STEEL

ESTABLISHED 1882

Contents

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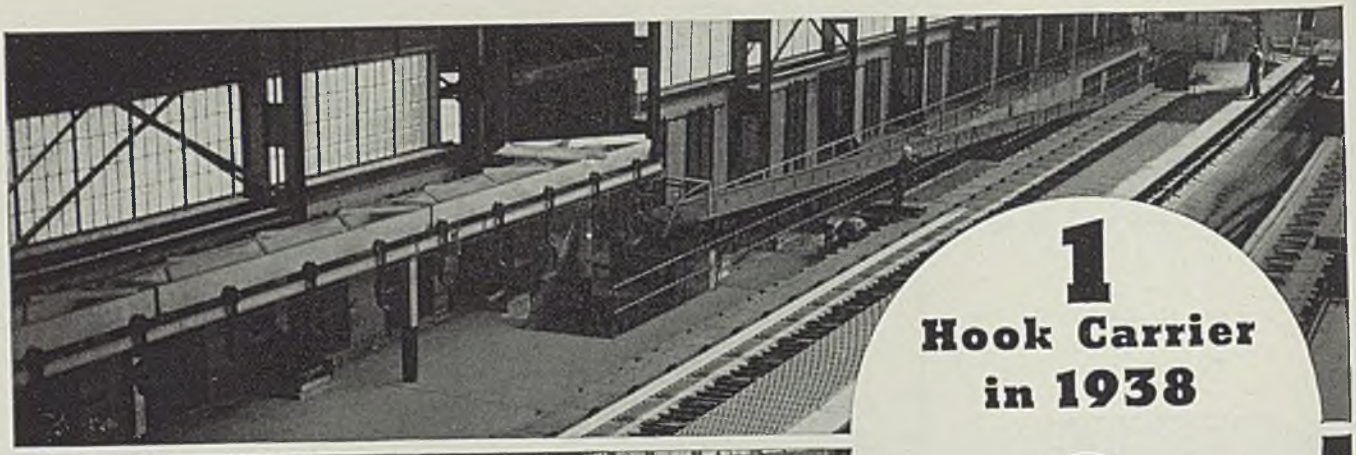

1
Hook Carrier in 1938

2
Hook Carriers in 1941

We planned it that way!

The reheating furnace, rod roughing train and intermediate stands were all planned and built to roll *four* strands. In 1938, the company installed a two-strand finishing train complete with laying and pouring reels, rod coil conveyor and hook carrier system.

In 1940 the rod capacity was doubled by adding a second finishing train and rod handling equipment shown in the lower illustration.

Everything fitted into position, of course, because we planned it that way!

MORGAN
WORCESTER
ENGINEERS AND MANUFACTURERS

CONTINUOUS ROLLING MILLS

Billet • Sheet Bar • Merchant • Rod • Strip • Skelp

MORGAN CONSTRUCTION COMPANY • WORCESTER, MASSACHUSETTS

HIGHLIGHTING THIS ISSUE OF STEEL

■ IN HIS second report to President Roosevelt (p. 21) Gano Dunn indicates a shortage of 1,400,000 tons in the 1941 steel supply and a 1942 deficit of 6,400,000 tons. Significant is his implication that steel production cannot be expanded to the 120,000,000 tons of ingots which OPM recently estimated as the total 1942 demand. Mr. Dunn's report is accepted by the industry as forecasting a reduction in the supply of steel available for nondefense purposes. . . . With steel deliveries becoming still more extended (p. 101) some sort of rationing plan is likely—provided a satisfactory one can be devised. It is not easy to apply preference ratings to civilian requirements and do it fairly.

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Urged To Tell People Facts

That consumer goods output faces drastic curtailment was the warning expressed (p. 23) at last week's preparedness conference of manufacturers and purchasing agents. The administration was urged to tell the people the facts on "what the nation demands that we sacrifice and for how long." One question raised was whether Washington would sacrifice social reforms to the extent necessary to permit all-out production. . . . In this same vein E. J. Kulas (p. 41) asks: "If a shipment desperately needed doesn't reach Britain in time, what difference does it make whether that shipment is sunk on the high seas or held up by a strike in an American plant?" He calls for a revision of the Wagner act.

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Number Of SAE Steels Fewer

The Society of Automotive Engineers (p. 28) has reduced to 83 the number of SAE steels. . . . Quick prosecution is promised by Leon Henderson (p. 33) when "prices are being driven up by any method which is a probable violation of the antitrust laws". . . . College courses in tool engineering (p. 45) are proposed by the American Society of Tool Engineers. . . . Output of lead-bearing steel (p. 41) has been sharply reduced. . . . Molybdenum high-speed steel may be produced royalty-free (p. 26) under patents of the Vanadium-Alloys Steel Co. . . . American Rolling Mill Co. (p. 26) has started construction of its Houston, Tex., steel plant. . . . Crane builders last week (p. 27) were given an improved preference rating.

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Welding Loads Equalized

H. C. Fornwall describes (p. 50) equipment and methods for painting shell. . . . A new method (p. 58) is devised to put an equal load on all phases of the usual 3-phase power system when resistance welding, thus helping to prevent power line disturbances. . . . Reliance Electric uses a unique fixture (p. 63) which accommodates nine sizes of motor frames in surface grinding bottom of motor feet. . . . One of the important advances in speeding metal analyses is described (p. 69), important for it gives quantitative checks at least six times faster than conventional chemical methods. . . . G. E. Huenerfauth tells (p. 77) of an unusually flexible automatic plating line that handles large volumes of diecastings.

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Shell Fuzes Are Analyzed

Professor Macconochie this week begins (p. 52) a study of shell and bomb fuzes, their development, operation and manufacture. . . . R. J. Kepfer and L. D. Eubank discuss (p. 84) latest methods for reducing dross formation in hot dip galvanizing. . . . J. G. Bucuss shows (p. 64) how "skid-load" handling methods can be used to speed materials handling, cut freight and packaging costs. Warehouse space is used to better advantage, too, and damage claims are reduced, according to Mr. Bucuss. . . . N. H. Bacon tells about British steel practice and how the metallurgical observer does his part to improve quality. Pouring speed is controlled to reduce number of cracked ingots.

It is fortunate

in this National Emergency

that there are

RESERVE STEEL STOCKS AVAILABLE

Ryerson has 10 steel-service plants strategically located in important industrial areas for quick stock shipment of rush orders. Without these available stocks, mill production would be seriously reduced by frequent changing of rolls to supply especially urgent requirements.

Stocks at the 10 Ryerson plants--America's great Reservoir of Steel--are quite complete, and service in general is prompt. In times like these, however, some sizes of certain products are naturally low, a few are out. But for the most part, you can depend on Ryerson for good service on reasonable quantities of over 10,000 different kinds, shapes and sizes of steel and allied products.

Joseph T. Ryerson & Son, Inc. Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Cleveland, Detroit, Buffalo, Philadelphia, Boston, Jersey City.

RYERSON *Certified* **STEELS**

RYERSON CERTIFIED STEELS

Steel's Surpluses Turned Into Deficits By Expanding War Requirements

Second Gano Dunn report indicates shortage of 6,400,000 tons in 1942 . . . Wisdom of expanding capacity questioned . . . Limitation of civilian consumption probable . . . Inadequacy in no way impairs defense program or aid to Britain

■ PROSPECTIVE deficit of 1,400,000 tons in 1941 and of 6,400,000 tons for 1942 was forecast by Gano Dunn, special consultant for the Office of Production Management, in his second report on the adequacy of steel capacity.

Passage of the lend-lease act and other developments of national policy have been accompanied by great increases in military requirements. These increases in expected demand have turned the surpluses indicated by Mr. Dunn in his first report into deficits.

Mr. Dunn left open the question as to how much expansion should be attempted in the face of present conditions.

"Inadequacy of the steel industry in the presence of increased estimates of requirements in no way impairs its capacity for national defense," Mr. Dunn stated, "since the total Army, Navy, Maritime and other military requirements, including all-out aid to Britain, represent only 25 per cent of the industry's capacity."

President Roosevelt after studying Mr. Dunn's report stated the question now being studied is whether to make a further curtailment of civilian use or to increase the capacity of the industry. He pointed out that Mr. Dunn had reported more than 4,000,000 tons of steel would be required to get 10,000,000 tons more capacity two years from now. The alternative, the Chief Executive explained, was to take out of the 75 per cent which is for civil use, an additional amount for defense requirements. That, he said, could be accomplished without any great hardship.

Highlights of Mr. Dunn's second report:

Maximum reliable industry capacity of 91,124,718 tons, forecast for Dec. 31, 1941, in his first report has been increased to 91,338,669 tons and further increases are in prospect.

Prospective deficits in Great Lakes transportation, blast furnace capacity, and coke oven capacity forecast for Dec. 31, 1941, in the first report now have been removed.

Highest estimate of total steel requirements now available was submitted to Mr. Dunn by the Bureau of Research and Statistics of OPM. For 1942 it amounts to 120,400,000 tons.

Not Enough Labor

"Irrespective of capacity of steel industry there is not enough skilled and semiskilled labor available in the United States to produce and consume this amount of steel," Mr. Dunn declared.

"To produce and consume 120,400,000 tons of steel in 1942 would require an increase of 6,047,200 employes over the 7,591,500 employes engaged in the same producing and consuming industries in 1940. Even if this increase could be obtained under other circumstances it could not be obtained when industries other than those involved in the production and consumption of that amount of steel would be bidding in the same market for skilled and semiskilled labor."

A second estimate based upon an adjustment of the Bureau of Research and Statistics 120,400,000-ton estimate, to take account of the curtailment of automobile production already ordered, an estimate of British exports upon a realizable basis, and elimination of certain duplication, results in 102,400,000 tons as total requirements for 1942.

On account of the limitation of labor supply this adjusted estimate would also be very difficult to realize, even if the capacity of the industry were adequate to it, which it is not. Against it the industry's capacity is in deficit by 11,300,000 tons.

A combination estimate based upon an investigation of actual consumption in 1940 and the first quarter of 1941 by the Committee of Commercial Research of the American Iron and Steel Institute gives a figure of 92,600,000 tons for total requirements in 1942. This figure, which is the lowest of the three estimates, is still 1,500,000 tons in excess of the industry's capacity.

"Under the present circumstances of rapidly changing conditions it cannot reliably be predicted whether the 102,400,000-ton estimate or the 92,600,000-ton estimate will be the more nearly correct."

A compromise figure halfway between the two, amounting to 97,500,000 tons, is used by Mr. Dunn as the probable 1942 requirements. This figure is 6,400,000 tons

in excess of the industry's capacity.

"A decision must be made," he said, "whether to curtail the civilian consumption contributing to these deficits or to expand the capacity of the industry to meet them.

"For 1942 the civilian consumption figure estimated by the Bureau of Research and Statistics is 88,600,000 tons; the figure of the adjusted bureau estimate is 78,300,000 tons and that of the Committee on Commercial Research is 68,500,000 tons."

Actual civilian consumption in 1940 was 55,300,000 tons.

If it should be decided to increase the capacity of the industry by 10,000,000 tons, such increase would involve an expenditure of $1,250,000,000 would require 3,000,000 tons of finished steel, or 4,160,000 tons of ingots, and would take two years to build.

A 10,000,000-ton horizontal expansion in capacity would have to include the following: Ore mine development and equipment; railroad equipment, locomotives and cars; dock facilities, loading and unloading; 30 lake vessels; coal mine development; limestone development; 1200 by-product coke ovens; 18 blast furnaces; 100 open-hearth furnaces; and electric furnaces, rolling mills, finishing equipment, electric power and drives.

"The question at issue is whether, in order to create a 10,000,000-ton increase in capacity two years hence it is desirable to abstract in the present fully loaded conditions of the industry 4,160,000 tons of steel now going into other purposes."

West Coast Mills To Expand

The creation on May 1, said Mr. Dunn, of the government-industry committee under authority of the attorney general and with the cooperation of the industry promises to greatly increase the effective capacity of the industry by bringing about the accomplishment of the recommendations in Mr. Dunn's first report in respect to evenness of loading, reallocation of orders, shift of open-hearth production to unused bessemer capacity and other organization features.

Steelmaking capacity to be added in 1941 has been increased by approximately 300,000 tons since Mr. Dunn compiled his first report. Net tons at normal rating to be added this year are now estimated at 3,698,800, as against the 3,396,700 forecast in the earlier report.

There are still further important additions to industry's steelmaking capacity now under contemplation. Among them is a proposed increase of more than 1,000,000 tons on the Pacific coast. Possibly some of this capacity will become effective before this year ends, but Mr. Dunn has not included the West coast expansion in his report.

W. A. Hauck, consultant in the iron and steel unit of OPM, recently made an extensive tour of the West coast area and reported to the President on the advisability of increasing steel capacity there. He recommended a minimum expansion of 1,115,200 tons of ingot capacity, accompanied by pig iron; coke and ore facilities to balance. Factors influencing his recommendation included coal and ore supplies, questions of market and transportation and strategic importance of being independent of eastern supplies on account of the vulnerability of the Panama canal.

An additional advantage accruing through Pacific coast expansion, it was pointed out, is that its ore supplies would come from Utah and Wyoming, without making additional demands on the already heavily loaded Great Lakes transportation system.

Enlarge Existing Plants

Mr. Dunn believes it "conservative to assume that 500,000 tons of Mr. Hauck's recommendation may be undertaken in the form of additions to the capacities of the existing steel companies that now have plants on the Pacific Coast."

There is no question that it is much more rapid and efficient to add increments to existing plants rather than to build new ones manned by new organizations. British experience has indicated that the new company or "green field" method of expansion is much less satisfactory than increasing existing plants.

While definite figures on steel finishing capacity are not available, Mr. Dunn reports that in the opinion of experts familiar with their particular mills there is no question that the sum of finishing capacities exceeds the sum of ingot capacities by at least 15 per cent.

"But when the demand for particular kind of finishing, like the present demand for ship plates, is out of proportion to the relation which demand for such plates usually bears to other demands in normal times, there occurs a congestion which, notwithstanding adequate ingot capacity, overloads the particular finishing capacity in question."

Measures are being taken as rapidly as possible to increase plate capacity. A new plate mill is under construction at the works of Tennessee Coal, Iron & Railroad Co. in Alabama, and several of the continuous strip mills in other parts of the country are undergoing structural changes that will adapt them to the finishing of plates.

■ Approximately half of Malaya's tin exports in the last calendar year were sent to the United States, according to the Commerce Department. Total shipments of tin in the first 11 months of the year amounted to 118,968 tons. Malaya also exported in the same period 1,758,752 tons of iron ore, 11,216 tons of manganese ore, 51,961 tons of bauxite, 427 tons of scheelite and 310 tons wolframite.

Limiting Production of Lead-Bearing Steel

■ In the interest of increasing production of steel to meet national defense requirements by limiting output to essential large tonnage grades, manufacture of free-machining, lead-bearing steel is being substantially curtailed for the present. This steel, which contains 0.15 to 0.35 per cent lead and has many useful properties, was developed by Inland Steel Co., Chicago, in 1937, and since that time has been widely licensed for manufacture both in the United States and abroad. It is well known as Ledloy.

Practically all of the 14 domestic licensees are scaling down or discontinuing output for the emergency period. Inland still is producing in limited amount and expects to continue. Bulk of the tonnage is being sold to Britain, with a small amount going to American users.

Output of lead-bearing steel in 1938 was about 10,000 tons, by 1939 it had reached 60,000 tons, and in 1940 amounted to over 100,000 tons. Until production can be resumed fully, its place is being taken by the old familiar high-sulphur type of free-machining steel.

Hillman Sees Shortage Of Skilled Metalworkers

■ Demands for skilled labor in the metalworking trades will soon outdistance supply, Sidney Hillman, co-director general of the Office of Production Management, has informed the Selective Service System.

Mr. Hillman wrote to Brig. Gen. Lewis B. Hershey, deputy director of Selective Service, that OPM will shortly furnish him with a complete analysis of the labor requirements in the metal trades and others vital to defense.

He commended General Hershey for desiring to cut down the induction of skilled workers into the Army, saying trained men "can serve their country most effectively at their factory benches."

"When a skilled worker is taken from any plant that may contribute to defense production, that plant loses not only the individual but also the time of a more highly skilled man to train the doubtful new workers," said Mr. Hillman.

16,000 Industrialists Pledge Knudsen: "Patriotism Above Personal Gain"

CHICAGO

■ THIS CITY last week rivaled Washington as a source of national defense developments. To two large conferences came high executives of the Office of Production Management and other emergency agencies to talk with representatives of manufacturers, most of whom are directly engaged in the production of goods for the military.

The meetings were the twenty-sixth annual international convention of the National Association of Purchasing Agents and the Chicago conference on preparedness, sponsored by the Illinois Manufacturers Association and the National Association of Manufacturers, both held at the Stevens hotel.

Throughout all sessions was stressed the urgent necessity for speeding up defense production. Consumer goods output, it was warned, faces drastic curtailment. More strict controls over raw materials, production facilities, and the labor supply in the near future were indicated.

At the purchasers' meeting, the consensus was that general priorities on iron and steel would be imposed within the next 60 days.

William S. Knudsen, director general, OPM, who spoke at both meetings emphasized that time is the No. 1 bottleneck in the armament program. Groundwork has been laid, he said, for producing in quantity the necessary planes, tanks, ships and guns.

"Even now we are a little ahead of where we were at this time in the last war. But war has changed and time is shorter. This is no time to argue methods of procedure . . . If defense progress calls for sacrifices in the form of long working hours, wealth and goods, we will make them. No sacrifice is too great to preserve American democracy."

Industrial representatives, as they consistently have since the rise of the emergency, pledged themselves to co-operate to the limit to make this country strong.

At the manufacturers' conference, a volume containing the signatures of 16,000 industrialists, pledging themselves to put "patriotism above personal gain" was presented to Mr. Knudsen. Not the smallest of their rewards was the OPM chief's simple statement: "We didn't consider pledges necessary."

While the manufacturers' determination for an all-out defense production was unanimous, questions were raised as to whether the New Deal administration was equally sincere—whether it would sacrifice social reform plans for the duration, whether labor was to be asked to put its shoulder to the wheel along with management and whether the social planners would be allowed to utilize the emergency to further develop a "blueprint for the New Deal of the future."

To some attending the sessions, it appeared that in the controls being imposed and in the casual forecasts and remarks of the New Dealers in the defense organization there has arrived a native socialism that may be threatening the free enterprise system.

"Give Us Speed" OPM Chief Asks at Manufacturers' Preparedness Rally

"Let's get this job done, and for Heaven's sake, let's get it done quickly."

Such was the keynote of Mr. Knudsen's speech before the manufacturers' preparedness conference.

The OPM director general outlined the progress made during the first year of the armament program and emphasized the necessity for speed NOW.

"We in Washington are here to help you. But it is your job. Manufacturers, engineers, executives and workmen must combine their energies to get this job done as it never has been done before.

"We will do it in a way that will provide initiative and free enterprise. This is a struggle between centralized and decentralized plans. We all know where America stands. This country was built on a decentralized plan, and it produced the greatest state in the world with the highest standard of living of any country.

"If anyone tries to interfere with our kind of democracy, we can meet that interference . . . No sacrifice is too great . . . "

That the administration appoint "an industrial chief of staff to clear the confusion of administrative duplication," was proposed by Walter D. Fuller, president, National Association of Manufacturers, and of the Curtis Publishing Co. He recommended Mr. Knudsen for the job. "He has won the job in the hearts of all Americans."

Mr. Fuller told the preparedness rally that the administration has used the terms "national defense" and "limited emergency" to bring about virtually complete government control of business.

For all practical purposes, he said, a manufacturer now is a branch manager for government.

Mr. Fuller cited governmental agencies' control over raw material purchases, wages, labor relations, plant allocations for defense, industrial borrowing, and prices.

He called for action to stop the "cancerous growth" of strikes in the arms industries.

He urged the administration to tell the people the facts on "what the nation demands that we sacrifice and for how long." He asserted that government officials have more information at hand than ever before, but that still the people have fewer facts to guide their judgment.

"Subterfuge Must End"

"It is not because men in high places do not know what is happening," he said. "It is because the people who must pay the bills and fight the battles are uninformed. It is a duty to the national morale for the government to stop taking our liberties by the creeping device of subterfuge."

That the government soon will demand drastic cuts in production for consumers and purchasing of ordinary raw materials, and the transfer of skilled labor to plants with defense priorities, was the message conveyed by Leon Henderson, director of Office of Price Administration and Civilian Supply, in his talk to the manufacturers. Mr. Henderson observed the preparedness program soon will be eating up national wealth at the rate of $1,500,000,000 a month, and he warned those upon whom the responsibility rests are facing drastic readjustments.

Further, he cautioned the business men that they face rationing of vital raw materials, that drafts may be made upon their highly skilled labor if craftsmen are needed more in other industries, that they will be fighting for freight cars to move stocks not related to the war effort, and that they must cut out some of the frills in the consumer goods lines.

The OPACS administrator outlined his agency's policies more specifically before the purchasing agents' convention, see page 24.

Robert M. Gaylord, president, Illinois Manufacturers Association, and president, Ingersoll Milling Ma-

chine Co., Rockford, Ill., declared labor must shoulder the responsibility of putting a stop to strikes in defense industries that are called simply to force men to join certain unions, or pay dues, or to obtain jurisdiction over workers.

"This national defense program and the emergency created by it should not be seized as an opportunity to force men to join unions they do not want to join," Mr. Gaylord said. "Men who use it in this manner are profiteers in the fullest sense of the word."

The blueprint for the New Deal "wave of the future" was introduced to the business men by Philip D. Reed, senior consultant to the Priorities Division, OPM, and chairman of the board, General Electric Co., Schenectady, N. Y.

Mr. Reed described the preparedness program as "advancing by several decades the twentieth century trend away from *laissez faire* and toward economic integration and industry-wide planning under government supervision."

Mr. Reed also passed along the word that an American "labor front," similar to the organization directed by Dr. Ley in Germany, which regiments both employer and employe under government direction, is in the process of arriving. He said:

"I anticipate and look forward to a mature, consolidated, national labor organization, led by able and understanding men, who will negotiate all questions pertaining to wages, hours, and conditions of work, with business leaders acting in concert through associations of employes on an industry basis."

David R. Clarke, general counsel of the Illinois Manufacturers, said such a move would mean the end of the present enterprise system.

Gen. Robert E. Wood, vice president, National Manufacturers' group, told a luncheon session that "regardless of conflicting versions of the war situation, America is unanimous on building its defense in a world of force.

"We have a job to be done in record time," he asserted. "We must preserve free enterprise for the future."

Still another speaker, John C. Gall, counsel, National Association of Manufacturers, told the rally that certain forces within the Roosevelt administration are using the preparedness program as "just another crisis, an opportunity to go ahead with their reforms and restrictions and regulations of business."

Purchasers Hear Price Controls Will Be Extended by Government

Special responsibility of industrial buyers during the present emergency was accented at the purchasing agents' meeting. Indicative of industry's realization of the seriousness of its responsibility was an attendance of more than 2000 executives at the convention, appropriately designated the "A-1-a Purchasing Conference," in keeping with the highest priority ratings.

Today's task for those in business and industry is to find ways in which they can best co-operate with the government's defense program to strengthen the nation and prepare it for any danger which might threaten, G. E. Price Jr., purchasing agent, Goodyear Tire & Rubber Co., Akron, O., and president of the association declared.

"This year at our convention," he continued, "we are looking not so much at the problems of how we can benefit our individual companies as how we can best serve our nation by co-operating with the government in the mammoth task it has undertaken. Our job is to protect our nation and join in the effort to create a huge military force.

"While keeping this fact in mind, we realize at the same time that not all business and industry is of such nature as to be useful in the defense program, and in the interest of taking care of civil needs, nondefense production should be carried on as normally as possible, so as not to disturb our economic balance. Our problems today consist in maintaining normal production wherever possible in nondefense industries while at the same time making an all-out effort to reach the goals which have been set for us in building a modern war machine."

Philip D. Reed, of the Priorities Division, addressed the meeting in place of Priorities Director E. R. Stettinius Jr., who was unable to attend. Mr. Reed stated his belief we have begun a struggle which may well last for years.

Of priorities, he said: "One of our most serious problems today is the direct result of the forehandedness of thousands of able and conscientious purchasing departments. As we all know, it is the task and duty of a purchasing agent not only to buy the needed materials as advantageously as possible, but to have them ready at the store or factory when needed for sale or to meet a carefully planned production schedule.

"What could be more natural, therefore, than that, when faced with greatly expanded needs, stiffening commodity prices and the threat if not the actuality of shortages in required materials, the purchasing department should place orders for these materials well beyond the amount needed to maintain normal inventories or to meet the requirements of current production.

"Under ordinary conditions, and viewed from the standpoint of the individual contractor who has a commitment to meet, this would be a simple foresight. Under today's conditions, however, with thousands of defense plants working directly or indirectly for the same customer and a great many of them requiring the same raw materials, the simultaneous action of most of these companies, plus a great many others seeking a reserve supply of the same materials for civilian needs, had pushed the demand clear off the scale and forced mandatory priority action to be taken months in advance of any real need for governmental intervention.

"Because at best governmental regulation is a poor substitute for voluntary co-operation, I cannot emphasize too strongly the importance of limiting parts and material purchases for inventories to actual needs on the basis of current production schedules. . . .

"Unnecessary accumulation of scarce materials, in raw, fabricated or scrap form, either by defense or nondefense manufacturers or by dealers, is seriously hurtful to the national program and must be recognized as undesirable, unpatriotic and ultimately profitless," Mr. Reed declared.

Wins Complete Confidence

A surprise speaker on the purchasers' program was Mr. Knudsen who was in town to address the manufacturers' rally and was persuaded to address the buyers. Creating his usual excellent impression on the audience, Mr. Knudsen was given an ovation when he entered and left the meeting. It was obvious his hearers had a complete confidence in him and apparent why industry is willing to work with and for him.

Discussing the nondefense industry's problem, George W. Aljian, purchasing agent, California & Hawaiian Sugar Refining Corp. Ltd., San Francisco, urged industry not to carry excess inventories and to keep new orders for material in line with consumption. Substitutions in materials frequently do not increase costs much and in some cases actually decrease them. He suggested that manufacturers be prepared for substitutions in advance of their necessity.

Among other suggestions offered by Mr. Aljian were: Pay more at-

tention to waste, and standardize and simplify types of product. This is a critical time for purchasing agents, he warned. They must handle the present situation to the best advantage of both management and government, else their function will be taken over by the government.

Effect of the national defense program and priorities on the supply of iron and steel was discussed at a luncheon meeting presided over by W. W. MacMillen, director of purchases, National Malleable & Steel Castings Co., Cleveland, and chairman of the association's iron and steel committee.

Speaking for the steel producing industry, Edward L. Ryerson Jr., chairman, Inland Steel Co., Chicago, expressed agreement with leading authorities in the industry that present capacity will be adequate to meet all defense needs. However, he pointed out, some requirements of nondefense may have to be sacrificed.

The picture insofar as pig iron is concerned was reviewed by Seymour Wheeler, Interlake Iron Corp., Chicago. It was his opinion that iron supply will be adequate for all defense needs and a good share of nondefense, providing the tonnage is properly distributed.

Capacity can be augmented somewhat by rehabilitating several long idle blast furnaces, but building new units is out of the question at present. Two years would be required to build new furnaces and to do so would aggravate the steel situation, for in addition to the requirements for the furnaces themselves, more coke ovens, more ore boats, railroad cars, and machinery would have to be manufactured. Mr. Wheeler estimated that loss of pig iron production due to the coal strike was 1,000,000 tons.

In discussion, it was pointed out further that shortage of scrap is placing an additional burden on pig iron, and there seems little possibility that the scrap shortage can be solved. Much of the discussion hinged on operation of General Metals Order No. 1 which becomes effective in June.

Discussing substitution possibilities in industry, Col. George S. Brady, chief, substitute and secondary materials section, Price Division, OPACS, said we are now rapidly entering a period in which the designer and salesman, especially in civilian products, will have to modify what they make and sell to conform with requirements of what is available in raw material markets.

A reasonable attitude toward suppliers, forward planning on requirements and conservative purchasing are three policies which industrial buyers should cultivate under present conditions, W. E. Bittner, purchasing agent, Diamond Alkali Co., Pittsburgh, recommended in speaking on "Wartime Expediting."

OPACS Administrator Henderson told the buyers his agency's function is not only to watch prices but to exercise an influence on the elements responsible for increases.

"Under the general charter of OPACS we have been in many fields. We expect to be in many more. We were in on the drafting of defense plant amortization plans. I appeared before the Ways and Means committee to exert the influence of my office on the tax program. We have sat in on discussions of rail and truck rates.

"I can tell you that just as we have used our influence in those fields we are prepared to move in other directions."

Inventory Control Probable

The next regulatory step likely to be taken by the government is inventory control supervised by administrative bodies which will seek to compile a specific record of all materials of importance in the defense program, asserted Frederick J. Heaslip, purchasing agent, Fairbanks, Morse & Co., Chicago, and chairman of the association's business survey committee. He said that in a few cases unnecessary stocks may have been accumulated but inventories generally are not burdensome.

Mr. Heaslip said also that if there had been sufficient machine tools, steel, aluminum and labor to satisfy the overnight requirements of industry last winter the volume of production in the United States by now "would have surpassed Germany at her best."

After nearly two years of war, there has been little or no rise in commodity prices in Canada, chiefly because there is a really earnest desire on the part of business there to co-operate with the government, Julian G. Davies, treasurer and purchasing agent, N. Slater Co. Ltd., Hamilton, Ont., declared.

F. Albert Hayes, American Hide & Leather Co., Boston, was elected president of the association, succeeding George E. Price Jr., purchasing agent, Goodyear Tire & Rubber Co., Akron, O.

District vice presidents were elected as follows: Robert L. Grube, Stephens-Adamson Mfg. Co., Los Angeles; B. R. Newbery, Lone Star Gas Co., Dallas, Tex.; B. B. Countryman, Minnesota Mining & Mfg. Co., St. Paul; C. E. Drake, National Standard Co., Niles, Mich.; Cecil C. Callowhill, American Can Co., Hamilton, Ont.; W. E. Bittner, Diamond Alkali Co., Pittsburgh; J. M. Gamble, Standard-Coosa-Thatcher Co., Chattanooga, Tenn.; R. C. Haberkern, R. J. Reynolds Tobacco Co., Winston-Salem, N. C.; B. G. Byrne, New England Butt Co., Providence, R. I.

Mounts No Guns, but Is Important to Defense

■ Equipped to handle heavy steel cable nets which may be stretched across harbor entrances and navigable rivers as antisubmarine protection, the U. S. S. TEABERRY, 700-ton net tender, was launched last week at the John H. Mathis & Co. yard at Camden, N. J. It is the first net tender to be built on the Atlantic seaboard and will be one of a fleet of 32 to be completed soon. NEA photo

Begin Work on Sheffield Steel Plant at Houston

HOUSTON, TEX.

■ Ground was broken last week for the $17,000,000 steel plant of the Sheffield Steel Corp. of Texas, subsidiary of the American Rolling Mill Co. at Irish Bend on the Houston Ship Channel. Participating were many distinguished industrialists and businessmen.

Speakers were George M. Verity, Armco chairman, and Calvin Verity, executive vice president and general manager.

A banquet in honor of the visitors was held at the Rice hotel, Houston, May 27. J. W. Evans was toastmaster and introduced W. S. Cochran, president, Houston Chamber of Commerce, who gave the address of welcome.

Banquet speakers were Charles R. Hook, Armco president, and William L. Batt, of the Office of Production Management.

Included in the party of visitors were R. L. Gray, president, Sheffield Steel Corp.; J. C. Shepherd, vice president of Sheffield Steel; J. Frank Drake, Pittsburgh, Gulf Oil Corp., and a director in Armco; and W. W. Sebald, Armco assistant general manager.

William C. Breed, senior partner in the New York law firm of Breed, Abbott & Morgan; Edward A. Deeds, president, National Cash Register Co., Dayton, O.; James B. Doan, chairman, American Tool Works, Cincinnati; William S. Horner, Charles S. Payson and Paul Sturtevant, all directors in the American Rolling Mill Co.

Plant will have 200,000 tons annual ingot capacity, operating principally on scrap, manufacturing billets for shell forgings, structural steel, light plates for shipbuilding, wire rods, oil field supplies and other defense items. Reconstruction Finance Corp. made a loan of $12,000,000 to finance construction. The plant is located on a 600-acre site on the ship channel, allowing loading of ocean-going ships direct. (See STEEL, Feb. 17, p. 46.)

Steel Industry Featured In Defense-Service Series

■ Steel's role in defense and the industry's confidence that "Steel will do the job" features the first of a series of advertisements sponsored by Johns-Manville Corp., New York, in the *Saturday Evening Post*. Well-known writers and radio commentators were engaged to prepare the articles.

Discussing need for informing the public of the completeness with which various industries have gone "all-out" for defense, Lewis H. Brown, Johns-Manville president, said ". . . too few people realize the indispensable part which industry is playing in building America's defense in the greatest crisis in our history. Certainly it is vitally important to the future of our American system that full publicity be given to the achievements now being made under free industrial enterprise."

Forms Closed Earlier

■ **Because of Memorial holiday the final forms for this issue of STEEL went to press Thursday noon, May 29, instead of the customary time Friday night. All news, market information and price corrections, therefore, are as of Thursday noon. —The Editors.**

Nine Workmen Share in $10,000 Revere Award

NEW YORK

■ Tops in a field of more than 2000 entries, nine typical American workmen were notified last week they were winners in the $10,000 award offered by Revere Copper & Brass Inc., for best contributions made by workers at the bench to America's defense plans, military and industrial.

Leading the list and winner of the first prize of $5000 was Eugene Phillips, Ft. Worth, Tex., creator of system for blind landing of airplanes.

Second award of $2500 went to William R. Holcomb, Burbank, Calif., for his invention of an electromagnetic riveting gun.

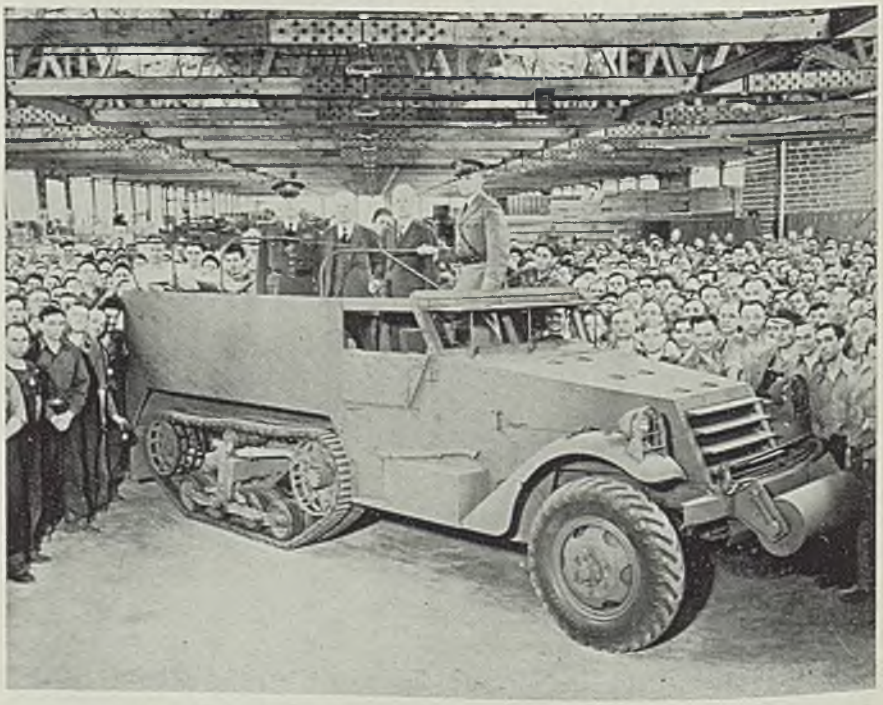
Third prize of $1000 was awarded to Oscar B. Leibst, Seattle, for a structural design eliminating use of rivets and clips.

These three inventions are of direct interest to United States military and naval officials. The second and third inventions have a specific interest to OPM as they relate to speeding up production of aircraft—military, naval and civilian.

In addition to the foregoing prizes, cash awards of $250 each went to the following: D. L. Wright, McComb, O.; Joseph A. Chyba, Baltimore; Marcus A. Campbell, Saginaw, Mich.; Martin J. Madison, Baltimore; John J. Kuettel, St. Paul; C. B. Barbee, North Hollywood, Calif.

The Revere award was created for workingmen in December, 1940, by C. Donald Dallas, president, Revere Copper & Brass. Main purpose was to encourage American initiative and enterprise and to aid national defense.

Troop Carriers Coming Off the Line



■ First of 2000 personnel carriers being made for the United States Army by the Diamond T Co., Chicago, rolls off the line with a cargo of officers. Each truck, half tractor, will carry 13 men, costs $7000. Standing in the carrier, left to right: Brig. Gen. Norman F. Ramsey, Rock Island, Ill., arsenal; Fred A. Preston, Chicago ordnance district; C. A. Tilt, Diamond T president; Col. Donald Armstrong, Chicago ordnance district. NEA photo

Steel and Iron Scrap Stocks Reduced 8 Per Cent

■ Domestic stocks of steel and iron scrap at consumers' and suppliers' plants and in transit March 31, amounted to 7,235,000 net tons, or 8 per cent less than 7,843,000 tons reported at the close of December, 1940, according to the Bureau of Mines, Washington.

Known stocks held by consumers and suppliers March 31 were equivalent to six weeks supply at the rate of consumption in March, a position slightly lower than at the end of the year, when available stocks were equivalent to seven weeks supply. Suppliers' stocks March 31 were 2,015,000 tons, compared with 2,191,000 tons Dec. 31 and consumers' stocks were 5,220,000 tons, compared with 5,652,000.

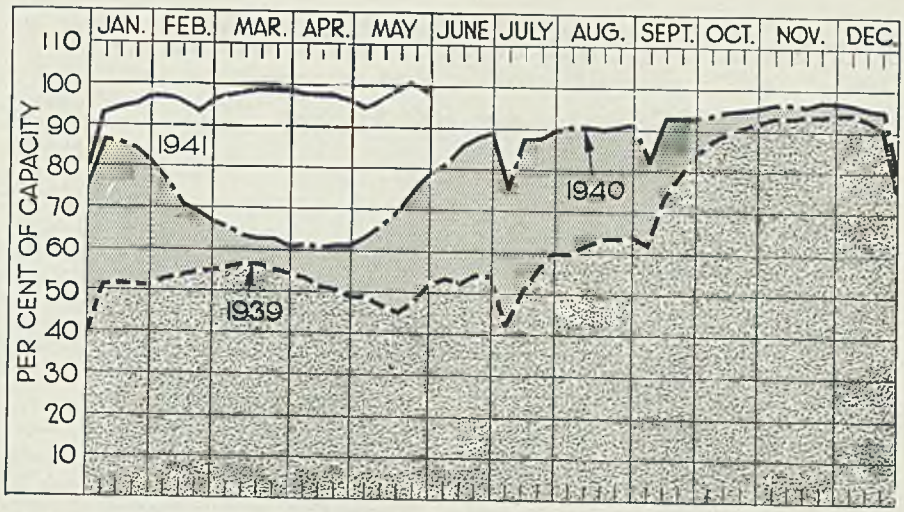
Inventories held by larger suppliers reporting in both canvasses declined 7 per cent, and railroad stocks dropped 17 per cent. In western Pennsylvania reported stocks of purchased and home scrap were equivalent to at least four weeks supply at the estimated rate of consumption in March. The district comprising eastern Ohio and West Virginia had five weeks supply and other principal scrap-consuming districts had from five to six weeks supply. Inventories in New England and the western states were sufficient for 61 weeks consumption. Estimates of consumer stocks are based on the assumption that companies reporting their inventories held 95 per cent of stocks at consumers' plants.

Consumption Up 50 Per Cent

Institute of Scrap Iron and Steel Inc., announced last week that steel mills, blast furnaces and foundries in the first four months this year consumed 17,518,000 gross tons of iron and steel scrap compared with 11,669,000 tons in the period last year. This 50 per cent increase compares with rise of 49 per cent in steel ingot production and 30 per cent in pig iron.

Notwithstanding requirements for steel, pig iron and castings for civilian and defense activities, the institute states sufficient scrap supply has been available for the program. April domestic consumption was 4,046,000 tons, a reduction of 256,000 tons from March. In April last year the melt was 2,548,000 tons.

■ S. G. Taylor Chain Co., Hammond, Ind., recently observed its sixty-eighth anniversary. Founded in 1873 by S. G. Taylor Sr., at Chicago, the company has had an unbroken succession of father-son management. S. G. Taylor Jr., for 50 years a chief executive, succeeded his father, and in turn was followed by his son, E. Winthrop Taylor, now president.



PRODUCTION . . . . Down

■ STEELWORKS operations last week dropped 1 point to 99 per cent, mainly because of furnace repairs. Two districts showed higher rates, three declined and seven were unchanged. A year ago the rate was 78½ per cent; two years ago it was 52 per cent.

Chicago—Declined 2 points to 100½ per cent after two weeks at the all-time record level of 102½ per cent. Four plants were obliged to take out open hearths for repair, one increased operations and one maintained its rate.

Birmingham, Ala.—Unchanged at 95 per cent for the third week, with 23 open hearths active.

Tennessee Coal, Iron & Railroad Co. has blown out its No. 2 blast furnace at Ensley, Ala., for relining and to increase its capacity from 675 to 900 or 1000 tons daily.

Buffalo—With 40 of its 43 open hearths in production the district holds its rate at 93 per cent. Two Bethlehem furnaces are idle and one is out at Wickwire Spencer plant.

St. Louis—Steady at 98 per cent for the ninth week. The same rate is scheduled for this week.

Detroit—Advanced 3 points to 92 per cent, only two of the district's 26 open hearths being down for repair. Both damaged Ford furnaces have been returned to service.

Pittsburgh—Small changes in schedule failed to affect the district rate, which remained at 100½ per cent.

Wheeling—Lost 1 point gained the previous week, returning to 88 per cent.

Central eastern seaboard—Continues at 96 per cent, as close as possible to practical capacity.

Cincinnati—Rose 3½ points to 92½ per cent, with only two open hearths idle.

Cleveland—Repairs at one plant overshadowed an increase at another, giving a net loss of ½-point to 96 per cent.

Youngstown, O.—With no interruption for the holiday steelmaking continued unchanged at 97 per cent, 74 open hearths and three bessemers active. Outlook for this week is for the same rate. Youngstown Sheet & Tube Co. and Shenango Furnace Co. each will light a blast furnace this week and Republic Steel Corp. probably will light one the following week, making all 25 in the district active.

New England—Continued at 90 per cent, with an increase expected this week.

District Steel Rates

Percentage of Ingot Capacity Engaged In Leading Districts

	Week ended May 31	Change	Same week 1940	Same week 1939
Pittsburgh	100.5	None	79	42
Chicago	100.5	− 2	83	53.5
Eastern Pa.	96	None	71	37
Youngstown	97	None	58	48
Wheeling	88	− 1	79	70
Cleveland	96	− .5	82	53
Buffalo	93	None	70	44
Birmingham	95	None	85	60
New England	90	None	56	35
Cincinnati	92.5	+ 3.5	64	60
St. Louis	98	None	57	37.5
Detroit	92	+ 3	74	57
Average	99	− 1	78.5	52

■ A Lockheed transport plane under construction at Burbank, Calif., will carry 64 persons, including a crew of seven, from Los Angeles to New York in 8½ hours, according to Jack Frye, head of Transcontinental & Western Air Inc.

Revised Specifications Cut SAE Standard Steels to 84 from 109

■ COMPREHENSIVE revisions of SAE steel specifications have just been published. Turning back the tide of increasing variations in the chemistry of steels demanded by users in recent years, the revised standards provide for 72 carbon and alloy grades and corrosion and heat-resisting alloys, or a total of 84 in place of the 109 SAE standard steels included in the series which they replace.

The revised series (which appears in the 1941 SAE Handbook) is the result of nearly a year's work by the iron and steel division of the SAE Standards Committee, the last previous general revision in these specifications having been made in 1935. Carrying out the present important revisions, Division Chairman F. P. Gilligan sought and obtained data on use of SAE steels from machine tool builders, electrical manufacturers, railroads, and scores of other nonautomotive users as well as from every part of the automotive industry itself. Final decisions were reviewed in co-operation with a technical committee of the American Iron and Steel Institute which had recently completed a survey restricted to steel producers and, in general, the conclusions reached by the two separate groups with respect to popular and desirable SAE compositions were similar.

"It is the belief of the iron and steel division," Mr. Gilligan said, "that the needs of the automotive and general user are adequately met with this revised list—and that this first and substantial step in the direction of simplification will inspire a determination on the part of both steel makers and steel users to seek a further diminution in varieties, to the end that increased volume in fewer production streams will facilitate more rapid deliveries and insure lower steel costs for all users."

The revised SAE steel specifications have been listed under two headings: "Primary" and "secondary." "Primary steels" are those used in substantial quantities; "secondary steels" are those considered essential by certain users, but not used extensively. This listing will indicate to users the limited-source materials and encourage them, where practicable, to adopt a primary steel for their purpose.

The accompanying tables give the chemical compositions of SAE steels as they appear in the 1941 SAE Handbook.

■ Synthetic ammonia for the manufacture of explosives soon will be produced in a new "blackout" plant at Wilson dam, near Sheffield, Ala. Koppers Co., Bartlett Hayward Division, Baltimore, has been awarded a contract by the Tennessee Valley Authority for the construction of a semiwater gas plant and auxiliary equipment. Construction will be started as soon as possible and will be completed 90 days later.

CHEMICAL COMPOSITIONS

Report of Iron and Steel Division adopted June 1941. Last revision January 1941.

CHROMIUM NICKEL AUSTENITIC STEELS—NOT CAPABLE OF HEAT TREATMENT

SAE No.	AISI[1] Type	Carbon	Manganese, Max.	Silicon, Max.	Phosphorus	Sulfur	Chromium Range	Nickel Range	Molybdenum	Selenium Range	Titanium or Columbium
30615 (type 1)	303	0.15 Max.	2.00	0.75	0.04 Max.	0.18–0.35	17.00–20.00	7.00–10.00	0.60 Max.	....	....
30615 (type 2)	303	0.15 Max.	2.00	0.75	0.12–0.17	0.04 Max.	17.00–20.00	7.00–10.00	0.60 Max.	0.15–0.35	....
30705	321	0.08 Max.	2.50	1.50	0.03 Max.	0.03 Max.	17.00 Min.	8.00 Min.	....	....	0.10[2] (Min. 0.70[3] Min.
	347										
30805	316	0.10 Max.	2.50	0.75	0.03 Max.	0.03 Max.	16.00–18.00	10.00–14.00	2.00–3.00	....	....
30905	304	0.08 Max.	2.00	0.75	0.03 Max.	0.03 Max.	18.00–20.00	8.00–10.00	....	....	....
30915	302	0.08–0.15	2.00	0.75	0.03 Max.	0.03 Max.	17.00–20.00	7.00–10.00	....	....	....

STAINLESS CHROMIUM IRONS

SAE No.	AISI[1] Type	Carbon	Manganese, Max.	Silicon, Max.	Phosphorus, Max.	Sulfur	Chromium Range	Nickel Range	Molybdenum, Max.
51210	410	0.08–0.15	0.60	0.50	0.03	0.03 Max.	11.50–13.00	....	....
51310	414	0.08–0.15	0.60	0.50	0.03	0.03 Max.	11.50–13.50	1.25–2.00	....
51335	420	0.25–0.40	0.60	0.50	0.03	0.03 Max.	12.00–14.00	....	....
X51410	416	0.13 Max.	1.20	0.75	0.04	0.18–0.35	12.00–14.00	....	0.60
51710	430	0.12 Max.	0.60	0.50	0.03	0.03 Max.	16.00–18.00	....	....

[1] American Iron and Steel Institute.
[2] Minimum if Titanium is used.
[3] Minimum if Columbium is used.

CHEMICAL COMPOSITIONS

SAE Standard

The composition limits of SAE steels apply to the steels as delivered to the purchaser. The Iron and Steel Division has not approved any chemical tolerances beyond these limits.

CARBON STEELS

SAE No. Primary	SAE No. Secondary	Carbon Range	Manganese Range	Phosphorus Max.	Sulfur Max.
1010	....	0.08–0.13	0.30–0.60	0.043	0.055
1015	....	0.10–0.20	0.30–0.60	0.043	0.055
X1015	....	0.10–0.20	0.70–1.00	0.043	0.055
1020	....	0.15–0.25	0.30–0.60	0.043	0.055
1020	....	0.15–0.25	0.70–1.00	0.043	0.055
1025	....	0.20–0.30	0.30–0.60	0.043	0.055
....	X1025	0.20–0.30	0.70–1.00	0.043	0.055
1030	....	0.25–0.35	0.60–0.90	0.043	0.055
1035	....	0.30–0.40	0.60–0.90	0.043	0.055
1040	....	0.35–0.45	0.60–0.90	0.043	0.055
1045	....	0.40–0.50	0.60–0.90	0.043	0.055
1050	....	0.45–0.55	0.60–0.90	0.043	0.055
1055	....	0.50–0.60	0.60–0.90	0.043	0.055
1060	....	0.55–0.70	0.60–0.90	0.043	0.055
....	1065	0.60–0.75	0.60–0.90	0.043	0.055
....	X1065	0.60–0.75	0.90–1.20	0.043	0.055
1070	....	0.65–0.80	0.60–0.90	0.043	0.055
1075	....	0.70–0.85	0.60–0.90	0.043	0.055
1080	....	0.75–0.90	0.60–0.90	0.043	0.055
1085	....	0.80–0.95	0.60–0.90	0.043	0.055
1090	....	0.85–1.00	0.60–0.90	0.043	0.055
1095	....	0.90–1.05	0.25–0.50	0.043	0.055

FREE CUTTING STEELS

SAE No. Primary	SAE No. Secondary	Carbon Range	Manganese Range	Phosphorus Range	Sulfur Range
1112	....	0.08–0.16	0.60–0.90	0.09–0.13	0.10–0.20
X1112	....	0.08–0.16	0.60–0.90	0.09–0.13	0.20–0.30
1115	....	0.13–0.20	0.70–1.00	0.043 max.	0.10–0.20
1314	....	0.10–0.20	1.00–1.30	0.043 max.	0.10–0.20
X1315	....	0.10–0.20	1.30–1.60	0.043 max.	0.10–0.20
1330	....	0.23–0.35	1.35–1.65	0.043 max.	0.10–0.20
X1335	....	0.30–0.40	1.35–1.65	0.043 max.	0.10–0.20
X1340	....	0.35–0.45	1.35–1.65	0.043 max.	0.10–0.20

CHEMICAL COMPOSITIONS

MANGANESE STEELS[1]

SAE No. Primary	SAE No. Secondary	Carbon Range	Manganese Range	Phosphorus, Max.	Sulfur, Max.
1330	....	0.25–0.35	1.60–1.90	0.040	0.050
1335	....	0.30–0.40	1.60–1.90	0.040	0.050
1340	....	0.35–0.45	1.60–1.90	0.040	0.050
....	1350	0.45–0.55	1.60–1.90	0.040	0.050

NICKEL STEELS[1]

SAE No. Primary	SAE No. Secondary	Carbon Range	Manganese Range	Phosphorus, Max.	Sulfur, Max.	Nickel Range
2315	....	0.10–0.20	0.30–0.60	0.040	0.050	3.25–3.75
2330	....	0.25–0.35	0.50–0.80	0.040	0.050	3.25–3.75
2340	....	0.35–0.45	0.60–0.90	0.040	0.050	3.25–3.75
2345	....	0.40–0.50	0.60–0.90	0.040	0.050	3.25–3.75
....	2515	0.10–0.20	0.30–0.60	0.040	0.050	4.75–5.25

NICKEL CHROMIUM STEELS[1]

SAE No. Primary	SAE No. Secondary	Carbon Range	Manganese Range	Phosphorus, Max.	Sulfur, Max.	Nickel Range	Chromium Range
....	3115	0.10–0.20	0.30–0.60	0.040	0.050	1.00–1.50	0.45–0.75
3120	....	0.15–0.25	0.50–0.80	0.040	0.050	1.00–1.50	0.45–0.75
....	3130	0.25–0.35	0.50–0.80	0.040	0.050	1.00–1.50	0.45–0.75
3135	....	0.30–0.40	0.50–0.80	0.040	0.050	1.00–1.50	0.45–0.75
3140	....	0.35–0.45	0.60–0.90	0.040	0.050	1.00–1.50	0.45–0.75
X3140	....	0.35–0.45	0.60–0.90	0.040	0.050	1.00–1.50	0.60–0.90
3145	....	0.40–0.50	0.60–0.90	0.040	0.050	1.00–1.50	0.45–0.75
3150	....	0.45–0.55	0.60–0.90	0.040	0.050	1.00–1.50	0.45–0.75
....	3215	0.10–0.20	0.30–0.60	0.040	0.050	1.70–2.00	0.90–1.25
....	3220	0.15–0.25	0.30–0.60	0.040	0.050	1.50–2.00	0.90–1.25
....	3250	0.33–0.43	0.30–0.60	0.040	0.050	1.50–2.00	0.90–1.25
....	3245	0.40–0.50	0.30–0.60	0.040	0.050	1.50–2.00	0.90–1.25
....	3250	0.45–0.55	0.30–0.60	0.040	0.050	1.50–2.00	0.90–1.25
3312	....	max. 0.17	0.30–0.60	0.040	0.050	3.25–3.75	1.25–1.75
....	3415	0.10–0.20	0.30–0.60	0.040	0.050	2.75–3.25	0.60–0.95

CHEMICAL COMPOSITIONS

MOLYBDENUM STEELS[1]

SAE No. Primary	SAE No. Secondary	Carbon Range	Manganese Range	Phosphorus, Max.	Sulfur, Max.	Chromium Range	Nickel Range	Molybdenum Range
X4130	....	0.25–0.35	0.40–0.60	0.040	0.050	0.80–1.10	....	0.15–0.25
4140	....	0.35–0.45	0.60–0.90	0.040	0.050	0.80–1.10	....	0.15–0.25
4150	....	0.45–0.55	0.60–0.90	0.040	0.050	0.80–1.10	....	0.15–0.25
4320	....	0.15–0.25	0.40–0.70	0.040	0.050	0.30–0.60	1.65–2.00	0.20–0.30
X4340	....	0.35–0.45	0.60–0.90	0.040	0.050	0.60–0.90	1.65–2.00	0.20–0.30
4615	....	0.10–0.20	0.40–0.70	0.040	0.050	....	1.65–2.00	0.20–0.30
4620	....	0.15–0.25	0.40–0.70	0.040	0.050	....	1.65–2.00	0.20–0.30
4640	....	0.35–0.45	0.50–0.80	0.040	0.050	....	....	....
4815	....	0.10–0.20	0.40–0.60	0.040	0.050	....	3.25–3.75	0.20–0.30
4820	....	0.15–0.25	0.40–0.60	0.040	0.050	....	3.25–3.75	0.20–0.30

CHROMIUM STEELS[1]

SAE No. Primary	SAE No. Secondary	Carbon Range	Manganese Range	Phosphorus, Max.	Sulfur, Max.	Chromium Range
5120	....	0.15–0.25	0.60–0.90	0.040	0.050	0.60–0.90
5140	....	0.35–0.45	0.60–0.90	0.040	0.050	0.80–1.10
5150	....	0.45–0.55	0.60–0.90	0.040	0.050	0.80–1.10
52100	....	0.95–1.10	0.20–0.50	0.030	0.030	1.20–1.50

CHROMIUM VANADIUM STEELS[1]

SAE No. Primary	SAE No. Secondary	Carbon Range	Manganese Range	Phosphorus, Max.	Sulfur, Max.	Chromium Range	Vanadium Min.	Vanadium Desired
6130	6135	0.30–0.40	0.60–0.90	0.040	0.050	0.80–1.10	0.15	0.18
6150	....	0.45–0.55	0.60–0.90	0.040	0.050	0.80–1.10	0.15	0.18

SILICON MANGANESE STEELS

SAE No. Primary	SAE No. Secondary	Carbon Range	Manganese Range	Phosphorus, Max.	Sulfur, Max.	Silicon Range
9254	....	0.45–0.55	0.60–0.90	0.040	0.050	1.30–1.80
9260	....	0.55–0.65	0.60–0.90	0.040	0.050	1.80–2.20

[1] Silicon range of all SAE basic open hearth alloy steels shall be 0.15–0.30. For electric and acid open hearth alloy steels, the silicon content shall be 0.15 minimum.

College Courses in Tool Engineering Proposed

■ General curriculum for college courses in tool engineering has been proposed by the national educational committee of the American Society of Tool Engineers, Detroit. Already under consideration by several universities and engineering colleges, the course would place science of tool engineering on the same fundamental basis as other engineering courses.

Relatively new as a profession, tool engineering is an outgrowth of the evolution of mass production methods.

Engineers in this field are defined as those responsible for taking drawings and blueprints of parts and determining on what types of machines and with what tools those parts can be produced most efficiently. Today most of these men are virtually self-trained, having "come up through the shop," and are widely skilled.

New course would comprise four years of study, and is featured by a close tieup between theoretical studies and practical problems in industry. In addition to regular subjects studied in engineering courses, the following are included: Military science, forging, heat treating, welding, materials of engineering, foundry practice and patternmaking, elementary and advanced machine shop practice, cost accounting, metallography of alloy steels, time and motion study, machine shop equipment, jig and fixture design, finishing processes, wages and compensation, production control, materials handling, die design, cost and production estimating, budgets and planning, and others.

The society is already co-operating with government and educational authorities in establishment of emergency training programs in tool design and engineering.

Vanadium-Alloys Waives Royalties on "Van-Lom"

■ Patented molybdenum high-speed steel, manufactured by Vanadium-Alloys Steel Co., Latrobe, Pa., under the trade name "Van-Lom," may now be made by all producers of tool steel and tool manufacturers without payment of royalties.

This announcement was issued by Vanadium-Alloys to further the defense program, and will remain in force for the duration. It includes both manufacture and use.

Patent on this steel was issued in 1938 to J. P. Gill, and assigned to the company. It covers a readily forgeable and machineable high-speed alloy of the molybdenum type, containing: Carbon, 0.75 to 1.20; chromium, 3.75 to 4.75; molybdenum, 8.25 to 10.0; and vanadium, 2.0 to 4.25. Ratio of vanadium to carbon varies from excess of 2½ to 1 to below 3½ to 1.

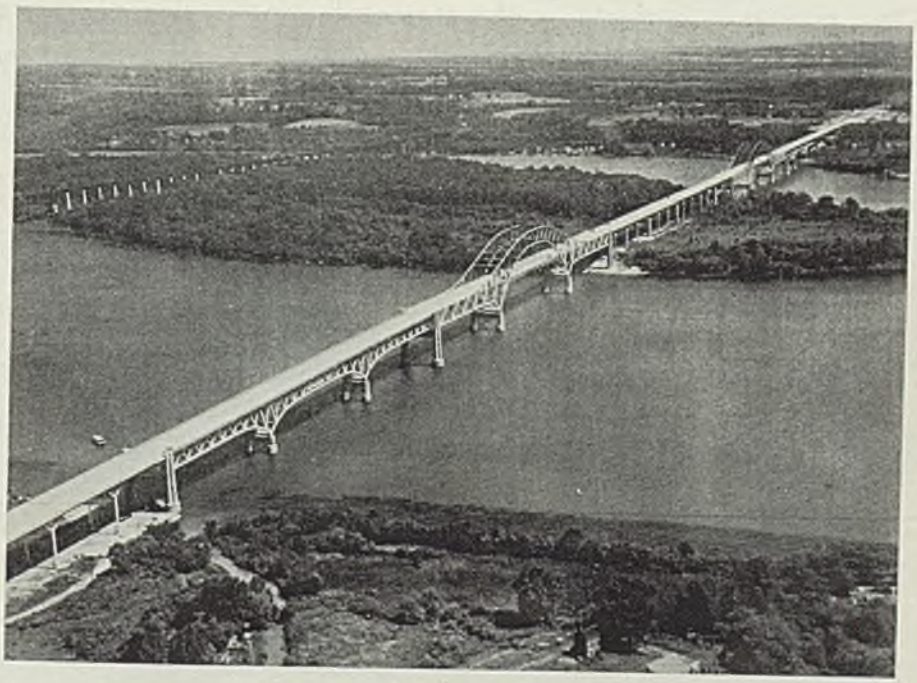
✦

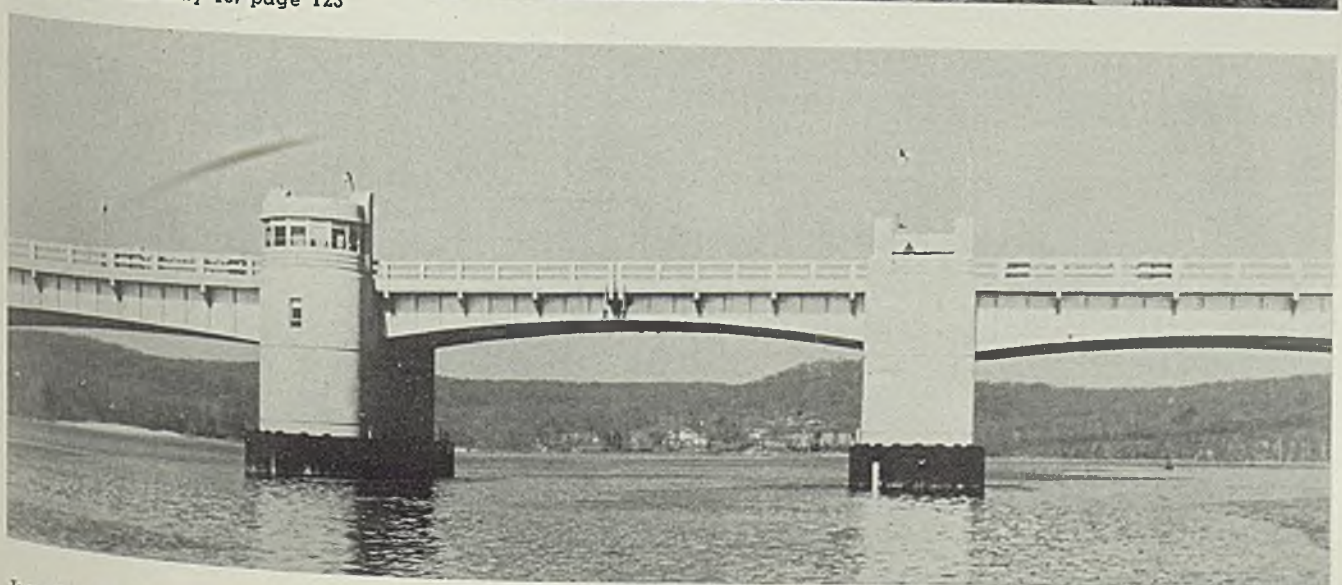
"Most Beautiful Bridges" Built in 1940

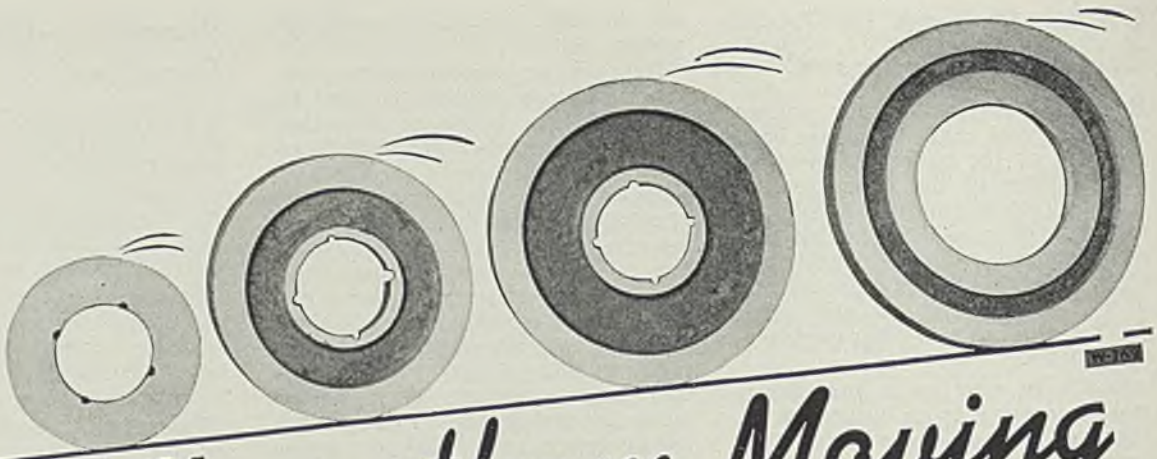
■ Most beautiful steel bridge in the monumental size class, completed in 1940, was the Susquehanna river bridge, right, between Havre de Grace and Perryville, Md., according to the board of judges in the American Institute of Steel Construction's thirteenth annual awards. Costing $4,085,000, the bridge has a total length of 7618 feet. It was fabricated by Bethlehem Steel Co.

First prize in the movable bridge class was awarded the Oceanic bridge, below, over the Navesink river between Locust Point and Rumson, N. J. Erected at a cost of $1,030,000, it has a bascule span length of 98 feet center to center of bearing. It also was fabricated by Bethlehem. For winners in other classes,

see STEEL, May 19, page 123







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WITH BLANCHARD SURFACE GRINDERS

The largest manufacturer of automobiles in the world keeps transmission gears moving down the line by using Blanchard No. 18 Surface Grinders for grinding the gear faces. These machines not only assure maximum production, but easily give the accuracy necessary (parallel within .0005") for subsequent operations. Both faces of several size gears are ground on Blanchard No. 18 Grinders, .020" of stock being removed from each surface. Production on the 3½" gear is 250 (500 surfaces) per hour — and changing from one size gear to another involves practically no down time. Blanchard production estimates are yours without obligation — just send samples or blueprints to

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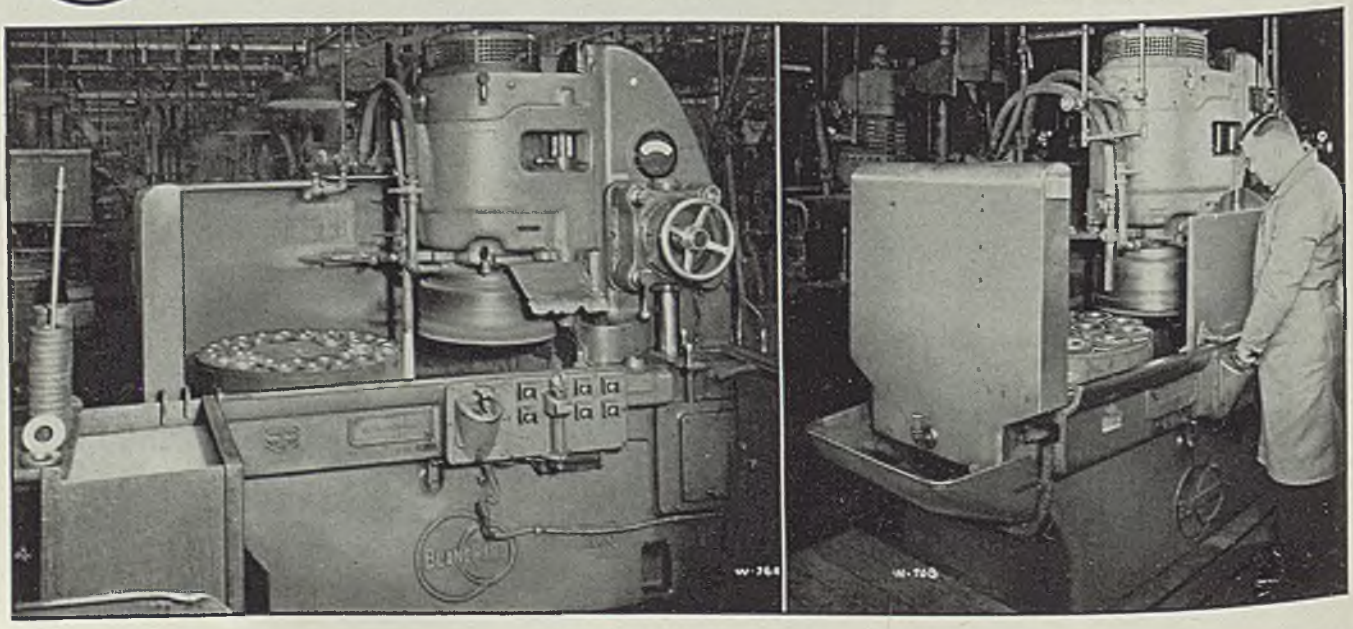

Windows of WASHINGTON

By L. M. LAMM
Washington Editor, STEEL

Military requirements to take virtually all aluminum production . . . Canadian vessels to be used to carry ore to lower lake ports . . . Ships and transportation equipment get largest share of defense funds . . . Zinc pool raised to 22 per cent . . . Compulsion may be used to extend subcontracting . . . James L. O'Neill named deputy director of priorities

WASHINGTON

■ JAMES L. O'NEILL, operating vice president of Guaranty Trust Co. of New York, last week succeeded Emil Schram as deputy director of OPM's Priorities Division.

OPM announced he will be in charge of all matters relating to operating of the priorities system. It will establish priorities field offices in 15 cities, to be staffed by experts who will explain priorities to industrialists and facilitate contacts of business men with the division in Washington.

Mr. O'Neill was credit manager for Carnegie Steel Co. from 1896 to 1918, when he resigned to join Guaranty Trust Co. He was appointed an administrator of NRA in 1934 and served during 1934 and 1935.

Dr. Wilbur A. Nelson, head of the geology department, University of Virginia, has been appointed as staff expert of the Ferrous Alloys and Minerals Branch, Priorities Division.

John Harris Ward, assistant to the financial vice president, Commonwealth Edison Co., Chicago, has been appointed assistant chief, Metals Inventory Control in the Minerals and Metals Group. He will assist Lawrence J. Martin, who will administer General Metals Order No. 1.

Crane Builders Granted A-1-a Priority Rating for Steel

Twenty-seven crane builders last week were given a preference rating of A-1-a to obtain steel and electrical equipment, Mr. Stettinius raised a previous A-1-c rating and

James L. O'Neill

tripled the number of builders covered by the order.

Materials on which the rating may be used include finished or semifinished fabricated parts and accessories, bar, plate, shapes, forgings and castings of steel, motors, switches, controllers and connections. The rating cannot be extended to subcontractors.

Defense To Take 95 to 100 Per Cent of Aluminum Output

Aluminum production, now at 600,000,000 pounds annual capacity, still lags behind needs and from 95 to 100 per cent of June production will be used for defense manufacture, Priorities Director E. R. Stettinius Jr., announced last week.

He also predicted aluminum scrap will be "increasingly diverted" to defense contractors.

To illustrate the rapidly rising defense demand, Mr. Stettinius said virgin aluminum production in March was 44,000,000 pounds, of which 79 per cent was used for defense. In April, with 48,000,000 pounds, more than 83 per cent was allocated for defense. Ninety-four per cent of May's 52,000,000 pounds' output was diverted. June production will be about 53,000,000 pounds.

Expansion of aluminum facilities already started will boost capacity to more than 800,000,000 pounds annually by July, 1942. Further large expansions are planned. However, the upward surge of military needs in the past few months indicates the shortage will be felt far into 1942.

Study Conservation of Steel In Petroleum Production

Possibilities of conserving steel in oil production were explored at a meeting of representatives of state regulatory bodies and the Interstate Oil Compact Commission, last week.

Meeting was called by R. E. McConnell, chief, Conservation Section, OPM.

Mr. McConnell stated that savings of 20 per cent in the steel tonnage used by the oil industry, or 250,000 tons annually, are possible through wider well spacings, unitization agreements, and by avoiding unnecessary drilling.

These savings, he said, can be effected without interfering substantially with oil production. Steel saved will be made available for new pipe lines and tankers, which are involved in this year's defense plans.

Construction of 9893 Defense Dwelling Units Approved

Construction with public funds of 9893 dwelling units for the families of civilian industrial workers and the enlisted personnel of the Army and Navy in 32 localities were approved last week.

In accordance with the provisions

of the Lanham act, which has provided $300,000,000 for defense housing needs, the President found that an acute shortage of housing exists in 28 localities, necessitating the expenditure of public funds for the construction of 9701 units. Construction with funds provided under the $100,000,000 amendment to the Army and Navy appropriation act was approved for the remaining 192 units in five localities recommended.

Subcontracting To Be Extended, By Compulsion, If Necessary

"Next twelve months undoubtedly will see more manufacturing plants engaged in our preparedness program than ever took part in any other such effort in any country at any time," R. L. Mehornay, Defense Contract Service chief, said last week.

"Through the 36 field offices of the Defense Contract Service we know that the manufacturers of America are fully awake to their responsibility. They see a threat to democracy. Better than others they know the mechanics of the huge task and are determined to make America prepared—to help Great Britain hold that line.

"The Army and Navy Munitions Board in a recent check found that 15,500 contracts had been awarded to 4750 direct contractors—that some 28,000 subcontractors were also engaged in defense work.

"With more than 15 billion dollars in contracts actually let, with almost 27 billion more to be placed, with the orders of the President to speed production, with the growing practice of awarding smaller and smaller contracts, my free prediction is that during the next fiscal year we will see 60,000 direct contracts of less than $100,000 each.

"From now on, it may be that the larger contracts will require definite subcontracting clauses; but that does not necessarily mean undue compulsion."

Zinc Pool Raised to 22 Per Cent of April Output

The zinc pool out of which the Priorities Division, OPM, allocates to meet emergency needs will be raised in June to 22 per cent of April production, it was announced last week by E. R. Stettinius Jr., director of priorities.

The 22 per cent pool for June will approximate 15,000 tons, he said.

For May, the pool was based on 17 per cent of March production and approximated 12,000 tons.

Under present arrangements, producers of slab zinc are required to set aside a designated proportion of their production each month in a pool which is available for allocation to emergency defense requirements.

Large-Scale Defense Production Starting as First Year Ends

Warning that industry "dare not be satisfied," John D. Biggers, OPM production director, last week noted the progress made toward large-scale production of defense materials as the first year of the rearmament program drew to a close.

Machine tool builders, he pointed out, are delivering 1000 units daily to contractors and the industry's dollar volume this year is now expected to reach $750,000,000, compared with $450,000,000 in 1940. May production is estimated to have been double that in May, 1940.

Almost 10,500 military planes of all types were produced in the past 12 months. Combat ships under construction or on order April 30 totaled 360. Thirteen-ton tanks are being turned out at a rate of 150 a month. Quantity production of me-

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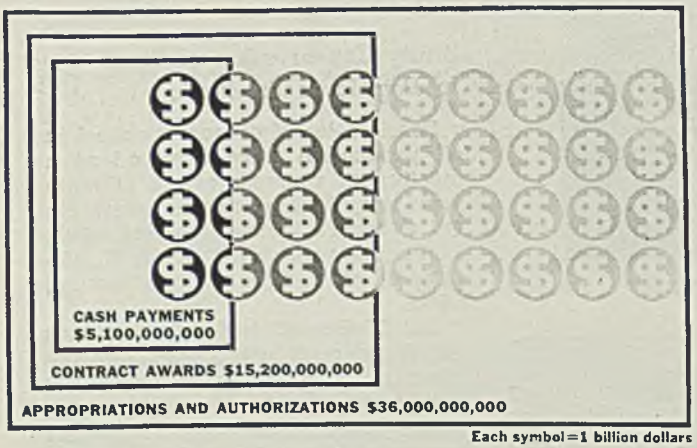
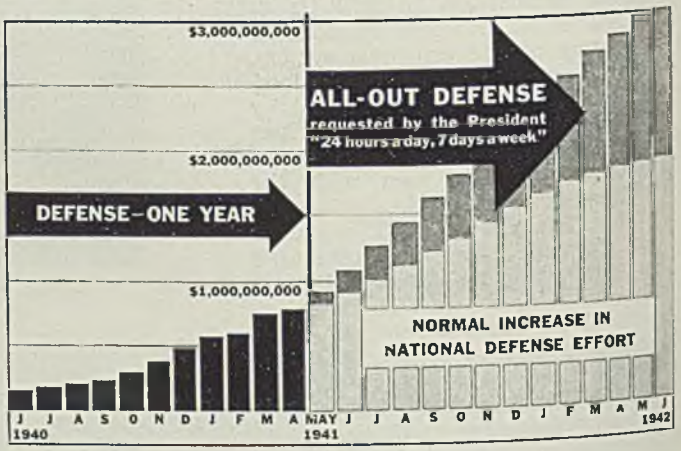
"Defense—One Year"

■ Charts from booklet issued last week by the Office for Emergency Management, Washington

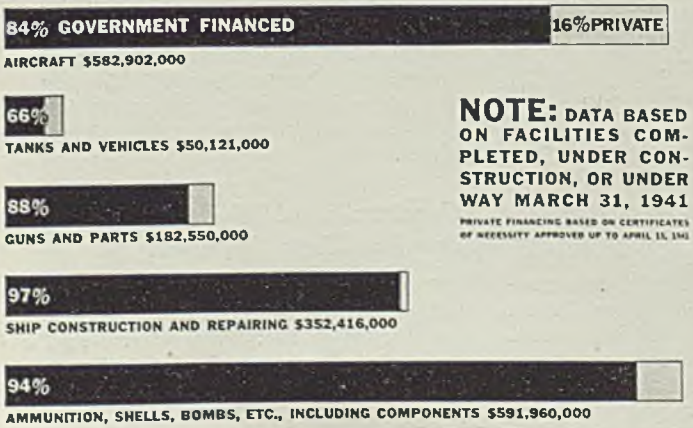
APPROPRIATIONS, CONTRACTS, PAYMENTS—MAY 1, 1941



MONTHLY DEFENSE SPENDING—THE SECOND YEAR



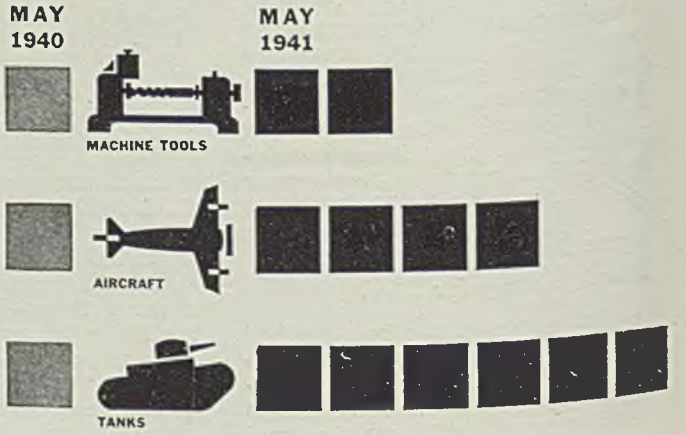
NEW DEFENSE PRODUCTION FACILITIES



NOTE: DATA BASED ON FACILITIES COMPLETED, UNDER CONSTRUCTION, OR UNDER WAY MARCH 31, 1941

PRIVATE FINANCING BASED ON CERTIFICATES OF NECESSITY APPROVED UP TO APRIL 15, 1941

TOOLS AND WEAPONS (MONTHLY PRODUCTION RATES)



dium 26-ton tanks will be delayed until late summer as production was deferred to give machine tool priority to more critically needed weapons.

