95,860	15	Failed
3	102,120	14	
	100,350	11	In
4	94,700	10.5	Weld
	96,350	13.0	
5	99,300	13.0	
	99,400	10.5	

From Fig. 5, it may be observed that the parent metal in the "as rolled" or "as furnished" condition varies from 225 to 240 brinell, the hardness jumping to between 260 and 280 brinell in the heat affected zone. The hardness of the weld deposit made from three of the electrodes varies from 210 to 230 brinell. The 2-per cent chromium electrode No. 3 maintained the same hardness as the heat-affected zone, namely 275 brinell. The results obtained with No. 4 electrode are definitely believed to be 25 points brinell low, but additional material was not available for a check on the original results.

Normalizing from 1600 degrees Fahr. removed the heat affected zone and produced a uniform parent metal hardness. A variation of 240 to 260 brinell in the parent metal of the five welds tested is due to the fact that manganese-molybdenum steel is sensitive to very slight differences in the cooling rate which undoubtedly occurred during air cooling.

Removal of the heat affected zone by normalizing the welds from 1600 degrees Fahr. is substantiated by the center specimen of Fig. 9. The weld metal hardness of electrode No. 5 remained approximately the same as in the as-welded condition, while the hardness of Nos. 1, 2 and 3, and probably No. 4, was slightly lowered. A rise in hardness is actually shown with No. 4 electrode,

Fig. 6—Results of hardness surveys of welds made in same material and with same electrodes as shown in Fig. 5 but after the welded joints had been normalized at 1600 degrees Fahr.



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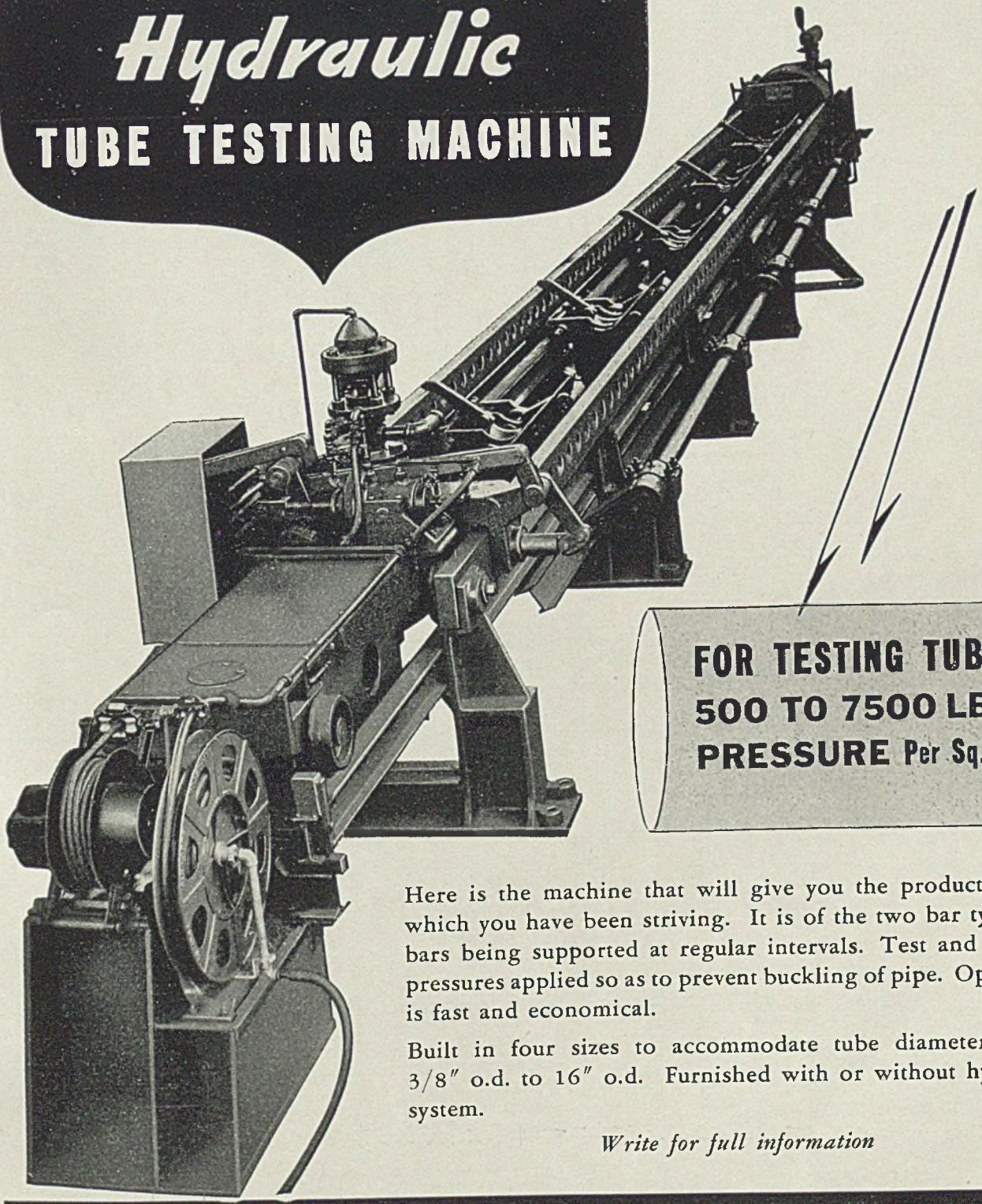

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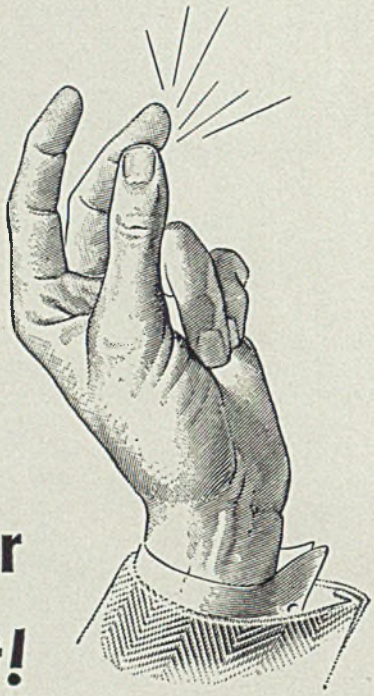

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Fig. 7—Composite structure of single bead weld and heat affected zone made using a 5/32-inch mild steel electrode. Shown at 100 diameters

resulting from the fact that an abnormally low hardness was obtained with this electrode in the as-welded condition.

Normalizing followed by stress relieving at 1150 degrees Fahr. produced a very uniform parent metal hardness of 215 to 225 brinell. The hardness of weld deposits made with electrodes Nos. 2, 3 and 5 remained approximately the same as after the single normalizing treatment, while the hardness of deposits made with electrodes Nos. 1 and 4 was somewhat increased.

Correlation between results of reduced section tensile and hardness tests was not apparent.

Tensile Tests: The results of the tensile tests are given in Tables II and III. From Table II, it is to be observed that the parent metal had a tensile strength of 130,000 pounds per square inch and an elongation of 20 per cent in 2 inches.

The average tensile strength produced using four of the five electrodes varied from 101,285 to 103,075 pounds per square inch with an average elongation of 8 to 9½ per cent in 2 inches. The elongation value seems very low. But considering that the yield point of the base metal was 108,000 pounds per square inch which is in excess of the tensile strength of the weld, this indicates that the entire elongation occurred in the weld metal which represents not more than half of the 2-inch gage length. On this basis it may be considered that the weld metal elongation varied from 16 to 19 per cent in 1 inch.

All specimens failed in the weld with a ductile fracture except that in which electrode No. 3 was used. In this case a higher tensile was obtained but the weld fracture was definitely brittle and also was found to be porous.

The tensile strength, after normalizing and stress relieving at 1150 degrees Fahr. using four of the five electrodes, was found to be from 1000 to 6000 pounds per square inch lower with corresponding increases in elongation. The same also applies to the tests made with No. 3 electrode, the tensile strength in this case however was lowered approximately 14,000 pounds per square inch with the occurrence of a ductile fracture.

Jig Bend Tests: The bend specimens were machined to ¾ x ⅜ inch in cross section and bent in a standard welding jig. The results of both root and face bends, in both the normalized and normalized-plus-stress-relieved condition are given in Tables IV and V.

From Table IV it may be seen that all face bends except one, made using electrodes Nos. 1, 2, 4 and 5, had an average elongation of 30 per cent, and that all root bends which passed the jig test without failure exceeded 30 per cent elongation. In some instances, small cracks or tears opened up in the root of the weld immediately after bending was started.

Since the weld metal was reasonably soft, this condition was at first puzzling. But close examination of the root of subsequent tests prior to bending disclosed root cracks in some cases visible to the eye. This condition was found to be most prevalent in tests made using No. 5 electrode.

Fig. 4 shows both longitudinal and transverse root cracks in bend tests prior to bending. It is to be emphasized that

TABLE IV—Bend Tests Made On Mn-Mo Steel Normalized from 1600° F. After Welding

Electrode No.		Per Cent	Remarks
		20.8	
(base metal)			180° in jig O:K
		22.9	
1	R_1	30.5	Bent 45°—1/16" tear in root.
	F_1	33.3	180° in jig O:K
	F_2	13.2	Bent 30° snapped.
2	R_1	42.0	Fine tear ¼" long 180° in jig.
	F_1	32.6	180° in jig O:K
	F_2	33.0	no defects
3	R_1	19.5	Bent 45° and all
	F_1	16.5	snapped in two pieces
	F_2	13.0	(Porosity present)
4	R_1	42.8	⅛" tear after bending 80°
	R_2	47.5	180° no defects
	F_1	30.8	180° no defects
	F_2	27.8	180° no defects
5	R_1	4.9	Bent 10° ¾" long tear along fusion line.
	R_2	34.0	Bent 80° ½" tear in weld metal.
	F_1	30.0	180° in jig no defects
	F_2		Bent on root by mistake 180° no defects
Retest No. 2	R_1	55.5	180° no defects
	R_2	17.0	Bent 40° tear across root, two small gas pockets.
	F_1	32.0	180° no defects
	F_2	29.6	180° no defects

Note: R indicates root bends; F, face bends

TABLE V—Bend Tests Made on Mn-Mo Steel Normalized 1600° F.—Stress Relieved 1150° F.

Electrode No.		Per Cent	Remarks
1	R	21.5	Bent 45° ¼" tear
	F	22.2	180° in jig O:K
2	R	22.5	60° ⅛" defect
	F	25.7	180° in jig O:K
3	R	18.0	45° ¼" tear
	F	20.9	O:K some porosity—180°
4	R_1	28.6	60° ¼" tear in root
	R_2	37.5	180° in jig O:K
	F_1	24.8	180° in jig O:K
	F_2	26.4	180° in jig O:K
5	R	19.1	30° ⅛" x ¼" root tear
	F	30.6	180° in jig O:K

Other two bends contained visible root cracks, not bent.

