Published by The Penton Publishing Co. Penton Building, Cleveland, Ohio. E. L. Shaner, President and Treasurer; G. O. Hays, Vice President; F. G. Steinebach, Secretary.

Member, Audit Bureau of Circulations; Associated Business Papers Inc., and National Publishers' Association.

Published every Monday. Subscription in the United States, Cuba, Mexico and Canada, one year $4, two years $6; European and foreign countries, one year $10. Single copies (current issues) 25c.

Entered as second class matter at the postoffice at Cleveland, under the Act of March 3, 1879.

STEEL
ESTABLISHED 1882

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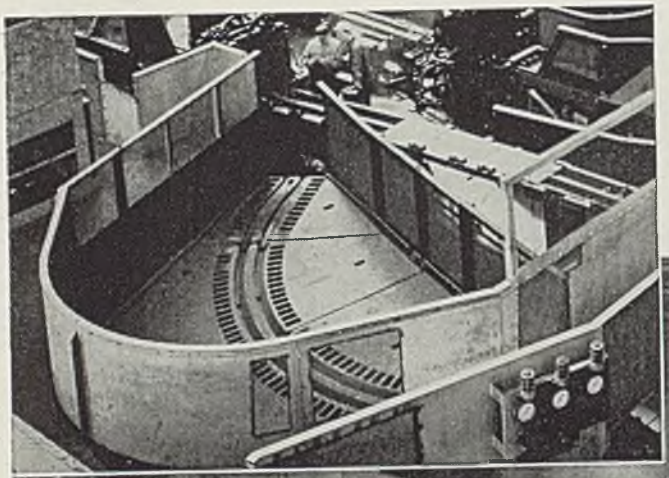
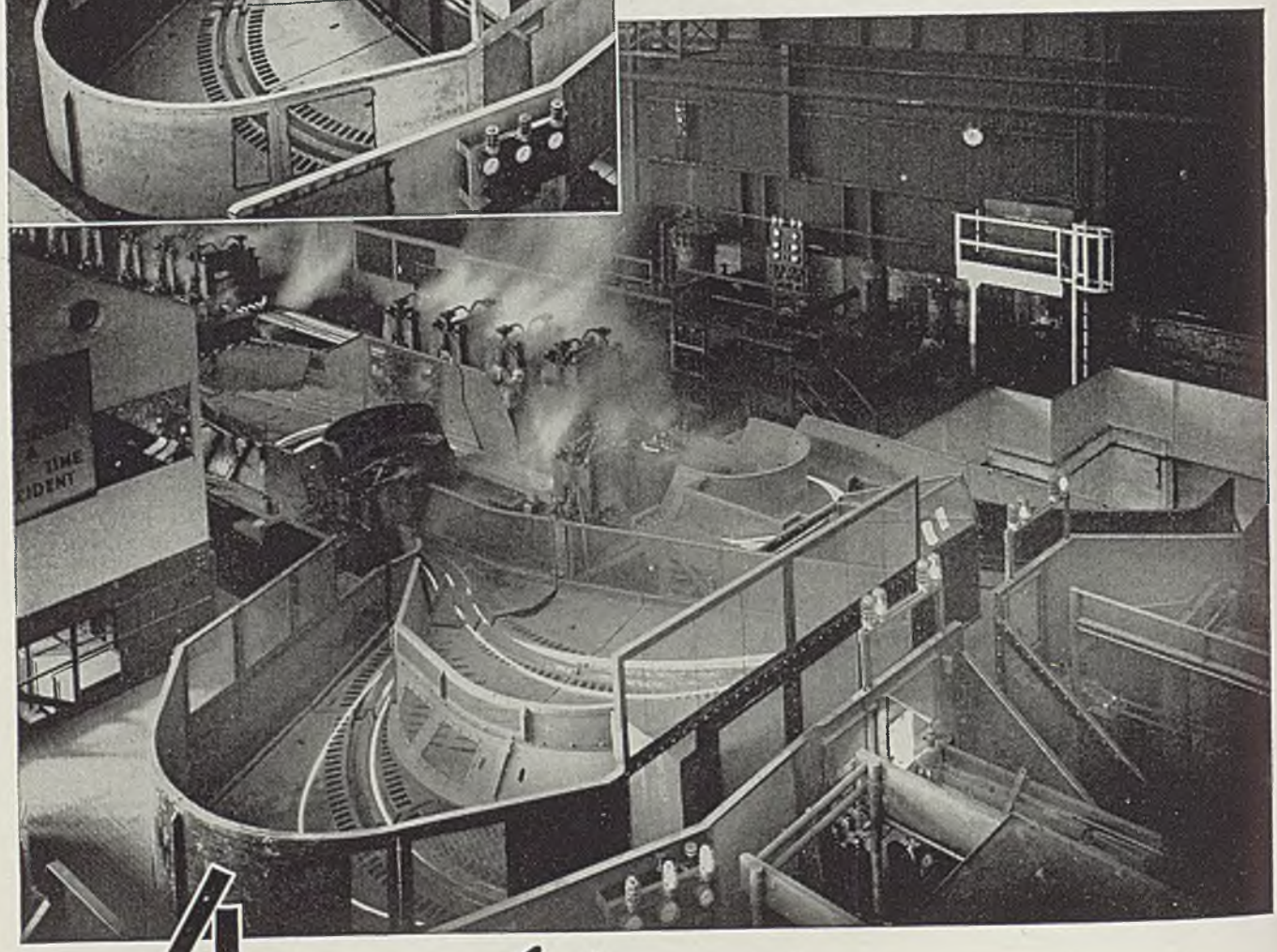
Volume 108—No. 18 May 5, 1941

PRODUCTION • PROCESSING • DISTRIBUTION • USE



2 strands in 1938



4 STRANDS IN 1941

We planned it that way!

In 1940, the company doubled the capacity of the wire rod mill by adding a second finishing train with coil handling equipment.

This was accomplished without interfering with the normal operation of the mill because every detail had been built *on paper* in the *original* plans.

Morgan always looks ahead.

MORGAN
WORCESTER
ENGINEERS AND MANUFACTURERS

R-87

CONTINUOUS ROLLING MILLS

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

MORGAN CONSTRUCTION COMPANY • WORCESTER, MASSACHUSETTS

HIGHLIGHTING
THIS ISSUE OF
STEEL

■ STRICT inventory controls **(p. 25)** are to be applied to all steel and nonferrous metal producers, distributors and consumers. Starting with June 10 monthly deliveries are to be reported to the Priorities Division of the Office of Production Management. It will be an "honor" system, with a field staff making sudden spot checks in manufacturing plants. . . . Though the coal miners resumed work May 1 the effects of the coal strike will linger on for months. Shortage of coal led to shortage of coke, shortage of pig iron and abnormal consumption of scrap. The March production peak of 100 per cent of ingot capacity may not be regained before Fall **(p. 27)**. Last week the rate dropped another point to 95 per cent.

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Steels, Iron Standardized

General Technical Committee of the American Iron and Steel Institute announces the first result of its simplification program aimed at permitting more efficient production of steel. It takes the form of a list **(p. 44)** of 76 standard compositions of alloy steels, designed to eliminate thousands of specifications previously in use. Indications are **(p. 37)** that the automobile industry will conform to it. At the same time the committee **(p. 46)** announced a list of 257 standard pig iron compositions. . . . Great majority of steelmakers **(p. 107)** resent "freezing" of steel prices following wage increase; one nonintegrated producer has withdrawn from the market pending action on its plea for permission to charge higher prices.

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Tremendous Tonnages

Contrary to the general impression the function of sales engineering **(p. 35)** is much more important today than normally, says Wendell E. Whipp. . . . Some fantastic tonnages **(p. 107)** figure in current defense business; priorities are becoming more embracing. . . . President Roosevelt calls upon industry **(p. 25)** to operate critical machine tools twenty-four hours a day, seven days a week. . . . OPM recommends bonuses to defense workers who **(p. 24)** will forego vacations this year. . . . United States Chamber of Commerce **(p. 32)** favors tax increase of $2,500,000,000 and reduction in nonmilitary spending of $2,000,000,000. . . . Additional steelmaking capacity is not needed **(p. 32)**, says William S. Knudsen.