Summarizing ordnance progress, Mr. Biggers said powder output has increased 1000 per cent over a year ago; small arms ammunition, 1200 per cent; 0.30-caliber machine gun production has tripled; 0.50-caliber machine gun output is four times greater; and gains of 40 and 35 per cent have been made in field artillery and antiaircraft guns.

Ships, Transportation Equipment Take Largest Share Arms Funds

Naval vessels, merchant ships, and land transportation equipment will take the largest single share of the $37,871,000,000 appropriated and authorized by Congress since June, 1940, for national defense, a compilation by OPM discloses. Tabulation is carried to May 17. Authorized expenditures for the fiscal years 1941 and 1942 total $8,963,000,000.

Ordnance equipment, such as guns, ammunition, and other munitions, has been allocated $7,414,000,000. Military aircraft and accessories account for $6,509,000,000.

New industrial facilities financed by the Government will absorb $3,772,000,000. Other allocations are: Military posts, depots, fortifications and defense housing, $3,420,000,000; other Army and Navy equipment, $1,778,000,000; miscellaneous, including pay, subsistence, and purchase of imported materials, $6,015,000,000.

Of the $37,300,000,000 the Army will get $13,100,000,000, the Navy $13,100,000,000, and Lease-Lend $7,000,000,000. Other defense agencies will share $2,300,000,000, while government lending agencies will distribute $1,800,000,000.

Contract awards on May 1 amounted to $15,200,000,000. Army and Navy accounted for $13,600,000,000 and other defense agencies for $1,600,000,000. British orders of $3,700,000,000 brought total orders to $18,900,000,000. Cash payments amounted to only $5,100,000,000 on the same date.

Total present program for national defense expenditures amounts to over $41,000,000,000. That is about $310 for every man, woman, and child in the United States. It includes a pending War Department supply bill of about $3,600,000,000 and urgency deficiency appropriations of $165,000,000 for defense housing and $540,000 for a patrol harbor at Bodega, Calif.

Threaten Quick Prosecution In Price Inflation Cases

Attorney General Robert H. Jackson and Leon Henderson, head of the Office of Price Administration and Civilian Supply, have concluded that immediate investigation and prosecution should follow disclosure of instances where "prices are being driven up or held up by any method which is a probable violation of the antitrust laws."

Agreement was revealed in a letter sent to Mr. Henderson by the attorney general referring to discussions held by them regarding "possible price inflation and consumer exploitation" as a result of the defense program.

Urging Mr. Henderson to certify immediately cases of unwarranted price rises through combinations that appear to be illegal, Mr. Jackson promised such cases will have priority of investigation and prosecution.

The attorney general said he will submit proposals of criminal or civil proceedings to Mr. Henderson "for advice as to whether the proposed action would have any adverse effect on your price-stabilizing efforts."

"Proposals of price action by you may be submitted to this department for an expression of advice as to the effect on any pending or contemplated proceedings or for information as to the industry which may be in the possession of this department," Mr. Jackson's letter added.

Exchange Data on U. S., Canadian Supplies

■ **Canada and United States will exchange information on strategic materials supplies through a joint Materials Co-ordinating Committee, members of which are shown below. Left to right: William L. Batt, deputy director of the production division, Office of Production Management; H. J. Symington, Montreal, Que., power controller for Canada; E. R. Stettinius Jr., director of priorities, OPM, and G. C. Bateman, Toronto, Ont., metals controller for Canada. Acme photo**

Senate Committee Approves Canadian Ships in Ore Trade

Senate Commerce Committee last week favorably reported a resolution to permit transportation of iron ore on the Great Lakes between United States ports by Canadian vessels.

The report said present facilities are inadequate for an all-rail movement of any considerable tonnage and that the United States ore fleet has been built to carry maximum quantities of ore for peace-time steelmaking. Use of vessels of Canadian registry, the committee said, is necessary to transport all the ore needed for the next year.

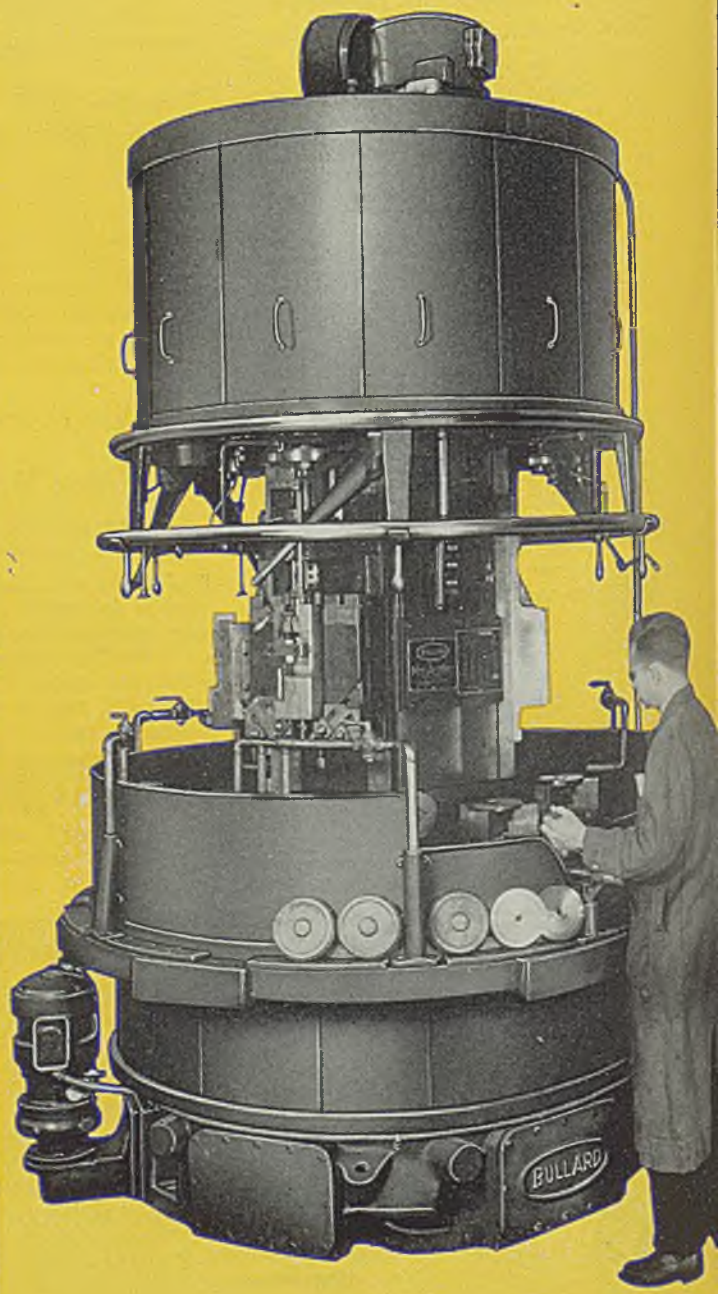
...ask me for anything you like.....except TIME

TODAY we can no more command time to stand still than could Napoleon. What we can do is to make the most profitable use of the time we have.

Can we produce two shells in the time it used to take to make one? Can we, more specifically, machine an aeroplane propeller barrel in 22½ minutes instead of 168 minutes?

We can! This exact time saving was made when a Bullard Mult-Au-Matic took over the job and the Mult-Au-Matic Method of independent speeds, independent feeds and simultaneous operation applied. Bullard Engineers are trained to apply the Mult-Au-Matic Method to any type of machining operation with the capacity of several machines.

BULLARD



THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

Mirrors of MOTORDOM

By A. H. ALLEN
Detroit Editor, STEEL

Materials shortages are overtaking car assemblies, with six weeks to go on model year. Need 550,000 for June and 290,000 for July to attain production goal . . . Ford issuing first budget for 1942 model, including 250,000 units . . . Unionization of auto industry creating new social problems which are not yet recognized generally . . . Propeller plant at Toledo? . . . Defense assignment "ready to roll"

DETROIT

■ HEADING into the home stretch for the 1941 model season, motor car production is holding to near-record levels. Another six to eight weeks remain in production schedules, but already the hot breath of materials shortages can be felt on the industry's flanks and the race of assemblies versus shortages to the finish line in July is going to be a close one. More than a possibility exists that empty stockbins will force some early closing.

Follow-up men are touring suppliers' plants, virtually begging for materials and parts, but many suppliers have been forced to limit production because of allocations of metals and hence can do little to oblige their motor plant customers. Research experts and engineers are burning plenty of midnight oil trying to work out substitutes for critical materials, with varying degrees of success. Already some lead die castings are appearing in place of zinc, plated steel stampings and plastic moldings in place of zinc die castings, cast iron in place of zinc or aluminum.

May Output 550,000 Units

Factory production of cars and trucks in U. S. and Canada for May appears likely to have exceeded 550,000; the holiday last week having meant a loss of perhaps 25,000 units. This brings assemblies for the first five months of the year pretty close to 2,600,000. In the last four months of 1940, output of 1941 models totaled about 1,850,000, which means that as of June 1 some 4,450,000 of the 1941 models had come off assembly lines. So, to reach the model year goal 5,289,972 from which curtailments were figured, 840,000 more cars and trucks must be built. It may be that this total will be attained, figuring another 550,000 for June and 290,000 for July. However, from the present outlook, odds are against any such performance.

Ford has revealed production plans to suppliers, covering the next few months of activity. Scheduled complement of 1941 models is 1,040,000 units and to meet it the plant will operate six days a week during June and up to about July 19, except for two days' cessation over the Fourth of July holiday. First formal inquiries for 1942 production were being prepared last week and were understood to cover about 250,000 units. Changeover to 1942 models will not require much time this summer, since no radical innovations are expected.

Production of the Ford 6 engine is being stepped up, last week running around 280 engines a day. As mentioned last week, one of the most significant features of this engine is the sealed water system operating at around 25 pounds pressure. So effective has this idea proved in overcoming previous difficulties with "hot" and noisy engines, that it probably will be extended to Lincoln Zephyr engines next year. No reports of troubles on this score have been reported from operators of the 12-cylinder Zephyr engine, but it is reasoned that the improvement resulting from high-pressure cooling in the six naturally would be realized to some extent in the V-12.

Results of the NLRB election at Ford were approximately as forecast here some weeks ago, except for the poor showing made by those voters who preferred neither union seeking representation. No statements were made by either of the Fords, but a company attorney took the opportunity to denounce the Wagner Act as tyrannical and to invoke the quotation that "revolt against tyranny is obedience to God."

Next step is for the UAW-CIO and Ford to confer on a contract covering wages, working conditions, seniority, grievance procedures, etc. Blanket wage increases of 10 cents an hour will be asked. An impasse in negotiations leading to a contract could easily be considered by the union as just cause for another strike, so this possibility must be kept in mind.

Union locals in most other auto plants are now asking for wage increases of 10 cents an hour. Hudson compromised on 8 cents, after offering 3 against the union's demand for 15. Chrysler and Packard are included in a drive for wage increases the UAW-CIO is sponsoring in all plants on Detroit's east side where the union holds contracts, covering more than 100,000 workmen. There is little doubt the drive will be successful in most cases.

Wages No Longer Keep Step With Men's Responsibilities

President of a leading motor company in conversation here recently called attention to one of the most important social implications arising from the unionization of industry in the past four years. It is the matter of beginners' or learners' wages. Years ago it was the policy to hire a young single man at, say, 45 cents an hour and then gradually to increase his wage rate at 5-cent jumps over a period of years

as he became more efficient and particularly as he acquired more responsibility in the form of a family and worldly goods. By so doing, the workman was able to meet his gradually mounting cost of living as his responsibilities grew.

Now the situation is different. A young man is hired and in a few months must be paid the top wage for his classification of work. When he is married, has a family, buys furniture or otherwise expands his scale of living, he has no increasing wage to apply against these investments. His only alternative is to go into debt, which he promptly does. And under unionization and seniority he stays right at that level indefinitely, unless he is among the three or four men out of a hundred who by virtue of inborn ability are able to lift themselves into supervisory jobs and on up into the ranks of management.

It is easy to see the social complications in this situation. The unions can proclaim loudly that they have brought this man to top wage rate in a couple of months, instead of the former period of several years, but the money means little or nothing to the man if he cannot apply it against his gradual rise in social status and responsibility. It may take years for the results of this changed outlook to register themselves, but the dangers are there and they are serious.

Automobile Production

Passenger Cars and Trucks—United States and Canada

By Department of Commerce

	1939	1940	1941
Jan.	356,962	449,492	524,126
Feb.	317,520	422,225	509,233
March	389,499	440,232	533,912
April	354,266	452,433	489,841
4 mos.	1,418,247	1,764,382	2,057,112
May	313,248	412,492	.....
June	324,253	362,566	.....
July	218,600	246,171	.....
Aug.	103,343	89,866	.....
Sept.	192,679	284,583	.....
Oct.	324,689	514,374	.....
Nov.	368,541	510,973	.....
Dec.	469,118	506,931	.....
Year	3,732,718	4,692,338	.....

Estimated by Ward's Reports

Week ended:	1941	1940†
May 3	130,610	99,305
May 10	132,630	98,480
May 17	127,255	99,030
May 24	133,560	99,810
May 31	106,395	61,255

†Comparable week.

Die Shops Busy on Auto Work

Advance dope on new models is rather thin this year, the defense program having stolen the show completely. However, two of the larger die shops in this district as late as last week were crowded with 1942 model automotive work and their business was averaging only about 5 per cent defense activity—not because they did not want any more but because it had not been offered them.

Newest defense project, not yet announced publicly, is another propeller plant, to be located at Toledo, O., and operated by Republic Aircraft Products Corp. here, a division of the Aviation Corp. Preliminary work on the plant is being supervised by Wayne Eddy, a former Packard engineer. At one time there was talk of the plant being located at Williamsport, Pa., but now it appears Toledo is the choice. The propeller to be manufactured is understood to be of an entirely new design, produced essentially from steel tubing. This will be the second large propeller plant for this district, the first being the Nash-operated plant at Lansing, mentioned here last week.

No Time for Service Tests

Metallurgist for an engine company which supplies truck power plants and guarantees them for a specified mileage, describes the difficulties confronting a change from nickel alloy cast iron hitherto used in engine blocks. He says it is a comparatively simple matter to work out a substitute analysis of iron for blocks which in laboratory tests appears the equal of the original material. But obviously no guarantee can be made on the engine without extensive service tests to prove durability. And service tests take time, of which there is very little these days.

Reports are heard of a new building program to be launched at Buick in Flint, Mich., presumably for some phase of the airplane engine program now under way at Melrose Park, Ill. One version is that production of most steel parts, particularly hardened steel pieces, will be retained at Flint, with finished parts shipped to Chicago for assembly. This would call for a major manufacturing effort at Flint, since crankshafts, connecting rods, valves and numerous other elements of the Pratt & Whitney engine which Buick will build are of steel.

Still in the rumor stage are Chevrolet's plans for radial airplane engine production at Tonawanda, N. Y., where the company operates large motor and axle plants. Official confirmation of the project is lacking, but it is believed in Detroit that the smaller Pratt & Whitney Wasp engine may be built there. Equipment buying is being done at Tonawanda.

Inspect Auto Parts After 25,000-Mile Test Run

■ Here are parts of 15 different 1941 models laid out for inspection after 25,000-mile test runs of the cars at General Motors proving grounds, Milford, Mich. E. E. Wilson, director of the grounds; P. A. Collins, Chevrolet experimental engineer; and J. G. Wood, assistant Chevrolet chief engineer, are inspecting some of the parts. Six weeks was required just to disassemble the cars and to clean and arrange the parts for comparison. Later, all cars will be reassembled and tested further

$322,490,000 Bomber Contracts Head Week's $422,804,907 Defense Awards

■ AIRCRAFT, aircraft parts and subassemblies' awards comprised more than three-fourths of the $422,804,907 total of defense contracts reported last week by the War and Navy departments. Immediate expansion in production of bombers is indicated by placement of two contracts for this type of plane totaling $322,490,000.

The bombers are to be assembled in newly constructed plants, goverment-owned, but operated by private companies long engaged in aircraft building. Subassemblies are to be fabricated mainly by the automotive industry.

Most other awards were small, mainly for machines and other articles required in defense manufacture. War department last week reported the following awards:

Bruening-Winans Corp., Rochester, N. Y., $93,519 lease with Defense Plant Corp., for acquisition of plant and installation of machinery and equipment for manufacture of aircraft parts.

Chrysler Corp., Detroit, $1,691,200 lease with Defense Plant Corp. for acquisition and installation in building leased by Chrysler Corp. of machinery and equipment necessary for manufacture of air frame assemblies. Chrysler will be subcontractor to Glenn L. Martin Co. in production of medium bombers in the government-owned bomber assembly plant at Omaha, Nebr.

Consolidated Aircraft Corp., San Diego, Calif., $163,640,000 for heavy bombers to be turned out at the new government-owned plant at Ft. Worth, Tex. Ford Motor Co. will be major subcontractor furnishing air frame parts in a plant under construction at Ypsilanti, Mich.

Continental Motors Corp., Muskegon, Mich., aircraft engines and spare parts, $5,241,746.

Douglas Aircraft Co. Inc., Santa Monica, Calif., $158,850,000 for Consolidated-type heavy bombers to be assembled at the new government-owned plant at Tulsa, Okla. Ford Motor Co. will be major subcontractor furnishing air frame parts manufactured in a plant under construction at Ypsilanti, Mich.

Fisher Body Division of General Motors Corp., Detroit, $3,957,029 lease with Defense Plant Corp. for acquisition and rehabilitation of buildings and acquisition of necessary machinery and equipment at Memphis, Tenn., for manufacture of air frame assemblies. Fisher Body Co. will be subcontractor to North American Aviation Corp. on assembly of medium bombers at new government-owned plant at Kansas City, Kans.

Kinner Motors Inc., Glendale, Calif., aircraft engines and spare parts, $968,278.

Lockheed Aircraft Corp., Burbank, Calif., airplanes and spare parts, $444,650.

Moore, C. C., Construction Co. Inc., Panama City, Fla., and Paul Smith Construction Co., Tampa, Fla., construction of flexible gunnery school at Panama City, at total estimated cost of $3,104,379.

Willys-Overland Motors Inc., Toledo, O., $2,172,000 lease with Defense Plant Corp. for acquisition and rehabilitation of buildings, and acquisition and installation of machinery and equipment necessary for aluminum forgings production.

Wright Aeronautical Corp., Paterson, N. J., aircraft engines and spare parts, $5,477,889.

Ordnance Department Awards

Adirondack Foundries & Steel Inc., Watervliet, N. Y., steel castings, $1358.93.

American Brake Shoe & Foundry Co., American Manganese Steel Division, Chicago Heights, Ill., castings, $1722.08.

American Manganese Bronze Co., Philadelphia, manganese bronze, $7508.70.

American Smelting & Refining Co., Federated Metals Division, Newark, N. J., solder, $3913.

Ames, B. C., Co., Waltham, Mass., gages, $2445.

Baldwin Locomotive Works, Baldwin-Southwark Division, Philadelphia, testing machines, $5335.

Barber-Colman Co., Rockford, Ill., hobs, end mills, $4657.44.

Barnes, W. F. & John, Co., Rockford, Ill., drilling machines, $7796.

Bay State Elevator Co., Springfield, Mass., electric elevators, $7488.

Belmont Iron Works, Philadelphia, erect structural steel galleries, $2400.

Belmont Smelting & Refining Works Inc., Brooklyn, N. Y., flaked aluminum, $2550.

Bendix Aviation Corp., Scintilla Magneto Division, Sidney, N. Y., parts for tanks, $5499.57.

Blakeslee, G. S., & Co., Cicero, Ill., metal machines, $3810.

Bliss, E. W., Co., Toledo, O., cold nose presses, $20,500.

Bodine Corp., Bridgeport, Conn., jigs and fixtures, $1500.

Bridgeport Machines Inc., Bridgeport, Conn., adapters and attachments, $1506.

Brown-Brockmeyer Co. Inc., Dayton, O., electric motors, $1760.

Brown & Sharpe Mfg. Co., Providence, R. I., parts for machinery, tool steel, $3783.30.

Carlton Machine Tool Co., Cincinnati, radial drilling machine, $22,905.

Carrier Corp., New York, equipment for tray drying and air conditioning system, $10,055.

Carter, Ralph B., Co., Hackensack, N. J., chlorinators and equipment, $6381.

Christiansen, C. B., Newark, N. J., gages, $3100.

Cincinnati Milling Machine & Cincinnati Grinders Inc., Cincinnati, centerless grinders, plain milling machines, $15,211.

Cleveland Universal Jig Co., Cleveland, drill jigs and equipment, $1210.

Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., parts for machine gun, $7325.

Continental Motors Corp., Muskegon, Mich., parts for tanks, $290,418.32.

Cook Chairs Inc., Ashland, Mass., chairs, $1040.

Crown Products Co., Ralston, Nebr., fender flaps, $1028.60.

Crucible Steel Co. of America, New York, steel, $8158.85.

Dallett Co., Philadelphia, tools, $2704.50.

Darwin & Milner Inc., Philadelphia, tool steel, $1136.30.

Derbyshire Machine & Tool Co., Philadelphia, install motor drives, $2640.

Detroit Broach Co. Inc., Detroit, broaches, $3624.50.

DuPont, E. I., de Nemours & Co. Inc., Pompton Lakes Works, Pompton Lakes, N. J., lead azide, detonator equipment and assemblies, $536,335.

Edgcomb Steel Co., Philadelphia, strip steel, $1555.75.

Federal Tool Corp., Chicago, gages and checks, $6080.

Finkl, A., & Sons Co., Chicago, steel, $1749.

Firth-Sterling Steel Co., McKeesport, Pa., tool steel, $1892.25.

Fischer, Charles, Spring Co., Brooklyn, N. Y., small arms materiel, $12,850.

Fox Munitions Corp., Philadelphia, gage assemblies, $4378.50.

Frazer, H. B., Co., Philadelphia, installing electric lighting, $1916.

Gamewell Co., Newton Upper Falls, Mass., alarm systems, $1539.

General Electric Supply Corp., Springfield, Mass., fluorescent lamps, $1310.

Goddard & Goddard Co. Inc., Detroit, milling cutters, $1480.

Great Lakes Steel Corp., Ecorse, Detroit, steel, $20,528.

Groh, Edward, Philadelphia, window and door guards, $1904.

Hampden Electric Supply Co., Springfield, Mass., wire, $1875.

Hanson-Whitney Machine Co., Hartford, Conn., taps, $1630.26.

Hardinge Bros. Inc., Elmira, N. Y., milling machines, $4330.

Harrisburg Steel Corp., Harrisburg, Pa., bombs, $1,471,180.

Hendey Machine Co., Torrington, Conn., lathes, $4711.

Heppenstall Co., Pittsburgh, die steel, $1313.55.

Hobart Welder Sales & Service, Troy, O., electric arc welders, $2675.

International Harvester Co., Chicago, tractors, $2225.

Jahn, B., Mfg. Co., New Britain, Conn., dies, $5195.

Keystone Drawn Steel Co., Spring City, Pa., carbon steel, $1072.64.

Latrobe Electric Steel Co., Latrobe, Pa., tool steel, $1806.10.

Lehigh Foundries Inc., Easton, Pa., base plugs, $22,165.05.

Leidy Electric Co., Phillipsburg, N. J., cable and wire, $1715.25.

Liberty Tool & Gage Works, Providence, R. I., flush pins, $1344.

Lincoln Engineering Co., St. Louis, equipment for tanks, $5623.04.

Magnaflux Corp., Chicago, inspection machines, $2281.

Magnus Tool & Die Co., Newark, N. J., drills and counterbores, $2700.

Metal Products Co., Miami, Fla., fuzes, $516,000.

Michigan Malleable Iron Co., Detroit, castings, $1016.87.

Midvale Co., Nicetown, Philadelphia, forgings, $14,283.30.

Minneapolis-Honeywell Regulator Co., Brown Instruments Division, Philadelphia, potentiometers, $2306.10.

Modern Tool & Die Co., Philadelphia, gages, $1125.

Montgomery Elevator Co., Moline, Ill., modernize freight elevator, $5098.

Morgan Machine Co., Rochester, N. Y., machines, $40,227.24.

Norco Metal Products Co., Philadelphia, punches and dies, $22,041.

Norton Co., Worcester, Mass., grinders, $21,783.54.

Otis Elevator Co., Philadelphia, change freight elevators, $3948.

Pipe Machinery Co., Cleveland, gages, $3110.55.

Production Tool & Die Co. Inc., Springfield, Mass., progressive dies, $1225.

Putnam Tool Co., Detroit, reamers, $1100.

Rahaim Machine & Tool Co., Gardner, Mass., gages, $2304.

Reed Small Tool Works, Worcester, Mass., knurls, $1161.

Republic Steel Corp., Chicago, steel, $3692.41.

Revere Copper & Brass Inc., Detroit, brass, $51,458.43.

Riehle Testing Machine Division, East Moline, Ill., testing machines, $5350.

Roessler Machine Co., Elkins Park, Pa., vent punches, $6750.

Sheffield Gage Corp., Dayton, O., gages, $12,040.

Sipp-Eastwood Corp., Paterson, N. J.,

spinning machines, $29,160.
Smith, A. O., Corp., Milwaukee, bombs, $3,224,000.
Somerville Machine & Foundry Co., Somerville, Mass., bronze castings, $1493.40.
Standard Pressed Steel Co., Jenkintown, Pa., steel furniture, $1481.19.
Standard Tube Co., Detroit, forgings, $1,544,000.
Star Machine & Tool Co., Cleveland, special plugs, $1154.
Steelblast Abrasives Co., Cleveland, steel grit, $10,850.
Stewart Warner Corp., Chicago, fuzes, $1,417,800.
Suburban-Essex Machinists, Orange, N. J., gages, $5983.80.
Swind Machinery Co., Philadelphia, coilers, $2275.
Titan Metal Mfg. Co., Bellefonte, Pa., rings, $126,000.
Tools & Gages Inc., Cleveland, gages, $22,215.
Union Twist Drill Co., Athol, Mass., cutting tools, $1048.60.
United-Carr Fastener Corp., Cambridge, Mass., studs and washers, $5400.
Utilities Engineering Co., Philadelphia, install fluorescent lighting, $13,696.
Vanadium Corp. of America, Niagara Falls, N. Y., ferrochrome, $1531.97.
Veit & Young, Philadelphia, tools, $32,160.
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., dial assemblies, assembly machines, $17,100.
Weaver, Frank M., & Co. Inc., West Lansdale, Pa., erect steel galleries, $1713.
Weldon Tool Co., Cleveland, end mills, $4360.
Western Automatic Machine Screw Co., Elyria, O., parts for tanks and cars, $22,720.
Western Cartridge Co., Winchester Repeating Arms Co. Division, New Haven, Conn., primers, $47,355.
Westinghouse Electric Supply Co., Philadelphia, stranded wire, $1120.23.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., electric arc welders, $1036.80.
White Motor Co., Cleveland, scout cars, engines, $171,296.64.
Wood, Alan, Steel Co., Mine Hill, N. J., aggregate, $7200.
Worcester Stamped Metal Co., Worcester, Mass., cartridge cases, $7645.
Yale & Towne Mfg. Co., Philadelphia, repair platform, $1792.
Zimmerman Steel Co., Bettendorf, Iowa, steel castings, $92,508.26.

Engineers Corps Awards

Bass, Joseph A., Co., Minneapolis, 6000-man cantonment, Jefferson barracks, Missouri, $1,112,600.
Brance-Krachy Co. Inc., Houston, Tex., transformers, Lowry field, Denver, $5440.50.
Cowper, John W., Co. Inc., Buffalo, administration and housing facilities, and hangar, 91st observation squadron, Pine Camp, N. Y., $264,000.
Evans Construction Co., Springfield, Ill., 4000-man cantonments, Jefferson barracks, Missouri, $677,243.
Interstate Equipment Corp., Elizabeth, N. J., machinery, equipment, materials and tools for cableway, $57,755.
Klaine, F. A., Co., Cincinnati, No. 5 (coal) army ranges, U. S. Flying School No. 1, Macon, Ga., $2599.80.
McCourt, John, Co., Boston, and John P. Condon Corp., Watertown, Mass., paving of runways and taxi-strip, Windsor Locks airfield, Connecticut, $692,040.
Midland Structural Steel Co., Cicero, Ill., structural steel, aircraft assembly plant, Tulsa, Okla., $2,488,200.
O'Driscoll Grove Co., New York, hospital group, Jefferson barracks, Missouri, $690,254.
Walton, Jack, Co., Houston, Tex., gasoline distribution station, Ellington field, Houston, Tex., $12,638.82.
Ziebarth, Fritz, Long Beach, Calif., pumping plant, Hill field, Ogden, Utah, $21,850.

Chemical Warfare Service Awards

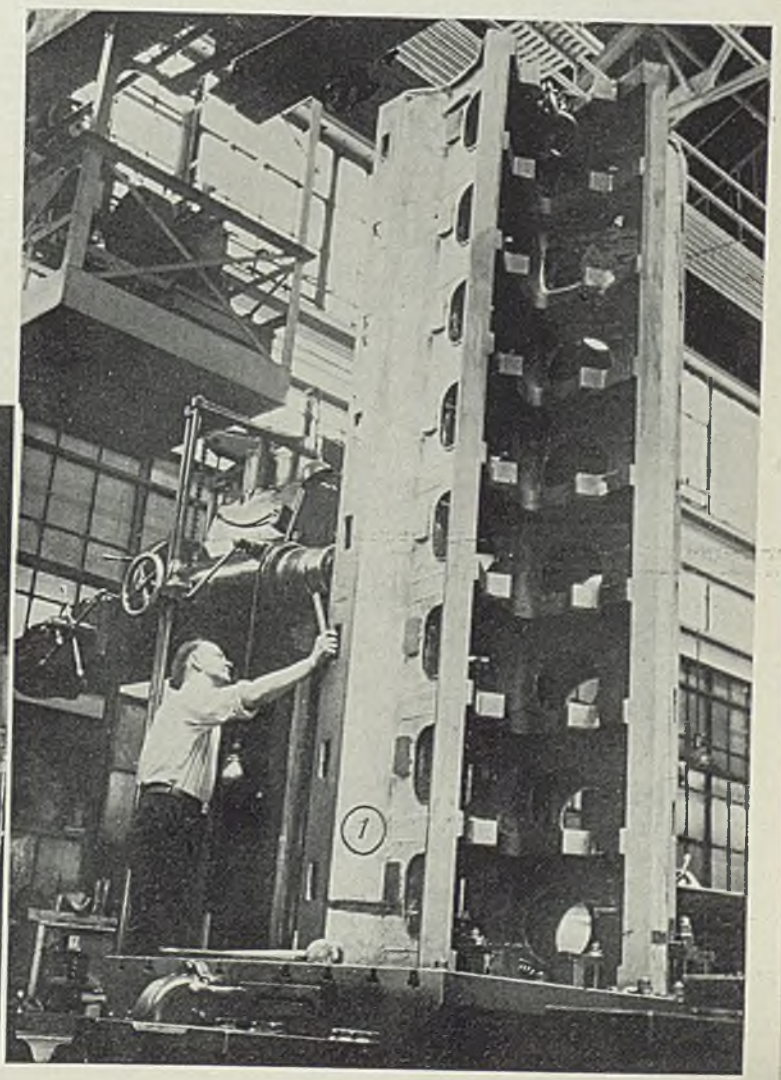
Fyr-Fyter Co., Dayton, O., chemical apparatus, $43,000.
Goodyear Tire & Rubber Co., Akron, O., assembling canisters, $105,400.

Medical Corps Awards

Blickman, S., Inc., Weehawken, N. J., cook's tables and coffee urns, $46,415.47.
Bramhall, Deane Co., Brooklyn, N. Y., laboratory autoclaves, $30,845.
Evansville Metal Bed Co., Evansville, Ind., hospital beds, $30,936.
Fiske, J. W., Iron Works, Brooklyn, N. Y., porch benches, $9420.
General Electric X-Ray Corp., Chicago, camera racks, $12,600.
Hard Mfg. Co., Buffalo, steel desks, $16,368.20.
Hospital Supply Co. and Watters Laboratories Consolidated, New York, drums for sterilizers, $6725.
Hu-Friedy Mfg. Co., Chicago, surgical scissors, $900.
Ohio Chemical & Mfg. Co., Heidbrink Division, Minneapolis, anesthesia apparatus, $85,605.50.
Polar Ware Co., Sheboygan, Wis., hospital and mess equipment, $53,369.44.
Superior Sleeprite Corp., Chicago, bed screens, medicine cabinets, $3550.
Union Dental Instrument Mfg. Corp.,

Making Diesel Units for New Fleet

■ Heavy cylinder block for diesel engine to propel one of the Navy's new vessels undergoes boring mill operations, right, in General Motors Diesel Engine Division, Cleveland. Company has orders for $89,400,000 diesels and now is completing a 200,000-square-foot expansion at its plant. Below, a Navy inspector checks the hardness of a crankshaft. NEA photo



Philadelphia, crown and splint remover, $2887.50.
White, S. S., Dental Mfg. Co., Staten Island, N. Y., engine bit holders, $600.
Wilmot Castle Co., Rochester, N. Y., incubators, $4659.20.

Quartermaster Corps Awards

Aluminum Goods Mfg. Co., Manitowoc, Wis., aluminum syrup pitchers, $42,000.
Clyde Cutlery Co., Clyde, O., knives, $4748.32.
Columbian Steel Tank Co., Kansas City, Mo., one ready built steel building, Savanna ordnance depot, Illinois, $1570.
Fargo Motor Corp., Detroit, eight-passenger car, $1165.30.
General Motors Sales Corp., Detroit, medium sedan cars, carryall trucks, $4944.99.
Hussman-Ligonier Co., St. Louis, meat and food chopper machines, $27,359.90.
International Silver Co., New York, forks, knives and spoons, $189,507.82.
Iskin Mfg. Co., Philadelphia, parachutist badges, $310.
Jones, J. A., Construction Co., Charlotte, N. C., 335 recreation buildings at Camp Shelby, Mississippi, $562,278.
Martinelli Construction Co., San Francisco, post office building (temporary) at Presidio of San Francisco, $6718.
McCarthy, Robert, San Francisco, office building for signal corps, at Ft. Mason, California, $10,617.
Miller, A. J., Auto Cruiser Trailer Co., Bellefontaine, O., trailers, $5707.60.
Morgan, J. B., & Sons, El Paso, Tex., fire station at William Beaumont general hospital, El Paso, Tex., $9880.
Oneida Ltd., Oneida, N. Y., knives and spoons, $68,728.75.
Ontario Knife Co., Franklinville, N. Y., knives, $13,464.35.
Pearson Construction Co., Benton Harbor, Mich., two warehouses at Jeffersonville quartermaster depot, Indiana, $708,400.
Pinkerton & Jameson, Corona, Calif., roads, grading, gas, sewer and water lines, electric distribution, 216 tent frames and 200 buildings at Camp Haan, California, $210,275.
Skilken Bros., Columbus, O., closed sheds, Columbus general depot, Ohio, $362,-592.
Sta-Brite Products Corp., New Haven, Conn., paring knives, $3200.
Thompson Steel Corp., West Haven, Conn., parts for barrack chairs, $4251.
Valley Construction Co., Seattle, concrete reservoirs and extensions to water distribution system, Ft. Lewis, Washington, $161,179.
Yarbrough, S. O., & George T. Reinhardt, Austin, Tex., recreation building and four barracks buildings at Ft. Sam Houston, Texas, $40,866.

Air Corps Awards

American Chain & Cable Co. Inc., American Cable Division, New York, swager assemblies, $55,000.
Consolidated Aircraft Corp., San Diego, Calif., turret assemblies, $345,369.57.
Goodyear Tire & Rubber Co. Inc., Akron, O., wheel and brake assemblies, $25,-511.
Mallory, P. R., & Co. Inc., Indianapolis, control assemblies, $31,150.
Pangborn Corp., Hagerstown, Md., sand blast rooms, $20,806.
Square D Co., Kollsman Instrument Division, Elmhurst, N. Y., maintenance parts for altimeter, $143,595.

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Following contracts were reported placed by the Navy department:

Bethlehem Steel Co., Bethlehem, Pa., projectiles, armor, $4,383,695. Contract was for a fixed price, with price adjustment clause covering increase in cost of labor and materials.
Consolidated Steel Corp. Ltd., Los Angeles, ordnance equipment items at total of $9,185,990.
Engineering & Research Corp., Riverdale, Md., entered into an agreement with the Defense Plant Corp. for construction of additional plant, and acquisition and installation of additional machinery, at maximum cost of $201,415. manufacture of aircraft propelling machinery at maximum cost of $201,415. New plant's manufacturing area to be 12,000 square feet.
Foote Bros. Gear & Machine Corp., Chicago, supplementary award of $160,-693 for acquisition and installation of machinery and equipment not previously contracted and to be used in manufacture of aircraft engine parts. Total estimated cost of contract now is $2,204,507.
Midvale Co., Nicetown, Philadelphia, projectiles, $1,638,616. Contract was for a fixed price, with price adjustment clause covering increased costs of labor and materials.
Quist, A. W., & Sound Construction Co., Seattle, fitting out pier at Puget sound navy yard, Bremerton, Wash., $1,278,-000.
Willys-Overland Motors Inc., Toledo, O., ordnance equipment items, $5,651,605.

Bureau of Supplies and Accounts Awards

Aircraft & Diesel Equipment Corp., Chicago, Adeco fuel injection equipment, $66,048.
Ajax Metal Co., Philadelphia, phosphor copper, $12,279.02.
Allegheny Ludlum Steel Corp., Brackenridge, Pa., steel, $279,532.26.
Aluminum Co. of America, Pittsburgh, aluminum alloy ingots, $61,950.
American Brass Co., Waterbury, Conn., copper, $39,565.70.
American Metal Co. Ltd., New York, slab (spelter) zinc, $15,220.
American Smelting & Refining Co., New York, slab (spelter) zinc, $28,240.
American Type Founders Sales Corp., Washington, printing presses, steel tables, cabinets, $7751.56.
Anaconda Sales Co., New York, slab (spelter) zinc, $33,000.
Baldt Anchor Chain & Forge Co., Chester, Pa., stockless anchors, $7256.
Brandtjen & Kluge Inc., St. Paul, printing presses, $10,287.13.
Buss Machine Works, Holland, Mich., wood planing machine, $6506.82.
Caswell Strauss & Co. Inc., New York, pig tin, $290,808.
Central Iron & Steel Co., Harrisburg, Pa., plate steel, $15,159.76.
Commercial Acetylene Supply Co. Inc., New York, acetylene cylinders, $10,-560.
Congdon & Carpenter Co., Providence, R. I., carbon steel twist drills, $17,-897.40.
Crane Co., Chicago, steel valves, $321,312.
Crucible Steel Co. of America, New York, nickel steel, $47,142.48.
Dulien Steel Products Inc. of California, Treasure Island, San Francisco, buildings and facilities on Treasure Island, $125,000.
Equipment & Furniture Corp., New York, metal wardrobe cabinets, $56,420.
Ethyl Gasoline Corp., New York, modified CRF engines, $27,000.
Fairbanks, Morse & Co., Chicago, spare parts, $17,148.80.
General Electric Co., Schenectady, N. Y., breakers, $82,280.
General Motors Overseas Operations, New York, generators and control cabinets, $76,498.65.
General Radio Co., Cambridge, Mass., radio equipment, $33,447.07.
Hancock Mfg. Co., Jackson, Mich., aluminum tubes, $35,000.
Hanna Furnace Corp., S. Weinstein Supply Co., Agent, New York, pig iron, $5630.75.
Hooven, Owens, Rentschler Co., Hamilton, O., engine parts, $25,992.
Illinois Zinc Co., New York, zinc, $73,-528.35.
International Minerals & Metals Corp., New York, slab (spelter) zinc, $203,000.
International Silver Co., Meriden, Conn., silver-plated ware and tableware, $676,076.15.
Jeffrey Mfg. Co., Columbus, O., chains and sprockets, $27,030.73.
Jessop Steel Co., Washington, Pa., C-R bar steel, $37,761.85.
Lloyd & Arms Inc., Philadelphia, radial drills, engine lathes, $40,724.80.
Manning, Maxwell & Moore Inc., Bridgeport, Conn., steel valves, $45,656.50.
National Twist Drill & Tool Co., Detroit, twist drills, $175,765.12.
New Jersey Zinc Sales Co. Inc., New York, slab (spelter) zinc, $51,089.40.
Phelps Dodge Copper Products Corp., British American Tube Division, New York, seamless brass pipe, $155,014.60.
Pittsburgh Steel Co., Pittsburgh, boiler tubes, $178,514.86.
Revere Copper & Brass Inc., Baltimore, copper, $102,802.41.
Reiner, John, & Co. Inc., Long Island City, N. Y., generator, $5526.
Rome Cable Corp., Rome, N. Y., electric cable, $27,635.
Rustless Iron & Steel Corp., Baltimore, steel, $46,953.82.
Scrimgeour, William, Washington, knives, $44,275.
Seagrave Corp., Columbus, O., fire engine, $7000.
Taylor Instrument Co., Rochester, N. Y., thermometers, $14,060.
Thew Shovel Co., Lorain, O., 16½-ton capacity crane truck, $14,475.
Willard Storage Battery Co., Cleveland, radio storage batteries, $7806.
Woodward Wight & Co. Ltd., twist drills, $27,524.56.
Worth Steel Co., Claymont, Del., plate steel, $36,871.35.

Bureau of Yards and Docks Awards

American Chain & Cable Co. Inc., Wright Mfg. Division, York, Pa., cranes for naval air stations as follows: One 2-ton unit each at Quonset Point, R. I.; Norfolk, Va.; Jacksonville, Fla.; Guantanamo bay, Cuba; San Juan, P. R.; Coco Solo, C. Z.; San Diego, Calif.; Alameda, Calif.; Kodiak, Alaska; Kaneohe bay, (Oahu) T. H.; Ford island, T. H.; Midway island; Wake island; 5-ton cranes, one each at Kaneohe bay, Midway island and Wake island. Total cost, $44,534.
Favrot, Gervais F., New Orleans, repairs to building and electric supply at naval station, New Orleans, $12,082.
Harnischfeger Corp., Milwaukee, bridge cranes for naval air stations as follows: One 10-ton unit each at Quonset Point, R. I., and Corpus Christi, Tex. One 15-ton unit at Norfolk, Va. Three 5-ton units at Corpus Christi, Tex., and one each at Miami and Jacksonville, Fla., and Guantanamo bay, Cuba. One 10-ton unit each at San Juan, P. R., and Kodiak, Alaska. One 5-ton unit each at Sitka and Unalaska, Alaska. Total, $176,830.
Magher, Arthur E., Co. Inc., New York, air conditioning system and storm sash for quarters at navy yard, Brooklyn, N. Y., $12,704.
Messinger Bearings Inc., Philadelphia, one pintle bearing complete 350-ton crane, $14,415.
Picker X-ray Corp., New York, radiographic X-ray unit, naval medical center, Washington, $14,315.
Shaw-Box Crane & Hoist Division of Manning, Maxwell & Moore Inc., Muskegon, Mich., one 15-ton bridge crane at power plant of naval air station, Wake island; and one 15-ton bridge crane at power plant of naval air station, Quonset Point, R. I., $7137.
Shepard Elevator Co., Cincinnati, elevators for extension of machine shop building at navy yard, Philadelphia, $23,095.

Wagner Act—Obstacle To National Defense

By E. J. KULAS
President, Otis Steel Co., Cleveland

■ THIS is certainly a queer country.

We have plunged into an all-out program of national defense and aid to Britain—a program in which production *in time* is of paramount importance and every man-hour counts.

Whereupon we proceed to obstruct and delay this program by a persistent wave of strikes and slowdowns such as this country has not seen for years.

One headline in the morning paper says, "President Roosevelt Asks Three-Shift Operation of Defense Plants." The headline next to it reads, "Five New Strikes in Defense Industries."

Are we really trying to accomplish the national defense production job we have set up for ourselves—or are we merely playing around with the idea?

As far as aid to Britain is concerned, the effect of strikes is exactly the same as that of bombs and torpedoes.

If a shipment, desperately needed, doesn't reach Britain in time, what difference does it make whether that shipment is sunk on the high seas or held up by a strike in an American plant?

What's the Reason?

If it were not for the precedent set by France, the picture in the United States today would no doubt be incomprehensible to the English. But France showed what could happen. The United States is giving a very good imitation of that debacle—one that must be very satisfying indeed to Herr Hitler.

Now—what's the reason? Why is this country behaving in this way?

Is it because this country is torn with internal conflict as was France? I don't think so. I believe all of us, including the very workmen who go on strike, are in favor of the national defense program. Everybody wants tanks, planes, guns and ships turned out at the earliest possible moment.

No, the trouble is not with American public sentiment as to national defense. But there certainly is a big monkey wrench somewhere in the machinery — and that monkey wrench, I believe, is the Wagner Act.

The Wagner Act as it stands is an open invitation to unscrupulous union leaders to exploit the defense program for their own purposes. National defense has become a Roman holiday for initiation fees and dues.

And it is only human nature for the honest and sincere labor leaders —and there are plenty of them—to swing the big stick handed them by the Wagner Act over the heads of manufacturers beset by the urgencies of national defense production.

With Uncle Sam desperately in need of the sinews of war, the national defense contractor will stretch every possible point to avoid a strike. His contracts call for deliveries on certain dates. The army and the navy, the British, are counting on his deliveries. Union leaders well know this. They put the Wagner Act in their hip pockets and go to town.

New Laws Not Needed

For the Wagner Act gives them peculiar special powers. They can call a strike, though most of the men in the plant concerned want no strike. They can call a strike for organization and dues-collecting purposes. They can request an election for collective bargaining purposes, although the employer cannot. They can threaten the employer with long and costly litigation, conducted before the Labor Board without regard to rules of evidence. They can cite an employer to the Board merely for expressing an opinion. They can demand back pay even for strikers who engaged in rioting and destruction of property. And what a marvelous opportunity the defense program gives them to use these special powers to the fullest extent!

There has been considerable discussion recently as to possible additional labor legislation on the question of strikes in defense industries. But why pass new laws? Why not amend the one we have? If the foundation of a house is rotten, you can't cure the situation by adding another story to the house.

The country has known for some years that the Wagner Act was sadly deficient. Enacted theoretically to decrease industrial disputes and disturbances, it was evident long before the defense program was even contemplated that the effect of the Act in practice was to *increase* industrial disputes and disturbances.

Over a year ago a committee of the House of Representatives investigated the Labor Board and the Wagner Act. They reported that the law was bad and should be changed. And yet, knowing all this, we went blithely into the biggest industrial production job this country has ever undertaken without taking a single step toward changing this law.

There has been a tendency to blame many of the deficiencies of the Wagner Act upon its administration by the Labor Board. The House Committee, in its majority report, went into considerable detail along this line.

Fault Is in Act

In the main, the committee's criticism of the Board was to the effect that it was biased and partisan and exercised its functions under the Act with a view toward fostering union organization. For instance, the committee's report quotes one of the Board's field examiners as taking the attitude that "The Board's chief value is in actively helping labor organize rather than just protecting their right to organize." Another examiner admitted, "My approach was that of a prosecutor anxious to convict." A substantial volume of evidence to this effect was brought out.

But to my mind evidence of partisanship upon the part of the Board does not excuse the defects in the Act. On the contrary, only under an Act sadly deficient in its construction could a Board charged with its administration be able to exercise extreme partisanship.

It is only human for men to be partisan. Even a judge may have strong personal opinions. A proper objective, it seems to me, would be to frame a labor law under which it would be impossible for personal leanings, one way or the other, to affect extensively the administration of the law.

In short, the Board is a creation of the Act—and its partisanship is merely a reflection of the Act itself.

The Wagner Act should be amended immediately in the interest of national defense. Some of the present provisions should be changed; and new provisions should be added.

Among changes in present provisions suggested by the House Committee majority report are the following:

As the Act stands today, there is no separation between the judicial and administrative functions of the Board. Thus a former regional director once said (see House Committee report) that he considered his duties as regional director to be "judge, jury and prosecutor."

The administrative and judicial functions should be separated. The

administrative division should carry on investigative and prosecuting functions, entirely distinct from the judicial division of the Board, whose function it should be to hear the cases and make decisions.

As it stands today, the Act states, "The rules of evidence prevailing in courts of law or equity shall not be controlling." It also states, "The findings of the Board as to the facts, if supported by evidence, shall be conclusive."

Hearsay Evidence Admitted

This means that in Labor Board hearings hearsay evidence and other evidence of a type not admitted in any court in the land can be freely introduced. The Board may then make its findings of fact on the basis of this evidence—and then, if the case is appealed to a federal court, the court is supposed to accept the Board's findings as facts!

In short, the law deliberately states that a judge must accept, as facts, findings based upon evidence of a type which he would never admit in his own court.

The Act should be amended requiring the proceedings of the Board to be conducted in accordance with the rules of evidence applicable in our courts.

Under the wording of the Act as it stands now, the union may ask the Board for an election—but an employer may not.

True, the Board, by its own ruling, now permits the employer to ask for an election, but this ruling is more honored in the breach than in the observance. In actual practice, the Board may ignore an employer's request for an election if the union concerned deems it inadvisable to hold an election because it is uncertain as to the outcome.

The failure of the Act to state specifically that the employer may demand an election is most unfortunate, particularly today.

A manufacturer, straining every effort to turn out munitions for national defense and aid to Britain, may find his plant strike-bound by a jurisdictional dispute.

The employer may beg the Labor Board, "Send someone down here to conduct an election to decide who is to be the collective bargaining agent. Let's get this thing settled so that we can get back to work." But will the Labor Board honor this request? Only if it chooses to do so.

The Act should be amended so that by the terms of the Act the employer has the same right to ask for an election as does the union.

The Act as it stands today provides that it shall be an unfair labor practice for an employer "to interfere with, restrain or coerce employes in the exercise of the rights guaranteed in section 7." Said the House Committee in its majority report, "This section has been construed by the Board as a mandate to close the employer's mouth."

Some employers, as you know, have been cited to the Board for expressing opinions in newspaper interviews. Others have been cited for distributing to their employes literature explaining the facts as to a situation involved in a dispute. Many have been charged with an unfair labor practice for merely saying to their old employes, who had been with them through the depression years, that they would endeavor to continue to operate their plants in the face of union threats to close them. This sort of high-handed procedure is in effect an abrogation of the right of free speech guaranteed in our Bill of Rights. The Act should be amended to permit the employer the same rights of free speech enjoyed by unions and by employes.

The present provisions of the Act relating to reinstatement of employes "wrongfully" discharged makes no exception in the case of employes who engaged in violence while on strike.

The omission in the act of any reference to this subject might seem unimportant, but in fact it p r a c t i c a l l y hands unscrupulous union leaders a blackjack which they can use with impunity.

Encourages Lawlessness

Unfortunately, it often happens in a strike that civil law breaks down. Local law enforcement machinery is not set up to take care of such large scale contingencies.

Consequently 10 per cent of the employes of a plant, aided by outsiders and well supplied with baseball bats and bricks, can keep a plant closed by physical violence in defiance of civil law and the wishes of the majority of the workers in the plant.

And as the law stands now, what is the penalty which these brick throwers and bat wielders pay? The "penalty" is *reinstatement with back pay.*

This puts a premium on violence and lawlessness and promotes thuggery as the strong right arm of unionism. The Act should be amended to provide that strikers guilty of violence in violation of civil laws have forfeited their rights to reinstatement.

Now as to new provisions to be added to the Act.

It is obvious that if we are going to arm this country, some steps must be taken to prevent the wholesale stoppage of production due to strikes.

As I said before, I do not think this calls for new legislation. I think it can be handled by adding to the Wagner Act provisions governing the conduct of strikes which might well be applicable to peacetime as well as emergency conditions.

Except in the event of the declaration of an extreme emergency or of war, I believe it would be dangerous to pass a law abolishing the right to strike. This would be an infringement upon a basic right, a move toward regimentation and dictatorship.

On the other hand, abuses of the right to strike should no more be tolerated in peace-time than in time of emergency.

Cannot we therefore develop and include in an amended Wagner Act rules and regulations as to the handling of strikes which will both maintain the right to strike and at the same time prevent its abuse?

Here are some suggestions along this line:

Provide that advance notice of, let us say, thirty days should be given before a strike can be called.

During this "cooling off" period make provisions for conciliation or mediation with the aid of federal or state conciliation or mediation service.

If at the end of thirty days conciliation or mediation has failed and the union still insists on strike, a vote should be taken by secret ballot of all of the employes affected, requiring a majority in favor of strike before the strike can be called.

Assuming that strike is voted, nature and extent of picketing should be defined so that physical violence may no longer be the determining factor in a strike picture.

If the vote of a majority of the employes affected was against the strike, and in spite of this the union called a strike and its men walked out, this strike would be considered as without standing under the Act and those striking would be denied the benefits of the Act. In short, such employes could not secure reinstatement by the Board and rehiring would be optional by the company.

Would Outlaw "Phoney" Strikes

Note that under these provisions if and when the majority of employes had a grievance which could not be settled by conference during the cooling-off period, their right to strike would be in no wise abridged and the only limitation upon the conduct of the strike itself which is not now in force would be the restricting of picketing to measures not involving violence or violation of civil laws.

In short, a real strike could go forward—but a "phoney" strike, in which the majority of the men were not interested, called for organiza-

tion or dues-collecting purposes, or because of jurisdictional disputes, would be prevented.

And for this reason the threat of strike could no longer arbitrarily be used as a universal blackjack. For unless a union leader felt sure that most of the men were in favor of a strike, mere strike threats would carry no weight.

With minority, jurisdictional, organization or wild-cat strikes eliminated, and only serious disputes heading toward a strike picture, it is probable that strenuous efforts would be made by both sides to settle these disputes in the cooling-off period.

I confidently believe that a revised Wagner Act could be drafted which would not only eliminate most of the strikes that are strangling national defense production but would serve as a sound foundation for a growing labor peace and elimination of labor disputes for years to come.

I believe, too, that if the Wagner Act were thus revised, many an employer who has held the union at arm's length would reverse his attitude and invite the union to sit down in the front office.

Employers know that unions and collective bargaining are here to stay. What worries the employer today is the threat of stoppage of production, the threat of violence to workmen, the threat of costly and involved Labor Board litigation, the threat of Labor Board findings and penalties based upon evidence improperly taken by a board functioning as judge, jury and prosecutor under a partisan law.

We need a labor law in this country that will be fair to all parties concerned — fair to union men, fair to non-union men, and fair to employers. Given such a law, I firmly believe that employers and employes can work out their differences with a minimum of difficulty. It has long since been done in England it can and must be done in the United States.

Survey Reveals Alaskan Nickel, Copper Deposits

■ Calculations based on investigations of nickel deposits of Bohemia basin and its vicinity, on Yakobi island, Alaska, made by the United States Geological Survey, indicate about 6,000,000 tons of rock containing about 0.36 per cent nickel and 0.27 per cent copper is present and available for mining in eight sulfide-bearing rock bodies that have been partly prospected.

Moving Western Mills To Use Scrap, Aid Ship Work

TORONTO, ONT.

■ Furnaces and rolling mills of Dominion Bridge Co. Ltd., Lachine, Que., will be moved from Calgary, Alta., to Vancouver, B. C., a distance of about 450 miles, and rolling of steel will begin within three months, it was reported last week by C. D. Howe, Canada's minister of munitions and supply. This is to meet increased demand for steel in British Columbia and to expedite shipbuilding on the Pacific coast.

Project will be financed by the company, which already owns and operates extensive steel fabricating facilities in the Vancouver area. The mill in Vancouver will use only scrap available in British Columbia and western Alberta, where it can be collected at comparatively low cost. Dealers there have been faced with problem of disposing of scrap which has accumulated since the war began.

Department of munitions and supply, in the week ended May 16, awarded 2897 contracts with total value of $13,347,099. Orders placed with United States companies aggregated $129,589. Week's awards:

Capital expenditure: Canadian Propellers Ltd., and Canadian Pratt & Whitney Aircraft Co., Longueuil, Que., $2,875,417; Canadian Car & Foundry Co. Ltd., Montreal, Que., $105,162; General Motors Products of Canada Ltd., Oshawa, Ont., $36,231; Harley-Kay Ltd., Georgetown, Ont., $15,000; Ford Motor Co. of Canada Ltd., Windsor, Ont., $35,000; Standard Machine Works, Winnipeg, Man., $6000.

Aircraft: Canadian Pratt & Whitney Aircraft Co. Ltd., Longueuil, $224,562; Aviation Electric Ltd., Montreal, $180,830; Canadian Car & Foundry Co. Ltd., Montreal, $13,872; Canadian Vickers Ltd., Montreal, $17,434; Drummond, McCall & Co. Ltd., Montreal, $8626; Noorduyn Aviation Ltd., Montreal, $36,465; Irvin Air Chute Ltd., Ottawa, Ont., $36,450; Coleman Lamp & Stove Co. Ltd., Toronto, $12,088; Progress & Engineering Corp., Toronto, $9396; National Steel Car Corp. Ltd., Malton, Ont., $17,243; Fleet Aircraft Ltd., Ft. Erie, Ont., $22,799; B. Greening Wire Co. Ltd., Hamilton, Ont., $8764; Macdonald Bros. Aircraft Ltd., St. James, Man., $63,121.

Instruments: Canadian General Electric Co. Ltd., Toronto, $64,783; Research Enterprises Ltd., Toronto, $2,989,670.

Dockyard supplies: Canadian John Wood Mfg. Co. Ltd., Toronto, $7052; Cordage Distributors Ltd., Toronto, $5467; Dominion Chain Co. Ltd., Niagara Falls, Ont., $19,495; McKinnon Columbus Chain Ltd., St. Catharines, Ont., $19,495; William Kennedy & Sons Ltd., Owen Sound, Ont., $17,904.

Electrical equipment: Aviation Electric Ltd., Montreal, $21,590; Canadian Marconi Co., Montreal, $8160; Canadian General Electric Co. Ltd., Ottawa, $28,503; Northern Electric Co. Ltd., Ottawa, $7920; Canadian Telephones & Supplies Ltd., Toronto, $6672; Research Enterprises Ltd., Toronto, $540,000; Sangamo Co. Ltd., Toronto, $15,368.

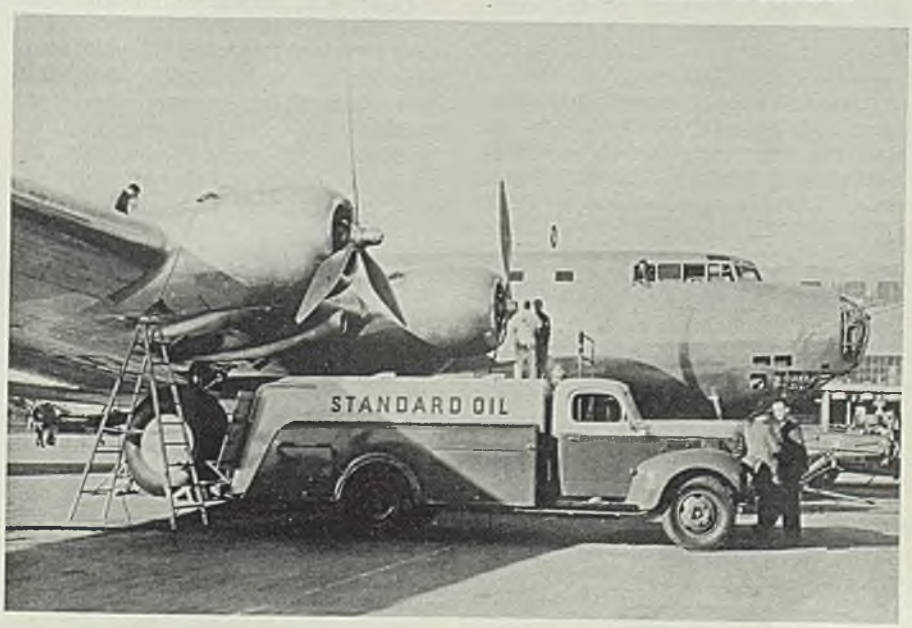
Machinery: Dominion Hoist & Shovel Co. Ltd., Montreal, $16,599; London Concrete Machinery Co. Ltd., London, Ont., $13,031.

Ordnance: John Inglis Co. Ltd., Toronto, $1,930,500.

Munitions: International Flare Signal Co. Ltd., Waterloo, Que., $14,241; Robert Mitchell Co. Ltd., Montreal, $282,421; Dominion Arsenals, Montreal, $83,400; T. W. Hand Fireworks Co. Ltd., Cooksville, Ont., $14,241; Wallaceburg Brass Ltd., Wallaceburg, Ont., $54,019.

Miscellaneous: Canadian Industries Ltd., Montreal, $64,136; John Powis Co. Ltd., Ottawa, $6490; International Business Machines Co. Ltd., Ottawa, $6179; Miner Rubber Co. Ltd., Granby, Que., $82,480; Canadian General Rubber Co. Ltd., Galt, Ont., $21,385; Kaufman Rubber Co. Ltd., Kitchener, Ont., $21,385.

Ten Truckloads of "Gas" to Fuel One Bomber



■ Ten loads of gasoline like that carried by this 1115-gallon Dodge tank truck are required to fuel this gigantic Douglas B-19 army bomber, reputed the world's largest airplane and now being tested at Santa Monica, Calif.

MEN of

V. P. Rumely

F. F. Trierweiler

■ **V. P. RUMELY,** the past four years works manager, Crane Co., Chicago, has been elected vice president in charge of manufacturing, succeeding **J. H. Collier,** recently elected president. Mr. Rumely has been associated with the Crane organization since 1937, and before that was factory manager, Hudson Motor Car Co., Detroit.

♦

H. F. Wyman, after an absence of two years, has returned as plant superintendent, Alloy Fabricators Inc., Perth Amboy, N. J.

♦

Louis N. Hunter, manager of research, National Radiator Co., Johnstown, Pa., has been elected a vice president. He will continue in charge of research activities.

♦

S. H. Sanford, manager of western sales division, Four Wheel Drive Auto Co., Clintonville, Wis., has been named secretary of the company. He succeeds the late Frank Gause.

♦

Carter Schupp, former sales manager, Elk Horn Coal Corp., Cincinnati, has been appointed sales representative in Chicago for the Delaware, Lackawanna & Western Coal Co.

♦

Joseph B. Kushner, metal finishing consultant and engineer, has moved his laboratories and offices to larger quarters at 114 East Thirty-second street, New York.

♦

Fernald S. Stickney has been appointed vice president and chief engineer, Instrument Specialties Co., Little Falls, N. J. He was formerly instrument designer at the Newark, N. J., works of Westinghouse Electric & Mfg. Co.

♦

Henry C. Schmielau has been named general auditor, Universal Atlas Cement Co., Chicago, and **John J. Heffernan** has become secretary. The new appointees succeed **O. N. Lindahl** who has become vice president of Carnegie-Illinois Steel Corp.

♦

Frank F. Trierweiler has been appointed manager, concrete reinforcing division, Joseph T. Ryerson & Son Inc., Chicago, with supervision of reinforcing business at all Ryerson plants. He succeeds the late E. W. Langdon. He joined the Jersey City, N. J., plant of Ryerson in 1924, and before that was in the general contracting business at Portland, Oreg.

♦

William J. Hawley, associated with Kent-Owens Machine Co., Toledo, O., 14 years, has been appointed sales engineer. He was tool room foreman eight years, after which he was employed in the service and engineering departments.

♦

Charles E. McManus, chairman of the board, has been elected president, Crown Can Co., Philadelphia. He succeeds **L. Frederick Gieg,** who has resigned to become president, National Can Corp., New York. Mr. McManus will remain chairman as well as president, Crown Cork & Seal Co., Baltimore, a subsidiary.

♦

R. E. Anderson, heretofore sales manager, Delta-Star Electric Co., Chicago, has been elected vice president. **C. S. Beattie,** formerly assistant sales manager, becomes manager of engineering; **W. O. Hampton,** of the engineering department, becomes chief design engineer; **S. C. Killian,** development and research engineer, and **W. H. Boyce,** manager of industrial sales.

♦

William P. Hemphill, for many years a senior partner in the management engineering firm of McKinsey, Kearney & Co., Chicago, has been elected president, Laclede Christy Clay Products Co., St. Louis, succeeding **W. J. Westphalen,** resigned. Mr. Hemphill is also a director of Borg-Warner Corp., E. H. Scott Radio Co., Harris Bros. Co., and Woods Bros. Construction Co.

♦

M. A. Wick has resigned as vice president in charge of finance and a director, Republic Steel Corp., Cleveland, effective July 1. Mr. Wick, who was president of Steel & Tubes Inc., now a part of Republic, joined the organization in 1930 as assistant to the president. The following year he was named vice president in charge of finance.

Born in Youngstown, O., and graduated from Sheffield Scientific School of Yale University in 1904, Mr. Wick became secretary-treasurer, Youngstown Furnace Co. the following year, and was treasurer, Delaware River Steel Co., Chester, Pa., from 1909 to 1912. In 1914 Mr. Wick joined his brother who had previously purchased the Elyria Iron & Steel Co., Elyria, O., and served as treasurer. Seven years later the purchase of patents covering the Johnson process of tube manufacture led to the organization of Steel & Tubes.

♦

Edward Riley has been named general manager of overseas operations of General Motors Corp., New York. Mr. Riley has served as acting general manager since July, 1940. He succeeds **Graeme K. Howard,** now vice president in charge of overseas operations.

Charles B. Stiffler has been appointed general assistant comptroller of General Motors at Detroit. Associated with the corporation since 1919, he has been general manager of United Motors Service, Detroit, since 1938. **Walter N. Potter,** vice president and general sales manager of United Motors Service since 1938, succeeds Mr. Stiffler as general manager.

Wallace G. Kileen has been named assistant GM comptroller in charge

INDUSTRY

C. F. Rassweiler

M. R. Dill

of the cost accounting section, and **J. A. Sarason** is now assistant controller in charge of the central office general accounting section.

♦

G. M. Fletcher, advertising manager, The Stanley Works, New Britain, Conn., has been elected president, Industrial Advertising and Marketing Council, western New England chapter of the National Industrial Advertisers Association. He succeeds **E. V. Creagh,** sales promotion manager, American Chain & Cable Co., Bridgeport, Conn.

Other officers are: First vice president, **H. E. Merrill,** General Electric Co., Bridgeport; second vice president, **G. P. Lonergan,** Bristol Co., Waterbury, Conn.; secretary-treasurer, **E. N. Bidwell,** Whitney Chain & Mfg. Co., Hartford, Conn.

♦

M. R. Dill, recently elected general counsel, Lincoln Electric Co., Cleveland, has also been elected a director. Graduating from the law school of Ohio State University in 1930, he immediately became associated with Squire, Sanders & Dempsey, Cleveland law firm.

♦

Dr. C. F. Rassweiler has been appointed director of research, Johns-Manville Corp., New York. He formerly was director of the Philadelphia laboratory of E. I. duPont de Nemours & Co. In his new position Dr. Rassweiler will be a member of the officers board in charge of Johns-Manville's research activities on which the company spends close to a million dollars annually.

♦

Samuel W. Moore, assistant master mechanic, Jessop Steel Co., Washingon, Pa., has been named construction engineer in charge of plant rehabilitation and new construction.

♦

E. N. Hommel, since 1929 vice president, O. Hommel Co., Pittsburgh, has been elected president, succeeding his father, the late Oscar Hommel.

♦

Charles H. Heist has been named general superintendent, Hanna Furnace Corp., Buffalo. Since 1935 he had been representative and service engineer for Standard Lime & Stone Co., Baltimore, and before that was superintendent of blast furnaces at the Youngstown, O., plant of Youngstown Sheet & Tube Co., and assistant general superintendent of the Campbell & Struthers works of Youngstown Sheet & Tube.

Glen A. Beaumont, formerly general superintendent of Hanna Furnace Corp., has been appointed chief metallurgist, dividing his time between Buffalo and Detroit.

♦

Robert S. Bubb, advertising manager, Lock Joint Pipe Co., Ampere, N. J., has been elected president, Industrial Marketers of New Jersey, Newark, N. J., local chapter of the National Industrial Advertisers Association. Other officers: Vice presidents, **Charles V. Allen,** Robert McKeown Co., Newark, N. J.; **Wallace W. King,** president, Wallace W. King Advertising Agency, Clifton, N. J.; **John Coakley,** director of publicity, Thomas A. Edison Industries Inc., West Orange, N. J.; secretary, **Alfred S. Otton,** advertising manager, Robins Conveying Belt Co., Passaic, N. J.; treasurer, **Samuel E. Gold,** sales and advertising manager, Lignum-Vitae Corp., Jersey City, N. J.

Fifty Years with Stanley Works

■ **Clarence F. Bennett,** chairman of the board, The Stanley Works, New Britain, Conn., recently was honored by associates on occasion of his completion of 50 years' service with the company. Mr. Bennett joined the Stanley Works in 1891, at the age of 19, as a shipping room employe. He later entered the production department and became production superintendent when only 25. Within a few years he became assistant general superintendent, then general superintendent, and in 1912 was elected a director.

In 1923, he was elected president and continued in that post until March of this year when **Richard E. Pritchard** became president and Mr. Bennett was elevated to the board chairmanship.

Mr. Bennett is regarded by Stanley employes not only as an efficient "big boss" but also as one intensely interested in the welfare of the workers and in civic affairs. At present he is leading a campaign to raise $700,000 for the New Britain hospital, and last year successfully led the revival of the Community Chest.

C. F. Bennett

"Unlimited" Means Important Limitations—from Now On

■ PRESIDENT ROOSEVELT'S important and long awaited address of last Tuesday evening accomplished three things.

• • •

First, it served notice to the world that "freedom of the seas" is one of the basic provisions of this nation's war policy.

Secondly, it called upon the people of the United States to intensify their defense effort so that the nation can be prepared for any contingency.

Thirdly, with the announcement that the President had proclaimed that a state of "unlimited" emergency exists, it implemented the "freedom of the seas" policy and the more intensive defense activity with additional authority.

Reports from all parts of the country indicate that the President's remarks were well received by an overwhelming majority of the American people. In many quarters, it was felt that in stating clearly the immediate objective of this nation's effort the President had clarified a point on which much confusion had arisen. The address undoubtedly has helped to improve the morale of the people.

• • •

Persons identified with industry undoubtedly gave the President's talk a high rating as a state paper. They realize that it was intended to perform a three-way task. It was phrased for consumption in the capitals of dictator states; for assuring the people of England, China and other free belligerent nations; and for promoting unity at home.

In connection with this last-named objective, industrialists wonder whether the President relied upon the announcement of the "unlimited" emergency or upon his direct words to "capital" and to "labor" to crack down upon the present epidemic of work stoppages, upon alleged reluctance to subcontract work, and upon other evidences of lack of co-operation for defense.

His direct deference, namely that "production and transportation . . . must not be interrupted by disputes between capital and capital, labor and labor, or capital and labor," may be interpreted as a warning. The authority to do something about interruptions, etc., if not already possessed under the state of "limited" emergency, certainly will be more than adequate under the new status of "unlimited" emergency.

• • •

However, there is nothing in this part of the President's address which changes industry's position drastically. Management long ago resigned itself to the prospect of increasing government controls. It has been expecting these to be extended until they cover practically every phase of industrial operations.

Industry has been hoping that something would happen to make its defense work more effective. It has been annoyed by delays and interruptions caused by factors beyond its control.

To the extent the new status will help remove these handicaps industry will welcome it. At the same time it knows that in the process it will be obliged to give up more of its traditional prerogatives.

The time for sacrifice is at hand.

E. L. Shaner

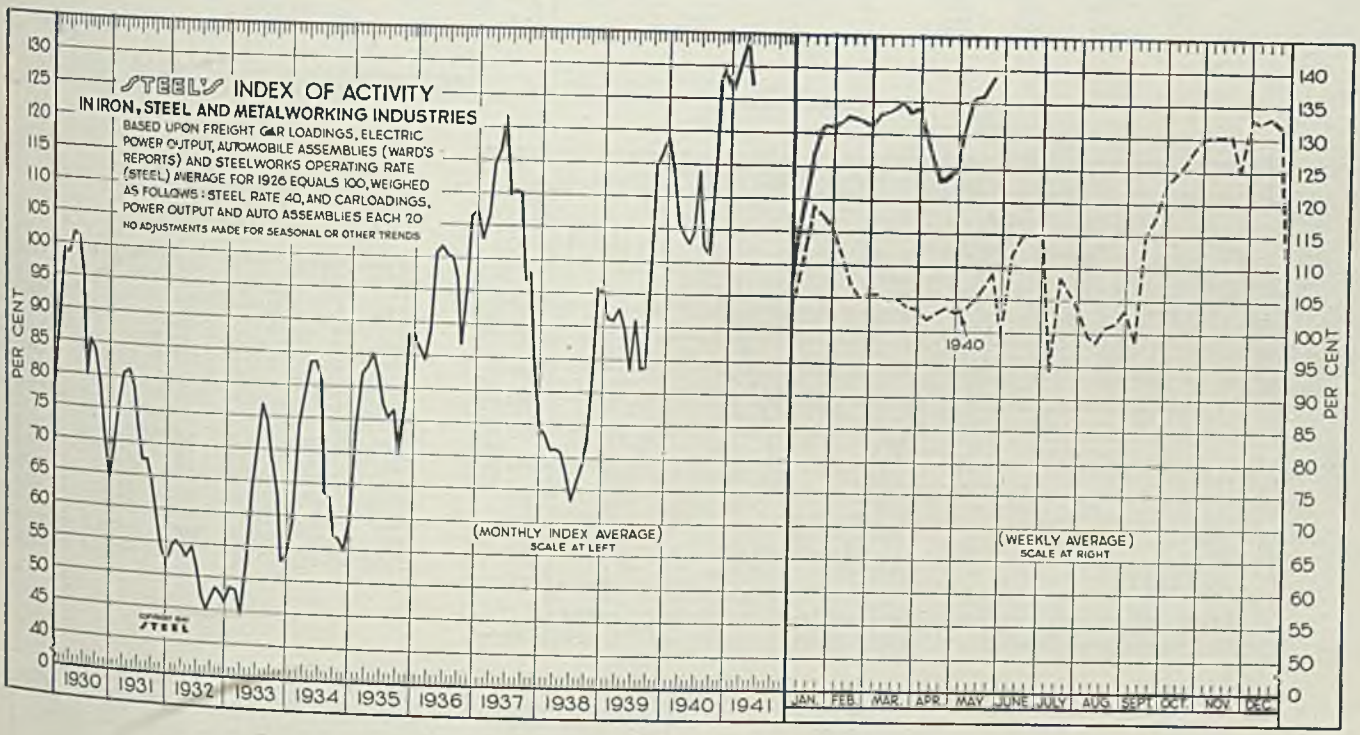
EDITOR-IN-CHIEF

The *BUSINESS TREND*

Industrial Production Records Further Gain

■ PACE of industrial production continues to move upward, reflecting the steady installation of new machinery in many defense industries and a further expansion in activity among numerous consumer goods lines. So far this month activity in the iron, steel and metalworking industries has been advancing more rapidly than a year ago when production was beginning to turn upward following the moderate recession during the first four months of that year. Settlement of the bituminous coal strike is the chief factor in the upturn in activity the past few weeks.

During the week ended May 24, STEEL's index recorded the sixth consecutive weekly advance to 138.5, the highest level on record. This represents a gain of 2.4 points over the preceding week's index figure and is well above 109.1 recorded by the index at this time a year ago. Observance of Memorial Day holiday will undoubtedly bring about a temporary decline in the index for the week of May 31. However, the recession should be less than usual.

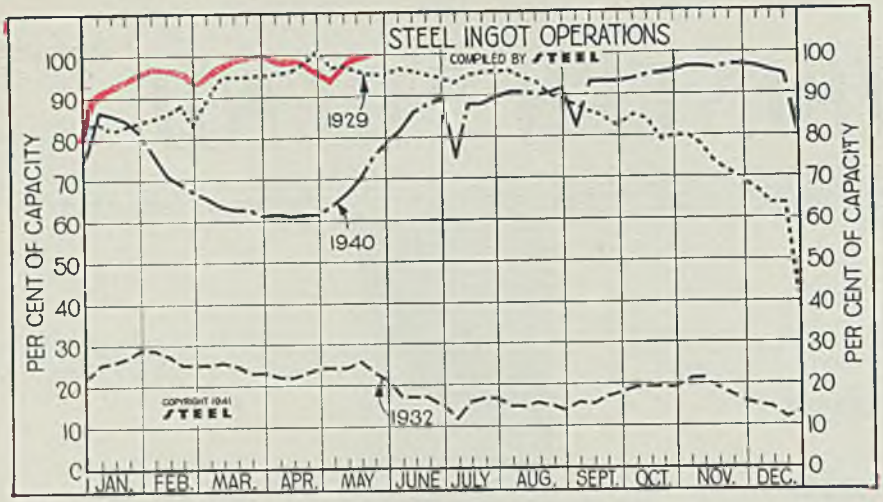


STEEL'S index of activity gained 2.4 points to 138.5 in the week ended May 24:

Week Ended	1941	1940
March 15	135.0	104.9
March 22	133.5	103.7
March 29	133.9	103.2
April 5	128.9	101.8
April 12	123.8	102.7
April 19	124.2	103.4
April 26	126.5	102.8
May 3	132.6	103.3
May 10	135.9	104.8
May 17	136.1	106.8
May 24	138.5†	109.1

†Preliminary.