Note: R indicates root bends; F, face bends.

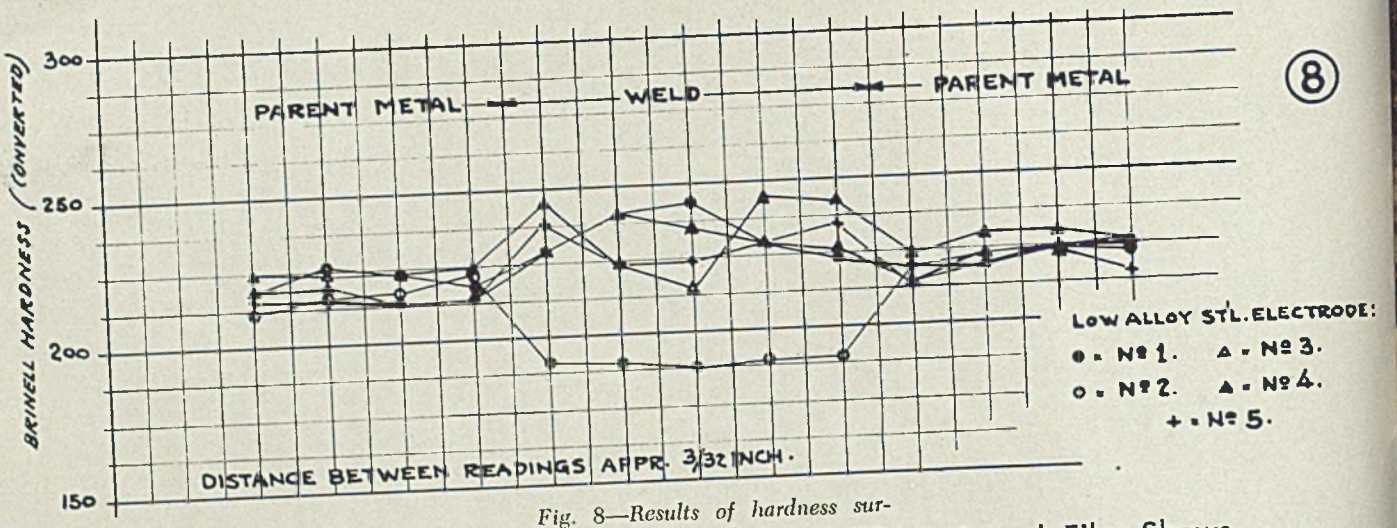


Fig. 8—Results of hardness surveys of welds made in same material and with same electrodes as shown in Fig. 5 but after the welded joints had been normalized and stress relieved at 1150 degrees Fahr.

the root cracks developed in spite of a 400-degree Fahr. preheat. *This definitely points to the need of a high preheat and close metallurgical control when welding this material.*

On the basis of weld metal hardness after normalizing and stress relieving, it is believed that the root bend tests listed in Table V, which show both low elongation and low bend angle, indicate premature failure. This is believed to have been the result of the formation of microscopic root cracks during welding, which immediately opened up upon bending.

It is also to be observed, that those bends which passed the jig test show lower elongation after normalizing and stress relieving than after a single normalizing operation. This is believed due to the fact that stress relieving lowered the parent metal hardness and that a more uniform elongation over the weld and parent metal occurred. In the normalized condition, the parent metal was considerably harder than the weld metal which produced a "forced stretch" in the weld metal.

Conclusions: Manganese and molybdenum, when present in the quantities as listed in Table I of this investigation, promote high hardenability. In turn, this high hardenability adversely affects weldability.

—The hardness obtained in the heat affected zone of single bead welds made on 7/16-inch thick pipe using no preheat, approached that obtained after water quenching this material.

—Cracks formed in the heat affected zone of all single bead welds when the hardness exceeded 350 brinell.

—When metallic arc welding this material with ferritic electrodes and no preheat, cracks will inevitably result in or adjacent to the weld.

—*A preheat of 500 to 700 degrees Fahr. should be maintained during welding followed by heat treatment after welding.*

—A tensile strength of 100,000 to 107,000 pounds per square inch and an elongation of 16 to 19 per cent can be produced in welds on manganese-molybdenum steel *after normalizing from* 1600 *degrees Fahr.*

—Provided root cracks are not formed as a result of insufficient preheat, 30 per cent elongation can be obtained by face or root bending in welded manganese-molybdenum steel *after normalizing from* 1600 *degrees Fahr.*

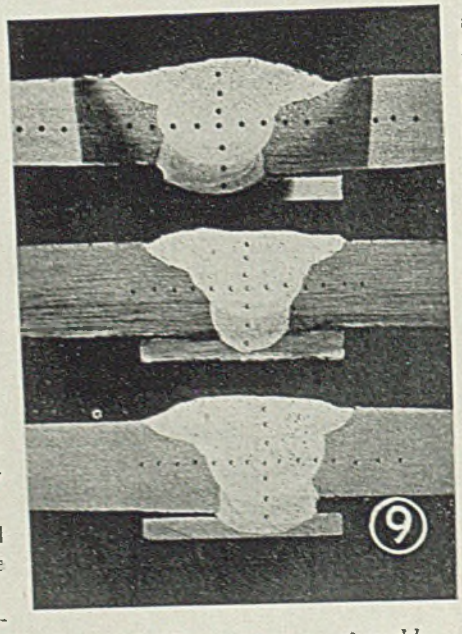


Fig. 9—Macrostructure of welds made with No. 1 electrode—top, shown as welded; center, normalized at 1600 degrees Fahr.; bottom, normalized and stress relieved at 1150 degrees Fahr. Shown actual size

Sound Film Shows Electronics at Work

Six basic functions of electronic tubes showing how each type of tube is used in some of the latest industrial and military applications are explained in an educational motion picture "Electronics at Work," released recently by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. A 20-minute sound film, it is being offered free for showing at war plants and engineering and technical societies.

Animated drawings showing tube construction are used to explain how the cathode, anode and grid elements rectify, amplify, generate, control, transform light into electric current and transform electric current into light.

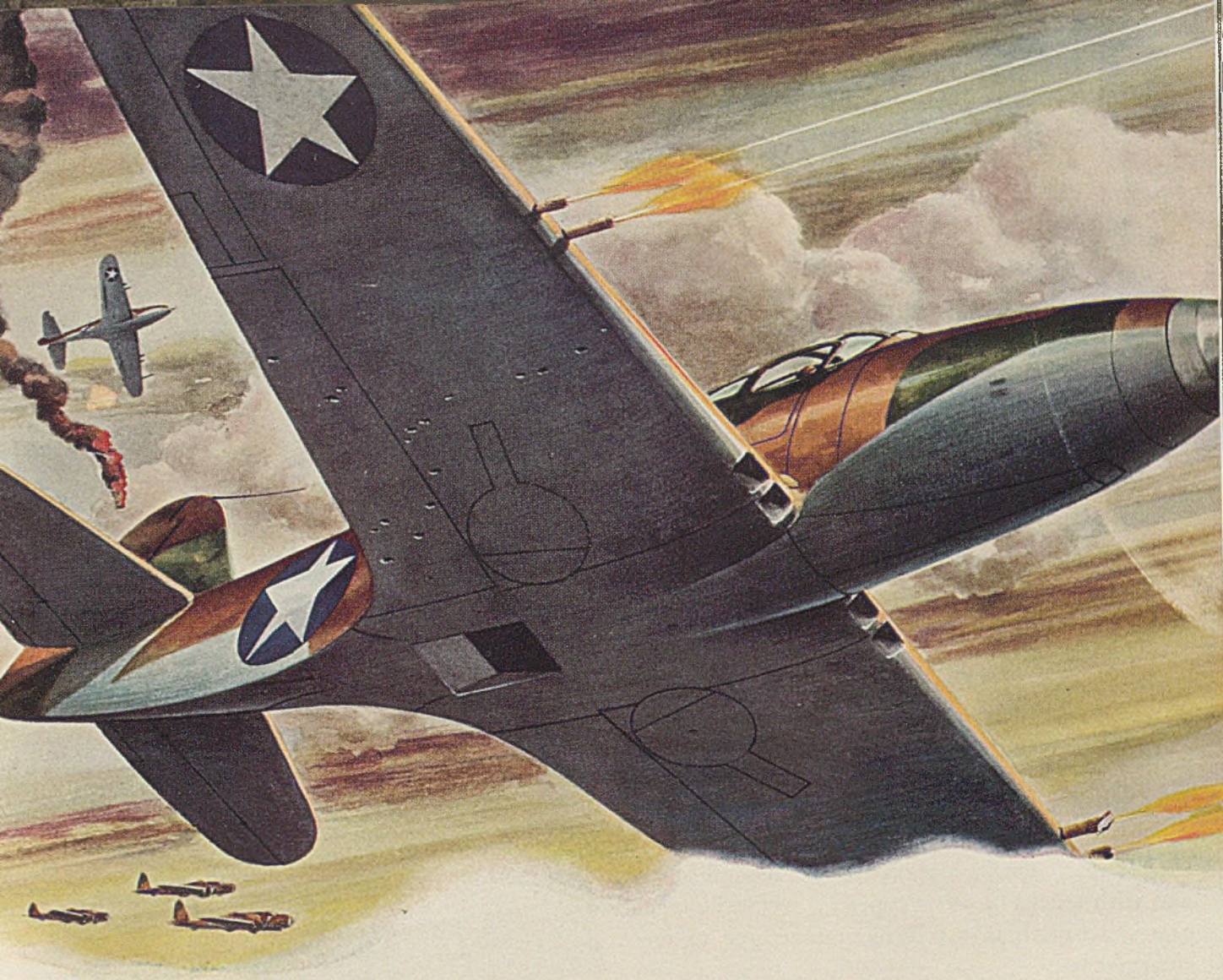
Precipitron, radio, and radio-television and industrial and medical X-ray are a few of the electronic devices which are illustrated and described to show how the tubes perform in the various applications.

Develops Process for Metal Plating Plastics

A new process by which plastics, glass or any nonconductor is plated with any of the plating metals is announced by Precision Paper Tube Co., Special Products Division, 2023 Charleston street, Chicago. By this process the plating goes on the plastic as perfectly and as permanently as the best in any plated metal, it is said.

Convex and concave surfaces, convolutions, corners and recesses are as thoroughly plated as flat or simple round surfaces. The metal plating does not crack, peel or chip in long and severe service, according to Precision.

Suggested uses of the process include plating magnetic and electric shielding of all kinds—radio shielding, electrostatic and magnetic shielding.



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In addition, Continental castings are serving on many types of machinery required in the manufacture of aircraft materials, from mines to the building of airports.

Continental's alloy rolls are making possible ever-increasing production of aircraft metals from mills throughout America.

Other Continental products include steel and alloy steel castings, special machinery and rolling mill equipment for the steel industry.