• • •

Perfect Joints From Welding

Making welds which will show up as perfect joints under X-ray examination is a problem now confronting many companies not familiar with most exacting procedure. Much defense work must meet this requirement. Those faced with this problem can derive much help from the three-part article **(p. 76)** by Harold Lawrence. . . . General Aniline Works **(p. 88)** have completed a plant with capacity for producing approximately one ton of iron powder daily from liquid iron penta-carbonyl. . . . J. A. Bates **(p. 82)** describes control methods and special devices by which General Electric Co. holds porcelain enamel rework below three per cent. . . . G. W. Birdsall, STEEL'S engineering editor, discusses **(p. 54)** army tank production.

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Stratospheric Laboratory

R. A. Weikel **(p. 64)** reports that much production trouble can be avoided by placing all instruments in a plant under the complete jurisdiction of a single, trained man. . . . Paul J. McKimm **(p. 66)** analyses the factors that influence quality of hot-rolled strip steel and sets forth some interesting facts on roll cost. . . . A stratospheric laboratory for testing airplane engines intended for use at high altitudes **(p. 80)** is being completed at Wright Field. . . . Recent investigations show that high-sulphur content in pig iron can be reduced successfully **(p. 60)** by placing soda ash in the bottom of the ladle. . . . Prof. G. B. Carson **(p. 91)** concludes his treatise on greater efficiency in materials handling.

THREE WAYS TO WORK ON THIS PROBLEM OF *STEEL*

FIRST... Place your steel requirements clearly and fairly before your regular source. Explain exactly what you need and *when* you need it. Don't try to get a corner on steel.

SECOND... Determine the physical property requirements for each job. List possible substitutions that may be used if necessary.

THIRD... Fill your immediate requirements with steel from warehouse reserve stocks. To save time send open orders, as needed sizes may be sold while the quotation is being made. You know this method is entirely safe through the Ryerson one-price policy of many years standing. Naturally, some sizes are missing but we can provide prompt shipment on most all steel products from our nearest plant.

When you have a problem of application, substitution, fabrication or procurement phone, wire or write us. We will be glad to work with you. Joseph T. Ryerson & Son, Inc. Steel-Service Plants at: Chicago, Detroit, Milwaukee, St. Louis, Cincinnati, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

Steel Industry's First Quarter Net Profit Second Best Since 1929

Eighteen producers, representing 87 per cent of capacity, report $86,281,130 . . . Operations at 98 per cent . . . Earnings equal to $4.90 per ton of ingots produced

■ COMBINED net income earned in the first quarter of 1941 by 18 leading steel producers representing 87 per cent of the industry's ingot capacity was $86,281,130. This was the best first quarter since the predepression period, second best of any quarter since 1929, and nearly double net profit earned by the same producers in the first period of 1940. It was slightly less than the aggregate of $36,964,239 net income reported by the 18 companies in the final period last year.

In the first quarter of 1939 the 18 companies' combined net income was $10,619,844, about 12 per cent as much as in the three months ended last March 31. Net loss of $4,893,385 was reported for the first quarter of 1938, nearly half their total deficit for that year. Total income in first three months of 1937 was $67,497,028 or 21.8 per cent less than in the corresponding quarter of 1941.

Sharp increase in steelmaking rate during the first quarter this year over that in the corresponding period of 1940 was reflected in the producers' earnings. This despite the even steeper increase in taxes accrued and provided for under the second revenue act of 1940. While most producers' tax provisions for the period were based on the rates now in effect, several provided for "contingencies" that might arise through tax revision.

Steel industry's ingot rate in the first 1941 quarter averaged 98 per cent of capacity, up 25.6 points from 72.4 per cent, first period average last year. Increase in rate was more than 35 per cent. Net income for the 18 companies in the first quarter of 1940 was $44,417,985.

Operating rate in last year's final quarter was 95.6 per cent or 2.4 points lower than in the succeeding period. Though normally in-

Steel Producers' Earnings Statements Summarized

	First 1941 Quarter	Fourth 1940 Quarter	First 1940 Quarter	First 1939 Quarter	First 1938 Quarter	First 1937 Quarter
United States Steel Corp.	$36,559,995	$32,793,212††	$17,113,995	$ 660,551	$ 1,292,151*	$28,561,533
Bethlehem Steel Corp.	10,436,028	14,516,779	10,891,139	2,409,059	994,908	8,293,833
Republic Steel Corp.	8,189,966	8,480,174	3,111,723	532,899	3,062,564*	5,567,063
Jones & Laughlin Steel Corp.	4,160,507	4,044,126	1,134,611	376,525*	1,269,725*	1,982,394
National Steel Corp.	5,430,389	6,271,187	4,009,193	2,426,668	1,088,635	5,695,819
Youngstown Sheet & Tube Co.	4,576,197	5,549,976§	1,253,929	217,107	139,529*	4,886,020
Inland Steel Co.	4,555,118	4,561,901	3,059,844	2,024,601	923,076	5,008,774
American Rolling Mill Co.	3,599,241	3,753,603§	1,005,194	793,479	197,311*	2,320,816
Wheeling Steel Corp.	1,981,009	2,388,744	644,652	728,661	531,035*	1,308,807
Colorado Fuel & Iron Corp.	1,141,756	320,064	564,927	163,630	389,561*	532,283
Crucible Steel Co. of America	3,044,270	2,859,682	1,193,156	.....	.....	.....
Otis Steel Co.	594,183	614,484	165,513*	180,326	297,379*	702,396
Sharon Steel Corp.	527,253	581,944	309,576	7,613	151,090*	475,778
Allegheny Ludlum Steel Corp.	2,720,164	1,591,954	1,000,297	206,582	†262,776*	†944,170
Granite City Steel Co.	93,195	213,234	43,152	13,435	155,093*	142,002
Continental Steel Corp.	313,122	286,631	211,456	279,178	55,208	279,447
Keystone Steel & Wire Co.	410,137	288,966	279,385	317,609	187,569	378,154
Rustless Iron & Steel Corp.	761,698	456,609	213,126	193,724	62,651*	171,012
Wickwire Spencer Steel Co.	231,172‡	250,651	262,701*	158,753*	331,916*	246,727
Total¶	$86,281,130	$86,964,239	$44,417,985	$10,619,844	$ 4,893,385*	$67,497,023

† Represents combined totals of Allegheny Steel Co. and Ludlum Steel Co. prior to their merger in August, 1938; § indicated; ‡ before taxes; * loss; †† revised; ¶ excluding Crucible Steel Co.

crease in operating rate results in greater earnings, higher taxes and in some cases less efficient operations contingent upon near-capacity output decreased net income.

Production in the first quarter of 1939 was at 54.8 per cent of capacity, just above the "break-even" point. In first period of 1938, rate was 31.6 per cent, and all but five of the 18 producers incurred deficits. Operating rate in the first quarter of 1937 averaged 85.2 per cent.

Accompanying tabulation presents these 18 producers' first quarter earnings since 1937, compared with net income in the final period of 1940. Crucible Steel Co., for which first quarter reports to 1937 were not available, is not included in the summary's totals.

Assuming their earnings to be typical, indicated net income for the entire industry would be about $99,631,780 for the first quarter, equal to $4.90 per ton of ingots produced. This compares with estimated $3.59 per ton of ingots produced in the corresponding quarter last year and with $5.12 per ton for the last 1940 quarter, $1.10 per ton in the 1939 period, and $4.78 in first three months of 1937. Net deficit in the quarter in 1938 was equal, for the industry, to about 92 cents per ton of ingots produced.

U. S. Steel Operates at 100.6 Per Cent; Earnings Are $36,559,995

Net income reported in first quarter, 1941, by United States Steel Corp., New York, totaled $36,559,995 largest for any three months period since the last quarter of 1929. Provision for state and federal taxes totaled $22,603,379.

Equal to $3.47 per share on common stock after preferred dividend requirements, net earnings in the March quarter compared with income of $17,113,995, or $1.24 per share, in the corresponding period in 1940. Net income in last quarter of 1940 was $32,793,212, or $3.04 per common share.

Tax provision in the first quarter was slightly less than the $22,673,974 in the fourth quarter last year. Social security taxes declined almost 30 per cent from the December period: to $10,803,379 from $15,202,823. Decline was seasonal, due to reduced ore operations. Provision for federal income taxes increased nearly 50 per cent, from $7,471,151 to $11,800,000.