Mo. Data	1941	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930
Jan.	127.3	114.7	91.1	73.3	102.9	85.9	74.2	58.8	48.6	54.6	69.1	87.6
Feb.	132.3	105.8	90.8	71.1	106.8	84.3	82.0	73.9	48.2	55.3	75.5	99.2
March	133.9	104.1	92.6	71.2	114.4	87.7	83.1	78.9	44.5	54.2	80.4	98.6
April	127.2	102.7	89.8	70.8	116.6	100.8	85.0	83.6	52.4	52.8	81.0	101.7
May	.....	104.6	83.4	67.4	121.7	101.8	81.8	83.7	63.5	54.8	78.6	101 2
June	.....	114.1	90.9	63.4	109.9	100.3	77.4	80.6	70.3	51.4	72.1	95.8
July	.....	102.4	83.5	66.2	110.4	100.1	75.3	63.7	77.1	47.1	67.3	79.9
Aug.	.....	101.1	83.9	68.7	110.0	97.1	76.7	63.0	74.1	45.0	67.4	85.4
Sept.	.....	113.5	98.0	72.5	96.8	86.7	69.7	56.9	68.0	46.5	64.3	83.7
Oct.	.....	127.8	114.9	83.6	98.1	94.8	77.0	56.4	63.1	48.4	59.2	78.8
Nov.	.....	129.5	116.2	95.9	84.1	106.4	88.1	54.9	52.8	47.5	54.4	71.0
Dec.	.....	126.3	118.9	95.1	74.7	107.6	88.2	58.9	54.0	46.2	51.3	64.3



Steel Ingot Operations

(Per Cent)

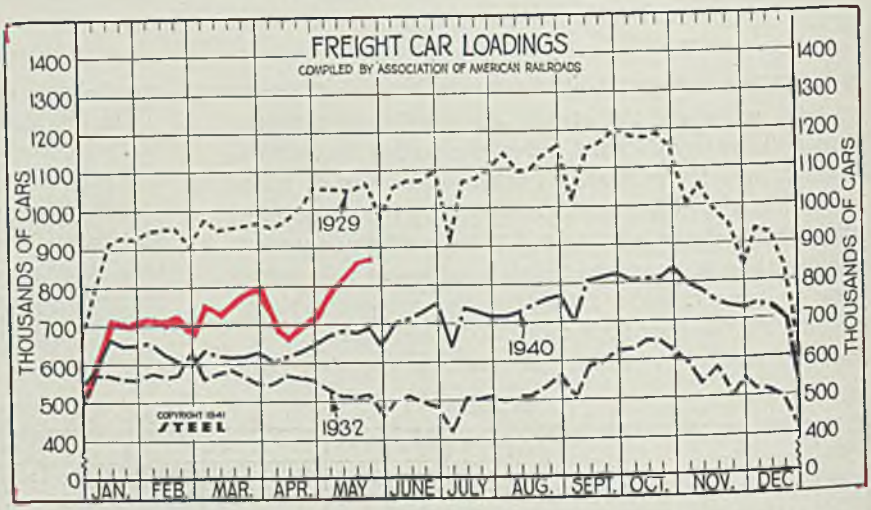
Week ended	1941	1940	1939	1938
May 24 ...	100.0	75.0	48.0	28.5
May 17....	99.5	70.0	45.5	30.0
May 10....	97.5	66.5	47.0	30.0
May 3....	95.0	63.5	49.0	31.0
April 26...	96.0	61.5	49.0	32.0
April 19...	98.0	61.5	50.5	32.5
April 12...	98.0	61.0	51.5	32.0
April 5...	98.0	61.5	53.5	32.0
March 29..	99.5	61.0	54.5	36.0
March 22..	99.5	62.5	55.5	35.0
March 15..	98.5	62.5	56.5	32.0
March 8...	97.5	63.5	56.5	30.0
March 1...	96.5	65.5	56.0	29.5
Feb. 22....	94.5	67.0	55.0	30.5
Feb. 15....	96.5	69.0	55.0	31.0

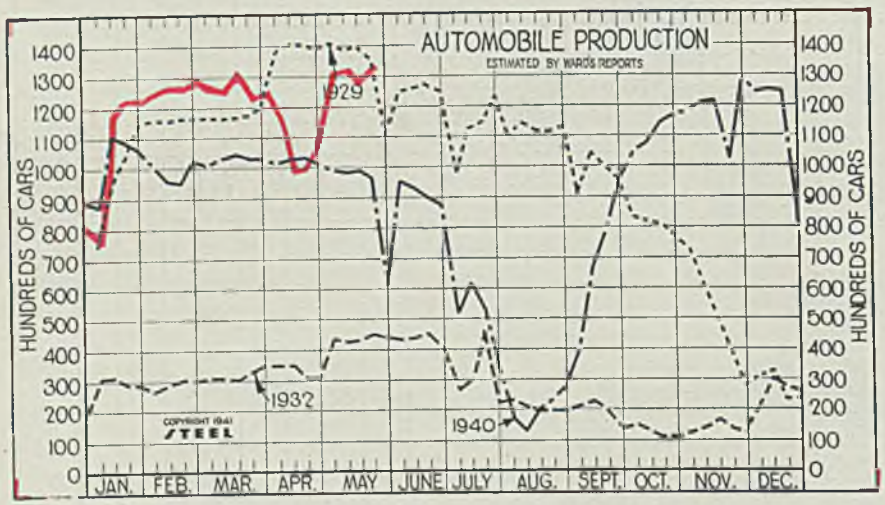
Freight Car Loadings

(1000 Cars)

Week ended	1941	1940	1939	1938
May 24.....	863†	687	628	562
May 17.....	864	679	616	546
May 10.....	837	681	555	542
May 3.....	794	666	573	536
April 26.....	722	645	586	543
April 19.....	698	628	559	524
April 12.....	680	619	548	538
April 5.....	682	603	535	522
March 29....	792	628	604	523
March 22....	769	619	605	573
March 15 ...	759	619	595	540
March 8.....	742	620	592	557
March 1.....	757	634	599	553
Feb. 22.....	678	595	561	512
Feb. 15.....	721	608	580	536

†Preliminary.





Auto Production

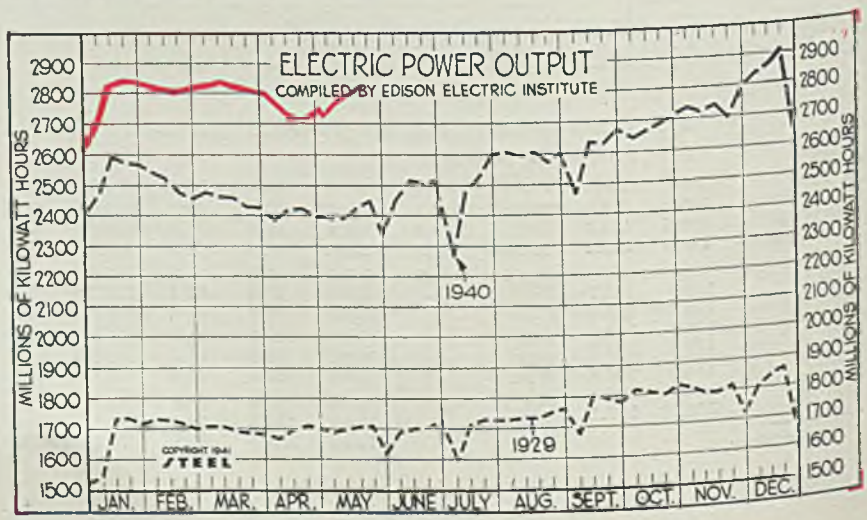
(1000 Units)

Week ended	1941	1940	1939	1938
May 24....	133.6	96.8	67.7	45.1
May 17....	127.3	99.0	80.1	46.8
May 10....	132.6	98.5	72.4	47.4
May 3....	130.6	99.3	71.4	53.4
April 26...	108.2	101.4	86.6	50.8
April 19...	99.9	103.7	90.3	60.6
April 12...	99.3	101.9	88.1	62.0
April 5....	116.3	101.7	87.0	61.0
March 29..	124.2	103.4	86.0	57.5
March 22..	123.8	103.4	89.4	56.8
March 15..	131.6	105.7	86.7	57.6
March 8...	125.9	103.6	84.1	57.4
March 1...	126.6	100.9	78.7	54.4
Feb. 22....	129.2	102.7	75.7	57.0
Feb. 15....	127.5	95.1	79.9	59.1

Electric Power Output

(Million KWH)

Week ended	1941	1940	1939	1938
May 24...	2,838	2,449	2,205	1,973
May 17...	2,800	2,422	2,170	1,968
May 10...	2,792	2,388	2,171	1,968
May 3...	2,734	2,386	2,164	1,939
April 26..	2,750	2,398	2,183	1,939
April 19..	2,702	2,422	2,199	1,951
April 12..	2,721	2,418	2,171	1,958
April 5...	2,779	2,381	2,174	1,990
March 29.	2,802	2,422	2,210	1,979
March 22.	2,809	2,424	2,199	1,975
March 15.	2,818	2,460	2,225	2,018
March 8..	2,835	2,464	2,238	2,015
March 1..	2,826	2,479	2,244	2,036
Feb. 22...	2,820	2,455	2,226	2,031
Feb. 15...	2,810	2,476	2,249	2,059

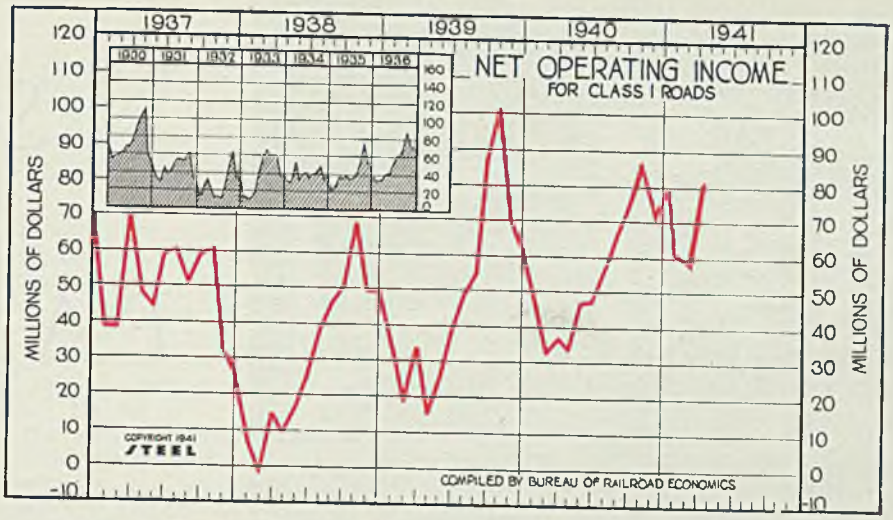


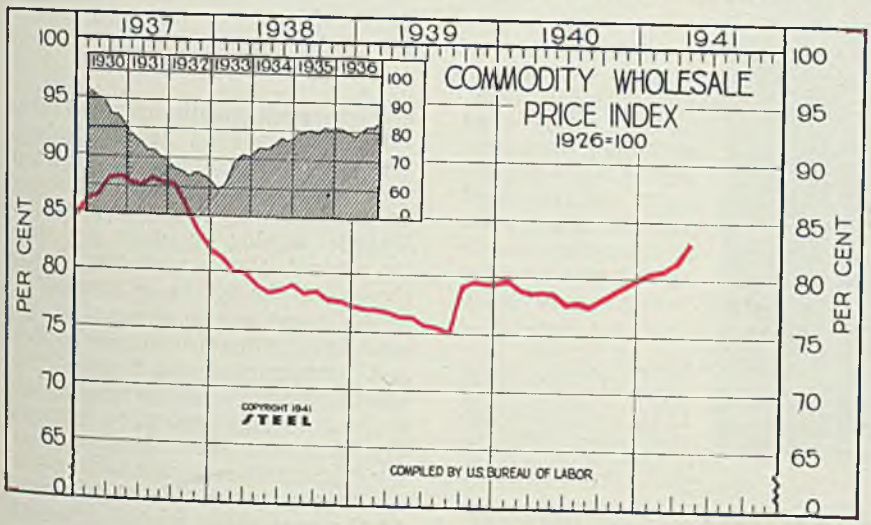
Class I Railroads
Net Operating Income

(Unit: $1,000,000)

	1941	1940	1939	1938
Jan.	$62.36	$45.57	$32.89	$7.14
Feb.	58.49	32.86	18.59	1.91*
Mar.	80.63	36.73	34.32	14.73
April	.....	33.82	15.32	9.40
May	.....	47.08	25.10	16.67
June	.....	47.42	39.10	25.16
July	.....	57.08	49.01	38.43
Aug.	.....	66.01	54.59	45.42
Sept.	.....	74.19	86.43	50.36
Oct.	.....	86.99	101.62	68.57
Nov.	.....	71.10	70.35	49.67
Dec.	.....	78.79	60.95	49.37
Average	.....	$56.84	$49.02	$31.02

*Indicates deficit.





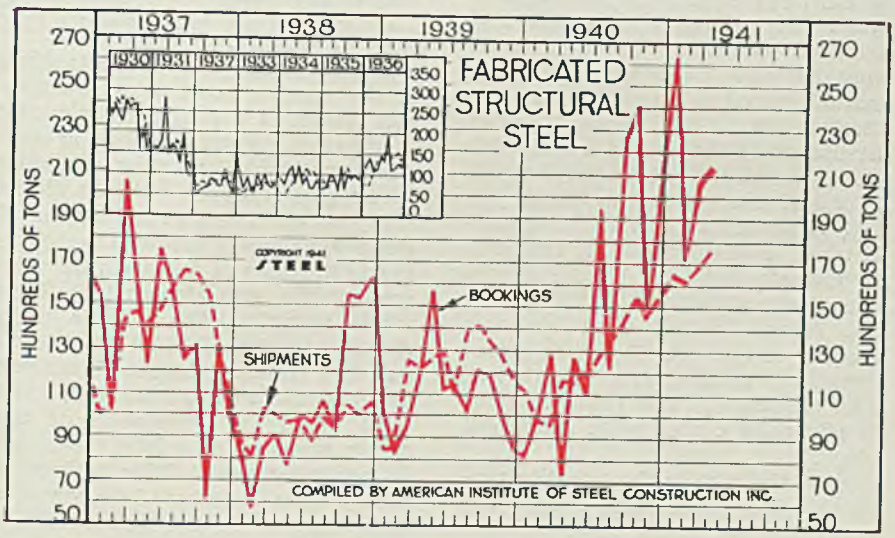
All Commodity
Wholesale Price Index
U. S. Bureau of Labor
(1926 = 100)

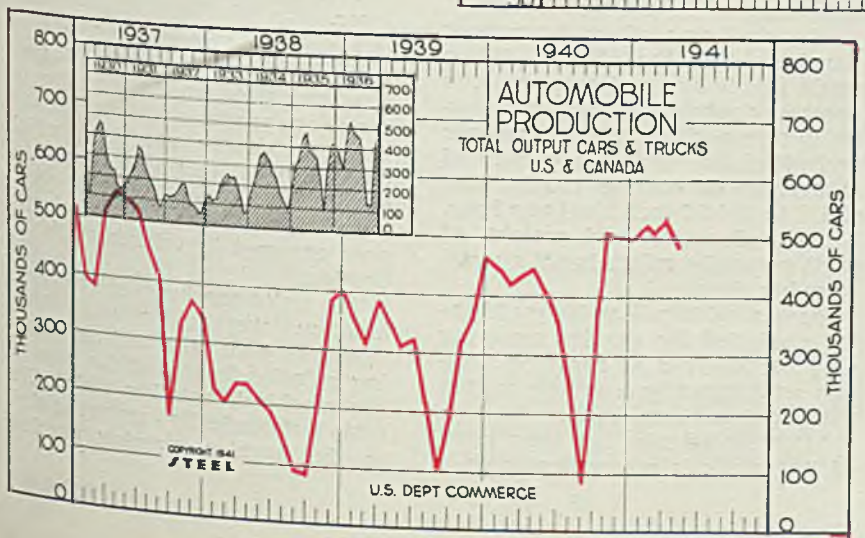
	1941	1940	1939	1938	1937
Jan.	80.5	79.4	76.9	80.9	85.9
Feb.	80.6	78.7	76.9	79.8	86.3
March	81.5	78.4	76.7	79.7	87.8
April	82.9	78.6	76.2	78.7	88.0
May	....	78.4	76.2	78.1	87.4
June	....	77.5	75.6	78.3	87.2
July	....	77.7	75.4	78.8	87.9
Aug.	....	77.4	75.0	78.1	87.5
Sept.	....	78.0	79.1	78.3	87.4
Oct.	....	78.7	79.4	77.6	85.4
Nov.	....	79.6	79.2	77.5	83.3
Dec.	....	80.0	79.2	77.0	81.7
Ave.	....	78.5	77.1	78.6	86.3

Fabricated Structural Steel

(1000 tons)

	Shipments			Bookings		
	1941	1940	1939	1941	1940	1939
Jan.	164.6	110.9	84.3	281.2	81.7	101.7
Feb.	161.4	97.2	84.4	173.6	98.9	82.7
Mar.	170.2	95.9	125.3	206.1	128.3	95.1
Apr.	176.6	116.3	120.9	211.3	73.8	118.3
May	.....	115.6	125.9	.....	126.8	156.9
June	.....	119.1	130.1	.....	109.7	111.6
July	.....	127.1	110.5	.....	194.9	114.1
Aug.	.....	134.9	139.7	.....	122.5	100.9
Sept.	.....	142.8	140.8	.....	225.5	121.4
Oct.	.....	153.2	133.8	.....	233.1	118.8
Nov.	.....	147.0	128.2	.....	141.9	99.3
Dec.	.....	155.5	116.2	.....	203.1	84.4
Tot.	.....	1515.5	1440.1	.....	1748.1	1305.0





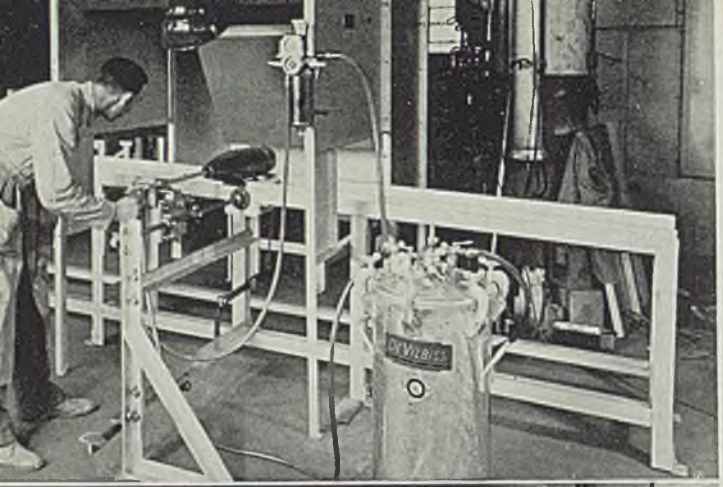
Automobile Production

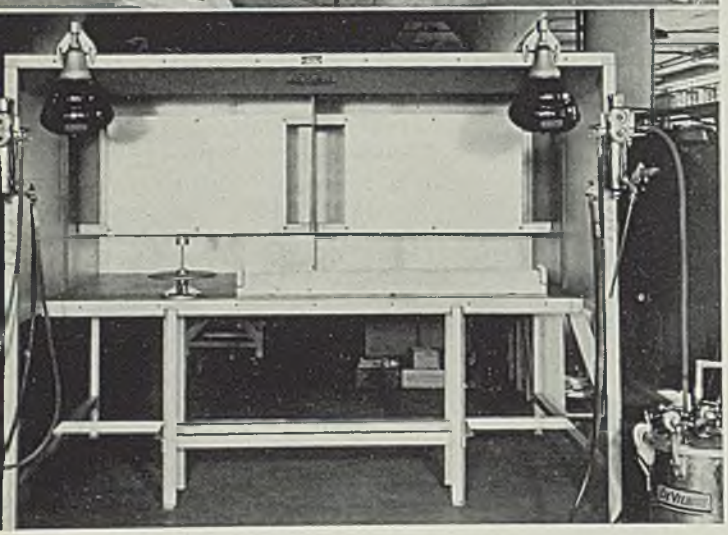
(Unit: 1000 Cars)

	1941	1940	1939	1938	1937
Jan.	524.1	449.3	357.0	227.1	399.2
Feb.	509.2	421.8	317.5	202.6	383.9
March	533.9	440.2	389.5	238.6	519.0
April	489.8	452.4	354.3	238.1	553.4
May	.....	412.5	313.2	210.2	540.4
June	.....	362.6	324.2	189.4	521.1
July	.....	246.2	218.5	150.4	456.9
Aug.	.....	89.9	103.3	96.9	405.1
Sept.	.....	284.6	192.7	89.6	175.6
Oct.	.....	514.4	323.0	215.3	338.0
Nov.	.....	511.0	370.2	390.4	376.6
Dec.	.....	506.9	469.0	407.0	346.9
Ave.	.....	391.0	311.0	221.3	418.0

SHELL PAINTING

By H. C. FORNWALL
Service Engineer
DeVilbiss Co.
Toledo, Ohio





Upper view, hand spraying shell interior by means of a hand spray gun equipped with extension nozzle and a guide and carriage for the insertion of gun nozzle into the shell

Lower view, spray equipment and spray booth for hand spraying shell exteriors

■ ALL TYPES of shell for ordnance work are painted both inside and outside. Generally the interior is sprayed with an acid-proof black, manufactured to United States specification No. 3-106-D. Some types of British shell are coated inside with Copal varnish. The exterior finish is one of many colors although yellow is probably the most frequently used. Exterior finishing material is manufactured to United States specification No. 3-162A. Tail pieces are often finished with brown lacquer or enamel. Bomb exteriors commonly receive an application of zinc chromate. The bomb interior is generally coated with acid-proof black.

As is the case in the quantity production of peace-time goods, the spray process is the most satisfactory method of applying protective coatings to the tools of war. Only by means of the spray can coatings be applied with the speed and uniformity so essential in shell manufacture. As is true of peace-time production, the character of spray painting equipment used depends upon the quantity and size of shell produced as well as the plant's manufacturing and handling facilities. Generally there are three methods of spray painting employed in coating bombs and shell.

Hand Spraying: This method is used where the volume of parts to be coated is small or the parts are of such size that the speed of automatic spraying may not be needed. This is true for both interior and exterior coating.

Smaller sizes of shell are trucked to the coating position where they are placed in a horizontal rotating mechanism. First the shell is coated on the inside by means of a hand spray gun equipped with an extension nozzle. The gun is inserted to the proper depth, through the opening in the nose of the shell, the trigger of the gun depressed. Then while spraying, the gun is withdrawn as the shell rotates. The result is a uniform, thorough coating of all surfaces within the shell body.

To steady the insertion of the spray gun nozzle, a holding device is generally used. This maintains the proper relation between the spray gun nozzle and the inside wall of the shell as well as determines the length of the stroke. When using this holder and carriage it is necessary only to insert the gun nozzle to stop position, pull the trigger and withdraw. This simple method is capable of coating the interior of 125 to 150 3.7-inch shell per hour. Length, diameter and weight of shell naturally affect handling and spraying time.

Mechanical Handling Helps: Heavier shell fed by gravity conveyor may be revolved at spraying position on a rotating conveyor section which reduces handling.

After the interior has been coated, the work is set vertically on a hand or mechanically operated turntable and sprayed as it revolves. One stroke of the gun, from the top to the bottom of the shell, uniformly coats all exposed surfaces. Guards, shields or plugs are used to protect those surfaces of the shell that are not to be painted.

The hand spray method is also used in painting the exterior of 1000 and 2000-pound aerial bombs. The bombs pass through the painting department while suspended from an overhead conveyor. The first operator sprays the bottom and about two-thirds up the side of the bomb. At the next spray station, a second operator finishes the sides, top and tail piece.

Semi-Automatic Spraying: A semi-automatic spray method is sometimes employed in the painting of exteriors of 155-millimeter and larger size shell. After the interior has been sprayed, the shell advances to the exterior spraying position via conveyor. At this point, semi-automatic spray guns are mounted to cover all exposed surfaces with one blast of spray. These guns are opened and closed by means of an air-actuated valve controlled by the operator. As each shell comes within the spraying range of these guns, the operator starts and stops the spray through the manipulation of a single hand lever.

Automatic Spraying: The automatic spray coating method is used wherever sizes from 37 to 155-millimeter are produced in large volume. Fully automatic machines, which coat both interior and exterior of shell of this size, are being used by practically all large manufacturers now engaged in volume shell production.

The units are inserted in a combination workholder and shield which in turn is placed on revolving spindles located at the edge of the machine's rotating table. The table automatically carries the shell to the interior spraying position.

Here the shell's forward motion is halted until an overhead extension gun enters the revolving shell, sprays its interior and then withdraws. As the gun reaches its "out" position, the table moves on to the exterior painting position.

Here two or more automatic guns are mounted in fixed position to spray all exposed exterior surfaces of the revolving shell while it is within spraying range. While this exterior coating operation is taking place the interior of another shell is being coated. The two operations in two different positions take place at the same time. Start, stop and duration of spray are controlled automatically. At the conclusion of the exterior spraying operation, the shell and work holder are lifted from the spindle, the shell removed from the work holder, inspected and later packaged.

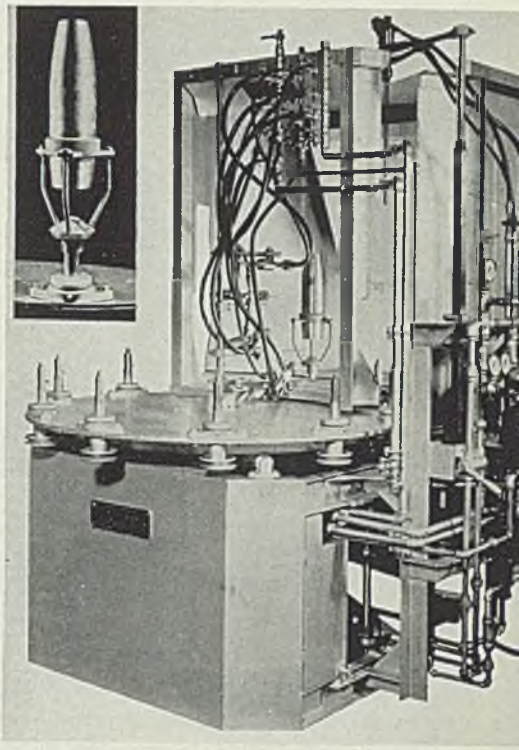
Production Rates: A table machine 76 inches in diameter and containing 72 spindles for 37-millimeter shell has a coating capacity of 1000 units an hour. Coating production of a 42-inch table machine with 20 spindles for 60-millimeter, 81-millimeter, short and long, 81-millimeter plus adapter and tail assemblies is 720 units per hour. A 42-inch table machine with 10 spindles for 75-millimeter, 90-millimeter, 90-millimeter plus adapter, 105-millimeter plus adapter and the 20-pound fragmentation bomb will coat 300 units per hour.

An automatic machine for high-speed coating of both the interior and exterior of shell from 37 to 155 millimeters. Insert shows shell on workholder

Spindles are mounted on ball bearings and the surface which contacts the work holder is hardened. The mechanism controlling the spray gun is operated by the spindle so the spray gun will open only when a loaded spindle enters the spray station.

The automatic spray guns at the exterior spray station are mounted stationary but are adjustable for angle and height. Movement of the gun at the internal spray station is accomplished by a sliding support rod which is actuated through a lever by a drum cam. Positive synchronization of cam and table drive eliminates any possibility of mechanism failure which would cause damage to the moving gun.

Department Location Important: The location of the shell finishing department and spray coating equipment is important and should be carefully considered. This operation should be so placed that the shell will reach it while they are still warm or hot from the final cleaning operation. This facilitates drying of both interior and exterior coatings. However, other methods such as the use of infra-red ray lamps, steam or electric ovens may be included where the speed of production or the character of the coating material requires them.



Proper exhaust either of the dry or water wash type is an integral part of the completely automatic shell coating machine. Adequate exhaust facilities should be provided at any hand operated or semi-automatic spraying station.

New Colorimetric Method Measures Phosphorous

■ Presence of phosphorus in steel and cast iron can be determined by a new colorimetric method developed by the National Bureau of Standards, Washington. According to the bureau, the development is of great importance to ferrous metallurgy because many determinations of phosphorus must be made, both to maintain the bath of molten metal within the proper limits and to insure that the finished products meet specifications.

Heretofore, phosphorus was traced by precipitating phosphorus as the yellow ammonium phosphomolybdate and titrating the washed precipitate with a standard alkali solution.

The method worked out by John L. Hague and Harry A. Bright of the bureau's chemistry division centers on use of rapid colorimetric or turbidimetric procedure, a step which was conceived after the recent improvements in filter photometers. Use is made of the phosphomolybdenum blue reaction employed for many years in biochemical work. The sample of steel is dissolved in diluted nitric acid and the phosphorus is converted to the orthor acid by fuming with perchloric acid.

The interference of iron is avoided by reducing it to the ferrous ion with sodium sulfite. The phosphate ion is then converted to the "blue compound" by adding a solution containing hydrazine sulphate and ammonium molybdate and heating at 90 degrees Cent. for about 5 minutes. The transmittency of the colored solution is measured with a photoelectric colorimeter and a Corning "lantern shade yellow" filter.

The quantity of phosphorus is determined from a standard curve or table prepared from data obtained from treating steels containing known amounts of phosphorus in the same manner as was used for the unknown.

High-Strength Insulating Block Now Offered

■ Armstrong Cork Co., Lancaster, Pa., reports a new high-strength Coprtex insulating block for use in heated equipment. Similar in many respects to the company's regular product, it is white in color and modified by the addition of diatomaceous earth to give a higher compressive strength. It is recommended for service at temperatures up to 1800 degrees Fahr.

The block has a low lineal shrinkage and offers low conductivity, despite its higher strength. It also has a high compressive strength and will yield sufficiently to accommodate rivet heads and other surface irregularities. Light in weight, the block is easily cut and worked. It is available in special shapes if desirable, being readily machinable.

Getting a Better Job

■ *How You Can Get a Better Job*, by Willard K. Lasher and Edward A. Richards; cloth, 175 pages, 5½ x 8¼ inches; published by American Technical Society, Chicago, for $1.50.

This volume is for men and women seeking employment or promotion. It sets forth fundamental principles which may lead to advancement by increasing the worker's value to the employer.

Chapter headings are illuminating and include: The human element; self-management; selling yourself.

SHELL and BOMB

(This Is Number 17 in a Series on Ordnance and Its Production. Prepared Exclusively for STEEL by Professor Macconochie)

Read about: Importance of the fuze; early forms; recent improvements; accidents from premature ignition; general characteristics of modern fuzes; the long-nosed fuze that helped blast the Germans out of France in 1918; safety devices—the centrifugal interrupter; supersensitive fuzes for impact burst on airplanes; fuze for armor piercers.

Next week, second part of this presentation will detail development of the mechanical fuze—latest and most important type fuze

■ *PICTURE, if you can, our position with respect to transportation had the development of the automobile been halted in this country 20 years or more ago, while the rest of the world proceeded to bring the automobile to its present high state of development. Now, suddenly realizing that automobiles are in demand, we make haste to overcome the handicap of the years of neglect.*

As it might have been with automobiles, so actually has it been with our armament—particularly our land defenses. This is no reflection on the personnel of our Ordnance Department. Handicapped since 1918 by indifference to the needs of research and development work in the face of the ever growing menace from across the waters of both the Atlantic and the Pacific, the most strenuous and devoted efforts are now being made to overtake the flight of time and to bring this country to a state of military preparedness which will guarantee our national safety. The intricacies of modern fuzes—their design, operation and production as detailed here—emphasize in a high degree the problems which American inventive genius might have solved long ago had we focussed sufficient energy upon their solution over the years.

■ WHILE the fate of empires may rest upon the ability of the modern projectile to pierce enemy armor mounted on battleship or tank, or to blast enemy concentrations or works—it is true with equal force that in the last analysis not only the high-explosive shell but also the airplane bomb depend for their successful action on the behavior of the fuze. All the refinements of modern gunnery and highly developed methods of ranging and controlling fire prove of no avail if the fuze fails at the crucial moment. Hence the greatest care is taken both with the design and manufacture of this last link in the long chain of events which originate in the vast complexities of naval and military establishments and culminate in the bursting of bomb or shell.

Perhaps the earliest reference to something which might be described as a fuze occurs in "Inventions and Devices" published in 1578. There we are instructed "when the missile is neere full (to) take some receite of soft fire work which will not burn too hastily and fill up the rest of the ball" (Bourne). This was in the nature of a time fuze. Some of the very early attempts to produce a percussion fuze must have involved considerable risk to the wrong party since we find them described as "curiosities specially adapted to hurry those who meddled with them into the next world."

We have traveled a long way since then, but the basic problems remain much the same and even modern fuzes have been known to hurry both gun and crew into the next world despite complexity of mechanical detail and the greatest display of ingenuity. However, we appear to be steadily gaining in the race against the increasing intensity of these fundamental problems of fuze design and construction. Quite recently several of our 2000-pound bombs were dropped from a great height on a concrete road with fuzes set at "safe". Not one exploded. Further, we have been successful, in recent years, in mounting upon the nose of the shell a device possessing many of the essential characteristics of an alarm clock, except that instead of ringing a bell it fires a primer. It would hardly be possible to conceive of any project less likely to succeed—yet it works.

Early Fuze: For many years and indeed up to the time when rifled cannon made their appearance, the fuze was commonly a simple affair, consisting of a tapered plug of beech wood, bored out to within a short distance of the smaller end and filled with a slow-burning composition driven in with blows from a mallet.

This train consisted of exactly the same ingredients as gunpowder with the addition of nitre and sulphur in quantities that were varied to give the desired rate of burning. The bore of the plug was usually enlarged at the upper end to receive a priming of mealed powder moistened with alcohol. This was protected from moisture, and, we may suppose, against evaporation of the alcohol, by a cap of weatherproof paper on which was marked the rate of burning.

In operation, the gunner "set" this fuze by boring into the stem with a gimlet or cutting off the end at such a point that the "slow match" would ignite the bursting charge of the hollow round shell at the proper time. Ignition of the fuze, of course, resulted

FUZES

By ARTHUR F. MACCONOCHIE
Head, Department of Mechanical Engineering
University of Virginia
University Station, Va.

from the explosion of the powder in the propelling charge in the gun.

Safety Devices: The frequency with which accidents occurred in former times as a result of fuze failure is impressive and helps us to understand the necessity for the apparent multiplicity of safety devices exhibited by modern designs. Among the requirements of modern practice are very positive guarantees against ignition of the charge in the shell either in storage or in the gun. Classic illustrations of the disastrous effects of premature ignition include the destruction of H.M.S. THESEUS in 1799 as a result of the explosion of a shell on the quarter-deck where it had been placed to see whether it was fit to use; and the wreckage resulting from the premature explosion of a shell in an 8-inch cannon on board the HOGUE. This gun fired a spherical shell fitted with metal instead of wooden plugs which required unscrewing of the cap protecting the priming. Instead of unscrewing the cap, the seaman unscrewed the entire fuze, exposing the bursting charge of the shell to the propelling charge of powder in the gun so they were both ignited as the gun was fired.

All modern fuzes, for whatever purpose designed, have certain characteristics in common inasmuch as they embody explosive trains, primers and mechanical devices which lock them in a safe position until fired from the gun. Thus, "arming" of the fuze is carefully avoided while the projectile remains in the bore.

Consider, for example, the point detonating fuze shown in Fig. 1. This is a World War I type, originating with the French and so fast in action that the shell has little or no chance to bury itself before detonation of its explosive charge. The time available between the instant of impact and the arrival of the shell proper at the target is only some two-thousandths of a second, but it suffices. For this reason, however, the body of the fuze is made as long as possible without undue interference with the ballistics of the shell.

As I recall this fuze, it did not originally exhibit the "interrupter" which operates under the action of centrifugal force to open the flash hole. So many accidents resulted however from prematures that it was added later and adopted into our service, with progressive modifications, down to the present time. In its

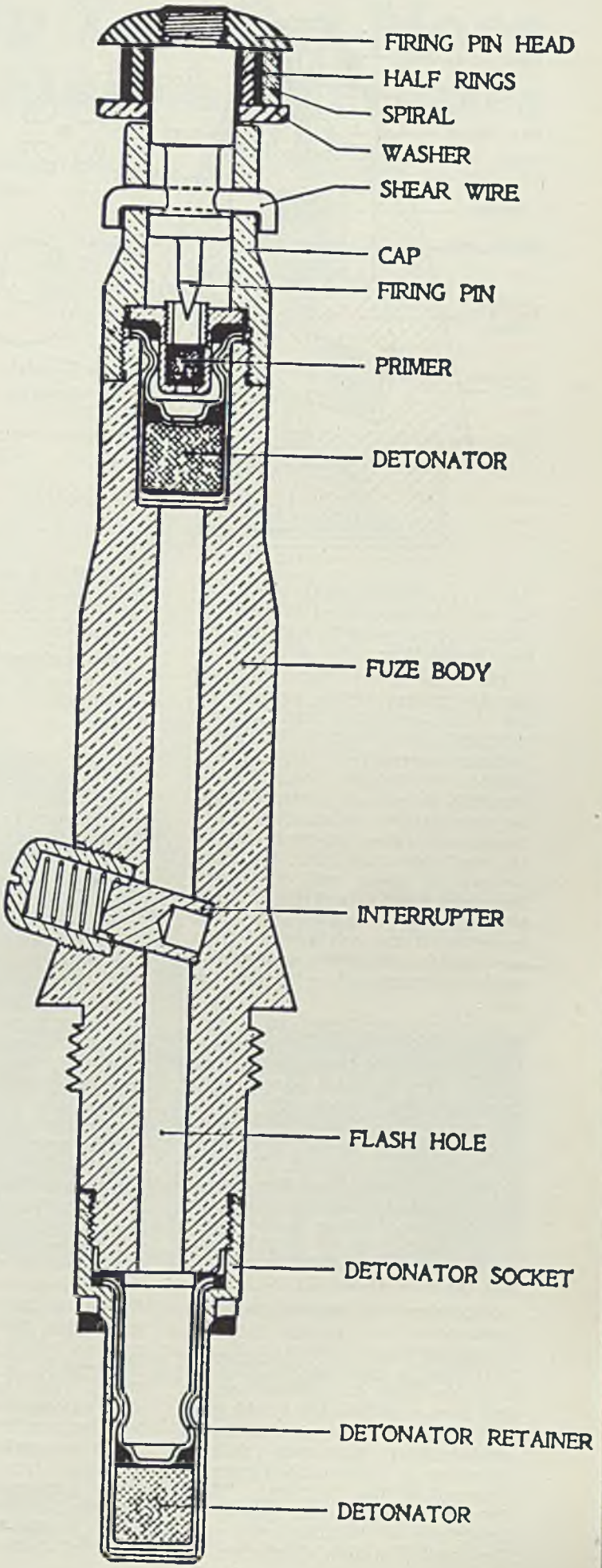
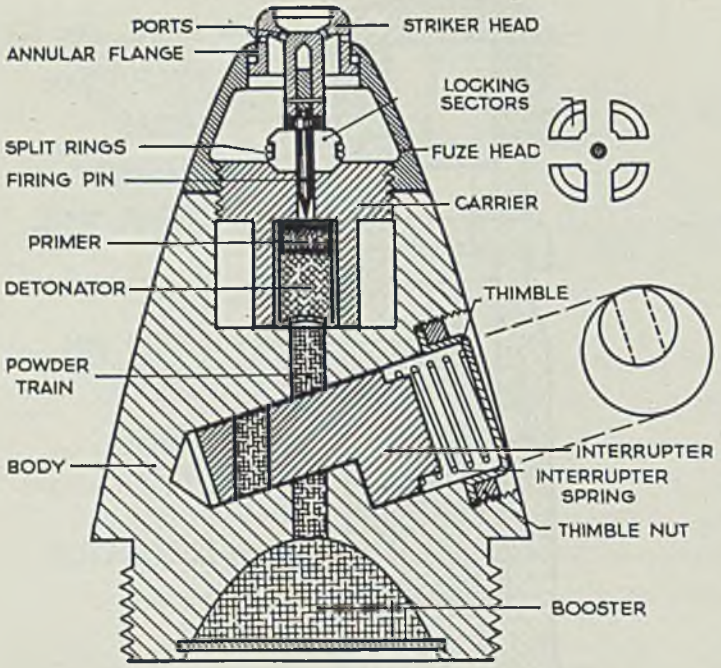


Fig. 1—This long-nose point-detonating fuze developed by French experts did excellent work in 1914-18. It is generally used in high-explosive shell fired against personnel and surface targets



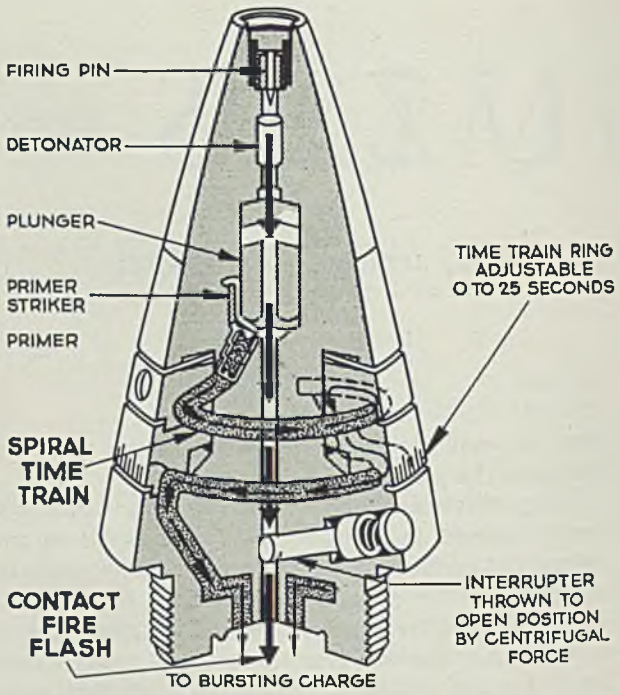


Fig. 2—This supersensitive fuze, left, is so delicately balanced in flight that striking the fragile structure of an airplane can be depended upon to detonate it. Figs. 1 and 2 from Colonel Hayes' **Elements of Ordnance**, by courtesy John Wiley & Sons

Fig. 3—Combined time and superquick fuze, right. Placed in nose of shell, this fuze sets off shell by contact with ground if spiral time train fails, is regarded as excellent fuze. Courtesy **Life**, New York

day, it did notable service in blasting the Germans out of France and was a potent factor in winning the first World War.

The Interrupter: Note the axis of this interrupter is inclined to the center line of the fuze. During set-back (acceleration in the gun), sufficient inertia force is present to prevent centrifugal force from throwing the plunger clear, but just as soon as the linear acceleration starts to decrease (on emergence of the shell from the gun), the components of linear and centrifugal force are additive and the plunger moves outward against the light pressure of the coil spring. This prevents the fuze from igniting the explosive charge before it leaves the gun.

Meantime, the brass coil wound around the half-rings has peeled off, leaving the head free to retreat on impact, shear the wire, puncture the primer and thus detonate the charge. To protect the spiral against unwinding before loading, a strip of friction tape encased it. Even so the possibilities of accident resulting from removal of *both* tape and spiral before loading are obvious. In the modern form of this fuze, these features have been eliminated and the fuze shortened.

Supersensitive Fuzes: Another point detonating fuze of considerable interest is shown in Fig. 2. This fuze is used on 37-millimeter shell designed for aircraft attack and is so sensitive that it will function against a target as light as an airplane wing. How such a delicate operation is accomplished may be observed in the diagram. First, there is the matter of freeing the firing pin or "arming" the fuze. The locking sectors embracing the firing pin will only fly out under the action of centrifugal force *after* the linear acceleration has changed sign from positive to negative (from increasing to decreasing velocity) at the muzzle, thus enabling the locking sectors to rise out of the recess in the carrier.

Next we note a series of air ports in the striker head. In flight, the nose of the shell encounters considerable wind resistance which would immediately drive in the striker head were it not for these air ports and the free passage they offer to a blast of air which equalizes the air pressure within and without the head of the fuze. Since the striker head is designed so it presents a greater area to this internal pressure than it does to the external dynamic thrust, the firing pin is held away from the primer until such time as the fuze encounters resistance sufficient to cut off the flow of air through the ports.

This cessation of air flow upsets the equilibrium of the striker head completely, there being no longer any opposition to the driving in of the head by a comparatively small force. Thus the comparatively delicate structure of an airplane wing will explode the shell. Once more there is a safety device of the interrupter type, functioning in the same manner as that in Fig. 1 previously described. There is no provision in this fuze for detonation in case of failure to encounter an aerial target. This is taken care of by a separate tracer element in the base of the shell.

How About Armor Piercers? These types which we have selected to illustrate the design of fuzes intended to detonate the explosive charge of the shell on impact are mounted in the shell nose. However, this is not always possible. Shell required to pierce armor plate must obviously avoid this arrangement, the fuze being commonly screwed into the base. Their action may be started by striking their objective. Such fuzes always incorporate a short "delay" designed to give the shell an opportunity to pierce the armor before bursting. This takes the form of a small pellet which burns for the time desired before igniting the detonator placed in a rotor-type safety element which moves into position as a result of the shell's rotation. A device of this type will be described more fully next week in connection with the mechanical fuze.

A further important feature of base detonating fuzes is the arming mechanism. In brief this consists of a rotatable element including the firing pin which in the unarmed position lies removed from the line of action. The mass of this element is so disposed about a pivot that the moment of the force due to set-back (acceleration in the gun) neutralizes the centrifugal moment. Just as soon, however, as the shell emerges

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from the bore, centrifugal force has free rein; safety pins engaging with the body of the firing pin withdraw, thus permitting the rotatable firing pin element to swing into the armed position.

Time Fuzes: Thus far we have been concerned with shell designed to explode immediately upon impact or very shortly thereafter. For many purposes, however, as for example in aircraft attack from ground batteries, we may require the shell to explode after the lapse of a predetermined interval. Such fuzes must include some device which measures time. There are perhaps three familiar methods of measuring time; namely, by burning something, such as a candle or a powder train; by allowing a fluid such as oil or sand to flow through a restricted orifice; or by means of some form of clock embodying a pendulum or other vibrating element such as a balance wheel under hair-spring control.

Of these three, one would be inclined to select at once the first mentioned as the most practical although not necessarily the most accurate; the second method has been frequently tried without any success; while the third, apparently the least promising of all, has finally found its place in the scheme of things in the form of the modern mechanical fuze.

Many Difficulties Involved: Writing in the March-April issue of *Army Ordnance* of 1937, Col. John G. Booton, chief of the Ammunition Division of the Ordnance Department, gives an excellent account of the trials and tribulations of the fuze designer and of the many failures which have attended the effort to find the perfect fuze. "We have heard," he writes, "of the difficulties in manufacture of a fuze powder that will burn at a uniform rate even when the pressure is uniform. And we know something of the search for a composition that will burn slowly enough to give a time much over 20 seconds in the length of train that can be built into the disk-type fuze. We have perhaps heard of the difficulty of venting a disk fuze to be fired with high rotational speed so that the centrifugal force acting upon the gases from the powder trail will not cause erratic burning. . . ."

To add to these perplexities, our targets instead of being on the ground may be 20,000 feet up and moving with a velocity approaching that of a revolver bullet. These factors thus demand greatly increased accuracy of fuze timing under conditions which progressively alter the rate of burning of mealed powder compositions.

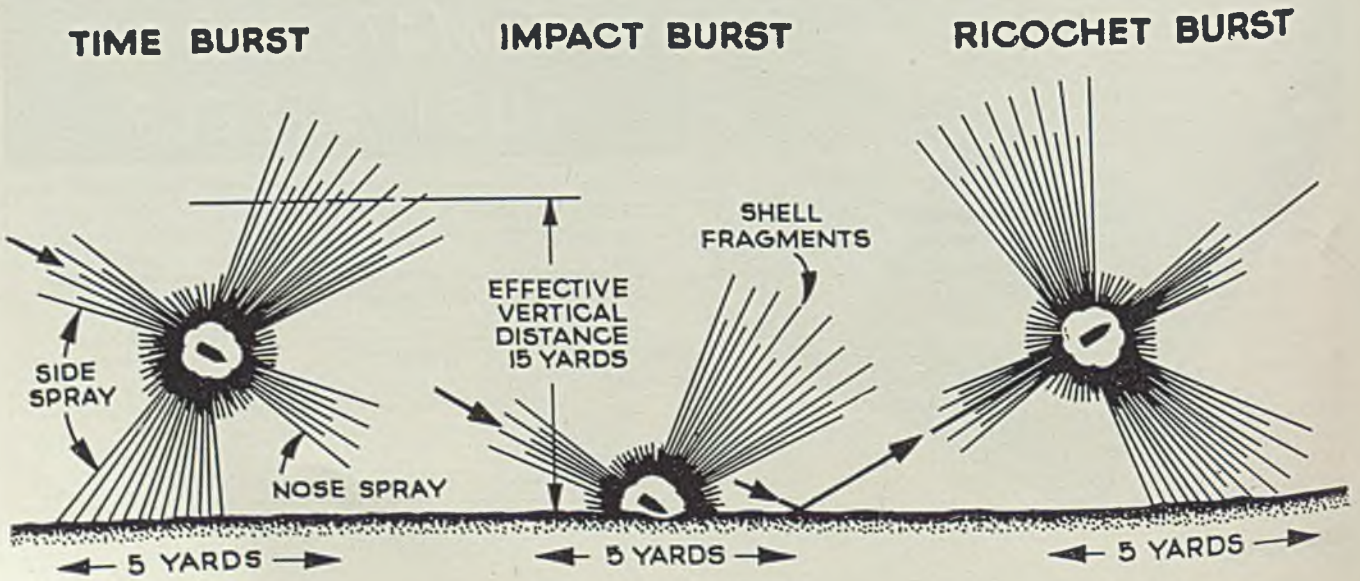
The combination time and percussion fuze, Fig. 3, employing mealed black powder in the time train is sufficiently well known to obviate the necessity of any extended reference here. Excellent accounts of its construction may be found in Colonel Hayes' *Ordnance and Gunnery,* page 590. In brief the time train, see Fig. 3, consists of trains of mealed black powder compressed into annular grooves in the upper (and stationary) and lower (and movable) rings of the fuze body. These annular grooves do not form complete circles, otherwise burning would proceed from a given point in two directions at once. Let us suppose the upper ring is ignited at one end. Burning then proceeds until a "pellet" communicating with the lower ring is reached. The lower ring now burns around until it in its turn ignites a pellet lying in a cavity of the metal face on which the lower ring rests. This latter pellet ignites the magazine charge. It will be apparent that by rotating the lower ring, the fuze may be caused to burn for a longer or shorter time, depending upon the direction in which the ring is rotated.

Severe Operating Conditions: Before considering alternatives to the arrangement just described, consider the conditions under which fuzes must operate. Let the rifle have one turn in 40 calibers and a velocity at the muzzle of 2700 feet per second. Then the 75-millimeter will produce an angular velocity of about 16,000 revolutions per minute. With steeper pitches of the rifling (such as one turn in 25 calibers), the angular velocities of rotation are correspondingly increased. Furthermore, the linear acceleration of the shell is extremely high, the velocity of 2700 feet per second being attained in a mere fraction of a second. Thus at the very outset, exceptionally severe mechanical stresses are imposed by these forces on any device which we mount on the nose of the shell. Since the fuze parts must arrive at least as far as the muzzle without permanent d e f o r m a t i o n, these stresses must all be within the elastic limit of the material used.

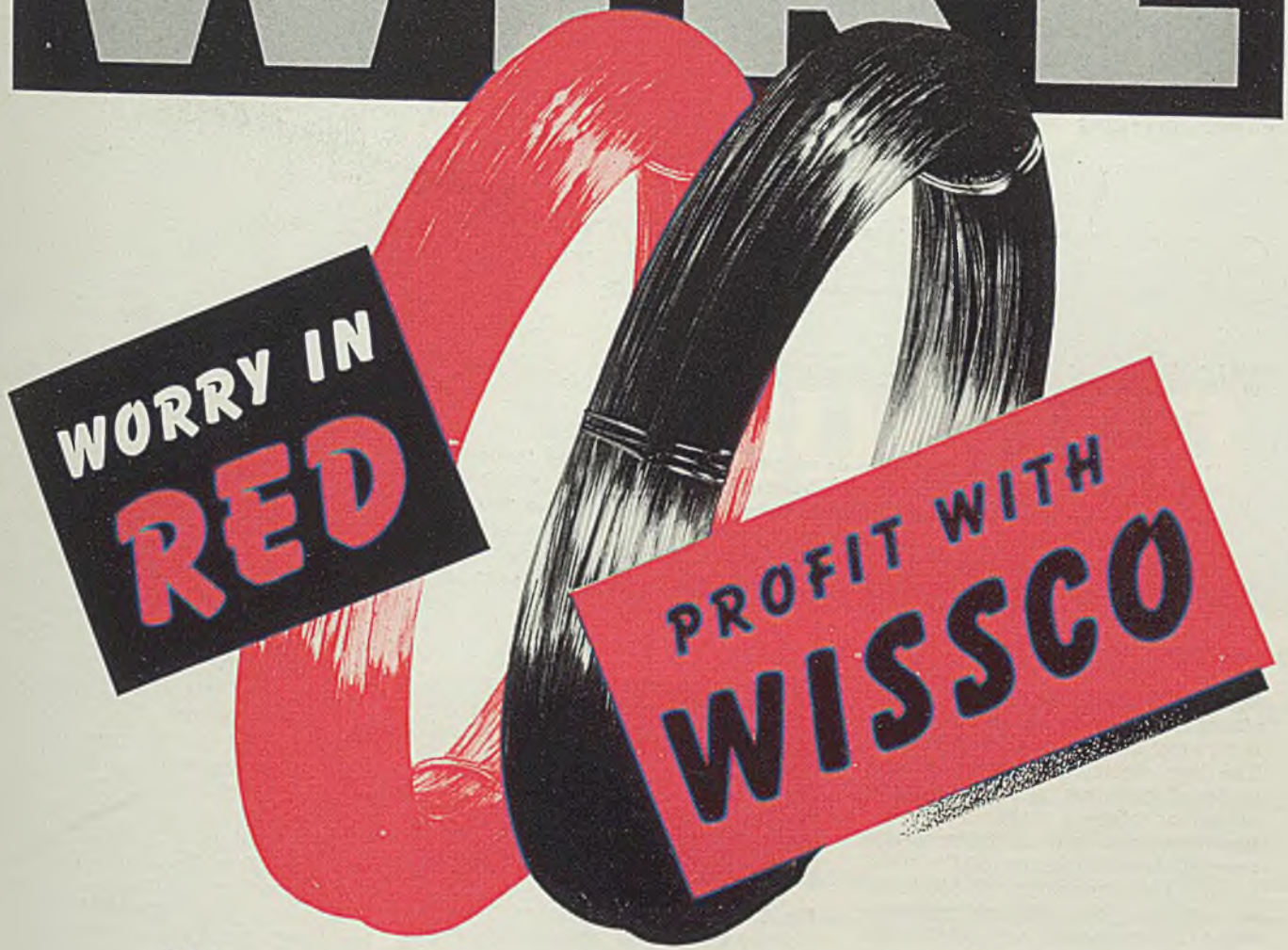
Nor, of course, is this the only major problem. While in flight, the centrifugal forces due to rotation are maintained—with diminishing intensity it is true—but still large enough to create a very serious problem of friction between moving parts subjected to these loads. Too, the linear acceleration, while small compared with the "set-back" in the gun (acceleration from firing), is large enough to merit important consideration.

Then add to these difficulties those caused by barrel whip, exploding gases or a combination of the two which may result in initial irregularities in flight, causing gyrations about the mean path and rather violent sidewise accelerations of any device which has the misfortune to be mounted in such an uncomfortable situation as the nose of the shell in flight.

Fig. 4—Various types of bursts produced by different fuzes or settings: Time burst, left, distributes jagged fragments over a wide area, is best against personnel in exposed positions. Impact burst, center, is best against materiel. Ricochet burst, right, is useful against men in trenches since its greatest effect is vertical.
Courtesy **Life**, New York



WIRE



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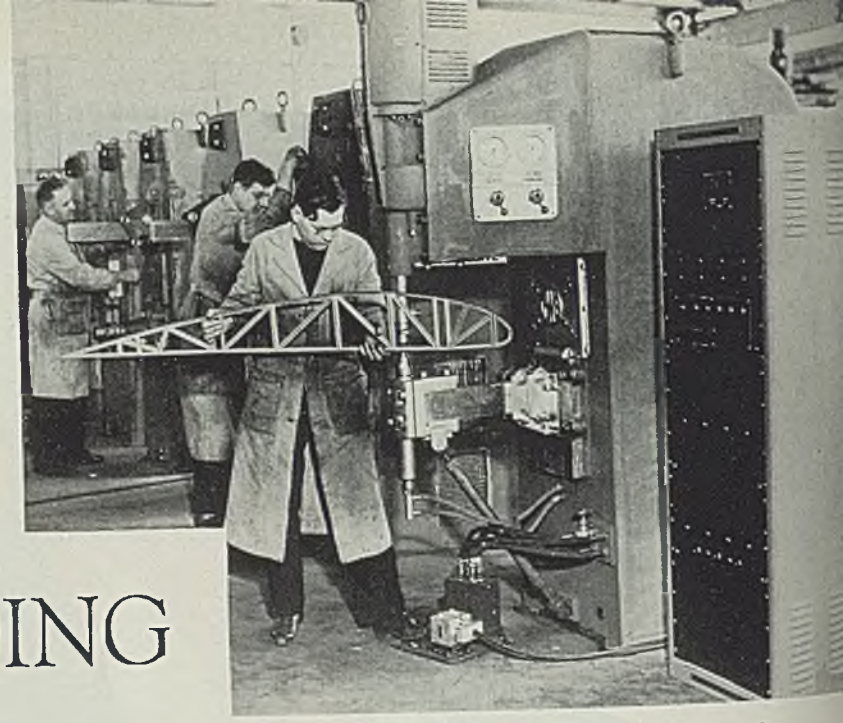


Fig. 1—Checking one of the new 3-phase high-speed aluminum welders in the production line at Progressive Welding Co. plant, Detroit

New resistance welding method is developed to produce desired wave form for welding aluminum. Electric elements are simple. A single unit easily handles wide range of work including thicknesses from two 0.032-inch sections of 24ST aluminum up to sections totaling 3/8-inch in thickness. Weld strengths obtainable show better than a 100-per-cent margin over government requirements. Strength variations are not over 5 per cent from average

■ OBTAINING uniform high-strength welds in sheet aluminum is no easy matter, as is well known. The low electric resistance of the material requires a large current value to obtain a weld. Also, the low plastic range of the material necessitates completion of the weld in an extremely short period of time. In addition, the welding pressure must be controlled accurately and balanced carefully with the current if excessive surface indentation is not to result.

To meet these critical requirements, a number of welding systems have been developed. Those creating the widest interest, previous to the new 3-phase system to be described here, are known as "stored energy" systems in which energy is stored either in capacitors or inductors and discharged through the weld. The capacitor system has proved extremely useful since it provides a rather uniform load on all three phases of the power system, thus going a long way to solve difficulties accompanying use of large-capacity single-phase welders which disturb power-line systems when in use.

Fig. 2—Macrograph of typical weld in aluminum showing satisfactory grain structure free from cracks, blowholes and the like

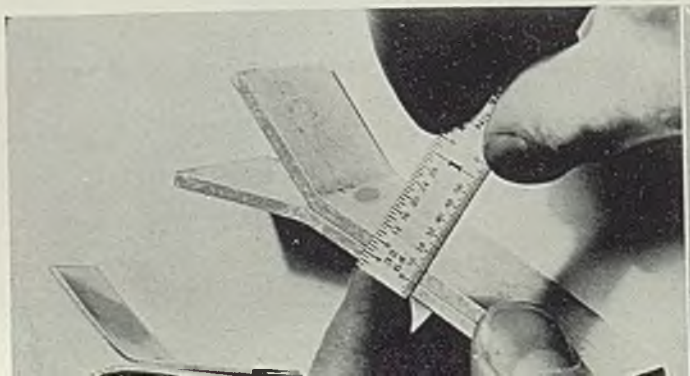
To these is now added a new 3-phase high-speed production welding method, recently announced by Progressive Welder Co., 3050 East Outer drive, Detroit. It involves an entirely new principle of operation as will be explained.

Welds made by the new process apparently are entirely free from cracks and blowholes. Fig. 2 is a macrograph of a typical specimen weld, showing satisfactory grain structure free from cracks, blowholes or other defects.

The welder is extremely flexible, handling a wide range of work. Only two adjustments—for welding pressure and for time the welding current is on—are involved in taking care of all conceivable types of welding operations within the capacity of the equipment. Apparently no adjustment is necessary for current

Fig. 3 (Left)—Versatility of the equipment is indicated by these two samples welded by the same machine within a few moments of each other. One sample is a weld made in two sections of 0.032-inch 24ST aluminum, the other is two pieces of 1/8-inch aluminum

Fig. 4 (Right)—Extreme range of the equipment is shown by this stack of 10 pieces totaling almost 3/8-inch and spot welded successfully



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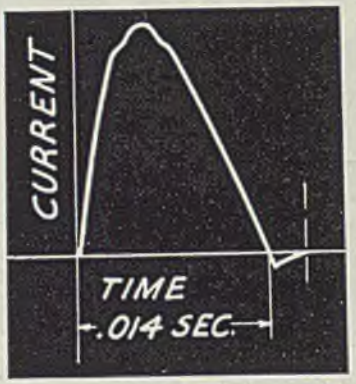


Fig. 6—How closely the actual wave form approximates the theoretical wave form is shown here. This was drawn from an oscillograph curve taken during actual welding. Note this closely simulates the flat-top form desired for welding aluminum in that it rises sharply, progresses along at a fairly uniform level and then drops off very steeply

TABLE I—Pull Tests on Spot-Welded Aluminum

24ST, 0.032-inch Alclad Sheet

Sample No.	Shear Strength Pounds	Sample No.	Shear Strength Pounds
1	500	48	500
3	500	51	500
5	500	54	470
7	470	57	465
9	500	60	465
11	500	62	470
13	500	64	465
16	500	66	470
17	500	69	490
19	470	71	465
20	500	74	450
23	470	76	480
24	500	78	460
25	500	81	460
29	460	82	500
31	465	83	460
34	470	87	450
36	500	91	500
39	500	92	500
42	500	95	475
45	500	98	520

Note: Welding pressure and timing constant for all tests. Size of test specimens 4½ x ¾-inch, overlapped ¾-inch and welded in center. Size of weld spot 0.2-inch diameter. Specimens gripped ½-inch from either end for shear test. Minimum government specification on this type of weld, 230 pounds.

since the total power input to the weld can be controlled by the vacuum tube switches as will be shown.

As an example of the extreme flexibility of the equipment, see Fig. 3, which shows not only welds in 0.032-inch sheet, but also welds made in aluminum sections totaling ¼-inch in thickness—both welds being made on the same machine. Further, Fig. 4 shows 10 pieces successfully spot welded together, totaling about ⅜-inch in thickness. A 150-kilovolt-ampere 3-phase machine can easily spot weld seven pieces of 24ST aluminum sheet 0.032-inch thick, and good welds over this extreme range are easily obtainable.

Shear strength tests made on 50 samples selected at random out of 100 run under operating conditions simulating actual shop conditions are tabulated in Table I. Welding pressure and time were constant for all the tests. Size of test specimens was 4½ x ¾-inch, overlapped ¾-inch and spot welded in the center of the overlap. Size of weld spot was 0.2-inch in diameter. Specimens were gripped about ½-inch from either end for the shear test. Minimum government specification on this type of weld is 230 pounds. Note that only one specimen, No. 74, showed less than double this requirement.

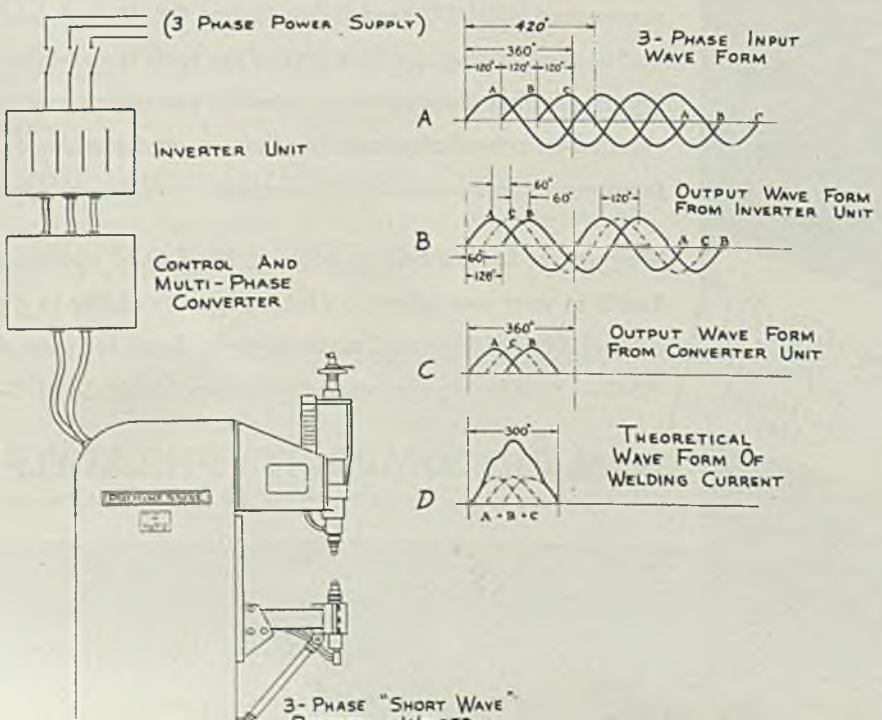
Exceptional uniformity obtainable is well illustrated here as none of these specimens gave a variation exceeding 5 per cent from the average. Thus uniformity of welds obtainable equals that possible in welding steel in production work. This may be a most important development in connection with mass production of airplanes where a simple, extremely flexible welding system has long been sought.

Neither is any special skill required on the part of the operator as the welding pressures and times, the only two variables here, once set, are controlled automatically with an exceptional degree of accuracy by the equipment itself. Welding speeds are directly in line with those customary in welding sheet steel and for the most part are limited only by the ability of the operator to move the work from one weld to the next.

The Setup: For patent reasons, the company has not divulged details of the equipment, but it is believed the following is an accurate

(*Please turn to Page* 97)

Fig. 5—One phase of the 3-phase power supply passes through a 1:1 ratio transformer called an inverter and used to shift the wave 180 degrees as shown by the wave form diagram at B. Next the power with one phase inverted is fed through three ignitron tubes which control weld timing and also act as electron valves to cut off the negative portion of the curve, resulting in the wave form shown at C. This is fed to a welding transformer having a 3-winding primary in which the inverted phase is added to the other two phases to produce welding current of the theoretical wave form shown at D



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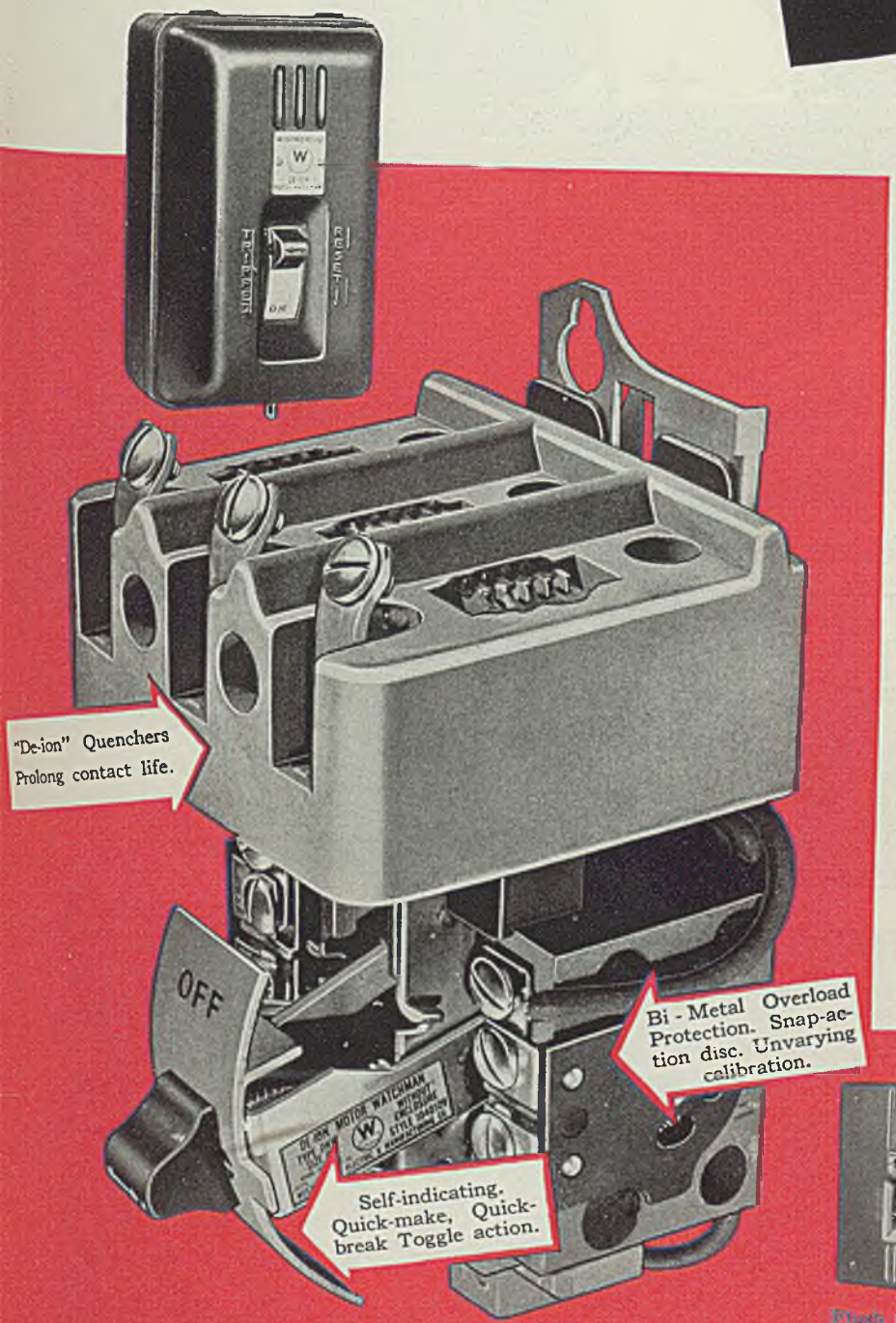

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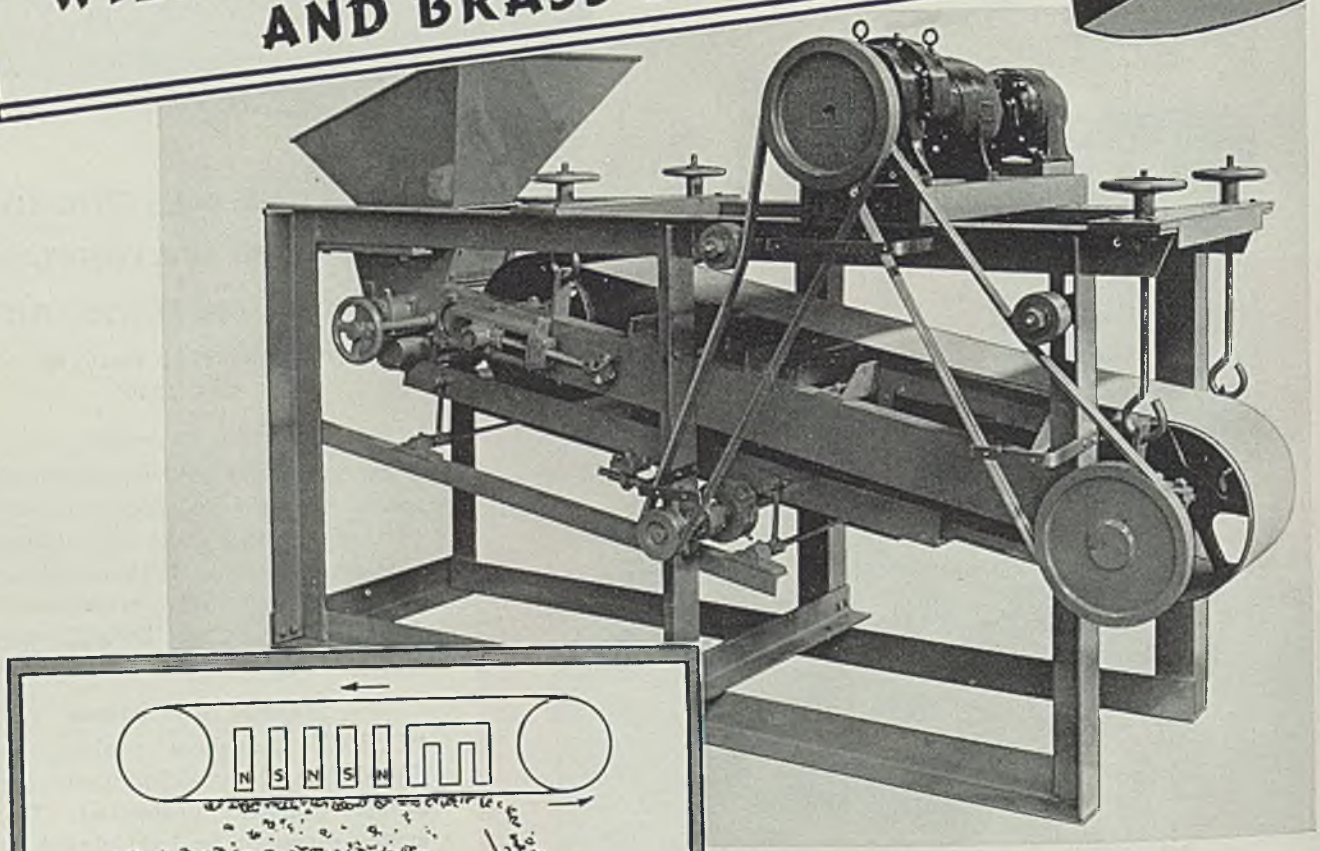

Above—Dings High Intensity Type BN Separator.

Left—Principle of Operation.

FROM A RECENT REPORT:

(Concerning Dings Type BN Separator Operating in a Midwestern plant. Owner requested firm name be omitted.)

"You may be interested in knowing that they are now operating with a space of 2½" between the belt and the tray. They are obtaining the best separation we ever saw on material of this sort. On the first run they keep the rectangular magnet (that's the last magnet in the bank) turned down to about ½ strength, pulling out every piece that has even a minute piece of iron attached to it."

• • •

The Dings Type BN *High Intensity* Separator was specially designed for separating such intimately entangled scrap as babbitt and cadmium borings from cast iron, *steel turnings from brass borings*, etc.

The Separator consists of an endless belt run above a vibrating shaker tray which tends to disentangle the scrap. Mounted between the belt pulleys are a series of powerful electromagnets having alternate polarities. Scrap "jumps" from pole to pole causing a jolting action which completes the disentanglement and allows any non-ferrous material to fall back on to the belt. The ferrous particles are held to the underside of the belt until they pass out of the magnetic field, at which point they drop off. The non-magnetic particles discharge at the end of the tray.

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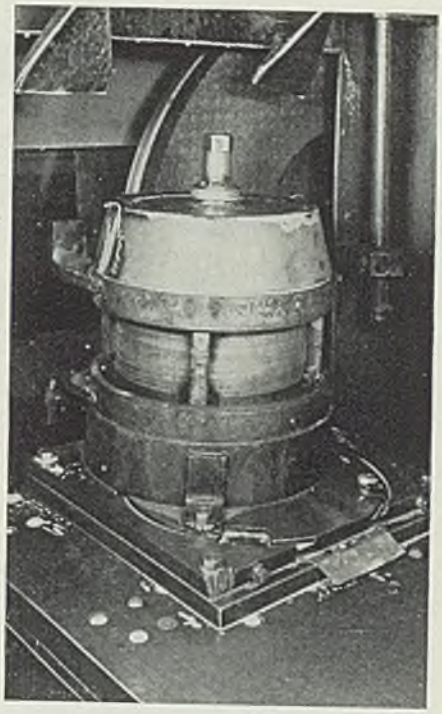


This close-up shows a stator frame for a Reliance fan cooled, enclosed, alternating-current motor, set up for grinding the feet which are held within 0.005-inch of flat on all sizes. Machine grinds from 10 to 25 frames per hour, depending on their size

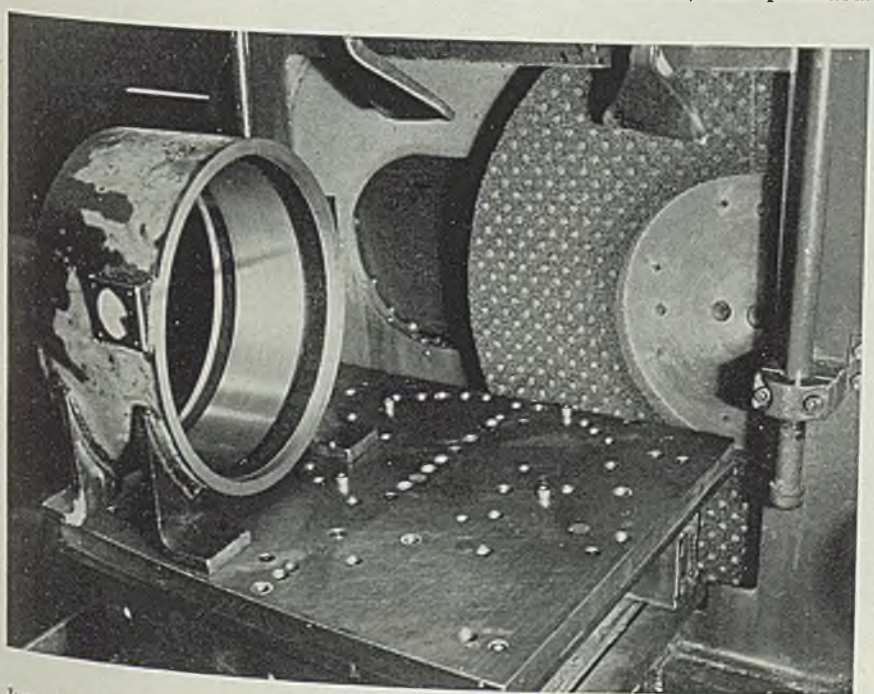
■ CARE exercised in finishing off the feet of a motor frame so they are exactly parallel to the line of the motor shaft greatly facilitates the ease and accuracy with which the finished motor can subsequently be lined up for coupling to the machine to be driven. Also, the actual distance from the center of the motor bore to the bottom of the feet must be held to fairly close tolerances.

Using a surface grinder for finishing off the bottom surfaces of the feet works well since little stock need be removed and the feet need not be braced to avoid distortion because this danger is not present with such a light cut. The grinding head of the surface grinder travels while the worktable remains stationary. The reciprocating slide which carries the grinding head is driven through an oil pump mounted inside the base casting. The abrasive wheel is passed several times across the face of the work. It is driven by a 50-horsepower splash-proof alternating-current Reliance motor at 1750 revolutions per minute, mounted on the reciprocating slide and connected to the spindle through multiple V-belts.

The fixture mounted on the worktable was specially designed to accommodate nine sizes of motor frames. It consists simply of a piece of boiler plate, surfaced on both sides and with a number of holes fitted with hardened and ground bushings. All frames have finished bores and faces, these surfaces having been machined prior to the grinding operation. Hardened and ground pins, lapped for a hand-wrung fit in the bushings and projecting above them, are provided. Since nine different sizes of frames are ground, each to be located by pins in four holes, there are 36 holes in all.