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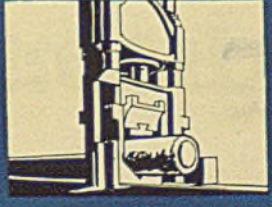
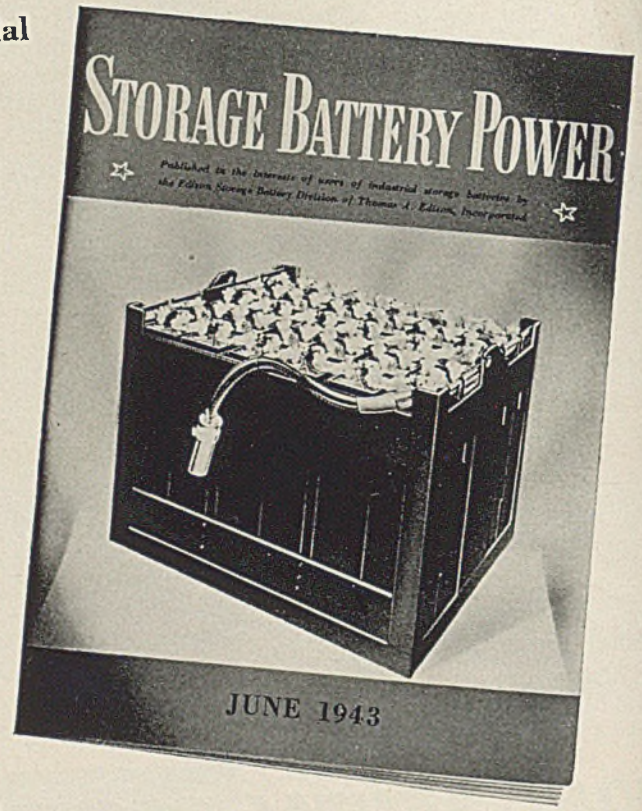


How an Important New War Plant Uses Battery Industrial Trucks

Pre-planned Coordination of Material Handling and Production Reported in "Storage Battery Power"



How fleets of battery industrial trucks in round-the-clock service in one of America's newest and greatest war plants are coordinated like the arms of a modern military organization makes one of the most exciting industrial stories of this war.

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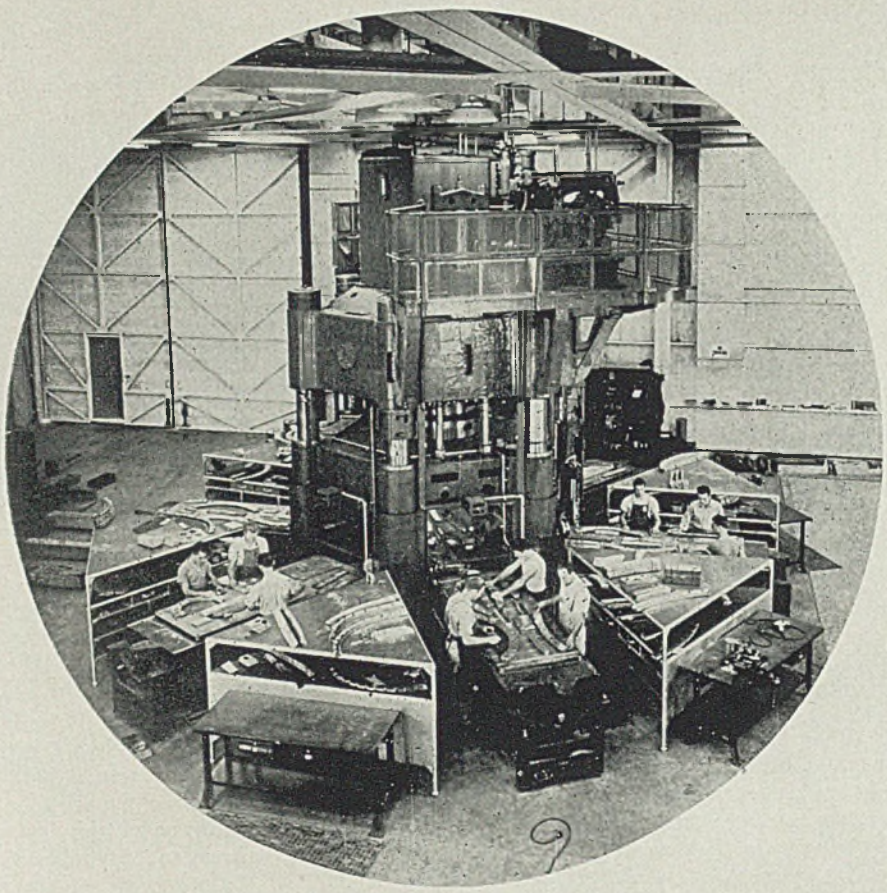


PRESS OUTPUT UPPED

. . . . by special built-in materials handling system

When the six-sided presses were first installed, they were operated entirely by men. Now these men have been replaced by girls who do a fine job because the work is not heavy, involving merely the placing of light aluminum pieces on the dies and removing the formed parts as they come from the dies

AFTER a comprehensive test and operation period of many months, Douglas Aircraft company machinery experts now declare the giant six-sided Bliss hydraulic presses installed in one of their Southern California plants completely successful from every design and production standpoint. The two presses, in fact, are almost too efficient; for when operated in unison, at full capacity, they tax the ability of the rest of the sheet metal operations to supply them with sufficient parts.

Their successful operation again focuses attention on materials handling engineering, for it is due largely to the highly efficient means of assuring a continuous flow of work through the presses that their high output is obtained. Cracking one of the more potentially serious bottlenecks in aircraft fabrication, these machines demonstrate once more the facility of America's aviation industry to solve the knotty problems of specialized aircraft mass production. Absorption of rising production quotas without disrupting normal output activities is an extremely valuable asset in wartime, and it is only by utilization of every possible increase in efficiency that national production totals are now reaching the levels necessary to smash the axis.

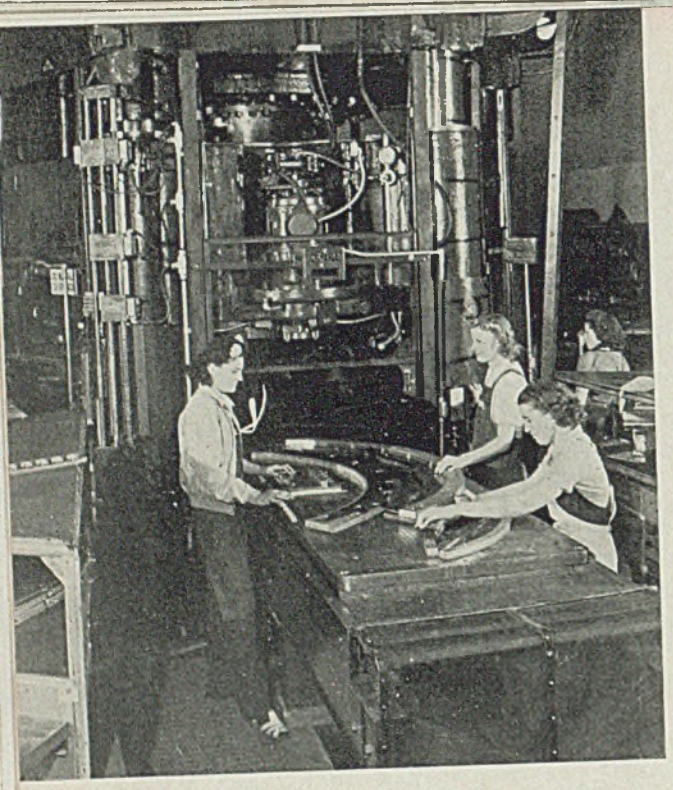
A primary disadvantage of older hydraulic press methods was the comparative slowness of part output. Earlier designs had only one loading bed and one padded ram; of necessity both bed and ram remained completely idle during the process of fitting parts to the dies. And after forming was complete, the bed and ram again stood idle while these formed parts were removed. In other words, the press was faster than the ability of one or two operators to feed it to an effective degree. Production records, needless to say, cannot be broken when machine operations are limited to purely manual speeds. But many hands can speed jobs, and it became a challenge to devise means by which more workers could have access to the same hydro-press bed without interferring with each other and without producing dangerous work areas.

An ingenious solution was reached in the huge six-sided multiple table presses shown in accompanying views. These presses quickly showed their value as some of the most powerfully effective fabricating machines in the entire aircraft industry. The six electrically operated tables slide under the ram in automatic sequence; continuous table loading, pressing and unloading occur simultaneously. Flow of work through the press is thus changed from an intermittent to a fast continuous operation.

Designed by E. W. Bliss Co. in collaboration with R. A. Steinbauer, Douglas machine wizard, the machine incorporated many radically new features. Despite the complicated operations, for instance, no master operator is necessary; all danger of injury or misoperation is minimized by an almost foolproof elimination of the human factor.

The six radiating die slides provide a flexible selectivity choice, in that any table can be inserted to the pressure area independent of its relations to the preceding slide. As many as four operators can load on each side of each table at once, if necessary. Convenient triangular stock racks placed between the tables facilitate parts handling and avoid inadvertent mixing of parts between individual slides. A surprising economy in floor space has been effected by the hexagonal design, despite the machine's unusually large size.

Several safety features built into the mechanism deserve particular mention. A vertical sliding window protects each bank of operators; as the table advances into the press the window retracts to allow it passage, then lowers behind it. No careless worker can insert an arm or hand under the descending ram for an ill-considered last minute adjustment of a part or die. Careful designing has kept all moving parts except the sliding table itself out of reach, reducing the possibility of accident to a minimum. All



Closeup of an electrically operated loading-unloading table which operates automatically in sequence as soon as operator presses "go-ahead" button. Note safety glass window which lowers, preventing operator from reaching into the danger zone

movement of the ram is enclosed within the body of the machine and is not accessible to the operators.

In regard to the operation of the machine, it has been discovered that women are well able to perform all normal functions attendant upon routine operation, and are holding their own with previous output quotas established for male operators. At present men and women are used together on the machine with entirely satisfactory results, and it is planned to inaugurate crews composed of women only.

Some interesting "by-products" of the hydro method are the facts that many design simplifications become possible, plus consolidation into single units of parts that were formerly fabricated from several joined components.

The Guerin process itself is not new, having been used extensively in the industry under license after its development by Henry Guerin, Douglas production executive. It replaces the female, or concave, half of the forming die with a thick pad of malleable rubber. Conventional drop hammers, of course, depend upon the heavy striking blow of a rigid die face for forming. In contrast to the rigid dies, the rubber pad is pressed against the male die shape with tremendous but even pressures to 5,000,000 pounds.

Although the molecular structure of the rubber is not actually modified, it assumes many characteristics of a true liquid, especially in that all pressures are exerted with almost absolute uniformity over the entire die surface. Danger of splitting or tearing is decreased, since the pressure is applied slowly rather than with the smashing impact of a dropped weight.

Drawings to a depth of nearly a foot are practical, although it is true that these deeper draws reduce the life of the rubber pad, which is now highly important in view of our national rubber situation.

Simple blanking has been accomplished without difficulty, and can be included with flanging or various other forming processes.