Dividend of $1 per share on common was declared, payable June 20 to record of May 20. Quarterly of $1.75 per share on the preferred was also declared. Accompanying tabulation summarizes the corporation's consolidated statement of income in the quarter ended March 31, 1941.

Backlog of rolled and finished steel orders is equal to four or five months' shipments at the present rate, declared Irving S. Olds, chairman. He estimated that 40 to 50 per cent of the corporation's business was on direct defense work, including navy and maritime ship construction. For steel alone, ratio was given at about 20 per cent, on a tonnage basis.

Steel exports in the quarter were 10 to 11 per cent of production, only half of the 20 per cent ratio for all of 1940. Decline was attributed to increased demands in this country and to a lack of cargo space.

Shortage of steel for defense requirements was not foreseen by Mr. Olds. With defense needs constantly increasing, commercial requirements may suffer, he remarked, adding "we must also take care of commercial needs."

Relatively little added capacity has been brought into operation this year by the corporation, although it has a substantial expansion program underway. Pencoyd, Pa., plant has resumed operations after having been shut down several years and new blast furnace capacity has increased the rate somewhat. The major Tennessee Coal, Iron & Railroad Co. program, initiated last October, will not be completed until near the close of 1941. No further important expansion is planned at present.

Costs generally are advancing, he asserted; expected, in view of widespread wage increases. Estimated direct cost of wage increases granted by the corporation will total more than $62,000,000 over a year's time at the current operating rate. This, he explained, will include all wage and salary advances.

Overtime, Mr. Olds pointed out, has not as yet proved a considerable item in the corporation's operating costs.

Production of ingots and finished steel, shipments and orders all reached a new high in the first quarter. Previous quarterly record in orders was set lats year: in production and shipments, in 1929.

National Steel's Federal Tax Accrual Equals 50% of Net Income

Net income earned in first quarter. 1941, by National Steel Corp., Pittsburgh, totaled $5,430,389 after

Big Steel's Shipments, Taxes, Payroll

	First Quarter 1941	Fourth Quarter 1940	First Quarter 1940
Net income	$36,559,995	$32,793,212	$17,113,995
Earnings per share for common stock	$3.47	$3.04	$1.24
Shipments of finished steel products			
Net tons	4,951,271	4,542,383	3,086,753
Per cent capacity	100.6	93.3	64.1
Provision for taxes			
State, local, social security	$10,803,379	$15,202,823	$9,772,538
Federal income	11,800,000	7,471,151	1,800,000
Total taxes	$22,603,379	$22,673,974	$11,572,538
Average number of employes	279,459	272,087	244,031
Total payroll	$125,744,513	$123,000,099	$99,135,515

Consolidated Statement of Income

	First Quarter 1941
Operating results (excluding items deducted below)	$84,391,344
Less, provisions for:	
Social security taxes (state and federal)	4,948,700
All other taxes (except federal income)	5,854,679
Net earnings after above taxes	$73,587,965
Less, depletion, depreciation, obsolescence allowances	17,892,168
Operating income	$55,695,797
Less,	
Net loss in sale of capital assets	821,059
Provision for contingencies	5,000,000
Net income before interest charges and federal income taxes	$49,874,738
Interest on bonds, mortgages (including net bond discount and expense)	1,514,743
Income before federal income taxes	$48,359,995
Provision for federal income taxes (Based approximately upon second revenue act of 1940)	11,800,000
Net income	$36,559,995
Dividends on stocks of United States Steel Corporation	
Preferred stock; payable May 20 to record of May 2	6,304,919
Common stock; payable June 20 to record of May 20	8,703,252
Balance	$21,551,824

All results stated subject to adjustments in the final audit of the 1941 accounts.

federal income and excess profits taxes and other charges. Equal to $2.46 per share on the corporation's capital stock, it compared with net profit of $4,009,193 or $1.82 per share in the period in 1940.

Net income reported for the fourth quarter, 1940, totaled $6,271,187, equal to $2.84 per share on the capital stock.

Provision for federal normal and excess profits taxes in the period aggregated $2,445,419, more than 50 per cent as much as remained available to investors after all charges. Normal tax provision in the quarter last year was $813,909.

Inland's Operating Rate Averaged 106.7%; Net Income $4,555,118

Inland Steel Co., Chicago, reports net profit in first quarter was $4,555,118 after federal income and excess profits taxes now in effect and all other charges. Profit was equal to $2.79 per share on the corporation's capital stock, and compared with net earnings of $3,059,844 or $1.88 per share in the corresponding period in 1940.

In fourth quarter, last year, net income was $4,561,901 and was equal to $2.80 per share.

Dividend of $1 per share was declared, payable June 2 to record of May 16. Same amount was paid in March.

Inland produced, in the first quarter, 868,775 tons of ingots, a record high for any quarter. Operating rate averaged 106.7 per cent of rated capacity.

Tonnage for defense purposes, said Edward L. Ryerson, chairman, has become a steadily increasing part of the company's business. Exports in the quarter, were 7.3 per cent of total shipments, against 9.9 per cent in last quarter of 1940.

Wheeling Steel Corp.'s First Quarter Net Profit $1,981,009

Wheeling Steel Corp., Wheeling, W. Va., reports net profit in first quarter ended March 31 was $1,981,009 after federal income taxes and other charges. It was equal, after dividend requirements on the $5 prior preferred and the 6 per cent preferred stocks, to $2.64 per share on common.

Net earnings in the corresponding period in 1940 totaled $644,652 or 29 cents per common share after preferred dividend requirements. In the fourth quarter of 1940, net profit was $2,388,744.

Wheeling's 6 per cent preferred stock, on which dividend accumulation of $31.50 per share was cleared in January, was called for redemption April 1.

Corporation's report declared no provision was made in the March quarter for federal excess profits taxes, computations indicating no liability for such.

Reasonable Price Adjustment Justifiable, Says Armco President

Net profit earned in the quarter ended March 31 by American Rolling Mill Co., Middletown, O., after depreciation, depletion, provision for federal income and excess profits taxes and other charges was $3,599,241. This was equal to $1.08 per share on common, after provision for dividend requirements on the company's 4½ per cent cumulative convertible preferred stock.

In the corresponding period last year, net profit was $1,005,193 or 17 cents per common share after preferred requirements. Indicated profit in fourth quarter last year, based on nine months' and the year's reports, was $3,753,603.

Dividend of 35 cents per share on common was declared, payable June 14 to record of May 14. Regular preferred dividend of $1.12½ per share was also declared, payable July 15 to record of June 18.

Recent wage increase and liberalizing vacations will add $4,000,000 annually to Armco's costs at present operating rate, Charles R. Hook, president, stated. "In addition to increasing payrolls, there has been an upswing in the cost of some of our basic raw materials and supplies, due to spiralling wage increases in other lines of industry. We believe it will be demonstrated that a reasonable adjustment in the price of certain grades of steel is justifiable."

Steel's Net Earnings in 1940 40% Below 1929 Total

Net earnings of the steel industry in 1940 were the highest of any year since 1929, but compared with that year they were 40 per cent lower although output was 6 per cent greater.

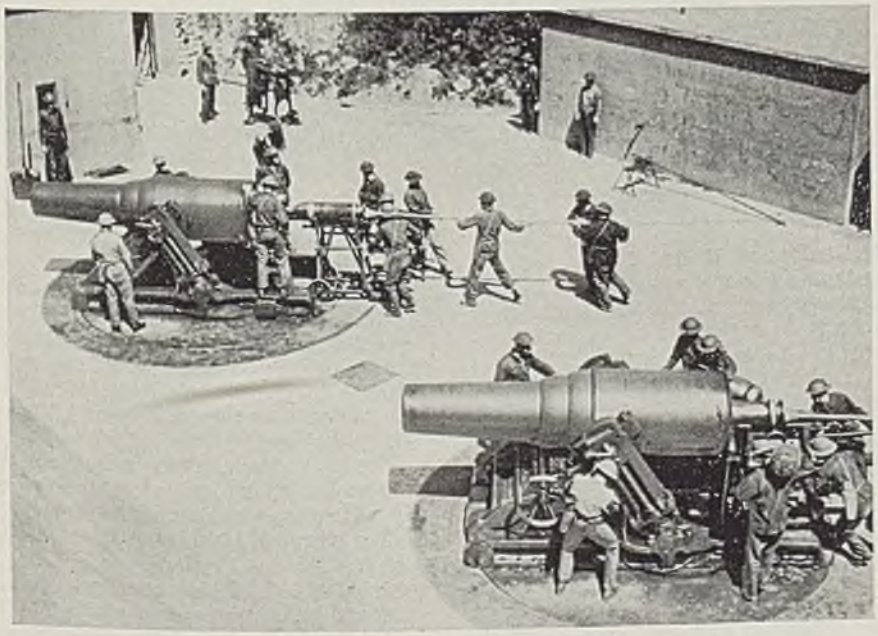
Last year companies in the steel industry representing over 90 per cent of the industry's steelmaking capacity, earned a total of $281,080,000 after meeting all charges but before paying dividends, according to reports compiled by the American Iron and Steel Institute.