The most important feature of these bushed holes is that they are so located that the bottom of the feet of all sizes of frames are finish-ground to the same common line. Thus, when changing from one size frame to another, it is not necessary to adjust either the fixture or the position of the cross-feed stop on the table of the machine. The operator merely pulls the four pins out of the bushed holes, relocates them in the correct bushings for the bore of the next frame to be ground, and then secures the frame to the fixture plate by a central bolt and cross-bar.

In fact, the operation of the grinder is so simple that one operator not only handles it but also runs a drill press at the same time. The feet of one frame are drilled while another is being ground. The rate of production, while possibly not so high as would be the case if the operator handled the grinder only, ranges from 10 to 25 frames per hour, depending on the size of the frame and the amount of stock to be removed.



Here is the fixture that accommodates nine sizes of motor frames by means of pins which fit closely into bushed holes. Photos by Reliance Electric & Engineering Co., Cleveland

"SKID-LOAD" HANDLING

cuts freight costs . . . cuts packaging costs

speeds loading, unloading

By J. G. BUCUSS

Not only are packaging and freight costs materially reduced by steel strapping loads on skids, but important savings in loading-unloading time and warehouse space also are obtained. Additional advantages are assurance of damage-free arrival, ability to feed directly into fabricating and processing lines, and other savings at receiving point. A number of case histories show a few of the exceptionally wide variety of products which can be handled efficiently by this method

■ THE SKID-LOAD process as developed by Acme Steel Co., Chicago, consists of steel strapping a number of units onto wooden skids or pallets to form a single compact unit that provides a positive way for manufacturers to increase profits by lowering packaging, shipping and handling expenses. Other advantages are: Damage-free arrival and consequent freedom from claims, increased customer good will, much faster handling operations, reduced possibilities of accidents to workmen.

In the automotive industry where large volume of parts are shipped to assembly plants, the method has been found especially advantageous. However, it certainly appears to have no limits as to size, type, shape, weight or kind of material which can be handled effectively. And some of the savings that it makes possible are rather hard to believe.

For instance, Fig. 1 shows how wire wound on spools now is steel strapped on wooden pallets in three tiers with 16 spools in each tier, enabling 48 spools to be handled by a fork truck as a unit load. Formerly the spools were boxed individually. Now the use of the skid-load method of handling affords a 46 per cent saving in cost and a reduction of 95 pounds in tare weight. It is easy to visualize how this method speeds loading and unloading of freight cars and highway trucks.

Fast and safe placement of products for carload movement is made economically possible by this method. Each half-car of skidded merchandise is braced with steel bands in the car to form a single larger compact unit which is free to shift and come to a sliding rest under impact. And to unload the shipment, the recipient merely ships the steel bands. There are no heavy bracing members to remove, no lost time and no loss of shipping materials since the pallets and skids are returnable to the shipper at small cost.

Fig. 1—Steel strapping spools of wire onto wooden pallets as shown here affords a 46 per cent saving in cost and reduction of 95 pounds in tare weight

Fig. 2 affords an excellent example of the savings available. These units are oil filters. Formerly they were packed individually in corrugated cartons and then 25 of these cartons shipped in a wire-bound case. At 13 pounds each, this totaled 335 pounds per case. Cost of shipping by this method involved cartons at 6 cents each, amounting to $1.50 per 25. The wire-bound box cost $1.04, and 75 feet of 2-inch gummed tape used to seal the cartons cost 0.045, making a total material cost of $1.585 for 25 filters. Cost of labor to pack, seal and place cartons in wire-bound box and then seal box was 35 cents per ½-hour's work, at rate of 70 cents per hour. This made a total of $1.935 for material and labor for 25 filters or $0.0773 per filter.

The new arrangement, shown in Fig. 2, permits shipping 60 filters in one unit, making a total load of 780 pounds. With this method, cost of material includes $1.178 for wood for the skid top brace and the separators, another $0.014 for nails and $0.169 for steel bands, mak-

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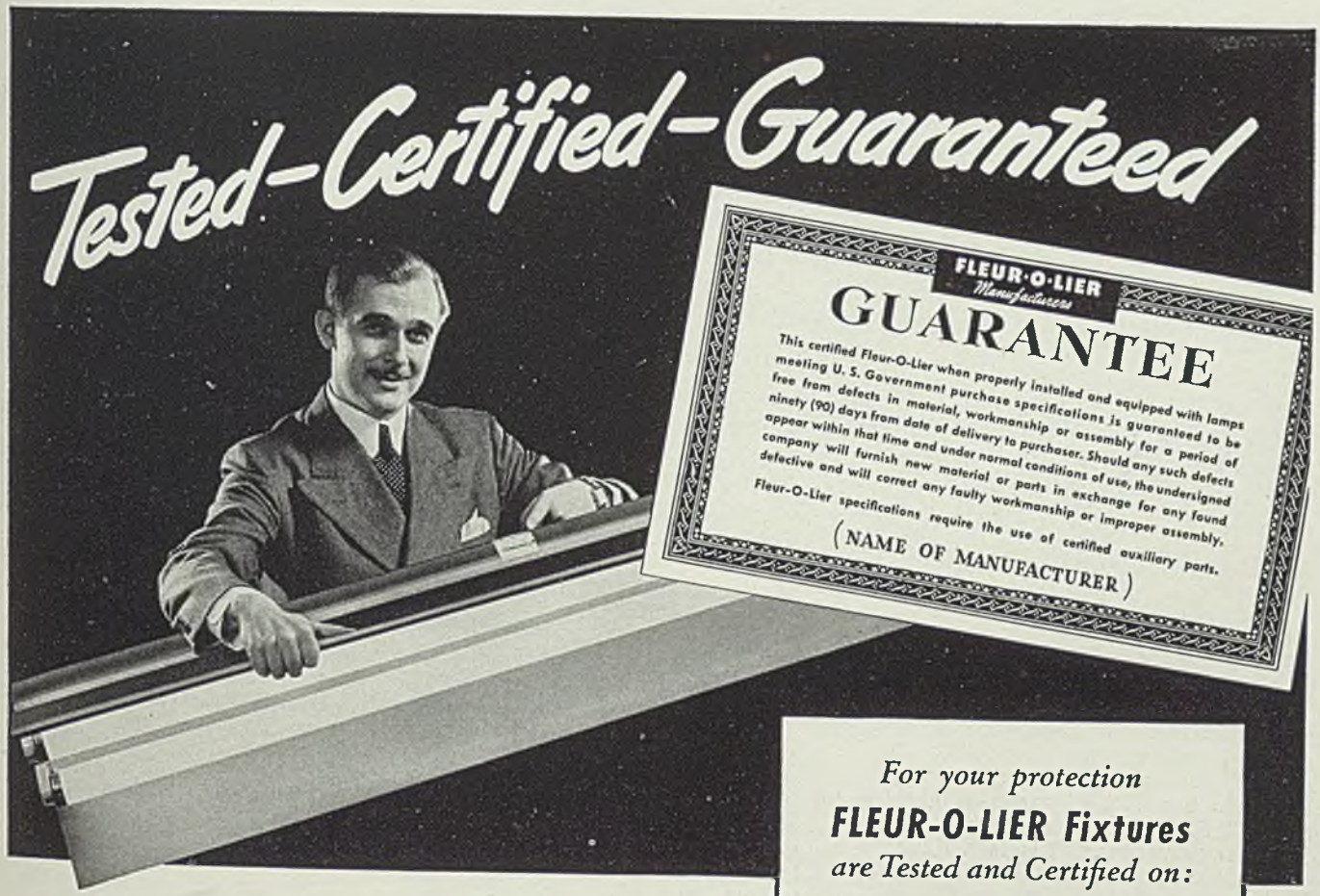

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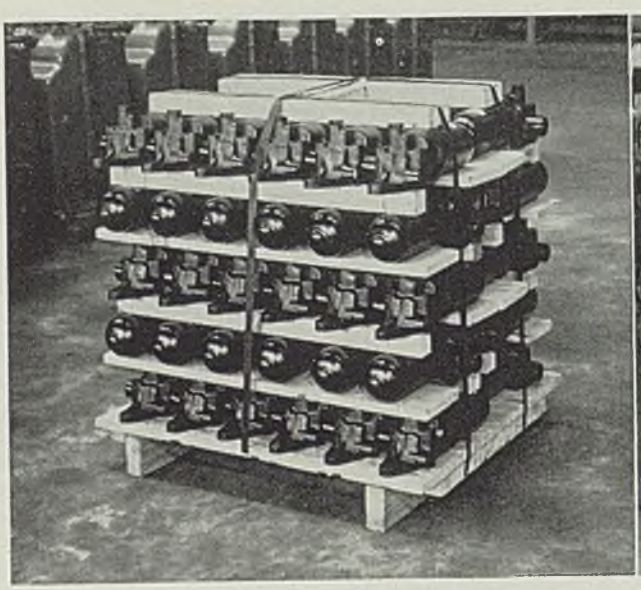


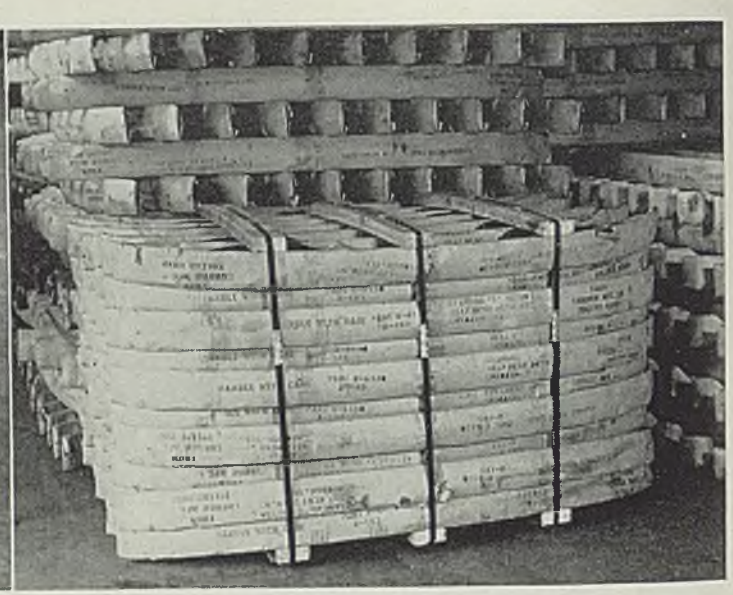


Fig. 2—This method, left, of packing oil filters produces a direct saving of 55.2 per cent in crating cost alone

Fig. 3—It's hard to believe, but this package, shown in view at right, saves more than 90 per cent in packaging costs, which does not include additional savings that accrue from occupying almost a third less storage space and lower freight costs from reduced tare weight

ing a total of $1.361 for material. Cost of labor involves ½-man-hour to cut the lumber and build the skid, 1/3-man-hour to load skid and 1/5-man-hour to apply the three bands, making a total cost of $0.721 (rate, 70 cents per hour). Adding this to the cost of material gives $2.082 for labor and material, or $0.0347 per filter. This is a direct saving of $0.0426 per filter or 55.2 per cent.

Figures Tell the Tale

It is difficult to imagine how a simple method like this can cut costs more than 50 per cent until the actual figures are at hand.

However, data on another instance shows savings that amounted to over 90 per cent. Fig. 3 shows graphically the old and new method of handling automotive bumpers. In the old method, bumpers were crisscrossed on the truck and piled in storage the same way—that is, the bumpers in one layer being laid crosswise those in the layer underneath as shown by the bumpers stacked in storage behind the skid load in Fig. 3. What is more important, each layer had to be separated by boards and each bumper stenciled individually four times with red and black stencil ink. A truck shipment of 265 bumpers required 120 pieces of 1 x 4-inch x 8-foot pieces of lumber, amounting to 320 board feet, and it took three men approximately one hour to load the truck. Each bumper is wrapped with paper-lined burlap.

Cost by the old method: For 320 board feet of lumber at $35 per 1000, $11.20; labor for 3-man-hours at 70 cents per hour to load the truck, $2.10; stenciling required 1 man-hour at same rate. This total labor cost of $2.80, added to the material cost of $11.20, gives $14 as the cost of loading 265 bumpers, or $0.528 per bumper.

Now compare this with handling these same units by the skid-load method as shown in Fig. 3, where 60 bumpers are packed into one compact package weighing 1575 pounds. Cost for material here amounts to only $0.506 as only 14½ board feet are required. To this is added $0.296 for steel bands and $0.015 for seals, making a total of $0.817 for material. To cut lumber, pile bumpers and apply bands requires only 1.3 man-hours, a charge of $0.91 for labor, so the total cost is only $1.727 for material and labor for the 60 bumpers, or $0.0288 per bumper. Since only one or two bumpers need be stenciled, or the stencil can be placed on the top brace, stenciling charge is omitted.

Comparing the cost of the two methods, it is seen that the skid-load method saves $0.4992 per bumper, or 94.4 per cent. In addition, the company is extremely interested in the skid-load method because bumpers piled on skids save approximately 25½ per cent in storage space. While 63 bumpers packed loose occupy 93.25 cubic feet, 60 bumpers skid-load occupy only 68.4 cubic feet. This saving is in addition to that mentioned above. Further, there are considerable savings in freight costs.

In addition, it is entirely feasible to pack the skid load as the material comes off the production line. This affords a further saving by eliminating a good portion of the labor required to form the package —an added saving not included in the above figures.

Add all these together and you arrive at an amazing total saving—not a theoretical one but a saving one company now obtains in its daily operations. When such a comparatively simple change can show results, it is understandable why the skid method is so widely utilized.

Develops Bright Copper Plating Process

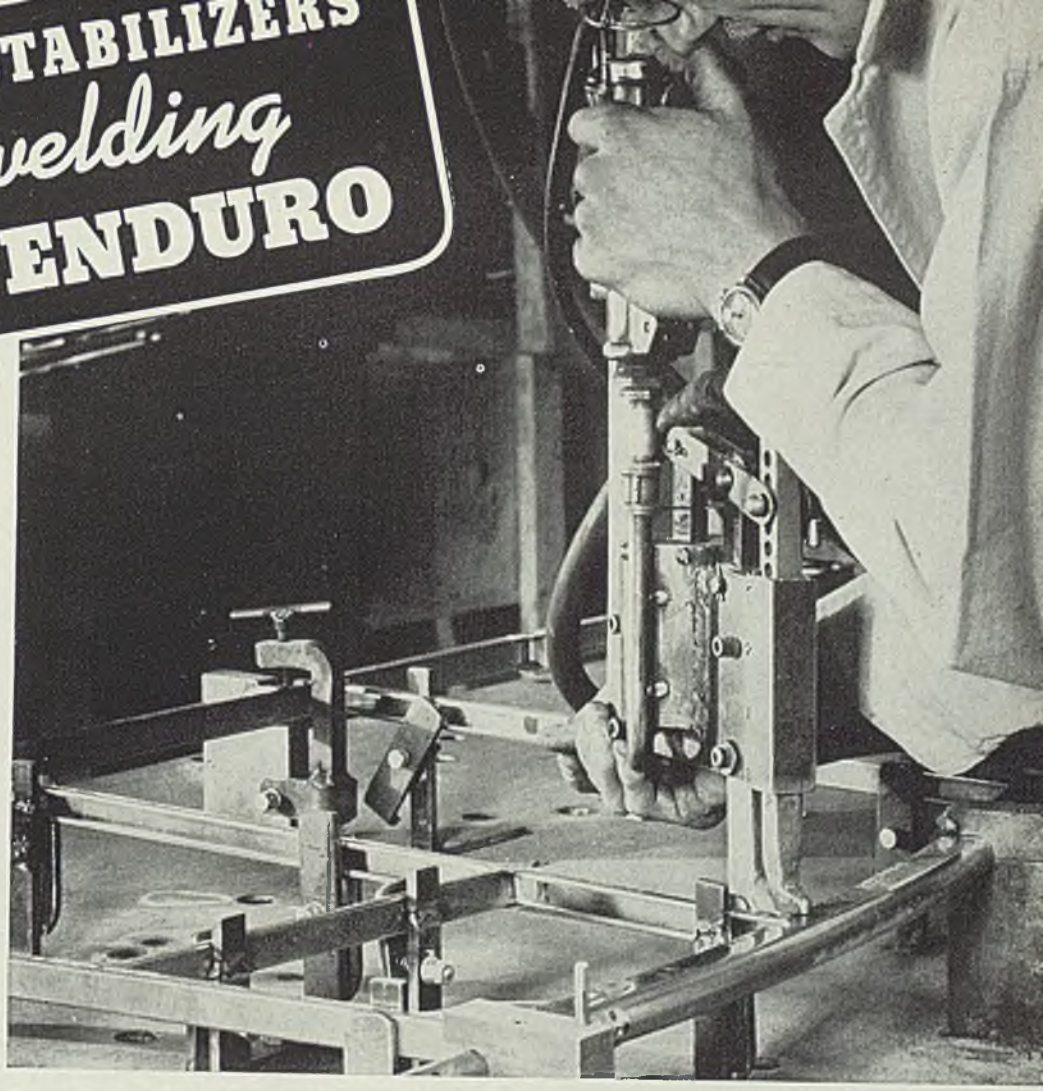
■ A new bright copper plating process which may be of interest to many concerns attempting to conserve nickel is announced by Dr. Louis Weisberg, 71 West Forty-fifth street, New York, It has a bright plating range extending from practically zero on the one hand up to over 100 amperes per square foot on certain simple types of work.

The basic ingredients of the solution used in the process are copper sulphate, diethylene triamine and ammonium sulphate. The copper is in the bivalent form, and the current efficiency at both anode and cathode is practically 100 per cent. The throwing power compares favorably with a cyanide copper solution.

Rubber lined equipment is necessary to carry out the process. Heating can be provided by means of a copper coil or a Duriron heat exchanger. The operating temperature of the process is approximately 140 degrees Fahr.

Before plating on zinc or steel, a cyanide copper flash is required. This need not be more than a 2 or 3-minute flash, except possibly on pieces carrying heavy scale such as bumpers where about 0.0001-inch of cyanide copper is recommended. Hanson-Van Winkle-Munning Co., Matawan, N. J., is the sole selling agent for this process.

LIGHT STRONG STABILIZERS made by welding REPUBLIC ENDURO



Formed sections of stainless steel, held fast in jig, are welded to form a stabilizer.

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If you are unable to obtain a special steel just when you want it, a Republic metallurgist may be able to suggest another steel that will do the job as well, be easier to obtain —and it might be less costly.

I make this suggestion because I feel that, as defense demands increase, delivery on special analysis steels will be worse before it gets better. True, we are the world's largest maker of alloy steels, but, to help you and to speed our national defense, we must all work together so that every man, every mill and every minute may produce in huge quantities the steels that are in greatest demand.

Through a simplification of your needs you can help yourself while helping us produce more and better *steel —first line of national defense.*

R. J. Wysor
PRESIDENT

The favorable strength-weight ratio of Republic ENDURO* Stainless Steel, its easy weldability and high corrosion-resistance make it the ideal metal for the construction of the modern airplane. Uniform chemical and physical properties assure uniformity in fabrication, speed up production and reduce construction costs.

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SHEETS—ST

DEFENSE AND THE FUTURE...

Copy of Letter to users of Products of The International Nickel Company, Inc.

The International Nickel Company, Inc.

EXECUTIVE OFFICES: 67 WALL STREET

ROBERT C. STANLEY,
PRESIDENT

New York, April 17, 1941.

Dear Sir:

Our plants, in common with those of most of America's industrial units, are working at their peak on defense production. In spite of this, hardship is being inflicted upon many consumers of our products who in the past have aided us in building a great business, and upon whom we must depend for our future success.

As this letter is written the monthly production rate of The International Nickel Company of Canada, Limited is already 20% above last year; three times that of 1929 and four times the peak rate of the last war. Its facilities have been increased to supply current defense demand and further increase in output will be available this year.

Upon the conclusion of this devastating war the future success of your business and ours will depend in large measure upon the retention of the good will of our customers. Any effort we can make, not conflicting with our full support of the defense program, should be directed toward this vitally important objective.

To this end we wish to offer our services especially to those customers whose requirements cannot for the moment be filled. One practical means of rendering such service is to offer you the assistance of our technical staff in solving problems of material arising from the temporary lack of nickel.

Our problems are complex and constantly changing and can only be solved through cooperation. As we see it, a large part of the solution lies in making clear the situation which we face. Your help and advice will be of invaluable assistance. It is our purpose to follow this letter with a personal call from one of our representatives, if you so desire, who will discuss with you in more specific detail our mutual problems.

Yours very truly,

RCS:JJS

PRESIDENT.

New Instrument Transforms hours into minutes In Making Metal Analyses

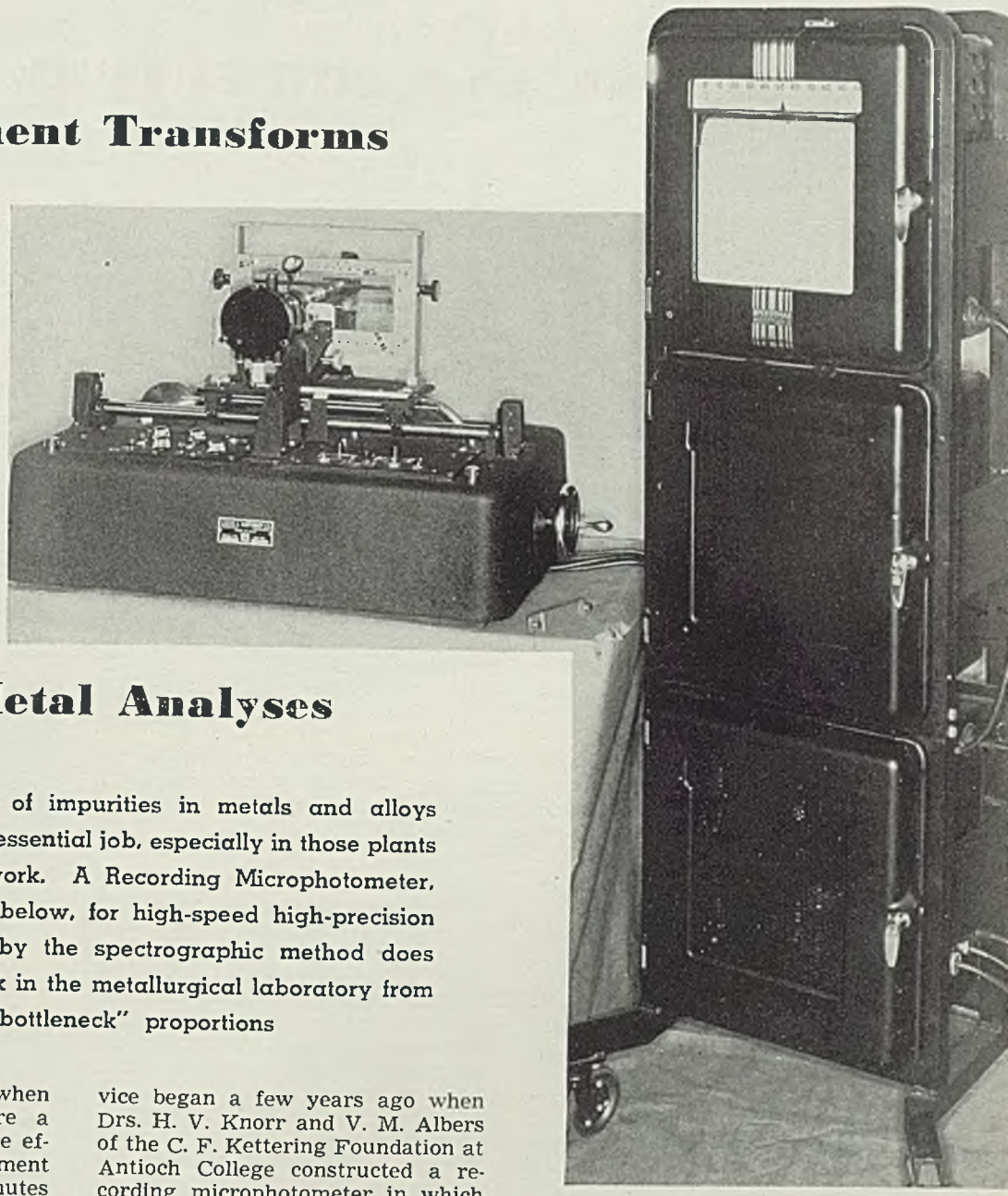

Fig. 1—Leeds & Northrup's new recording Microphotometer: The setup consists of a plate-scanning unit, shown at left, above, and a Speedomax recorder, at right

Detecting the presence of impurities in metals and alloys quickly nowadays is an essential job, especially in those plants involved in ordnance work. A Recording Microphotometer, like the one described below, for high-speed high-precision metallurgical analyses by the spectrographic method does much in preventing work in the metallurgical laboratory from reaching "bottleneck" proportions

■ IN THESE "hectic" days when minutes count and hours are a waste of time so far as defense effort is concerned, any development tending to turn hours into minutes is welcomed with open arms by manufacturers. Especially is this true in regard to manufacturers turning out war materials involving metallurgical tests in which the quick determination of impurities present in metals in small percentages is an essential factor.

A development recently announced—one that makes previous methods of metal analyses in metallurgical laboratories as antiquated as "grandpa's one-horse shay" against the automobile of today—is the Recording Microphotometer introduced by the Leeds & Northrup Co., Philadelphia. In a large metallurgical laboratory where it used to take chemists eight hours to analyze 150 samples, the instrument now makes it possible for these men to do their work, within the conventional tolerances of chemical methods, at least six times as fast as before.

The development of this new device began a few years ago when Drs. H. V. Knorr and V. M. Albers of the C. F. Kettering Foundation at Antioch College constructed a recording microphotometer in which they used a Leeds & Northrup Speedomax recorder to obtain inked records of the intensity of the lines of a spectrogram. The outgrowth of this development resulted in the present device which was made possible by the co-operation of several industrial laboratories in setting up specifications for equipment which would best meet their needs in quantitative spectrographic analysis.

Two Devices in One

Fig. 1 shows the instrument as a combination of two units — the scanning unit and the Speedomax unit. The scanning unit holds the spectrogram and scans it with a narrow, focused beam of light. The light of the scanning beam transmitted through the spectrogram falls on a photocell producing a current which varies with the density of the spectrum. The Speedomax unit records this current as a continuous line which represents the relative densities and positions of the spectrum lines. Automatically-drawn records of standard and test spectrograms on the same chart provide a quick and accurate method of determining the presence of impurities.

Fig. 2 shows the Scanning unit in greater detail. Designed to accommodate plates or films as large as 4 inches high by 10 inches wide, it includes on a heavy, cast base an optical system, a plate stage, a drive mechanism for the plate stage, an alternating current operated amplifier and all necessary controls grouped at a convenient location. Movement of the plate stage can be either automatic or by hand. To permit spectrographic plates to be

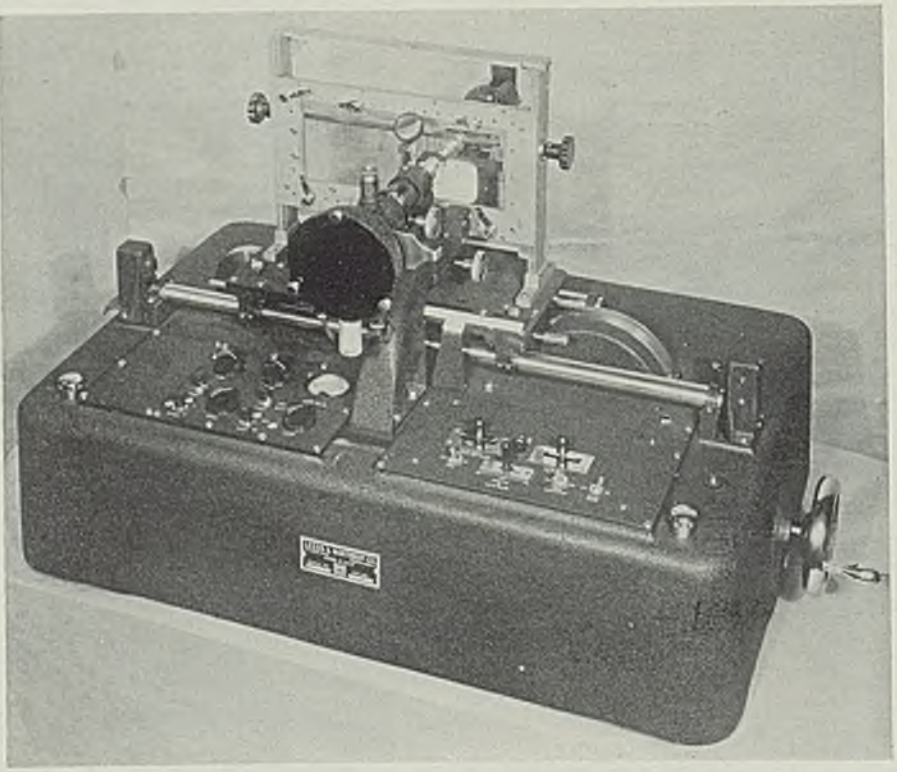

Fig. 2—The photographic plate taken from the spectrograph is placed in the scanning device shown in the accompanying view. The latter then automatically moves the plate past a photoelectric device which is electrically connected to the Speedomax recorder

moved rapidly to the desired line or group of lines, the handwheel takes precedence over the synchronous motor. At any part of the spectrographic plate reached by use of the handwheel, the motor drive will take over the movement of the plate stage and keep it synchronous with the movement of the Speedomax chart. Nine plate-stage speeds, yielding an equal number of ratios of plate travel to Speedomax chart travel (50 millimeters per minute) are made available by the synchronous motor drive.

The Speedomax unit is a high-speed, null-type potentiometer recorder similar to the one which is widely used to record the temperature of moving objects such as metals being rolled—rails, slabs or billets. So rapid is its response that in less than 2 seconds the pen can move from one position on the chart to another—even across the entire width. It is quick because the galvanometer and mechanical balancing mechanism that characterize most potentiometer-type recorders have been replaced by an electrical system which operates a motor to restore balance with unusual speed whenever a change in photocell output unbalances the potentiometer measuring circuit. A thyratron relay controls the balancing motor. To assure fast recording, the balancing motor has a high rate of acceleration. Overshooting is prevented by an electrical tachometer built into the motor which reverses the motor torque as required for quick, precise balance. Because the synchronous motors of the Speedomax and scanning units operate from the same alternating-current source, a definite relationship between travel of chart and travel of spectrogram is assured. Either of two scales can be supplied. One is an arbitrary uniform scale, graduated 0 to 100 divisions. The other is a logarithmic scale having a range from infinity to zero, graduated in terms of photographic density.

Because this new recording microphotometer has done away with the delays, uncertainties and limitasions attending the use of dark rooms, high-sensitivity galvanometers and photographic methods, it has changed the status of the recording microphotometer from a little-used research tool to a thoroughly practical device for routine analyses in the industrial laboratory. Its continuous record permits operators to judge the effect of the presence of other lines (which are distinctly resolved, but not completely separated) on the density of the lines to be measured. The continuous record also assures the automatic recording of the peak density and permits the accurate measurement of lines which are hardly visible when projected. Since recording is automatic, measurements are obtained without eyestrain. Pen position can be read at a glance on an indicating scale as the record is being drawn.

New Booklet Details Welding Process

■ Metal & Thermit Corp., 120 Broadway, New York, announces publication of a new 36-page booklet describing the Thermit welding process and its applications. Profusely illustrated, the booklet explains the reaction of the process and gives considerable information on the physical properties of the welds. It also describes the application of the process to the welding of rails, to the repair and reclamation of crankshafts and steel mill equipment and its use in fabrication of heavy machine parts, such as housings and frames. Copies are available on request.

More Southern Furnaces To Be Air Conditioned

■ Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., recently awarded York Ice Machinery Corp., York, Pa., a contract for an air conditioning system capable of extracting nearly 80 tons of water daily from air used in the blast furnaces.

The system will condition 90,000 cubic feet of air per minute for two blast furnaces by means of a turbo-compressor water-cooling unit driven by a 900-horsepower steam turbine. The air blast will pass through a special dehumidifier before entering the furnaces.

Another dry blast system is scheduled to be placed in operation by York for Republic Steel Corp.'s furnace at Thomas, Ala.

Novel Reflects Days Of Steel's Development

■ *Not For the Meek*, by Elizabeth Dewing Kaup; cloth, 697 pages; published by the Macmillan Co., New York, for $2.75.

Martin Lyndendaal, Danish peasant who ran away to sea, came to the United States and Pittsburgh, rose to affluence and leadership in the steel industry. Some of his associates are sketched from leaders in early steel development, men who built the business and carried it forward.

The thread of the story is carried by the memories recalled by Lyndendaal in his old age. While entirely fiction, the story reflects the spirit of the men who made steel a powerful factor in American life. While Lyndendaal's life was lived among a hard race of builders, the book abounds in the softer sides of life, his relation with his beautiful wife, his understanding attitude toward his children and grandchildren, who lived in a later age, unlike his own surroundings. Altogether it is well wrought and highly readable.

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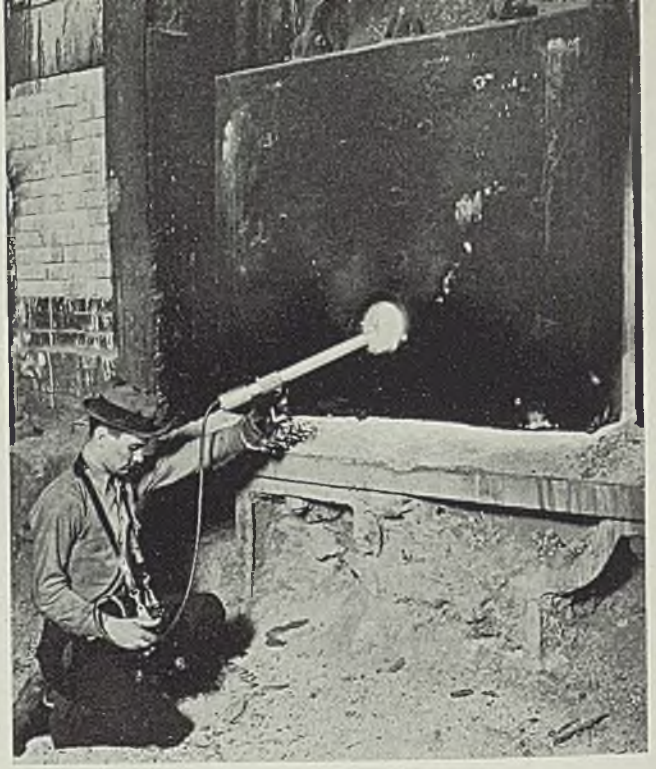

One of the duties of the observer is to check furnace temperature

Use of partially shut ladle stopper to control pouring speed reduces the number of cracked ingots. Boiling nozzles in tar reduces wear and eliminates stickiness and splitting. Segregation of steel in corners of octagon molds is remedied by making inserts deeper. Detailed information provided by observers results in an improvement in steel products

By N. H. BACON
Steel, Peech & Tozer, Ltd.,
Sheffield, England

■ CONSIDERABLE responsibility rests upon the human element in pouring of steel. Some teemers and pitmen excel in some points but are inferior in others. In order to help carry good practice from one shift to another, and to give observers a wider experience they should change shifts in reverse direction to the men. This enables them to discover the merits and demerits of the other two shifts. They are able to note how a greater number of men tackle the various jobs around the casting pit, and this added experience makes them more valuable as observers.

In addition to the variety which arises due to working with a fresh group of men each week, and to working alternate weeks in melting shop and mill, they work one month in turn from 9 a.m. to 5 p.m. attending to the testing of free-cutting steel, etc. This month affords a break from shift work and enables them to get a more general view of the various problems engaging the attention of the department. The success of an observer's department depends largely upon the energy and keenness of every individual member and they must look upon the works as a huge laboratory, where every operation presents a field for research.

Since our observers carry on their work, in both the acid and basic melting shops, and the various rolling mills and forges, they have excellent opportunities of increasing their knowledge and experience, and so preparing themselves for a better position. The first assistant devotes his attention, more particularly, to the acid melting shop and the press, forge and machine shops, and has with him six men on shifts, three in the acid melting shop and three following up in the manipulating departments. The second assistant devotes his attention more particularly to the basic melting shop and the rolling mills. He has with him six men on shifts, three in the melting shops and three in the mills.

Obviously the metallurgical department of itself could achieve but little. It is a service department which provides information to the various departmental managers, and, as the result of collecting and examining data, is able from time to time to proffer advice or suggest modifications in practice. It is a department which also depends for its success upon the co-operation of the general laboratory, the research department, and the inspection department. When dealing with some of the work which has been accomplished, it must be understood that the results achieved are not due to the metallurgical department alone, but are due to the co-operative effort of many workers in numerous departments.

Careful records are kept of the details of operation; charging the furnace, melting, refining, casting, rolling, examination and dressing of the finished steel. These data are continually being examined, and this examination is facilitated by making use of the comptometer department. This enables a much greater mass of data to be analyzed than would be otherwise possible.

Bottom Pouring Extended

It was most important that the quality of the billet should be improved. Systematic observation and correlation of furnace and casting pit data with the yield data began to produce good results. The practice of bottom pouring was rapidly extended, as bottom-poured ingots, cone shaped at both ends, were found to give a 3 to 4 per cent better yield than top-poured ingots; a much superior surface finish with correspondingly less dressing. It was found that the percentage of cracked ingots could be more easily reduced by controlling the teeming speed by a partially shut stopper, than simply by nozzle size and grouping. Controlling the teeming speed by stopper control was found to necessitate a number of alterations in practice. The nozzle was lengthened from 7 to 10½ inches; the practice was adopted of always boiling the nozzles in tar until they were saturated throughout. This was found to eliminate the danger of split nozzles; reduce the wear, and

Abstracts from a paper presented before the Sheffield Society of Engineers and Metallurgists, Sheffield, England, Oct. 21, 1940.

Table I—Analyses of Mold Life

Time lapse between casting and service of mold	No. of molds used	No. of ingots poured
Within 1 week	54	86
1 to 2 weeks	257	84
2 to 3 weeks	108	85
3 to 4 weeks	76	85
4 to 8 weeks	134	85
8 to 12 weeks	37	85
12 to 16 weeks	16	85

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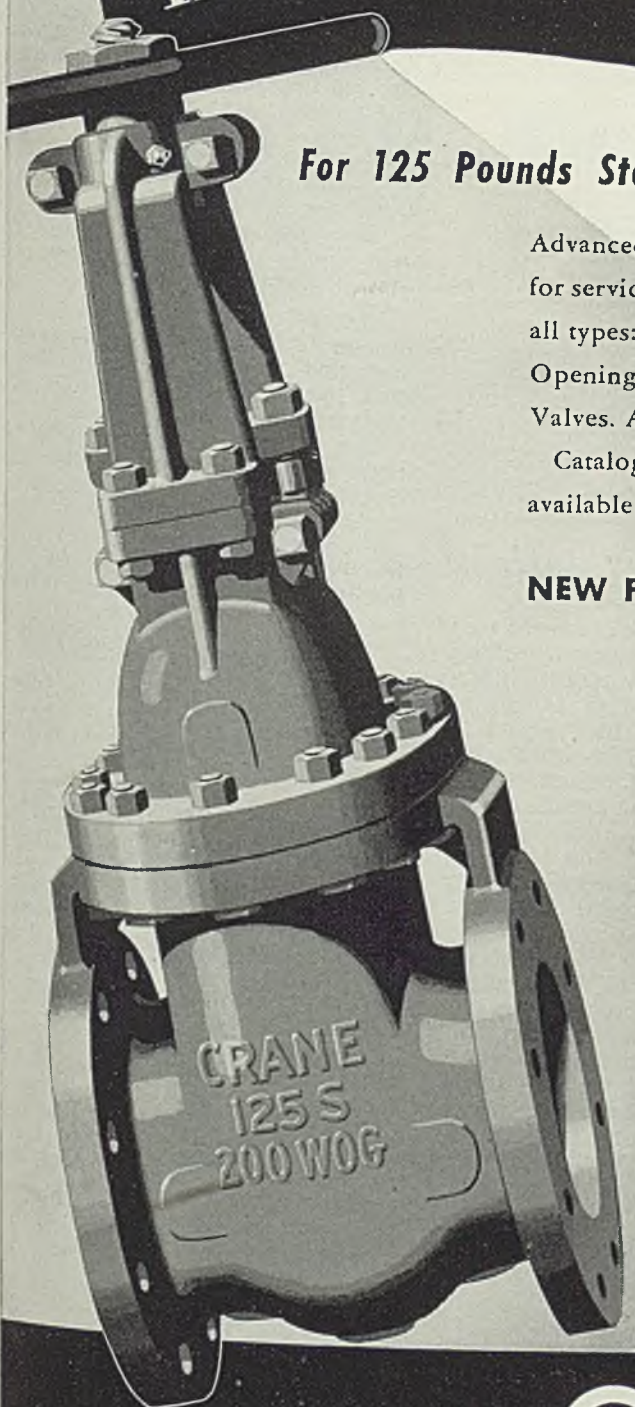

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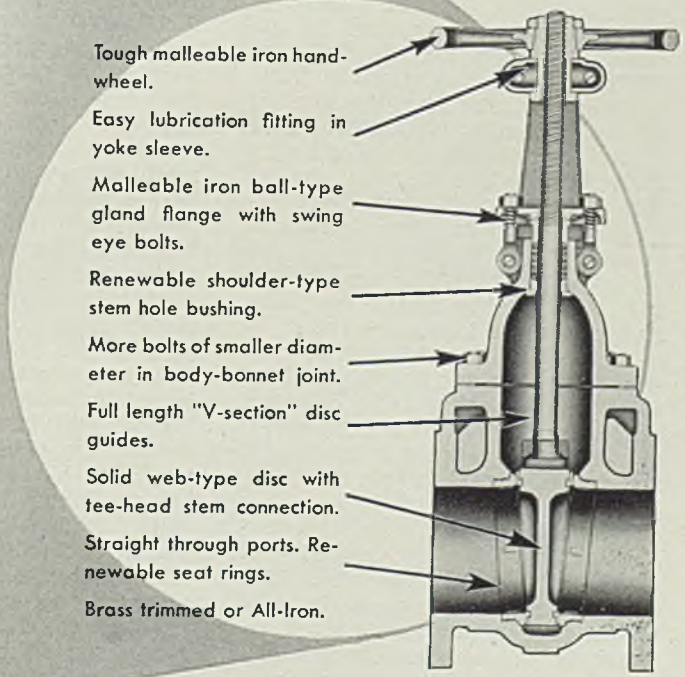

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Table II—Effect of Composition on Sand Defects

Sand defects, per cent	No. of casts	Average Carbon, per cent	Average Silicon, per cent	Average Defects, per cent
Less than 1.0	23	0.55	0.274	0.55
1 to 2.9	56	0.57	0.271	1.96
3 to 4.9	62	0.55	0.274	3.84
5 to 7.9	34	0.60	0.277	6.06
8 to 9.9	11	0.66	0.286	9.16
Over 9.9	13	0.66	0.288	12.99

Table III—Grouping According to Carbon Content

Carbon, per cent	No. of casts	Carbon, per cent	Silicon, per cent	Defects, per cent
0.40 to 0.49	60	0.45	0.282	3.2
0.50 to 0.59	40	0.55	0.268	3.43
0.60 to 0.69	56	0.62	0.273	4.82
Over 0.69	43	0.72	0.283	5.49

Table IV—Grouping According to Silicon Content

Silicon, per cent	No. of Casts	Average Carbon, per cent	Average Silicon per cent	Average Defects, per cent
0.23 to 0.259	50	0.57	0.246	3.12
0.26 to 0.279	56	0.57	0.268	3.99
0.28 to 0.299	62	0.56	0.286	5.1
0.30 and over	31	0.63	0.311	5.0

Table V—Classified According to Silicon Content

Carbon, per cent	Casts under 0.27 per cent Silicon: No. of casts	Casts under 0.27 per cent Silicon: Defects, per cent	Casts over 0.27 per cent Silicon: No. of casts	Casts over 0.27 per cent Silicon: Defects, per cent
0.40 to 0.49	20	2.7	40	3.4
0.50 to 0.59	24	2.8	17	4.4
0.60 to 0.69	23	3.4	33	5.6
0.70 and over	15	4.4	28	6.0

also put an end to the danger of stopper and nozzle sticking together when they got hot and plastic. It was also found necessary to enlarge the stopper end.

With these modifications in ladle equipment, controlling the rise of metal in the mold, to the point where the metal tended to cream or ice on the rising surface, became practicable. In spite of this practice occasional casts are tapped at temperatures so high that cracking of the ingot occurs. When this happens the mill observer has to use his judgment when the ingots are rolled. If the cracking is slight and he considers the defects resulting will be satisfactorily dealt with by chipping or flame dressing the billets, he allows rolling to proceed. If the cracks are more severe than this, the ingot is sent back after the first few passes and stood up in a water-cooled steel box having vertical slots down each of its four sides. The cracks are then dressed out by means of an oxyacetylene torch, inserted through the slots. In this way cracks can be dressed out in about one-tenth of the time it would take if the ingots were allowed to go cold, and of course the necessity for heating up again from the cold is eliminated. The mill also made considerable improvements in the heating practice and took the necessary steps to eliminate overfilling of the passes; roller twist guides were introduced to do away with the guide scratching, which was a continual source of trouble, particularly on the smaller billet sizes, 2½ inches square and under.

On certain qualities of steel it was found advantageous to do the rolling in two steps, and bloom-heating furnaces were provided to permit of this being done. This secondary scaling of the surface eliminates many small surface defects which might otherwise give trouble. It is now established that the close cooperation of melting shop and mill, helped by the detailed information which the metallurgical observers were able to provide, resulted in a steady improvement from year to year in the quality of the product.

In any process where a large number of factors play a part, examination by statistical methods is often by far the quickest way of determining if this or that particular item has any influence on the ultimate results. As an example, it was suggested a few years ago that putting ingot molds into service soon after they were cast had an adverse effect on the life; that resting them for a period before putting into service might prove beneficial. The results obtained on 682 molds of a standard size and after careful examination are shown in Table I.

The results of this test are far more convincing than putting, perhaps, six molds into service immediately after casting and comparing them with six molds which had been allowed three months' rest. One or the other group might show the longer life, due to factors apart from the one under consideration. It becomes necessary to take a number large enough to ensure the equalization of the many other interfering factors.

The following is a good example: Some years ago considerable trouble arose owing to sand inclusions in tire steel. An examination was made of 199 casts of steel, all made in 12 x 14-inch molds. These casts were arranged, in the first place, according to the incidence of sand defects, and the averages were taken out for a large number of items, which, it was thought, might have a bearing on the results. The two items which showed any marked variation were the carbon and silicon content of the steel (Table II).

The casts grouped according to their carbon content is shown in Table III.

The casts grouped according to their silicon content gave the results shown in Table IV.

The casts were next split into two groups, 0.27 per cent silicon and less, and over 0.27 per cent silicon and then subdivided according to their carbon contents (Table V).

The influence of carbon will be noted on casts having a similar silicon, and the influence of silicon on casts having similar carbon. The carbon content required is governed by the tensile strength called for, but the silicon content is within the control of the steelmaker.

Dressed Before Heating

The sand defects have been reduced from an average of 4.2 to 0.3 per cent. The biggest single factor, perhaps, in bringing about this reduction was the institution of systematic examination and dressing of the tire blanks before charging into the heating furnaces. The chippers are paid a bonus according to the results achieved. This bonus is in two parts. One part is based on sand defects found in the tires; it reaches a maximum with no sand defects, and is nil if the defects are 3 per cent or more. With this inducement alone, the chippers would be inclined to reject any doubtful blank, and so the other part of the bonus is based on the chipping results. If no blanks are scrapped, the bonus reaches the maximum; if 3 per cent or more blanks are scrapped, no bonus is paid. It is to the chippers' interest, therefore, to make every blank good, and they draw attention, in no uncertain fashion, to any cast below par. This gives the steelmaker a chance to see any defective steel at a stage when the class of defect is beyond dispute, a much more satisfactory method than viewing the defective tires when the cause of the defect has been largely obscured during the process of heating and rolling.

Another example which may be

(*Please turn to Page 93*)

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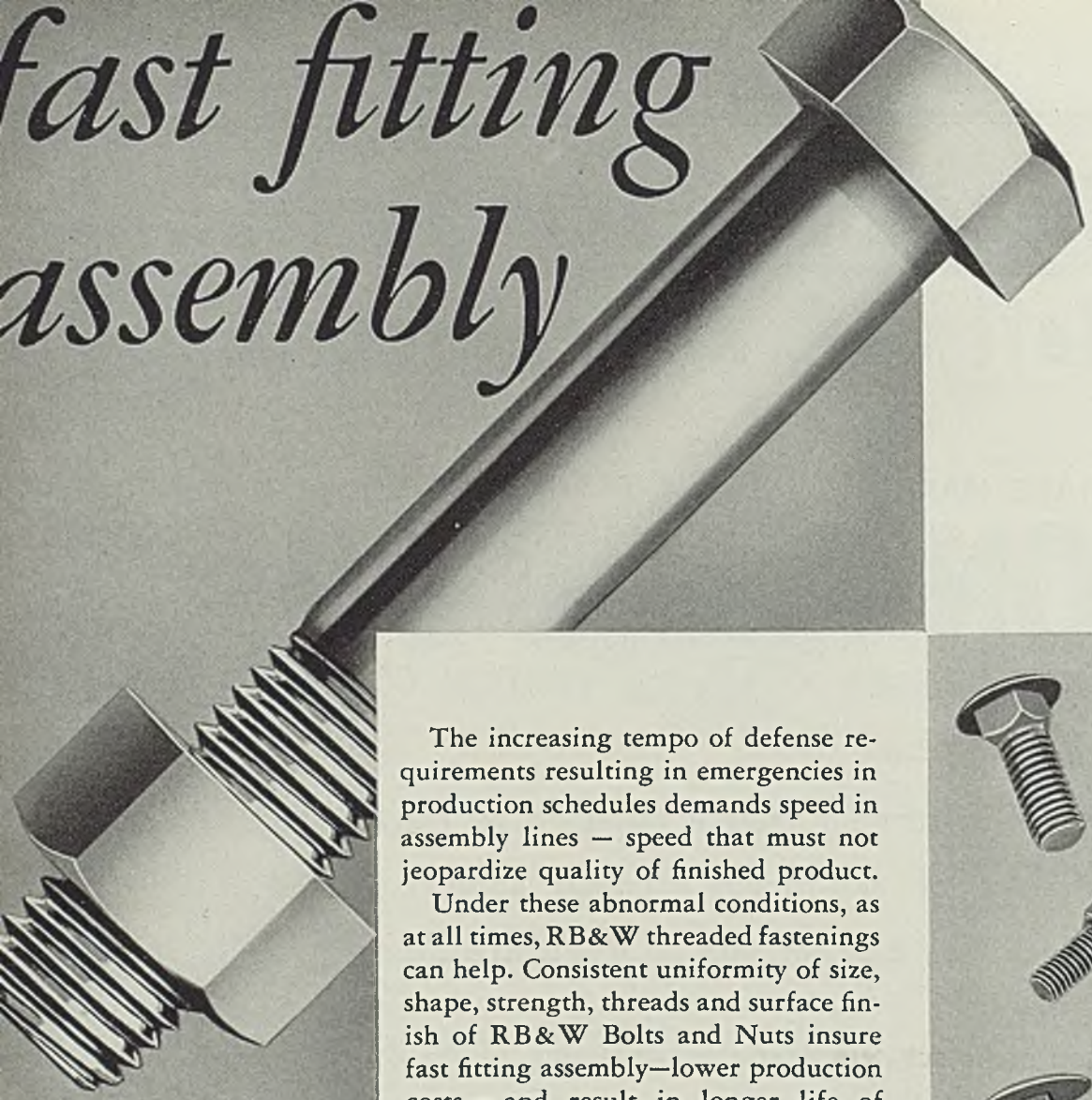
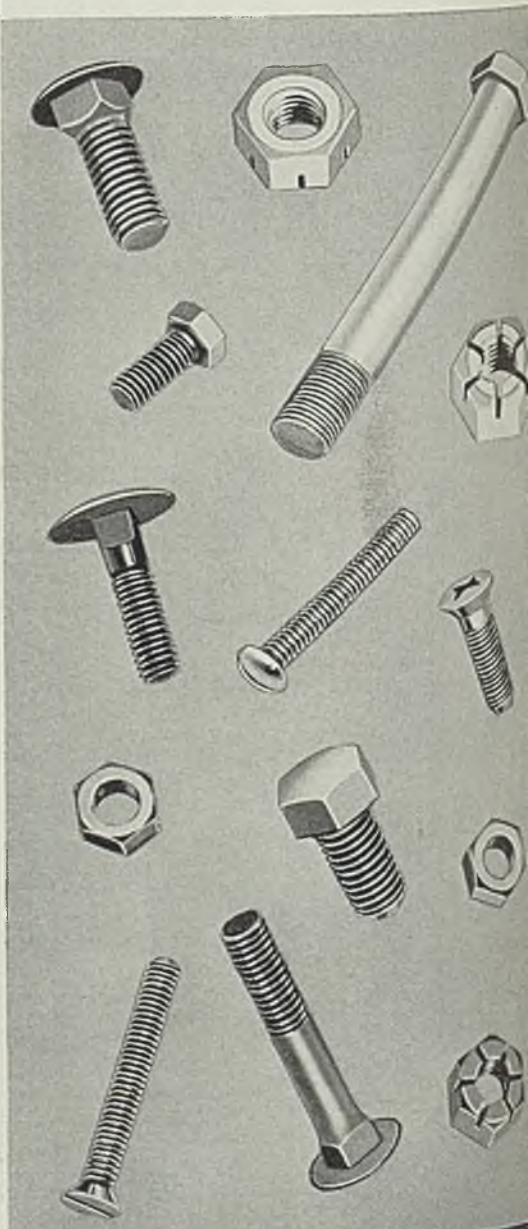


The increasing tempo of defense requirements resulting in emergencies in production schedules demands speed in assembly lines — speed that must not jeopardize quality of finished product.

Under these abnormal conditions, as at all times, RB&W threaded fastenings can help. Consistent uniformity of size, shape, strength, threads and surface finish of RB&W Bolts and Nuts insure fast fitting assembly—lower production costs — and result in longer life of finished product.

New plant additions, increased manufacturing facilities, the latest in improved equipment — all have been recently added to RB&W facilities to enable the production of EMPIRE Bolts, Nuts, Rivets and other Threaded Industrial Fastenings in sufficient quantity to better fill today's demands of industry.

Since 1845, RB&W has learned how to keep pace with progress and rapidly meet new and changing industrial demands for modern threaded fastenings. And today, RB&W offers everything required in quality industrial fastenings, supplied to meet modern service demands and at no premium in price—regardless of rushed business conditions.



BOLTS: Carriage - Machine - Lag - Plow - Stove - Elevator - Step - Tap - Wheel & Rim - Battery - U-Bolts - Tire - Automotive - Drilled - Faced - Special Heat Treated, etc. - **NUTS:** Cold Punched - Semi-Finished - Hot Pressed - Case Hardened - Slotted - Castle - Machine Screw - Marsden Lock - Low Sulphur - **RIVETS:** Standard - Tinners' - Coopers' - Culvert - Clevis and Hinge Pins - **SCREWS:** - Cap - Machine - Hanger - Sheet Metal - Phillips Recessed Head - **WASHERS:** Plate - Burrs - **MATERIALS:** Steels - Alloys - Brass - Bronze - Naval Brass - Everdur - Herculoy - and others - **RODS:** Stove - Seat - Ladder - **PLATED PARTS:** Cadmium - Zinc - Chromium - Nickel - Hot Galvanized - Copper - Tin - **SPECIAL UPSET & PUNCHED PRODUCTS.**

€ 350

BOLTS EMPIRE NUTS-RIVETS

RUSSELL, BURDSALL & WARE

BOLT AND NUT COMPANY

PORT CHESTER, N. Y. ROCK FALLS, ILL. CORAOPOLIS, P

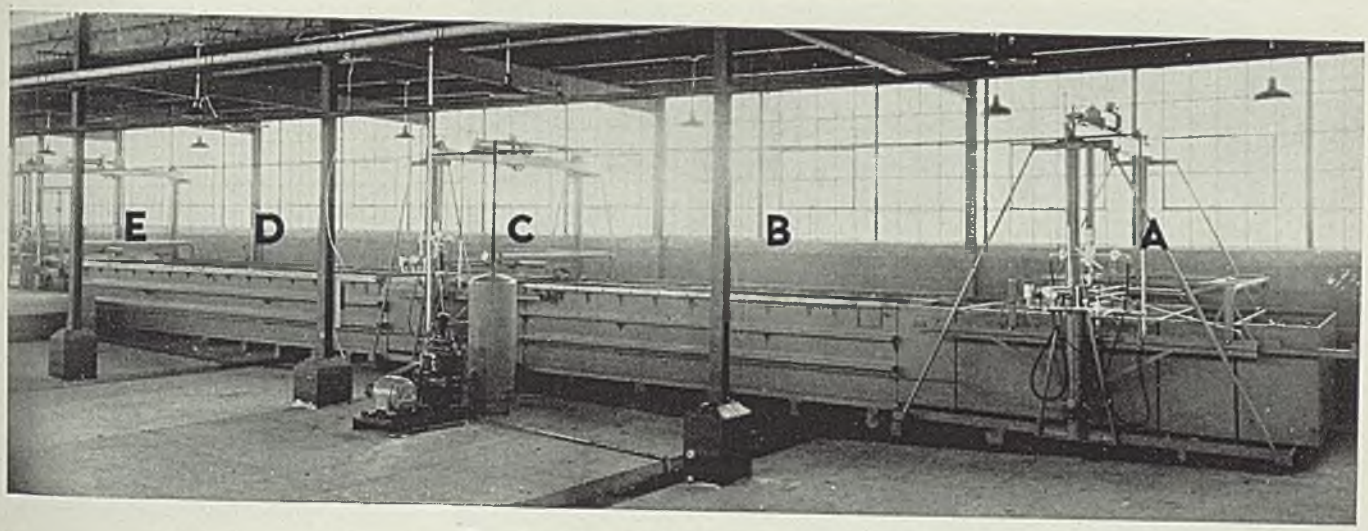


Fig. 1—Automatic copper and nickel plating machine consists of five units set in line. These are A, copper cleaning unit; B, copper plating; C, copper rinse; D, nickel plating; E, nickel rinse—with automatic transfers at A, C and E

HIGH-PRODUCTION FINISHING

of diecastings

Huge volumes of diecastings are finished daily in new plant equipped with a new type of unusually flexible automatic equipment for copper and nickel plating. Typical cycle of finishing operations from burnishing or polishing through copper, nickel and chromium plating, filling of enamel and so on is also presented

■ THE NEW plant of Gerity-Adrian Mfg. Corp. at Adrian, Mich., is of unusual interest to metal finishers because of the number of special facilities provided for finishing an enormous volume of zinc alloy diecastings—largely for the automotive industry.

The automatic copper and nickel plating equipment, handling 270 racks of work per hour, consists of five separate units. These units have no connection with one another but are set in line so as to work in series automatically. Transfer units with long arms overlap the plating tanks to provide means for transferring the racks from one machine to the next in line.

The unusual advantages of such an arrangement include: First, the elimination on this machine of the need for 87 feet of superstructure and an 87-foot drive shaft; second, a great reduction in number of moving parts and elimination of gears and other highly machined parts; third, speed of transfer is flexible as any one of the four directions of travel can be changed independently of the other three. Thus, unlike a mechanical transfer where the speed is the same during the entire cycle, the up-and-down, forward or return travel can be changed at will independently. For example, a slow up movement for drainage and a fast forward movement with slow down travel or any other combination can be had.

Fourth, the fact that the tanks can be split allows two different cycles of work to be run on the machine at the same time. In this case, for example, two rows of work can be run through a bright nickel and two through a white nickel, if so desired. Although at the present time all four racks are being run through on bright nickel, a change in the future can readily be made. Another important advantage obtained is that the absence of any superstructure and the fact that the five units are independent of each other allows any change in cycle to be arranged as desired to meet future requirements. And such a rearrangement can be made at nominal cost.

By G. E. HUENERFAUTH
Crown Rheostat & Supply Co.
Chicago

Let's see how it's done:

Fig. 1 shows view of this automatic machine before it was installed in the pits in the plant which bring the tops of the tanks at a convenient working height for the operators. This machine consists of five individual units—copper cleaning unit, A Fig. 1; copper plating unit at B; copper rinse at C; nickel plating unit at D; nickel rinse unit at E. The overall length of these five units is 87 feet. With loading and unloading stands, the total is 93 feet. The overall width is 13½ feet, overall height also 13½ feet. The 104-inch width of the tanks allows four separate lines of work to move down the machine simultaneously. The four racks across the unit are hung on a common copper rod. When this is picked up and carried along the plating tank, the four racks are taken through the plating cycle together.

Work comes to the plating machine on a chain conveyor from which it is removed and placed on the racks at the loading stand ahead of the line just to the right of A Fig. 1. With four racks loaded on a rod, it is pushed into position by the operator for transferring onto the first unit.

This first machine, the copper

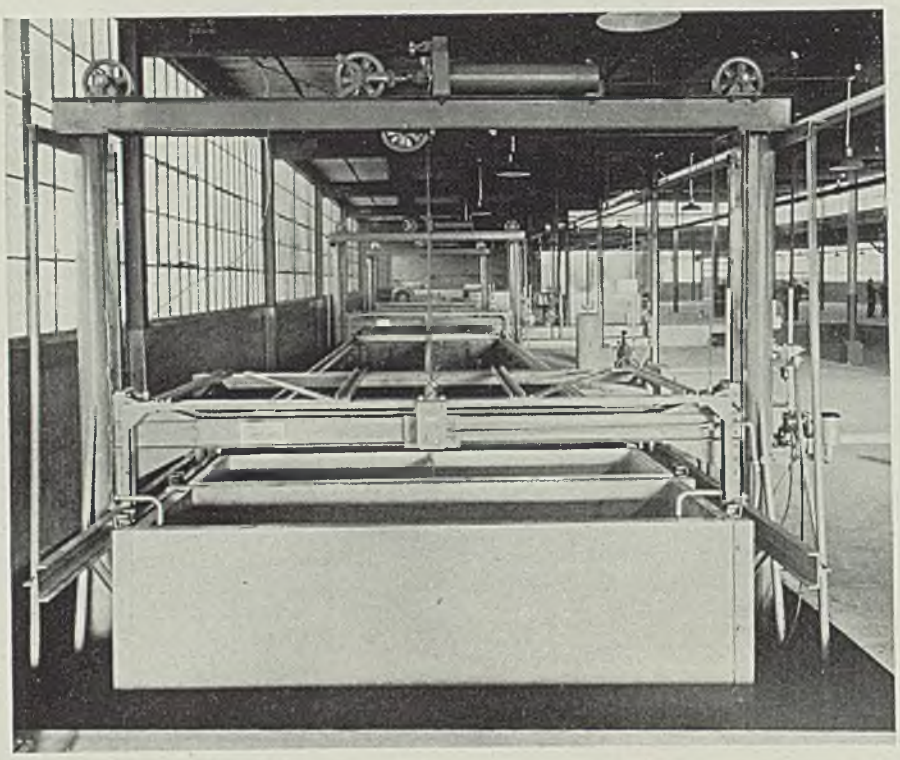


Fig. 2—Closeup of automatic transfer unit at E, Fig. 1

cleaning unit at A, has six tanks served by a pneumatically operated pickup which lifts the racks off the loading stand and automatically transfers them through the six tanks in sequence and into the copper plating machine at B. Method of transfer will be detailed later. In these first six tanks, the work passes through an electrified alkali cleaner, a warm rinse, a 0.3 per cent sulphuric acid dip, two rinses and a cyanide dip, respectively.

The second unit consists of two copper plating tanks at B Fig. 1, each 21 feet long and placed side by side. On the outside of the pair of tanks is mounted a conveyor chain and bus bar. The rods from which the four racks are hung reach across both tanks and rest upon the bus bars on the outside. The conveyor chain slides the rod forward through the tanks, using the bus bars as rails. These two tanks are bussed for a total of 8000 amperes. Current is supplied by a 6000-ampere generator.

It requires 11 minutes for the racks to travel the 21-foot length. Copper plating solution is the conventional Rochelle salt solution, held between 163 and 170 degrees Fahr. A current density from 30 to 50 amperes per square foot usually produces a copper plate ranging from 0.0003 to 0.0005-inch thick. Each tank has a pump which passes the solution through a continuous filtering unit, then into heat exchangers and back to the tank for agitation.

When the rack reaches the end of the copper plating tank, the overlapping arm of the transfer unit at C automatically lifts it out of the copper plating tank and deposits it in the first of a series of rinses in the third unit at C. Here four tanks are provided through which the work passes sucessively—two rinses, an 0.75 per cent sulphuric acid dip and a water rinse. From the last rinse, the transfer unit automatically sets the racks into the nickel plating tank in the fourth unit at D.

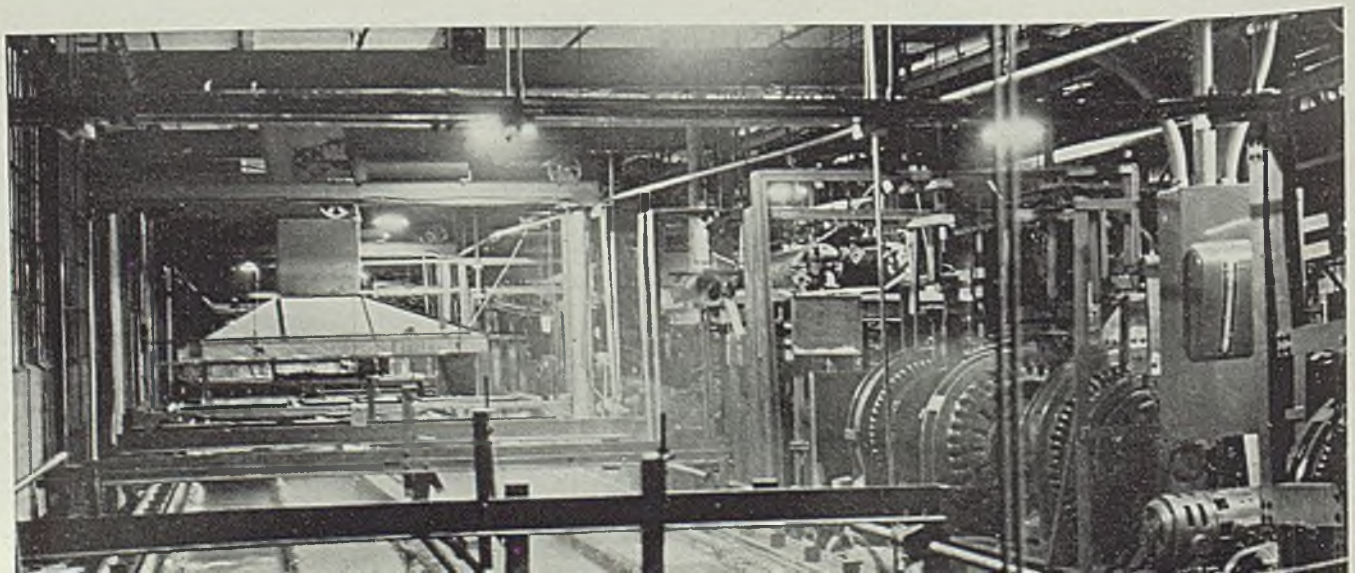
The nickel plating machine at D likewise is made up of two tanks set side by side with conveyor chains and bus bars on the outside. These two tanks are each 34 feet long; are rubber lined; are bussed for 16,000 amperes have pumps, filters and heat exchangers, as do the copper tanks. All plating tanks have bottoms sloping from each end toward a center sump where the pump suction is connected with return from the pump being at both tends of the tank. Thus movement of the solution has a tendency to wash any sediment toward the suction pump where it can be removed and filtered out.

The bright nickel solution is maintained at 135 degrees Fahr. plus or minus 2 degrees, a current density from 50 to 80 amperes per square foot applying plate varying from 0.0009 to 0.001-inch thick. Three generators having a combined capacity of 13,000 amperes supply the current.

The fifth and last unit in the line, E Fig. 1, is a nickel rinse consisting of two tanks—a cold rinse and a hot rinse. The work is deposited automatically by a transfer unit from the end of the nickel tank into the two rinse tanks in succession. Upon leaving the hot rinse, the work is deposited on the unloading stand automatically by the transfer unit.

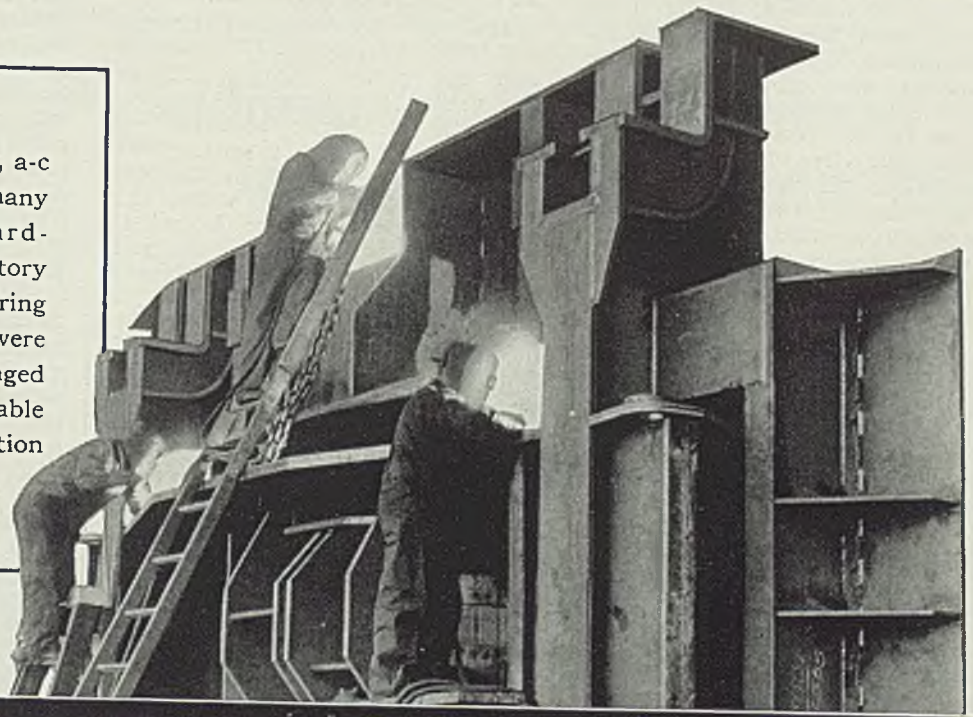
Total time from the loading to the unloading stand is 41 minutes.

Fig. 3—View of line after installation was completed with plating motor-generator sets at right, bus bars overhead, tank lineup at left

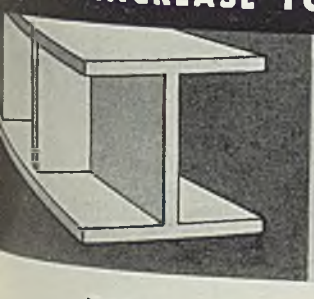


Here's where you can work wonders with A-C WELDING!

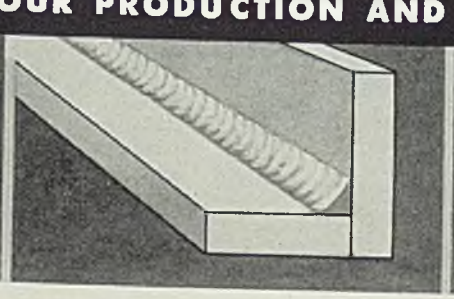
WHILE not a cure-all, a-c welding *has* helped many operations that were hard-pressed to show a satisfactory profit. Countless shops, desiring higher speeds than they were getting with d-c, have changed over to a-c with very profitable results in reduced production time and improved welds.



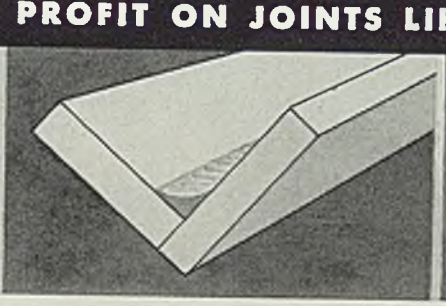
INCREASE YOUR PRODUCTION AND PROFIT ON JOINTS LIKE THESE



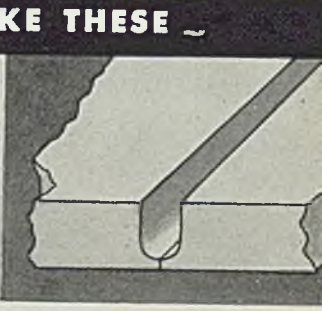
Welding In Corners — where magnetic blow prevails—reworks and rejects of unsound welds caused by magnetic blow are reduced to the minimum with a-c welding. The use of higher currents and larger electrodes on work like this also results in faster welding.



On Horizontal Fillets, welding speeds can be increased 15 to 30 per cent, especially on currents above 200 amp. One shop, for example, was producing 11 linear feet of $\frac{5}{16}$-in. horizontal fillets per hour, using d-c welders and $\frac{3}{16}$-in. rods. After changing to a-c, welding current was successfully increased to permit use of $\frac{1}{4}$-in. electrodes, and *15* ft. of welded joint were produced per hour. A-c welding, in this case, increased production speed 36 per cent.



Flat Fillets—On this type of joint where high travel speeds are possible with the aid of high-melting-rate electrodes and heavy currents, the elimination of *magnetic blow*, by means of a-c welding with its easily controlled arc, permits the use of the maximum currents and largest electrodes your work can stand.



If You Weld Deep-groove Bu Joints, where large electrodes, high d osition rates and thorough penetrat are paramount factors, a-c welding off many advantages in speed and finish quality that are impossible to obta with d-c. The uniform, sound we obtained with a-c on this type of wo are readily indicated by an improv appearance and are *proved* by testi and X-ray inspection.

If your work includes any or all of the types of joints illustrated above, there's a good possibility that a-c welding can be applied to your operations with *an extra profit for you.*

Your nearest G-E arc welding distributor will be glad to demonstrate a-c welding on your work—no obligation. His recommendations will be unbiased, *based only on what will give best results.* He can do this because he carries the G-E line of welders—the most complete line of welders on the market.

For complete and *reliable* information—see your G-E arc welding distributor or G-E office today. If you prefer, write direct to General Electric, Schenectady, New York.

GENERAL ELECTRIC

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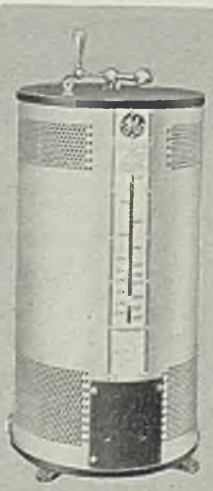


New 300-amp a-c welder, transformer type, similar to the 500-amp size. Running gear

During this period, the racks have been transferred in and out of 14 different tanks by means of three transfer mechanisms, each of which operates as follows:

Fig. 2 shows closeup view of the nickel rinse tanks at E Fig. 1 as viewed from the unloading stand. This picture, taken before the installation was complete, is presented since it shows better detail of the transfer equipment. Fig. 3 is a similar view of the completed installation. Each transfer unit is controlled by two air cylinders, one which operates the lift mechanism vertically, the other one operating the horizontal or transverse motion of the frame. There are four sliding bronze shoes, two for the vertical motion are mounted on the cylindrical posts at each side of the tank lineup and two others carried on the frame to allow horizontal movement.

The two air cylinders actuate the frame by means of two cables and five power sheaves. Three air valves are arranged to produce the following sequence of motions: As a rod carrying four racks and traveling down the preceding tank strikes a valve, the vertical power cylinder is actuated lifting the frame and the rod with its load clear of the tank. When it reaches its top position, a limit valve is actuated, causing the horizontal power cylinder to move the frame horizontally one transfer length—the distance between the successive tanks. As this motion is completed, the vertical power-cylinder is again actuated automatically to lower the entire frame, depositing the rod and its load in the next tank. With its load deposited, the frame automatically travels horizontally to the pickup position. With each movement of the frame, of course, a complete set of racks is moved simultaneously from each station to the next in line.

The simplicity of this arrangement and the fact that it eliminates all overhead superstructure are important. For instance, the number of parts is the same on the first unit at A, which has seven transfers as on the fifth unit at E Fig. 1, also shown at Fig. 2, which has but three. In addition, as mentioned previously, such an arrangement eliminates lengthy drive shafts, affords any desired time cycle for the various steps in the transfer and allows rearrangement of the entire sequence of the operations at will.

Now let's see how this equipment ties in with a typical complete sequence of operations at the Adrian plant.

Burnishing: Some diecastings are tumble burnished in dry wood-lined barrels in three steps—coarse, medium and fine. In the first step, fruit pit granules and an abrasive are used with barrels turning at 21 revolutions per minute; second and third steps employ sawdust with a fine abrasive such as tripoli, the barrels turning as slow as 17 revolutions per minute.

Polishing is done on abrasive coated cloth wheels. Automatic machines where the work is carried in succession under a series of polishing heads also are used on certain parts.

Cleaning: A neutral emulsion of synthetic and organic solvents is used, the sequence including a soak for 45 seconds at 190 degrees Fahr., followed by a spraying of the same solvent in the second stage, rinsing in water at 120 degrees Fahr. and then at 130 degrees Fahr. A continuous flotation system removes most of the sediment from the cleaning solution. This, with filtration once every 32 hours, enables a 50 per cent recovery.

Copper and nickel plating is handled in the automatic equipment described above.

Chromium Plating: With the diecastings copper and bright nickel plated, little buffing usually is required to prepare for chromium plating. After going through a 25-

(*Please turn to Page 96*)

Advertisement

JUNE, 1941

COPPER ALLOY BULLETIN

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

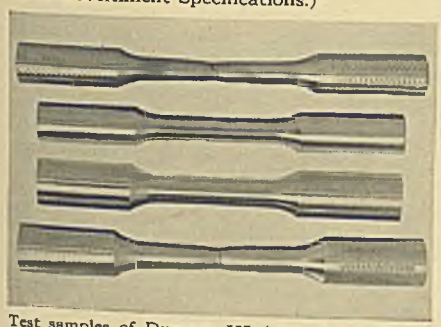
Prepared Each Month by the Bridgeport Brass Co. "Bridgeport" *Headquarters for BRASS, BRONZE and COPPER*

Test Proves Duronze III is Stronger, Lighter

Recently completed tests show that the superior strength and low specific gravity of Bridgeport's Duronze* III permit an extremely large saving in weight over many other frequently used alloys. A typical contrast in characteristics is as follows:

	Duronze III Rod (Annealed)	Naval Brass Rod (Annealed)
Breaking Strength lbs./sq. in. . . .	18,000	17,200
Tensile Strength lbs./sq. in. . . .	91,800	61,000
% Elongation in 2"	32	38.5
Bend Test	O. K.	O. K.
Rod Diameter . .	.4995"	.599"
Weight lbs./100 ft.	65	104

(The Naval Brass Rod tested was made to U. S. Government Specifications.)