Development of Composite Steel Saves Critical Metal

Savings of high speed and other alloy steels ranging from 50 to 80 per cent per tool are now possible through the development of a composite steel by Jessop Steel Co., Washington, Pa. The metal consists of a section of alloy steel continuously and permanently bonded to a backing of mild steel—the proportions of the alloy section being controllable.

Use of this composite, it is reported, results in substantial savings in material costs and in critical alloys, and at the same time, it gives the performance of a solid alloy metal on the inserted or clad section.

New England Carbide Offers New Tools

Four styles of tools, both right and left-hand as well as pointed and square-tipped tools, are included in a new line of standard tungsten carbide tipped tools announced recently by New England Carbide Tool Co., 60 Brookline street, Cambridge, Mass. These are regularly furnished in U grade for cutting all materials except steel, such as aluminum, cast iron, brass, bronze, non-metallic, etc., and in S grade for cutting steel.

Goodrich Obtains Patent On Transcord Breaker

A patent was recently granted B. F. Goodrich Co., Akron, O., on its Transcord breaker used in constructing conveyor belting.

Principal feature of the development is that breaker cords are placed across the belt width, rather than parallel with the cords of the belt itself. This is said to provide greater resistance to cutting action from materials striking the belt.

The development also provides much greater adhesion between cover and carcass than the regular breaker construction, it is said. Tests of both types on conveyors in heavy duty service have definitely proved this.

Two other advantages of the construction are: It tends to stop most cuts and gouges before they penetrate to the belt carcass. The breaker is usually placed a short distance above the top ply, leaving a protective layer of rubber between breaker and carcass.

Offers Overseas Shop Coating for Metals

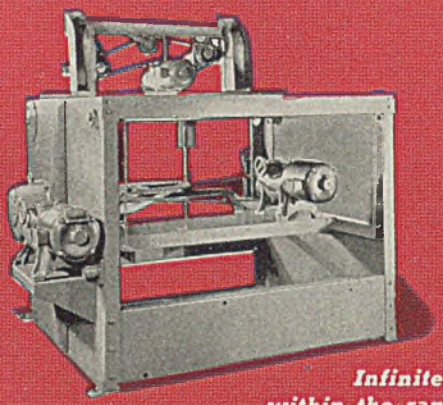
A protective coating which meets requirements and specifications of various governmental departments for protection of metal parts whether finished or unfinished, while in storage or in shipment overseas, is reported by Carbozite Corp., 1001 First National Bank building, Pittsburgh. It is applied by brush, dip or spray and has a drying time of from 15 to 30 minutes.

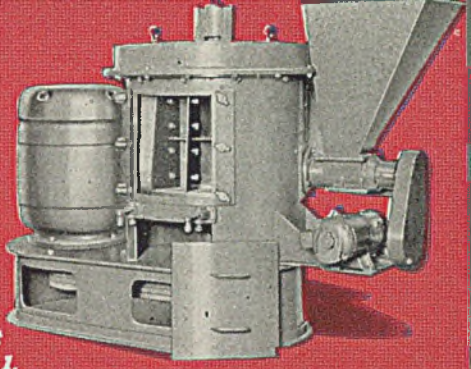
According to Carbozite, the coating can be removed easily by naphthas.

Harnischfeger Offers New All-Position Electrodes

Coincident with its recent announcement of a new line of alternating-current industrial arc welders, the Harnischfeger Corp., Milwaukee, reports a new all-position electrode designed especially for use with alternating-current welding machines.

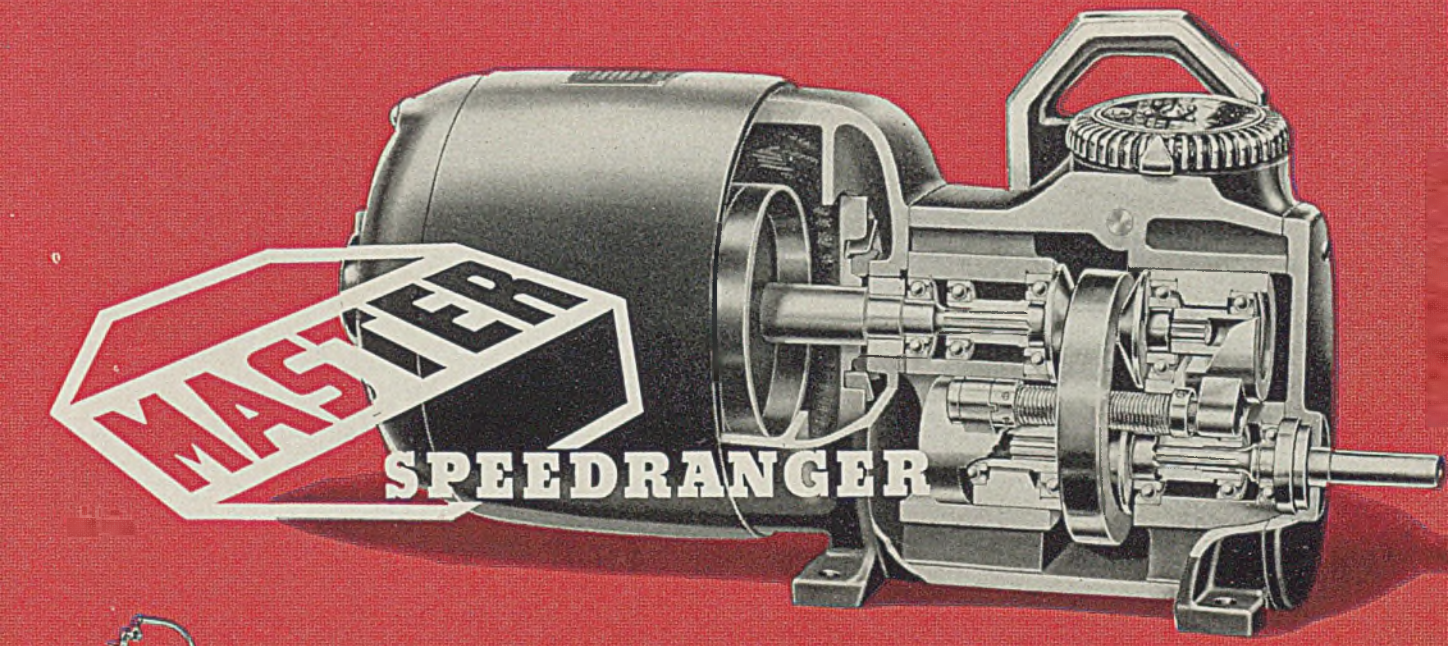
Suited for all mild steel applications, it is being made in the usual sizes of 1/8, 5/32, 3/16, 1/4, and 5/16 inch, and 14 and 18 inch lengths.





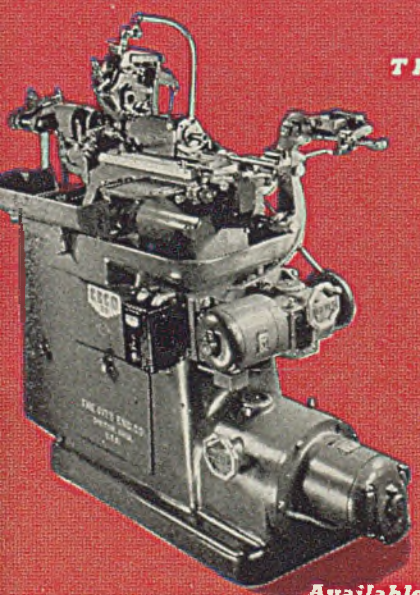
Available in sizes up to and including 3 horsepower in three different speed ranges 3 to 1, 6 to 1 and 9 to 1. Only with an all-metal drive can you secure the compactness, simplicity, flexibility and economy that are so advantageous today.

Infinitely variable speed may be secured to any R.P.M. within the range of the unit. The output speed is increased or decreased by variation of the position of the ring on the two driving and two driven cones.



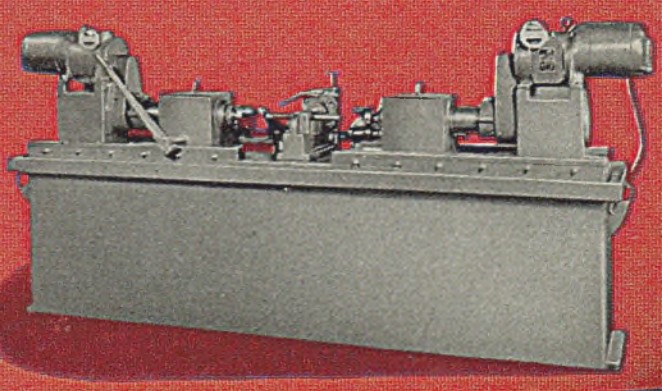
MASTER SPEEDRANGER

THE MASTER ELECTRIC COMPANY • DAYTON, OHIO



Save material and save space with the simple compact, integrally built Master Speedranger. The all-metal construction insures greatest possible durability and freedom from service interruptions.

Available in the vast number of types that make up the Master line including the flanged type as shown, also gearhead, unibrake, fan-cooled, explosion-proof, splash-proof, multi-speed, etc.

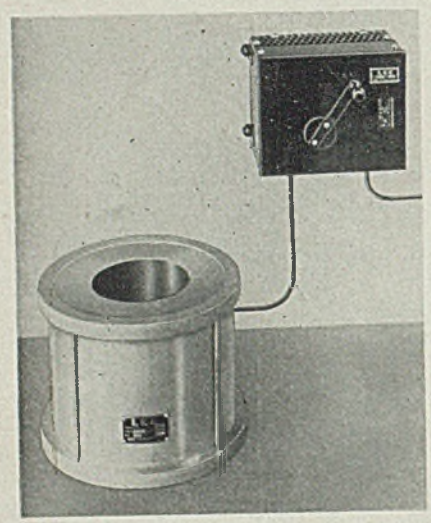


Heat Treating Furnace

Industrial Furnace Division, Lee Grinder Co., 4708 Armitage avenue, Chicago, announces a new Cub bench type heat treating furnace for tool room use. It is particularly designed for use with accelerated carburizing salts and operates at a maximum temperature of 1600 degrees Fahr.

Regulation of the temperature for hardening carbon steel parts is provided by the control unit. Latter combines switch, magnetic circuit breaker and voltage control. The control also can be set to "coast" the bath at a low temperature when required for intermittent operation.

The furnace can be operated on any



11 to 130-volt circuit. The salt is uniformly heated even when the level of the bath varies widely. Dimensions of the furnace are 13⅝ inches in diameter, 11 inches high. Its seamless, corrosion-resistant alloy pot is 6 inches deep by 6¾ inches in diameter.

Salt Bath Furnace

Upton Electric Furnace Division, 7450 Melville, Detroit, is offering a new internally heated, electric salt bath furnace, design of which eliminates all necessity for changing electrodes yet provides improved operating efficiency. It is said to make it impossible for work to be burned, permitting faster starting and more uniform treating of small tools.