In 1929, the industry earned a total of nearly $455,000,000 while in 1939, steel company earnings totaled $147,468,000.

The industry's earnings record in 1929 represented a return of 9.2 per cent on the amount of its investment, while earnings in 1940 represented a return of 7.5 per cent. Over the 1930-1939 decade, the industry earned an average of only 1.8 per cent on its investment. Losses were incurred in five years.

Taxes paid last year totaled $225,160,000, an increase of 57.5 per cent over the total of nearly $143,000,000 paid in 1939. Comparison of the taxes paid by an identical group of major steel companies over the past 12 years shows that in 1940 taxes paid per ton of finished steel produced were nearly 80 per cent above 1929.

Steel "Sausages" Defend San Diego Harbor



■ Twelve-inch mortars to "protect San Diego, Calif., harbor" figured in maneuvers last week. They were manned by regulars and selective service draftees. NEA photo

March Steel Employment Establishes New Record with 613,000 Workers

■ EMPLOYMENT in the steel industry established a new record in March at 613,000, American Iron and Steel Institute reports. Previous high was 603,000 attained in the summer of 1937 and equaled in February this year.

March payrolls also established a new record at $98,025,000, compared with previous peaks of $94,322,000 in 1937. In February this year payrolls totaled $89,586,000, while in March, 1940, they totaled $68,768,000.

Wage-earning employes averaged 87.7 cents an hour in March, compared with 86.9 cents in February and 83.6 cents in March, 1940.

An average of 38.5 hours per week was worked in March, against 39.4 hours in February and 32.3 hours in March, 1940.

With 150,000 more workers employed than in the summer of 1939, the steel industry to date has experienced no labor shortage serious enough to curtail its current record output.

Adequate trained manpower has generally been found to permit the production of all the steel needed for national defense as well as for other purposes, "although the immediately available supply of some products is becoming increasingly tight," according to the institute.

Recommends Bonuses for Those Who Give Up Vacations

Payment of bonuses to workers in defense industries who voluntarily give up vacations this year so that production will not be interrupted, was recommended today by the OPM. The policy was adopted as a means of getting maximum summer production without impairing rights and health of workers.

The OPM said employes in plants turning out munitions or war materials should be paid as bonus the equivalent amount they would receive during their customary vacation.

"In no instance should a vacation be denied a worker who for reasons of health desires a rest. Vacations that are allowed should be staggered as much as possible through the period May 30 to Aug. 31."

Canadian Government Takes Over Shellmaking Plant

The Canadian government last week took over the struck plant of the National Steel Car Co., Hamilton, Ont., and appointed a government controller to operate it. Company is manufacturing shells.

C. D. Howe, minister of munitions and supply, said the action resulted from the management's refusal to comply with a Board of Conciliation recommendation that the company reinstate a worker, president of the Congress of Industrial Organizations local, who had been dismissed. Company contended the man had been released because he had reported late for work. Union said dismissal resulted from union activity.

Workers Offered Co-operation in Providing for Increased Taxes

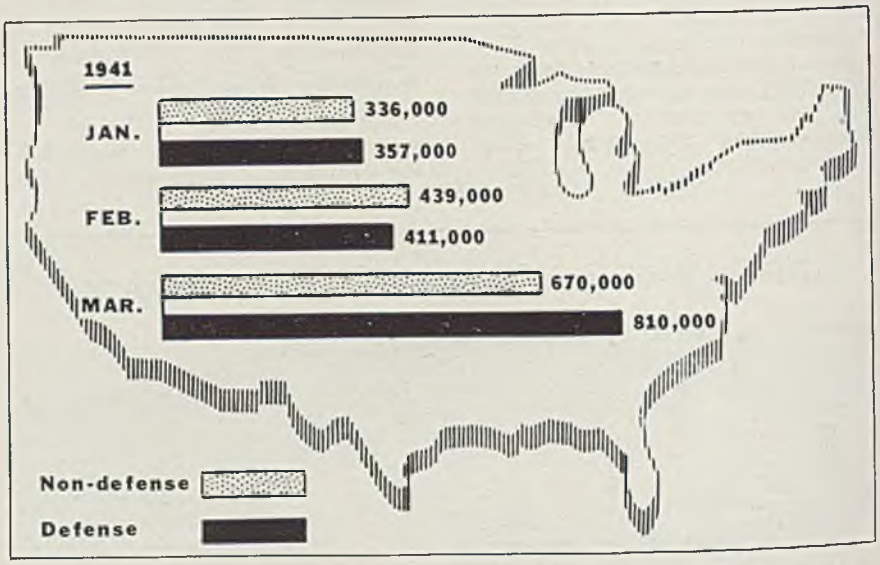
Employes of at least two Pittsburgh district concerns have been notified by the companies that taxes will be higher next year. The companies further declared that in connection with the recently granted wage increases, they are willing to co-operate with employes in making provisions to cover taxes.

One concern has indicated its willingness to pay its employes by two checks instead of one, to facilitate savings. Offer was made also to mail the second check directly to a savings account if desired.

Pointing out a large part of the wage increases now being granted will be taken by the government under the new tax program, and additional parts absorbed by higher commodity prices, notices appeared in workers' pay envelopes when the increases were put into effect. More companies in the area are expected to provide the same type of co-operation if request is made.

■ Blanket exemption from the draft for all men with bona fide engineering experience and all regular students of recognized engineering schools has been asked in a resolution adopted by the American Association of Engineers, Chicago. The association also requested that engineers drafted be recalled.

Three Months' Strikes Cost 3,022,918 Man-Days



■ Strikes in United States defense industries increased sharply in the first three months of 1941 and now constitute a "major bottleneck," according to a study by the National Association of Manufacturers. The study shows 3,022,918 man-days lost in the first quarter this year, compared with 905,000 in the same period in 1940. Strikes in defense industries cost 1,577,816 man-days and in non-defense industries 1,445,102 man-days.

A steady increase from month to month was noted; 693,000 man-days were lost in January, 849,768 man-days in February, and 1,480,150 man-days in March. April figures, when available, will show a tremendous increase over the March figures, due in large part to the 28-day coal miners' strike.

(Bureau of Labor Statistics last week estimated 330 new strikes started in March involving 113,000 workers and causing a loss of 1,400,000 man-days).

The manufacturers' group contrasted the strike losses in this country with those in England. In 1940, there were 940,000 man-days lost by strikes in England, compared with 6,500,000 in this country.

Nearly as many days were lost in defense industries alone in March this year as were lost in all British industries in the entire year of 1940.

"Work Critical Machines 24 Hours a Day, 7 Days a Week," Says Roosevelt

WASHINGTON

■ PRESIDENT ROOSEVELT last Friday called on industry to speed up the manufacture and use of "critical" machine tools, and to comb the country for machinists. In an identical letter to Knudsen and Hillman he said:

"My recent discussions with you have emphasized in my mind the urgent necessity of expanding and speeding up the manufacture and use of critical machine tools. . .

"The ever increasing demands for munitions, planes and ships caused by the critical situation which confronts our nation requires that they be produced in even larger quantities and ahead of the schedules assigned to them.

"It is essential industry increase the number of vital machines manufactured and that every single critical machine in the United States be used the maximum number of hours each week . . . if they be in defense plants, by increased hours of operation on the work at hand; if in other plants, by finding defense items or parts for them to make or, as a last resort, by moving the tools to defense plants where they may be urgently needed.