Test samples of Duronze III (above) and Naval Brass (below).

Among other advantages of Duronze III are its hardness, high corrosion resistance, machinability, and ease of hot working.

There are unquestionably many applications where this extremely strong, lighter-weight alloy can make substantial improvements in products now made with other materials. For further information write for Duronze III Technical Bulletin.

Unusual Valve Uses Bridgeport Brass

The Cadwell #25 Relief Valve is called the only diaphragm-operated, self-closing or re-seating temperature and pressure valve. The construction is said to prevent any possibility of sticking seat. It must relieve, it is reported, when its pre-determined relieving point—either temperature or pressure—is reached.

Bridgeport Brass is employed in the brass components of the valve because of its excellent resistance to corrosive attack, high strength and other good qualities. Maker of the valve is The Beaton & Cadwell Mfg. Co., New Britain, Conn.

Additional Factors Considered in Replacing Brass with Copper

Properties to be Compared include Tensile Strength, Ease of Manufacture, Season Cracking, Conductivity, and Color

Last month's COPPER ALLOY BULLETIN described some of the differences between copper and commercial high brass when both metals are in the annealed condition. The curves shown with that discussion may be considered together with the curves which accompany this article and which show how the two types of copper previously discussed differ on cold working from brass. In the previous curves no values for contraction of area were given in the interest of simplicity. In the present curves no values are given for grain size, because the size of the grain structures is not changed by cold working.

How Tensile Strengths Differ

The differences in the tensile strength in the annealed condition as shown by the previous curves are increased by cold working. Although there is a slight difference between the two types of copper, coppers and high brass differ considerably in this respect. It is obvious, therefore, that if strength or hardness is an important factor in the use

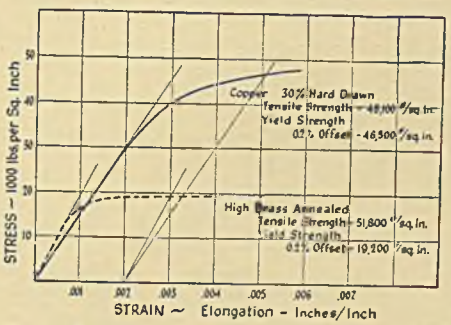


Fig. 1. Comparative stress-strain characteristics of hard drawn copper and annealed high brass.

of the finished product, copper will not constitute a useful substitute. This is the reason, for instance, why copper cannot be substituted for brass in cartridge cases.

There are some instances, however, in which brass must be finished by an annealing operation, but in which copper can be finished and left in the cold worked condition. In such cases, the copper may actually be stronger than the annealed high brass and thus serve its purpose better than the brass it replaces. This may be true even though the tensile strength of the cold worked copper is no higher than that of the annealed brass. The reason for this apparent anomaly is the increase in yield strength of cold worked material. This is illustrated in the stress-strain diagram. (Fig. 1.)

In addition to these borderline cases there are many cases in which strength is not as important a factor as is ease of manufacture, for instance. In such cases copper may readily be used in place of brass.

Reworking of Copper, Brass

In the previous discussion it was pointed out that copper could not be worked as severely as brass in a single operation but that it could be reworked without intermediate annealing more than brass. An examination of the curves in Fig. 2 will indicate the reason for this. At the left of the graph the properties of the annealed materials are indicated at the intersections with the vertical line marked "soft." It will be seen that brass has appreciably higher elongation and

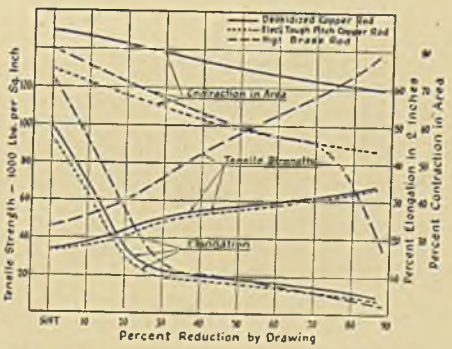


Fig. 2. Comparative properties of high brass and copper in the cold worked condition.

strength, but it also will be observed that its contraction of area is not as high as the deoxidized copper.

It is apparent, then, that brass can be stretched more before breaking than either type of copper, and this is confirmed by experience. After cold working by stretching—or by stretching and ironing—to a reduction of 30 to 40%, its physical properties are changed more than copper. This is particularly true regarding contraction of area and tensile strength. Although further simple stretching operations of either metal are not feasible, they both can be drawn by ironing operations. The deoxidized copper can be drawn more severely before its contraction of area drops off to the point where it becomes susceptible to failure due to notch effects. Another factor which enters into the commercial application of these properties is the increased power required to redraw brass compared with that required for the lower strength copper. Therefore, from the

(*Continued on page 2 col. 2*)

COPPER ALLOY BULLETIN

ALLOYS OF COPPER

This is the twenty-fourth of a series of articles on the properties and uses of copper alloys, and continues the subject of modifications of the copper-zinc alloys.

ADDITIONS OF LEAD TO COPPER-ZINC ALLOYS

Of all the elements which are added to the copper zinc alloys or occur as impurities, lead is by far the most important. Although the only desirable property conferred by lead is an increase in machinability, this is such an important improvement that lead is added to many of the standard alloys. If it were not for the difficulties in processing due to the presence of lead, these additions would be even more generally made.

Forms A Mechanical Dispersion

The effect of lead in copper alloys is explained by the fact the lead is not dissolved in solid copper or copper alloys. The lead therefore is distributed as solid particles mechanically dispersed in the matrix of copper-zinc solid solution. In general, the more finely and uniformly dispersed these particles are, the more satisfactory the resulting alloy. When such an alloy is machined, the particles of relatively weak metal in the chip cause the chip to break up into fine pieces which are easily removed from the vicinity of the cutting surface. This in turn reduces the pressure on the cutting tool.

Proportions of Lead Used

This same dispersion of lead particles leads to difficulty in hot working some of the copper-zinc alloys. This is due to the fact that at the temperatures at which brass is hot worked, the lead is molten and these molten particles of lead cause intercrystalline weaknesses which result in intercrystalline cracking. In the alloys containing from 55% to 63% of copper, another copper-zinc solid solution exists in considerable quantity at hot-working temperatures. This second solid solution is much more ductile at high temperatures and the lead does not have as injurious an effect as in the higher copper alloys.

For these reasons, most of the leaded alloys are those in which the copper content is in the 55% to 63% range. All other copper-zinc alloys which contain lead are so sensitive to high temperatures that much care must be used in processing and fabricating them to avoid difficulty.

The leaded alloys will be discussed in more detail in this column next month.

Properties of Copper

(Continued from page 1 col. 3)

standpoint of ease of manufacture, copper and, in particular, deoxidized copper have a definite advantage over brass for certain types of work.

Season Cracking, Conductivity

There is another advantage in copper and that is the freedom from failures due to season cracking. While such failures can be largely eliminated by care in processing brass, they are still an occasional source of difficulty which the use of copper would entirely eliminate. While electrical conductivity is not normally a property in which the present use of high brass is involved, the greater electrical and thermal conductivity of both types of copper as compared with high brass must be borne in mind. In some applications of high brass, such as those which involve spot welding, the high conductivity is a distinct disadvantage and other ways of joining the copper parts would have to be used. Both types of copper can be readily joined by soft soldering, but if this is to be done without loss of strength or hardness in the copper, the supplier should be so informed, to enable him to supply a copper which will have the necessary higher softening point. Such material may be secured in either the electrolytic tough-pitch or the deoxidized copper grades.

Both Colors Are Pleasing

The difference in color is one other difficulty which may arise in the substitution of copper for high brass. With pieces to be plated this is not important, but in other articles it may cause some question. The general public has come to regard brass as a satisfactory permanent metal of a pleasing yellow color. It should not be difficult to show that copper is of equal permanence and that its natural red color may be equally pleasing to everyone.

New Factory Built With Copper, Brass

Bronze bolts replace nails and rivets; copper shoes are used to tie wood beams in the joints; and brass, copper and other nonferrous materials are used for conduits, pipes, girders and many other structural parts, in a recently completed factory of a Long Island instrument company, in order to secure non-magnetic construction.

NEW DEVELOPMENTS

Electric polishers have been developed for cleaning and polishing metal and removing stains. While designed for use with special brushes for polishing, the tools may be readily converted by the user into portable electric drills. **(No. 200)**

A marking process impresses number, words or trademarks on enameled brass or bronze surfaces without engraving. The new method is said to reduce marking time by at least ten to one and to give more attractive results. **(No. 201)**

A six-station turret lathe is reported to be designed especially to satisfy the demand for a simple, plain-head, hand-operated screw machine which does not require a highly skilled operator. **(No. 202)**

A variable speed lathe, capable of speeds as low as 20 rpm. for lapping work and as high as 4000 rpm. for rotating heavy work, is offered for final finishing operations, such as polishing, filing and burring. A quick-acting, automatic brake is included. **(No. 203)**

A file holder intended to provide an easier, more positive, better balanced method of gripping surface files is announced. It provides a planer-like grip, with a front handle that improves the handling of various types of files. **(No. 204)**

A recessing tool has been developed for use in internal work to groove, undercut, neck, or face. The tool bits are said to be readily adjusted. Applications include screw machines, turret lathes, drill presses and horizontal boring mills. **(No. 205)**

A milling cutter for external work on rods, tubes, and other circular parts up to 4 inches in diameter has teeth which lie at different angles to provide a shearing cut and to eliminate the chance of chattering, according to the maker. **(No. 206)**

A rotating pipe joint now has renewable bronze wearing plates to back up the carbon-graphite rings. Pipe sizes handled include 3- to 6-inch. Pressure capacity is 150 pounds, it is stated. **(No. 207)**

Hard-soldering materials and fluxes, said to develop high tensile strengths, for use with copper and bronzes, are now being made in this country. **(No. 208)**

A drill press attachment is said to provide an ideal and economical means of acquiring both lower and higher speeds than could otherwise be attained on either high speed or low speed models. The multi-speed unit is quickly removed and easily adjusted. **(No. 209)**

This column lists items manufactured or developed by many different sources. Further information on any of them may be obtained by writing Bridgeport Brass Company, which will gladly refer readers to the manufacturer or other source.

We're on the job day and night!

"A shipbuilding company required 7 tons 1" Bamboo Bars — cut to lengths, in connection with building new docks to meet the Navy Department's demand for early delivery of ships. They were short 7 tons on mill shipments. Order was received by us at 10:35 a. m. and material was in customer's plant in New Jersey at 12:15 p. m."

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Reducing Dross Formation in Hot Dip Galvanizing

Use of zinc ammonium chloride as a galvanizing flux offers distinct advantages in that it effects a reduction in iron salt carryover into galvanizing kettle and promotes smoother, more ductile and more adherent coating. Treatise describes tests to show difference in quantity of dross produced when using this salt as a predip compared with hydrochloric acid

By R. J. KEPFER and L. D. EUBANK
Chemists
E. I. du Pont de Nemours & Co.
Grasselli Chemicals Dept., Cleveland

■ FOR MANY YEARS the usual practice for galvanizing iron or steel consisted of pickling the metal in acid solutions, rinsing in water and then storing in or treating with a dilute solution of muriatic acid in order to hold rusting to a minimum until the metal reached the galvanizing pot. It has long been recognized that one of the sources of dross in the galvanizing pot is iron which comes from the metal which has been predipped in the dilute muriatic acid solution.

It was not until about the beginning of the last decade that zinc ammonium chloride began to be extensively used as a galvanizing flux. At about this time the galvanizing industry in general learned that zinc ammonium chloride could be successfully used not only as a top flux in place of sal ammoniac, but also as a predip in place of the dilute muriatic acid used previously for this purpose.

Considerable doubt still exists in the minds of many galvanizers as to how much reduction in dross formation may be expected from the use of zinc ammonium chloride preflux solutions.

It was thought that conclusive data could be obtained on the advantages of using zinc ammonium chloride predips in miscellaneous galvanizing operations, such as those carried on in job, hand dip, wire or pipe galvanizing plants by dipping known areas of steel in the two types of predip solutions, allowing them to stand for fixed lengths of time, dipping them into molten zinc and observing the amount of iron dissolved by the zinc.

The test procedure consisted of cutting SAE-1020 hot-rolled black sheets (sheets were chosen in preference to castings, stampings, etc., because of ease of handling and calculating amount of surface galvanized) into pieces 3 x 4 inches, pickling them in 8.5 per cent sulfuric acid at 160 degrees Fahr. for four minutes, rinsing by dipping into running tap water three times, immersing in the preflux solution for two minutes and then standing in room atmospheres for periods of three, 10 and 50 minutes. In accordance with general plant practice, the predips containing zinc ammonium chloride were kept at about 160 degrees Fahr. and muriatic acid solutions at room temperature. After standing the pieces were galvanized by immersing for a period of 45 seconds in molten No. 1 grade zinc held at 860 degrees Fahr. after which they were withdrawn and given a quick shake to remove excess zinc. The zinc was contained in a small glass beaker partially immersed in a much larger zinc bath and was covered with a thin layer of top flux maintained by occasional additions of zinc ammonium chloride and glycerine. No iron could get into the beaker of zinc except that origmally present and that which came from the steel sheets.

The zinc was analyzed for iron content and then 16 sheets were dipped into it (representing an average 8-hour production in an average commercial zinc pot with respect to ratio of surface galvanized to weight of zinc in the pot) and the

(*Please turn to Page 95*)

From a paper presented before the American Hot Dip Galvanizers' Association, Pittsburgh, Feb. 27-28.

Table I—Grams of Iron Taken Up by the Galvanizing Bath Per 384 Sq. In. of Surface Galvanized

Time of standing after predipping, minutes	Predip Solution Used: 20% zinc ammonium chloride, grams	35% zinc ammonium chloride, grams	50% zinc ammonium chloride, grams	3% muriatic acid, grams
3	0.150	0.144	.....	0.210
10	.....	0.116	.....	0.222
50	0.149	0.128	0.125	0.192

Table II—Average Pounds of Dross Produced from Metal To Be Galvanized

Predip Solution Used	Lbs. dross per 100 lbs. zinc coating	Lbs. dross‡ per 5000 sq. ft. of surface galvanized
50% Zinc ammonium chloride	4.6	17.2
35% Zinc ammonium chloride	4.8	17.9
20% Zinc ammonium chloride	5.6	20.7
3% Muriatic acid (Freshly prepared)	7.7	28.9

‡Based on a zinc coating of 1.2 ounces per square foot of surface covered and dross containing 3 per cent iron.

FURNACES

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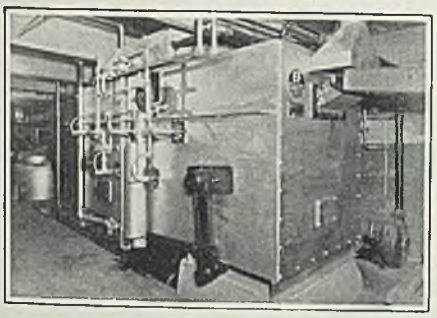
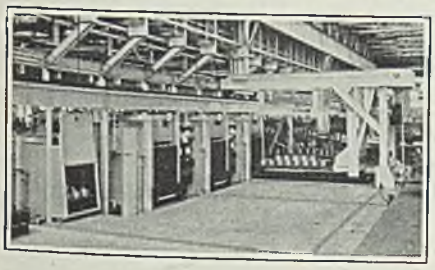


Machine Gun Cartridge Clips

Machine Gun Cartridge Clips are heat treated uniformly, continuously, and scale-free in this E.F. special atmosphere continuous chain belt conveyor type furnace—one of a number of continuous furnaces built by The Electric Furnace Co., Salem, Ohio, adapted to heat treating arms and ammunition components.

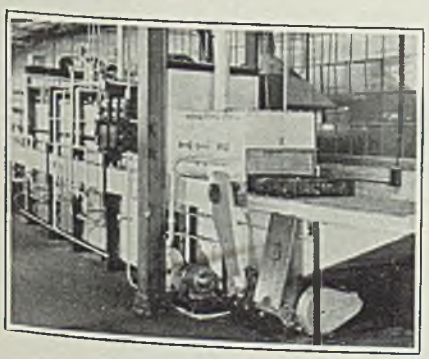


Brass for Cartridges

Brass for Cartridges and other products are uniformly treated in various types of E.F. continuous, semi-continuous and batch type furnaces. The above installation shows 3 gas-fired, hearth type forced circulation furnaces with quench, cooling chamber and handling crane—one of several similar installations made in prominent non-ferrous plants by The Electric Furnace Co., Salem, Ohio.

Aircraft Engine Parts

Aircraft Engine Parts are nitrided in this battery of double-ended reciprocating type furnaces—part of the world's largest nitriding furnace installation. These furnaces were designed and built by The Electric Furnace Co., Salem, Ohio, and installed in a prominent U.S. aircraft engine plant.



Annealing Shells

Annealing Shells. Designed for annealing brass shells, this E.F. gas-fired continuous roller hearth furnace is also adapted to treating steel shells. Large shells are carried direct on rollers—smaller shells are loaded into pans on trays. Built in various sizes by The Electric Furnace Co., Salem, Ohio.

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The Electric Furnace Co., Salem, Ohio

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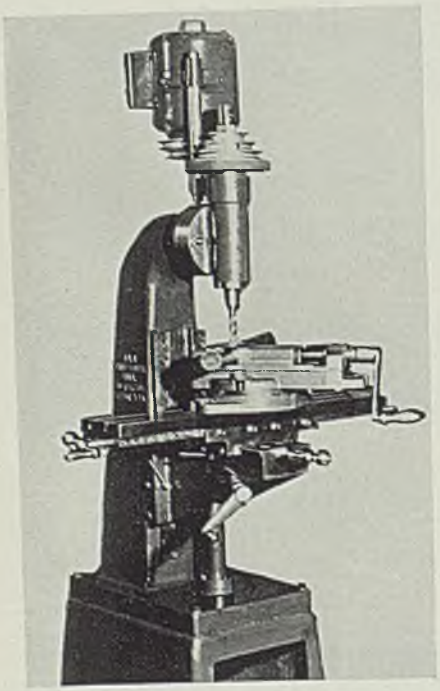
Industrial Equipment

End Milling Machine

■ Univertical Machine Co., 620 St. Antoine street, Detroit, announces a No. 1 Univertical high-speed end milling machine for absorbing small jobs and releasing larger units for heavier work. It is a vertical type unit and mills, drills and bores. It may be used as a contour miller and is designed for the use of cut-



ting tools up to ⅝-inch. It also can be adapted to small grinding operations. The machine's table measures 24 x ⅞-inch. It has a longitudinal travel of 17 inches and a cross travel of 7 inches. Its vertical travel is 10 inches. The spindle head swings through an arc of 180 degrees. The machine is equipped with a ½-horsepower motor, and is available as either a bench or floor type.

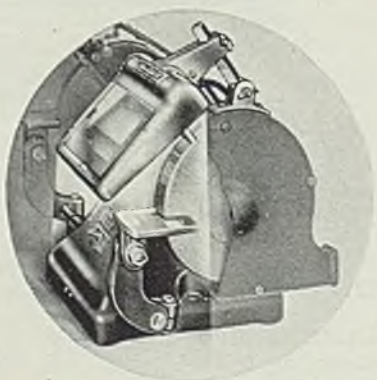
Portable Searchlight

■ Dewar Mfg. Co., 34 Thirty-fifth street, Brooklyn, N. Y., has introduced a portable searchlight capable of supplying over 50,000 beam candle-power. Powered by an 8-volt storage battery, it is particularly adapted for use by police departments, fire departments, public utility crews, or emergency crews of any type. Because the battery is of the nonspillable type, the lamp can be used at any angle. The searchlight throws a broad beam carrying brilliant illumination to distant places. Lamp and battery units are interchangeable so that

additional or reserve batteries can be kept on hand. The unit uses the new No. 4010 Sealbeam unit with precision lens and reflector molded of heat resisting glass. This unit is hermetically sealed, thereby eliminating all dirt, moisture and loss of light due to reflector tarnish.

Eye Shields

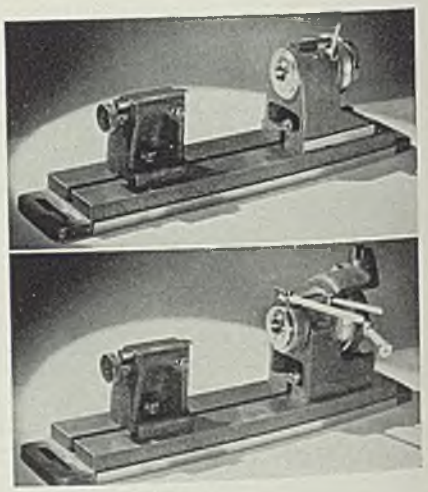
■ Stanley Electric Tool Division, New Britain, Conn., has placed on the market a new No. 600 Flud-Lite eye shield for use on all grinders, belt or motor-driven. Fitted with two bayonet type light bulbs it throws light directly on the grinding wheel and work. The lighting arrangement is said to provide 30 per cent more visibility for the operator than previous models. The eye shield is adjustable up or down and can be arranged to suit the operator's position. It cannot, however, be moved to a nonguarding position without dismantling. Its frame is a sturdy die casting, and



holds two sheets of glass 4 x 6 inches—one piece safety glass with ordinary window glass beneath. The bulbs incorporate a supported filament to withstand vibration. The shield can be set up so that lights work with grinder switch on units with 115 or 220-volt motors. A reflector, mounted behind light bulbs, floodlights work and wheel.

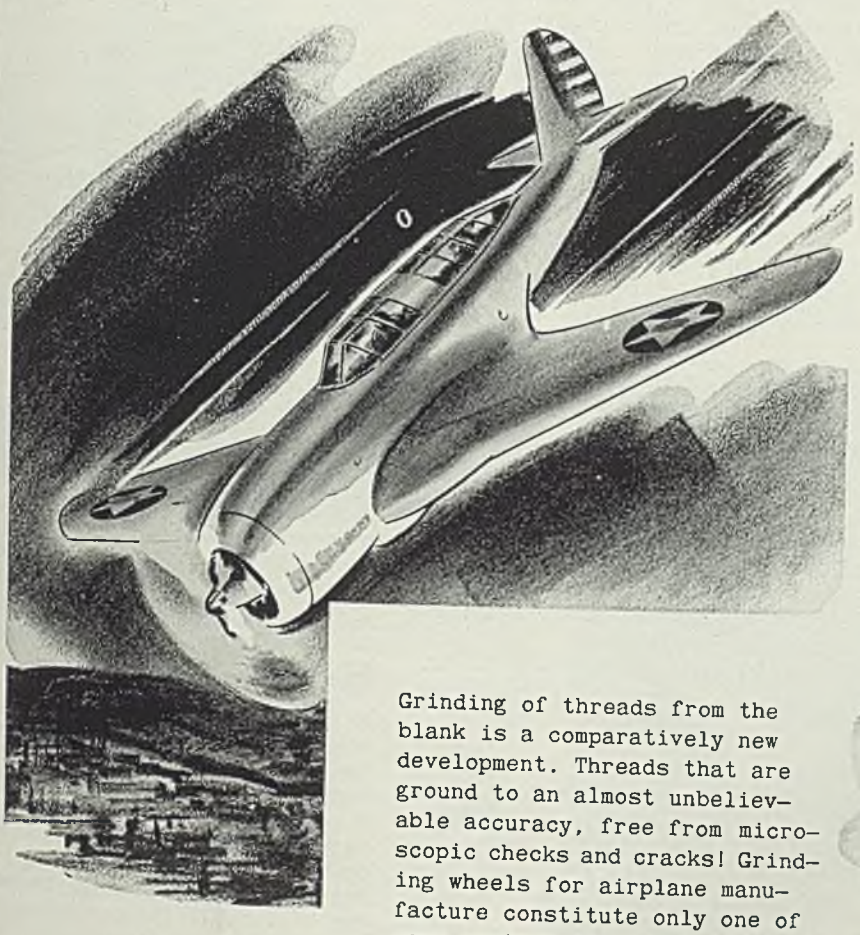
Collet Index Fixtures

■ Hardinge Bros. Inc., Elmira, N. Y., announces new collet index fixtures equipped with sub-base and tailstock for holding work accurately and providing a means for rapid indexing. They also are for use on existing milling machines, grinders, shapers and drill presses. The H-4 horizontal collet index fixture, as shown in illustration above, is for use in toolroom and inspection departments. The spindle takes 1-inch capacity collets and has a hardened and ground index plate with 24 holes to give 2, 3, 4, 6, 8, 12 and 24 divisions or 15-degree spacings. Index holes and index pin have 8-degree included angle taper for posi-



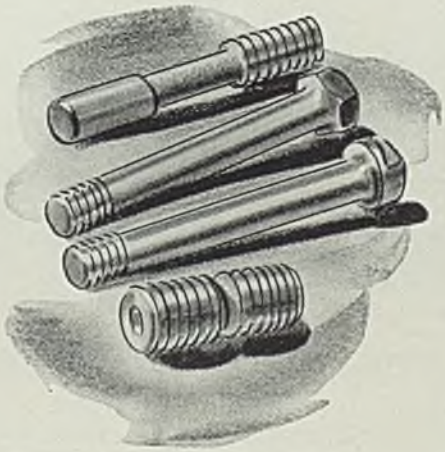
tioning and locking. The index pin is spring backed for quick location in the index holes. Fixture is provided with ½-inch wide removable keys for parallel or right angle fitting to sub-base or machine table. The HV-4 horizontal-vertical collet index fixture, shown in lower view, is for use in production departments. It incorporates the features of the fixture described above, plus four additional features: (1) Hardened and ground index plate with a preselecting arrangement. (2) A collet closer with 100:1 leverage to facilitate rapid chucking of work on a production basis. (3) Ratchet device for rapidly rotating the spindle when indexing. (4) Base for operation in either a horizontal or vertical position. The index plate has a screw in each of the 24 index holes so that holes not required for a particular job can be "blinded." As an example, the screws in the plate can be arranged so that the index pin can enter in six holes only, or four only, or any other number divisible into 24, with even and odd spacings. This means that the index plate holes can be

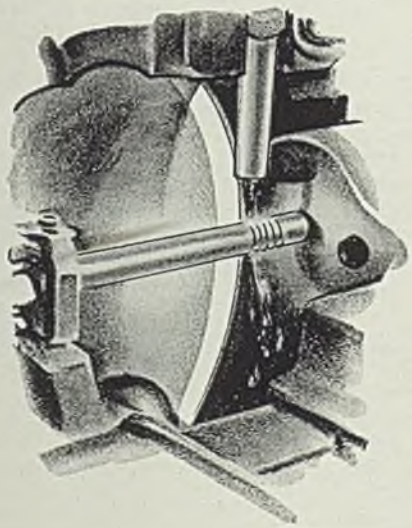
What holds a dive bomber together at 500 M.P.H.?



The answer is design and construction and materials and craftsmanship. But accuracy and finish of parts are also important in building a plane to withstand terrific speeds and that depends on grinding. Vibration is minimized by grinding all moving parts of the power unit to extreme accuracy. Safer and stronger threaded parts are ground with special grinding wheels such as are made by The Carborundum Company.

Grinding of threads from the blank is a comparatively new development. Threads that are ground to an almost unbelievable accuracy, free from microscopic checks and cracks! Grinding wheels for airplane manufacture constitute only one of many contributions made to industry by Carborundum during its fifty-year existence.





Carborundum manufactures and can specify the right wheel for every grinding job. And Carborundum engineers will gladly show you the best methods of using these wheels for higher production, improved quality of work and lower costs. Write The Carborundum Company, Niagara Falls, N.Y.

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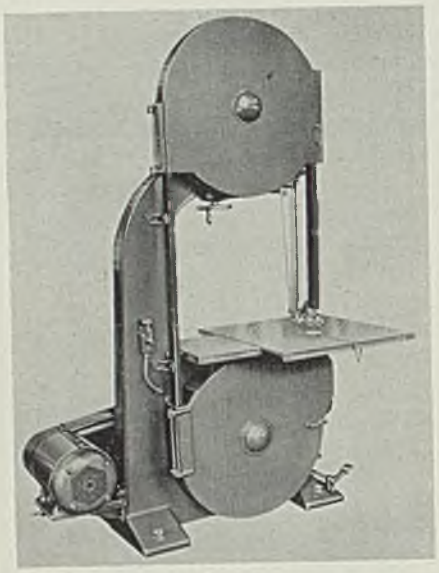
ABRASIVE PRODUCTS
50 YEARS OF SERVICE TO ALL INDUSTRY

arranged for any one job. The preselector screws in the index plate are tightened securely against a shoulder when certain holes are not in use or against a retaining ring when being used.

Band Saw

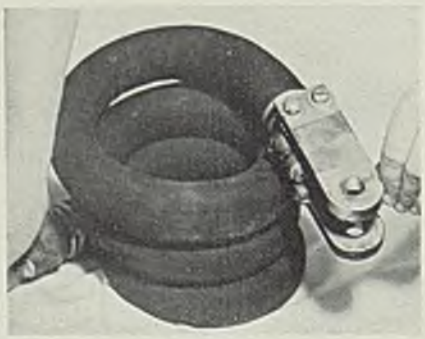
■ Tannewitz Works, Grand Rapids, Mich., announces a special 36-inch band saw with V-belt motor drive



for sawing magnesium blocks 30 inches thick. To accommodate work of this thickness the guide rises above the table more than 36 inches. Designed for cutting various aluminum alloys and pure magnesium, the motor and multiple V-belt drive with motor mounted on a bracket at the side, offers an effective means of securing desired saw blade travel for the specific material handled.

Kickless Welding Cables

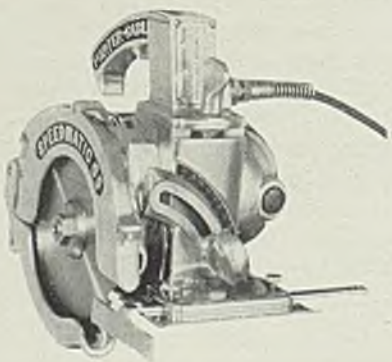
■ Progressive Welder Co., 3050 East Outer drive, Detroit, has introduced a line of kickless welding cables of "full concentric" design for reduced current loss and with positive and negative current strands wound at steep helical angles to increase



ease of flexing. Developed in conjunction with Habirshaw Cable & Wire Co., the new P-H cables are available in a complete range of capacities to suit almost any portable welding gun used. They have a rated capacity 50 per cent in excess of conventional cables of the same size. The water supply core of the cable consists of ⅜-inch interlocked bronze tubing having high flexibility characteristics. Six current-carrying bundles, of seven copper strands each, enclose this core and are so formed that any flexing causes them to "unwind" rather than bind. A heavy reinforcced rubber insulating tube separates these inner strands from the outer strands which also are wound at a steep helical angle. The cable can be ordered with almost any terminal for welding guns of any standard make.

Electric Hand Saw

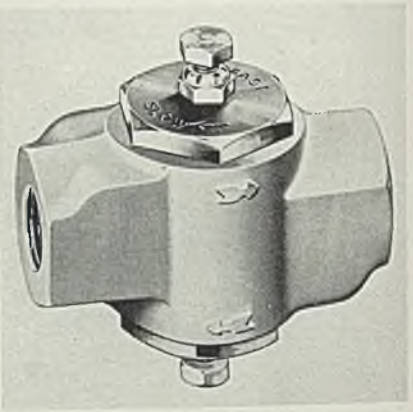
■ Porter-Cable Machine Co., Syracuse, N. Y., announces a new type K-65 high-speed electric hand saw having a cutting capacity of 2-inch material. It features a 6½-inch diameter blade which travels at 7200 revolutions per minute. Perfectly balanced and equipped with a ¾-horsepower motor, the saw weighs only 15½ pounds. Its base raises and lowers for depth adjustment, and tilts to 45 degrees for bevels. A cast-in and enameled graduated scale affords quick and accurate setting. The frame is die



cast aluminum, polished to a mirror finish. Standard equipment includes a combination saw blade, ripping guide, cross cutting guide, 15 feet of insulated conductor cable with plug and socket, metal carrying case and blade change wrench.

Speed Control Valve

■ Hanna Engineering Works, 1765 Elston avenue, Chicago, has placed on the market a new 2-direction speed control valve for controlling the speed of pneumatically actuated cylinders. It controls the speed of piston travel. Installed between operating valve and one end of a cylinder, one such valve provides adjustable control of inflow as well as exhaust of the air independently to and from one side of the piston. One valve will therefore control the piston speed in two directions. For extra sensitive adjustment and control of piston speed, two control valves, one for each end of the cylinder, are recommended. The valve is constructed so the two adjusted ori-



fices which control the airflow in the two directions are set before flow takes place. This insures control from the start of movement. The valve body is cadmium plated and all other valve parts are of corrosion resistant materials. The unit is recommended for 250 pounds maximum air pressure. It is available in ⅛, ¼, ⅜, ½, ¾ and 1-inch pipe size.

Shell Holding Device

■ Landis Machine Co., Waynesboro, Pa., announces a new fixture for holding 37 millimeter shell caps rigidly in alignment for threading. It comprises a hardened and ground supporting bushing, a supporting center and a supporting center locking member. In operation, the shell cap is placed on the supporting center while in the position shown in the accompanying illustration. The center is then moved forward until the work enters the seats in the supporting bushing. The work is then locked into position for thread-

ing with the supporting center locking lever. The entire unit is adjustable both horizontally and vertically. This work holding feature is designed for use on the Landis ¾ and ⅞-inch single or double head threading machines. The shape of the parts will not permit gripping on the outside surface and makes it necessary to employ this socket type

fixture and an internally tripped die head. Any slight variation in size would change the location of the work in the fixture. Thus, the internally tripped die head prevents any possibility of the chasers striking the shoulder of the work and it also assures threads of uniform length. The leadscrew assures a correct start of the die head onto the work so that the first threads are accurately formed.

Rubber-Tread Idlers

■ Link-Belt Co., 220 South Belmont avenue, Indianapolis, announces a new line of rubber-tread idlers for supporting the return run of 14 to 60-inch wide belt conveyors. Each complete idler consists of four to twelve 6-inch diameter rubber-tired rolls suitably spaced and mounted on a roller-bearing-equipped steel tube that will fit into the same

supporting hangers as the regular return idler roll. The individual rolls consist of a renewable extruded rubber tire clamped between two steel disks held together by three round-head bolts. As the rubber tire is split, it can readily be replaced with a new tire when required, by just removing three nuts, instead of stripping the entire unit and other rolls off the tube. The new idlers are especially recommended for conveyors handling corrosive, abrasive, wet or sticky materials.

Cable Connection Plug

■ Ohio Brass Co., Mansfield, O., announces a new trailing cable connection plug for 80-ampere loads. Designated as the 80-ampere Mechano-Plug, it accommodatees a 3-conductor cable of No. 6 or smaller

sizes of wire. The plug is of flat design and can be installed on the cable end in the field without special tools or equipment. Malleable iron clamps holding the two sections of the male and female plug bodies are quickly removed. A double locking arrangement holds the two halves of the plug in positive engagement, preventing inadvertent separation. All joints of the male and female rubber plug bodies are moisture and dust-proof. The insulated rubber body protects man and device from possible shock.

Nonsparking Tachometer

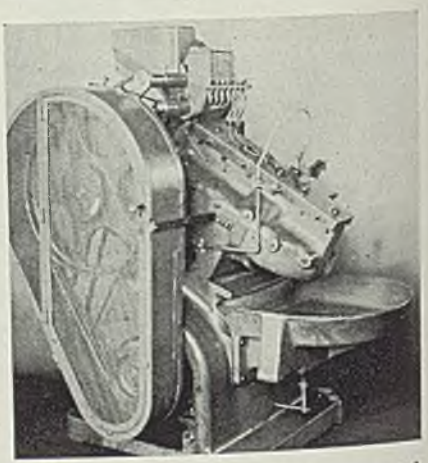
■ Westinghouse Electric & Mfg. Co., Newark, N. J., has developed a new alternating-current tachometer which because of its nonsparking generator permits its use any place where explosive vapors are present. It does not incorporate brushes or commutator and the current generated is rectified and indicated in terms of either rotational or linear speeds.

Its indicating instrument can be calibrated in revolutions per minute, feet per minute, gallons per minute or other units depending on the application.

Thread Rolling Machines

■ Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., has introduced a line of screw thread rolling machines for rolling screw threads on screws, bolts, rods and other threaded parts. The line consists of four types of units all of which are the same basic design.

Each type, however, is built in several sizes. The line includes an inclined machine with an automatic lift blade hopper feed for threaded work of medium length up to and including ½-inch diameter, an inclined unit with an automatic chain hopper feed for work up to and including ¾-inch diameter and practically any length up to 6 inches, or even longer—a horizontal-hand feed machine for work up to 1-inch diameter and 5 inches threaded length and an inclined side-hand feed unit for long work such as rods, spokes, studs, etc., having a threaded length not over 6 inches for 1-inch diameter work or not over 8 inches for ¾-inch diameter work. Although general improvements have been made in the entire line the principal ones apply chiefly to the automatic machines. The illustration shows one of the smaller sizes, with motor drive and lift blade hopper feed. It operates at relatively high speeds. The wearing surface of the reciprocating gate, where it slides in the frame has been increased in area and provided with a bronze plate. The frame has been extended to the extreme end of the gate and has a removable hardened steel liner. The cross transfer slide which carries the blanks from the lower end of the feed chute to the dies, now operates from a cam and can be manually actuated independently of the reciprocating die, by means of a device which prevents starting the slide in motion except at the proper time. The driving pulley is furnished with a shear pin that prevents damage to the dies by causing the machine to stop if a blank should become improperly located. Machines of this type are mounted on a pedestal to house the motor, when motor-driven. The motor is mounted on a swing-plate, so that its weight serves to maintain the proper tension on the driving belts. The additional feature of the threaders with chain hopper feed is the feed, which is attached to the rear of the standard threader in place of the lift blade feed. The feed is designed so that it may replace the lift blade feed if desired. It will handle longer and more varied work. The blanks are agitated in the hopper by a floating spiral cam and are carried up the inclined passageway to the threader feed chute by a series of extending fingers attached to a traveling chain

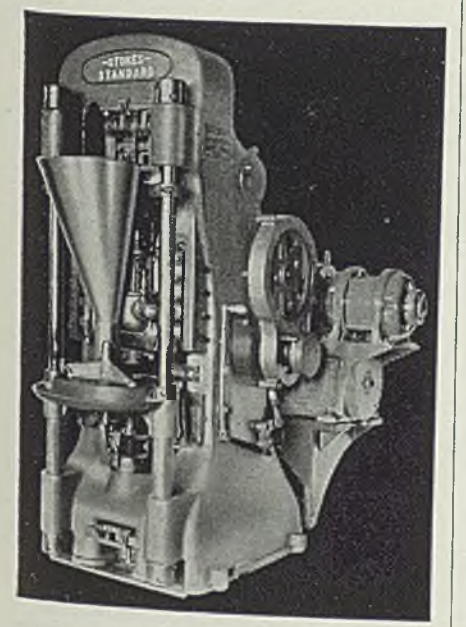


driven through a variable speed mechanism. The fingers are spaced so as to feed maximum length work. A safety device stops the travel of the chain automatically in case of any interference. The threaders having a horizontal feed are recommended for relatively small quantities or for work which cannot be fed automatically, such as headless blanks, long slender ones, and those which are extra short. In the side-hand feed machine the dies are inclined and the work, usually long rods, is provided with a supporting table and means for locating the work accurately at right-angles to the dies. The rods are fed against a depth gage to give the correct threaded length and, if long, are provided with either an auxiliary stand to support the extending end or with magazine for stacking.

Toggle-Type Press

■ F. J. Stokes Machine Co., Philadelphia, has placed on the market

an automatic No. 280 cam-operated toggle-type press for use in compressing powdered metals. It applies a 100-ton slow, smooth squeeze to the material to allow more time for the metal to flow and thus obtain greater hardness and density in the parts produced. The press opens and closes rapidly in the clear, but the toggle action automatically slows down the movement as the punch and die are finally closed. Although pressure is applied slowly and smoothly, speed of the unit is about 50 strokes per minute. Power requirement of the press is so low that only a 7½ or 10 horsepower motor is needed. A combined clutch and brake starts and stops the machine—under load if desired. Variable speed drive permits adjustment of the press speed to the characteristics of the material or size of the work. The press is fully automatic, has a 2-inch die-fill and produces parts such as iron



rings with a maximum of 4-inch diameter. A hydraulic compensating device cushions the shock of compression and aids in setting-up to the desired pressure. Press is said to be particularly well-suited to the production of parts of comparatively thin section and large diameter.

Center-Drive Screw Gun

■ Van Dorn Electric Tool Co., Towson, Md., has developed a new No. 8 center-drive Scrugun for operation in a suspended position. Its center spindle improves "aim," and the bonnet grip or paddle switch arrangement eliminates handles. It

will operate in reverse at full power when equipped with a reversing switch. It is available with either positive or adjustable clutch, and with either bonnet grip and toggle switch or paddle switch. The unit will drive wood screws up to No. 10 x 2-inch, self-tapping screws up to No. 12, and machine screws and nuts up to ¼-inch diameter. Its no-load speed is 750 revolutions per minute.

Fire Extinguisher with Trigger Control

■ Walter Kidde & Co. Inc., Bloomfield, N. J., announces that the trigger control valve recently developed for its 2-pound carbon dioxide extinguisher is now standard equipment on its new type 4-pounder. Like its predecessor, this extinguisher is discharged by simply pulling a trigger.

This control not only permits the extinguisher to go into action faster, but also prevents wasting of the carbon dioxide gas while the operator is maneuvering around the blaze. When trigger pressure is released the discharge is shut off immediately. In addition, the nozzle arm is equipped with a swivel, so that the discharge horn is held in a

"down" position when the extinguisher is not in use.

The cylinder of this new unit is considerably larger, permitting greater ease in recharging and, as an added safety factor, gives increased tolerance for high temperature if the extinguisher is used near stoves, furnaces, etc. The model No. 4 is designed especially for protection of laboratories, trucks, garages and smaller hazards involving electrical or flammable liquid fires.

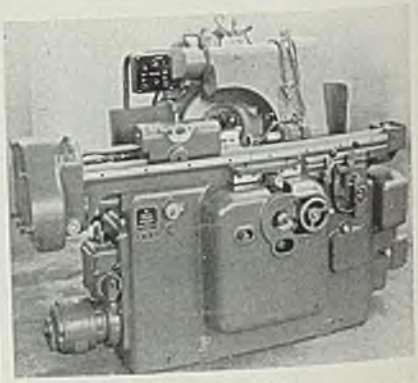
Combination Grinder

■ Machinery Mfg. Co., Dept. S. 441, 1915 East Fifty-first street, Vernon, Los Angeles, has introduced a new combination universal grinder for all types of tool, cutter and reamer grinding, internal and external as well as surface grinding. It has several new features incorporated in its design, particularly the fact that the motor which carries the grinding wheels swivels through 350 degrees vertically, and the column on which the motor is mounted also swivels through 350 degrees horizontally.

When used as a surface grinder, the machine accommodates a 6 x 10-inch magnetic chuck and will grind a complete area of 6 x 16 x 7½ inches above the table. Extreme rigidity has been maintained in the surface grinder by making it an integral part of the machine. The machine table is traversed by a 2-speed hand wheel and may be operated from either the front or rear of the machine. Carboloy tools can be ground by tilting the motor and swiveling the column. Provision also is made for the use of a coolant pump.

Thread Grinding Machine

■ Jones & Lamson Machine Co., Springfield, Vt., announces a line of new fully automatic internal thread grinding machines. Machines included in the line are the model TG-63, model TG-624 and Model TG-1230. The first swings 7½ inches. It will grind threads up to 6-inch diameter and 3-inch maximum length, in work up to 10 inches maximum length overall. This model is a light, fast machine. The second model will grind threads up to 6½ inches diameter and 5 inches maximum length, in work up to 24 inches



maximum length overall. It is capable of handling toolroom or production work of any size or weight within its rated capacity. It swings 7½ inches. The third swings 21 inches and will grind threads up to 14 inches diameter and 5 inches maximum length, in work up to 24 inches maximum length overall. It also is capable of handling toolroom or production work within its rated capacity. For models TG-624 and TG-1230, a hardened and ground master lead screw and pitch change gears are furnished as standard equipment for grinding any pitch thread from 2 to 48 inclusive, either right or lefthand and either single, double, triple, quadruple or sextuple lead. On all models the grinding wheel spindle is automatically withdrawn from the grinding position to the wheel dressing position. The wheel is dressed automatically and the grinding wheel spindle is returned to the working position. Each model is provided with a direct-current wheel motor with rheostat control to permit a complete range of grinding wheel speeds. Ample clearance is permitted for gaging and the work.

Metallurgical Observer

(*Concluded from Page 74*)

cited, of the value of systematic observation and recording refers to corner segregation in alloy steel. It had been the practice in the case of a certain class of alloy steel to turn the 26-inch octagon ingot in the lathe until all trace of corner segregation was removed; this was checked by sulphur printing as turning proceeded.

Systematic recording revealed several interesting features: The fault was confined to one, two or three adjacent corners. These corners coincided with the side of the ingot adjacent to its neighbor, the molds being set in pairs. Some improvement resulted from wider spacing of the molds. A reduction in teeming speed resulted in much less corner segregation, but trouble arose due to sand inclusions, owing to sluggish metal resulting from too slow teeming. Correlation of the mold with the ingots made in it yielded an interesting result.

Mold No. 29 failed to produce one ingot out of seven free from corner segregation. This mold was examined carefully, but did not show anything to account for the poor result.

Sound Ingots Produced

The suggestion was made that deepening the corners of the molds by machining might cure the trouble, so as an experiment, mold No. 29 was machined. The result was startling for while we continued to get from standard molds 50 per cent or more corner segregated ingot, mold No. 29 commenced producing sound ingots every time it was used. It became clear that the contour of the octagon mold was of overriding importance in connection with the problem. Now that the corners had been deepened it was found that the radius of the inverts was the same as the radius of the inner dimension of the mold, i.e., 13 inches. This led to an examination of the whole series of octagon molds from 24 to 63 inches and it was found that the radius of the invert was in all cases less than the radius of the inner dimensions of the mold.

All the molds are now made with this deeper invert, i.e.: 24-inch octagon, radius of inverts, 12 inches; 28-inch octagon, radius of inverts, 14 inches; 54-inch octagon, radius of inverts, 27 inches; and so on.

For the past two years, with the redesigned mold, there has been no further instance of corner segregation. Instead of annealing and turning, the ingots have gone hot to the press for forging, which procedure has taken a considerable load off the annealing furnaces and lathes.

Another example of the value of systematic observation and recording in conjunction with periodical statistical examination of data, is that of ingot molds. The factors affecting mold life are numerous, for apart from the quality of the mold metal, there is the influence of design; chemical composition; frequency of use; method and speed of teeming; temperature and chemical analysis of the steel cast; time lapse between casting and stripping the ingot; method of stripping, and so on. The study of the subject made during the past ten years has led to modification in design; method grouping; chemical analysis; and improved supervision in the stripping, setting and rotation of usage.

The silicon content has been found to have an important bearing on the life, and this has gradually been reduced from the 1.8/2.2 per cent, at which it had stood for many years, to 1.0 per cent silicon; 0.8 per cent has been found to be the lower limit advisable; below this the life falls off.

It has recently been found that phosphorus also has an important influence on the mold life, but its effects had, up to recently, been obscured by the large variation in the silicon content. The effect of phosphorus content higher than 0.1 per cent is now being investigated.

Determine Freezing Points of Steel

■ Freezing point determinations on high-purity iron and on 23 other samples of iron and steels, each of which had been chemically analyzed, have been made by the National Bureau of Standards, Department of Commerce, Washington, In this regard, "freezing point" means the temperature at which the melted metal starts to solidify. This temperature has on value for pure iron and quitet different values when other elements are added to convert the iron into any one of the numerous varieties of steel.

The freezing temperature of high-purity iron (99.99 + per cent) in an atmosphere of helium was measured with an optical pyrometer and found to be 2802 degrees Fahr. The same samples of iron were found to freeze 2 degrees lower in an atmosphere of hydrogen. In addition, the initial freezing temperatures of some irons of lesser purity and of some steels were measured in an atmosphere of helium to determine the effects of various impurities and alloying elements. Many combinations of 17 elements, which include all these generally found in commercial irons and steels, were measured.

The samples containing less than 0.1 per cent of impurities were melted in beryllium oxide crucibles and the other samples, in all but two cases, were melted in crucibles of aluminum oxide. Temperatures were determined by means of an optical pyrometer sighted into hollow tubes of refractory material immersed in the freezing metal, and which have the same temperature as the metal itself.

Westinghouse Conforms With NEMA's Standards

■ Following the adoption of NEMA's new standards for breaker interruption ratings, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., announces new information on large air circuit breakers.

In determining interrupting capacity, the previous standards called for measuring the current at the point on the oscillogram where the arc voltage first appeared. This now has been changed to current measurement one-half cycle after the short circuit occurs, a point where the peak current is greater. Thus a breaker with an old interrupting rating of 40,000 amperes automatically becomes 50,000 amperes when measured under the new standards.

To conform to the revised schedule, Westinghouse DA air circuit breakers with ratings from 15 amperes and above will carry the new designations, and their application to circuits should be made accordingly.

Tungsten Needs Reduced By Carbide Tools

■ Placing of tungsten products under the Federal general priorities system, along with aluminum and magnesium, etc., will probably not affect the production of tungsten carbide tools, according to W. G. Robbins, president, Carboloy Co. Inc., General Electric subsidiary and major producers of such tools.

If anything, Mr. Robbins said, it will place greater emphasis on the use of tungsten carbide tools since an average Carboloy tool actually contains less than one-fifth the amount of tungsten needed for a high-speed steel tool of the same size. Also, a tungsten carbide tool will usually do about 20 times as much work before it is scrapped. Thus a pound of tungsten in a tungsten carbide tool will do as much work as 100 pounds of tungsten in conventional tools, according to Mr. Robbins.

Hot Dip Galvanizing

(*Concluded from Page* 84)

iron analysis repeated. This operation was repeated a second, third and fourth time, and the four different amounts of iron picked up by the zinc bath averaged. The average zinc coating obtained was 1.2 ounces per square foot of surface covered.

In order to expedite the work no attempt was made to settle, withdraw and weigh the dross formed. Instead the zinc was thoroughly stirred before withdrawing the samples for iron analysis. The average results are shown in Table I.

More Iron Dissolved

From the data given in Table I it will be noted that in general from 35 to 70 per cent more iron was dissolved by the galvanizing bath when muriatic acid was used as the predip than when using zinc ammonium chloride solutions. It is believed that in commercial practice even greater differences would be noted for it is a known fact that muriatic acid solutions usually contain a relatively high concentration of dissolved iron while zinc ammonium chloride solutions even under adverse conditions never contain more than a small amount of iron. The most that we have ever noted in zinc ammonium chloride predips was about 0.25 per cent iron. A fresh solution of muriatic acid was used for each series of tests so that its iron content was kept low.

Table I also shows that contrary to expectations no increase in the amount of iron dissolved by the galvanizing bath was noted as the time of standing between predipping and galvanizing was increased. Also, within experimental error there was little or no difference between the results obtained when using 20, 35 or 50 per cent zinc ammonium chloride solutions.

Dross formation was calculated by converting the iron contents found to their corresponding amounts of dross. There may be some question as to the average iron content of commercial dross. We have chosen a figure of 3 per cent iron for an average commercial dross and have used this figure as the basis for converting the iron content of our zinc bath to dross production as shown in Table II.

From the data given in Table II it will be noted that on an average about 11 pounds more dross per 5000 square feet of surface galvanized was formed when using a freshly prepared 3 per cent muriatic acid predip than when using a 35 per cent solution of zinc ammonium chloride. It seems probable that if the muriatic acid solution used had contained as much iron as predips usually found in use in plant of rough estimation, 5000 square feet of surface may be taken as the amount of metal galvanized in an average galvanizing shop (sheet mills excluded) per 8-hour operation. However, this is only a rough average, for in five different galvanizing plants, which were using zinc ammonium chloride as the flux, we have noted production rates ranging from 1200 to 50,000 square feet of surface galvanized per 8-hour operation.

Expressing these results on another basis, we may say that for practice, a still greater difference would have been noted. For the sake of each ton of zinc used for coating purposes, a minimum of 55 to 60 pounds more dross was formed when using the muriatic acid predip than when using a solution of zinc ammonium chloride. These results indicate the superiority of zinc ammonium chloride over muriatic acid when used as a predip for galvanizing operations where zinc ammonium chloride will give satisfactory fluxing action, for example, in hand dip, wire, job or pipe galvanizing plants.

Summary: A study has been made of the difference in amount of dross which is produced when

galvanizing pieces of low-carbon steel which have been predipped in zinc ammonium chloride solutions as compared to using similar steel predipped in dilute muriatic acid.

Although there were some variations depending upon the concentrations of predip solution used and on the time of standing between predipping, in general, the amount of iron dissolved from the steel by the galvanizing bath was about 60 per cent greater when using fresh muriatic acid predip than when using a solution of zinc ammonium chloride.

By converting the figures for iron dissolved to dross formation an average dross savings of about 11 pounds per 5000 square feet of surface galvanized was obtained when using a zinc ammonium chloride solution predip, or stated on another basis, for each ton of zinc used for coating purposes, a minimum of 55 to 60 pounds more dross was formed when using a muriatic acid predip.

Finishing Diecastings

(*Concluded from Page* 80)

second cathodic alkali cleaning, a spray rinse, a 10-second dip in water, another spray rinse, work enters the chromium plating tank where exposure to a current density of 150 to 215 amperes per square foot for about 3 minutes gives a chromium plate around 0.00002-inch thick. Then after a cold-water dip, a cold-water spray, drying in a warm-air duct, work is removed from the racks, which then are stripped and ready for reuse. Racks used in copper and nickel plating are carried through the chromium plating line so there is no reloading of diecastings from one line to the next.

Enameling: In adition to the automatic long-run work, short-run work is plated in a number of tanks designed for hand operation while diecastings requiring application of enamel in recesses are sent into a room, masks applied and the enamel sprayed on. Masks used are made originally by plating steel or iron onto the diecasting and afterward stripping off the heavy plate which thus affords a perfect fit for masking purposes. Mask edges are turned down covering sides of letters so the plated letter edges remain bright, and also protecting the back of the masks so they can be used as many as 15 times without cleaning. Masks are used in pairs, so one can be cleaned while the other is in production.

Enameled work on a chain conveyor is passed through an oven. After being baked at 250 degrees Fahr. for 30 minutes, the quick drying enamel is hard. Some 25,000 castings a day or nearly 3000 pounds an hour are handled in the enamel room alone—giving some idea of the tremendous volume of work handled in this plant.

Hints for Teachers of Vocational Training

■ *Fifty Hints for Teachers of Vocational Subjects*, by M. R. Bass; paper, looseleaf, 46 pages, 5½ x 8½ inches; published by American Technical Society, Chicago, for 50 cents.

In the present drive for vocational training to augment supply of workers with some skills, this handy manual is of value in giving instructors information as to better ways of handling classes, to gain co-operation and enlist the interest of students. The author formerly was assistant director of William Hood Dunwoody Industrial Institute, Minneapolis, and now is director of David Rankin School of Mechanical Trades, St. Louis.

The material is practical and well arranged. Based on experience in this class of teaching, it is certain to contain much of value for those charged with developing this class of students.

High-Speed Welding

(*Concluded from Page 60*)

description of the elements involved and their operation:

The equipment is divided into three units—an inverter, a vacuum tube switching unit and the welder itself, housing the welding transformer. The purpose and operation of these units is as follows: One phase of the 3-phase power supply is fed through a 1:1 ratio transformer to shift the wave form 180 degrees in relation to the other two phases. Thus incoming three phases are each 120 degrees apart as shown in the upper set of curves at A. This relation is changed to that shown in the second set of curves at B where the phases are only 60 electrical degrees apart since phase C is now inverted.

These three phases are fed into the control unit, where three ignitron tubes act as valves or electron switches to afford control of the period that current is applied to the welding transformer which is housed in the welding machine.

The welding transformer is a special unit having three primary windings to form what might be termed a "3-phase" primary. The secondary, of course, is a conventional single winding feeding the electrodes through short leads.

Now let's see how this works. Three-phase power with one phase inverted is fed through the ignitron tube to the 3-winding primary of the welding transformer. But since the ignitron tubes pass current only in one direction, the bottom or negative half of the waves shown at B are cut off as at C, Fig. 5, leaving only the upper or positive portions of the power waves to be impressed upon the welding transformer itself. In the welding transformer, these three overlapping waves are added, so the secondary or welding current assumes the theoretical form shown at D, Fig. 5.

It will be noted this theoretical weld current has a time cycle closely approximating 300 electrical degrees instead of 360. Note also that the current rises to maximum value almost instantly, carries along at this value for practically the entire duration of the weld and then drops to zero in an extremely short period of time. This type of wave form is well suited for welding aluminum.

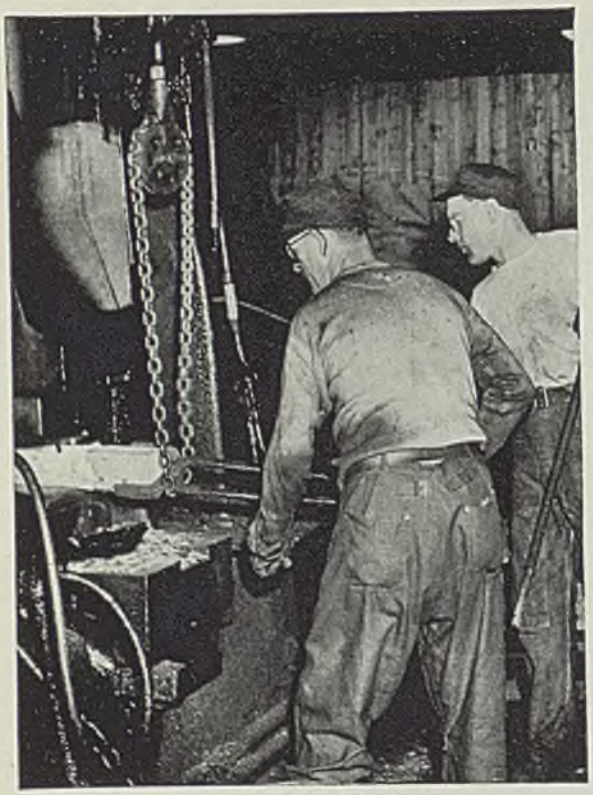
How close this theoretical wave form is approximated is revealed by Fig. 6, drawn from an oscillograph recording made during a weld.

The inverter or single-phase transformer is housed in a separate cabinet along with the ignitron tube timing equipment as shown in Fig. 1. The automatic timing equipment has an unusually wide range as the current can be applied for any period from 1/72-second down to zero. No taps being used on the welding transformer to adjust the current, the total power input to the weld being controlled entirely by the length of the period that current is applied.

Automatic repeat timing allows sufficient interval between welds to reposition work, thus permitting any number of welds to be made in succession automatically without reclosing the power device for each weld. Of course, this interval between welds can be adjusted to accommodate variations in time required to handle different jobs.

Mechanically the equipment is almost identical with standard Progressive pedestal-type welding equipment. Welding pressures are obtained through a standard direct air-operated pressure cylinder which is mounted on the upper arm. It actuates the upper welding electrode and is designed to provide a "follow through" as the metal softens during the making of the weld.

To provide a more positive and closer connection between welding transformer and work, an air-operated secondary shunt clamp grips the upper electrode after the work is under welding pressure.



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<< HELPFUL LITERATURE >>

1. Steel Erection Crane

Northwest Engineering Co.—8-page illustrated bulletin points out salient features of Model 71 steel erection crane. In addition to steel handling, machine can be used pile driving, machinery setting, stone setting or it may be equipped with clam shell bucket, dragline bucket or concrete bucket.

2. Variable-Speed Drives

Electric Machinery Manufacturing Co.—12-page illustrated bulletin presents principles, characteristics, advantages, and constructional forms of magnetic drives. Drive coupled between motor and load is used to provide controllable variable delivery for boiler draft fans and centrifugal pumps.

3. Cold Sawing Machine

Motch & Merryweather Machinery Co.—8-page illustrated bulletin describes two sizes of cold sawing machines with attachments particularly adapted to cutting shell slugs. Saw grinder and segmental saw blades are also covered.

4. Duplicator Control

Detroit Universal Duplicator Co.—12-page illustrated bulletin sets forth features of duplicator control which can be used to control almost any machine tool and provide accurate duplicating control permitting reproduction of original model directly in metal.

5. Welding Rod

Ampco Metal, Inc.—Illustrated bulletin sets forth features of "Ampco-Trode" coated aluminum-bronze welding rod which can be used for overlaying, forming and drawing dies; building up broken gear teeth; refacing wearing surfaces; repairing broken parts, and welding steel, cast iron, bronze and similar metals.

6. Thread Rolling Machines

Waterbury Farrel Foundry & Machine Co.—Four illustrated bulletins describe models of thread rolling machines. No. 916-A deals with inclined machine with lift blade feed; No. 917-A, with inclined machine with chain feed: No. 918-A, with horizontal machine with hand feed; and No. 919-A, with inclined machine with side hand feed. Complete specifications are given for all models.

7. Internal Grinders

Bryant Chucking Grinder Co.—35-page bulletin "Aircraft Engine Parts Ground on Bryant Grinders" is series of photographs and line drawings showing grinding operations on variety of aircraft parts. Some of parts include cylinders, single and double bank crank cases, connecting rods and cam gears.

8. Motorized Valves

Brown Instrument Co.—24-page illustrated bulletin No. 77-1 describes line of motor power units and motorized valves designed to operate with company's line of control instruments. Dimensional tables and schematic diagrams expedite selection of proper equipment.

9. High Capacity Blowers

Allis-Chalmers Manufacturing Co.—32-page illustrated bulletin No. B-6104 describes multi-stage turbo-blowers for use in handling air or gas for diverse applications like blast furnace and convertor blowing, gas boosting and exhausting, agitating and aerating, circulating gases in chemical plants and compressing refrigerants.

10. V-Belt Drives

Fort Worth Steel & Machinery Co.—64-page illustrated bulletin gives practical information on multiple V-belt drives to aid designing engineer, plant engineer or millwright. Belt construction, prices, selection tables, sheave construction and prices, and engineering data are included.

11. Insulating Firebrick

Babcock & Wilcox—16-page illustrated bulletin is devoted to insulating firebrick. General advantages, selection of most economical brick, properties and weights of various types, and applications are covered together with photographs of typical applications and charts of brick sizes.

12. Transmission Products

W. A. Jones Foundry & Machine Co.—20-page illustrated bulletin No. 80 tells about herringbone reducers, worm gear, speed reducers, spur gear reducers, and special drives for spotting cars, handling furnace doors, and running skip hoists. Sectional views present details of construction and design.

13. Milling Machines

W. B. Knight Machinery Co. 28-page illustrated plastic-bound catalog "Knight Millers" reports in detail features and advantages of company's milling machine. Construction details are pointed out graphically and in text. Tables list general specifications. Accessories are also shown and discussed.

14. Foundry Ovens

Despatch Oven Co.—16-page illustrated bulletin No. 31 presents information on core making as well as core baking. Photographs show number of typical installations and type of work handled in each. General discussion of core making and baking practice is included.

15. Technical Reprints

International Nickel Co.—36-page bulletin is reprint of two papers of American Society for Testing Materials. "Some Observations of the Potentials of Metals and Alloys in Sea Water" tells effects of tests made to determine effect of sea water on various metals and alloys. "Controlling Factors in Galvanic Corrosion" deals with tests conducted on iron coupled with copper in neutral sodium chloride solution.

16. Metal Working Equipment

Yoder Co.—8-page illustrated bulletin describes equipment for use in steel mills, automotive factories, aircraft industries, structural shops, and for sheet metal workers. These machines include roll forming and cut-off equipment, complete tube mills, rotary gang slitters and side trimmers, reels, recoilers, and coil boxes.

17. Shape Cutting Machine

Air Reduction—8-page illustrated bulletin No. ADC-623A sets forth features, advantages, and usage of No. 10 "Pianograph," shape cutting machine of pantograph type for single or double torch operation. Such subjects as cutting speed, cutting range, motor control, torch and torch holder, and central gas control unit are covered.

18. Wrenches

Blackhawk Manufacturing Co. — 40-page illustrated catalog No. 241 lists and pictures line of socket, open-end and box-type wrenches. These tools are sold individually or in complete case or bench sets.

19. Steel Shop Equipment

Lyon Metal Products — Four-fold broadside describes number of steel products especially adapted to shop use. These include nesting boxes, cabinets, bar racks, tool stands, tool toters, bench legs, steel desks, and lockers.

20. Adjustable V-Belting

Manheim Manufacturing & Belting Co.—16-page illustrated bulletin graphically tells story of "Veelos" adjustable V-belt. Installation directions and other information are given for belting which can be taken apart in less than 60 seconds.

21. Variable Speed Drives

Link-Belt Co.—40-page illustrated bulletin No. 1574 presents design data on line of positive infinitely variable speed transmissions. Line drawings present features of construction, tables list speeds and horsepowers and unassembled views point out features of operation.

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HELPFUL LITERATURE

(Continued)

22. Steel Stock

Joseph T. Ryerson & Son, Inc.—268-page general catalog for 1941-42 lists sizes and shapes of all grades of S.A.E. steels available for shipment from stock. Charts show S.A.E. standard specifications, average physical properties of various steels, trade customs and other useful information.

23. Combustion Instruments

Hays Corp.—12-page illustrated bulletin, "How to Save 10% to 25% of Your Steam Plant Fuel," discusses process of combustion as applied to steam plants, how process can be made more efficient, and types of control instruments which will aid in obtaining increased efficiency.

24. Boring Machine

Ex-Cell-O Corp.—Five 4-page illustrated bulletins Nos. 31201, 31301, 31401, and 31501 list advantages, construction and design features of Style 2112-A junior single end, Style 112-C senior single end, Style 215-A senior double end, and Style 218 senior double end heavy duty boring machines, respectively.

25. Rustproofing

Parker Rust-Proof Co.—40-page illustrated semi-technical bulletin describes "Bonderizing" rustproof process. Principles of process, how it is applied, and where it is effectively used are explained in detail with accompanying explanatory diagrams, charts, and photographs.

26. Industrial Fans

Emerson Electric Manufacturing Co.—16-page illustrated catalog No. X4059 describes exhaust fans, shutters, protective mesh guards and air circulators. Method of determining proper size of fan, and installation suggestions are given. Dimensions, performance data and prices are included for entire line.

27. Copper & Copper Alloys

Revere Copper & Brass, Inc.—43-page bulletin "For the Mechanical Industries" lists chemical and physical properties, available shapes, data on forming and fabricating, technology and other information on types of copper, brass, bronze, cupro-nickel, nickel-silver and copper-bearing alloys.

28. Gear Lapper

Michigan Tool Co.—4-page illustrated bulletin No. 993 is devoted to universal duplex gear lapper No. 993. Text and action photographs point out details of construction, features of operation, and specifications.

29. Stampings

Globe Machine & Stamping Co.—6-page illustrated folder tells of services and products of company. Series of action photographs depict various plant operations, and text explains advantages of stampings for production work.

30. Salt Tablets

Morton Salt Co.—Four-fold illustrated broadside "Heat-Fag" explains advantages of salt tablets in combating sickness and death due to excessive heat. Scientific and medical facts are presented, together with information on how to use tablets.

31. Induction Motor

General Electric Co.—12-page illustrated bulletin No. GEA 3580 concerns itself with "Tri-Clad" induction motor. Unassembled views point out details of construction and design, and text presents installation and maintenance information.

32. Electric Furnaces

Hevi Duty Electric Co.—4-page illustrated bulletin HD-441 presents detailed description and specifications on line of box-type electric furnaces for operating temperatures up to 2000 degrees Fahr.

33. Fan Housings

Commercial Shearing & Stamping Co.—4-page illustrated bulletin and 4-page price list deal with venturi-type pressed steel fan housings. They are available in thickness from 14 to 16 gage and in variety of sizes from 10 to 24 inches.

34. Metal Office Chairs

Artility Metal Products—16-page illustrated bulletin No. A-48 is devoted to line of metal office chairs. Complete dimensions and specifications are given for each model.

35. Perforated Pipe

Armco Drainage Products Association—8-page illustrated bulletin, "What Happens When Your Roads Break Up?" Explains how 80 per cent of road surface failures are caused by groundwater. Use of perforated pipe to effect drainage is offered as cure for condition.

36. Switchgear

Westinghouse Electric & Manufacturing Co.—8-page illustrated bulletin No. 81-330 announces automatic switchgear for synchronous converter substations in mining service. It contains general description of application, and outlines functions that must be performed and why. Distinctive features are listed and explained, and full specifications given.

37. Tool Steel

Bethlehem Steel Co.—8-page illustrated bulletin No. 143 presents data on physical and chemical properties of air-hardening tool steel. Instructions for working, annealing, hardening and tempering are given in detail with accompanying charts and photomicrographs.

38. Brazing Alloys

Handy & Harman—4-page illustrated bulletin tells how "Sil-Fos" and "Easy-Flo" low temperature brazing alloys can be used to make uniformly sound, leak-proof metal joint on production basis. Action photographs show alloys being used and several typical applications.

39. Diesinkers' Burs

Grobet File Corp. of America—30-page catalog describes complete line of diesinkers' burs with illustrations of each type. These tungsten steel burs or cutters can be used with all makes of small electric hand drills, and flexible shaft machines equipped with hand pieces of 1/8 or 3/32-inch capacity.

40. Barge Construction

Wood Preserving Corp.—Bulletin No. G-14 presents details of boat and barge construction and repair service. Photographs show some of typical repair and construction jobs.

41. Steel Floor Plate

Inland Steel Co.—16-page illustrated bulletin describes advantages of "4-Way" floor plate which provides steel safety tread for firm traction in factories, power plants, public buildings, and other locations. Illustrations point out features of floor plate and show many typical installations.

42. Synthetic Rubber

Hydrocarbon Chemical & Rubber Co.—8-page non-technical booklet relates story of "Hycar" group of synthetic rubbers. It tells how synthetic rubber is handled like natural rubber; describes physical characteristics of "Hycar O.R." an oil resistant type; and pictures some of steps in manufacture.

43. Pneumatic Tools

Independent Pneumatic Tool Co.—64-page illustrated catalog No. 42 gives specifications, description and other data on rock drills, paving breakers, clay diggers, sump pumps, tampers, grinders, saws, hammers and other pneumatic tool accessories. Also listed are portable electric tools and accessories.

44. Brass & Copper Welding

Chase Brass & Copper Co.—32-page illustrated bulletin outlines more recent advances made in art of welding copper and copper base alloys by both oxy-acetylene and carbon-arc methods. It also includes description of each type of "Olympic" bronze welding rod together with its advantages and suggested uses.

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Down 1 point to 99.

■ PRESIDENT ROOSEVELT'S declaration of an "unlimited national emergency" is expected to speed even more rapidly developments in the steel industry. Larger proportions of steel are expected to go for Britain and defense, with civilian uses correspondingly curtailed. Business as usual, with complete supplying of all peace time steel needs, apparently now seems impossible, even to the die-hards. Steelmakers expect, at least hope, that the President's reference to needs for more harmonious relations between capital and labor will be backed up by strict enforcement of industrial peace by Washington.

The declaration of national emergency implies more regimentation of steel and other industries. It is recognized that priorities may be extended, inventory control tightened over the loose rulings now in force and civilian needs limited more drastically. In speaking of the possible necessity of curtailing automobile production more sharply, sentiment was expressed typically by a steel man remarking: "Better to walk, if that will insure against bombs dropping on our homes."

Deliveries are becoming ever more extended. For one large maker of plates orders now being placed on books, where no priority rules, specify 1943 delivery. Some makers who had been selling halfheartedly for 1942 delivery are becoming stricter because of the rapidly-changing picture and difficulty of foreseeing conditions in 1942. Such strictness makes incoming orders taper sharply.

A new inquiry calls for 400,000 tons of plates for shipbuilders who are to turn out 123 more merchant ships. A pipe line from Baton Rouge, La. to New York, involving 435,000 tons of mostly 24-inch pipe, is about to be placed.

Tin plate capacity has been engaged for 420,000 tons of tin plate for Great Britain over the next twelve months, to be shipped 35,000 tons monthly. For the same destination pig iron producers are actively figuring on 240,000 tons of pig iron, half low phos and half bessemer, one discussed plan being to allocate among producers with respect to their percentage of national capacity.

Fabricators of shapes are making new speed records for fabricating and erecting for defense plants. Thus Bethlehem Steel Co. fabricated, delivered and erected 2000 tons for a defense shop for the Otis Elevator Co., Harrison, N. J. in under three months; it also booked 4800 tons for the Republic Aviation Co., Farmingdale, N. Y. early in February, started erection Feb. 10, completed fabrication that month and finished the contract April 1.

Much confusion has attended filling out of reports by steelmakers for General Metal Order No. 1, known as inventory control. Apparently no two steel companies interpreted the order in the same manner. One important interpretation, which has become common, through much inter-company consultation, is that tonnages of products delivered to customers does not need to be listed; only the kinds of products. Many expect supplemental ruling from Washington later, these perhaps to provide for mention of tonnages, which would seem needed to give an accurate picture of inventories. The initial report must be filed by June 10.

The Central Iron and Steel Co., Harrisburg, Pa., maker of plates, has been granted an exception in the steel price freezing order by the OPACS whereby it may charge $5 per ton over the official 2.10-cent price, this being the second company to be granted specifically an exception.

In line with the current move to simplify steels the number of SAE standard steels has been cut from 109 to 85, the last previous revision having been made in 1935.

Though Memorial Day is not an official holiday in the steel industry, many departments observed it as such. Some warehouse distributors closed from Thursday night to Monday morning.

The national steel ingot production rate fell one point last week to 99 per cent. Declines took place in three districts: Chicago 2 points to 100½, Wheeling 1 point to 88 and Cleveland ½ point to 96. Three districts advanced, Detroit by 3 points to 92, New England 5 points to 95 and Cincinnati by 3½ points to 92½. Unchanged were the following: Buffalo at 93, Birmingham at 95, St. Louis at 98, Pittsburgh at 100½, eastern Pennsylvania at 96 and Youngstown at 97.

STEEL'S three composite price groups for last week were unchanged: iron and steel at $38.15, finished steel at $56.60 and steelworks scrap at $19.16.

COMPOSITE MARKET AVERAGES

	May 31	May 24	May 17	One Month Ago April, 1941	Three Months Ago Feb., 1941	One Year Ago May, 1940	Five Years Ago May, 1936
Iron and Steel	$38.15	$38.15	$38.15	$38.15	$38.22	$37.33	$32.92
Finished Steel	56.60	56.60	56.60	56.60	56.60	56.60	52.20
Steelworks Scrap..	19.16	19.16	19.16	19.16	19.95	16.00	14.39

Iron and Steel Composite:—Pig iron, scrap, billets, sheet bars, wire rods, tin plate, wire, sheets, plates, shapes, bars, black pipe, rails, alloy steel, hot strip, and cast iron pipe at representative centers. Finished Steel Composite:—Plates, shapes, bars, hot strip, nails, tin plate, pipe. Steelworks Scrap Composite:—Heavy melting steel and compressed sheets.

COMPARISON OF PRICES

Representative Market Figures for Current Week; Average for Last Month, Three Months and One Year Ago

Finished Material

	May 31, 1941	April 1941	Feb. 1941	May 1940
Steel bars, Pittsburgh	2.15c	2.15c	2.15c	2.15c
Steel bars, Chicago	2.15	2.15	2.15	2.15
Steel bars, Philadelphia	2.47	2.47	2.47	2.47
Iron bars, Chicago	2.25	2.25	2.25	2.25
Shapes, Pittsburgh	2.10	2.10	2.10	2.10
Shapes, Philadelphia	2.215	2.215	2.215	2.215
Shapes, Chicago	2.10	2.10	2.10	2.10
Plates, Pittsburgh	2.10	2.10	2.10	2.10
Plates, Philadelphia	2.15	2.21	2.225	2.15
Plates, Chicago	2.10	2.10	2.10	2.10
Sheets, hot-rolled, Pittsburgh	2.10	2.10	2.10	2.10
Sheets, cold-rolled, Pittsburgh	3.05	3.05	3.05	3.05
Sheets, No. 24 galv., Pittsburgh	3.50	3.50	3.50	3.50
Sheets, hot-rolled, Gary	2.10	2.10	2.10	2.10
Sheets, cold-rolled, Gary	3.05	3.05	3.05	3.05
Sheets, No. 24 galv. Gary	3.50	3.50	3.50	3.50
Bright bess., basic wire, Pitts.	2.60	2.60	2.60	2.60
Tin plate, per base box, Pitts.	$5.00	$5.00	$5.00	$5.00
Wire nails, Pittsburgh	2.55	2.55	2.55	2.55

Semifinished Material

Sheet bars, Pittsburgh, Chicago	$34.00	$34.00	$34.00	$34.00
Slabs, Pittsburgh, Chicago	34.00	34.00	34.00	34.00
Rerolling billets, Pittsburgh	34.00	34.00	34.00	34.00
Wire rods No. 5 to 9/32-inch, Pitts.	2.00	2.00	2.00	2.00

Pig Iron

	May 31, 1941	April 1941	Feb. 1941	May 1940
Bessemer, del. Pittsburgh	$25.34	$25.34	$25.34	$24.34
Basic, Valley	23.50	23.50	23.50	22.50
Basic, eastern, del. Philadelphia	25.34	25.34	25.34	24.34
No. 2 fdry., del. Pgh., N.&S. Sides	24.69	24.69	24.69	23.69
No. 2 foundry, Chicago	24.00	24.00	24.00	23.00
Southern No. 2, Birmingham	20.38	20.38	20.38	19.38
Southern No. 2, del. Cincinnati	24.06	24.06	24.06	23.06
No. 2X, del. Phila. (differ. av.)	26.215	26.215	26.215	25.215
Malleable, Valley	24.00	24.00	24.00	23.00
Malleable, Chicago	24.00	24.00	24.00	23.00
Lake Sup., charcoal, del. Chicago	31.34	30.34	30.34	30.34
Gray forge, del. Pittsburgh	24.19	24.19	24.17	23.17
Ferromanganese, del. Pittsburgh	125.33	125.33	125.33	105.33

Scrap

Heavy melting steel, Pitts.	$20.00	$20.20	$20.75	$18.00
Heavy melt. steel, No. 2, E. Pa.	17.75	18.00	18.50	16.00
Heavy melting steel, Chicago	18.75	18.80	19.25	17.25
Rails for rolling, Chicago	22.25	22.65	23.75	21.25
Railroad steel specialties, Chicago	23.75	23.75	23.55	20.25

Coke

Connellsville, furnace, ovens	$6.25	$5.50	$5.50	$4.75
Connellsville, foundry, ovens	7.25	6.00	6.00	5.75
Chicago, by-product fdry., del.	12.25	11.75	11.75	11.25

STEEL, IRON, RAW MATERIAL, FUEL AND METALS PRICES

Except when otherwise designated, prices are base, f.o.b. cars.