Success of the new "sealed-electrode" design has already been proved in operation in a number of commercial heat-treating concerns and heat-treating departments of several of the largest producers of cutting tools in the country, it is said.

Secret of the new design lies in the method of sealing the electrodes through the sides of the furnace so that the electrodes can be located beneath the surface of the salt or at the extreme bottom

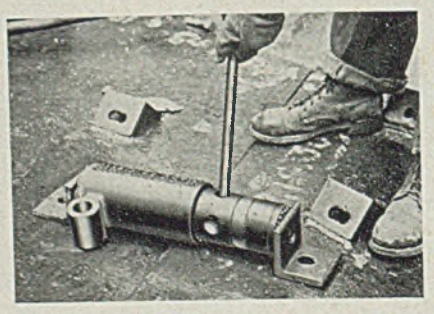
of the pot with none of the heated portion exposed to the air.

Cooling of electrodes is by means of circulating water of normal tap temperatures. The water circulates through the transformers and through the electrodes. About 1½ quarts per minute is the maximum amount of water required to cool a transformer and a pair of electrodes. Design of the furnace is such as to permit it to be built to any reasonable depth without any increase in the area being required.

According to the company, producers of small tools on a small production basis can operate the furnace on merely enough salt to heat the tools. Fast starting characteristic of the furnace is due to the small amount of salt required to hold it in operation. About three inches of salt is all that is required.

Heavy-Duty Jack

Templeton, Kenly & Co., Chicago, announces a Simplex-Astin shiplifters' jack No. 7460 designed for setting heavy deck plates for butt or lap weld joints. Of 35-ton capacity, it exerts a direct



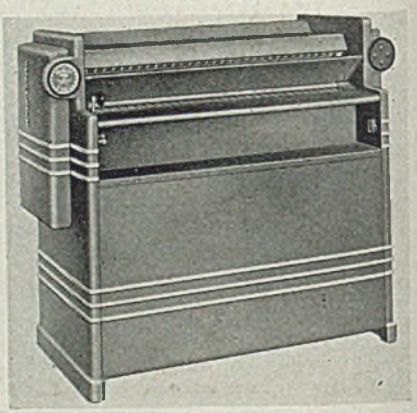
push on the angle brackets, tack-welded to the plates to insure quick, accurate plate alignment and aid proper weld deposit.

Because the jack can be successfully operated by a single, inexperienced workman, expert men are released for more complicated tasks. The jack, it is said, will not twist out from under the load when pressure is applied because of a sturdy anchor which holds the jack firmly to the plate on which the jack is set. Weight of the unit is 48 pounds without the lever bar.

Blue Print Printer

Paragon-Revolute Corp., Rochester, N. Y., is now offering a new 8 Q printer especially designed to meet the needs of industries whose print production has graduated from the small to the intermediate stage. Simple, speedy, occupying small floor space, the printer exposes blueprints, direct process prints and sepia negatives up to 54 inches wide without static, slippage and without chalking tracings. Its speed ranges from six inches to 32 lineal feet per minute, according to the company.

The machine, in operation, employs the revolving contact principle. It is equipped with a revolving pyrex glass

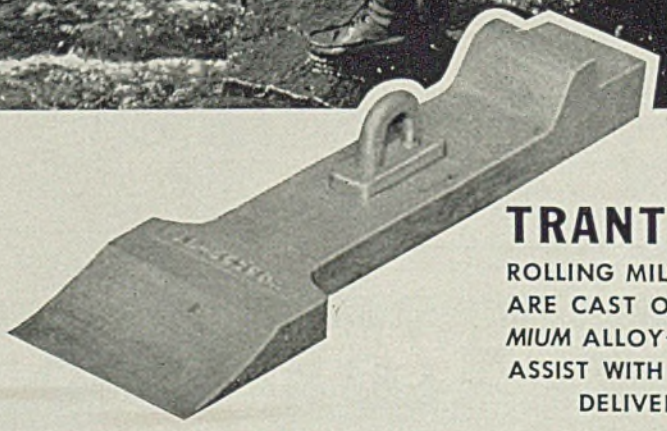


cylinder 8 inches in diameter, mounted in metal end rings and supported on ball bearing rollers. The tracing and the sensitized material are held firmly against the cylinder by a series of narrow contact bands which are guided through the machine.

A new feature in connection with a quartz high pressure mercury vapor lamp assures uniform light distribution and freedom from ventilating troubles. This feature, a special method of enclosing the entire quartz lamp, also confines the ozone fumes and prevents their escape into the surrounding atmosphere.

The lamp's operating time is recorded on a meter connected in the lamp circuit and the unit is guaranteed for a period of operation of 1000 hours. Both the mercury vapor lamp and the Pyrex glass cylinder are cooled by a squirrel-cage exhaust fan. The ventilating system is designed so it provides the most efficient light output. Printing speed is indicated on a large tachometer, conveniently located at the left end of the feeding leaf.

Green GUIDES fall short on Premium Deliveries



TRANTINYL

ROLLING MILL GUIDES ARE CAST OF A *PREMIUM* ALLOY—HENCE, ASSIST WITH *PREMIUM* DELIVERIES

Youngstown Alloy Casting Corporation

YOUNGSTOWN, OHIO

New Wire Rope Simplification Plan Welcomed by Users

In this, the 16th of a series of informative articles on wire rope, the Macwhyte Wire Rope Company presents a condensed report of "Simplified Practice Recommendation R198-43." This sound and widely discussed plan was developed through the combined efforts of the National Bureau of Standards and engineers of the Wire Rope Industry. This timely information will be most useful to wire rope users.

* * *

For many years, both wire rope users and the wire rope industry have hoped for a reduction and simplification of the number of wire rope items. The wide variety of items was not only confusing to users, but also increased the problems of manufacturing and stocking so many different ropes.

Shortly after Pearl Harbor, it became obvious that both a steel and a manpower shortage would develop. Since reduction and simplification of wire ropes would help save steel, conserve time and manpower, and expedite deliveries, the Bureau of Standards worked out a plan described in "Wire Rope Simplified Practice Recommendation R198-43." Copies may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. Price 10 cents. This plan is one which consumers, distributors and manufacturers have long wanted; not only as a wartime conservation measure, but as a basis for improved service afterwards.

What, briefly, is this simplification plan? How does it affect you?

The wire rope simplification program is concerned primarily with a reduction in the number of different sizes, varieties, and grades of wire rope produced for stock purposes.

Wire rope engineers working with the Bureau of Standards found that 20 wire rope constructions cover the vast majority of wire rope tonnage.

By adhering to these constructions, the number of ropes are reduced from 973 to 643, or 33.9%.

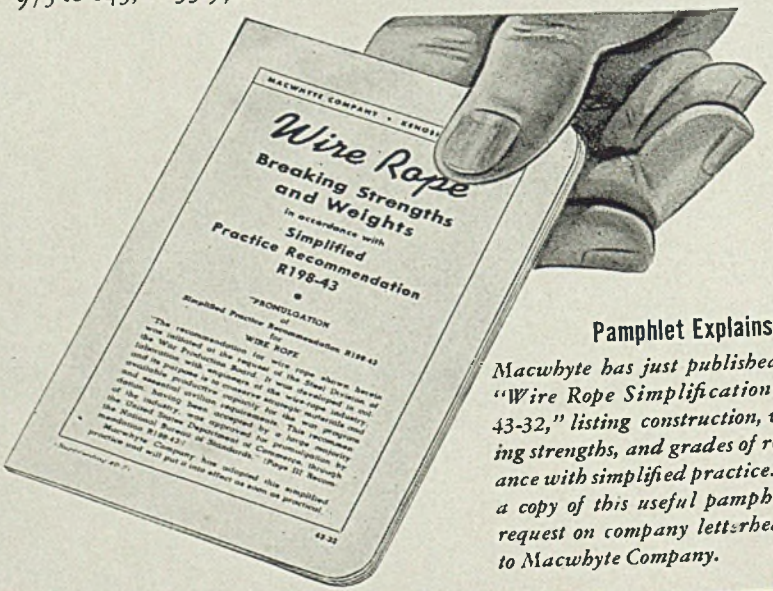
How Users Benefit

By reducing the number of "special" ropes, more attention can be paid to faster production of those ropes most widely used. Better service and delivery can be made to users as larger stocks will be available due to greater production of fewer items.

Your Cooperation

Hundreds of manufacturers, distributors, users, and all wire rope manufacturers have indicated in writing, their acceptance of this simplified wire rope practice which will result in increased efficiency for manufacturers, distributors and users . . . not only now but also in the post-war period.

Wire rope users can aid materially in the success of this program by voluntarily confining their specifications and orders, so far as possible, to the items recommended by the simplified practice program.



Pamphlet Explains All

Macwhyte has just published a pamphlet, "Wire Rope Simplification Practice No. 43-32," listing construction, weights, breaking strengths, and grades of ropes in accordance with simplified practice. If you care for a copy of this useful pamphlet, write your request on company letterhead and send it to Macwhyte Company.

Properties of Rubber

(*Continued from Page 82*)

steel "keyed" plate being sent to a rubber company, complete with built-in bolts, to have rubber vulcanized on to it; it was proposed to have the whole returned to the press to be fitted into the converted top box.

To revert to the smaller type of hydraulic press where the engineer has scope to design his own "box" according to needs, the "laminated" system shows great advantages. Any thickness can be arranged and such sheets can vary from ¼-inch up to 1-inch thick—the pad thus being made any depth according to convenience. In all cases the box walls must be strong enough to stand the total bursting pressure developed by the working pressure of the platen when it closes the lower side of the box. The box should be filled to about two-thirds of its cavity volume with rubber. The platen, or tool plate, should be made capable of fitting snugly into the box and a good fit as it passes through the lower opening of the box.

Provide Greater Mobility

The principle throughout this process being "displacement" then the more closely this factor is controlled, the better. As distinct from using a solid block, it is immediately apparent that laminations provide greater mobility. Thus a boxed pad, say, 3¾ inches deep, could be built up of three 1-inch slabs, one ½-inch and one ¼-inch, or even better still, four ¾-inch, one ½-inch and one ¼-inch slabs. The order of assembly is one of individual choice. If a smear of soft soap be applied between the sheets of rubber when mounting in the box, there will be extensive and facile displacement. The greater stress and resistance to free movement such as is experienced with a solid block when an irregular shape, such as a tool, meets it, is thus avoided. There are other advantages in this laminating system as will be seen below.

A little engineering ingenuity is necessary to evolve the best way of holding the sheets in the box. This is usually done by strip metal retainers along the lower edges of the box, or taper construction of the box itself, or both. If the laminated pad "bellies" in the center slightly after some long usage, this matters little and does not affect the operation. It is an advantage to vent the sheets by punching one hole in each to prevent adhesion by air exclusion on press closure. In operation these holes are closed by displacement, but on release of pressure, air is allowed to enter the working faces.

It is of interest to remark that on a big press—say, 8 by 4 feet bed area—the force required to overcome this adhesion would be approximately 30 to 35 tons.