"Our problem is to see to it that there is no idle critical machine in the United States. The goal should be to work these machines 24 hours a day and seven days a week, relieving the machines only for such time as is required for overhauling and repairs.

"The country should be further combed for men who have had experience on these machines. We should ask them to transfer their efforts to this operation which is so essential to our defense. No effort or justifiable expense should be spared in speeding this program, in order to obtain the objective which our national interests require. Workers and managers will, I believe, join with you with spirit and determination in pursuing and achieving this goal at the earliest possible moment."

Inventory Controls Imposed on 16 Metals and Metal Classes by OPM

■ STRICT inventory controls designed to prevent artificially high accumulations of stocks were imposed on producers, dealers and users of 16 metals and metal classes last week by E. R. Stettinius, director of priorities, Office of Production Management.

Producers, dealers and users will be required to file monthly affidavits covering all deliveries after June 10.

Metals affected are antimony, cadmium, chromium, cobalt, copper, all types of ferrous alloys, iridium, iron and steel products including rolled, drawn, forgings, castings and pig iron, lead, manganese or spiegeleisen, mercury, molybdenum, all types of nonferrous alloys, tin, vanadium and secondary materials containing these metals and any others subject to priorities control.

Suppliers must not make deliveries unless they have first received from the customer a sworn statement covering inventories during the previous calendar month, Mr. Stettinius stated. Deliveries are not to be made if the supplier has reason to believe they will raise the customer's inventory above the amount necessary to meet his contracts.

"It will be an honor system with the judgment of the supplier determining what inventories are reasonable," Mr. Stettinius said. "If this fails we will install mandatory priorities and allocations."

Mr. Stettinius said a field staff will be created to audit inventories and make sudden, spot checks in plants.

Explaining the terms of the order, Mr. Stettinius emphasized these points:

Customers must file sworn copies of the inventory affidavits sent to suppliers with the OPM priorities division. The OPM will have final decision on permitting a shipment to be delivered.

Suppliers will be required to fill out an OPM questionnaire, which will be distributed shortly, giving complete information on their inventories. The metal that will be covered first by questionnaire has not yet been selected.

Customers who hold excessive inventories will be denied supplies until their stocks are reduced to "reasonable levels." Compliance affidavits must be filed by producers, primary and secondary smelters, remelters, brokers, warehouse and wholesale distributors, processors and fabricators.

Mr. Stettinius said persons who send in false affidavits can be prosecuted for perjury, and the OPM will prevent them from making deliveries by court injunctions.

Admitting that Leon Henderson, head of the Office of Price Administration and Civilian Supply, had a hand in the drafting of the inventory controls, Mr. Stettinius maintained nevertheless that if the order is carried out price schedules on the metals will be made unnecessary.

OPACS Tells Phoenix To Hold Shape, Bar Prices

WASHINGTON

■ Phoenix Iron Co., Phoenixville, Pa., was given permission last Friday to fix a base price "ceiling" for structural shapes and bars above the official iron and steel price schedule.

The price for shapes allowed by OPACS is $2.30 per 100 pounds, and for bars, $2.35. They are the approximate bases at which the company closed sales during the five weekly periods ending in March.

OPACS pointed out that the action merely authorized Phoenix to charge the same prices it has already been charging. It is retroactive to all sales closed on or after April 17, 1941.

The company had petitioned OPACS for relief from provisions of the price schedule. Examination of its books showed it otherwise would be forced to operate at a loss. No question of absorbing or passing on wage rate increases is involved in the case, OPACS said.

Andrews Steel Co., with open-hearth furnaces and finishing mills at Newport, Ky., last week asked for a hearing, seeking relief from the present price "ceiling." The company buys pig iron and scrap, has capacity for 400,000 tons of ingots yearly, and rolls sheets.

■ Production of steel rails in 1940 amounted to 1,678,986 net tons, compared with 1,312,647 tons in 1939. Of the 1940 total 1,629,344 tons were open hearth and 683 tons bessemer and electric steel. Rails rerolled from new seconds totaled 3448 tons and from old rails 45,511 tons.

Steel Ingots, Castings, Hot-Rolled Products in 1940

American Iron and Steel Institute figures as reported last week. All figures of production are in net tons.

ANNUAL STEEL PRODUCTION (Ingots and steel for castings)

Years	Open hearth			Bessemer	Crucible	Electric	Total
	Basic	Acid	Total				
1915	24,985,772	1,534,822	26,520,594	9,281,678	127,436	79,452	36,009,160
1920	35,140,810	1,451,712	36,592,522	9,949,057	80,937	566,370	47,188,886
1925	41,537,823	1,060,804	42,598,627	7,530,837	21,910	689,373	50,840,747
1929	52,900,309	1,254,926	54,155,235	7,977,210	7,442	1,065,603	63,205,490
1930	38,380,514	874,559	39,255,073	5,639,714	2,523	686,111	45,583,421
1931	24,786,016	424,668	25,210,714	3,386,259	1,733	460,255	29,058,961
1932	13,151,801	184,406	13,336,210	1,715,925	722	270,044	15,322,901
1933	22,464,004	363,469	22,827,473	2,720,246	763	471,747	26,020,229
*1934	26,047,187	307,651	26,354,838	2,421,840	595	404,651	29,181,924
1935	34,004,585	396,695	34,401,280	3,175,235	719	606,471	38,183,705
1936	48,288,605	471,858	48,760,463	3,873,472	914	865,150	53,499,999
1937	51,265,211	559,768	51,824,979	3,863,918	1,046	947,002	56,636,945
1938	28,774,999	305,017	29,080,016	2,106,340	7	565,627	31,751,990
1939	47,828,700	581,100	48,409,800	3,358,916	931	1,029,067	52,798,714
1940	60,882,840	690,243	61,573,083	3,708,573	1,024	1,700,006	66,982,686

ANNUAL STEEL INGOT PRODUCTION

Years	Open hearth			Bessemer	Crucible	Electric	Total
	Basic	Acid	Total				
1915	24,612,696	1,084,326	25,697,022	9,178,105	110,909	52,281	35,038,317
1920	34,637,560	850,194	35,487,754	9,831,480	79,000	388,925	45,787,159
1925	41,027,907	543,024	41,570,931	7,470,544	19,857	376,295	49,437,627
1929	52,241,511	645,560	52,887,071	7,942,681	6,454	596,279	61,432,485
1930	37,966,340	411,243	38,377,583	5,623,058	1,751	344,308	44,346,700
1931	24,625,365	217,715	24,843,080	3,372,761	931	263,621	28,480,393
1932	13,092,235	117,369	13,209,604	1,711,969	270	158,287	15,080,130
1933	22,369,542	218,954	22,588,496	2,716,872	447	335,785	25,641,600
1934	26,023,970	225,202	26,249,172	2,421,840	595	390,986	29,062,593
1935	33,974,575	278,333	34,252,908	3,175,235	719	584,436	38,013,298
1936	48,239,427	311,815	48,551,242	3,873,472	914	788,718	53,214,346
1937	51,205,848	373,490	51,579,338	3,863,918	1,046	912,027	56,356,329
1938	28,746,725	218,227	28,964,952	2,106,340	7	524,843	31,596,142
1939	47,788,763	437,307	48,226,070	3,358,916	931	951,522	52,537,439
1940	60,821,802	510,433	61,332,235	3,708,573	1,024	1,608,032	66,649,864

PRODUCTION OF DUPLEX STEEL

Years	Net tons	Years	Net tons	Years	Net tons
1915	1,995,270	1931	1,059,345	1936	2,350,994
1920	3,672,613	1932	323,975	1937	3,256,837
1925	3,132,996	1933	432,492	1938	1,325,658
1929	3,316,647	1934	662,338	1939	2,317,382
1930	2,290,710	1935	1,075,222	1940	2,208,072

PRODUCTION OF ALLOY STEEL INGOTS AND CASTINGS

Years	Ingots	Castings	Total	Years	Ingots	Castings	Total
1915	1,034,041	109,644	1,143,685	*1934	1,787,009	18,739	1,805,748
1920	1,782,972	76,555	1,859,527	1935	2,337,918	36,099	2,374,017
1925	2,598,837	126,093	2,724,930	1936	3,122,672	106,985	3,229,657
1929	4,216,001	216,071	4,432,072	1937	3,332,670	63,871	3,396,541
1930	2,595,245	141,263	2,736,508	1938	1,606,977	46,533	1,653,510
1931	1,529,931	100,692	1,630,623	1939	3,120,859	91,096	3,211,955
1932	848,467	45,969	894,436	1940	4,854,738	111,149	4,965,887
1933	1,652,448	80,397	1,732,845				

PRODUCTION OF ALLOY STEEL INGOTS AND CASTINGS BY PROCESSES

Years	Open hearth			Bessemer	Crucible	Electric	Total
	Basic	Acid	Total				
1929	3,629,393	120,968	3,750,361	107,870	2,607	571,234	4,432,072
1935	1,829,566	82,208	1,911,774	.....	172	462,071	2,374,017
1936	2,508,671	129,658	2,638,329	.....	234	591,094	3,229,657
1937	2,559,200	164,455	2,723,655	.....	270	672,616	3,396,541
1938	1,179,031	102,089	1,281,120	13	5	372,372	1,653,510
1939	2,302,273	156,581	2,458,854	3,486	231	749,384	3,211,955
1940	3,421,961	252,965	3,674,926	3,990	255	1,286,716	4,965,887

*The figures for 1934 and subsequent years include only that portion of the steel for castings which was produced in foundries operated by companies producing steel ingots.
†Revised.