Sheet Steel

Hot Rolled

Pittsburgh	2.10c
Chicago, Gary	2.10c
Cleveland	2.10c
Detroit, del.	2.20c
Buffalo	2.10c
Sparrows Point, Md.	2.10c
New York, del.	2.34c
Philadelphia, del.	2.27c
Granite City, Ill.	2.20c
Middletown, O.	2.10c
Youngstown, O.	2.10c
Birmingham	2.10c
Pacific Coast ports	2.65c

Cold Rolled

Pittsburgh	3.05c
Chicago, Gary	3.05c
Buffalo	3.05c
Cleveland	3.05c
Detroit, delivered	3.15c
Philadelphia, del.	3.37c
New York, del.	3.39c
Granite City, Ill.	3.15c
Middletown, O.	3.05c
Youngstown, O.	3.05c
Pacific Coast ports	3.70c

Galvanized No. 24

Pittsburgh	3.50c
Chicago, Gary	3.50c
Buffalo	3.50c
Sparrows Point, Md.	3.50c
Philadelphia, del.	3.67c
New York, delivered	3.74c
Birmingham	3.50c
Granite City, Ill	3.60c
Middletown, O.	3.50c
Youngstown, O.	3.50c
Pacific Coast ports	4.05c

Black Plate, No. 29 and Lighter

Pittsburgh	3.05c
Chicago, Gary	3.05c
Granite City, Ill.	3.15c

Long Ternes No. 24 Unassorfed

Pittsburgh, Gary	3.80c
Pacific Coast	4.55c

Enameling Sheets

	No. 10	No. 20
Pittsburgh	2.75c	3.35c
Chicago, Gary	2.75c	3.35c
Granite City, Ill.	2.85c	3.45c
Youngstown, O.	2.75c	3.35c
Cleveland	2.75c	3.35c
Middletown, O.	2.75c	3.35c
Pacific Coast	3.40c	4.00c

Corrosion and Heat-Resistant Alloys

Pittsburgh base, cents per lb.

Chrome-Nickel

	No. 302	No. 303	No 304
Bars	24.00	26.00	25.00
Plates	27.00	29.00	29.00
Sheets	34.00	36.00	36.00
Hot strip	21.50	27.00	23.50
Cold strip	28.00	33.00	30.00

20% Ni.-Cr. Clad

Plates	18.00*
Sheets	19.00

**Annealed and pickled*

Straight Chromes

	No. 410	No. 416	No. 430	No. 442
Bars	18.50	19.00	19.00	22.50
Plates	21.50	22.00	22.00	25.50
Sheets	26.50	27.00	29.00	32.50
Hot strip	17.00	18.25	17.50	24.00
Cold stp.	22.00	23.50	22.50	32.00

Steel Plate

Pittsburgh	2.10c
New York, del.	2.29c
Philadelphia, del.	2.15c
Boston, delivered	2.43c-2.57c
Buffalo, delivered	2.33c
Chicago or Gary	2.10c
Cleveland	2.10c
Birmingham	2.10c
Coatesville, Pa.	2.10c-2.35c
Sparrows Point, Md.	2.10c-2.35c
Claymont, Del.	2.10c-2.35c
Youngstown	2.10c
Gulf ports	2.45c
Pacific Coast ports	2.65c

Steel Floor Plates

Pittsburgh	3.35c
Chicago	3.35c
Gulf ports	3.70c
Pacific Coast ports	4.00c

Structural Shapes

Pittsburgh	2.10c
Philadelphia, del.	2.21½c
New York, del.	2.27c
Boston, delivered	2.41c
Bethlehem	2.10c
Chicago	2.10c
Cleveland, del.	2.30c
Buffalo	2.10c
Gulf ports	2.45c
Birmingham	2.10c
St. Louis, del.	2.34c
Pacific Coast ports	2.75c

Tin and Terne Plate

Tin Plate, Coke (base box)

Pittsburgh, Gary, Chicago	$5.00
Granite City, Ill.	5.10

Mfg. Terne Plate (base box)

Pittsburgh, Gary, Chicago	$4.30
Granite City, Ill.	4.40

Roofing Ternes

Pittsburgh base, package 112 sheets 20 x 28 in., coating I.C.

8-lb.	$12.00	25-lb.	$16.00
15-lb.	14.00	30-lb.	17.25
20-lb.	15.00	40-lb.	19.50

Bars

Soft Steel

(Base, 20 tons or over)

Pittsburgh	2.15c
Chicago or Gary	2.15c
Duluth	2.25c
Birmingham	2.15c
Cleveland	2.15c
Buffalo	2.15c
Detroit, delivered	2.25c
Philadelphia, del.	2.47c
Boston, delivered	2.52c
New York, del.	2.49c
Gulf ports	2.50c
Pacific Coast ports	2.80c

Rail Steel

(Base, 5 tons or over)

Pittsburgh	2.15c
Chicago or Gary	2.15c
Detroit, delivered	2.25c
Cleveland	2.15c

Buffalo	2.15c
Birmingham	2.15c
Gulf ports	2.50c
Pacific Coast ports	2.80c

Iron

Chicago	2.25c
Philadelphia, del.	2.37c
Pittsburgh, refined	3.50-8.00c
Terre Haute, Ind.	2.15c

Reinforcing

New Billet Bars, Base

Chicago, Gary, Buffalo, Cleve., Birm., Young., Sparrows Pt., Pitts.	2.15c
Gulf ports	2.50c
Pacific Coast ports	2.60c

Rail Steel Bars, Base

Pittsburgh, Gary, Chicago, Buffalo, Cleveland, Birm.	2.15c
Gulf ports	2.50c
Pacific Coast ports	2.60c

Wire Products

Pitts.-Cleve.-Chicago-Birm. base per 100 lb. keg in carloads

Standard and cement coated wire nails	$2.55

(Per Pound)

Polished fence staples	2.55c
Annealed fence wire	3.05c
Galv. fence wire	3.40c
Woven wire fencing (base C. L. column)	67
Single loop bale ties, (base C.L. column)	59
Galv. barbed wire, 80-rod spools, base column	70
Twisted barbless wire, column	70

To Manufacturing Trade

Base, Pitts.-Cleve.-Chicago Birmingham (except spring wire)

Bright bess., basic wire.	2.60c
Galvanized wire	2.60c
Spring wire	3.20c

Worcester, Mass., $2 higher on bright basic and spring wire.

Cut Nails

Carload, Pittsburgh, keg..$3.85

Cold-Finished Bars

	Carbon	Alloy
Pittsburgh	2.65c	3.35c
Chicago	2.65c	3.35c
Gary, Ind.	2.65c	3.35c
Detroit	2.70c	*3.45c
Cleveland	2.65c	3.35c
Buffalo	2.65c	3.35c

*Delivered.

Alloy Bars (Hot)

(Base, 20 tons or over)

Pittsburgh, Buffalo, Chicago, Massillon, Canton, Bethlehem 2.70c
Detroit, delivered 2.80c

S.A.E.	Alloy Diff.	S.A.E.	Alloy Diff.
2000	0.35	3100	0.70
2100	0.75	3200	1.35
2300	1.70	3300	3.80
2500	2.55	3400	3.20

4100 0.15 to 0.25 Mo. 0.55
4600 0.20 to 0.30 Mo. 1.50-2.00 Ni. 1.20
5100 0.80-1.10 Cr. 0.45
5100 Cr. spring flats 0.15
6100 bars 1.20
6100 spring flats 0.85
Cr. N., Van. 1.50
Carbon Van. 0.85
9200 spring flats 0.15
9200 spring rounds, squares 0.40
Electric furnace up 50 cents.

Alloy Plates (Hot)

Pittsburgh, Chicago, Coatesville, Pa. 3.50c

Strip and Hoops

(Base, hot strip, 1 ton or over; cold, 3 tons or over)

Hot Strip, 12-inch and less

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Middletown, Birmingham	2.10c
Detroit, del.	2.20c
Philadelphia, del.	2.42c
New York, del.	2.46c
Pacific Coast ports	2.75c
Cooperage hoop, Young., Pitts.; Chicago, Birm.	2.20c
Cold strip, 0.25 carbon and under, Pittsburgh, Cleveland, Youngstown	2.80c
Chicago	2.90c
Detroit, del.	2.90c
Worcester, Mass.	3.00c

Carbon	Cleve., Pitts.
0.26—0.50	2.80c
0.51—0.75	4.30c
0.76—1.00	6.15c
Over 1.00	8.35c

Worcester, Mass. $4 higher.

Commodity Cold-Rolled Strip

Pitts.-Cleve.-Youngstown	2.95c
Chicago	3.05c
Detroit, del.	3.05c
Worcester, Mass.	3.35c

Lamp stock up 10 cents.

Rails, Fastenings

(Gross Tons)

Standard rails, mill	$40.00
Relay rails, Pittsburgh 20—100 lbs.	32.50-35.50
Light rails, billet qual., Pitts., Chicago, B'ham.	$40.00
Do., rerolling quality	39.00

Cents per pound

Angle bars, billet, mills.	2.70c
Do., axle steel	2.35c
Spikes, R. R. base	3.00c
Track bolts, base	4.15c
Car axles forged, Pitts., Chicago, Birmingham.	3.15c
Tie plates, base	2.15c

Base, light rails 25 to 60 lbs., 20 lbs., up $2; 16 lbs. up $4; 12 lbs. up $8; 8 lbs. up $10. Base railroad spikes 200 kegs or more; base plates 20 tons.

Bolts and Nuts

F.o.b. Pittsburgh, Cleveland, Birmingham, Chicago. Discounts for carloads additional 5%, full containers, add 10%.

Carriage and Machine

½ x 6 and smaller.....65½ off
Do., ⅝ and ¾ x 6-in. and shorter.....63½ off
Do., ⅞ to 1 x 6-in. and shorter .....61 off
1⅛ and larger, all lengths 59 off
All diameters, over 6-in. long .....59 off
Tire bolts .....50 off

Stove Bolts

In packages with nuts separate 71-10 off; with nuts attached 71 off; bulk 80 off on 15,000 of 3-inch and shorter, or 5000 over 3-in.
Step bolts .....56 off
Plow bolts .....65 off

Nuts

Semifinished hex.	U.S.S.	S.A.E.
½-inch and less.	62	64
⅝-1-inch	59	60
1⅛-1½-inch	57	58
1⅝ and larger	56	..

Hexagon Cap Screws

Upset 1-in., smaller .....64 off

Square Head Set Screws

Upset, 1-in., smaller.....71 off
Headless set screws.....60 off

Piling

Pitts., Chgo., Buffalo .. 2.40c

Rivets, Washers

F.o.b. Pitts., Cleve., Chgo., Bham.

Structural 3.75c
⅞-inch and under....60-5-5 off
Wrought washers, Pitts., Chi., Phila., to jobbers and large nut, bolt mfrs. l.c.l. $5.40; c.l. $5.75 off

Welded Iron, Steel, Pipe

Base discounts on steel pipe. Pitts., Lorain, O., to consumers in carloads. Gary, Ind., 2 points less on lap weld, 1 point less on butt weld. Chicago delivery 2½ and 1½ less, respectively. Wrought pipe, Pittsburgh base.

Butt Weld

Steel

In.	Blk.	Galv.
½	63½	51
¾	66½	55
1—3	68½	57½

Iron

¾	30	10
1—1¼	34	16
1½	38	18½
2	37½	18

Lap Weld

Steel

2	61	49½
2½—3	64	52½
3½—6	66	54½
7 and 8	65	52½

Iron

2	30½	12
2½—3½	31½	14½
4	33½	18
4½—8	32½	17
9—12	28½	12

Line Pipe

Steel

1 to 3, butt weld	67½
2, lap weld	60
2½ to 3, lap weld	63
3½ to 6, lap weld	65
7 and 8, lap weld	64

Iron

	Blk.	Galv.
¾ butt weld	25	4
1 and 1¼ butt weld	29	10
1½ butt weld	33	12½
2 butt weld	32½	13
1½ lap weld	23½	4
2 lap weld	25½	6
2½ to 3½ lap weld	26½	8½
4 lap weld	28½	12
4½ to 8 lap weld	27½	11
9 to 12 lap weld	23½	6

Boiler Tubes

Carloads minimum wall seamless steel boiler tubes, cutlengths 4 to 24 feet; f.o.b. Pittsburgh, base price per 100 feet subject to usual extras.

Lap Welded

Sizes	Gage	Steel	Charcoal Iron
1½"O.D.	13	$ 9.72	$23.71
1¾"O.D.	13	11.06	22.93
2" O.D.	13	12.38	19.35
2¼"O.D.	13	13.79	21.68
2¼"O.D.	12	15.16	....
2½"O.D.	12	16.58	26.57
2¾"O.D.	12	17.54	29.00
3" O.D.	12	18.35	31.36
3½"O.D.	11	23.15	39.81
4" O.D.	10	28.66	49.90
5" O.D.	9	44.25	73.93
6" O.D.	7	68.14	....

Seamless

Sizes	Gage	Hot Rolled	Cold Drawn
1" O.D.	13	$ 7.82	$ 9.01
1¼"O.D.	13	9.26	10.67
1½"O.D.	13	10.23	11.79
1¾"O.D.	13	11.64	13.42
2" O.D.	13	13.04	15.03
2¼"O.D.	13	14.54	16.76
2¾"O.D.	12	16.01	18.45
2½"O.D.	12	17.54	20.21
2¾"O.D.	12	18.59	21.42
3" O.D.	12	19.50	22.48
3½"O.D.	11	24.62	28.37
4" O.D.	10	30.54	35.20
4½"O.D.	10	37.35	43.04
5" O.D.	9	46.87	54.01
6" O.D.	7	71.96	82.93

Cast Iron Pipe

Class B Pipe—Per Net Ton

6-in., & over, Birm.	$45.00-46.00
4-in., Birmingham	48.00-49.00
4-in., Chicago	56.80-57.80
6-in. & over, Chicago	53.80-54.80
6-in. & over, east fdy.	49.00
Do., 4-in.	52.00

Class A Pipe $3 over Class B
Stnd. fitgs., Birm., base $100.00.

Semifinished Steel

Rerolling Billets, Slabs

(Gross Tons)

Pittsburgh, Chicago, Gary, Cleve., Buffalo, Youngs., Birm., Sparrows Point	$34.00
Duluth (billets)	36.00
Detroit, delivered	36.00

Forging Quality Billets

Pitts., Chi., Gary, Cleve., Young, Buffalo, Birm.	40.00
Duluth	42.00

Sheet Bars

Pitts., Cleveland, Young., Sparrows Point Buffalo, Canton, Chicago	34.00
Detroit, delivered	36.00

Wire Rods

Pitts., Cleveland, Chicago, Birmingham No. 5 to ⅝-inch incl. (per 100 lbs.)	$2.00
Do., over ⅝ to 47/64-in. incl.	2.15

Worcester up $0.10; Galveston up $0.25; Pacific Coast up $0.50.

Skelp

Pitts., Chi., Youngstown, Coatesville, Sparrows Pt.	1.90c

Shell Steel

Pittsburgh, Chicago, base, 1000 tons of one size, open hearth

3-12-inch	$52.00
12-18-inch	54.00
18-inch and over	56.00

Coke

Price Per Net Ton

Beehive Ovens

Connellsville, fur.	$6.00- 6.25
Connellsville, fdry.	7.00- 7.50
Connell. prem. fdry.	7.25- 7.60
New River fdry.	6.50- 7.00
Wise county fdry.	5.50- 6.50
Wise county fur.	5.00- 5.25

By-Product Foundry

Newark, N. J., del.	12.60-13.05
Chicago, outside del.	11.50
Chicago, delivered	12.25
Terre Haute, del.	11.75
Milwaukee, ovens.	12.25
New England, del.	13.75
St. Louis, del.	12.25
Birmingham, ovens.	8.50
Indianapolis, del.	12.00
Cincinnati, del.	11.75
Cleveland, del.	12.30
Buffalo, del.	12.50
Detroit, del.	12.25
Philadelphia, del.	12.13

Coke By-Products

Spot, gal., freight allowed east of Omaha

Pure and 90% benzol	14.00c
Toluol, two degree	27.00c
Solvent naphtha	26.00c
Industrial xylol	26.00c

Per lb. f.o.b. Frankford and St. Louis

Phenol (less than 1000 lbs.)	13.75c
Do. (1000 lbs. or over)	12.75c

Eastern Plants, per lb.

Naphthalene flakes, balls, bbls. to jobbers	7.00c

Per ton, bulk, f.o.b. port

Sulphate of ammonia	$30.00

Pig Iron

Delivered prices include switching charges only as noted. No. 2 foundry is 1.75-2.25 sil.; 25c diff. for each 0.25 sil. above 2.25 sil.; 50c diff. below 1.75 sil. Gross tons

Basing Points:	No. 2 Fdry.	Malleable	Basic	Bessemer
Bethlehem, Pa.	$25.00	$25.50	$24.50	$26.00
Birmingham, Ala.§	20.38	.....	19.38	24.00
Birdsboro, Pa.	25.00	25.50	24.50	26.00
Buffalo	24.00	24.50	23.00	25.00
Chicago	24.00	24.00	23.50	24.50
Cleveland	24.00	24.00	23.50	24.50
Detroit	24.00	24.00	23.50	24.50
Duluth	24.50	24.50	.....	25.00
Erie, Pa.	24.00	24.50	23.50	25.00
Everett, Mass.	25.00	25.50	24.50	26.00
Granite City, Ill.	24.00	24.00	23.50	24.50
Hamilton, O.	24.00	24.00	23.50	24.50
Neville Island, Pa.	24.00	24.00	23.50	24.50
Provo, Utah	22.00	.....	.....	.....
Sharpsville, Pa.	24.00–24.50	24.00–24.50	23.50–24.50	24.50–25.00
Sparrow's Point, Md.	25.00	.....	24.50	.....
Swedeland, Pa.	25.00	25.50	24.50	26.00
Toledo, O.	24.00	24.00	23.50	24.50
Youngstown, O.	24.00–24.50	24.00–24.50	23.50–24.50	24.50–25.00

§Subject to 38 cents deduction for 0.70 per cent phosphorus or higher.

Delivered from Basing Points:				
Akron, O., from Cleveland	25.39	25.39	24.89	25.89
Baltimore from Birmingham†	25.61	.....	25.11	.....
Boston from Birmingham†	25.12	.....	.....	.....
Boston from Everett, Mass.	25.50	26.00	25.00	26.50
Boston from Buffalo	25.50	26.00	25.00	26.50
Brooklyn, N. Y., from Bethlehem	27.50	28.00	.....	.....
Canton, O. from Cleveland	25.39	25.39	24.89	25.89
Chicago from Birmingham	†24.22	.....	.....	.....
Cincinnati from Hamilton, O.	24.44	25.11	24.61	.....
Cincinnati from Birmingham†	24.06	.....	23.06	.....
Cleveland from Birmingham†	24.12	.....	23.62	.....
Mansfield, O., from Toledo, O.	25.94	25.94	25.44	.....
Milwaukee from Chicago	25.10	25.10	24.60	25.60
Muskegon, Mich., from Chicago, Toledo or Detroit	27.19	27.19	.....	.....
Newark, N. J., from Birmingham†	26.15	.....	.....	.....
Newark, N. J., from Bethlehem	26.53	27.03	.....	.....
Philadelphia from Birmingham†	25.46	.....	24.96	.....
Philadelphia from Swedeland, Pa.	25.84	26.34	25.34	.....

Pittsburgh dist.: Add to Neville Island base, North and South Sides, 69c; McKees Rocks, 55c; Lawrenceville, Homestead, McKeesport, Ambridge, Monaca, Aliquippa, 84c; Monessen, Monongahela City, $1.07; Oakmont, Verona, $1.11; Brackenridge, $1.24.

	No. 2 Fdry.	Malleable	Basic	Bessemer
Saginaw, Mich., from Detroit	26.31	26.31	25.81	26.81
St. Louis, northern	24.50	24.50	24.00	.....
St. Louis from Birmingham	†24.12	.....	23.62	.....
St. Paul from Duluth	26.63	26.63	.....	27.13

†Over 0.70 phos.

Low Phos.

Basing Points: Birdsboro and Steelton, Pa., and Buffalo, N. Y., $29.50, base; $30.74 delivered Philadelphia.

Gray Forge		Charcoal	
Valley furnace	$23.50	Lake Superior fur.	$28.00
Pitts. dist. fur.	23.50	do., del. Chicago	31.34
		Lyles, Tenn., high phos.	28.50

†Silvery

Jackson county, O., base: 6-6.50 per cent $29.50; 6.51-7—$30.00; 7-7.50—$30.50; 7.51-8—$31.00; 8-8.50—$31.50; 8.51-9—$32.00; 9-9.50—$32.50; Buffalo, $1.25 higher.

Bessemer Ferrosilicon†

Jackson county, O., base; Prices are the same as for silveries, plus $1 a ton.

†The lower all-rail delivered price from Jackson, O., or Buffalo, is quoted with freight allowed.

Manganese differentials in silvery iron and ferrosilicon, 2 to 3%, $1 per ton add. Each unit over 3%, add $1 per ton.

Refractories

Per 1000 f.o.b. Works, Net Prices

Fire Clay Brick

Super Quality

Pa., Mo., Ky.	$60.80

First Quality

Pa., Ill., Md., Mo., Ky.	47.50
Alabama, Georgia	47.50
New Jersey	56.00

Second Quality

Pa., Ill., Ky., Md., Mo.	42.75
Georgia, Alabama	34.20
New Jersey	49.00

Ohio

First quality	39.90
Intermediate	36.10
Second quality	31.35

Malleable Bung Brick

All bases	$56.05

Silica Brick

Pennsylvania	$47.50
Joliet, E. Chicago	55.10
Birmingham, Ala.	47.50

Ladle Brick

(Pa., O., W. Va., Mo.)

Dry press	$28.00
Wire cut	26.00

Magnesite

Domestic dead-burned grains, net ton f.o.b. Chewelah, Wash., net ton, bulk	22.00
net ton, bags	26.00

Basic Brick

Net ton, f.o.b. Baltimore, Plymouth Meeting, Chester, Pa.

Chrome brick	$50.00
Chem. bonded chrome	50.00
Magnesite brick	72.00
Chem. bonded magnesite	61.00

Fluorspar

Washed gravel, duty pd., tide, net ton	$25.00-$26.00
Washed gravel, f.o.b. Ill., Ky., net ton, carloads, all rail	20.00-21.00
Do. barge	20.00
No. 2 lump	20.00-21.00

Ferroalloy Prices

Ferromanganese, 78-82%,

carlots, duty pd.	$120.00
Ton lots	130.00
Less ton lots	133.50
Less 200 lb. lots	138.00
Do., carlots del. Pitts.	125.33

Spiegeleisen, 19-21% dom.

Palmerton, Pa., spot	36.00

Ferrosilicon, 50%, freight allowed, c.l.

	74.50
Do., ton lot	87.00
Do., 75 per cent	135.00
Do., ton lots	151.00

Spot, $5 a ton higher.

Silicomanganese, c.l., 2½ per cent carbon

	118.00
1½% carbon	128.00

Contract ton price $12.50 higher; spot $5 over contract.

Ferrotungsten, stand., lb. con. del. cars 1.90-2.00

Ferrovanadium, 35 to 40%, lb., cont. 2.70-2.80-2.90

Ferrophosphorus, gr. ton, c.l., 17-18% Rockdale, Tenn., basis, 18%, $3 unitage, 58.50; electric furn., per ton, c. l., 23-26% f.o.b. Mt. Pleasant, Tenn., 24% $3 unitage 75.00

Ferrochrome, 66-70 chromium, 4-6 carbon, cts. lb., contained cr., del. carlots 11.00c

Do., ton lots 11.75c

Do., less-ton lots 12.00c

less than 200 lb. lots. 12.25c

67-72% low carbon:

	Carloads	Ton lots	Less ton
2% carb.	17.50c	18.25c	18.75c
1% carb.	18.50c	19.25c	19.75c
0.10% carb.	20.50c	21.25c	21.75c
0.20% carb.	19.50c	20.25c	20.75c

Spot ¼c higher

Ferromolybdenum, 55-65% molyb. cont., f.o.b. mill, lb. 0.95

Calcium molybdate, lb. molyb. cont., f.o.b. mill 0.80

Ferrotitanium, 40-45%, lb., con. ti., f.o.b. Niagara Falls, ton lots

	$1.23
Do., less-ton lots	1.25
20-25% carbon, 0.10 max., ton lots, lb.	1.35
Do., less-ton lots	1.40

Spot 5c higher

Ferrocolumbium, 50-60% contract, lb. con. col., f.o.b. Niagara Falls

	$2.25
Do., less-ton lots	2.30

Spot is 10c higher

Technical molybdenum trioxide, 53 to 60% molybdenum, lb. molyb. cont., f.o.b. mill 0.80

Ferro-carbon-titanium, 15-18%, ti., 6-8% carb., carlots, contr., net ton $142.50

Do., spot 145.00

Do., contract, ton lots 145.00

Do., spot, ton lots 150.00

15-18% ti., 3-5% carbon, carlots, contr., net ton 157.50

Do., spot 160.00

Do., contract, ton lots. 160.00

Do., spot, ton lots 165.00

Alsifer, contract carlots, f.o.b. Niagara Falls, lb. 7.50c

Do., ton lots 8.00c

Do., less-ton lots 8.50c

Spot ½c lb. higher

Chromium Briquets, contract, freight allowed, lb. carlots, bulk 7.00c

Do., ton lots 7.50c

Do., less-ton lots 7.75c

Do., less 200 lbs. 8.00c

Spot ¼c lb. higher

Tungsten Metal Powder, according to grade, spot shipment, 200-lb. drum lots, lb. $2.50

Do., smaller lots 2.60

Vanadium Pentoxide, contract, lb. contained $1.10

Do., spot 1.15

Chromium Metal, 98% cr., contract, lb. con. chrome, ton lots 80.00c

Do., spot 85.00c

88% chrome, cont. tons 79.00c

Do., spot 84.00c

Silicon Metal, 1% iron, contract, carlots, 2 x ⅛-in., lb. 14.50c

Do., 2% 13.00c

Spot ¼c higher

Silicon Briquets, contract carloads, bulk, freight allowed, ton $74.50

Ton lots 84.50

Less-ton lots, lb. 4.00c

Less 200 lb. lots, lb. 4.25c

Spot ¼-cent higher

Manganese Briquets, contract carloads, bulk freight allowed, lb. 5.50c

Ton lots 6.00c

Less-ton lots 6.25c

Spot ¼c higher

Zirconium Alloy, 12-15%, contract, carloads, bulk, gross ton 102.50

Do., ton 108.00

35-40%, contract, carloads, lb., alloy 14.00c

Do., ton lots 15.00c

Do., less-ton lots 16.00c

Spot ¼c higher

Molybdenum Powder, 99%, f.o.b. York, Pa. 200-lb. kegs, lb. $2.60

Do., 100-200 lb. lots 2.75

Do., under 100-lb. lots 3.00

Molybdenum Oxide Briquets, 48-52% molybdenum, per pound contained, f.o.b. producers' plant $0.00

WAREHOUSE STEEL PRICES

Base Prices in Cents Per Pound, Delivered Locally, Subject to Prevailing Differentials

	Soft Bars	Bands	Hoops	Plates ¼-in. & Over	Structural Shapes	Floor Plates	Sheets: Hot Rolled	Sheets: Cold Rolled	Sheets: Galv. No. 24	Cold Rolled Strip	Cold Drawn Bars: Carbon	Cold Drawn Bars: S.A.E. 2300	Cold Drawn Bars: S.A.E. 3100
Boston	3.98	4.06	5.06	3.85	3.85	5.66	3.71	4.48	5.11	3.46	4.13	8.88	7.23
New York (Met.)	3.84	3.96	3.96	3.76	3.75	5.56	3.58	4.60	5.00	3.51	4.09	8.84	7.19
Philadelphia	3.85	3.95	4.45	3.55	3.55	5.25	3.55	4.05	4.75	3.31	4.06	8.56	7.16
Baltimore	3.85	4.00	4.35	3.70	3.70	5.25	3.50	....	5.05	....	4.05	....	....
Norfolk, Va.	4.00	4.10	....	4.05	4.05	5.45	3.85	....	5.40	....	4.15	....	....
Buffalo	3.35	3.82	3.82	3.62	3.40	5.25	3.25	4.30	4.75	3.52	3.75	8.40	6.75
Pittsburgh	3.35	3.60	3.60	3.40	3.40	5.00	3.35	....	4.65	....	3.65	8.40	6.75
Cleveland	3.25	3.50	3.50	3.40	3.58	5.18	3.35	4.05	4.62	3.20	3.75	8.40	6.75
Detroit	3.43	3.43	3.68	3.60	3.65	5.27	3.43	4.30	4.84	3.40	3.80	8.70	7.05
Omaha	4.10	4.20	4.20	4.15	4.15	5.75	3.85	5.32	5.50	....	4.42	....	....
Cincinnati	3.60	3.67	3.67	3.65	3.68	5.28	3.42	4.00	4.92	3.47	4.00	8.75	7.10
Chicago	3.50	3.60	3.60	3.55	3.55	5.15	3.25	4.10	4.85	3.30	3.75	8.40	6.75
Twin Cities	3.75	3.85	3.85	3.80	3.80	5.40	3.50	4.35	5.00	3.83	4.34	9.09	7.44
Milwaukee	3.63	3.53	3.53	3.68	3.68	5.28	3.18	4.23	4.73	3.54	3.88	8.38	6.98
St. Louis	3.64	3.74	3.74	3.69	3.69	5.29	3.39	4.24	4.99	3.61	4.02	8.77	7.12
Kansas City	4.05	4.15	4.15	4.00	4.00	5.60	3.90	....	5.00	....	4.30	....	....
Indianapolis	3.60	3.75	3.75	3.70	3.70	5.30	3.45	....	5.01	....	3.97	....	....
Memphis	3.90	4.10	4.10	3.95	3.95	5.71	3.85	....	5.25	....	4.31	....	....
Chattanooga	3.80	4.00	4.00	3.85	3.85	5.80	3.75	....	4.50	....	4.39	....	....
Tulsa, Okla.	4.44	4.34	4.34	4.49	4.49	6.09	4.19	....	5.79	....	4.69	....	....
Birmingham	3.50	3.70	3.70	3.55	3.55	5.93	3.45	....	4.75	....	4.43	....	....
New Orleans	4.00	4.10	4.10	3.80	3.80	5.75	3.85	....	4.80	5.00	4.60	....	....
Houston, Tex.	3.75	5.95	5.95	4.10	4.10	5.50	4.20	....	5.25	....	6.90	....	....
Seattle	4.00	4.00	5.20	4.00	4.00	5.75	4.00	6.50	5.25	....	5.75	....	....
Portland, Oreg.	4.25	4.50	6.10	4.00	4.00	5.75	3.95	6.50	5.00	....	5.75	....	....
Los Angeles	4.15	4.65	6.45	4.15	4.15	6.40	4.30	6.50	5.50	....	6.60	10.55	9.80
San Francisco	3.90	4.40	6.00	3.90	3.90	5.60	3.90	6 40	5.65	....	6.80	10.65	9.80

	S.A.E. Hot-rolled Bars (Unannealed): 1035-1050	2300 Series	3100 Series	4100 Series	6100 Series
Boston	4.28	7.75	6.05	5.80	7.90
New York (Met.)	4.04	7.60	5.90	5.65	....
Philadelphia	4.10	7.56	5.86	5.61	8.56
Baltimore	4.45	....	....	....	....
Norfolk, Va.	....	....	....	....	....
Buffalo	3.55	7.35	5.65	5.40	7.50
Pittsburgh	3.40	7.45	5.75	5.50	7.60
Cleveland	3.30	7.55	5.85	5.85	7.70
Detroit	3.48	7.67	5.97	5.72	7.19
Cincinnati	3.65	7.69	5.99	5.74	7.84
Chicago	3.70	7.35	5.65	5.40	7.50
Twin Cities	3.95	7.70	6.00	6.09	8.19
Milwaukee	3.83	7.33	5.88	5.63	7.73
St. Louis	3.84	7.72	6.02	5.77	7.87
Seattle	5.85	....	8.00	7.85	8.65
Portland, Oreg.	5.70	8.85	8.00	7.85	8.65
Los Angeles	4.80	9.55	8.55	8.40	9.05
San Francisco	5.25	9.65	8.80	8.65	9.30

BASE QUANTITIES

Soft Bars, Bands, Hoops, Plates, Shapes, Floor Plates, Hot Rolled Sheets and SAE 1035-1050 Bars: Base, 400-1999 pounds; 300-1999 pounds in Los Angeles; 400-39,999 (hoops, 0-299) in San Francisco; 300 pounds and over, Portland, Seattle; 400-14,999 Twin Cities; 400-3999 Birmingham; 400 pounds and over in Memphis.

Cold Rolled Sheets: Base, 400-1499 pounds in Chicago, Cincinnati, Cleveland, Detroit, New York, Omaha, Kansas City, St. Louis; 450-3749 in Boston; 500-1499 in Buffalo; 1000-1999 in Philadelphia, Baltimore; 750-4999 in San Francisco; 300-4999 in Portland, Seattle; any quantity in Twin Cities; 300-1999 Los Angeles.

Galvanized Sheets: Base, 150-1499 pounds, New York; 150-1499 in Cleveland, Pittsburgh, Baltimore, Norfolk; 150-1049 in Los Angeles; 300-4999 in Portland, Seattle; 450-3749 in Boston; 500-1499 in Birmingham, Buffalo, Chicago, Cincinnati, Detroit, Indianapolis, Milwaukee, Omaha, St. Louis, Tulsa; 3500 and over in Chattanooga; any quantity in Twin Cities; 750-1500 in Kansas City; 150 and over in Memphis; 25 to 49 bundles in Philadelphia; 750-4999 in San Francisco.

Cold Rolled Strip: No base quantity; extras apply on lots of all size.

Cold Finished Bars: Base, 1500 pounds and over on carbon, except 0-299 in San Francisco, 1000 and over in Portland, Seattle; 1000 pounds and over on alloy, except 0-4999 in San Francisco.

SAE Hot Rolled Alloy Bars: Base, 1000 pounds and over, except 0-4999, San Francisco; 0-1999, Portland, Seattle.

EUROPEAN IRON, STEEL PRICES

Dollars at $4.02½ per Pound Sterling
Export Prices f.o.b. Port of Dispatch—

By Cable or Radio

	BRITISH Gross Tons f.o.b U.K. Ports	£	s	d
Merchant bars, 3-inch and over	$66.50	16	10	0
Merchant bars, small, under 3-inch, re-rolled	3.60c	20	0	0
Structural shapes	2.79c	15	10	0
Ship plates	2.90c	16	2	6
Boiler plates	3.17c	17	12	6
Sheets, black, 24 gage	4.00c	22	5	0
Sheets, galvanized, corrugated, 24 gage	4.61c	25	12	6
Tin plate, base box, 20 x 14, 108 pounds	$ 6.29	1	11	4

British ferromanganese $120.00 delivered Atlantic seaboard duty-paid.

Domestic Prices Delivered at Works or Furnace—

		£	s	d
Foundry No. 3 Pig Iron, Silicon 2.50—3.00	$25.79	6	8	0(a)
Basic pig iron	24.28	6	0	6(a)
Furnace coke, f.o.t. ovens	7.15	1	15	6
Billets, basic soft, 100-ton lots and over	49.37	12	5	0
Standard rails, 60 lbs. per yard, 500-ton lots & over	2.61c	14	10	6
Merchant bars, rounds and squares, under 3-inch	3.17c	17	12	0††
Shapes	2.77c	15	8	0††
Ship plates	2.91c	16	3	0††
Boiler plates	3.06c	17	0	6††
Sheets, black, 24 gage, 4-ton lots and over	4.10c	22	15	0
Sheets, galvanized 24 gage, corrugated, 4-ton lots & over	4.70c	26	2	6
Plain wire, mild drawn, catch weight coils, 2-ton lots and over	4.28c	23	15	0
Bands and strips, hot-rolled	3.30c	18	7	0

(a) del. Middlesbrough 5s rebate to approved customers. ††Rebate 15s on certain conditions.

Ores

Lake Superior Iron Ore

Gross ton, 51½%

Lower Lake Ports

Old range bessemer	$4.75
Mesabi nonbessemer	4.45
High phosphorus	4.35
Mesabi bessemer	4.60
Old range nonbessemer	4.60

Eastern Local Ore

Cents, unit, del. E. Pa.

Foundry and basic 56-63%, contract	10.00

Foreign Ore

Cents per unit, c.i.f. Atlantic ports

Manganiferous ore, 45-55% Fe., 6-10% Mang.	Nom.
N. African low phos.	Nom.
Spanish, No. African basic, 50 to 60%	Nom.
Chinese wolframite, net ton, duty pd.	$24.00-25.00
Brazil iron ore, 68-69%, ord.	7.50c
Low phos. (.02 max.)	8.00c

F.O.B. Rio Janeiro.

Scheelite, imp.	23.50-24.00
Chrome ore, Indian, 48% gross ton, clf.	$43.00-46.00

Manganese Ore

Including war risk but not duty, cents per unit cargo lots.

Caucasian, 50-52%	....
So. African, 48%	70.00-72.00
Brazilian, 46%	69.00-71.00
Chilean, 47%	65.00-70.00
Cuban, 50-51%, duty free	67.50

Molybdenum

Sulphide conc., lb., Mo. cont., mines	$0.75

IRON AND STEEL SCRAP PRICES

Maximum Prices Announced by Office of Price Administration and Civilian Supply (Gross Tons)

	Pittsburgh, Wheeling, Steubenville	Youngstown, Canton, Sharon	Chicago, Kokomo, Peoria	S. Bethlehem	*East. Pa.	Sparrows Pt.	Cleveland	Buffalo	South Ohio†
No. 1 heavy melting	$20.00	$20.00	$18.75	$18.25	$18.75	$18.25	$19.50	$19.25	$18.50
No. 1 hyd. comp. black sheets	20.00	20.00	18.75	18.25	18.75	18.25	19.50	19.25	18.50
No. 2 heavy melting	19.00	19.00	17.75	17.25	17.75	17.25	18.50	18.25	17.50
Dealer No. 1 bundles	19.00	19.00	17.75	17.25	17.75	17.25	18.50	18.25	17.50
Dealer No. 2 bundles	18.00	18.00	16.75	16.25	16.75	16.25	17.50	17.25	16.50
Mixed borings and turnings	15.25	15.25	14.00	13.50	14.00	13.50	14.75	14.50	13.75
Machine shop turnings	15.50	15.50	14.25	13.75	14.25	13.75	15.00	14.75	14.00
Shovel turnings	16.50	16.50	15.25	14.75	15.25	14.75	16.00	15.75	15.00
No. 1 busheling	19.50	19.50	18.25	17.75	18.25	17.75	19.00	18.75	18.00
No. 2 busheling	15.50	15.50	14.25	13.75	14.25	13.75	15.00	14.75	14.00
Cast iron borings	15.75	15.75	14.50	14.00	14.50	14.00	15.25	15.00	14.25
Uncut structurals and plate	19.00	19.00	17.75	17.25	17.75	17.25	18.50	18.25	17.50
No. 1 cupola	21.00	21.00	20.00	22.50	23.00	22.00	22.00	20.00	21.00
Heavy breakable cast	19.50	19.50	18.50	21.00	21.50	21.00	20.50	18.50	19.50
Stove plate	19.00	.....	16.00	18.00	18.50	18.00	15.75	19.00	13.00
Low phos. billet, bloom crops	25.00	25.00	23.75	23.25	23.25	23.25	24.50	24.25	23.50
Low phos. bar crops and smaller	23.00	23.00	21.75	21.25	21.75	21.25	22.50	22.25	21.50
Low phos. punch., plate scrap	23.00	23.00	21.75	21.25	21.75	21.25	22.50	22.25	21.50
No. 2 cupola	20.00	20.00	19.00	21.50	22.00	21.50	21.00	19.00	20.00
Machinery cast cupola size	22.00	22.00	21.00	23.50	24.00	23.50	23.00	21.00	22.00
No. 1 machine cast, drop broken, 150 pounds and under	22.50	22.50	21.50	24.00	24.50	24.00	23.50	21.50	22.50
Clean auto cast	22.50	22.50	21.50	24.00	24.50	24.00	23.50	21.50	22.50
Punchings and plate scrap†‡	22.00	22.00	20.75	20.25	20.75	20.25	21.50	21.25	20.50
Punchings and plate scrap§§	21.00	21.00	19.75	19.25	19.75	19.25	20.50	20.25	19.50
Heavy axle and forge turnings	19.50	19.50	18.25	17.75	18.25	17.75	19.00	18.75	18.00
Medium heavy elec. furnace turnings	18.00	18.00	16.75	16.25	16.75	16.25	17.50	17.25	16.50

	St. Louis	Kansas City	Detroit	Duluth	Birmingham¶	Chattanooga	Radford, Va.	New England‡	Pacific Coast§
No. 1 heavy melting	$17.50	$16.00	$17.85	$18.00	$17.00	$.....	$.....	$15.50	$14.50
No. 1 hyd. comp. black sheets	17.50	16.00	17.85	18.00	17.00	.....	.....	15.50	14.50
No. 2 heavy melting	16.50	15.00	16.85	17.00	16.00	.....	.....	14.50	13.50
Dealer No. 1 bundles	16.50	15.00	16.85	17.00	16.00	.....	.....	14.50	13.50
Dealer No. 2 bundles	15.50	14.00	15.85	16.00	15.00	.....	.....	13.50	12.50
Mixed borings and turnings	12.75	11.25	13.10	13.25	12.25	.....	.....	10.75	9.75
Machine shop turnings	13.00	11.50	13.35	13.50	12.50	.....	.....	11.00	10.00
Shoveling turnings	14.00	12.50	14.35	14.50	13.50	.....	.....	12.00	11.00
No. 1 busheling	17.00	15.50	17.35	17.50	16.50	.....	.....	15.00	14.00
No. 2 busheling	13.00	11.50	13.35	13.50	12.50	.....	.....	11.00	10.00
Cast iron borings	13.25	11.75	13.50	13.75	12.75	.....	.....	11.25	10.25
Uncut structurals and plate	16.50	15.00	16.25	17.00	16.00	.....	.....	14.50	13.50
No. 1 cupola	20.00	15.00	19.00	21.00	17.75	20.00	21.00	22.00	18.00
Heavy breakable cast	18.50	13.50	17.50	19.50	16.25	.....	.....	20.50	17.00
Stove plate	14.50	12.50	12.75	.....	12.00	.....	.....	14.00	14.00
Low phos. billet and bloom crops	22.50	21.00	22.85	23.00	22.00	.....	.....	20.50	.....
Low phos. bar crops and smaller	20.50	19.00	20.85	21.00	20.00	.....	.....	18.50	.....
Low phos. punch. and plate scrap**	20.50	19.00	20.85	21.00	20.00	.....	.....	18.50	.....
No. 2 cupola	19.00	14.00	18.00	20.00	16.75	19.00	20.00	21.00	17.00
Machinery cast cupola size††	21.00	16.00	20.00	22.00	18.75	21.00	22.00	23.00	19.00
No. 1 machine cast, drop broken, 150 pounds and under	21.50	16.50	20.50	22.50	19.25	21.50	22.50	23.50	19.50
Clean auto cast	21.50	16.50	20.50	22.50	19.75	21.50	22.50	23.50	19.50
Punchings and plate scrap†‡	19.50	18.00	19.85	20.00	19.00	.....	.....	17.50	.....
Punchings and plate scrap§§	18.50	17.00	18.85	19.00	18.00	.....	.....	16.50	.....
Heavy axle and forge turnings	17.00	15.50	17.35	17.50	16.50	.....	.....	15.00	14.00
Medium heavy elec. furnace turnings	15.50	14.00	15.85	16.00	15.00	.....	.....	13.50	12.50

*Claymont, Del., Coatesville, Phoenixville, Harrisburg, Pa. †Portsmouth, Middletown, O., Ashland, Ky. ‡Worcester,, Mass.; Bridgeport, Conn.; Phillipsdale, R. I. §Los Angeles, San Francisco, Portland, Oreg., Seattle; ¶Prices are for scrap delivered to the Birmingham, Ala., consuming point, excepting scrap for Birmingham consumption originating west of the western boundary of Alabama. In the latter case the Birmingham, Ala., consumer may pay $1 more than the prices indicated under "Birmingham"; **⅜-inch and heavier, cut 12 inches and under; ††may include clean agricultural cast; ‡‡under ⅜-inch to ¼-inch, cut 12 inches and under; §§under ¼-inch to No. 12 gage, cut 12 inches and under.

Maximum Prices for Iron and Steel Scrap Originating from Railroads

	Pittsburgh, Wheeling, Steubenville	Youngstown, Canton, Sharon	Chicago, Kokomo, Peoria	S. Bethlehem	*East. Pa.	Sparrows Pt.	Cleveland	Buffalo	South Ohio†
No. 1 Railroad grade heavy melting steel	$21.00	$21.00	$19.75	$.....	$19.75	$19.75	$20.50	$20.25	$19.50
Scrap rails	22.00	22.00	20.75	.....	20.75	20.75	21.50	21.25	20.50
Rerolling quality rails	23.50	23.50	22.25	.....	22.25	22.25	23.00	22.75	22.00
Scrap rails 3 feet and under	24.00	24.00	22.75	.....	22.75	22.75	23.50	23.25	22.50
Scrap rails 2 feet and under	24.25	24.25	23.00	.....	23.00	23.00	23.75	23.50	22.75
Scrap rails 18 inches and under	24.50	24.75	23.50	.....	23.50	23.50	24.25	24.00	23.25

	St. Louis	Kansas City	Detroit	Duluth	Birmingham	Chattanooga	Radford, Va.	New England‡	Pacific Coast§
No. 1 Railroad grade heavy melting steel	$18.50	$17.00	$18.85	$19.00	$18.00	$.....	$.....	$16.50	$15.50
Scrap rails	19.50	18.00	19.85	20.00	19.00	.....	.....	17.50	16.50
Rerolling quality rails	21.00	19.50	21.35	21.50	20.50	.....	.....	19.00	18.00
Scrap rails 3 feet and under	21.50	20.00	21.85	22.00	21.00	.....	.....	19.50	18.50
Scrap rails 2 feet and under	21.75	20.25	22.10	22.25	21.25	.....	.....	19.75	18.75
Scrap rails 18 inches and under	22.25	20.50	22.60	22.75	21.75	.....	.....	20.25	19.25

*Philadelphia, Wilmington, Del. †Portsmouth, Middletown, O., Ashland, Ky. ‡Worecester, Mass.; Bridgeport, Conn.; Phillipsdale, R. I. §Los Angeles, San Francisco, Portland, Oreg., Seattle.

NOTE: Where the railroad maker of scrap operates in two or more of the consuming points named above, the highest of the maximum prices set out above for such consuming points shall be the maximum price at consumer's plant at any point on the railroad's line, except: Where a railroad from which scrap originates operates in two or more consuming points having different switching charges, the price of such railroad scrap: (1) To a consumer located within a consuming point having the highest switching charge, shall not exceed the maximum on-the-line price established above; (2) To a consumer located within a consuming point not having the highest switching charge, shall not exceed the maximum on-the-line price established above less the difference between the switching charges at that consuming point and at the consuming point having the highest switching charges; (3) To a consumer located on the line of the railroad at a point having no switching charges, shall not exceed the maximum on-the-line price established above less the highest switching charge at any consuming point on the line; and (4) To a consumer located off the line of the railroad, shall not exceed the maximum off-the-line price established below less the highest switching charge at any consuming point on the line.

Sheets, Strip

Sheet & Strip Prices, Pages 102, 103

Sheetmakers are booking little tonnage outside actual defense requirements, as they have backlogs sufficient for the remainder of the year, with additional priority orders coming out steadily. In general, books have not been opened for 1942 but orders for that delivery are not being returned, being filed, with delivery promises to be made later.

Non-defense users find increasing difficulty in obtaining delivery. Automotive users continue the heaviest consumers. Refrigerator and other manufacturers of household equipment are fabricating an unusual tonnage of sheets to build up stocks of products for the period when they may be unable to obtain further supply. The government has placed heavy orders for refrigerator units for cantonments and housing projects.

A large sheet producer finds shipments of strip mill size sheets, formerly eight to nine months are now nine to ten months. Southern mills find an increase in strip orders, principally for cotton ties. Sheet and strip mills in that section are operating at about 90 per cent.

Plates

Plate Prices, Page 102

Heavy defense requirements for steel plates prevent mills making progress against backlogs, though inquiries from miscellaneous consumers have slackened recently. Allocation of shipments to meet most urgent needs is the greatest problem to mills.

Shipbuilding needs predominate in the East and with best efforts to meet the situation it seems probable official preferential ratings may be needed. Non-defense users find available tonnage decreasing steadily. Additional steel tonnage will be allocated soon for 123 merchant vessels for the Maritime Commission. Ten of these ships each have been awarded to Sun Shipbuilding & Dry Dock Co., Chester Pa., and Pusey & Jones Corp., Wilmington, Del.

No other formal applications for exception to the government's steel price freezing order are reported following announcement of permission to Central Iron & Steel Co., Harrisburg, Pa., to quote $5 a ton on plates above the present market at existing bases. This establishes the Claymont, Del., Coatesville, Pa., and Sparrows Point, Md., base for this producer at a maximum of 2.35c.

New England producers of small tanks and pontoons have met scarcity of light plates, under half-inch. Large orders are being placed for these products through the Rhode Island naval base. Deliveries on floor plates, heads, dished and flange work are better than on plain plates, floor plates being available in five to six weeks.

PLATE CONTRACTS PENDING

Unstated, six 180-foot, 935 ton, diesel-

powered cutters for coast guard; Astoria Marine Iron Works, Astoria, Oreg., $771,900 each for three; $769,850 each for four units; Hydraulic Supply Mfg. Co., Seattle, $1,044,238 each.

Bars

Bar Prices, Page 102

Increasing proportion of steel bar production is moving directly or indirectly into defense of armament work, some estimates being as high as 85 to 90 per cent. Except for occasional opportunity for placing a small tonnage in rolling schedules bar mills are booked full for the remainder of the year. Demand is quieter, due to coverage and to inability to obtain a delivery promise.

For most part only regular customers are able to obtain consideration by mills, consumers seeking to place business with other than their usual sources being turned down consistently. Even offers of premium prices for early delivery have no effect, mills uniformly holding to published prices. Some jobbers are said to have accepted premiums on badly needed material. Selling f.o.b. mill, the buyers to pay transportation cost, is not being followed generally, all important producers observing the basing point plan.

New England bar consumers are heavy users of alloy bars, due largely to huge contracts for small arms, the two government armories buying heavily, deliveries being largely direct from mill, instead of through jobbers. Stocks of the latter are badly out of balance. Forging stock, largely for the airplane industry, is strong and specifications are being filed steadily.

Pipe

Pipe Prices, Page 103

Standard pipe is in strong demand from all sections of the country, oil country goods show an increase and pipe line buying is in excess of supply. Mechanical and pressure tubing are under greatest stress. Producers view with misgivings the forthcoming railroad program, with its requirements for boiler tubes. This department is heavily engaged and even with priorities for locomotive tubes it will be difficult to meet all needs.

One prominent maker of mechanical and pressure tubing is concentrating on the latter, except where priority orders call for mechanical tubes. This company, which also fabricates boilers, has large orders for marine and power plant boilers and will be able to sell little tubing to others.

Orders for 435,000 tons of seamless and electric welded line pipe will be allocated soon for a crude oil line from Baton Rouge, La., to New York, to be built by Standard Oil of New Jersey and other oil companies. Main line will be 24-inch, which will limit awards to a relatively few producers. Valves, fittings and pumps present a problem as makers of these accessories are already heavily booked. Additional storage tanks will be required.

CAST PIPE PLACED

100 tons, municipal projects at South Bend and Tacoma, Wash., to H. G. Purcell, Seattle, for United States Pipe & Foundry Co., Burlington, N. J.

Rails, Cars

Track Material Prices, Page 103

Provision for priority on steel for freight cars will ease the situation among car builders, who have not been able to obtain as much steel as required. Additional cars to meet the demands of defense transportation are considered an important factor and relief by OPM is about to be given.

CAR ORDERS PLACED

Atchison, Topeka & Santa Fe, 2000 box cars, to Pullman-Standard Car Mfg. Co., Chicago; in addition to 1700 units placed a few weeks ago.

Baltimore & Ohio, 100 caboose cars, to own shops.

Boston & Maine, 1300, 500 gondolas and 200 hoppers going to Bethlehem Steel Co., Bethlehem, Pa., and 600 box cars to Magor Car Corp., Passaic, N. J.

Denver & Rio Grande Western, 500 forty-ton box cars to Pressed Steel Car Co., Pittsburgh, and three flat cars to own shops; also has awarded four streamlined passenger coaches, with power plant in each car, to Edward G. Budd Mfg. Co., Philadelphia.

Detroit, Toledo & Ironton, 50 covered hopper cars to Greenville Steel Car Co., Greenville, Pa.

Nashville, Chattanooga & St. Louis, 500 box and 300 gondolas, to Pullman-Standard Car Mfg. Co., Bessemer, Ala., shops.

Union Pacific, 2000 fifty-ton box cars and 250 automobile cars, to own shops.

CAR ORDERS PENDING

Akron, Canton & Youngstown, 130 hoppers.

Central of Georgia, 150 automobile, 50 box cars.

Chicago, Rock Island & Pacific, 1000 box cars.

Great Northern, 2000 box cars.

Gulf, Mobile & Ohio, 500 box cars.

Nashville, Chattanooga & St. Louis, ten passenger coaches.

New York Central, 1000 box cars, 500 gondolas; bids June 9.

Norfolk & Western, 1000 hopper cars; bids June 5.

Southern Pacific, 2500 box cars, contemplated; in addition to a similar amount placed several weeks ago.

LOCOMOTIVES PLACED

Boston & Maine, two 1000-horsepower and two 660-horsepower diesel-electric switch engines, to Electro-Motive Corp., La Grange, Ill., and one 1000-horsepower and one 660-horsepower units to American Locomotive Co., New York.

Canadian Pacific, twenty 4-6-2 type locomotives, to Montreal Motive Works, Montreal.

Denver & Rio Grande Western, 17 diesel-electric motors, nine 600-horsepower units to Baldwin Locomotive Co., Eddystone, Pa., four 1000-horsepower units to American Locomotive Co., New York; three 5400-horsepower units to Electro-Motive Corp., La Grange, Ill.; and one 380-horsepower to General Electric Co., Schenectady, N. Y.

Navy, two 50-ton diesel-electric switch engines, to H. K. Porter Co., Pittsburgh.

Union Pacific, twenty 4-6-6-4 locomotives to American Locomotive Co., New York.

LOCOMOTIVES PENDING

Nashville, Chattanooga & St. Louis, 16 locomotives, of which six are diesel-electric.

Structural Shapes

Structural Shape Prices, Page 102

Dry docks account for the largest individual structural steel tonnages in the East, including an unusually large graving dock at Bayonne, N. J., two smaller units at the Brooklyn navy yard and one at Portsmouth, N. H. Thousands of tons are also required for a spurt in air field construction, including hangars. The fabricating industry is establishing new records for speed, made possible by turning in of complete and detailed plans at the start. Thus Bethlehem Steel Co. fabricated, delivered and erected 2000 tons for a defense shop for Otis Elevator Co., Harrison, N. J., in less than three months. The same fabricator booked 4800 tons for Republic Aviation Co., Farmingdale, N. Y., early in February, completed fabrication that month, started erection Feb. 10, finishing April 1. Other shops have attained similar speeds. Plain material deliveries lengthen, now being beyond 10 weeks.

SHAPE CONTRACTS PLACED

3000 tons, brass rolling mill, Revere Copper & Brass Inc., Chicago, to Beth-

SHAPE AWARDS COMPARED

	Tons
Week ended May 31	11,725
Week ended May 24	40,611
Week ended May 17	37,442
This week, 1940	24,692
Weekly average, 1941	33,196
Weekly average, 1940	28,414
Weekly average, April 1941	28,441
Total to date, 1940	399,893
Total to date, 1941	730,314

Includes awards of 100 tons or more.

lehem Steel Co., Bethlehem, Pa., James Stewart Corp., Chicago, contractor.

2300 tons, factory building, American Can Co., St. Louis, to American Bridge Co., Pittsburgh.

1100 tons, bridge, San Joaquin river, Lathrop, Calif., for Southern Pacific Co., to American Bridge Co., Pittsburgh.

900 tons, by-pass bridges, Hartford, Conn., for state, to American Bridge Co., Pittsburgh.

600 tons, 30-inch cylinder piles, dry dock, Philadelphia navy yard, to Bethlehem Steel Co., Bethlehem, Pa.

500 tons, addition, Lever Bros., Baltimore, Md., to Bethlehem Fabricators Inc., Bethlehem, Pa.; Stone & Webster Engineering Corp., Boston, contractor.

475 tons, building, quartermaster depot, New Cumberland, Pa., to Anthracite Bridge Co., Scranton, Pa.

435 tons, outpatients' department building, Harlem hospital, New York, to Schacht Steel Construction Co., New York.

350 tons, beam spans, various locations, Chicago & North Western railway to American Bridge Co., Pittsburgh.

325 tons, Ohio state bridge, Scioto county, to Fort Pitt Bridge Co., Pittsburgh; erroneously reported as to American Bridge Co.

255 tons, warehouse, proving ground, Savanna, Ill., for government, to Mississippi Valley Structural Steel Co., Decatur, Ill.

250 tons, raising Berwick Bay bridge, Berwick-Morgan City, La., Texas & New Orleans railway, to American Bridge Co., Pittsburgh.

240 tons, administration and shop building, U. S. Coast Guard, Curtis Bay, Md., to Park Iron Works, Baltimore.

225 tons, seaplane hangars, Quonset Point, R. I., to Lehigh Structural Steel Co., Allentown, Pa., through Merritt-Chapman & Scott and George A. Fuller Co., New York, joint contractors.

160 tons, state bridge, Commerce street, Hartford, Conn., to American Bridge Co., Pittsburgh.

150 tons, power house, Philadelphia navy yard, to Frank M. Weaver & Co. Inc., Lansdale, Pa.

145 tons, state bridge RC-41-14, Ft. Covington, N. Y., to American Bridge Co., Pittsburgh.

135 tons, bridge, Illinois Central System, Coldwater, Miss., to American Bridge Co., Pittsburgh.

130 tons, dock shed, Ordnance Department, Curtis Bay, Md., to Belmont Iron Works, Eddystone, Pa.

130 tons, addition, Eastern Overall Co., Philadelphia, to Bethlehem Steel Co., Bethlehem, Pa.

120 tons, state bridge RC-41-8, Marcy, N. Y., to American Bridge Co., Pittsburgh.

100 tons, addition, Clover Manufacturing Co., Norwalk, Conn., to Porcupine Bridge Co., Bridgeport, Conn., through Hewlett Construction Co., Bridgeport, contractor.

Unstated tonnage, 2-story addition, Geometric Tool Co., New Haven, Conn., to Connecticut Steel Erecting Co., New Haven; Fusco-Amatruda Co., New Haven, contractor.

Unstated tonnage, including 65 tons, fabricated structural steel, 2-story addition, American Locomotive Co., Schenectady, N. Y., to Utica Structural Steel Co., Utica, N. Y.; Thompson Construction Co., Albany, contractor.

SHAPE CONTRACTS PENDING

5000 tons, bridge over Illinois river, Peoria, Ill., state highway commission; bids June 13.

4000 tons, brass rolling mill building,

Defense Plant Corp., Chicago.

2500 tons, power plant, Edison Electric Illuminating Co., Boston; Thomas O. Connor Co., Boston, contractor.

1500 tons, neoprene plant, E. I. du Pont de Nemours & Co., Louisville, Ky.

1200 tons, repair dock, government air field, Middletown, Pa.; bids May 31.

1200 tons, court house, Harrisburg, Pa.; William Berbusse Inc., White Plains, N. Y., low.

825 tons, reconstruction Melrose avenue bridges, New York.

800 tons, mill buildings, General Electric Co., Schenectady, N. Y.

750 tons, engine storehouse, Olmsted field, Middletown, Pa., for U. S. government.

600 tons, engine storage warehouse, government air field, Middletown, Pa.

550 tons, building addition, Linde Air Products Co., Tonawanda, N. Y.

525 tons, state bridge, Tygart river, Norton, W. Va.

500 tons, foundry extension, Westinghouse Electric & Mfg. Co., Trafford, Pa.

475 tons, buildings, Kingsbury ordnance plant, La Porte, Ind., for government.

400 tons, substations, Niagara Falls Power Co., Niagara Falls, N. Y.

350 tons, state bridge, contract 2165, Farmland, Ind.

340 tons, materials, storehouse, ordnance depot, Proving Ground, Ill., for government.

330 tons, mill building, Republic Steel Corp., South Chicago, Ill.

320 tons, extension to light machine shop, Westinghouse Electric & Mfg. Co., Essington, Pa.

310 tons, office building, Defense Plant Corp., Cleveland.

300 tons, armory, Syracuse, N. Y., to be rebid.

275 tons, state highway bridge, Julion, Pa.

230 tons, state bridge, contract 2173, Austin, Ind.

220 tons, state bridge, contract 2172, Austin, Ind.

210 tons, state bridge RC-41-16, Philadelphia, N. Y.

200 tons, overpass, Pennsylvania railroad, Landover, Md., for state.

190 tons, state bridge, Northbridge, Mass.

180 tons, state bridge FAGH-842-B, Pacific Junction, Iowa.

180 tons, turbine foundation, Connecticut Light & Power Co., Devon, Conn.

175 tons, state bridge, Elkins, W. Va.

165 tons, state bridge, Chicago, St. Paul, Minneapolis & Omaha railway, Worthington, Minn.

160 tons, state bridge, Richmond, Mass.

155 tons, state bridge FAS-521, Long Point, Iowa.

150 tons, extension to building 431, Bremerton, Wash., for navy.

125 tons, addition, Jefferson office building, for Illinois Bell Telephone Co., Peoria, Ill.

Unstated, plant addition, American Car & Foundry Co., Buffalo.

Unstated, plant addition for Bliss & Laughlin Inc., Buffalo.

Unstated, 850 steel transmission towers, 42 to 70 feet high, Coulee-Covington transmission line, 183 miles; bids to Bonneville project, Portland, June 6.

Reinforcing Bars

Reinforcing Bar Prices, Page 103

In a few cases concrete work in place of fabricated structural steel is being resorted to with object of

securing prompter deliveries, though often the builder is disappointed in concrete bar promises. Where bars are secured from mills September and October are usually best delivery obtainable, but from warehouses small quantities can be had promptly. In a few cases concrete bar mills can make deliveries in four or five weeks for defense. In New England highway and small bridge requirements are heavier, with pending inquiry 10,000 tons.

REINFORCING STEEL AWARDS

1800 tons, Lincoln Court housing, Cincinnati, O., to Pollak Steel Co., Cincinnati; H. M. Boyajohn, contractor.

1259 tons, flood wall, unit 2, Portsmouth, O., U. S. engineer, to West Virginia Rail Co.; Charles D. Smith, contractor.

1200 tons, grade crossing elimination, contract 7, Long Island railroad, Brooklyn, N. Y., to Jones & Laughlin Steel Corp., Pittsburgh; Tully & di Napoli Co., New York, contractor.

600 tons, building, General Electric Co., Everett, Mass., to Bethlehem Steel Co., Bethlehem, Pa.

600 tons, factory and warehouse, St. Joseph, Mo., Western Tablet Co., to Sheffield Steel Corp., Kansas City, Mo.

500 tons, ordnance plant foundations, Weldon Springs, Mo., to Truscon Steel Co., Youngstown, O.; Fraser Brace Engineering Co., contractor.

425 tons, addition, Lever Bros., Baltimore, Md., to Concrete Steel Co., Boston; Stone & Webster Engineering Corp., Boston, contractor.

400 tons, underground magazines, Watson, Ind., to Truscon Steel Co., Youngstown, O.; Sollitt Construction Co., contractor.

400 tons, partial requirements, air base, Borinquam field, San Juan, Puerto Rico, to Republic Steel Corp., through Capitol Steel Corp. of New York; McCloskey & Co., contractor.

396 tons, laboratories, G. D. Searle & Co., Skokie, Ill., to Ceco Steel Products Corp., Chicago; George A. Fuller Co., Chicago, contractor; bids May 16.

350 tons, mesh, paving, Pine Camp, N. Y., to Truscon Steel Co., Youngstown, O., through John W. Cowper Co., Buffalo, contractor.

330 tons, mesh, highway project, Southern State Parkway, section 7, Suffolk county, New York, to American Steel & Wire Co., New York; Andrew Weston Co. Inc., Woodmere, N. Y., contractor, $478,437.35; bids May 14, Albany.

300 tons, defense housing project, Philadelphia, to Bethlehem Steel Co., Bethlehem, Pa., through Fireproof Products Co.; H. R. H. Construction Co., contractor.

270 tons, bars and mesh, state highway, Beacon Falls, Conn.; 170 tons, mesh, to American Steel & Wire Corp., Worcester, Mass.; 100 tons, bars, to Truscon Steel Co., Youngstown, O.

260 tons, factory and offices, Metal Moulding Co., Detroit, to Joseph T. Ryerson & Son Inc., Chicago; Copper Con-

CONCRETE BARS COMPARED

	Tons
Week ended May 31	11,343
Week ended May 24	6,242
Week ended May 17	15,532
This week, 1940	5,137
Weekly average, 1941	11,758
Weekly average, 1940	9,661
Weekly average, April, 1941	18,030
Total to date, 1940	176,890
Total to date, 1941	258,672

Includes awards of 100 tons or more.

struction Co., contractor.

250 tons, municipal stadium, Roanoke, Va., to Virginia Steel Co.; Blackwell Engineering Co., contractor.

200 tons, building, Public Service Co. of New Jersey, Maplewood, N. J., to Truscon Steel Co., Youngstown, O.

180 tons, mesh, highway project, Boston-Albany turnpike, Rensselaer county, New York, to Truscon Steel Co., Youngstown, O.; Louis Longhi & Son, Torrington, Conn., contractor, $204,813; bids May 14, Albany.

175 tons, bridge and highway, Saugus-Revere, Mass., to Northern Steel Co., through G. Rotondi Sons, Melrose, Mass., contractor.

168 tons, grade separation, Flint, Mich., to Bethlehem Steel Co., Bethlehem, Pa.; Ramer Bros., contractors.

150 tons, highway project, Sutton, Mass., to Concrete Steel Co., through C & R Construction Co., Boston, contractor.

150 tons, apartment building, Mayfair Co., Merion, Pa., to Truscon Steel Co., Youngstown, O.

140 tons, Little Miami interceptor sewer, Cincinnati, O., to Pollak Steel Co., Chicinnati; Nolan Construction Co., contractor.

120 tons, test building, Continental Motor Co., Detroit, to Taylor-Gaskin Inc.; F. H. Martin, contractor.

120 tons, railroad yard repairs, Santa Fe, Chicago, to Truscon Steel Co., Youngstown, O.

100 tons, store, Goodwin Inc., Wyandotte, Mich., to McRae Steel Co.; A. O. Misch, contractor.

100 tons, procurement office inv. 503-4491, Harrisburg, Pa., to Truscon Steel Co., Youngstown, O.

100 tons, tank proving grounds, Macomb county, Michigan, Chrysler Corp., to Bethlehem Steel Co., Bethlehem, Pa.; O. W. Burke, contractor.

100 tons, Ohio state project, 27, Franklin county, to Truscon Steel Co., Youngstown, O.; L. L. Clymer, Bluffton, O., contractor.

100 tons, building, Corning Glass Works, Corning, N. Y., to Bethlehem Steel Co., Bethlehem, Pa., through H. K. Ferguson Co., Cleveland.

100 tons, warehouse and garage, Miller & Rhoades, Richmond, Va., to Bethlehem Steel Co., Bethlehem, Pa., through Virginia Steel Co.; Doyle & Russell, contractors.

REINFORCING STEEL PENDING

2860 tons, Guyandotte flood wall, Huntington, W. Va., U. S. engineer.

2000 tons or more, pier, Puget Sound navy yard, Wash.; A. W. Quist and Sound Constructing & Engineering Co., Seattle, contractors.

1700 tons, Frisco railroad relocation, Durant, Okla., U. S. engineer; bids May 16.

950 tons, flood protection wall, sect. 4, Binghamton, N. Y.

950 tons, flood protection, sect. 4, Binghamton, N. Y.

600 tons, superstructure, Fort Greene housing, Brooklyn, N. Y.

500 tons, sewage plant, WPA 56385, Carbondale, Ill.

500 tons, flood protection wall at Cairo, Ill.; bids June 5.

500 tons, Murray Hill high school, New York, Caristo Construction Co., contractor.

300 tons, buildings, Sisters of Good Shepherd, Wayne county, Michigan; W. E. Wood Co., contractor.

290 tons, flood wall, Cairo, Ill., U. S. engineer.

250 tons, Ford airplane assembly plant, Dearborn, Mich.

247 tons, bridge, Barren river, Warren

Behind the Scenes with STEEL

Washroom Survey

■ Our Roving Reporter is back again, telling us what the real trouble is in a lot of defense industry plants. What with fifteen minute lunch periods the vogue to up production, the tough job is to get a decent hand-washing when men's toilets have not been kept up to standards set by modern production methods. We absolutely disclaim any responsibility in presenting this survey, and any resemblance to persons, or toilet facilities you may have encountered is no doubt a horse of a different color. We quote:

Plant A—a modern, windowless factory employing about 1500 workers. All of high caliber but with hands that would scare Gargantua. On pretext of being a wandering fortune teller, examined hands of turret lathe, bore grinder, and stamping machine operators. Washroom facilities reminiscent of dark ages with one soapator per 100 workers. At noon hour rush unable to do more than talk to men at end of long line. No. 15 in line sized the situation up pretty well when he remarked: $\$\#\%\&"'*)\#—\&$.

Plant B—smaller plant with somewhat more modern system. Soap here consisted of a carrot colored powder, which someone said was called "Dissolvoquik." One shot had to be followed by a quick wash with *plenty* of H_2O. Submitted this powder to the Alkali Test, as prescribed in Manual B-14, whereby a red litmus paper is used which will turn blue if excessive alkali is present, thereby being injurious to workers' hands. Litmus paper completely disappeared.

Plant C—using chain-guard system. Chain is embedded in bars of hard soap—one bar per bowl, or rather one chain per bowl. Some chains looked like the rats had chewed off the soap, or vice versa. Advantages include retrievability, if washee happens to drop bar in midst of sudsing operation. Also easy to hand soap to new user, simply by swinging the chain like a hammer throw and letting him have it, thereby encouraging playfulness, with resulting instances of black eyes, bloody noses, and off-the-record fights.

Plant D—Soapatory rates 97%. Everything fine except soap, which is sold in barrel quantities to a kind hearted P. A., by his brother-in-law, at his own wife's suggestion. Called "Eau de Helen" after his sweetheart who dances in night clubs, etc., and smells just too-too lovely. Tinted orchid which gives rise to a great deal of rinse-house humor, such as punning "Oh you kid!" into a derisive shout of "Orchid."

Brotherly Description

■ Art "Mirrors of Motordom" Allen takes exception to calling his brother Harry a "look-alike" in his own inimitable style: He has a definite Roman retrouche proboscis in contrast to my upturned Aryan snout. His boiled-owl eyes, coming from long hours of staring into open-hearth boils through too-thin cobalt glasses, contrast sharply with my dove-gray orbs and overnight bags beneath. He is taller than I by a couple of inches, heavier by 20 pounds and of course lacks the cultured polish that one acquires from long association with the great and near-great of motordom. (Ahem.)

Fuzes With A "Z"

■ Just to forestall any arguments, we might as well explain right now that the headline of Professor Macconochie's article this week on page 52-3 is not misspelled. "Fuzes" are "fuzes" and not "fuses," in spite of the fact that the proof room and the editors almost came to blows. The thing that finally won the battle was direct word from the Ordnance Department verifying the "z" in army usage.

Scanning the Ads

■ Hats off to the Gisholt copy writer for the stopping power and interesting tie-in of the album photo on page 11.

Get It?

■ New advice for the children: All work and no play makes jack.

SHRDLU.

county, Kentucky; bids June 6.

180 tons, housing project, Quincy, Ill.

180 tons, two warehouses, U. S. government, Charleston, Ind.

146 tons, bridge 1452, Norton, W. Va.; bids May 27.

Unstated, Morrison street bridge approaches, Portland, Oreg.; L. H. Hoffman, Portland, low, $78,005.

Unstated, 400 foot viaduct and siphon, state projects Umatilla county, Oregon; C. J. Montag & Sons, Portland, low, $61,578.

Pig Iron

Pig Iron Prices, Page 104

With all available blast furnaces in blast during most of May and threat of a further coal strike fading some progress is being made against heavy backlogs. Merchant iron shipments in May are expected to be a high for the year. The situation is still tight but foundries and non-integrated steel plants are being fairly well covered, cases of actual distress being rare. Demand by foundries is increasing as defense work calls for larger supplies of castings and this is keeping pace with enlarged production.

Although some orders are being booked for third quarter no price is being named and it is doubted that announcement will be made at the usual time, about June 1. Except for occasional instances where foundry requirements have exceeded estimates or where forward coverage was neglected shipments are adequate to consumer needs.

Inquiry for 240,000 tons of pig iron for Great Britain has been formally issued by the procurement division, Treasury Department, bids to be opened June 2. Deliveries are to begin July 1 and be completed by Nov. 30. The inquiry asks for at least 50 per cent low phosphorus iron and the remainder bessemer. The low phosphorus analysis asked is as follows: Silicon 1 to 1½ per cent; sulphur .03 maximum; phosphorus .035 maximum; manganese .40 minimum. The bessemer calls for silicon 1¼ to 2 per cent; sulphur .05 maximum; phosphorus .10 maximum; manganese 1 to 1½ minimum.

Output by gray iron foundries in the Philadelphia Federal Reserve district increased 9.9 per cent during April to a new high point, according to the industrial research department, University of Pennsylvania. Gain over a year ago was 44.2 per cent. Shipments increased 12 per cent to stand 55.9 per cent larger than last year. Unfilled orders were 260.7 per cent ahead of a year ago but declined 2.1 per cent from March. Production by steel foundries declined 12.6 per cent in April, but shipments of finished castings were only 4 per cent lower and unfilled orders rose 16.7 per cent. Backlogs showed a 231.7 per cent gain over last year.

Metallurgical Coke

Coke Prices, Page 103

The coke situation is considerably

brighter. Additional beehive ovens are being brought into production, with coal supplied by truck and the product shipped via truck. Some specialty foundries are having considerable difficulty obtaining by-product coke but there will be a sufficiency of beehive material for all purposes by third quarter.

Scrap

Scrap Prices, Page 106

Under government regulations and ceiling prices the scrap market is not yet functioning smoothly and many points remain to be cleared up. One effect is to reduce the flow of scrap and volume being handled is far below normal. In the Chicago market it is estimated at little more than 50 per cent of usual tonnage under present conditions. Large shipments before May 10 on old price schedules cleared yards so completely that rebuilding stocks is difficult. Melters are ready to buy, at ceiling prices, but tonnage is not available and present consumption is largely from stock.

In many cases sales are being made into adjoining districts with the consumer paying freight. It is not clear if this is a violation of the government plan and a decision is being sought. Another point at issue in some areas is the classification of No. 1 compressed sheets and No. 1 bundles.

Railroad scrap offerings are progressively smaller and the opinion is growing that considerable material is being sold direct to consumers on the line of various roads, without passing through the hands of brokers and without the formality of bids, the price being the government ceiling.

Export business will draw moderate tonnages from seaboard points in coming months. In addition to 75,000 tons recently placed, a tentative 280,000 tons is involved in proposed shipments to Britain during second half. This latter figure has not been definitely decided.

Frankford Arsenal, Philadelphia, is asking bids June 17 on an estimated 1500 tons of iron and steel turnings, 1000 tons of accumulated wrought iron and steel and 200 tons of wrought iron and steel shell ends, representing the arsenal's scrap production over the next six months.

Tin Plate

Tin Plate Prices, Page 102

Capacity has been engaged for supplying Great Britain 420,000 tons of tin plate over the next 12 months, 35,000 tons per month, much of it to be handled under the lease-lend act, it is understood. This tonnage, added to domestic requirements, assures capacity operations for a year. Some domestic tonnage is being deferred to allow monthly shipments to be made to Britain on schedule.

In addition to this tonnage about 175,000 tons for British colonies and other countries engaged in canning provisions for Great Brit-

ain also will be required over the next year, thus making for a total of almost 600,000 tons.

Tin mill shipments are approaching the rate of buying as the latter turns downward because of ample coverage. Another hot mill has been removed from potential capacity, Blaw-Knox Co. buying the Laughlin works of Carnegie-Illinois Steel Corp. at Martins Ferry, O., for dismantling. Current production is at 90 per cent, with all active mills at capacity.

Pacific Coast

Seattle—Diversion of at least one third of the 79 large freighters operating on the intercoastal route on May 1 by mid-July presents an acute problem to the steel market and industrial field of the Pacific Coast. These vessels will be used in carrying supplies as required under the lend-lease bill. Space on this route has been inadequate for months and withdrawal of additional units will throw a heavy burden upon railroads and greatly increase c.i.f. costs.

Important construction projects, involving steel, continue to develop. Bonneville project has called bids June 6 for the Coulee-Covington transmission line, a 183-mile $1,944,000 job, involving 850 steel towers, tonnage unstated. Six 180-foot steel cutters for the coast guard, contracts pending, call for an unstated tonnage of plates and shapes.

State highway officials in the Pacific Northwest are shaping their programs to avoid use as far as possible of essential defense materials. In the last two Washington openings, less than 100 tons of concrete bars were involved in a dozen projects. Rolling mills and fabricating shops are laboring under a 60 to 90-day backlog and are not interested in new business. Delivery of materials from Eastern and Gulf mills continues slow and has affected the cast iron pipe situation. For this reason, Puyallup, Wash., has temporarily abandoned a sizeable water system expansion.