When a tool and metal sheet are in position and the press starts to close, deformation of the rubber starts immediately its surface touches the metal. Each point is held and pressure is exerted equally in all directions as the rubber flows away in an endeavor to fill all available space left to it. It is obvious, then, that "hardness" controls the process only up to a given point—the rubber should only be just so hard as will permit complete filling of the cavity within the maximum pressure of the ram.

Shearing Requires Harder Rubber

For shearing operations a fair amount of pressure is necessary before complete deformation is reached and a harder rubber is therefore required. It will be noticed on shearing operations with the rubber process that the metal has a compressed edge—not a torn edge such as can be observed with the steel tool process. Eighteen-gage metal can be sheared by using steel shearing dies. In addition to the blanking, holes can be pierced down to ½-inch diameter. Shearing dies are normally ¼ to ½-inch thick, and made of steel plate backed in any way suited to the engineer.

For flanging operations, a standard pad can be used ranging around 65 to 70 degrees Shore, but can be softened down for *forming* operations by changing the face sheet and its neighbor for a softer grade. If it is desired to use the standard pad for shearing, then the converse is the case—change the face sheet and it's of rubber. For *drawing* operations, it is generally accepted now that the press is subject to limitations, and it is expecting too much to demand the same flexibility of operation as is possible on the drop hammer. Nevertheless for non-severe draw, extra soft, loose sheets can be inserted in the closure at selected strategic points.

The following hardnesses provide a fair guide:

Drawing . . . 50 to 60° Shore Durometer
Forming . . . 65 to 70° Shore Durometer
Shearing . . . 75 to 80° Shore Durometer

Full use of this laminating system has not yet been made, nor has it been adequately investigated, but greater latitude can be obtained and the scope of the press extended by it. The attention of the engineer to this type of filling is well worth special direction.

It should be pointed out that if the press engineer insists on having a solid block, that is, of course, available to him at all times, but if his needs are for some nonstandard size of solid block, he is likely to have to pay more in total for it than if he used the laminated system.

At this juncture some reference should be made to another system of filling, or rather, auxiliary filling common to press or drop hammer, but not practiced in this country except in the case of isolated experiment. It should be borne in mind that with a standard pad of rubber and a fixed maximum pressure available, it must follow that the forming processes of two pieces of sheet metal, having a shallow depression in the one, but a deep depression in the other, will vary from one another. The pressure available to force a fixed hardness pad into a deep depression must have a delayed effect when compared under the same conditions with the shallower job.

Rubber Ball Method

In Germany, some years ago, experiments were carried out using auxiliary rubber balls. This method necessitated the finish work being carried out downward. A part of the deep depression was formed as a first operation and the press released. The operator had by him a box containing a number of soft solid rubber balls varying anywhere between ¾ and 2 inches diameter. A glance at the depression and in went two or three 2-inch balls, then a few 1½-inch, and then a cluster of 1-inch and the press was then slowly closed. The balls fell naturally to the lowest point—that was where most rubber displacement was to be desired for deforming purposes. The balls displaced into the spaces permitted by the tools were followed intimately by the rubber pad proper, the latter, however, not having to be displaced nearly so rapidly nor fiercely as would have been the case had the balls not been used. The balls were kept in French chalk which acted as a lubricant for them.

Lubricants: The general question of lubricants—most especially in drawing operations—is of great importance. French chalk, fine graphite, soft soap, and some proprietary materials are in common use. They provide great help between the rubber and the metal to be processed. Oil or grease must not be used as these have a damaging effect on natural rubber compoundings, and it is of these that all good tooling rubbers are made. Mineral oils have a destructive effect on rubber and vegetable oils are even worse. The bad effect is that the rubber surface absorbs the oil, which swells and denatures it, and then loses its elasticity when it begins to wear away and indent rapidly. The consequent roughening increases the surface area vulnerable to the oil and the sticky,

decomposing action proceeds at an accelerated rate.

Synthetic rubber will withstand the action of oils and greases, but this material is not used for tool rubber for a variety of reasons. Among these are tensile strength, lower physical recovery values, slower "return", high cost, and many others.

It seems clear from many careful observations that the drop hammer or stamp is a most important production tool of the future. In this process the use of two cast tools, usually of zinc and lead together, with rubber filling *selected at will* gives much wider scope. Loose sheets of rubber any size or thickness or shape can be quickly built up as desired between the tools and the metal. These can be varied between the blows of the hammer, which itself in turn can be varied from a light blow to the heaviest the stamp is capable of delivering. Also, the hammer can be "inched" down by most sensitive controls and most of the advantages of the press are available.

"Inflexible" Presses: Since rubber can be the whole heart of the pressing process, irrespective of the type of equipment, only a moment's thought is required to see what happens on a drawing attempt when carried out on an "inflexible" press. First, under normal conditions the rubber hardness cannot be selected for the job; the material available must be used. The tool and the metal are introduced to the pad by closure.

Immediately the metal and rubber touch one another it is the rubber that flows, and the metal, having little choice, tends to be gripped and stretched instead of flowing. The blank is held by the displacing rubber advancing across and down the contours of the lower tool which it seeks to "feel" through the metal sheet. This is not nearly so pronounced in the case of a drop hammer where two soft tools are used and the rubber can be graded to the particular operation.

A common method of drawing attempted on a press is to put a slab or slabs of rubber over the part to be deformed, pressure being then applied. The press is released, and more slabs are introduced to extend the draw. The metal is then annealed and the operation is repeated over and over again until the desired depth is attained. Some authorities claim that this inter-operation annealing is not necessary—it depends entirely on the nature of the job, the metal and the engineer. It is claimed that a 7-inch draw can be reached in four operations with suitable metals, but the writer has never seen this depth produced on a press without considerably more operations than four, and even then plenty of wrinkles and thinning were in evidence.

The broad rule seems to be about one-third to one-half depth for the first operation, followed by annealing. The operation is then progressively forward to one-quarter the amount of the initial draw.

The force available for shaping or shearing metal is governed by the surface area of the platen. Thus, if with a particular size of ram the platen area is halved, then the available pressure is doubled.

Particular care should be taken if this is done to make quite sure that the press is capable of withstanding this concentrated loading on head center. A fairly common range of working pressures suitable for this work is 350 to 500 pounds per square inch over the platen.

The press has some advantage in that group loading on a ganging plate can be arranged, and using dual loading tables, one can be operated "in" while the other is being loaded "out". Some presses have been provided with four loading tables—all provided with roller-bearings and register stops, to be moved back and forth by hand.

With such a cycle the times must be carefully arranged otherwise all value is lost.

For such a cycle there also must be an abundance of widely varied work. It is more reasonable to use two tables only and even then economy arrangements must be made.

Tool Rubber Processing: Fillers are most carefully selected according to the job the rubber must finally do. The case under description is confined to tool-rubbers where there are no complicated chemical dangers to guard against, but the factors which must be taken into consideration are resistance to abrasion, good tensile strength, good ageing properties, even extensibility and prompt recovery after deformation. These are achieved by careful compounding with superfine powder fillers and careful control of the vulcanizing process which follows.

A tool rubber consists of the usual basic rubber content, the cleaned vegetable rubber as received from the plantations, to which is added in precise proportion carbon black, zinc oxide and suitable vulcanizing agents, of which one can be sulphur. No reclaim, ground waste, or vulcanized oil is normally used in this compounding; a specific gravity of about 1.2 is aimed at; also a tensile strength of about 3500 pounds per square inch.

The elongation at break should be about 400 to 500 per cent. The usual test is to put a nest of buffers in the finished vulcanized mix under compression when, after being forced down to half their original thickness for 6 hours, they must, on release, effect prompt recovery.

The shape and size of the filler particles used is of importance as in most rubber mixes they affect the behavior of the vulcanized product. Microscopically, the tension existing between the surfaces of such filler particles and the particles of the rubber itself control the value of the filler as a reinforcement agent.

This is very important in a good tool rubber.

When rubber is extended, it produces internal heat resulting from friction. Although this is never developed high enough in tooling work to be dangerous or cause appreciable change, it nevertheless exists. The formation of rubber with inert fillers causes part of the energy used in extension to distort the rubber phase and the remainder goes to tear the rubber particles from the filler particles.

Small Filler Particles Best

Thus it is apparent that if large filler particles are used the reinforcement value is low. It is, therefore, best to use small filler particles as the surface of contact and adhesion of one particle to another is greater.

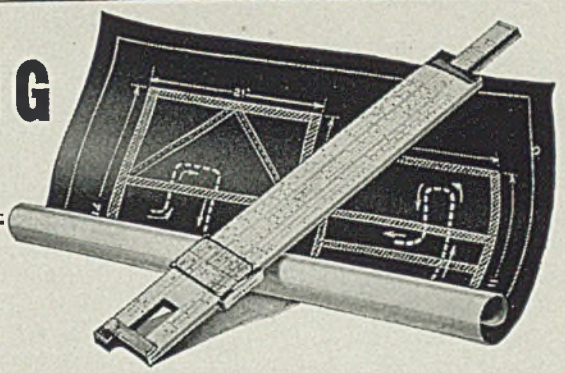
To this end extremely finely sifted and ground powders are used, and the higher reinforcement value so attained renders rupture of the rubber structure less likely, as the internal stresses set up are dissipated in overcoming the increased internal friction.

In milling the compound, care is taken to insure that the ingredients are intimately and evenly mixed. Excessive heat in milling has to be guarded against, otherwise when the vulcanizing agents are in, there may be local part "curing" which will cause uneven texture in the finished product. If a mix is kept too long on the mill the rubber loses its "nerve"—if too short, the mixing will not be even. In vulcanizing, every care is taken to see that even heat reaches all parts of the confined shape, otherwise there would be different physical conditions—at various depths through the finished product.

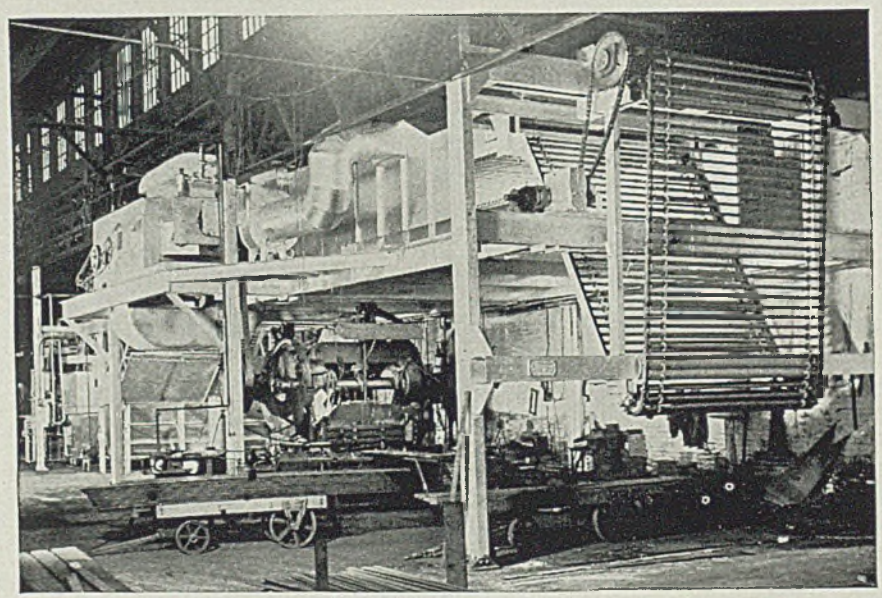
It might seem to those outside the rubber industry that these conditions are not necessary for this work, but it certainly is, for on just such care and attention depends extensibility, long wear, consistency and prompt recovery. Already, as the result of random experiment and a desire by some engineers to cut down costs, surplus materials never intended for this work have been very widely used.