PRODUCTION OF HOT ROLLED IRON AND STEEL PRODUCTS BY YEARS

Years	Iron	Steel	Total
1915	1,450,213	25,869,862	27,320,075
1920	1,542,874	34,686,733	36,229,607
1925	814,548	36,578,847	37,393,395
1929	532,055	45,465,691	45,997,746
1930	353,979	32,700,589	33,054,568
1931	211,373	21,265,628	21,477,001
1932	110,558	11,594,661	11,705,219
1933	146,331	18,596,965	18,743,296
1934	181,597	21,064,250	21,245,847
1935	150,630	26,689,668	26,840,298
1936	226,093	37,631,451	37,857,544
1937	181,840	40,996,516	41,178,356
1938	77,553	† 23,491,398	† 23,568,951
1939	139,780	† 38,927,773	† 39,067,553
1940	114,860	48,545,509	48,660,369

PRODUCTION OF HOT ROLLED IRON AND STEEL PRODUCTS BY STATES

States	1936	1937	1938	1939	1940
Massachusetts, Rhode Island, Conn.	276,546	258,610	151,829	240,358	269,633
New York	1,612,842	2,051,368	1,087,130	1,868,642	2,494,866
New Jersey	124,373	126,562	84,030	119,639	114,276
Pennsylvania	11,235,879	12,507,869	6,583,138	11,024,196	14,635,438
Delaware, Md., Va.	1,531,053	1,980,982	1,453,271	2,206,873	2,784,347
West Virginia	1,334,371	1,260,428	† 851,605	† 1,414,688	1,668,413
Kentucky, Tenn., Ga., Texas	737,812	666,098	411,483	605,385	752,909
Alabama	1,217,904	1,420,356	† 1,132,329	1,665,451	2,056,270
Ohio	8,620,971	8,685,531	5,200,010	8,609,872	9,933,907
Indiana	4,962,821	5,484,020	† 2,914,441	† 5,010,257	6,488,696
Illinois	2,811,479	3,103,713	† 1,523,405	2,721,429	3,416,246
Michigan, Wis., Minn.	1,913,984	2,218,543	1,274,028	2,080,614	2,296,346
Missouri, Okla.	353,574	323,465	216,751	376,510	425,974
Colorado, Wash.	598,677	610,458	286,271	606,531	699,682
California, Canal Zone	525,258	480,353	399,230	517,109	623,366
Total	37,857,544	41,178,356	†23,568,951	†39,067,553	48,660,369

PRODUCTION OF HOT ROLLED IRON AND STEEL PRODUCTS IN 1940

	Net tons
FLAT ROLLED PRODUCTS:	
Plates (sheared and universal)	4,323,408
Sheets	11,705,956
Strip	2,077,744
Hoops	97,074
Cotton ties and baling bands	44,918
Strip and sheets for cold reduced black plate and tin plate	3,103,627
Black plate	521,924
Total	21,874,651
BARS:	
Merchant	6,459,263
Concrete reinforcement	1,425,998
Total Bars	7,885,261
Structural shapes	4,232,346
Sheet piling	186,125
Rails	1,678,986
Long splice bars, tie plate bars, etc.	515,928
Skelp	2,709,000
Blanks or pierced billets for seamless tubes	2,320,966
Wire rods	4,351,848
Car wheels (rolled steel)	191,102
Cross ties	13,478
Rolled forging blooms, billets and axle blanks	919,826
Blooms, billets, slabs and sheet bars for export	1,677,905
All other finished hot rolled products	102,947
Total	18,900,457
Grand total	48,660,369

Industrial Machinery Exports Up 8 Per Cent

■ United States exports of industrial machinery in March were valued at $40,418,406, an 8 per cent increase over the February shipments which amounted to $37,493,575, the Durable Goods Unit of the Department of Commerce reports.

The most important factor was a gain of more than $4,000,000 in metalworking machinery.

Shipments to England recovered somewhat from the sharp drop registered in February, but still remained below the high levels established at the end of last year. Rising from $8,674,766 in February, the March exports to England reached $11,364,720. Well over 60 per cent of the total machine tool shipments in March went to England.

Exports to Canada continued to advance, totaling $4,614,941 in March compared with $4,272,527 in February. This is the fifth consecutive month that shipments to Canada have increased. Exports to Japan rose slightly in March to $38,932 from $16,930, while consignments to Russia dropped to $255,038 from $484,542 in February.

Rated Capacity Exceeded By 17 Steel Producers

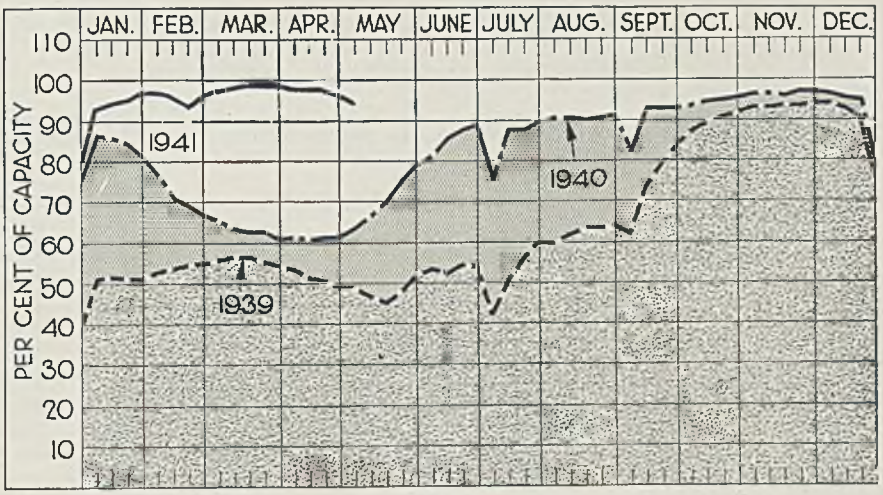
■ Two-thirds of the 35 steel companies reporting operations weekly to the American Iron and Steel Institute operated at rated capacity or higher during the first four months this year. Some also reached or exceeded rated capacity for many weeks in 1940.

Rated capacity was equaled by six companies and exceeded by 17 others.

March Canadian Steel Output Sets New Record

■ Steel production in Canada set a new high record in March and pig iron and ferroalloy output made gains over February. Daily average steel production in March was 6306 gross tons, compared with 6168 tons in February and 5075 tons in March, 1940. Pig iron output averaged 3292 tons per day in March, compared with 3256 tons per day in February. Eight blast furnaces were active all month, 82 per cent of blast furnace capacity. Further comparisons follow:

	Steel ingots, castings	Pig iron	Ferro-alloys
March, 1941	195,481	102,038	15,201
Feb., 1941	172,698	91,165	11,471
March, 1940	157,326	91,772	8,298
3 mos., 1941	554,482	296,288	41,903
3 mos., 1940	464,165	283,507	23,855



PRODUCTION . . . . Lower

■ STEELWORKS operations last week declined 1 point to 95 per cent, mainly due to coke shortage. Three districts gained slightly, four declined and five were unchanged. A year ago the rate was 63.5 per cent; two years ago it was 49 per cent.