Plant improvements and industrial expansion are adding to the demand for small tonnages of concrete bars and shapes.

Jobbing houses report steady demand for all items in stock but supplies of some lines are badly depleted and substitutions are frequently necessary. Prices are firm. Unless there is an increase in the maximum prices of steel melting scrap, now pegged at $13.50 and $14.50 for No. 2 and No. 1, respectively, dealers anticipate a shortage as receipts at present are less than consumption. Cast iron scrap continues scarce and is in strong demand, prices ranging from $17 to $18.50.

Canada

Toronto, Ont.—Despite the fact that Canada is extending every effort to produce raw materials for war use, primary producers in this country now are being called upon to supply large tonnages to the United States. In this connection announcement has just been made that the United States navy has placed an order with Atlas Steels Ltd., Welland, Ont., for $900,000 worth of stainless steel ingots for shipbuilding. It also is announced that the Canadian government has submitted tenders to the United States army for a wide range of ordnance equipment, in connection with which orders are expected to be placed soon with Canadian companies.

In the Canadian markets buying continues on an increasing scale, and plans are proceeding for further large increase in production facilities. To relieve pressure and provide quick delivery for immediate needs heavy imports of steel are reported from the United States. Demand for plate and sheets are specially featured in the Canadian markets and producers report contracts running well into next year, and no supplies available for shipment on new orders before the year-end. In addition to the sustained deliveries by Canadian mills, imports are approximately 25,000 tons per month. Shipbuilding and motor vehicle production are largely responsible for the brisk demand for plates and sheets.

Orders for merchant bars are gaining in volume and producers are extending rolling periods to keep pace with requirements. Shell makers are calling more frequently for supplies and producers are giving preference in deliveries on this account.

Heavy buying continues in iron and steel scrap and inquiries indicate more will develop when regulated prices are made known for iron grades. Foundries are in the market for machinery cast and stove plate for current needs. At present wide price spreads prevail and current quotations are only nominal, those on iron grades being well below the actual levels at which transactions are put through.

Iron Ore

Iron Ore Prices, Page 105

Virtually all private trading in foreign manganese ores is in the lower grades, around 46 per cent manganese, with most from Brazil. Current transactions are at higher prices, some recent sales of 46 per cent Brazilian having been sold at 69 to 71 cents, before duty, and also some 48 per cent Brazilian which has been booked at around 70 to 72 cents. Prices on these Brazilian ores are affected considerably by the iron content and have been based recently on a $13 ocean rate.

An increasing amount of medium grade ores is being supplied by Cuba, it being estimated that 30,000 to 40,000 tons of 46 per cent ore will be moved here this year. This will be in addition to at least 130,000 tons of high grade, most if

not all of which is already under contract.

There has been little trading recently in Chilean, with a result that prices are largely nominal at around 65 to 70 cents, Atlantic ports, before duty for 47 per cent. Production of manganese ore in Chile is not large and some importers assert they have sold all they can supply for some time to come.

So far as can be learned little 50 per cent ore is being sold for private account, although heavy tonnages are under contract with government purchasing agencies, particularly the Metals Reserve Co.

The Cleveland Cliffs Iron Co., Cleveland, has bought from the Oliver Iron Mining Co. 100,000 tons of iron ore contained in stockpiles at the Champion mine near Ishpeming, Mich. Plans are now being made for treating and transporting the ore to lower lake ports and it is probable that some will be shipped during the 1941 season. The Champion mine, opened in 1867, has been idle since 1912 and is one of the deepest of the Marquette range underground properties. It has produced 4,413,131 tons of hard ore.

Steel in Europe

Foreign Steel Prices, Page 105

London—(*By Cable*)—There is little change in the steel and iron situation in Great Britain, home production reaching new records. Some works are operating at full capacity and some new plants have been put into production. Delivery periods for essential material are shortening. Pig iron supply is plentiful, except hematite, whose consumption is severely restricted. Tin plate exports continue limited as the home trade requirements are enlarged by canning requirements.

Sulphate Price Frozen

Producers and distributors of ammonium sulphate, a coke oven by-product, have been asked by OPACS to continue current prices, $28 per ton, contract, at inland ovens; $29 at port and $1 higher for spot shipment. This material is one of the important sources of fertilizer nitrogen.

Equipment

New York — Few builders of equipment are as heavily booked as overhead electric crane fabricators. Limited in capacity by the relatively few producers of this type of equipment, the defense program and generally improved production has thrown a heavy load on the industry. Although operating with a high priority rating and subletting considerably, deliveries and installations average close to 210 days on overhead bridge cranes of normal capacity and well beyond that period for heavier units. Most shops are booked through next year.

Nonferrous Metals

New York—Efforts to supply defense industries with sufficient tonnages of nonferrous metals to maintain production at a high rate held the chief interest of traders last week. E. R. Stettinius Jr., director of priorities, OPM, said from 95 to 100 per cent of available aluminum supplies will be used for defense in June and that production which is now at a 600-million pound annual capacity still lags behind defense needs. He said the upward surge of military needs indicates the shortage will be felt far into 1942. OPM will allocate

Nonferrous Metal Prices

May	Copper Electro, del. Conn.	Copper Lake, del. Midwest	Copper Casting, refinery	Straits Tin, New York Spot	Straits Tin, New York Futures	Lead N. Y.	Lead East St. L.	Zinc St. L.	Aluminum 99%	Antimony Amer. Spot, N.Y.	Nickel Cathodes
24	12.00	12.00	12.25	52.12½	51.87½	5.85	5.70	7.25	17.00	14.00	35.00
26	12.00	12.00	12.25	52.25	52.00	5.85	5.70	7.25	17.00	14.00	35.00
27	12.00	12.00	12.25	52.12½	51.85	5.85	5.70	7.25	17.00	14.00	35.00
28	12.00	12.00	12.25	52.25	51.95	5.85	5.70	7.25	17.00	14.00	35.00
29	12.00	12.00	12.25	52.25	51.95	5.85	5.70	7.25	17.00	14.00	35.00
30	Holiday										

F.o.b. mill base, cents per lb. except as specified. Copper brass products based on 12.00c Conn. copper

Sheets

Yellow brass (high) 19.48
Copper, hot rolled 20.87
Lead, cut to jobbers 9.10

Zinc, 100 lb. base 12.50

Tubes

High yellow brass 22.23
Seamless copper 21.37

Rods

High yellow brass 15.01
Copper, hot rolled 17.37

Anodes

Copper, untrimmed 18.12

Wire

Yellow brass (high) 19.73

OLD METALS

Nom. Dealers' Buying Prices

No. 1 Composition Red Brass

New York 9.25
Cleveland 9.50-10.00
Chicago 9.00-9.25
St. Louis 9.00

Heavy Copper and Wire

New York, No. 1 ..... 10.25-10.37½
Cleveland, No. 1 ..... 10.00-10.50
Chicago, No. 1 ..... 10.00-10.25
St. Louis 10.00

Composition Brass Turnings

New York 9.00

Light Copper

New York 8.25-8.37½
Cleveland 8.00-8.50
Chicago 8.00-8.25
St. Louis 8.00

Light Brass

Cleveland 4.50-5.00
Chicago 6.25-6.50
St. Louis 5.00

Lead

New York 4.85-5.00
Cleveland 4.75-5.00
Chicago 4.75-5.00
St. Louis 4.50

Old Zinc

New York 4.50
Cleveland 4.00-4.12½
St. Louis 5.00

Aluminum

Mis., cast 11.00
Borings, No. 12 ..... 9.50
Other than No. 12 ..... 10.00
Clips, pure 13.00

SECONDARY METALS

Brass ingot, 85-5-5-5, l. c. l. 13.25
Standard No. 12 aluminum 16.00

58,000 pounds of aluminum to the light plane manufacturers for June and an equal amount for July.

Copper — Fabricators continued short of the large total of 231,104 tons of copper in April. Metals Reserve Co. now controls about 35 per cent of all copper being distributed to consumers, and official priorities are expected to be extended to the balance. Domestic plus available foreign supplies are still under this country's requirements and part of the future supply is uncertain due to shipping shortage.

Lead—Inquiry remained in excess of supplies and all leading producers maintained waiting lists. Bookings for May delivery established a record high. Counting the 10,000 to 15,000 tons of foreign lead brought in each month this year, the United States is taking about 27 per cent more lead from all sources than in 1940.

Zinc—Total output of recoverable zinc from domestic mines came to 60,035 tons in March, 54,583 in February, and 59,684 in January, according to the monthly survey made by the Bureau of Mines. Demand continues well ahead of production and OPM has ordered about 15,000 tons of June output to be reserved for emergency distribution to defense industries.

Tin—Prices remained unusually steady at 52.12½c to 52.25c.

Construction and Enterprise

Michigan

ANN ARBOR, MICH.—Metal Compress Co. has been incorporated with $1000 capital to process metals, by J. F. Ervin, 311 West Huron street.

DETROIT—Pelton-Kurtz Supply Co., 2809 East Larned street, has been incorporated with $30,000 capital to fabricate metals, by Harry H. Kurtz, 14528 Scripps avenue.

DETROIT—Industries Motor Corp., 1810 David Stott building, has been incorporated with $50,000 capital to build engines by Lewis F. Green, 29904 Jefferson avenue, St. Clair Shores, Mich.

DETROIT — Saia Tool Engineering Corp. 10633 Canfield avenue, has been incorporated with 1000 shares no par value to deal in dies and jigs, by Joseph Saia, 4788 Belvidere avenue.

DETROIT—Century Motors Corp., 2605 Fisher building, has been incorporaed with $111,100 capital to deal in crankshafts, by Victor W. Klein, 1881 National Bank building.

DETROIT—Alpha Tool Works is taking bids through L. B. Jameson, architect, Hamtramck, Mich., for a tool shop at its Detroit plant.

DETROIT—American Brake Block Co. has given contract to Austin Co., Detroit, for a plant addition to cost $74,860.

HUDSON, MICH.—McGehee & Sayre Mfg. Co. has been formed to manufacture screw machines, with Alton McGehee general manager and Max Sayre plant foreman.

MILAN, MICH.—Ideal Furnace Co., W. Johnson, president, is rebuilding its plant at cost of $125,000.

RIVER ROUGE, MICH.—Ford Motor Co., Dearborn, Mich., will build a one-story airplane plant addition costing over $1,000,000. Giffels & Vallet, 1000 Marquette building, Detroit, are architects.

WYANDOTTE, MICH. — Pennsylvania Salt Mfg. Co. has let general contract for a one and two-story addition 122 x 126 feet and one-story 30 x 65 feet, to Barton-Malow Co., 1900 East Jefferson street, Detroit, to cost about $75,000.

New York

COLONIE, N. Y.—Deere & Co., 325 Third avenue, Moline, Ill., has let general contract for 120 x 230-foot plant to Lange Finn Construction Co. Inc., 240 State street, Albany, N. Y., to cost about $75,000. (Noted Feb. 3.)

FARMINGDALE, N. Y.—Ranger Engineering Corp., engine manufacturing division of Fairchild Aviation Corp., has let general contract to Brown & Matthews Inc., New York, for an expansion of its plant to increase engine production. Plans are by Albert Kahn, Kahn Inc., New Center building, Detroit.

SCHENECTADY, N. Y.—General Electric Realty Corp., River road, will let contract soon for a 240 x 360-foot turbine building costing $250,000. Charles I. Main Inc., 201 Devonshire street, Boston, is architect.

Additional Construction and Enterprise leads may be found in the list of Shapes Pending on page 110 and Reinforcing Bars Pending on page 113 in this issue.

New Jersey

BOUND BROOK, N. J.—Bakelite Corp., 247 Park avenue, New York, will let contract soon for a one-story warehouse addition 190 x 240 feet and a two-story machine shop addition, on River road. Francisco & Jacobus, 511 Fifth avenue, New York, are architects.

NEW BRUNSWICK, N. J. — Quimby Pump Co., 340 Thomas street, Newark, N. J., will build a one-story plant on Jersey avenue, to cost about $75,000. General contract has been given James Mitchell, 40 Clinton street, Newark, N. J.

PHILLIPSBURG, N. J. — Canister Co., North Broad street, will build a one-story 90 x 230-foot addition, general contract to Collins & Maxwell Inc., Easton Terminal building, Easton, Pa. Cost about $40,000.

RAHWAY, N. J.—Merck & Co., 126 East Lincoln avenue, will let contract soon for a 40 x 90-foot boiler house. Lockwood Greene Inc., 10 Rockefeller Plaza, New York, is architect and engineer.

Ohio

AKRON, O.—Goodyear Aircraft Corp., P. W. Litchfield, chairman, is building an additional aircraft parts building at Akron airport, 85,000 square feet floor space, costing about $400,000, without equipment. Plant will manufacture

parts for fighter planes.

CLEVELAND — Truck Engineering Corp., 1802 East Thirty-eighth street, manufacturer of trailer and truck equipment has bought building at 1285 West Seventieth street which will be remodeled at cost of $60,000, giving double present manufacturing space. Julius Glick is president and general manager.

CLEVELAND—John Harsch Bronze & Foundry Co., 12502 Berea road, will add 2700 square feet to warehouse space as part of general expansion program.

CLEVELAND — Cleveland Graphite Bronze Co., 16800 St. Clair avenue, has let general contract for $3,000,000 plant expansion to Albert M. Higley Co., 2036 East Twenty-second street. (Noted May 12.)

CLEVELAND—Lake Erie Chemical Co., 2200 Scranton road, is being licensed to build a midget fire pumper designed for fighting incendiary bomb fires, invented by Frank Sigmund, former Czechoslovakian.

TOLEDO, O.—Bunting Brass & Bronze Co., Spencer street, has bought three acres adjoining its plant and will build two additional units.

WARREN, O.—Thomas Steel Co., Delaware avenue, is building an addition 50 x 80 feet to increase production.

Pennsylvania

JOHNSTOWN, PA.—City, H. L. Wilson, city engineer, has revised plans for a municipal sewage disposal plant and appurtenances to cost $400,000 to $500,000. W. A. Goff, 220 South Sixteenth street, Philadelphia, is engineer.

WESLEYVILLE, PA.—General Electric Co., East Lake Road, Erie, Pa., is expanding local plant by several buildings, costing over $50,000. J. F. Tridle, care owner at Erie, is engineer.

Illinois

CHICAGO—American Gear Mfg. Co., 6665 West Sixty-fifth street, will build an 80 x 150-foot addition costing $125,000, with equipment. Company completed main plant less than a month ago. New plant devoted entirely to manufacture of airplane and diesel engine gears and gears for machine tools.

CHICAGO — Pullman-Standard Car Mfg. Co., 79 East Adams street, will build a plant to manufacture airplane parts for the government. Defense Plant Corp. will advance $1,108,900 for the project.

CHICAGO—Powers Regulator Co., 2720 North Greenview avenue, manufacturer of industrial regulators, will build a two-story 55 x 125-foot addition to increase facilities for defense work. E. O. Sessions & Co., 120 South La Salle street, are taking bids.

CHICAGO—Wallace Supplies Mfg. Co., 1312 West Diversey Parkway, manufacturer of bending machines, metal furniture, etc., plans plant extension including one-story 85 x 126 feet and two-story 31 x 60 feet, for manufacture of airplane and tank accessories. Company recently leased 9000 square feet to permit increase in operations.

PROVING GROUND, ILL. — Major Daniel A. Branigan, construction quartermaster, Savanna ordnance depot, will take bids June 3 for extension of electrical distribution system, including 30,000 feet of underground cable, 60,000 feet of copper wire and other equipment.

QUINCY, ILL.—J. C. Frost Steel Co. has been incorporated by J. C. Frost, Harvey, Ill., and associates, to operate a steel business.

Wisconsin

BELOIT, WIS.—Fairbanks, Morse & Co., manufacturer of diesel engines, electric motors, pumps, etc., has let general contract to Cunningham Bros., for a one-story experimental laboratory, 59 x 183 feet, W. Fred Dolke, Merchandise Mart, Chicago, is architect.

DANBURY, WIS.—Clam River Dam Co., Grantsburg, Wis., Walter M. Jensen in charge, plans construction of a hydroelectric generating station on Clam river, including two hydraulic turbines, generators and auxiliaries, to cost about $90,000. Herman T. Hagestad, River Falls, Wis., is consulting engineer.

FOND DU LAC, WIS.—Giddings & Lewis Machine Tool Co. has let contracts for a one-story pattern building 40 x 100 feet.

KENOSHA, WIS. — Dynamatic Corp. has let contract to Anton J. Larson for a one-story addition 36 x 130 feet.

KOHLER, WIS.—Kohler Co., manufacturer of plumbing fixtures, portable light plants, etc., has given contract to Permanent Construction Co., Milwaukee, for a five-story addition to its brass plant, 80 x 200 feet. Richard Phillip, 756 Milwaukee street, Milwaukee, is architect. (Noted Feb. 24.)

MILWAUKEE—Milwaukee Tool & Die Co. has been incorporated by Fred Busch, F. A. Dean and W. J. Stell.

MILWAUKEE—Magnus Metals division of National Lead Co., manufacturer of bearing metals, has given contract to Campbell-Lowrie-Lautermilch Corp., 400 West Madison street, Chicago, for a one-story foundry 278 x 212 feet, to house furnace room, core room and pattern shop. Olsen & Urbain, 8 East Huron street, Chicago are architects.

MILWAUKEE—Milwaukee Malleable & Grey Iron Works has let contract to Meredith Bros. for a one-story plant addition 42 x 141 feet. Fred A. Rankl, 121

East Washington street, is engineer.

California

BAKERSFIELD, CALIF. — Earnshaw Motors Inc. has been incorporated with 2500 shares no par value by William H. McKinney and associates. Company has built a plant on North Cester avenue, Oildale, Calif., and will manufacture a new type motor for aircraft and other uses.

BERKELEY, CALIF.—Berkeley Pump Corp., 817 Bancroft way, has let general contract for a machine shop to W. K. Owen, 1501 Powell street, Berkeley, costing about $40,000.

LOS ANGELES—Western Galvanizing Co., Harriet and Twenty-fifth streets, is building a new warehouse, costing about $17,000.

LOS ANGELES—Standard Steel Corp., 5001 South Boyle avenue, will build a new ship building addition, costing $2000.

LOS ANGELES—Kinney Iron Works, 2525 East Forty-ninth street, will build an office and shop building costing $4000.

LOS ANGELES—General Petroleum Corp., 2525 East Thirty-seventh street, is building a warehouse and office building costing $26,530.

LOS ANGELES—Columbia Steel Co., 2087 East Slauson avenue, is building a warehouse addition costing $90,000.

LOS ANGELES—Deer Creek Tungsten Co. has been incorporated with 14,000 shares no par value by A. R. Parsons, Burbank, Calif., and associates. Cobb, Campbell & Kelley, 639 Spring street, are representatives.

LOS ANGELES—Beryllium Inc. has been incorporated with $25,000 capital by Ray E. Craig and associates. Musick & Burrell, Subway Terminal building, are representatives.

LOS ANGELES—Welded Aircraft Parts Co., 13007 South Main street, has been organized by Arnold H. Rahn and Lee W. Rook.

OAKLAND, CALIF.—Pacific Oxygen Co., 2205 Magnolia street, has let general contract for a plant to C. C. Rosenberry, 1401 Mountain boulevard, costing about $42,500.

SAN DIEGO, CALIF.—Woolard Aircraft Corp. has been organized with $500,000 capital by F. H. Nottbusch, Commonwealth building, and associates.

SAN DIEGO, CALIF.—National Iron Works will build addition to its structural steel plant and a new foundry building, costing about $40,000. Will add 30 per cent to plant area and 20 per cent to operating capacity.

Washington

OLYMPIA, WASH.—Pearl E. Richards, Tacoma, Wash., has applied to state authorities for water rights on the Cle Elum river, Kittitas county, for building a 20,000-horsepower electric generating plant costing $2,200,000.

PUGET SOUND NAVY YARD, WASH. —Public works officer will open bids June 10 for an ammunition depot 50 x 100 feet, specification No. 10382.

SEATTLE—Doran Co., whose plant recently was damaged by fire, plans two foundry units at 63 Horton street, 68 x 100 and 70 x 100 feet, costing about $20,000.

SEATTLE—Puget Sound Sheet Metal Works, 3641 West Marginal Way, has let contract to the Austin Co. for a 44 x 80-foot assembly building.

SEATTLE—Popple & Knowles Sheet Metal Co., 1122 Post street, is enlarging its plant because of defense orders.

TACOMA, WASH.—Plans are in preparation for a proposed $11,000,000 municipal dam and power plant on Nisqually river, on which bids will be called late this summer.

Canada

ST. CATHARINES, ONT.—Lightning Fastener Co. Ltd., 50 Niagara street, will build a $60,000 plant addition for which general contract has been let to C. F. Monk, 399 St. Paul street. L. A. Hesson is architect.

ST. CATHARINES, ONT.—Hydro Electric Power Commission of Ontario, 620 University avenue, Toronto, Ont., will build a power plant at Decew Falls, near here, to cost about $250,000.

TORONTO, ONT.—Ideal Welding Co. Ltd., 195 Duchess street, has let contract to Evan S. Martin, 16 Saulter street for an addition to cost $20,000.

TORONTO, ONT. — Hydro Electric Power Commission of Ontario 620 University avenue, has let contract to Dominion Construction Corp. Ltd., 217 Bay street, for $600,000 power development at Bark Lake dam, Madawaska River, Ont.

MONTREAL, QUE.—Canadian Car & Foundry Co. Ltd., 621 Craig street, will build addition to forge shop at Longue Pointe, costing $150,000. General contract to Foundation Co. of Canada Ltd.

THREE RIVERS, QUE.—Canada Iron Foundries Ltd., 227 St. Maurice street, has let general contract to Joseph Renaud, 145 Laviolette street for plant addition excavation, other contracts to follow.

WHERE-TO-BUY

A classified list of advertisers according to products. ¶Index to advertisements gives page number of any advertiser.

ABRASIVES (Blast Cleaning)
American Foundry Equipment Co., The, 509 So. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., 4839 Harrison St., Pittsburgh, Pa.

ABRASIVES (Polishing)
Carborundum Co., The, Niagara Falls, N. Y.
Norton Co., Worcester, Mass.

ABRASIVES (Wheels)
Bay State Abrasive Products Co., Westboro, Mass.

ACCUMULATORS
Elmes, Chas. F., Engineering Wks., 243 N. Morgan St., Chicago, Ill.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Morgan Engineering Co., The, Alliance, O.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

ACETYLENE
Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., The, 30 E. 42nd St., New York City.

ACID-PROOF LININGS
Cellcote Co., 750 Rockefeller Bldg., Cleveland, O.
Pennsylvania Salt Mfg. Co., Dept. E, Pennsalt Cleaner Div., Philadelphia, Pa.
Quigley Co., 56 W. 45th St., New York City.

ACIDS (Pickling)
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Ampco Metal, Inc., Dept. S-62, 3830 W. Burnham St., Milwaukee, Wis.
Pennsylvania Salt Mfg. Co., Dept. E, Pennsalt Cleaner Div., Philadelphia, Pa.

AIR COMPRESSORS—See COMPRESSORS (Air)

AIR CONDITIONING EQUIPMENT
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Worthington Pump & Machinery Corp., Harrison, N. J.

AIRLESS BLAST CLEANING EQUIPMENT
American Foundry Equipment Co., The, 509 So. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

ALKALI CLEANING COMPOUNDS
Pennsylvania Salt Mfg. Co., Dept. E, Pennsalt Cleaner Div., Philadelphia, Pa.

ALLOYS (Hard Surfacing)
Stoody Co., Whittier, Calif.

ALLOYS—See FERROALLOYS

ANGLES, CHANNELS—See BEAMS, CHANNELS, ANGLES

ANGLE IRON BENDERS
Excelsior Tool & Machine Co., Ridge & Jefferson Ave., E. St. Louis, Ill.

ANNEALING BOXES—See BOXES (Annealing)

ANNEALING COVERS
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.

ANODES (All Types)
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

ANODES (Nickel)
Seymour Manufacturing Co., Seymour, Conn.

AXLES
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Republic Steel Corp., Dept. ST, Cleveland, O.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

BABBITT METAL
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.

BALANCING MACHINES
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.

BALING PRESSES
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.

BALL TRANSFERS
Mathews Conveyer Co., 142 Tenth St., Ellwood City, Pa.

BALLS (Brass or Bronze)
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Strom Steel Ball Co., 1842 S. 54th Ave., Cicero, Ill.

BALLS (Special Alloy Metals)
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

BALLS (Steel)
Strom Steel Ball Co., 1842 S. 54th Ave., Cicero, Ill.

BAND FILES (Metal)
Continental Machines, Inc., 1324 So. Washington Ave., Minneapolis, Minn.

BAND SAWS (Metal Cutting)
Continental Machines, Inc., 1324 So. Washington Ave., Minneapolis, Minn.

BANDS—See HOOPS AND BANDS

BANDS (Iron and Steel)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

BAR BENDERS
Kardong Bros. Inc., 346 Buchanan St., Minneapolis, Minn.

BAR DRAWER AND STRAIGHTENING MACHINES
Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland, O.

BARGES (Steel)
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Dravo Corp. (Engin'r'g Works Div.) Neville Island, Pittsburgh, Pa.
Federal Shipbuilding & Dry Dock Co., Kearney, N. J.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Maryland Dry Dock Co., Baltimore, Md.

BARRELS (Plating)
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

BARRELS (Steel)
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.

BARS (Alloy)
Ampco Metal, Inc., Dept. S-62, 3830 W. Burnham St., Milwaukee, Wis.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Copperweld Steel Co., Warren, O.
Firth-Sterling Steel Co., McKeesport, Pa.
LaSalle Steel Co., Dept. 10-A, P. O. Box 6800-A, Chicago, Ill.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.

BARS (Brass, Bronze or Copper)
American Brass Co., The, Waterbury, Conn.
Copperweld Steel Co., Warren, O.
Johnson Bronze Co., 550 So. Mill St., New Castle, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Sumet Corporation, 1553 Fillmore Ave., Buffalo, N. Y.

BARS (Concrete Reinforcing)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BARS (Iron)—See IRON (Bar)

BARS (Steel)
(*Also Stainless)
*Allegheny Ludlum Steel Corp., Dept. S-125, Oliver Bldg., Pittsburgh, Pa.
*Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
*Copperweld Steel Co., Warren, O.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
*Midvale Co., The, Nicetown, Philadelphia, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
*Rustless Iron & Steel Corp., 3400 E. Chase St., Baltimore, Md.
*Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Sutton Engineering Co., Park Bldg., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Canton, O.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BATTERIES (Storage)
Edison Storage Battery Div. of Edison, Thomas A., Inc., West Orange, N. J.
Electric Storage Battery Co., The, 19th St. and Allegheny Ave., Philadelphia, Pa.
Graybar Electric Co., Dept. ST, Graybar Bldg., New York City.

BATTERY CHARGING APPARATUS
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

BEAMS, CHANNELS, ANGLES, ETC.
(*Also Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Levinson Steel Co., 33 Pride St., Pittsburgh, Pa.
*Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BEARINGS (Ball)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
Bantam Bearings Corp., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
New Departure Div., General Motors Corp., Bristol, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Torrington Co., The, Torrington, Conn.

BEARINGS (Babbitt)
Johnson Bronze Co., 550 So. Mill St., New Castle, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.

WHERE-TO-BUY

BEARINGS (Brass, Bronze)
Ampco Metal, Inc., Dept. S-62, 3830 W. Burnham St., Milwaukee, Wis.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Johnson Bronze Co., 550 So. Mill St., New Castle, Pa.
Lawrence Copper & Bronze, Bessemer Bldg., Pittsburgh, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Shenango-Penn Mold Co., Dover, O.
Sumet Corporation, 1553 Fillmore Ave., Buffalo, N. Y.

BEARINGS (Journal)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
Bantam Bearings Corp., South Bend, Ind.
Bower Roller Bearing Co., 3040 Hart St., Detroit, Mich.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Division, General Motors Sales Corp., Harrison, N. J.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Shafer Bearing Corp., 35 E. Wacker Drive, Chicago, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS (Needle)
Torrington Co., The, Torrington, Conn.

BEARINGS (Non-Metallic)
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.

BEARINGS (Oilless)
Rhoades, R. W., Metaline Co., P. O. Box 1, Long Island City, N. Y.

BEARINGS (Quill)
Bantam Bearings Corp., South Bend, Ind.

BEARINGS (Radial)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
American Roller Bearing Co., 416 Melwood St., Pittsburgh, Pa.
Bantam Bearings Corp., South Bend, Ind.
Bower Roller Bearing Co., 3040 Hart St., Detroit, Mich.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Link-Belt Co., 519 No. Holmes Ave., Indianapolis, Ind.
New Departure Div., General Motors Corp., Bristol, Conn.
Shafer Bearing Corp., 35 E. Wacker Drive, Chicago, Ill.
SKF Industries, Inc., Front St., and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The Canton, O.

BEARINGS (Roll Neck)
Bantam Bearings Corp., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
Harrison, N. J.
Hyatt Bearings Div., General Motors Sales Corp.,
Morgan Construction Co., Worcester, Mass.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS (Roller)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
American Roller Bearing Co., 416 Melwood St., Pittsburgh, Pa.
Bantam Bearings Corp., South Bend, Ind.
Bower Roller Bearing Co., 3040 Hart St., Detroit, Mich.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Shafer Bearing Corp., 35 E. Wacker Drive, Chicago, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS (Roller Tapered)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.

BEARINGS (Rolling Mill)
American Roller Bearing Co., 416 Melwood St., Pittsburgh, Pa.
Bantam Bearings Corp., South Bend, Ind.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Morgan Construction Co., Worcester, Mass.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Shafer Bearing Corp., 35 E. Wacker Drive, Chicago, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS (Thrust)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
Bantam Bearings Corp., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., 519 No. Holmes Ave., Indianapolis, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Shafer Bearing Corp., 35 E. Wacker Drive, Chicago, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.
Timken Roller Bearing Co., The, Canton, O.

BELTING (Chain and Link)
Link-Belt Co., 220 So. Belmont Ave., Indianapolis, Ind.

BELTING (Metal, Conveyor, High and Low Temperature)
Cyclone Fence Co., Waukegan, Ill.

BENCHES
Challenge Machinery Co., Grand Haven, Mich.

BENCH PLATES
Challenge Machinery Co., Grand Haven, Mich.

BENDING AND STRAIGHTENING MACHINES
Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Kardong Bros., Inc., 346 Buchanan St., Minneapolis, Minn.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Morgan Engineering Co., The, Alliance, O.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.

RENZOL AND TOLUOL RECOVERY PLANTS
Koppers Co., Engineering and Construction Div., 300 Koppers Bldg., Pittsburgh, Pa.
Koppers Co., Tar & Chemical Div., 901 Koppers Bldg., Pittsburgh, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BILLETS (Alloys and Carbon Steel)
Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Firth-Sterling Steel Co., McKeesport, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Stanley Works, The, New Britain, Conn.
Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Washburn Wire Co., Phillipsdale, R. I.

BILLETS (Forging)
Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.

BILLETS (Forging)—Con.
Copperweld Steel Co., Warren, O.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.

BILLETS AND BLOOMS (*Also Stainless)
*Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
*Copperweld Steel Co., Warren, O.
*Firth-Sterling Steel Co., McKeesport, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
*Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BINS (Storage)
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.

BLAST CLEANING EQUIPMENT (Sand)
American Foundry Equipment Co., The, 509 So. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

BLAST FURNACE CLEANING (Gas)
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.

BLAST FURNACE HOT BLAST STOVES
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.

BLAST FURNACE SPECIALTIES
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brassert, H. A., & Co., 1st National Bk. Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.

BLAST FURNACE STOCK HOUSES
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.

BLAST FURNACES—See FURNACES (Blast)

BLOCKS (Chain)
Reading Chain & Block Co., Dept. 36, Reading, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

BLOWERS
General Electric Co., Schenectady, N. Y.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
North American Mfg. Co., The, 2901 E. 75th St., Cleveland, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., Dept. 112, 5600 Roosevelt Rd., Chicago, Ill.

BLOWPIPES (Oxy-Acetylene)
Linde Air Products Co., The, 30 E. 42nd St., New York City.

BOILER HEADS
Bethlehem Steel Co., Bethlehem, Pa.

BOILER TUBES—See TUBES (Boiler)

BOILERS
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Oil Well Supply Co., Dallas, Texas.

BOLT AND NUT MACHINERY
Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland, O.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., The, Tiffin, O.

BOLTS (*Also Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
*Erie Bolt & Nut Co., Liberty Ave., at W. 12th St., Erie, Pa.
*Harper, H. M., Co., The, 2646 Fletcher St., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
*Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
*Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

BOLTS (Carriage and Machine)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
Harper, H. M., Co., The, 2646 Fletcher St., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.

BOLTS (Special)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
Harper, H. M., Co., The, 2646 Fletcher St., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOLTS (Stove)
Central Screw Co., 3517 Shields Ave., Chicago, Ill.
Cleveland Cap Screw Co., 2934 E. 79th St., Cleveland, O.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.

BOLTS (Stove, Recessed Head)
American Screw Co., Providence, R. I.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.

BOLTS (Track)—See TRACK BOLTS

BOOKS
International Correspondence Schools, Box 9373-C, Scranton, Pa.

BORING MACHINES (Precision)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Heald Machine Co., Worcester, Mass.

BOXES (Annealing)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
National-Erie Corp., Erie, Pa.
Union Steel Casting Div. of Blaw-Knox Co., 62nd & Butler Sts., Pittsburgh, Pa.
United Engineering & Foundry Co., First National Bank Bldg., Pittsburgh, Pa.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

BOXES (Open Hearth Charging)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Morgan Engineering Co., The, Alliance, O.

BRAKE LININGS
Johns-Manville Corp., 22 E. 40th St., New York City.

BRAKES (Electric)
Clark Controller Co., The, 1146 E. 152nd St., Cleveland, O.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.

BRAKES (Press)
Cincinnati Shaper Co., Elam and Garrard Sts., Cincinnati, O.
Cleveland Crane & Engineering Co., The, Steelweld Machinery Div., 1125 E. 283rd St., Wickliffe, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.

BRICK—(Insulating)—See INSULATING BRICK

BRICK (Refractory)—See REFRACTORIES, CEMENT, ETC.

BRICK (Ladle)
Globe Brick Co., The, East Liverpool, O.

BRICK (Silicon Carbide)
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Perth Amboy, N. J.
Norton Co., Worcester, Mass.

BRIDGE CRANES (Ore and Coal Handling)—See CRANES (Bridge)

BRIDGES, BUILDINGS, VIADUCTS, STACKS, ETC.
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Belmont Iron Works, 22nd St., and Washington Ave., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Co., Blawnox, Pa.
Columbia Steel Co., San Francisco, Calif.
Ingalls Iron Works Co., The, Birmingham, Ala.
Levinson Steel Co., 33 Pride St., Pittsburgh, Pa.

BROACHING CUTTERS
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

BROACHING MACHINES
American Broach & Machine Co., Ann Arbor, Mich.
Bullard Co., The, Bridgeport, Conn.
Cincinnati Milling Machine & Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Colonial Broach Co., 147 Jos. Campau, Detroit, Mich.

BRUSHES
Fuller Brush Co., The, Industrial Div., Dept. SC, 3582 Main St., Hartford, Conn.

BRUSHES (Industrial)
Fuller Brush Co., The, Industrial Div., Dept. SC, 3582 Main St., Hartford, Conn.

BRUSHES (Steelgript)
Fuller Brush Co., The, Industrial Div., Dept. SC, 3582 Main St., Hartford, Conn.

BUCKETS (Clam Shell, Dragline Grab, Single Line)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Blaw-Knox Co., Blawnox, Pa.
Cullen-Friestedt Co., 1308 So. Kilbourn St., Chicago, Ill.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Owen Bucket Co., 7762 Breakwater St., Cleveland, O.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland, O.

BUCKETS (Single Hook, Automatic Dump, Automatic Single Line)
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland, O.

BUILDINGS (Steel)—See BRIDGES, BUILDINGS, ETC.

BULLDOZERS
Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland, O.
Beatty Machine & Mfg. Co., Hammond, Ind.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.

BURNERS (Acetylene)—See TORCHES AND BURNERS

BURNERS (Automatic)
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
North American Mfg. Co., The, 2910 E. 75th St., Cleveland, O.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Wean Engineering Co., Warren, O.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

BURNERS (Fuel, Oil, Gas, Combination)
American Gas Furnace Co., Elizabeth, N. J.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
North American Mfg. Co., The, 2901 E. 75th St., Cleveland, O.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Stewart Furnace Div., Chicago Flexible Shaft Co., Dept. 112, 5600 Roosevelt Rd., Chicago, Ill.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Wean Engineering Co., Warren, O.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

BUSHINGS (Bronze)
Ampco Metal, Inc., Dept. S-812, 3500 W. Burnham St., Milwaukee, Wis.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Johnson Bronze Co., 550 So. Mill St., New Castle, Pa.
Lawrence Copper & Bronze, Bessemer Bldg., Pittsburgh, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Shenango-Penn Mold Co., Dover, O.
Sumet Corporation, 1553 Fillmore Ave., Buffalo, N. Y.

BUSHINGS (Jig)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

BUSHINGS (Oilless)
Rhoades, R. W., Metaline Co., P. O. Box 1, Long Island City, N. Y.

BY-PRODUCT PLANTS
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

CADMIUM
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

CADMIUM PLATING PROCESS
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

CAISSONS (Pneumatic)
Dravo Corp., (Contracting Div.), Neville Island, Pittsburgh, Pa.

CALCIUM METAL AND ALLOYS
Electro Metallurgical Co., 30 E. 42nd St., New York City.

CAP SCREWS—See SCREWS (Cap, Set, Safety-Set)

CAR DUMPERS
Industrial Brownhoist Corp., Bay City, Mich.

CAR PULLERS and SPOTTERS
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
Cullen-Friestedt Co., 1308 So. Kilbourn St., Chicago, Ill.
Link-Belt Co., 2410 W. 18th St., Chicago, Ill.

CARBIDE
Linde Air Products Co., The, 30 E. 42nd St., New York City.
National Carbide Corp., 60 E. 42nd St., New York City.

CARS (Charging)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Morgan Engineering Co., The, Alliance, O.

CARS (Cinder Pot)
Pressed Steel Car Co., (Koppel Div.) Koppers Bldg., Pittsburgh, Pa.

CARS (Dump)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.
Pressed Steel Car Co., (Koppel Div.) Koppers Bldg., Pittsburgh, Pa.

CARS (Industrial and Mining)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Differential Steel Car Co., Findlay, O.
Pressed Steel Car Co., (Koppel Div.) Koppers Bldg., Pittsburgh, Pa.

CARS (Scale)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.

CASTING WASHER EQUIPMENT
Pangborn Corp., Hagerstown, Md.

CASTINGS (Acid Resisting)
Ampco Metal, Inc., Dept. S-62, 3830 W. Burnham St., Milwaukee, Wis.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
International Nickel Co., Inc., The, 67 Wall St., New York City.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Shenango-Penn Mold Co., Dover, O.

CASTINGS (Alloy Iron)
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.

CASTINGS (Alloy Steel)
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Damascus Steel Casting Co., New Brighton, Pa.
Electro-Alloys Co., The, Elyria, O.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
National-Erie Corp., Erie, Pa.
Ohio Steel Foundry Co., Lima, O.
Springfield, O.
Pittsburgh Rolls, Div. of Blaw-Knox Co., Pittsburgh, Pa.
Union Steel Casting Div. of Blaw-Knox Co., 62nd and Butler Sts., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

CASTINGS (Brass, Bronze, Copper, Aluminum)
Ampco Metal, Inc., Dept. S-62, 3830 W. Burnham St., Milwaukee, Wis.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
Lawrence Copper & Bronze, Bessemer Bldg., Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Shenango-Penn Mold Co., Dover, O.
Sumet Corporation, 1553 Fillmore Ave., Buffalo, N. Y.

CASTINGS (Corrosion Resisting)
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.

CASTINGS (Die)—See DIE CASTINGS

CASTINGS (Electric Steel)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Damascus Steel Casting Co., New Brighton, Pa.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
National-Erie Corp., Erie, Pa.
Reading Steel Casting Div. of American Chain & Cable Co. Inc., Reading, Pa.
West Steel Casting Co., 805 E. 70th St., Cleveland, O.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

CASTINGS (Gray Iron, Alloy, or Semi-Steel)
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Brown, Inc., 456 So. Main St., Lima, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Erie Foundry Co., Erie, Pa.
Etna Machine Co., The, 3400 Maplewood Ave., Toledo, O.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Roll & Foundry Co., The, Avonmore, Pa.
Oil Well Supply Co., Dallas, Texas.
Shenango-Penn Mold Co., Dover, O.
Western Gas Div., Koppers Co., Fort Wayne, Ind.

CASTINGS (Heat Resisting)
Electro-Alloys Co., The, Elyria, O.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
Shenango-Penn Mold Co., Dover, O.

CASTINGS (Malleable)
American Chain & Cable Co. Inc., Bridgeport, Conn.
Lake City Malleable Co., 5026 Lakeside Ave., Cleveland, O.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CASTINGS (Manganese Steel)
Damascus Steel Casting Co., New Brighton, Pa.

CASTINGS (Steel) (*Also Stainless)
*Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Damascus Steel Casting Co., New Brighton, Pa.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
*Midvale Co., The, Nicetown, Philadelphia, Pa.
National-Erie Corp., Erie, Pa.
National Roll & Foundry Co., The, Avonmore, Pa.
Ohio Steel Fdry. Co., Lima, O., Springfield, O.
Oil Well Supply Co., Dallas, Texas.
Pittsburgh Rolls Div. of Blaw-Knox Co., Pittsburgh, Pa.
Standard Steel Works Co., Paschall P. O., Philadelphia, Pa.
Steel Founders' Society of America, 920 Midland Bldg., Cleveland, O.
Strong Steel Fdry. Co., Hertel & Norris Ave., Buffalo, N. Y.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Union Steel Casting Div. of Blaw-Knox Co., 62nd and Butler Sts., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.
West Steel Casting Co., 805 E. 70th St., Cleveland, O.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

CASTINGS (Wear Resisting)
Shenango-Penn Mold Co., Dover, O.

CASTINGS (Worm and Gear Bronze)
Ampco Metal, Inc., Dept. S-62, 3830 W. Burnham St., Milwaukee, Wis.
Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh, Pa.
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.

CEMENT (Acid Proof)
Pennsylvania Salt Mfg. Co., Dept. E., Pennsalt Cleaner Div., Philadelphia, Pa.

CEMENT (High Temperature)
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Perth Amboy, N. J.
Eagle-Picher Lead Co., The, Cincinnati, O.
Johns-Manville Corp., 22 E. 40th St., New York City.
Norton Company, Worcester, Mass.
Quigley Company, 56 W. 45th St., New York City.

CEMENT (High Temperature Hydraulic)
Atlas Lumnite Cement Co., Dept. S-14, Chrysler Bldg., New York City.

CENTRAL STATION EQUIPMENT
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

CHAIN (Conveyor and Elevator)
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Draw Bench)
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Malleable)
Lake City Malleable Co., 5026 Lakeside Ave., Cleveland, O.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Power Transmission)
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Roller)
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Sling)
American Chain & Cable Co. Inc., Bridgeport, Conn.

CHAIN (Sprocket)
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Steel-Finished Roller)
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.

CHAIN (Welded or Weldless)
American Chain & Cable Co. Inc., Bridgeport, Conn.

CHARGING MACHINES (Cupola)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Morgan Engineering Co., The, Alliance, O.

CHARGING MACHINES (Open Hearth)
Morgan Engineering Co., The, Alliance, O.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland, O.

CHARGING MACHINES AND MANIPULATORS (Autofloor Type)
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

CHECKER BRICK
Loftus Engineering Corp., Oliver Bldg., Pittsburgh, Pa.

CHECKS (Metal)
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.

CHISELS (Chipping)
Steel Conversion & Supply Co., P. O. Box 537 (Castle Shannon), Pittsburgh, Pa.

CHROME ORE
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

CHROMIUM METAL AND ALLOYS
Chromium Mining & Smelting Corp., Ltd., 700 Bank of Commerce Bldg., Hamilton, Ont.
Electro Metallurgical Co., 30 E. 42nd St., New York City.

CHROMIUM PLATING PROCESS
United Chromium, Inc. 51 E. 42nd St., New York City.

CHUCK OPERATING CYLINDERS
Airgrip Chuck Div., Anker-Holth Mfg. Co., Port Huron, Mich.

CHUCKING MACHINES (Multiple Spindle)
National Acme Co., The, 170 E. 131st St., Cleveland, O.

CHUCKS (Automatic Closing)
Airgrip Chuck Div., Anker-Holth Mfg. Co., Port Huron, Mich.
Tomkins-Johnson Co., The, 617 N. Mechanic St., Jackson, Mich.

CLAMPS (Drop Forged)
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

CLEANING SPECIALTIES
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Pennsylvania Salt Mfg. Co., Dept. E, Pennsalt Cleaner Div., Philadelphia, Pa.

CLIPS (Packaging)
Consumer's Steel Products, 6454 E. McNichols Rd., Detroit, Mich.

CLUTCHES (Friction)
Jones, W. A. Fdry. & Mach. Co., 4437 Roosevelt Rd., Chicago, Ill.

CLUTCHES (Magnetic)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Dings Magnetic Separator Co., 663 Smith St., Milwaukee, Wis.

COAL OR COKE
Alan Wood Steel Co., Conshohocken, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cleveland-Cliffs Iron Co., Union Commerce Bldg., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Hanna Furnace Corp., The, Ecorse, Detroit, Mich.
Koppers Co., Gas & Coke Div., 300 Koppers Bldg., Pittsburgh, Pa.
Koppers Coal Co., 300 Koppers Bldg., Pittsburgh, Pa.
New England Coal & Coke Co., Boston, Mass.
Shenango Furnace Co., Oliver Bldg., Pittsburgh, Pa.
Snyder, W. P., & Co., Oliver Bldg., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wieman & Ward Co., The, Oliver Bldg., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., The, Youngstown, O.

COAL, COKE, ORE AND ASH HANDLING MACHINERY
Atlas Car & Mfg. Co., The, Waukesha, Wis.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Industrial Brownhoist Corp., Bay City, Mich.

COAL, COKE, ORE, ASH HANDLING MACHY.—Con.
Koppers Co., Engineering & Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
Koppers-Rheolaveur Co., 300 Koppers Bldg., Pittsburgh, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

COILS (Furnace)
Production Plating Works, Inc., The, 123-129 Main St., Lebanon, O.

COKE—See COAL OR COKE

COKE OVEN MACHINERY
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Morgan Engineering Co., The, Alliance, O.

COKE OVENS (By-Product)
Koppers Co., Engineering and Construction Div., 100 Koppers Bldg., Pittsburgh, Pa.

COLUMBIUM
Electro Metallurgical Co., 30 E. 42nd St., New York City.

COMBUSTION BULBS
Norton Company, Worcester, Mass.

COMBUSTION CONTROLS
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Morgan Construction Co., Worcester, Mass.
Norton Company, Worcester, Mass.

COMPARATORS (Optical)
Jones & Lamson Machine Co., Springfield, Vt.

COMPENSATORS (Automatic)
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.

COMPRESSORS (Air)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Curtis Pneumatic Machinery Co., 1996 Kienlen Ave., St. Louis, Mo.
General Electric Co., Schenectady, N. Y.
Worthington Pump & Machinery Corp., Harrison, N. J.

CONCRETE (Heat Resistant)
Atlas Lumnite Cement Co., Dept. S-14, Chrysler Bldg., New York City.

CONCRETE REINFORCING BARS —See BARS (Concrete Reinforcing)

CONDENSERS (Surface, Barometric, Multi-Jet)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Western Gas Div., Koppers Co., Fort Wayne, Ind.
Worthington Pump & Machinery Corp., Harrison, N. J.

CONDUITS (Electric)
Youngstown Sheet & Tube Co., The, Youngstown, O.

CONDUITS (Pressure-Treated Wood)
Wood Preserving Corp., The, 300 Koppers Bldg., Pittsburgh, Pa.

CONNECTING RODS
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
New Brighton, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.

CONTRACTORS—See ENGINEERS AND CONTRACTORS

CONTROL SYSTEMS (Automatic)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

CONTROLLERS (Electric)
Allen-Bradley Co., 1320 So. Second St., Milwaukee, Wis.
Clark Controller Co., The, 1146 E. 152nd St., Cleveland, O.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.
General Electric Co., Schenectady, N. Y.

CONTROLS (Combustion)—See COMBUSTION CONTROLS

CONTROLS (Temperature)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

CONVEYOR BELTS (High and Low Temperature)
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

CONVEYOR BELTS (Wire)
Cyclone Fence Co., Waukegan, Ill.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

CONVEYORS (Apron)
Link-Belt Co., 300 W. Pershing Road, Chicago, Ill.
Mathews Conveyer Co., 142 Tenth St., Ellwood City, Pa.

CONVEYORS (Chain)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Mathews Conveyer Co., 142 Tenth St., Ellwood City, Pa.

CONVEYORS (Elevating)
Link-Belt Co., 300 W. Pershing Road, Chicago, Ill.
Mathews Conveyer Co., 142 Tenth St., Ellwood City, Pa.

CONVEYORS (Overhead Trolley)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Link-Belt Co., 300 W. Pershing Road, Chicago, Ill.
Reading Chain & Block Corp., Dept. 36, Reading, Pa.

CONVEYORS (Roller—Power and Gravity)
Mathews Conveyer Co., 142 Tenth St., Ellwood City, Pa.

CONVEYORS (Vibratory)
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.

COPPER (Phosphorized)
National Bearing Metals Corp., 928 Shore Ave., Pittsburgh, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.

COPPERING COMPOUND
American Chemical Paint Co., Dept. 310, Ambler, Pa.

CORRESPONDENCE COURSES
International Correspondence Schools, Box 9373-C, Scranton, Pa.

COTTER PINS
American Chain & Cable Co., Inc., York, Pa.
Hindley Mfg. Co., Valley Falls, R. I.
Hubbard, M. D., Spring Co., 430 Central Ave., Pontiac, Mich.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.

COUNTERBORES
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

COUPLINGS (Flexible)
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.
American Flexible Coupling Co., 18th & Pittsburgh Aves., Erie, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Clark Controller Co., The, 1146 E. 152nd St., Cleveland, O.
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
James, D. O., Mfg. Co., 1120 W. Monroe St., Chicago, Ill.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.
Lovejoy Flexible Coupling Co., 4973 W. Lake St., Chicago, Ill.
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.
Poole Fdy. & Mach. Co., Woodberry St., Baltimore, Md.
Waldron, John, Corp., New Brunswick, N. J.

COUPLINGS (Pipe)
Bethlehem Steel Co., Bethlehem, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Oil Well Supply Co., Dallas, Texas
Republic Steel Corp., Dept. ST, Cleveland, O.
Youngstown Sheet & Tube Co., The, Youngstown, O.

CRANES, BRIDGE (Ore and Coal Handling)
Dravo Corp. (Engin'r'g Works Div.), Neville Island, Pittsburgh, Pa.
Industrial Brownhoist Corp., Bay City, Mich.

CRANES (Charging)
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Morgan Engineering Co., The, Alliance, O.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

CRANES (Crawler, Erection)
Bucyrus-Erie Corp., So. Milwaukee, Wis.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.

CRANES (Electric)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Morgan Engineering Co., The, Alliance, O.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Reading Chain & Block Corp., Dept. 36, Reading, Pa.
Shaw-Box Crane & Hoist Div., Manning, Maxwell & Moore, Inc., 406 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

CRANES (Gantry)
Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Cullen-Friestedt Co., 1308 So. Kilbourn Ave., Chicago, Ill.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.
Reading Chain & Block Corp., Dept. 36, Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

CRANES (Gasoline and Diesel)
Cullen-Friestedt Co., 1308 So. Kilbourn Ave., Chicago, Ill.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.

CRANES (Hand)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Curtis Pneumatic Machinery Co., 1996 Kienlen Ave., St. Louis, Mo.
Industrial Brownhoist Corp., Bay City, Mich.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Reading Chain & Block Corp., Dept. 36, Reading, Pa.
Shaw-Box Crane & Hoist Div., Manning, Maxwell & Moore, Inc., 406 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

CRANES (Jib)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Reading Chain & Block Corp., Dept. 36, Reading, Pa.
Wright Mfg. Div. of American Chain & Cable Co. Inc., York, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

CRANES (Locomotive)
Cullen-Friestedt Co., 1308 So. Kilbourn Ave., Chicago, Ill.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, O.

CRANES (Monorail)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Reading Chain & Block Corp., Dept. 36, Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

CRANES (Traveling)
Reading Chain & Block Corp., Dept. 36, Reading, Pa.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.

CRANK SHAFTS
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Union Drawn Steel Div. Republic Steel Corp., Massillon, O.

CRUSHERS
American Pulverizer Co., 1539 Macklind Ave., St. Louis, Mo.

CUSHIONS (Pneumatic)
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.

CUT-OFF MACHINES (Abrasive)
Challenge Machinery Co., Grand Haven, Mich.

CUTTERS (Die Sinking & End Milling)
Brown & Sharpe Mfg. Co., Providence, R. I.
Tomkins-Johnson Co., The 317 N. Mechanic St., Jackson, Mich.

CUTTERS (Gang Slitter)
Cowles Tool Co., 2086 W. 110th St., Cleveland, O.

CUTTING AND WELDING—See WELDING

CUTTING OILS—See OILS (Cutting)

CUTTING-OFF MACHINES (Rotary)
Taylor-Wilson Mfg. Co., 15 Thompson Ave., McKees Rocks, Pa.

CYLINDERS (Air or Hydraulic)
Airgrip Chuck Div., Anker-Holth Mfg. Co., Port Huron, Mich.
Curtis Pneumatic Machinery Co., 1996 Kienlen Ave., St. Louis, Mo.
Hanna Engineering Works 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Tomkins-Johnson Co., The, 617 N. Mechanic St., Jackson, Mich.

CYLINDERS (Hydraulic)
American Hollow Boring Co., 1054 W. 20th St., Buffalo, N. Y.

CYLINDERS (Pressure)
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.

DEGREASERS
Pennsylvania Salt Mfg. Co., Dept. E, Pennsalt Cleaner Div., Philadelphia, Pa.

WHERE-TO-BUY

DIE BLOCKS
American Shear Knife Co., 3rd & Ann Sts., Homestead, Pa.
Ampco Metal, Inc., Dept. S-62, 3830 W. Burnham St., Milwaukee, Wis.
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Heppenstall Co., 47th and Hatfield Sts., Pittsburgh, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.

DIE CENTERS
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

DIE CUSHIONS
Dayton Rogers Co., Dept "C," 2830-13th Ave., So., Minneapolis, Minn.

DIE HEADS
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., The, 170 E. 131st St., Cleveland, O.

DIE-SINKING MACHINES
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.

DIES (Cast)
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
Forgings & Castings Corp., 1350 Jarvis St., Ferndale, Mich.

DIES (Punching, Stamping, Blanking)
Columbus Die, Tool & Mach. Co. 955 Cleveland Ave., Columbus, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

DIES (Steel, Embossing)
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.

DOLOMITE—FLUX AND REFRACTORIES
Basic Refractories, Inc., Hanna Bldg., Cleveland, O.

DOORS & SHUTTERS (Steel, Fire, and Rolling)
Kinnear Mfg. Co., 1780-1800 Fields Ave., Columbus, O.

DRAGLINES (Crawler)
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.

DRAFT GAGES (Indicating, Recording)
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.

DRILL HEADS (Multiple)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

DRILL RODS—See RODS (Drill)

DRILLING MACHINES (Radial)
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.

DRILLING MACHINES (Vertical)
Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill.
Cleereman Machine Tool Co., Green Bay, Wis.

DRILLS (Twist)—See TWIST DRILLS

DRIVES (Chain)
Link-Belt Co., 220 S. Belmont Ave., Indianapolis, Ind.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.

DRIVES (Cut Herringbone Gear)
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

DRIVES (Multi-V-Belt)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

DRIVES (Reciprocating)
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.

DRUMS (Steel)
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.

DRYERS (Compressed Air)
Ruemelin Mfg. Co., 3860 N. Palmer St., Milwaukee, Wis.

DRYERS (Rotary)
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

DUST ARRESTING EQUIPMENT
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Pangborn Corp., Hagerstown, Md.
Ruemelin Mfg. Co., 3860 N. Palmer St., Milwaukee, Wis.

ECONOMIC SERVICE
Brookmire Corp., 551 Fifth Ave., New York City.

ECONOMIZERS
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.

ELECTRIC WELDING—See WELDING

ELECTRIC WIRING—See WIRE AND CABLE

ELECTRICAL EQUIPMENT
Allen-Bradley Co., 1320 So. Second St., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.
Fairbanks, Morse & Co., Dept. F75, 600 S. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Graybar Electric Co., Dept ST, Graybar Bldg., New York City.

ELECTRODES (Carbon and Graphite)
National Carbon Co., W. 117th St. at Madison Ave., Cleveland, O.

ELECTRODES (Hard Surfacing Welding)
Stoody Co., Whittier, Calif.

ELEVATING AND CONVEYING MACHINERY—See CONVEYORS

ENGINEERS AND CONTRACTORS
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Brassert, H. A., & Co., 1st National Bank Bldg., Pittsburgh, Pa.
C. H. Hunt, 1213 1st National Bk. Bldg., Pittsburgh, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Morgan Engineering Co., The, Alliance, O.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Wean Engineering Co., Warren, O.

ENGINEERS (Consulting)
Brassert, H. A., & Co., 1st National Bank Bldg., Bank Bldg., Pittsburgh, Pa.
C. H. Hunt, 1213 1st National Bk. Bldg., Pittsburgh, Pa.
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
Lindemuth, Lewis B., 140 Cedar St., New York City.
Loftus Engineering Corp., Oliver Bldg., Pittsburgh, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.
Wean Engineering Co., Warren, O.

ENGINES (Diesel)
Cooper-Bessemer Corp., Mt. Vernon, O.
Fairbanks, Morse & Co., Dept. F75, 600 S. Michigan Ave., Chicago, Ill.

ENGINES (Gas, Oil)
Fairbanks, Morse & Co., Dept. F75, 600 So. Michigan Ave., Chicago, Ill.
Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES (Kerosene)
Fairbanks, Morse & Co., Dept. F75, 600 S. Michigan Ave., Chicago, Ill.

ENGINES (Steam)
Oil Well Supply Co., Dallas, Texas.

EXCAVATORS
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.

FANS (Crane Cab)
Graybar Electric Co., Dept. ST, Graybar Bldg., New York City.
Perkins, B. F. & Son, Inc., Holyoke, Mass.

FANS (Exhaust Ventilating)
Graybar Electric Co., Dept. ST, Graybar Bldg., New York City.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.

FANS (High Temperature)
Garden City Fan Co., 332 S. Michigan Ave., Chicago, Ill.

FANS (Portable)
Graybar Electric Co., Dept. ST, Graybar Bldg., New York City.
Perkins, B. F., & Son, Inc., Holyoke, Mass.

FANS (Wall)
Graybar Electric Co., Dept. ST, Graybar Bldg., New York City.
Perkins, B. F. & Son, Inc., Holyoke, Mass.

FENCE (Chain Link)
Cyclone Fence Co., Waukegan, Ill.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.

FENCING (Wire)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

FERROALLOY (Briquets)
Electro Metallurgical Co., 30 E. 42nd St., New York City.

FERROALLOYS
Cleveland-Cliffs Iron Co., Union Commerce Bldg., Cleveland, O.
Electro Metallurgical Co., 30 E. 42nd St., New York City.
International Nickel Co., Inc., The, 67 Wall St., New York City.
Ohio Ferro-Alloys Corp., Citizens Bldg., Canton, O.

FERROCHROME
Electro Metallurgical Co., 30 E. 42nd St., New York City.
Ohio Ferro-Alloys Corp., Citizens Bldg., Canton, O.
Samuel, Frank & Co., Inc. Harrison Bldg., Philadelphia, Pa.

FERROMANGANESE
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Electro Metallurgical Co., 30 E. 42nd St., New York City.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Ohio Ferro-Alloys Corp., Citizens Bldg., Canton, O.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

FERROPHOSPHORUS
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa

FERROSILICON
Electro Metallurgical Co., 30 E. 42nd St., New York City.
Ohio Ferro-Alloys Corp., Citizens Bldg., Canton, O.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.
Southern Ferro Alloys Co., 2108 Chestnut St., Chattanooga, Tenn.

FERROVANADIUM
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.

FILES AND RASPS
Simonds Saw & Steel Co., Fitchburg, Mass.

FILTER CLOTH (Asbestos)
Johns-Manville Corp., 22 E. 40th St., New York City.

FIRE EXTINGUISHERS
Kidde, Walter, & Co., Inc., 662 West St., Bloomfield, N. J.

FIRE CLAY—See REFRACTORIES
FIRE DOORS & SHUTTERS—See DOORS & SHUTTERS

FITTINGS (Electric Steel)
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

FLAME HARDENING
Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., 30 E. 42nd St., New York City.
National-Erie Corp., Erie, Pa.

FLANGES (Welded Steel)
King Fifth Wheel Co., 2915 No. Second St., Philadelphia, Pa.

FLOOR RESURFACING
Flexrock Co., 2330 Manning St., Philadelphia, Pa.

FLOORING (Monolithic)
Carey, Philip, Co., The, Dept. 71 Lockland, Cincinnati, O.
Johns-Manville Corp., 22 E. 40th St., New York City.

FLOORING (Steel)
Alan Wood Steel Co., Conshohocken, Pa.
Blaw-Knox Co., Blawnox, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Dravo Corp. (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Open Steel Flooring Institute, Inc., Dept. E-519, American Bank Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tri-Lok Co., 5515 Butler St., Pittsburgh, Pa.

FLUE DUST CONDITIONERS
Broslus, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

FLUE GAS ANALYZERS
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.

FLUORSPAR
Hillside Fluor Spar Mines, 38 S. Dearborn St., Chicago, Ill.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

FLUXES (Soldering, Welding & Tinning)
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Kester Solder Co., 4222 Wrightwood Ave., Chicago, Ill.

FORGING BILLETS—See BILLETS

FORGING MACHINERY
Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland, O.
Erie Foundry Co., Erie, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.
National Machinery Co., The, Tiffin, O.

FORGING ROLLS
Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland, O.

FORGINGS (Brass, Bronze, Copper)
American Brass Co., The, Waterbury, Conn.
Ampco Metal, Inc., Dept. S-62, 3830 W. Burnham St., Milwaukee, Wis.
Bridgeport Brass Co., Bridgeport, Conn.

FORGINGS (Drop) (*Also Stainless)
*Atlas Drop Forge Co., Lansing, Mich.
*Bethlehem Steel Co., Bethlehem, Pa.
Oil Well Supply Co., Dallas, Texas.
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

FORGINGS (Hollow Bored)
American Hollow Boring Co., 1054 W. 20th St., Erie, Pa.
Atlas Drop Forge Co., Lansing, Mich.
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

FORGINGS (Iron and Steel) (*Also Stainless)
*Atlas Drop Forge Co., Lansing, Mich.
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
*Midvale Co., The, Nicetown, Philadelphia, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Oil Well Supply Co., Dallas, Texas.
Standard Steel Works Co., Paschall P. O., Philadelphia, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

FORGINGS (Upset)
Atlas Drop Forge Co., Lansing, Mich.
Bethlehem Steel Co., Bethlehem, Pa.

FROGS AND SWITCHES
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.

FURNACE INSULATION—See INSULATION

FURNACES (Blast)
Brassert, H. A., & Co., 1st National Bank Bldg., Pittsburgh, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.

FURNACES (Brazing)
Hevi Duty Electric Co., 4100 W. Highland Blvd., Milwaukee, Wis.
Upton Electric Furnace Div. of Commerce Pattern Mach. & Fdry. Co., 2213 Grand River Ave., Detroit, Mich.

FURNACES (Electric Heating)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Electric Furnace Co., The, Salem, O.
General Electric Co., Schenectady, N. Y.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Hevi Duty Electric Co., 4100 W. Highland Blvd., Milwaukee, Wis.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1257, Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

FURNACES (Electric Melting)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
General Electric Co., Schenectady, N. Y.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1257, Pittsburgh, Pa.

FURNACES (Forging)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Electric Furnace Co., The, Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., Dept. 112, 5600 Roosevelt Rd., Chicago, Ill.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Wilson, Lee, Sales Corp., 1370 Blount St., Cleveland, O.

FURNACES (Galvanizing)
Salem Engineering Co., 714 So. Broadway, Salem, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., Dept. 112, 5600 Roosevelt Rd., Chicago, Ill.
Wilson, Lee, Sales Corp., 1370 Blount St., Cleveland, O.

FURNACES (Gas or Oil)
Electric Furnace Co., The, Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., Dept. 112, 5600 Roosevelt Rd., Chicago, Ill.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Wilson, Lee, Sales Corp., 1368 Blount St., Cleveland, O.

FURNACES (Heat Treating, Annealing, Carburizing, Hardening, Tempering)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
American Gas Furnace Co., Elizabeth, N. J.
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Carborundum Co., The, Perth Amboy, N. J.
Despatch Oven Co., 922 Ninth St., S.E., Minneapolis, Minn.
Electric Furnace Co., The, Salem, O.
General Electric Co., Schenectady, N. Y.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Hevi Duty Electric Co., 4100 W. Highland Blvd., Milwaukee, Wis.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
Ohio Crankshaft Co., The, 6600 Clement Ave., Cleveland, O.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., Dept. 112, 5600 Roosevelt Rd., Chicago, Ill.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Upton Electric Furnace Div. of Commerce Pattern Mach. & Fdry. Co., 2213 Grand River Ave., Detroit, Mich.
Wean Engineering Co., Warren, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.
Wilson, Lee, Sales Corp., 1370 Blount St., Cleveland, O.

FURNACES (Laboratory)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Hevi Duty Electric Co., 4100 W. Highland Blvd., Milwaukee, Wis.

FURNACES (Non-Ferrous Melting)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Wilson, Lee, Sales Corp., 1370 Blount St., Cleveland, O.

FURNACES (Open Hearth)
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Brassert, H. A., & Co., 1st National Bank Bldg., Pittsburgh, Pa.
Lindemuth, Lewis B., 140 Cedar St., New York City.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland, O.

FURNACES (Recuperative)
Electric Furnace Co., The, Salem, O.
Hagan, Geo. J. Co., 2400 E. Carson St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.

FURNACES (Rivet Heating)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.

FURNACES (Sheet and Tin Mill)
Electric Furnace Co., The, Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Wean Engineering Co., Warren, O.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

FURNACES (Steel Mill)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Electric Furnace Co., The, Salem, O.
General Electric Co., Schenectady, N. Y.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.
Salem Engineering Co., 714 So. Broadway, Salem, O.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland, O.
Wilson, Lee, Engineering Co., 1370 Blount St., Cleveland, O.

WHERE-TO-BUY

GAGE BLOCKS
Dearborn Gage Co., 22036 Beech St., Dearborn, Mich.

GAGES
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.
Sheffield Corp., The, Gage Div., Dayton, O.

GAGES (Automatic Control & Recording)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.

GAGES (Indicating and Recording)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.
Sheffield Corp., The, Gage Div., Dayton, O.

GAGES (Pressure & Vacuum Recording)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.

GALVANIZING (Hot Dip)
Acme Galvanizing, Inc., Milwaukee, Wis.
Acme Steel & Malleable Iron Works, Buffalo, N. Y.
American Hot Dip Galvanizers Assoc., Inc., 903 American Bank Bldg., Pittsburgh, Pa.
American Tinning & Galvanizing Co., Erie, Pa.
Atlantic Steel Co., Atlanta, Ga.
Buffalo Galvanizing & Tinning Works, Inc., Buffalo, N. Y.
Cattie, Jos. P., & Bros., Gaul and Liberty Sts., Philadelphia, Pa.
Commercial Metals Treating, Inc., Toledo, O.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Enterprise Galvanizing Co., 2507 E. Cumberland St., Philadelphia, Pa.
Equipment Steel Div., of Union Asbestos & Rubber Co., Blue Island, Ill.
Fanner Mfg. Co., The, Cleveland, O.
Finn, John, Metal Works, San Francisco, Calif.
Gregory, Thomas, Galvanizing Works, Maspeth, N. Y.
Hanlon-Gregory Galvanizing Co., 5515 Butler St., Pittsburgh, Pa.
Hill, James, Mfg. Co., Providence, R. I.
Hubbard & Co., Oakland, Calif.
Independent Galvanizing Co., Newark, N. J.
International-Stacey Corp., Columbus, O.
Isaacson Iron Works, Seattle, Wash.
Joslyn Co. of California, Los Angeles, Calif.
Joslyn Mfg. & Supply Co., Chicago, Ill.
Koven, L. O., & Bro., Inc., Jersey City, N. J.
Lehigh Structural Steel Co., Allentown, Pa.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Missouri Rolling Mill Corp., St. Louis, Mo.
National Telephone Supply Co., The, Cleveland, O.
Penn Galvanizing Co., Philadelphia, Pa.
Riverside Foundry & Galvanizing Co., Kalamazoo, Mich.
San Francisco Galvanizing Works, San Francisco, Calif.
Sanitary Tinning Co., The, Cleveland, O.
Standard Galvanizing Co., Chicago, Ill.
Wilcox, Crittenden & Co., Inc., Middletown, Conn.
Witt Cornice Co., The, Cincinnati, O.

GALVANIZING PLANTS FOR SHEETS
Erie Foundry Co., Erie, Pa.
Wean Engineering Co., Warren, O.

GALVANIZING PRODUCTS
Enterprise Galvanizing Co., 2507 E. Cumberland St., Philadelphia, Pa.

GAS HOLDERS
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.

GAS PRODUCER PLANTS
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

GAS RECOVERY COKE OVEN AND GAS PLANTS
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

GAS SCRUBBERS
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Brassert, H. A., & Co., 1st National Bank Bldg., Pittsburgh, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.

GASKETS (Asbestos, Metal or Rubber)
Johns-Manville Corp., 22 E. 40th St., New York City.

GEAR BLANKS
Ampco Metal, Inc., Dept. S-62, [illegible] W. Burnham St., Milwaukee, Wis.
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
King Fifth Wheel Co., 2915 No. Second St., Philadelphia, Pa.
National-Erie Corp., Erie, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Waldron, John, Corp., New Brunswick, N. J.

GEAR MACHINERY (Generating)
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.

GEAR MACHINERY (Lapping, Finishing, Checking)
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

GEARS (Non-Metallic)
Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill.
Pittsburgh Gear & Machine Co., 2680-2700 Smallman St., Pittsburgh, Pa.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.

GEARS (Steel Laminated)
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.
Waldron, John, Corp., New Brunswick, N. J.

GEARS (Worm)
Cleveland Worm & Gear Co., 3270 E. 80th St., Cleveland, O.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Pittsburgh Gear & Machine Co., 2680-2700 Smallman St., Pittsburgh, Pa.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.

GEARS AND GEAR CUTTING
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
General Electric Co., Schenectady, N. Y.
Grant Gear Works, 2nd & B. Sts., Boston, Mass.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
James, D. O., Mfg. Co., 1120 W. Monroe St., Chicago, Ill.
Jones, W. A., Fdry. & Mach. Co., 4437 Roosevelt Rd., Chicago, Ill.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466 Pittsburgh, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
National-Erie Corp., Erie, Pa.
Pittsburgh Gear & Machine Co., 2680-2700 Smallman St., Pittsburgh, Pa.
Simonds Gear & Mfg. Co., 25th St., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

GENERATING SETS
Electric Generator & Motor Co., 4519 Hamilton Ave., Cleveland, O.
Fairbanks, Morse & Co., Dept. F75, 600 So. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Reliance Electric & Eng. Co., 1081 Ivanhoe Rd., Cleveland, O.

GENERATING SETS—Con.
Westinghouse Electric & Mfg. Co., Dept. 7-N. East Pittsburgh, Pa.

GENERATORS (Acetylene—Portable and Stationary)
Linde Air Products Co., The, 30 E. 42nd St., New York City.

GENERATORS (Electric)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Dept. F75, 600 S. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Lincoln Electric Co., The, Cleveland, O.
Reliance Electric & Eng. Co., 1081 Ivanhoe Rd., Cleveland, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

GENERATORS (Plating)
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

GRABS—FOR SHEETS, COILS, INGOTS
J-B Engineering Sales Co., 1743 Orange St., New Haven, Conn.

GRAPPLES (Scrap Handling)
Owen Bucket Co., 7762 Breakwater St., Cleveland, O.

GRATING
Blaw-Knox Co., Blawnox, Pa.
Dravo Corp., (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.
Tri-Lok Co., 5515 Butler St., Pittsburgh, Pa.

GREASE (Lubricating)—See LUBRICANTS (Industrial)

GREASE RETAINERS AND SEALS
Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill.

GRINDERS (Foundry Core)
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.

GRINDERS (Precision Thread)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Jones & Lamson Machine Co., Springfield, Vt.

GRINDERS (Single Slide Internal)
Bryant Chucking Grinder Co., Springfield, Vt.

GRINDERS (Surface)
Brown & Sharpe Mfg. Co., Providence, R. I.
Heald Machine Co., Worcester, Mass.
Norton Company, Worcester, Mass.

GRINDER CENTERS
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

GRINDING COMPOUNDS
Sun Oil Co., Dept. 1, 1608 Walnut St., Philadelphia, Pa.

GRINDING MACHINES (Automotive Reconditioning)
Heald Machine Co., Worcester, Mass.

GRINDING MACHINES (Centerless, Internal and External)
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Heald Machine Co., Worcester, Mass.

GRINDING MACHINES (Chucking)
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Heald Machine Co., Worcester, Mass.

GRINDING MACHINES (Crank Pin, Cam, Piston & Valve Face)
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Norton Company, Worcester, Mass.

GRINDING MACHINES (Oscillating)
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.

GRINDING MACHINES (Plain and Universal)
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Norton Co., Worcester, Mass.

GRINDING MACHINES (Roll)
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Norton Co., Worcester, Mass.

GRINDING MACHINES (Rotary Surface)
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.
Heald Machine Co., Worcester, Mass.

GRINDING MACHINES (Tool and Cutter)
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Kearney & Trecker Corp., 5926 National Ave., Milwaukee, Wis.
Norton Co., Worcester, Mass.

GRINDING MACHINES (Swing Frame)
Excelsior Tool & Machine Co., Ridge & Jefferson Aves., E. St. Louis, Ill.

GRINDING (Shear Knife)
American Shear Knife Co., 3rd & Ann Sts., Homestead, Pa.

GRINDING WHEELS
Bay State Abrasive Products Co., Westboro, Mass.
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Norton Co., Worcester, Mass.

GRINDING WHEELS (Segmental)
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Norton Company, Worcester, Mass.

GUARDS (Belt, Machine & Window)
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.

GUIDE SHOES
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

GUIDES (Mill)
Ampco Metal, Inc., Dept. S-62, 3880 W. Burnham St., Milwaukee, Wis.
National-Erie Corp., Erie, Pa.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

GUNS (Blast Furnace Mud)
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

GUNS (Steam, Hydraulic, Electric)
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

HAMMER BUSHINGS
Steel Conversion & Supply Co., P. O. Box 537 (Castle Shannon), Pittsburgh, Pa.

HAMMERS (Drop)
Chambersburg Engineering Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.

HAMMERS (Power)
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

HAMMERS (Steam)
Alliance Machine Co., The, Alliance, O.
Chambersburg Engineering Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.

HANGERS
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
Grinnell Co., Inc., Providence, R. I.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

HANGERS (Shaft)
Bantam Bearings Corp., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Division, General Motors Sales Corp., Harrison, N. J.
New Departure Div., General Motors Corp., Bristol, Conn.
Snafer Bearing Corp., 35 E. Wacker Drive, Chicago, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

HEADING MACHINERY
Ajax Mfg. Co., 1441 Chardon Rd., Cleveland, O.
National Machinery Co., Tiffin, O.

HEATERS (Air)
Airtherm Manufacturing Co., 726 S. Spring Ave., St. Louis, Mo.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.

HEATERS (Electric Space)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

HEATERS (Unit)
Airtherm Manufacturing Co., 726 S. Spring Ave., St. Louis, Mo.
Dravo Corp. (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.
Grinnell Co., Inc., Providence, R. I.

HEAT TREATING
Commercial Metals Treating, Inc., Toledo, O.

HELMETS (Blast Cleaning)
Pangborn Corp., Hagerstown, Md.

HITCHINGS (Mine Car)
American Chain & Cable Co., Inc., Bridgeport, Conn.

HOBS
Brown & Sharpe Mfg. Co., Providence, R. I.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

HOISTS (Chain)
Ford Chain Block Div. of American Chain & Cable Co., Inc., 2nd & Diamond Sts., Philadelphia, Pa.
Reading Chain & Block Co., Dept. 36, Reading, Pa.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

HOISTS (Electric)
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Reading Chain & Block Corp., Dept. 36, Reading, Pa.
Shaw-Box Crane & Hoist Div., Manning, Maxwell & Moore, Inc., 406 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Wright Mfg. Div. of American Chain & Cable Co. Inc., York, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

HOISTS (Monorail)
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Reading Chain & Block Corp., Dept. 36, Reading, Pa.
Shaw-Box Crane & Hoist Div., Manning, Maxwell & Moore, Inc., 406 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

HOISTS (Pneumatic)
Curtis Pneumatic Machinery Co., 1996 Kienlen Ave., St. Louis, Mo.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.

HOOKS (Chain)
American Chain & Cable Co., Inc., Bridgeport, Conn.

HOOPS AND BANDS
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

HOSE (Flexible Metal)
American Metal Hose Branch of The American Brass Co., Waterbury, Conn.

HUMIDIFIERS (Industrial)
Grinnell Co., Inc., Providence, R. I.

HYDRAULIC MACHINERY
Alliance Machine Co., The, Alliance, O.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Morgan Engineering Co., The, Alliance, O.
National-Erie Corp., Erie, Pa.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

HYDRAULIC PRESSES—See PRESSES (Hydraulic)

HYDRAULIC UNITS
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

INDICATORS (Blast Furnace Stock Line)
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

INDICATORS (Temperature)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

INGOT MOLDS
Bethlehem Steel Co., Bethlehem, Pa.
Shenango-Penn Mold Co., Oliver Bldg., Pittsburgh, Pa.
Superior Mold & Iron Co., Penn, Pa.
Valley Mould & Iron Corp., Hubbard, O.

INHIBITORS
American Chemical Paint Co., Dept. 310, Ambler, Pa.