These have all, from time to time, caused difficulties and complications; they have proved false economy.

OVEN ENGINEERING NEWS



This Machine Processes 4250 Airplane Landing Mat Sections Every 10-Hour Shift



● At the Empire Plow Company in Cleveland, gigantic presses knock out 180 tons of portable landing mats every 10 hours. To achieve this unprecedented production rate in degreasing, painting, drying, baking and loading operations, Industrial Oven engineers designed the system shown above.

This oven-conveyer system carries mat sections automatically through a degreasing bath, agitated dip tank, drying zone, baking oven and cooling zone, depositing them on a conveyer running to a freight car. Overhead construction conserves floor space.

Triple Economy

Major economies of the system are as follows:

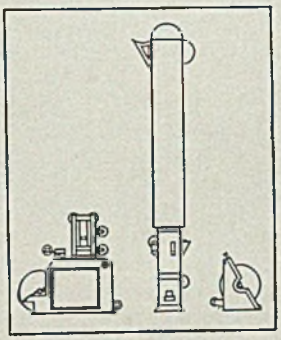
1. *Heating*—Heavily insulated oven shell, maximum re-circulating of oven atmosphere, and use of pre-heated air from cooling zone as make-up air for heating system result in 12% fuel saving, by actual test.
2. *Labor*—Automatic operation, including use of mechanical loaders and unloaders, enables 4 men to handle the production of the system. In other cases, 18 men have been needed to carry on the same operation.
3. *Scrap Rejection*—Rejects run less than ¼ of 1% of total production, a tiny fraction of reject percentage in manual operation.

Flexibility

The equipment is designed to handle a wide variety of shapes and sizes, and when America again hammers its swords into plowshares, Empire Plow's wartime oven conveyer system will be easily converted to peacetime use.

(Please feel free to ask for additional information on any fact presented on this page.)

Complete Tower Systems For Insulated Cable



Processing speeds are very high, impregnation complete, dielectric strength high, and surface finish excellent in Industrial Oven systems for lacquering Communications, Aircraft and General Purpose Cable. Systems can be used on all classes of natural and synthetic finishes. The wire is processed at constant tension through all operating speeds, assuring accurate concentricity of finish and conductor size.

Labor Facts

On properly engineered oven-conveyer installations, female labor can handle heavy loads without fatigue. *Engineering does the heavy work.* Sometimes by the addition of simple conveyers attendant labor can be reduced as much as 80%.

Free Engineering Data

"Blueprint For Industry" is the name of an 18-page book of engineering information on high-production convection-heated ovens for batch and continuous heating processes used in several types of industrial operation. It contains much general data of value to engineers, metallurgists and research men. Write today for your copy.

THE INDUSTRIAL *Oven Engineering* **COMPANY**

11621 Detroit Avenue **Cleveland, Ohio**

Tool Builders' Prospects

(*Concluded from Page 71*)

quickly and in scheduled sequence with the help of built-in dial gages, see Figs. 1 and 3, in a manner similar to that employed on a jig boring machine. Speeds and feeds, as demonstrated by the operator of the left-hand head in Fig. 1, are dial-controlled.

Tools, of which a considerable number and variety are involved, are laid out in their proper order on racks at each working position, as depicted in Figs. 1 and 2. These tools include drills, single and multiple cutter boring tools, counterbores, shell reamers, milling cutters, backfacing cutters which can be applied inside the apron, and working gages. All the cutting tools are mounted on taper shanks allowing quick change—a feature demonstrated by the operator of the right-hand head in Fig. 1.

As the two-girl teams become proficient, each half of a team keeps in almost perfect step with the other half on all identical operations. Those not identical are arranged in the schedule so that a comparable one goes on at the same time on the other side. Therefore there is little or no time lost by one half of a team waiting for the other half to complete an operation. The girls become amazingly proficient in making every move count. They have clear understanding of proper speeds and feeds, exact tool setting and cutting condition of the tools. The inspector also is a woman and all that they ask of the men is a lift in getting the aprons in and out of the machines—of which there now are four in the department. Incidentally, it is a rule throughout the Warner & Swasey shop that no woman worker shall ever be called upon to do any heavy lifting of tools or work. Hoists and men take care of that.

While the primary object of installing this battery of dual head boring machines was to break one bottleneck in the mass production of turret lathes—machines critically needed in the war production program—a number of secondary advantages have been achieved. One has been the making of this work far more suitable for women workers than it was with the previous equipment. Another is attainment of more consistent accuracy at high speeds, because of reduced overhang of the tools.

And last but by no means least, these dual head boring machines—along with numerous other "unorthodox" machines installed first and foremost to smash various other bottlenecks in wartime turret lathe manufacture—unquestionably open wide postwar production possibilities on a wider range of postwar products than would be the case had the company attempted to solve its wartime problems in traditional ways.

As this writer looked over the impressive, busy array of this modern production equipment, there came to mind a caption under a photograph of a similar vista which appeared on page 56 of the June 21, 1943 issue of STEEL. This caption expresses this thought:—"Is this an armory, an aircraft engine plant, a shop making parts for naval equipment? It might be any of these. Actually it is part of a machine tool plant. Conversion of such a plant to a wide variety of work other than machine tools will not be difficult."

New Product Prepares Galvanized Metal for Paint

Permanent paint adhesion on galvanized metal—with no chipping or peeling—now is insured by preparing the surface before painting with Redi-Paint, according to its manufacturer, Turco Products Inc., Los Angeles. In addition, the paint passivates or "cools" the "hot galvanizing" so regular paint will hold, and the work can be kept in good condition.

Feature of Redi-Paint is color control—a dark tint develops on areas properly treated, leaving the untreated area conspicuously bright. With other treatments, it is said, constant backtracking occured because the solution so blended with the color of the metal surface itself that it was virtually impossible to determine accurately which section had been covered.

The new development changes the surface of the metal chemically, giving a permanent protection and base for the paint. It does this by displacing the slick, oily surface typical of galvanized metal with a roughened, "toothy" surface to form a very tight bond with the paint.

The surface treatment can be applied by hand or by tank immersion. When applied by hand, it is wiped on full strength, or diluted with water, with a sponge or rag.

Keystone Offers Bearing Lists as Customer Service

Lists containing pertinent information on Selflube porous bronze bearings carried in stock and available for immediate delivery are being released by Keystone Carbon Co., Saint Marys, Pa., as a customer service. These include data on available quantities, sizes, and also code numbers of bearings which are of porous bronze, molded to size and oiled.

The bearings are ready for installation as received, and are designed to eliminate a reaming operation.

Contour Saw Container Keeps Blades in Order

A solid box or container designed to keep contour saw blades closely confined in order to prevent them from getting badly tangled is announced by Capewell Mfg. Co., Hartford, Conn. It is reported to make it easier to withdraw the blade stock from the box as needed.

Open-Hearth Design

(*Continued from Page 87*)

much gas as cold metal furnace of corresponding size.

Furnace Pressure Balances: The size of the furnace passages must be such that the necessary quantities of gas and air enter freely at the available pressure, and that the products of combustion and whatever excess air enters by infiltration, may be drawn out by the available draft.

By the laws of conservation of energy, the energy of a flowing gas stream may be expressed in terms of static pressure, as follows:

$$p_v = 8.8 \times 10^{-7}\, s v^2 (273 \times t_g)$$

where

p_v is the equivalent static pressure (in. water gage) generally called "velocity head."

s is the density of the flowing gas relative to air = 1.

v is the velocity of the gas in feet per second at normal temperature and pressure.

t_g is the gas temperature in deg. Cent.

In an ideal furnace system dynamic and static energy are completely interconvertible. Thus, at a contraction in section the increase in velocity is accompanied by a corresponding decrease in static pressure, and the original static pressure is recovered if the passage subsequently regains its original section. In practice, eddying occurs whenever there is a bend or a change of section; this results in a permanent conversion of pressure energy into heat. Such eddying also occurs at the surface of rough walls, causing the pressure losses attributable to friction.

The fraction of the velocity head p_v lost at each bend or change of section is generally denoted by f_1; the fraction of p_v lost due to wall friction by f_2. Thus the permanent static pressure drop in any flue system due to bends, changes of section, and friction is $(f_1 + f_2)p_v$ in. water gage.

In a furnace system there are also pressure changes due to the buoyancy of the hot gases. Such pressure changes we may denote by p_s. There are several formulae for calculating p_s; a convenient form is (in water gage):

$$p_s = 0.0147H \left[1 - s\left(\frac{273 + t_a}{273 + t_g}\right)\right]$$

where H is the change of vertical height

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in feet and t_c is the outside air temperature in degrees Cent.

As suggested by Etherington, the simplest way of calculating the pressure balance is to construct a table of the appropriate values, as shown in Table III.

This is the pressure balance for the ingoing air to a furnace which requires 400,000 cubic feet of air per hour (measured at normal temperature and pressure). The balance shows that the natural draft provided by the hot checkers and uptakes is not sufficient to overcome the resistance and that either the uptakes or port should be enlarged, or a fan to give 0.04-inch water gage at the reversing valve should be provided.