While coal production has been resumed and blast furnaces are being returned to service as rapidly as possible, it will be several weeks before maximum output of pig iron is attained. Steelmakers have been drawing on stocks of cold iron and scrap for open hearths, reducing reserves considerably.

Youngstown, O.—Production averaged 89 per cent last week, down 5 points, as result of coke shortage. Two bessemers and 74 open hearths were active. Outlook for this week is about 95 per cent. Eight blast furnaces were banked in the district.

Pittsburgh—Production averaged 93 per cent for the week, 3 points below the previous week. Schedule for this week is higher as coke becomes available.

Carnegie-Illinois Steel Corp. has resumed blowing one blast furnace at Mingo Junction and one at Edgar Thomson plant. It also has blown in Carrie No. 3, just relined. Jones & Laughlin Steel Corp. has blown out Eliza No. 2 for relining.

Cleveland—Increased production by one interest caused a rise of ½-point to 92½ per cent. American Steel & Wire blast furnaces, which were blowing at about 50 per cent, due to coal shortage, will resume as rapidly as possible, about ten days being required to reach maximum.

Wheeling—Continued at 88 per cent.

Central eastern seaboard—Off 1 point to 95 per cent, partially a result of coke shortage.

Birmingham, Ala.—Unchanged at 90 per cent for ninth week.

Detroit—Steelmaking advanced 9 points to 88 per cent as Ford furnaces resumed nearly full production. Active furnaces number 23 of 26 in the district.

St. Louis—Held steady at 98 per cent, with 27 of 28 furnaces active.

Cincinnati—Open hearth curtailment for repair caused the rate to drop 2 points to 90½ per cent. Coke shortage had no effect on output.

Buffalo—With 39 of 43 open hearths in production the district rate continued at 90½ per cent. The only idle blast furnace here is expected to be blown in this week.

New England—Advanced 3 points to 95 per cent.

Chicago—Coke shortage and repair work held production down to 96 per cent, an increase being scheduled for this week. Carnegie-Illinois Steel Corp. has resumed production on its four banked blast furnaces. This company also started production May 1 in one of three by-product coke batteries at Joliet, Ill., taken out because of coal shortage.

District Steel Rates

Percentage of Ingot Capacity Engaged In Leading Districts

	Week ended May 3	Change	Same week 1940	Same week 1939
Pittsburgh	93	— 3	58	44
Chicago	96	None	59.5	47
Eastern Pa.	95	— 1	57	36
Youngstown	89	— 5	50	43
Wheeling	88	None	94	64
Cleveland	92.5	+ .5	70	44.5
Buffalo	90.5	None	44	35
Birmingham	90	None	83	55
New England	95	+ 3	53	45
Cincinnati	90.5	— 2	53	52
St. Louis	98	None	42.5	51
Detroit	88	+ 9	70	59
Average	95	— 1	63.5	49

Details of 1940 Pig Iron and Ferroalloy Production

American Iron and Steel Institute figures, as reported last week. All pig iron and ferro-alloys are included, whether made in blast furnaces or in electric furnaces. Ferro-alloys include ferro-manganese, spiegeleisen, ferro-silicon, ferro-phosphorus, ferro-vanadium, ferro-chrome, etc. All figures of production in net tons.

PRODUCTION OF PIG IRON AND FERRO-ALLOYS

	1936	1937	1938	1939	1940
PIG IRON:					
Pennsylvania	10,195,220	12,735,786	5,416,285	9,809,487	14,287,826
Ohio	8,071,454	8,852,417	4,715,776	8,033,411	9,969,704
Indiana, Mich.	4,668,495	5,288,994	2,628,993	4,786,803	6,687,707
Md., West Va., Ky., Tenn.	2,354,359	2,835,232	2,030,954	3,116,744	3,575,981
Illinois	3,267,058	3,837,250	1,855,382	2,968,606	4,047,376
Alabama	2,237,997	2,890,355	2,266,060	2,935,685	3,418,895
Mass., New York	2,486,984	3,184,480	1,459,603	2,422,844	3,113,002
Minn., Iowa, Col., Utah	560,965	840,633	398,545	735,102	971,175
Total	33,842,532	40,465,147	20,771,598	34,808,682	46,071,666
FERRO-ALLOYS:					
Pennsylvania	370,119	489,793	184,687	309,543	515,263
Ohio, Iowa, Col.	183,874	193,064	171,078	239,197	345,210
New York, N. J.	272,357	290,733	213,282	191,802	323,467
Va., West Va., Ala., Tenn.	83,807	143,813	119,519	127,873	142,923
Total	910,157	1,117,403	688,566	868,415	1,326,863
Grand total	34,752,689	41,582,550	21,460,164	35,677,097	47,398,529

PIG IRON MADE FOR SALE IN 1940

States	Basic	Bess. & low-phos.	Foundry	All Other	Total
Massachusetts, New York	118,786	207,513	276,290	475,916	1,078,505
Pennsylvania	437,295	430,572	184,746	218,843	1,271,456
Md., W. Va., Ala., Tenn.	151,522	2,591	1,196,897	.....	1,351,010
Ohio	343,819	146,796	190,081	539,415	1,220,111
Indiana, Illinois	195,618	15,722	125,802	500,782	837,924
Mich., Minn., Ia., Col., Utah	29,611	.....	119,791	40,762	190,164
Total	1,276,651	803,194	2,093,607	1,775,718	5,949,170

HALF-YEARLY PRODUCTION OF PIG IRON AND FERRO-ALLOYS

States	Blast furnaces (a) Dec. 31, 1940: In blast June 30, 1940	In	Out	Total	Production: First 6 months 1940	Second 6 months 1940	Total 1940
Mass.	0	1	0	1	1,293,618	1,819,384	3,113,002
New York	11	13	1	14			
Penna.	55	61	9	70	6,448,392	7,839,434	14,287,826
Maryland	6	6	0	6	1,743,147	1,832,834	3,575,981
West Va.	3	3	0	3			
Kentucky	2	2	0	2			
Tennessee	1	1	0	1			
Alabama	15	17	1	18	1,584,935	1,833,960	3,418,895
Ohio	37	44	2	46	4,269,739	5,699,965	9,969,704
Illinois	11	15	8	23	1,687,167	2,360,209	4,047,376
Indiana	16	18	1	19	3,062,445	3,625,262	6,687,707
Michigan	8	8	0	8			
Minnesota	2	2	0	2			
Iowa	0	0	0	0	467,406	503,769	971,175
Colorado	2	3	0	3			
Utah	1	1	0	1			
TOTALS:							
Pig iron	170	195	22	217	20,556,849	25,514,817	46,071,666
Ferro-alloys- Blast furnaces	14	11	3	14	494,567	412,858	907,425
Electric furnaces	....	....	....	....	186,958	232,480	419,438
Grand total	184	206	25	231	21,238,374	26,160,155	47,398,529

(a) Completed and rebuilding blast furnaces.

HALF-YEARLY PRODUCTION OF PIG IRON BY GRADES AND FERRO-ALLOYS BY KINDS

BASIC PIG IRON

States	First 6 months 1940	Second 6 months 1940	Total 1940
Massachusetts, New York	834,839	1,145,289	1,980,128
Pennsylvania	4,538,815	5,469,590	10,008,405
Maryland, West Virginia, Ky., Ala.	2,570,411	2,751,789	5,322,200
Ohio	3,018,345	3,679,745	6,698,090
Indiana, Illinois	3,432,332	4,476,212	7,908,544
Michigan, Minnesota, Colorado, Utah	1,033,890	1,036,477	2,070,367
Total	15,428,632	18,559,102	33,987,734

BESSEMER AND LOW-PHOSPHORUS PIG IRON

Pennsylvania	1,644,628	2,203,748	3,848,376
Mass., New York, Md., West Va., Ala.	325,765	476,445	802,210
Ohio	961,735	1,548,474	2,510,209
Indiana, Illinois	263,427	411,054	674,481
Total	3,195,555	4,639,721	7,835,276
Total Bessemer	3,035,114	4,351,206	7,386,320
Total Low-Phosphorus	160,441	288,515	448,956