INSTRUMENTS (Electric Indicating and Recording)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
General Electric Co., Schenectady, N. Y.
Graybar Electric Co., Dept. ST, Graybar Bldg., New York City.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

INSULATING BLOCK
Armstrong Cork Co., 985 Concord St., Lancaster, Pa.
Eagle-Picher Lead Co., The, Cincinnati, O.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City

INSULATING BRICK
Armstrong Cork Co., 985 Concord St., Lancaster, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.
Quigley Co., 56 W. 45th St., New York City.

INSULATING CONCRETE
Atlas Lumnite Cement Co., Dept. S-14, Chrysler Bldg., New York City.

INSULATING CONCRETE—Con.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.

INSULATING POWDER AND CEMENT
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Armstrong Cork Co., 985 Concord St., Lancaster, Pa.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Eagle-Picher Lead Co., The, Cincinnati, O.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.

INSULATION (Building)
Carey, Philip, Co., The, Dept. 71, Lockland, Cincinnati, O.
Eagle-Picher Lead Co., The, Cincinnati, O.
Johns-Manville Corp., 22 E. 40th St., New York City.

INSULATION (Furnace, Boiler Settings, Ovens, Steam Pipe, Etc.)
Armstrong Cork Co., 985 Concord St., Lancaster, Pa.
Eagle-Picher Lead Co., The, Cincinnati, O.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.
Quigley Co., 56 W. 45th St., New York City.

IRON (Bar)
Ryerson, Jos. T., & Son Co., 16th & Rockwell Sts., Chicago, Ill.

IRON ORE
Alan Wood Steel Co., Conshohocken, Pa.
Cleveland-Cliffs Iron Co., Union Commerce Bldg., Cleveland, O.
Hanna Furnace Corp., The, Ecorse, Detroit, Mich.
Shenango Furnace Co., Oliver Bldg., Pittsburgh, Pa.
Snyder, W. P., & Co., Oliver Bldg., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., The, Youngstown, O.

JIG BORERS
Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill.
Cleereman Machine Tool Co., Green Bay, Wis.

JIGS AND FIXTURES
Columbus Die, Tool & Mach. Co., 955 Cleveland Ave., Columbus, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.

KEYS (Machine or Woodruff)
Moltrup Steel Products Co., Beaver Falls, Pa.

KNIVES
American Shear Knife Co., 3rd and Ann Sts., Homestead, Pa.
Cowles Tool Co., 2086 W. 110th St., Cleveland, O.
Ohio Knife Co., Dreman Ave. & B. & O. R.R., Cincinnati, O.

LABORATORY WARE
Bay State Abrasive Products Co., Westboro, Mass.
Norton Company, Worcester, Mass.

LAMPS (Industrial)
General Electric Co., Dept. 166-S-D, Nela Park, Cleveland, O.

LAPPING MACHINES
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.
Norton Company, Worcester, Mass.

LAPPING PLATES
Challenge Machinery Co., Grand Haven, Mich.

LARRIES (Coal)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.

LATHE CENTERS
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

LATHE DOGS (Drop Forged)
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

LATHES
Axelson Manufacturing Co., 6160 So. Boyle Ave., Los Angeles, Cal.
Jones & Lamson Machine Co., Springfield, Vt.
LeBlond, R. K., Machine Tool Co., Dept. J-1, Cincinnati, O.
Monarch Machine Tool Co., Sidney, O.
South Bend Lathe Works, 863 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, O.

LATHES (Automatic)
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
Monarch Machine Tool Co., Sidney, O.

LATHES (Chucking)
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.

LATHES (Engine)
Monarch Machine Tool Co., Sidney, O.
South Bend Lathe Works, 863 E. Madison St., South Bend, Ind.

LATHES (Roll Turning)
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
United Engineering & Fdry Co., First National Bank Bldg., Pittsburgh, Pa.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, O.

LATHES (Turret)
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Company, The, Bridgeport, Conn.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, O.

LAYOUT SURFACE PLATES
Challenge Machinery Co., Grand Haven, Mich.

LEAD (Tellurium)
National Lead Co. 111 Broadway, New York City.

LEVELING MACHINES
Erie Foundry Co., Erie, Pa.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
McKay Machine Co., Youngstown, O.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Sutton Engineering Co., Park Bldg., Pittsburgh, Pa.
Voss, Edward W., 2882 W. Liberty Ave., Pittsburgh, Pa.
Wean Engineering Co., Warren, O.

LIFT TRUCKS—See TRUCKS (Lift)

LIFTING MAGNETS—See MAGNETS (Lifting)

LIGHTING (Fluorescent)
Fleur-O-Lier Manufacturing Co., 2108-B Keith Bldg., Cleveland, O.

LIGHTING (Industrial)
General Electric Co., Dept. 166-S-D, Nela Park, Cleveland, O.
Graybar Electric Co., Dept. ST, Graybar Bldg, New York City.

LINERS (Pump and Cylinder)
Shenango-Penn Mold Co., Dover, O.

LOCOMOTIVE CRANES—See CRANES (Locomotive)

LOCOMOTIVES (Diesel-Electric)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.
Porter, H. K., Co., Inc., 49th & Harrison Sts., Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Diesel Mechanical)
Porter, H. K., Co., Inc., 49th & Harrison Sts., Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Electric)
Porter, H. K., Co. Inc., 49th & Harrison Sts., Pittsburgh, Pa.

LOCOMOTIVES (Electric Trolley)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.
General Electric Co., Schenectady, N. Y.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Fireless)
Porter, H. K., Co. Inc., 49th & Harrison Sts., Pittsburgh, Pa.

LOCOMOTIVES (Gasoline-Electric)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.
General Electric Co., Schenectady, N. Y.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Gasoline Mechanical)
Differential Steel Car Co., Findlay, O.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Oil-Electric)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Differential Steel Car Co., Findlay, O.

LOCOMOTIVES (Steam)
Porter, H. K., Co., Inc., 49th & Harrison Sts., Pittsburgh, Pa.

LOCOMOTIVES (Storage Battery)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Whitcomb Locomotive Co., Rochelle, Ill.

LUBRICANTS (Industrial)
American Lanolin Corp., Railroad St., Lawrence, Mass.
Gulf Oil Corp. of Penna., Gulf Refining Co., 3800 Gulf Bldg., Pittsburgh, Pa.
New York & New Jersey Lubricant Co., 292 Madison Ave., New York City.
Penola, Inc., 34th & Smallman Sts., Pittsburgh, Pa.
Pure Oil Co., The, 35 E. Wacker Dr., Chicago, Ill.
Shell Oil Co., Inc., 50 W. 50th St., New York City.
Socony-Vacuum Oil Co., Inc., 26 Broadway, New York City.
Sun Oil Co., Dept. 1, 1608 Walnut St., Philadelphia, Pa.
Tide Water Associated Oil Co., 17 Battery Place, New York City.

LUBRICATING SYSTEMS
Farval Corp., The, 3270 E. 80th St., Cleveland, O.

MACHINE WORK
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Federal Shipbuilding & Dry Dock Co., Kearney, N. J.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.

MACHINERY (Special)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Brosius, Edgar E., Inc., Sharpsburgh Branch, Pittsburgh, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Columbus Die, Tool & Mach. Co., 955 Cleveland Ave., Columbus, O.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa
Morgan Engineering Co., The, Alliance, O.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.
National-Erie Corp., Erie, Pa.
National Roll & Fdry. Co., The, Avonmore, Pa.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Oil Well Supply Co., Dallas, Texas.
Shuster, F. B., Co., The, New Haven, Conn.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

MACHINERY (Used & Rebuilt)
Albert, L., & Son, Whitehead Rd., Trenton, N. J.
Crawbuck, John D., Co., Empire Bldg., Pittsburgh, Pa.
Galbreath Machinery Co., Empire Bldg., Pittsburgh, Pa.
General Blower Co., 404 No. Peoria St., Chicago, Ill.
Iron & Steel Products, Inc., Hegewisch Sta., Chicago, Ill.
Lang Machinery Co., 28th & A.V.R.R., Pittsburgh, Pa.
Marr-Galbreath Machinery Co., 53 Water St., Pittsburgh, Pa.
Motor Repair & Mfg. Co., 1558 Hamilton Ave., Cleveland, O.
Philadelphia Transformer Co., 2829 Cedar St., Philadelphia, Pa.
West Penn Machinery Co., 1208 House Bldg., Pittsburgh, Pa.

MAGNESIA (Electrically Fused)
Norton Co., Worcester, Mass.

MAGNETIC SEPARATORS—See SEPARATORS (Magnetic)

MAGNETS (Lifting)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Dings Magnetic Separator Co., 663 Smith St., Milwaukee, Wis.
Electric Controller & Mfg. Co., 2670 E. 79th St., Cleveland, O.
Ohio Electric Mfg. Co., The, 5906 Maurice Ave., Cleveland, O.

MAGNETS (Separating)
Dings Magnetic Separator Co., 663 Smith St., Milwaukee, Wis.
Ohio Electric Mfg. Co., The, 5906 Maurice Ave., Cleveland, O.

MANDRELS (Expanding)
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

MANGANESE METAL AND ALLOYS
Electro Metallurgical Co., 30 E. 42nd St., New York City.

MANGANESE ORE
Cuban-American Manganese Corp., 122 E. 42nd St., New York, N. Y.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

MANIFOLDS (Gas)
Production Plating Works, Inc., The, 123-129 Main St., Lebanon, O.

MANIPULATORS
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Morgan Engineering Co., The, Alliance, O.

MARKING DEVICES
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.

METAL (Perforated)—See PERFORATED METAL

METAL BLAST ABRASIVES (Shot and Grit)
American Foundry Equipment Co., The, 509 So. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., 4839 Harrison St., Pittsburgh, Pa.

METAL CLEANERS
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Pennsylvania Salt Mfg. Co., Dept. E. Pennsalt Cleaner Div., Philadelphia, Pa.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

METAL FINISHES
American Nickeloid Co., 1310 N. Second St., Peru, Ill.

METAL SPECIALTIES AND PARTS—See STAMPINGS

METAL STAMPINGS—See STAMPINGS

METALS (Hard Surfacing)
Stoody Co., Whittier, Calif.

METALS (Nonferrous)
American Brass Co., The, Waterbury, Conn.
International Nickel Co., Inc., The, 67 Wall St., New York City.

MICROMETERS
Brown & Sharpe Mfg. Co., Providence, R. I.

MILLING CUTTERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine and Cincinnati Grinders, Inc., Oakley Sta., Cincinnati, O.
Kearney & Trecker Corp., 5926 National Ave., Milwaukee, Wis.
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.

MILLING MACHINES (Milling and Centering Combined)
Jones & Lamson Machine Co., Springfield, Vt.

MILLS (Blooming, Universal, Plate, Sheet, Tin, Bar, Strip, Etc.)—See ROLLING MILL EQUIPMENT

MOLDING MACHINERY (Foundry)
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.

MOLDS (Ingot)—See INGOT MOLDS

MOLYBDENUM
Climax Molybdenum Co., 500 Fifth Ave., New York City.

MONEL METAL (All Commercial Forms)
International Nickel Co., Inc., The, 67 Wall St., New York City.

MONORAIL SYSTEMS
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Reading Chain & Block Corp., Dept. 36, Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

MOTORS (Electric)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Dept. F75, 600 So. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Graybar Electric Co., Dept. ST, Graybar Bldg., New York City.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Lincoln Electric Co., The, Cleveland, O.
Reliance Electric & Eng. Co., 1081 Ivanhoe Rd., Cleveland, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

MUCK BAR
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

NAILS
(*Also Stainless)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
*Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

NAILS (Coated and Galvanized)
Wickwire Brothers, 189 Main St., Cortland, N. Y.

NICKEL (All Commercial Forms)
International Nickel Co., Inc., The, 67 Wall St., New York City.

NICKEL (Shot)
International Nickel Co., Inc., The, 67 Wall St., New York City.

NICKEL STEEL (Cold Drawn)
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Republic Steel Co., Dept. ST, Cleveland, O.
Union Drawn Steel Div. Republic Steel Corp., Massillon, O.

NOZZLES (Blasting)
Pangborn Corporation, Hagerstown, Md.

NUTS
(*Also Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Elastic Stop Nut Corp., 2340A Vauxhall Rd., Union, N. J.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
*Harper, H. M., Co., The, 2646 Fletcher St., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
*Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Tinnerman Products, Inc., 2039 Fulton Rd., Cleveland, O.

NUTS (Castellated)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Acme Co., The, 170 E. 131st St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

NUTS (Machine Screw)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.

NUTS (Self Locking)
Elastic Stop Nut Corp., 2340A Vauxhall Rd., Union, N. J.

NUTS (Semi-Finished)
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

NUTS (Wing)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Parker-Kalon Corp., 194-200 Varick St., New York City.

OIL RETAINERS AND SEALS
Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill.

OILS (Cutting)
Gulf Oil Corp. of Penna., Gulf Refining Co., 3800 Gulf Bldg., Pittsburgh, Pa.
Penola, Inc., 34th & Smallman Sts., Pittsburgh, Pa.
Pure Oil Co., The, 35 E. Wacker Dr., Chicago, Ill.
Shell Oil Co., Inc., 50 W. 50th St., New York City.
Socony-Vacuum Oil Co., Inc., 26 Broadway, New York City.
Sun Oil Co., Dept. 1, 1608 Walnut St., Philadelphia, Pa.
Tide Water Associated Oil Co., 17 Battery Place, New York City.

OILS (Lubricating)—See LUBRICANTS (Industrial)

OILS (Rust Preventive)
American Chemical Paint Co., Dept. 310, Ambler, Pa.

OPEN-HEARTH FURNACES—See FURNACES (Open-Hearth)

OVENS (Annealing, Japanning, Tempering)
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh, Pa.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Stewart Furnace Div., Chicago Flexible Shaft Co., Dept. 112, 5600 Roosevelt Rd., Chicago, Ill.

OVENS (Coke, By-Product Recovery)
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

OVENS (Core and Mold)
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh, Pa.

OXY-ACETYLENE WELDING AND CUTTING—See WELDING

OXYGEN IN CYLINDERS
Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., The, 30 E. 42nd St., New York City.

PACKING (Asbestos or Rubber)
Carey, Philip, Co., The, Dept. 71, Lockland, Cincinnati, O.
Johns-Manville Corp., 22 E. 40th St., New York City.

PACKINGS—MECHANICAL LEATHER (Cup, U-Cup, Flange and Vees)
Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago, Ill.

PAINT (Alkali Resisting)
Pennsylvania Salt Mfg. Co., Dept. E. Pennsalt Cleaner Div., Philadelphia, Pa.

PAINT (Aluminum)
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

PAINT (Heat Resisting)
American Chemical Paint Co., Dept. 310, Ambler, Pa.

PAINT (Industrial)
Carey, Philip, Co., The, Dept. 71, Lockland, Cincinnati, O.

PAINT (Marking)
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

PAINT (Rust Preventive)
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

PARALLELS
Challenge Machinery Co., Grand Haven, Mich.

PARTS (Precision)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

PATTERN EQUIPMENT (Wood or Metal)
Wellman Bronze & Aluminum Co., The, 6002 Superior Ave., Cleveland, O.

PERFORATED METAL
Chicago Perforating Co., 2443 W. 24th Pl., Chicago, Ill.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Harrington & King Perforating Co., 5634 Fillmore St., Chicago, Ill.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

PHENOL RECOVERY PLANTS
Koppers Co., Engineering and Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.

PICKLING COMPOUNDS
American Chemical Paint Co., Dept. 310, Ambler, Pa.
Pennsylvania Salt Mfg. Co., Dept. E. Pennsalt Cleaner Div., Philadelphia, Pa.

PICKLING CRATES
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.

PICKLING EQUIPMENT
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.
International Nickel Co., The, 67 Wall St., New York City.

PICKLING MACHINERY
Erie Foundry Co., Erie, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Wean Engineering Co., Warren, O.

PICKLING TANK LININGS
Cellcote Co., 750 Rockefeller Bldg., Cleveland, O.
Pennsylvania Salt Mfg. Co., Dept. E. Pennsalt Cleaner Div., Philadelphia, Pa.

PICKLING TANKS—See TANKS (Pickling)

PIERCER POINTS
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

PIG IRON
Alan Wood Steel Co., Conshohocken, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Brooke, E. & G., Iron Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cleveland-Cliffs Iron Co., Union Commerce Bldg., Cleveland, O.
Hanna Furnace Corp., The, Ecorse, Detroit, Mich.
Jackson Iron & Steel Co., Jackson, O.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Samuel, Frank & Co., Inc., Harrison Bldg., Philadelphia, Pa.
Shenango Furnace Co., Oliver Bldg., Pittsburgh, Pa.
Snyder, W. P., & Co., Oliver Bldg., Pittsburgh, Pa. Birmingham, Ala.
Wieman & Ward Co., The, Oliver Bldg., Pittsburgh, Pa.

PIG IRON (Charcoal)
Tennessee Products Corp., Nashville, Tenn.

PILING (Iron and Steel)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 South Dearborn St., Chicago, Ill.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.

PILING (Pressure-Treated Wood)
Wood Preserving Corp., The, 300 Koppers Bldg., Pittsburgh, Pa.

PILLOW BLOCKS (Ball)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.

PILLOW BLOCKS (Roller Bearing)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis, Ind.
Shafer Bearing Corp., 35 E. Wacker Drive, Chicago, Ill.

PILLOW BOXES
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa.

PINIONS (Mill)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
National-Erie Corp., Erie, Pa.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh, Pa.
United Engineering & Foundry Co., First National Bank Bldg., Pittsburgh, Pa.

PINS (Case Hardened or Heat Treated)
Erie Bolt & Nut Co., Liberty Ave. at W. 12th St., Erie, Pa.

PINS (Taper)
Moltrup Steel Products Co., Beaver Falls, Pa.

PIPE (Brass, Bronze, Copper)
American Brass Co., The, Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Shenango-Penn Mold Co., Dover, O.

PIPE (Square and Rectangular)
Youngstown Sheet & Tube Co., The, Youngstown, O.

PIPE (Steel)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
American Rolling Mill Co., The, 740 Curtis St., Middletown, O.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Crane Co., 836 So. Michigan Ave., Chicago, Ill.
General American Transportation Corp., 135 S. LaSalle St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.

WHERE-TO-BUY

PIPE (Steel)—Con.
Republic Steel Corp., Dept. ST, Cleveland, O.
Western Gas Div., Koppers Co., Fort Wayne, Ind.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

PIPE BALLS
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

PIPE BENDING
Crane Co., 836 So. Michigan Ave., Chicago, Ill.

PIPE CUTTING AND THREADING MACHINERY
Landis Machine Co., Waynesboro, Pa.

PIPE FITTINGS
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Crane Co., 836 So. Michigan Ave., Chicago, Ill.
Grinnell Co., Inc., Providence, R. I.
Oil Well Supply Co., Dallas, Texas.
Worthington Pump & Machy. Corp., Harrison, N. J.

PIPE LINES (Riveted and Welded)
Bethlehem Steel Co., Bethlehem, Pa.

PIPE MILL MACHINERY
Taylor-Wilson Mfg. Co., 15 Thompson Ave., McKees Rocks, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

PIPE ROLLS (Magnetic)
Dings Magnetic Separator Co., 663 Smith St., Milwaukee, Wis.

PIPE STRAIGHTENING MACHINERY
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Sutton Engineering Co., Park Bldg., Pittsburgh, Pa.
Taylor-Wilson Mfg. Co., 15 Thompson Ave., McKees Rocks, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

PIPE TOOLS
Greenfield Tap & Die Corp., Greenfield, Mass.

PIPING CONTRACTORS
Grinnell Co., Inc., Providence, R. I.
Power Piping Co., Beaver and Western Ave., Pittsburgh, Pa.

PISTON RINGS
American Hammered Piston Ring Div., Koppers Co., Baltimore, Md.

PISTON RODS
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Heppenstall Co., 47th and Hatfield Sts., Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Union Drawn Steel Div. Republic Steel Corp., Massillon, O.

PLANERS AND SHAPERS
Cincinnati Shaper Co., Elam and Garrard Sts., Cincinnati, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.

PLATE CASTORS
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.

PLATES (Sheared or Universal) (*Also Stainless)
*Alan Wood Steel Co., Conshohocken, Pa.
*Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
*American Rolling Mill Co., The, 740 Curtis St., Middletown, O.
*Bethlehem Steel Co., Bethlehem, Pa.
*Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Levinson Steel Co., 33 Pride St., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
*Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Worth Steel Co., Claymont, Del.
Youngstown Sheet & Tube Co., The, Youngstown, O.

PLATES (Stainless Clad)
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.

PLATES (Steel—Floor)—See FLOORING (Steel)

PLATES (Terne and Tin)—See TIN PLATE

PLATING EQUIPMENT
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

PLUGS (Expansion)
Hubbard, M. D., Spring Co., 430 Central Ave., Pontiac, Mich.

PLUGS (Rolling Mill)
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

POLES (Tubular Steel)
National Tube Co., Frick Bldg., Pittsburgh, Pa.

POLISHING MACHINERY (Tube and Bar)
Medart Co., The, 3520 de Kalb St., St. Louis, Mo.

POTENTIOMETERS
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.

POTS (Case Hardening)
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.

POTS (Melting)
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.

POWER UNITS (Gasoline, Electric for Industrial Trucks)
Ready-Power Co., The, 3828 Grand River Ave., Detroit, Mich.

PREHEATERS
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.

PRESSED METAL PARTS
Stanley Works, The, Pressed Metal Div., New Britain, Conn.

PRESSES
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Tomkins-Johnson Co., The, 617 N. Mechanic St., Jackson, Mich.
Watson-Stillman Co., Roselle, N. J.

PRESSES (Bending)
Watson-Stillman Co., Roselle, N. J
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

PRESSES (Extrusion)
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Watson-Stillman Co., Roselle, N. J.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

PRESSES (Forging)
Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland, O.
Erie Foundry Co., Erie, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.

PRESSES (Forging)—Con.
National Machinery Co., The, Tiffin, O.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

PRESSES (Forming and Braking)
Cincinnati Shaper Co., Elam and Garrard Sts., Cincinnati, O.
Cleveland Crane & Engineering Co., The, Steelweld Machinery Div., 1125 E. 283rd St., Wickliffe, O.
Watson-Stillman Co., Roselle, N. J.
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

PRESSES (Hydraulic)
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
National-Erie Corp., Erie, Pa.
Watson-Stillman Co., Roselle, N. J.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

PRESSES (Pneumatic)
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.

PRESSES (Punching, Drawing, Coining, Blanking, etc.)
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

PRESSES (Riveting)
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.

PRESSES (Scrap Bundling and Baling)
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.

PRESSES (Stamping)
Zeh & Hahnemann Co., 56 Avenue A, Newark, N. J.

PRESSES (Welding)—See WELDERS

PRESSES, BRIQUETING (Turnings & Borings)
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.

PRESSURE VESSELS
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
General American Transportation Corp., 135 So. LaSalle St., Chicago, Ill.

PRODUCER GAS SYSTEMS—See GAS PRODUCER PLANTS

PUG MILLS (For Blast Furnaces and Sintering Plants)
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.

PULLEYS (Magnetic)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Dings Magnetic Separator Co., 663 Smith St., Milwaukee, Wis.

PULVERIZERS
American Pulverizer Co., 1539 Macklind Ave., St. Louis, Mo.

PUMP HOUSES
Dravo Corp. (Contracting Div.), Neville Island, Pittsburgh, Pa.

PUMPS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Dept. F75, 600 S. Michigan Ave., Chicago, Ill.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Oil Well Supply Co., Dallas, Texas.
Roper, The Geo. D., Corp., Rockford, Ill.
Weinman Pump & Supply Co., The, 210 Blvd. of the Allies, Pittsburgh, Pa.

PUMPS (Boiler Feed)
Fairbanks, Morse & Co., Dept. F75, 600 S. Michigan Ave., Chicago, Ill.
Weinman Pump & Supply Co., The, 210 Blvd. of the Allies, Pittsburgh, Pa.
Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS (Centrifugal)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
Fairbanks, Morse & Co., Dept. F75, 600 So. Michigan Ave., Chicago, Ill.
Tomkins-Johnson Co., The, 617 N. Mechanic St., Jackson, Mich.
Weinman Pump & Supply Co., The, 210 Blvd. of the Allies, Pittsburgh, Pa.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.
Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS (Fuel Injection)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.

PUMPS (Hydraulic)
Brown & Sharpe Mfg. Co., Providence, R. I.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee, Wis.
Roper, The Geo. D., Corp., Rockford, Ill.
Weinman Pump & Supply Co., The, 210 Blvd. of the Allies, Pittsburgh, Pa.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.
Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS (Reciprocating)
Fairbanks, Morse & Co., Dept. F75, 600 S. Michigan Ave., Chicago, Ill.
Weinman Pump & Supply Co., The, 210 Blvd. of the Allies, Pittsburgh, Pa.

PUMPS (Rotary)
Brown & Sharpe Mfg. Co., Providence, R. I.
Fairbanks, Morse & Co., Dept. F75, 600 S. Michigan Ave., Chicago, Ill.
Roper, The Geo. D., Corp., Rockford, Ill.
Weinman Pump & Supply Co., The, 210 Blvd. of the Allies, Pittsburgh, Pa.

PUMPS (Vacuum)
Fairbanks, Morse & Co., Dept. F75, 600 S. Michigan Ave., Chicago, Ill.
Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS (Vertical Turbine)
Layne & Bowler, Inc., Memphis, Tenn.

PUNCHES (Multiple)
Cincinnati Shaper Co., Elam and Garrard Sts., Cincinnati, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.

PUNCHING AND SHEARING MACHINERY
Beatty Machine & Mfg. Co., Hammond, Ind.
Chambersburg Engineering Co., Chambersburg, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

PYROMETER TUBES
Norton Company, Worcester, Mass.

PYROMETERS
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

RAIL BREAKERS
National Roll & Foundry Co., The, Avonmore, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

RAILS (New and Relaying)
Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.

RAILS (Steel)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Ryerson, Jos. T. & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.

REAMERS
Blanchard Machine Co., The, 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., The, 1242 E. 49th St., Cleveland, O.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.

REBUILT EQUIPMENT
Albert, L., & Son, Whitehead Rd., Trenton, N. J.
Crawbuck, John D., Co., Empire Bldg., Pittsburgh, Pa.
Galbreath Machinery Co., Empire Bldg., Pittsburgh, Pa.
General Blower Co., 404 N. Peoria St., Chicago, Ill.
Iron & Steel Products, Inc., Hegewisch Sta., Chicago, Ill.
Lang Machinery Co., 28th & A.V.R.R., Pittsburgh, Pa.
Marr-Galbreath Machinery Co., 53 Water St., Pittsburgh, Pa.
Motor Repair & Mfg. Co., 1558 Hamilton Ave., Cleveland, O
Philadelphia Transformer Co., 2829 Cedar St., Philadelphia, Pa.
West Penn Machinery Co., 1208 House Bldg., Pittsburgh, Pa

RECEIVERS
Pressed Steel Tank Co., 1461 So 66th St., Milwaukee, Wis.

RECORDERS (Combustion)
Hays Corp., The, 960 Eighth Ave. Michigan City, Ind.

RECORDERS (Pressure, Speed, Temperature, Time)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

REDUCERS (Speed)—See SPEED REDUCERS

REDUCTION GEARS
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn. 322 Vulcan St., Buffalo, N. Y.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
National-Erie Corp., Erie, Pa.

REFRACTORIES (Dolomite)
Basic Refractories, Inc., Hanna Bldg., Cleveland, O.

REFRACTORIES (Fire Clay)
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York City.
Carter County Fire Clay Corp., 212-214 Kitchen Bldg., Ashland, Ky.
Eureka Fire Brick Co., 1100 B. F. Jones Law Bldg., Pittsburgh, Pa.
Globe Brick Co., The, East Liverpool, O.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.

REFRACTORIES (For High Frequency Furnaces)
Ajax Electrothermic Corp., Ajax Park, Trenton, N. J.
Carborundum Co., The, Perth Amboy, N. J.
Norton Company, Worcester, Mass.

REFRACTORIES (Silicon Carbide)
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Perth Amboy, N. J.
Norton Co., Worcester, Mass.

REFRACTORY CONCRETE
Atlas Lumnite Cement Co., Dept. S-14, Chrysler Bldg., New York City.
Johns-Manville Corp., 22 E. 40th St., New York City.

REGULATORS (Pressure)
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.
Wisconsin Steel Co., 180 No. Michigan Ave., Chicago, Ill.

REGULATORS (Temperature)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia, Pa.

REINFORCEMENT FABRIC (Electric Welded)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

RESISTORS (Edgewound)
Clark Controller Co., The, 1146 E. 152nd St., Cleveland, O.

RESISTORS (Graphite Disc)
Allen-Bradley Co., 1320 So. 2nd St., Milwaukee, Wis.

RHEOSTATS (Plating)
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

RINGS (Steel)
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
King Fifth Wheel Co., 2915 No. Second St., Philadelphia, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.

RINGS (Weldless) (*Also Stainless)
*Midvale Co., The, Nicetown, Philadelphia, Pa.

RIVET SETS
Pittsburgh Saw & Tool Co., 78-80 Sycamore St., Etna P. O., Pittsburgh, Pa.

RIVETERS (Hydraulic—Portable and Stationary)
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.

RIVETERS (Pneumatic)
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.

RIVETING MACHINERY
Chambersburg Engineering Co., Chambersburg, Pa.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Shuster, F. B., Co., The, New Haven, Conn.
Tomkins-Johnson Co., The, 617 N. Mechanic St., Jackson, Mich.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

RIVETS (*Also Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
*Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
*Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

RODS (Brass, Bronze, Copper, Nickel Silver, Silicon-Bronze)
American Brass Co., The, Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Roebling's, John A., Sons Co., Trenton, N. J.
Seymour Manufacturing Co., Seymour, Conn.

RODS (Drill)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.

RODS (Phosphor Bronze)
Seymour Manufacturing Co., Seymour, Conn.

RODS (Rounds, Flats and Shapes) (*Also Stainless)
*Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.

WHERE-TO-BUY

RODS (Rounds, Flats, Shapes) (*Also Stainless)—Con.
*American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
*Copperweld Steel Co., Warren, O.
*Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Washburn Wire Co., Phillipsdale, R. I.
Youngstown Sheet & Tube Co., The Youngstown, O.

RODS (Steel and Iron)
Firth-Sterling Steel Co., McKeesport, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

RODS (Welding)—See WELDING RODS

RODS (Wire)—See WIRE PRODUCTS

ROLLER LEVELERS (Backed-up)
Voss, Edward W., 2882 W. Liberty Ave., Pittsburgh, Pa.

ROLLING DOORS & SHUTTERS—See DOORS AND SHUTTERS

ROLLING MILL BEARINGS—See BEARINGS (Rolling Mill)

ROLLING MILL EQUIPMENT
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Cold Metal Process Co., The, 2131 Wilson Ave., Youngstown, O.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Morgan Engineering Co., The, Alliance, O.
National Roll & Foundry Co., The, Avonmore, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.
Voss, Edward W., 2882 W. Liberty Ave., Pittsburgh, Pa.
Wean Engineering Co., Warren, O.
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

ROLLS (Bending and Straightening)
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.

ROLLS (Sand and Chilled)
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
National Roll & Foundry Co., The, Avonmore, Pa.
Ohio Steel Fdry. Co., Lima, O.
Pittsburgh Rolls Div. of Blaw-Knox Co., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

ROLLS (Steel and Iron)
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
Hyde Park Fdry. and Machine Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Roll & Fdry. Co., The, Avonmore, Pa.
Ohio Steel Fdry. Co., Lima, O.
Springfield, O.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

ROLLS (Tinning Machine)
American Shear Knife Co., 3rd & Ann Sts., Homestead, Pa.

ROOFING AND SIDING
Johns-Manville Corp., 22 E. 40th St., New York City.

ROOFING AND SIDING (Corrugated and Plain)
American Rolling Mill Co., The, 740 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carey, Philip, Co., The, Dept. 71, Lockland, Cincinnati, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Johns-Manville Corp., 22 E. 40th St., New York City.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
New Jersey Zinc Co., 160 Front St., New York City.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Sons, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

ROOFING (Plastic and Liquid)
Carey, Philip, Co., The, Dept. 71, Lockland, Cincinnati, O.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.

RUST PREVENTIVES
Alrose Chemical Co., 80 Clifford St., Providence, R. I.
American Lanolin Corp., Railroad St., Lawrence, Mass.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.
Parker Rust Proof Co., 2158 E. Milwaukee Ave., Detroit, Mich.

RUST PROOFING COMPOUNDS
Parker Rust Proof Co., 2158 E. Milwaukee Ave., Detroit, Mich.

RUST PROOFING PROCESS
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh, Pa.
Parker Rust Proof Co., 2158 E. Milwaukee Ave., Detroit, Mich.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit, Mich.

SAFE ENDS (Boiler Tube)
National Tube Co., Frick Bldg., Pittsburgh, Pa.

SAFETY DEVICES
Junkin Safety Appliance Co., 934 W. Hill St., Louisville, Ky.

SAFETY DEVICES (Electric)
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.

SALT TABLETS
Fairway Laboratories, Div. The G. S. Suppiger Co., 1530 Hadley St., St. Louis, Mo.
Morton Salt Co., 310 So. Michigan Ave., Chicago, Ill.

SAND-BLASTING NOZZLES (Boriun)
Stoody Co., 1134 W. Slauson Ave., Whittier, Calif.

SAND CONDITIONING AND PREPARING MACHINERY
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

SAWING MACHINES (Hot and Cold)
Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland, O.
Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago, Ill.
Morgan Engineering Co., The, Alliance, O.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, O.
Pittsburgh Saw & Tool Co., 78-80 Sycamore St., Etna P. O., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

SAWING MACHINES (Contour)
Continental Machines, Inc., 1324 So. Washington Ave., Minneapolis, Minn.

SAWS (Band—Metal Cutting)
Huther Bros. Saw & Mfg. Co., 1190 University Ave., Rochester, N. Y.
Simonds Saw & Steel Co., Fitchburg, Mass.

SAWS (Hack)
Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago, Ill.
Simonds Saw & Steel Co., Fitchburg, Mass.

SAWS (Hot and Cold)
Huther Bros. Saw & Mfg. Co., 1190 University Ave., Rochester, N. Y.

SAWS (Inserted Tooth, Cold)
Huther Bros. Saw & Mfg. Co., 1190 University Ave., Rochester, N. Y.
Pittsburgh Saw & Tool Co., 78-80 Sycamore St., Etna P. O., Pittsburgh, Pa.
Simonds Saw & Steel Co., Fitchburg, Mass.

SAWS (Metal Cutting)
Brown & Sharpe Mfg. Co., Providence, R. I.
Pittsburgh Saw & Tool Co., 78-80 Sycamore St., Etna P. O., Pittsburgh, Pa.
Simonds Saw & Steel Co., Fitchburg, Mass.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SAWS (Segment)
Pittsburgh Saw & Tool Co., 78-80 Sycamore St., Etna P. O., Pittsburgh, Pa.

SCAFFOLDING (Tubular)
Dravo Corp. (Machinery Div.) 300 Penn Ave., Pittsburgh, Pa.

SCALES
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Fairbanks, Morse & Co., Dept. F75, 600 So. Michigan Ave., Chicago, Ill.
Kron Co., The, Bridgeport, Conn.

SCALES (Dial & Recording)
Fairbanks, Morse & Co., Dept. F75, 600 S. Michigan Ave., Chicago, Ill.

SCALES (Laboratory)
Fairbanks, Morse & Co., Dept. F75, 600 S. Michigan Ave., Chicago, Ill.

SCALES (Monorail)
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Fairbanks, Morse & Co., Dept. F75, 600 So. Michigan Ave., Chicago, Ill.
Kron Co., The, Bridgeport, Conn.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Toledo Scale Co., 3216 Monroe St., Toledo, O.

SCHOOLS
International Correspondence Schools, Box 9373-C, Scranton, Pa.

SCRAP BALING PRESSES—See BALING PRESSES

SCREENS AND SIEVES
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.
Chicago Perforating Co., 2443 W. 24th Pl., Chicago, Ill.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Harrington & King Perforating Co., 5634 Fillmore St., Chicago, Ill.
Koppers Co., Engineering & Construction Div., 901 Koppers Bldg., Pittsburgh, Pa.
Ludlow-Saylor Wire Co., The, Newstead Ave. & Wabash R. R., St. Louis, Mo.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

SCREENS (Vibrating)
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.

SCREW EXTRACTORS
Greenfield Tap & Die Corp., Greenfield, Mass.

SCREW MACHINE PRODUCTS
Barnes, Wallace, Co., The, Div. Associated Spring Corp., Bristol, Conn.
Hindley Mfg. Co., Valley Falls, R. I.
National Acme Co., The, 170 E. 131st St., Cleveland, O.

SCREW MACHINES (Automatic, Single and Multiple Spindle)
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Machine Co., Inc., Windsor, Vt.
National Acme Co., The, 170 E. 131st St., Cleveland, O.

SCREW PLATES
Greenfield Tap & Die Corp., Greenfield, Mass.

SCREW STOCK—See STEEL (Screw Stock)

SCREWS
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Continental Screw Corp., New Bedford, Mass.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Cap, Set, Safety-Set)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Acme Co., The, 170 E. 131st St., Cleveland, O.

SCREWS (Cold Headed)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Cleveland Cap Screw Co., 2930 E. 79th St., Cleveland, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.

SCREWS (Conveyor)
Lee Spring Co. Inc., 30 Main St., Brooklyn, N. Y.

SCREWS (Drive)
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Hardened Self-Tapping)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Machine)
Central Screw Company, 3517 Shields Ave., Chicago, Ill
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.

SCREWS (Machine, Recessed Head)
American Screw Co., Providence, R. I.
Central Screw Co., Chicago, Ill.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Harper, H. M., Co., The, 2646 Fletcher St., Chicago, Ill.
International Screw Co., Detroit, Mich.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., 194-200 Varick St., New York City.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.

SCREWS (Self Locking)
Shakeproof Lock Washer Co., 2525 N. Keeler Ave., Chicago, Ill.

SCREWS (Sheet Metal, Recessed Head)
American Screw Co., Providence, R. I.
Central Screw Co., Chicago, Ill.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
Parker-Kalon Corp., 194-200 Varick St., New York City.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Shakeproof Lock Washer Co., Chicago, Ill.

SCREWS (Socket, Cold Forged)
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Thread-Cutting)
Shakeproof Lock Washer Co., 2525 N. Keeler Ave., Chicago, Ill.

SCREWS (Thumb)
Central Screw Company, 3517 Shields Ave., Chicago, Ill.
Parker-Kalon Corp., 194-200 Varick St., New York City.

SCREWS (Wood, Recessed Head)
American Screw Co., Providence, R. I.
Chandler Products Co., Euclid, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland, O.
Parker, Charles, Co., The, Meriden, Conn.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Southington Hdwe. Mfg. Co., Pawtucket, R. I.
Whitney Screw Co., Nashua, N. H.

SEAMLESS STEEL TUBING—See TUBES

SEPARATORS (Magnetic)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.
Dings Magnetic Separator Co., 663 Smith St., Milwaukee, Wis.
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.
Ohio Electric Mfg. Co., The, 5906 Maurice Ave., Cleveland, O.

SHAFT HANGERS—See HANGERS (Shaft)

SHAFTING
Bliss & Laughlin, Inc., Harvey, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Dept. 10A, P. O. Box 6800-A, Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Union Drawn Steel Div. Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

SHAKERS
Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.

SHAPERS
Cincinnati Shaper Co., Garrard and Elam Sts., Cincinnati, O.

SHAPES (Steel)—See STEEL (Structural)

SHAPES, SPECIAL (Steel)
Bliss & Laughlin, Inc., Harvey, Ill.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Union Drawn Steel Div. Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

SHEAR BLADES
American Shear Knife Co., 3rd and Ann Sts., Homestead, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
Ohio Knife Co., Dreman Ave, & B. & O. R.R., Cincinnati, O.
Wapakoneta Machine Co., The, Wapakoneta, O.

SHEARS
Beatty Machine & Mfg. Co., Hammond, Ind.
Cincinnati Shaper Co., Garrard and Elam Sts., Cincinnati, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
Hallden Machine Co., The, Thomaston, Conn.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
Lewis Fdry. & Mach. Div. of Blaw-Knox Co., Pittsburgh, Pa.
Morgan Engineering Co., The, Alliance, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

SHEARS, ROTARY (Slitting, Beveling, Circling, Flanging)
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

SHEET BARS
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEET LIFTERS AND CARRIERS
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago, Ill.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
J-B Engineering Sales Co., 1743 Orange St., New Haven, Conn.

SHEET METAL PRODUCTS—See STAMPINGS

SHEET METAL WORKERS MACHINES
Cincinnati Shaper Co., Elam and Garrard Sts., Cincinnati, O.
Excelsior Tool & Machine Co., Ridge & Jefferson Aves., E. St. Louis, Ill.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y.
Yoder Co., The, W. 55th St. & Walworth Ave., Cleveland, O.

SHEET STEEL PILING (New and Used)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.

SHEETS (Acid Resisting)
International Nickel Co., Inc., The, 67 Wall St., New York City.

SHEETS (Black)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Andrews Steel Co., The, Newport, Ky.

SHEETS (Black)—Con.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.

SHEETS (Brass, Bronze, Copper, Nickel Silver, Silicon-Bronze)
American Brass Co., The, Waterbury, Conn.
Ampco Metal, Inc., Dept. S-62, 3830 W. Burnham St., Milwaukee, Wis.
Bridgeport Brass Co., Bridgeport, Conn.

SHEETS (Corrugated)
American Rolling Mill Co., The, 740 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Deep Drawing and Stamping)
Alan Wood Steel Co., Conshohocken, Pa.
American Rolling Mill Co., The, 740 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Wheeling Steel Corp., Wheeling, W. Va.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Electrical)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
American Rolling Mill Co., The, 740 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc. Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Galvanized)
American Rolling Mill Co., The, 740 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.
Weirton Steel Co., Weirton, W. Va.

SHEETS (Hot Rolled and Hot Rolled Annealed)
Alan Wood Steel Co., Conshohocken, Pa.
American Rolling Mill Co., The, 740 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Levinson Steel Co., 33 Pride St., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.
Weirton Steel Co., Weirton, W. Va.
Worth Steel Co., Claymont, Del.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Long Terne)
Andrews Steel Co., The, Newport, Ky.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHEETS (Nickel Silver)
Seymour Manufacturing Co., Seymour, Conn.

SHEETS (Perforated)
Harrington & King Perforating Co., 5634 Fillmore St., Chicago, Ill.

SHEETS (Phosphor Bronze)
Seymour Manufacturing Co., Seymour, Conn.

SHEETS (Reinforced)
Erdle Perforating Co., 171 York St., Rochester, N. Y.

SHEETS (Roofing)—See ROOFING AND SIDING

SHEETS (Stainless)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
American Rolling Mill Co., The, 740 Curtis St., Middletown, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Republic Steel Corp., Massillon, O.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.

SHEETS (Stainless Clad)
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.

SHEETS (Tin)—See TIN PLATE

SHEETS (Tin Mill Black)
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va

SHEETS—HIGH FINISH (Automobile, Metal Furniture, Enameling)
American Rolling Mill Co., The, 740 Curtis St., Middletown, O.
Andrews Steel Co., The, Newport, Ky.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SHELLS (Seamless Drawn)
Crosby Co., The, 183 Pratt St., Buffalo, N. Y.

SHOVELS (Power)
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.

SIEVES—See SCREENS AND SIEVES

SIGNALING & INTER-COMMUNICATION EQUIPMENT
Graybar Electric Co., Dept. ST, Graybar Bldg., New York City.

SILICO-MANGANESE
Electro Metallurgical Co., 30 E. 42nd St., New York City.
Ohio Ferro-Alloys Corp., Citizens Bldg., Canton, O.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa

SILICON METAL AND ALLOYS
Electro Metallurgical Co., 30 E. 42nd St., New York City.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.

SKELP (Steel)
Alan Wood Steel Co., Conshohocken, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

SLAG GRANULATING MACHINES (Blast Furnace and Open Hearth)
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

SLITTERS
Ohio Knife Co., Dreman Ave. & B. & O. R.R., Cincinnati, O.

SMALL TOOLS
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., The, 1242 E. 49th St., Cleveland, O.

SOAKING PITS
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Corp., 2375 Dorr St., Toledo, O.

SOLDER
Kester Solder Co., 4222 Wrightwood Ave., Chicago, Ill.

SOLENOIDS (Electric)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

SOLVENT (Degreasing)
Pennsylvania Salt Mfg. Co., Dept. E, Pennsalt Cleaner Div., Philadelphia, Pa.

SPACING TABLES
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh, Pa.

SPECIAL MACHINERY—See MACHINERY (Special)

SPEED REDUCERS
Cleveland Worm & Gear Co., 3270 E. 80th St., Cleveland, O.
Farrel-Birmingham Co., Inc., 110 Main St., Ansonia, Conn.
322 Vulcan St., Buffalo, N. Y.
Grant Gear Works, 2nd & B. Sts., Boston, Mass.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland, O.
James, D. O., Mfg. Co., 1120 W. Monroe St., Chicago, Ill.
Jones, W. A., Fdry. & Mach. Co., 4437 Roosevelt Rd., Chicago, Ill.
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
New Departure Div., General Motors Corp., Bristol, Conn.

SPIEGELEISEN
Electro Metallurgical Co., 30 E. 42nd St., New York City.
New Jersey Zinc Co., 160 Front St., New York City.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia, Pa.

SPIKES (Screw)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

SPINDLES (Grinding)
Bryant Chucking Grinder Co., Springfield, Vt.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Heald Machine Co., Worcester, Mass.

SPINDLES (Lathe)
American Hollow Boring Co., 1054 W. 20th St., Erie, Pa.

SPLICE BARS (Rail)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

SPRINGS (*Also Stainless)
*American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
*Barnes, Wallace, Co., The, Div. Associated Spring Corp., Bristol, Conn.
Hubbard, M. D., Spring Co., 430 Central Ave., Pontiac, Mich.
Lee Spring Co., Inc., 30 Main St., Brooklyn, N. Y.
Pittsburgh Spring & Steel Co., Farmers Bank Bldg., Pittsburgh, Pa.
*Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.
Washburn Wire Co., 118th St. & Harlem River, New York City.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

SPRINGS (Alloy)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., Bristol, Conn.
Pittsburgh Spring & Steel Co., Farmers Bank Bldg., Pittsburgh, Pa.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.

SPRINGS (Coil & Elliptic)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., Bristol, Conn.
Pittsburgh Spring & Steel Co., Farmers Bank Bldg., Pittsburgh, Pa.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.

SPRINGS (Compression)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., Bristol, Conn.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.

SPRINGS (Oil Tempered—Flat)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., Bristol, Conn.
Davis Brake Beam Co., Laurel Ave., & P. R. R., Johnstown, Pa.
Pittsburgh Spring & Steel Co., Farmers Bank Bldg., Pittsburgh, Pa.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.

SPRINGS (Torsion)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., Bristol, Conn.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.

SPRINGS (Valve)
Barnes, Wallace, Co., The, Div. Associated Spring Corp., Bristol, Conn.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.

SPRINKLERS (Automatic)
Grinnell Co., Inc., Providence, R. I.

SPRUE CUTTERS
Shuster, F. B., Co., The, New Haven, Conn.

STACKS (Steel)—See BRIDGES, ETC.

STAINLESS STEEL—See BARS, SHEETS, STRIP, PLATES, ETC.

STAMPINGS
American Tube & Stamping Plant, (Stanley Wks.), Bridgeport, Conn.
Barnes, Wallace, Co., The, Div. Associated Spring Corp., Bristol, Conn.
Crosby Co., The, 183 Pratt St., Buffalo, N. Y.
Davis Brake Beam Co., Laurel Ave., & P. R. R., Johnstown, Pa.
Dayton Rogers Co., Dept "C," 2830-13th Ave., So., Minneapolis, Minn.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Hubbard, M. D., Spring Co., 430 Central Ave., Pontiac, Mich.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.
Shakeproof Lock Washer Co., 2525 N. Keeler Ave., Chicago, Ill.
Stanley Works, The, Bridgeport, Conn.
New Britain, Conn.
Toledo Stamping & Mfg. Co., 90 Fearing Blvd., Toledo, O.
Whitehead Stamping Co., 1667 W. Lafayette Blvd., Detroit, Mich.

STAMPS (Steel)
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh, Pa.

STAPLES (Wire)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STARTERS (Electric Motor)
Electric Controller & Mfg. Co., The, 2670 E. 79th St., Cleveland, O.

STEEL (Alloy)
Alan Wood Steel Co., Conshohocken, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Columbia Steel Co., San Francisco, Calif.
Copperweld Steel Co., Warren, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
Jessop Steel Co., 584 Green St., Washington, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Simonds Saw & Steel Co., Fitchburg, Mass.
Stanley Works, The, New Britain, Conn.
Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Washburn Wire Co., Phillipsdale, R. I.

STEEL (Alloy, Cold Finished)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bliss & Laughlin, Inc., Harvey, Ill.
Copperweld Steel Co., Warren, O.
Firth-Sterling Steel Co., McKeesport, Pa.
LaSalle Steel Co., Dept. 10A, P. O. Box 6800-A, Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

STEEL (Clad—Corrosion Resisting) (*Also Stainless)
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
*Copperweld Steel Co., Warren, O.
*Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Jessop Steel Co., 584 Green St., Washington, Pa.
Superior Steel Corp., Carnegie, Pa.

STEEL (Cold Drawn)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bliss & Laughlin, Inc., Harvey, Ill.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Roebling's, John A., Sons Co., Trenton, N. J.
Sutton Engineering Co., Park Bldg., Pittsburgh, Pa.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

STEEL (Cold Finished)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Dept. 10A, P. O. Box 6800-A, Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Roebling's, John A., Sons Co., Trenton, N. J.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.

STEEL (Corrosion Resisting)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
American Rolling Mill Co., The, 740 Curtis St., Middletown, O.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Midvale Co., The, Nicetown, Philadelphia, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
National Tube Co., Frick Bldg., Pittsburgh., Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Rustless Iron & Steel Corp., 3400 E. Chase St., Baltimore, Md.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Stanley Works, The, New Britain, Conn.
Bridgeport, Conn.
Superior Steel Corp., Carnegie, Pa.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.

STEEL (Die)
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL (Electric)
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Copperweld Steel Co., Warren, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.

STEEL (High Speed)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Jessop, Wm., & Sons Co., 627-629 Sixth Ave., New York City.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL (High Tensile, Low Alloy)
Alan Wood Steel Co., Conshohocken, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cold Metal Process Co., The, 2131 Wilson Ave., Youngstown, O.
Columbia Steel Co., San Francisco, Calif.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STEEL (Nitriding)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.

STEEL (Rustless)—See STEEL (Corrosion Resisting)

STEEL (Screw Stock)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Dept. 10A, P. O. Box 6800-A, Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
Wyckoff Drawn Steel Co., First National Bank Bldg., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STEEL (Spring)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Barnes, Wallace, Co., The, Div. Associated Spring Corp., Bristol, Conn.
Cold Metal Process Co., The, 2131 Wilson Ave., Youngstown, O.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Washburn Wire Co., 118th St. & Harlem River, New York City.
Phillipsdale, R. I.

STEEL (Stainless)—See STEEL (Corrosion Resisting)

STEEL (Strip, Copper Coated)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Stanley Works, The, New Britain, Conn.
Bridgeport, Conn.
Thomas Steel Co., The, Warren, O.

STEEL (Strip, Hot and Cold Rolled) (*Also Stainless)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
*American Rolling Mill Co., The, 740 Curtis St., Middletown, O.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
American Tube & Stamping Plant, (Stanley Wks.), Bridgeport, Conn.
Andrews Steel Co., The, Newport, Ky.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cold Metal Process Co., The, 2131 Wilson Ave., Youngstown, O.
Columbia Steel Co., San Francisco, Calif.
Enterprise Galvanizing Co., 2525 E. Cumberland St., Philadelphia, Pa.
*Firth-Sterling Steel Co., McKeesport, Pa.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York City.

WHERE-TO-BUY

STEEL (Strip, Hot and Cold Rolled)—Con.
Jessop Steel Co.,
584 Green St. ,Washington, Pa.
Jones & Laughlin Steel Corp.,
Jones & Laughlin Bldg.,
Pittsburgh, Pa.
Republic Steel Corp., Dept. ST.
Cleveland, O.
Roebling's, John A., Sons Co.,
Trenton, N. J.
*Ryerson, Jos. T., & Son, Inc.,
16th & Rockwell Sts., Chicago, Ill.
Seneca Wire & Mfg. Co.,
Fostoria, O.
*Stanley Works, The,
New Britain, Conn.
Bridgeport, Conn.
Superior Steel Corp., Carnegie, Pa.
Tennessee Coal, Iron & Railroad
Co., Brown-Marx Bldg.,
Birmingham, Ala.
Thomas Steel Co., The, Warren, O.
Washburn Wire Co.,
118th St. & Harlem River,
New York City.
Phillipsdale, R. I.
Weirton Steel Co., Weirton, W. Va.
Wickwire Spencer Steel Co.,
500 Fifth Ave., New York City.

STEEL (Strip, Tin Coated)
American Steel & Wire Co.,
Rockefeller Bldg., Cleveland, O.
Roebling's, John A., Sons Co.,
Trenton, N. J.
Thomas Steel Co., The, Warren, O.
Washburn Wire Co., 118th St. &
Harlem River, New York City.

STEEL (Strip, Zinc Coated)
American Steel & Wire Co.,
Rockefeller Bldg., Cleveland, O.
Roebling's, John A., Sons Co.,
Trenton, N. J.
Thomas Steel Co., The, Warren, O.
Washburn Wire Co., 118th St. &
Harlem River, New York City.

STEEL (Structural)
(*Also Stainless)
American Bridge Co.,
Frick Bldg., Pittsburgh, Pa.
Belmont Iron Works, 22nd St. and
Washington Ave., Philadelphia,
Pa.
Bethlehem Steel Co.,
Bethlehem, Pa.
Carnegie-Illinois Steel Corp.,
Pittsburgh-Chicago.
Columbia Steel Co.,
San Francisco, Calif.
Enterprise Galvanizing Co.,
2525 E. Cumberland St.,
Philadelphia, Pa.
Inland Steel Co.,
38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp.,
Jones & Laughlin Bldg.,
Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg.,
St. Louis, Mo.
Levinson Steel Co.,
32 Pride St., Pittsburgh, Pa.
*Republic Steel Corp., Dept. ST.
Cleveland, O.
Ryerson, Jos. T., & Son, Inc.,
16th & Rockwell Sts.,
Chicago, Ill.
Tennessee Coal, Iron & Railroad
Co., Brown-Marx Bldg.,
Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The,
Youngstown, O.

STEEL (Tool)
Allegheny Ludlum Steel Corp.,
Dept. T-125,
Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co.,
Bethlehem, Pa.
Bissett Steel Co., The,
900 E. 67th St., Cleveland, O.
Carpenter Steel Co., 139 W. Bern
St., Reading, Pa.
Copperweld Steel Co., Warren, O.
Darwin & Milner, Inc.,
1260 W. 4th St., Cleveland, O.
Firth-Sterling Steel Co.,
McKeesport, Pa.
Ingersoll Steel & Disc Div., Borg-
Warner Corp., 310 S. Michigan
Ave., Chicago, Ill.
Jessop, Wm., & Sons Co.,
627-629 Sixth Ave.,
New York City.
Jessop Steel Co.,
584 Green St., Washington, Pa.
Latrobe Electric Steel Co.,
Latrobe, Pa.
Midvale Co., The, Nicetown,
Philadelphia, Pa.
National Broach & Mach. Co.,
5600 St. Jean, Detroit, Mich.
Republic Steel Corp., Dept. ST.
Cleveland, O.
Ryerson, Jos. T., & Son, Inc.,
16th & Rockwell Sts., Chicago, Ill.
Tennessee Coal, Iron & Railroad
Co., Brown-Marx Bldg.,
Birmingham, Ala.
Vanadium Alloys Steel Co.,
Latrobe, Pa.

STEEL BUILDINGS—See BRIDGES, BUILDINGS, ETC.

STEEL DOORS & SHUTTERS—See DOORS & SHUTTERS

STEEL FABRICATORS—See BRIDGES, BUILDINGS, ETC.

STEEL FLOATING AND TERMINAL EQUIPMENT
Dravo Corp. (Engin'r'g Works
Div.), Neville Island,
Pittsburgh, Pa.

STEEL PLATE CONSTRUCTION
American Bridge Co.,
Frick Bldg., Pittsburgh, Pa.
Bartlett-Hayward Div.,
Koppers Co., Baltimore, Md.
Belmont Iron Works,
22nd St., and Washington Ave.,
Philadelphia, Pa.
Bethlehem Steel Co.,
Bethlehem, Pa.
Federal Shipbuilding & Dry Dock
Co., Kearney, N. J.
General American Transportation
Corp., 135 So. LaSalle St.,
Chicago, Ill.
Jones & Laughlin Steel Corp.,
Jones & Laughlin Bldg.,
Pittsburgh, Pa.
Western Gas Div., Koppers Co.,
Fort Wayne, Ind.

STELLITE
Haynes Stellite Co., Harrison and
Lindsay Sts., Kokomo, Ind.

STOKERS
Babcock & Wilcox Co., The,
Refractories Div., 85 Liberty St.
New York City.

STONES (Honing)
Bay State Abrasive Products Co.,
Westboro, Mass.

STOOLS
Superior Mold & Iron Co., Penn Pa.

STOPPERS (Cinder Notch)
Bailey, Wm. M. Co.,
702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc.,
Sharpsburg Branch,
Pittsburgh, Pa.

STOPPERS (Rubber)
Rhoades, R. W., Metaline Co.,
P. O. Box 1, Long Island City,
N. Y.

STORAGE BATTERIES—See BATTERIES (Storage)

STRAIGHTENING MACHINERY
Cleveland Punch & Shear Works
Co., The, 3917 St. Clair Ave.,
Cleveland, O.
Elmes, Chas. F., Engineering
Works, 243 N. Morgan St.,
Chicago, Ill.
Lewis Foundry & Machine Div. of
Blaw-Knox Co., Pittsburgh, Pa.
Lewis Machine Co.,
3450 E. 76th St., Cleveland, O.
Logemann Brothers Co.,
3126 Burleigh St., Milwaukee,
Wis.
Medart Co., The,
3520 de Kalb St., St. Louis, Mo.
Shuster, F. B., Co., The,
New Haven, Conn.
Sutton Engineering Co.,
Park Bldg., Pittsburgh, Pa.
Voss, Edward W., 2882 W. Liberty
Ave., Pittsburgh, Pa.

SULPHURIC ACID
Cleveland-Cliffs Iron Co., The,
Union Commerce Bldg.,
Cleveland, O.
New Jersey Zinc Co.,
160 Front St., New York City.
Pennsylvania Salt Mfg. Co., Dept.
E. Pennsalt Cleaner Div.,
Philadelphia, Pa.

SWITCHES (Electric)
Cutler-Hammer, Inc., 1211 St. Paul
Ave., Milwaukee, Wis.
Electric Controller & Mfg. Co., The,
2670 E. 79th St., Cleveland, O.
General Electric Co., Dept. 166-S-D,
Nela Park, Cleveland, O.
General Electric Co.,
Schenectady, N. Y.
Westinghouse Electric & Mfg. Co.,
Dept. 7-N, East Pittsburgh, Pa.

TACHOMETERS
Bristol Co., The, 112 Bristol Rd.,
Waterbury, Conn.
Brown Instrument Div. of Minne-
apolis-Honeywell Regulator Co.,
4462 Wayne Ave.,
Philadelphia, Pa.
Foxboro Co., The, 118 Neponset
Ave., Foxboro, Mass.

TANK LININGS
Cellcote Co., 750 Rockefeller Bldg., Cleveland, O.
Goodyear Tire & Rubber Co., 1144 E. Market St., Akron, O.
National Carbon Co., W. 117th St. and Madison Ave., Cleveland, O.

TANKS (Pickling)
Goodyear Tire & Rubber Co., 1144 E. Market St., Akron, O.
National Carbon Co., W. 117th St. and Madison Ave., Cleveland, O.

TANKS (Storage, Pressure, Riveted, Welded)
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Bethlehem Steel Co., Bethlehem, Pa.
General American Transportation Corp., 185 So. LaSalle St., Chicago, Ill.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.
Pressed Steel Tank Co., 1461 So. 66th St., Milwaukee, Wis.
Western Gas Div., Koppers Co., Fort Wayne, Ind.

TANKS (Wood or Steel, Rubber or Lead Lined)
Goodyear Tire & Rubber Co., 1144 E. Market St., Akron, O.
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.

TANTALUM-TUNGSTEN CARBIDE
Carboloy Co. Inc., The, 11141 E. 8 Mile Rd., Detroit, Mich.
Vascoloy-Ramet Corp., No. Chicago, Ill.

TAPS AND DIES
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., The, 170 E. 131st St., Cleveland, O.

TERMINALS (Locking)
Shakeproof Lock Washer Co., 2525 N. Keeler Ave., Chicago, Ill.
Thompson-Bremer & Co., 1638 W. Hubbard St., Chicago, Ill.

TERNE PLATE—See TIN PLATE

TESTING MACHINERY (Materials)
National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.

THERMOMETERS
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Brown Instrument Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stanton Ave., Philadelphia, Pa.

THREAD CUTTING TOOLS
Landis Machine Co., Waynesboro, Pa.

TIE PLATES
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Republic Steel Corp., Dept. ST, Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.

TIN PLATE
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Weirton Steel Co., Weirton, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TIN PLATE MACHINERY
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore, Md.
Wean Engineering Co., Warren, O.

TONGS (Chain Pipe)
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

TONGS (Rail Handling)
Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago, Ill.

TOOL BITS (High Speed)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Haynes Stellite Co., Harrison and Lindsay Sts., Kokomo, Ind.
Jessop Steel Co., 584 Green St., Washington, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

TOOL BITS (Tantalum Carbide)
Vascoloy-Ramet Corp., N. Chicago, Ill.

TOOL HOLDERS
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

TOOLS (Pneumatic)
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland, O.

TOOLS (Precision, Lathe, Metal Cutting, etc.)
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Inc., The, 11141 E. 8 Mile Rd., Detroit, Mich.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
Gisholt Machine Co., 1217 E. Washington Ave., Madison, Wis.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.
Vascoloy-Ramet Corp., N. Chicago, Ill.

TOOLS (Tantalum Carbide)
Carboloy Co., Inc., The, 11141 E. 8 Mile Rd., Detroit, Mich.
Vascoloy-Ramet Corp., N. Chicago, Ill.

TOOLS (Tipped, Carbide)
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit, Mich.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

TORCHES AND BURNERS (Acetylene, Blow, Oxy-Acetylene)
Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., The, 30 E. 42nd St., New York City.

TOWBOATS
Dravo Corp. (Engin'r'g Works Div.) Neville Island, Pittsburgh, Pa.

TOWERS (Transmission)
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.

TOWERS (Tubular Hoisting)
Dravo Corp., (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.

TRACK ACCESSORIES
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.

TRACK BOLTS
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TRAILERS
Ohio Galvanizing & Mfg. Co., Penn St., Niles, O.

TRAILERS (Arch-Girder)
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

TRAMRAILS
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

TRANSMISSIONS—VARIABLE SPEED
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.

TRAPS (Compressed Air)
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

TRAPS (High Pressure Steam)
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

TRAPS (Steam)
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

TREADS (Safety)
Alan Wood Steel Co., Conshohocken, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Dravo Corp. (Machinery Div.), 300 Penn Ave., Pittsburgh, Pa.
Inland Steel Co., 38 So. Dearborn St., Chicago, Ill.
Moore, Lee C., & Co., Neville Island, Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Tri-Lok Co., 5515 Butler St., Pittsburgh, Pa.

TROLLEYS
American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Ford Chain Block Div. American Chain & Cable Co. Inc., 2nd & Diamond Sts., Philadelphia, Pa.
Northern Engineering Works, 2609 Atwater St., Detroit, Mich.
Reading Chain & Block Co., Dept. 36, Reading, Pa.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

TRUCK CRANES
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill.

TRUCKS AND TRACTORS (Electric Industrial)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland, O.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

TRUCKS AND TRACTORS (Gasoline Industrial)
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland, O.
Clark Tructractor Div., Clark Equipment Co., 127 Springfield Pl., Battle Creek, Mich.

TRUCKS (Dump-Industrial)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.

TRUCKS (Hydraulic Lift)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.

TRUCKS (Industrial)
Ohio Galvanizing & Mfg. Co., Penn St., Niles, O.

TRUCKS (Lift)
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland, O.
Clark Tructractor Div., Clark Equipment Co., 127 Springfield Pl., Battle Creek, Mich.
Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

TUBE MILL EQUIPMENT
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh, Pa.
Taylor-Wilson Mfg. Co., 15 Thompson Ave., McKees Rocks, Pa.

TUBES (Boiler)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Steel and Tubes Division, Republic Steel Corp., Cleveland, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TUBES (Brass, Bronze, Copper, Nickel Silver)
American Brass Co., The, Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.

TUBES (High Carbon)
Ohio Seamless Tube Co., Shelby, O.
Steel and Tubes Division, Republic Steel Corp., Cleveland, O.

TUBING (Alloy Steel) (*Also Stainless)
*Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
*National Tube Co., Frick Bldg., Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
*Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Steel and Tubes Division, Republic Steel Corp., Cleveland, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.

TUBING (Copper, Brass, Aluminum)
American Brass Co., The, Waterbury, Conn.
Bundy Tubing Co., 10951 Hern Ave., Detroit, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Shenango-Penn Mold Co., Dover, O.

TUBING (Seamless Flexible Metal)
American Metal Hose Branch of The American Brass Co., Waterbury, Conn.

TUBING (Seamless Steel)
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Columbia Steel Co., San Francisco, Calif.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
Ohio Seamless Tube Co., Shelby, O.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago, Ill.
Steel and Tubes Division, Republic Steel Corp., Cleveland, O.
Timken Roller Bearing Co., The, Steel and Tubes Division, Republic
Youngstown Sheet & Tube Co., The, Youngstown, O.

WHERE-TO-BUY

TUBING (Square, Rectangular)
Ohio Seamless Tube Co., Shelby, O
Steel & Tubes Division, Republic Steel Corp., Cleveland, O.

TUBING (Welded Steel)
Bundy Tubing Co., 10951 Hern Ave., Detroit, Mich.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Ohio Seamless Tube Co., Shelby, O.
Republic Steel Corp., Dept. ST, Cleveland, O.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Steel and Tubes Division, Republic Steel Corp., Cleveland, O.
Youngstown Sheet & Tube Co., The, Youngstown, O.

TUBULAR PRODUCTS
Ohio Seamless Tube Co., Shelby, O.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Steel and Tubes Division, Republic Steel Corp., Cleveland, O.

TUMBLING BARRELS (Coke Testing)
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

TUNGSTEN CARBIDE
Bissett Steel Co., The, 900 E. 67th St., Cleveland, O.
Haynes Stellite Co., Harrison and Lindsay Sts., Kokomo, Ind.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

TUNGSTEN CARBIDE (Tools and Dies)
Carboloy Co., Inc., The, 11141 E. 8 Mile Rd., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
McKenna Metals Co., 200 Lloyd Ave., Latrobe, Pa.

TUNGSTEN METAL AND ALLOYS
Electro Metallurgical Co., 30 E. 42nd St., New York City.

TURBINES (Steam)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

TURBO BLOWERS—See BLOWERS

TURNTABLES
American Bridge Co., Frick Bldg., Pittsburgh, Pa.
Atlas Car & Mfg. Co., The, 1140 Ivanhoe Rd., Cleveland, O.

TURRET LATHES—See LATHES (Turret)

TWIST DRILLS
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

VALVE CONTROL (Motor Operated Units)
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee, Wis.

VALVES (Blast Furnace)
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

VALVES (Brass, Iron and Steel)
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

VALVES (Check)
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

VALVES (Control—Air and Hydraulic)
Airstrip Chuck Div., Anker-Holth Mfg. Co., Port Huron, Mich.
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
Hannifin Mfg. Co., 621-631 So. Kolmar Ave., Chicago, Ill.
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

VALVES (Electrically Operated)
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

VALVES (Gas and Air Reversing)
Blaw-Knox Co., Blawnox, Pa.

VALVES (Gate)
Bartlett-Hayward Div., Koppers Co., Baltimore, Md.
Crane Co., The, 836 So. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.
Western Gas Div. Koppers Co., Fort Wayne, Ind.

VALVES (Globe)
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

VALVES (Hydraulic)
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Elmes, Chas. F., Engineering Works, 243 N. Morgan St., Chicago, Ill.
Wood, R. D., Co., 400 Chestnut St., Philadelphia, Pa.

VALVES (Needle)
Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

VALVES (Open Hearth Control—Oil, Tar, Steam & Air)
Nicholson, W. H., & Co., 177 Oregon St., Wilkes-Barre, Pa.

VALVES (Proportioning)
North American Mfg. Co., The, 2901 E. 75th St., Cleveland, O.

VALVES (Steam and Water)
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Bridgeport, Conn.

VALVES AND FITTINGS—See PIPE FITTINGS

VANADIUM
Electro Metallurgical Co., 30 E. 42nd St., New York City.

VIADUCTS (Steel)—See BRIDGES, ETC.

WALKWAYS—See FLOORING—(Steel)

WASHERS (Iron and Steel)
Hubbard, M. D., Spring Co., 430 Central Ave., Pontiac, Mich.
Thompson-Bremer & Co., 1638 W. Hubbard St., Chicago, Ill.

WASHERS (Lock)
Shakeproof Lock Washer Co., 2525 N. Keeler Ave., Chicago, Ill.
Thompson-Bremer & Co., 1638 W. Hubbard St., Chicago, Ill.
Washburn Co., The, Worcester, Mass.

WASHERS (Spring)
Barnes, Wallace, Co. The, Div. Associated Spring Corp., Bristol, Conn.
Raymond Mfg.Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.
Shakeproof Lock Washer Co., 2525 N. Keeler Ave., Chicago, Ill.
Thompson-Bremer & Co., 1638 W. Hubbard St., Chicago, Ill.

WELDERS (Electric—Arc)
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Hobart Bros., Dept. ST61, Troy, O.
Lincoln Electric Co., The, Cleveland, O.

WELDERS (Electric-Resistance)
Federal Machine & Welder Co., Dana St., Warren, O.

WELDING
Bartlett-Hayward Div. Koppers Co., Baltimore, Md.
General American Transportation Corp., 135 So. LaSalle St., Chicago, Ill.
Lincoln Electric Co., The, Cleveland, O.
Western Gas Div., Koppers Co., Fort Wayne, Ind.

WELDING (Welded Machine Steel Bases)
Kirk & Blum Mfg. Co., The, 2838 Spring Grove Ave., Cincinnati, O.

WELDING AND CUTTING APPARATUS AND SUPPLIES (Electric)
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Hobart Bros., Dept. ST61, Troy, O.
Lincoln Electric Co., The, Cleveland, O.
Wilson Welder & Metals Co., 60 E. 42nd St., New York City.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

WELDING AND CUTTING APPARATUS AND SUPPLIES (Oxy-Acetylene)
Air Reduction, 60 E. 42nd St., New York City.
Linde Air Products Co., The, 30 E. 42nd St., New York City.

WELDING RODS (Alloys)
American Agile Corp., 5806 Hough Ave., Cleveland, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Lincoln Electric Co., The, Cleveland, O.
Maurath, Inc., 7311 Union Ave., Cleveland, O.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.

WELDING RODS (Bronze)
American Brass Co., The, Waterbury, Conn.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.

WELDING RODS (Hard Surfacing)
Stoody Co., Whittier, Calif.

WELDING RODS OR WIRE
Air Reduction, 60 E. 42nd St., New York City.
American Agile Corp., 5806 Hough Ave., Cleveland, O.
American Brass Co., The, Waterbury, Conn.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bridgeport Brass Co., Bridgeport, Conn.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Hobart Bros., Dept. ST61, Troy, O.
Lincoln Electric Co., The, Cleveland, O.
Linde Air Products Co., The, 30 E. 42nd St., New York City.
Maurath, Inc., 7311 Union Ave., Cleveland, O.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York City.
Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.
Seneca Wire & Mfg. Co., Fostoria, O.
Washburn Wire Co., Phillipsdale, R. I.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Wilson Welder & Metals Co., 60 East 42nd St., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WELL WATER SUPPLY SYSTEMS
Layne & Bowler, Inc., Memphis, Tenn.

WHEELS (Car and Locomotive)
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
Midvale Co., The, Nicetown, Philadelphia, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia, Pa.

WHEELS (Track)
National-Erie Corp., Erie, Pa.

WHEELS (Trolley)
Crosby Co., The, 183 Pratt St., Buffalo, N. Y.

WINCHES (Electric)
American Engineering Co., 2484 Aramingo Ave., Philadelphia, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

WIRE (Alloy Steel) (*Also Stainless)
*American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Columbia Steel Co., San Francisco, Calif.
Firth-Sterling Steel Co., McKeesport, Pa.
*Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
*Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

WIRE (Annealed, Bright, Galvanized)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Wheeling Steel Corp., Wheeling, W. Va.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WIRE (Barb)
Bethlehem Steel Co., Bethlehem, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WIRE (Cold Drawn)
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Washburn Wire Co., 118th St. & Harlem River, New York City.

WIRE (High Carbon)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Washburn Wire Co., 118th St. and Harlem River, New York City.

WIRE (Music)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Washburn Wire Co., 118th St. and Harlem River, New York City.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

WIRE (Nickel Silver)
Seymour Manufacturing Co., Seymour, Conn.

WIRE (Phosphor Bronze)
Seymour Manufacturing Co., Seymour, Conn.

WIRE (Round, Flat, Square, Special Shapes)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Columbia Steel Co., Los Angeles, Calif.
Page Steel & Wire Div., of American Chain & Cable Co., Inc., Monessen, Pa.

WIRE (Round, Flat, Square, Special Shapes)—Con.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Washburn Wire Co., 118th St. and Harlem River, New York City.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WIRE (Spring)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Washburn Wire Co., 118th St. & Harlem River, New York City.

WIRE (Stainless)
Allegheny Ludlum Steel Corp., Dept. T-125, Oliver Bldg., Pittsburgh, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Rustless Iron & Steel Corp., 3400 E. Chase St., Baltimore, Md.

WIRE (Welding)—See WELDING RODS OR WIRE

WIRE AND CABLE (Electric)
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
General Electric Co., Sec. CDW-1205, Appliance & Merchandise Dept., Bridgeport, Conn.
Graybar Electric Co., Dept. ST, Graybar Bldg., New York City.
Roebling's John A., Sons Co., Trenton, N. J.

WIRE CLOTH
Cyclone Fence Co., Waukegan, Ill.
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.
Roebling's John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

WIRE DIES
Vascoloy-Ramet Corp., N. Chicago, Ill.

WIRE FORMS, SHAPES AND SPECIALTIES
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Barnes, Wallace, Co., The, Div. Associated Spring Corp., Bristol, Conn.
Columbia Steel Co., San Francisco, Calif.
Firth-Sterling Steel Co., McKeesport, Pa.
Hubbard, M. D., Spring Co., 430 Central Ave., Pontiac, Mich.
Ludlow-Saylor Wire Co., The, Newstead Ave. & Wabash R. R., St. Louis, Mo.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 So. Centre St., Corry, Pa.
Roebling's John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.

WIRE FORMING MACHINERY
Nilson, A. H., Machine Co., The, Bridgeport, Conn.

WIRE MILL EQUIPMENT
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh, Pa.
Lewis Machine Co., 3450 E. 76th St., Cleveland, O.
Morgan Construction Co., Worcester, Mass.
Shuster, F. B., Co., The, New Haven, Conn.

WIRE NAILS—See NAILS

WIRE PRODUCTS (*Also Stainless)
*American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Buffalo Wire Works Co., 437 Terrace, Buffalo, N. Y.
Hubbard, M. D., Spring Co., 430 Central Ave., Pontiac, Mich.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Leschen, A., & Sons Rope Co., 5909 Kennerly Ave., St. Louis, Mo.
Ludlow-Saylor Wire Co., The, Newstead Ave. & Wabash R. R., St. Louis, Mo.
*Pittsburgh Steel Co., 1653 Grant Bldg., Pittsburgh, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Washburn Wire Co., 118th St. and Harlem River, New York City.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.
Youngstown Sheet & Tube Co., The, Youngstown, O.

WIRE ROPE AND FITTINGS (*Also Stainless)
American Cable Div. of American Chain & Cable Co., Inc., Wilkes-Barre, Pa.
*American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Broderick & Bascom Rope Co., 4203 N. Union St., St. Louis, Mo.
Hazard Wire Rope Div. of American Chain & Cable Co., Inc., Wilkes-Barre, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Leschen, A., & Sons Rope Co., 5909 Kennerly Ave., St. Louis, Mo.
Macwhyte Co., 2912 14th Ave., Kenosha, Wis.
Roebling's John A., Sons Co., Trenton, N. J.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York City.

WIRE ROPE SLINGS
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Broderick & Bascom Rope Co., 4203 N. Union St., St. Louis, Mo.
Leschen, A., & Sons Rope Co., 5909 Kennerly Ave., St. Louis, Mo.
Macwhyte Co., 2912 14th Ave., Kenosha, Wis.
Roebling's John A., Sons Co., Trenton, N. J.

WIRE STRAIGHTENING AND CUTTING MACHINERY
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Lewis Machine Co., 3450 E. 76th St., Cleveland, O.
Shuster, F. B., Co., The, New Haven, Conn.

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ZIRCONIUM METAL AND ALLOYS
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Motor can be reconnected for 2300 Volt service.

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28"—2 HIGH STANDS BOTH STEEL AND IRON
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VERT. MILL, 8' Betts, 2 Hds., Grd. Fds.
TURRET LATHE, 26" Libby 7-1/2" H.S., S.P.D.
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2000 Feet—⅛" O.D. x 17 BWG
3500 Feet—⅞" O.D. x 12 BWG
1400 Feet—⅝" O.D. x 22 BWG
10000 Feet—⅜" O.D. x 20 BWG
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Where-to-Buy Products Index carried in first issue of month.

ADVERTISING INDEX

Where-to-Buy Products Index carried in first issue of month.

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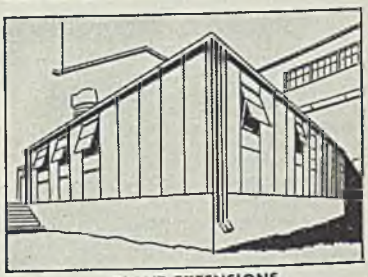

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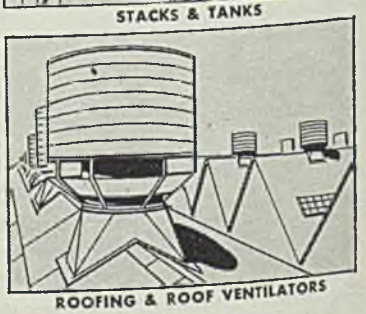

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