Friction Relatively Unimportant

The whole of the table need not be completed; for instance, the wall friction may be neglected in certain parts of the furnace. In these parts a knowledge of f_2, and therefore of the length and perimeter (from which f_2 is calculated), is not required. Friction in the checker, although not negligible, is looked after by

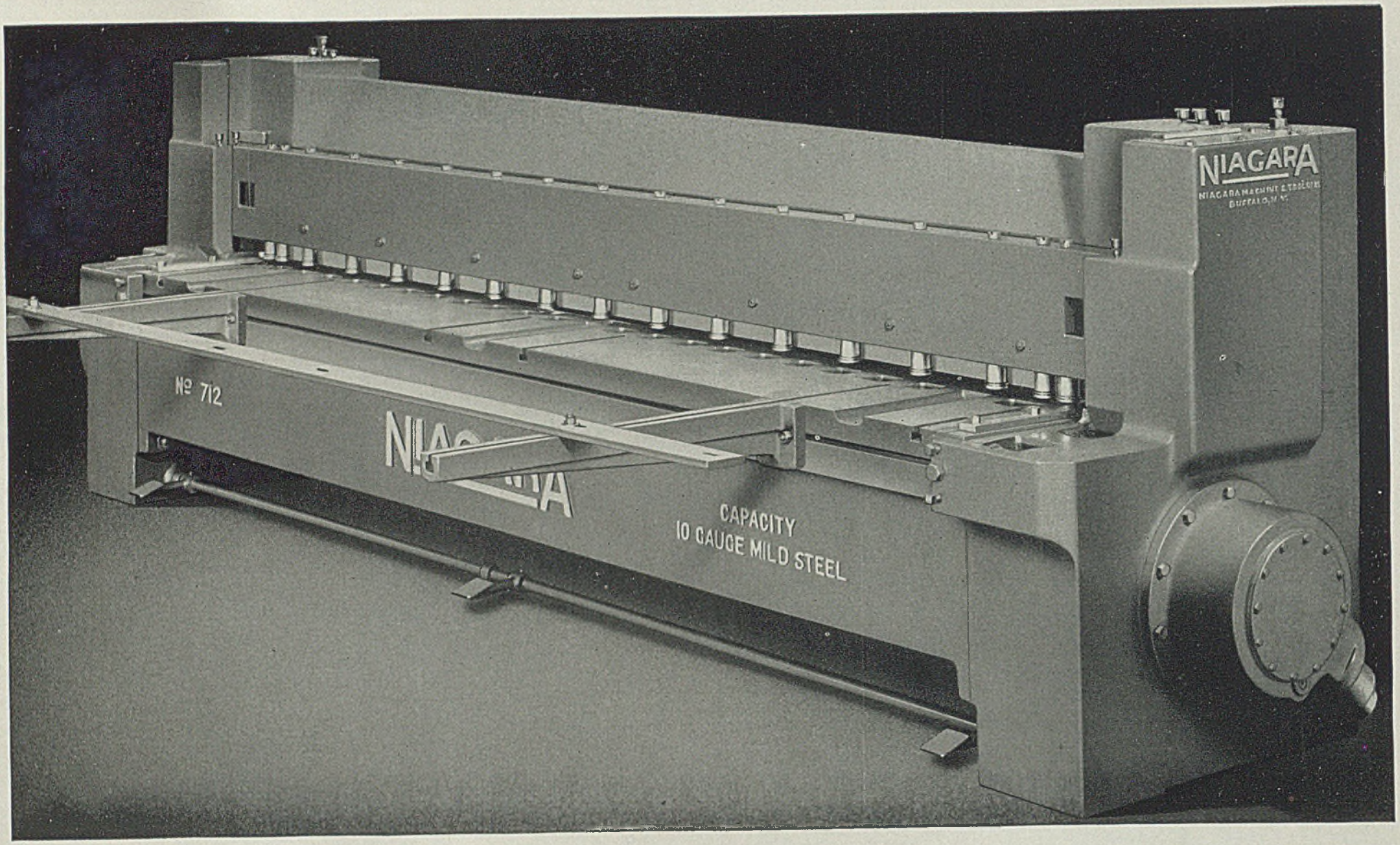
Table IV—Suggested Dimensions for Open-Hearth Flues Uptakes and Ports

Furnace capacity tons	Gas Flues sq. ft.	Gas Uptake sq. ft.	Gas Port sq. ft.	Air Flues sq. ft.	Air Uptakes (total) and port sq. ft.
40	10	7	2.25	16	15.5
60	14.5	10	3.1	22	22
80	18	12.5	3.8	29	27
100	20	14	4.00	35	30

the f_1 value for checkers, referred to later. It should be emphasized that, unlike most other furnaces and gas-flue systems, friction plays a relatively unimportant part in open-hearth furnaces. This is because the bends and changes of section between the valves and the port are so frequent that by far the largest pressure drop is occasioned by these bends and changes of section.

The crux of the pressure-balance calculation is selection of the coefficient f_1, f_2, and—

may be taken as $\frac{0.0125LP}{A}$ where L,P and A have the values given in Table III. Values of f_1 for various bends and section changes are given in the literature and for full details reference should be made to the work of Etherington,[3] Heil,[4] and Bansen,[5,6]. Unfortunately, the values recommended by the various authors do not always agree. Determination of the best values for f_1 is part of the Iron and Steel Industrial Research Council program, but, owing to war conditions, it has only been possible to do a small amount of work so far. From this, and



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consideration of the published data, the following values for f_1 may be taken as working figures for the time being, but the information given here is necessarily very condensed.[17]

Bends—Right-angle bends, 1.5; 45-degree bends, 0.5; rounded bends, if curve radius exceeds 5 diameter of flue, $f_1=0$; for sharper curves f_1 increases up to the full 1.5 for 90-degree bend, according to the curvature. For ultra-sharp bends, such as that from uptake to gas port, $f_1=2.0$ or over. If a 90-degree bend is made out of a T-piece with one arm blanked off, leaving a "dead" volume, $f_1=2.0$.

Changes of Section—Entry to a narrow section from a large chamber or infinite volume, e.g., slag pocket to uptake or entry to air valve, $f_1=2.0$. This decreases as the ratio of the two areas approaches unity. Etherington[18] and others give standard curves for contractions, but these give low values; for instance, the true f_1 is about three times the value given by Etherington's curve for a contraction. Escape from a narrow passage to a large volume, e.g., gas port to working chamber, $f_1=1.0$. As the area ratio approaches unity, the value may be taken from Etherington's contraction curve.[18] The above refer to sharp changes. If a contraction is made gradual or rounded, the f_1 value is much reduced, but, unless the taper is made gradual, there is no gain by tapering an enlargement.

Subdivision of Stream, e.g., entry to checkers, $f_1=2.0$.

Checkers—0.3 per course of bricks,[19] applied to a velocity calculated on an effective free area of half the theoretical free area.

Slag Pocket and Bridgewall—1.0 for ingoing gas or air; rather less for outgoing waste gas.

Reversing Valves—2.5 for drum types.[7]

The foregoing are to be applied to the velocity in the narrower of two sections, if a change in velocity is taking place.

Division of Waste Gases

The pressure, or rather draft, balance for the outgoing gases is calculated in exactly the same way, allowing for gas flow in the opposite direction. A slight complication is introduced by division of the waste gases between the gas and air checkers. This is got over by assuming an arbitrary partition, say 30 per cent through the gas checker and 70 per cent through the air checker. The calculated resistances p_y will then usually calculate out different for each path. The total pressure change through each path must be the same, and p_y depends on the square of the gas velocity, while the change of pressure due to buoyancy p_s does not change with velocity. Hence if x is the true partition and p_e the eddy loss calculated on a basis of 30 per cent through the gas checkers, we have

$$\left(\frac{x}{0.3}\right)^2 pv+ps=\left[\frac{1-x}{0.7}\right]^2 pv+ps$$

for gas system — for air system

Thus x is determined, and either term above will give the true pressure change

to be expected over the divided path.

Study of the pressure balances of open-hearth furnaces shows that the uptakes are a common bottleneck. By far the largest proportion of the pressure loss takes place in the uptakes and the ports.

The gas port cannot be made large because of the necessity for maintaining flame direction as far as possible, but in attempting to reduce pressure drop enlargement of the uptakes will often have the greatest beneficial effect. In general, all bends should be rounded as far as possible, all contractions made gradual, and changes of section avoided as far as possible. In this way f_1 is kept small.

Checker Design: While much work has been done on the theory of regenerators[20] from the point of view of practical operation the most important points are the following:

(1) *Adequate Height* — In natural draft furnaces the pressure necessary to provide the ingoing air is provided by the chimney effect in the hot checkers and uptakes. A tall chamber is therefore advisable, and a minimum height of checkerwork of 20 feet is desirable in open-hearth furnaces.

(2) *Area* — A low checker of large cross-sectional area is bad, as not only will the chimney effect be less, but the gases passing through vertically, will not expand to fill the chamber properly, so that a large part of such a chamber will not be used.

(3) *Filling* — Although heat transfer is improved in theory by the high velocities produced by a close filling, in practice close filling and staggered patterns cause extra resistance and choke easily, and so are not desirable. Little seems to be gained by departing from the standard 6x6-inch opening.

Port Design. — This thorny problem has been discussed on many occasions, but in the present state of knowledge a fundamental theoretical treatment is hardly possible. Opinions based on operating experience differ, but it seems evident that fast-melting furnaces require a high air port area: gas port area ratio; at least the 6:1 recommended by the Open Hearth Committee[21].

The best port design for any particular furnace must be found from practical experience, and one way of doing this is to use the furnace "characteristic curves" of melting rate plotted against gas rate. Melting rate rises with gas rate until a maximum is reached: if the gas rate is further increased, melting rate decreases, as the furnace is then receiving more gas than it can burn, and the surplus has the same effect as excess air, cooling down the melting chamber. Once this maximum gas rate is established for any one port design, new designs can be tried on each rebuild to ascertain which will allow the maximum amount of gas to be efficiently burned, and so give optimum melting rate.

Furnace Design: Steps leading to effi-

cient furnace design from the aerodynamic point of view may therefore be summarized as follows:—

1. Calculate the gas, air and waste gas flows.
2. Choose the maximum convenient dimensions for the various passages (guidance on this point is given by Buell[22]) and construct the pressure balance for air, gas and waste gases.

From these it will be seen whether the available gas pressure will be adequate, whether positive air will be necessary and what draft will be required. The necessity for any modification in the dimensions of the passages will be revealed.

3. During the first few campaigns it should be possible to obtain a good idea of the best port design and dimensions for this type of furnace from the characteristic curves.

Table IV shows some dimensions for flues, uptakes and ports which might be taken as a starting point. If these are used there is every probability that the pressure balance will turn out to be satisfactory when calculated. The gas port areas suggested are purposely large, and if the characteristic curve subsequently indicates that they are too large, reduction is easy during a run. It is assumed that 20 feet of checker height will be available.

Tilting Furnace Another Problem

The foregoing applications are chiefly intended to apply to furnaces working a cold charge. Where up to 50 per cent hot metal is worked in fixed furnaces, little modification of these principles is required, as there is still a considerable amount of scrap melting to be done in such furnaces.

The large tilting furnaces employing a charge of 80 per cent or more of hot metal are a different problem. Naturally the laws of gas flow and methods of calculation apply equally to these furnaces, but the chief differences lie in the quantities involved. The working of a high-percentage hot metal charge consists of first a few hours of charging and partial melting of the scrap and slag-forming materials as in cold-metal furnaces. Mixer metal is then added, and for the remainder of the working time the surface of the bath is principally liquid.

If the rate at which the bath can take up heat is calculated[23] and plotted against temperature as in Fig. 2, there is a sudden drop when the surface "glazes," owing to the substantially lower emissivity of molten material surfaces. The heat which the flame can give up is not known precisely, but rough calculations indicate that this lies within a zone which crosses the vertical portion of the curve. Thus, while the charge is solid it can take up all the heat the flame can release (with normal rates of gas flow); indeed the furnace walls cool down, but