FOUNDRY PIG IRON

Massachusetts, New York, Penna.	254,117	220,849	474,966
Kentucky, Tenn., Ala.	557,043	680,369	1,237,412
Ohio	80,380	121,795	202,175
Indiana, Ill., Mich., Minn., Col., Utah	156,210	221,412	377,622
Total	1,047,750	1,244,425	2,292,175

MALLEABLE PIG IRON

Massachusetts, New York, Penna.	264,808	354,421	619,229
Ohio	204,657	342,170	546,827
Indiana, Illinois, Minnesota	327,181	339,164	666,345
Total	796,646	1,035,755	1,832,401

FERRO-ALLOYS BY KINDS

Ferro-manganese	281,141	228,935	510,076
Spiegeleisen	129,009	107,811	236,820
Ferro-Silicon	236,146	262,686	498,832
Other ferro-alloys	35,229	45,906	81,135
Total	681,525	645,338	1,326,863

PRODUCTION OF PIG IRON AND FERRO-ALLOYS IN 1940

(For sale and for maker's use)

	For sale	For maker's use	Total
PIG IRON:			
Basic	1,276,651	32,711,083	33,987,734
Bessemer and low-phosphorus	803,194	7,032,082	7,835,276
Foundry	2,093,607	198,568	2,292,175
Malleable	1,688,038	144,363	1,832,401
Forge or mill	3,590	.....	3,590
White and mottled, direct castings, etc.	84,090	36,400	120,490
Total	5,949,170	40,122,496	46,071,666
FERRO-ALLOYS:			
Ferro-manganese and spiegel	312,485	434,411	746,896
Ferro-silicon	494,677	4,155	498,832
Other ferro-alloys	81,135	.....	81,135
Total	888,297	438,566	1,326,863
Grand total	6,837,467	40,561,062	47,398,529

Daily Pig Iron Output in April Down 4.6 Per Cent; Operating Rate 91.9

■ OUTPUT of coke pig iron and ferroalloys in April decreased 4.6 per cent from the record daily average in March, from 151,707 net tons to 144,723 tons. Operating rate for the industry declined from 96.3 per cent of capacity in the previous month to 91.9 per cent, a drop of 4.4 points.

Stacks active April 30 totaled 191, a net decrease of 14 from the end of March, according to reports from operators of the nation's 229 potential coke blast furnaces. Total production in the month, including estimates for output of two minor pig iron producers, was 4,341,681 tons.

Although daily average in April was lowest since October, 1940, it was nearly 40 per cent greater than in April last year and almost double daily output in the month in 1939. Daily average for the year to date was 149,314 tons, against 113,542 in the first four months last year.

Monthly total, down 7.7 per cent from peak of 4,702,905 tons in March, compared with production of 3,139,043 tons in April last year. In the month in 1939, aggregate was 2,301,965 tons.

Net decrease in number of stacks active at the month's end, while indicating extent of the coke shortage, fell short of the true picture. Many stacks had been banked for varying periods within the month, some as many as 13 and 15 days. Others were kept on at decreased blast, cutting output considerably while still considered active. Only two or three were reported blown out for relining or other repairs.

Sixteen stacks that had been in blast March 31 were reported blown out or banked as of the end of April. Fourteen were of the steelworks or nonmerchant classification, and one merchant. One merchant furnace was put into blast and one taken out.

Merchant iron production last month totaled 606,011 tons, down from 711,833 tons in March, and compared with total of 3,735,670 tons nonmerchant. It was nearly 14 per cent of the month's total output. In March, merchant iron comprised 17.8 per cent of the combined total, and in February, 14 per cent.

Stacks blown in during April:

In Ohio: Anna, Struthers Iron & Steel Co. In Pennsylvania: Cambria K, Bethlehem Steel Co.

Stacks blown out or banked: In Illinois: One South Works New, Carnegie-Illinois Steel Corp. In Indiana: One Gary, Carnegie-Illinois Steel Corp. In Ohio: Mary, Sharon Steel Corp.; River No. 2, and Youngstown No. 4, Republic Steel Corp.; Mingo No. 4 and Ohio No. 1, Carnegie-Illinois Steel Corp.; Campbell No. 1, Youngstown Sheet & Tube Co.; Lorain No. 5, National Tube Co.

In Pennsylvania: Shenango No. 2, Shenango Furnace Co.; Carrie No. 1, Duquesne No. 4 and Edgar Thomson F, Carnegie-Illinois Steel Corp.; Eliza No. 2, Jones & Laughlin Steel Corp.; Monessen No. 2, Pittsburgh Steel Co.; One Swede, Alan Wood Steel Co.

Carnegie-Illinois Steel Corp. reported, late last week, the following stacks were put back into blast:

In Illinois: One South Works. In Indiana: Gary No. 4. In Ohio: Mingo No. 4. In Pennsylvania: Edgar Thomson F and Carrie No. 3. Latter had been down for relining, the others banked or blown out due to coke shortage.

Jones & Laughlin's Eliza No. 2, in Pennsylvania, was blown out May 2 for relining.

PIG IRON STATISTICS

RATE OF FURNACE OPERATION
(Relation of Production to Capacity)

	1941[1]	1940[2]	1939[3]	1938[4]
Jan.	95.5	85.4	51.0	33.6
Feb.	95.3	75.0	53.5	33.6
March	96.3	69.5	56.1	34.2
April	91.9	68.9	49.8	33.4
May	....	74.2	40.2	29.4
June	....	83.6	51.4	25.5
July	....	86.1	55.0	28.2
Aug.	....	89.9	62.4	34.8
Sept.	....	91.5	69.7	40.5
Oct.	....	94.2	85.2	48.0
Nov.	....	96.4	90.3	55.0
Dec.	....	96.4	88.5	51.4

[1] Based on capacity of 57,503,030 net tons, Dec. 31, 1940; [2] capacity of 55,628,060 net tons, Dec. 31, 1939; [3] capacity of 56,222,790 net tons, Dec. 31, 1938; [4] capacity of 56,679,168 net tons, Dec. 31, 1937. Capacities by American Iron and Steel Institute.

APRIL IRON PRODUCTION
Net Tons

	No. in blast last day of April	No. in blast last day of March	Total Tonnages—Merchant	Total Tonnages—Non-merchant
Alabama	17	17	111,775	172,033
Illinois	16	17	99,340	302,324
Indiana	17	18	2,293	497,525
New York	13	13	96,692	189,333
Ohio	41	47	125,338	881,385
Penna.	62	68	136,276*	1,213,876*
Colorado	3	3		
Michigan	5	5		
Minnesota	2	2	15,194*	178,472
Tennessee	1	1		
Utah	1	1		
Kentucky	2	2		
Maryland	6	6		
Mass.	1	1	19,103*	300,722
Virginia	1	1		
West Va.	3	3		
Total	191	205	606,011*	3,735,670*

*Includes ferromanganese and spiegeleisen.

MONTHLY IRON PRODUCTION
Net Tons

	1941	1940	1939
Jan.	4,666,233	4,024,556	2,436,474
Feb.	4,206,826	3,304,368	2,307,405
March	4,702,905	3,270,575	2,680,446
April	4,341,681	3,139,043	2,301,965
Tot. 4 mo.	17,917,645	13,738,542	9,726,290
May	.....	3,497,157	1,923,625
June	.....	3,813,092	2,373,753
July	.....	4,060,513	2,638,760
Aug.	.....	4,234,576	2,979,774
Sept.	.....	4,172,551	3,218,940
Oct.	.....	4,437,725	4,062,670
Nov.	.....	4,397,656	4,166,512
Dec.	.....	4,542,864	4,219,718
Total	.....	46,894,676	35,310,042

AVERAGE DAILY PRODUCTION
Net Tons

	1941	1940	1939	1938
Jan.	150,524	129,825	78,596	52,201
Feb.	150,244	113,943	82,407	52,254
March	151,707	105,502	86,465	53,117
April	144,723	104,635	76,732	51,819
May	.....	112,811	62,052	45,556
June	.....	127,103	79,125	39,601
July	.....	130,984	85,121	43,827
Aug.	.....	136,599	96,122	54,031
Sept.	.....	139,085	107,298	62,835
Oct.	.....	143,152	131,053	74,697
Nov.	.....	146,589	138,883	85,369
Dec.	.....	146,544	136,119	79,943
Ave.	149,314	128,128	96,740	57,962

Seaway Project's Defeat Urged on Coal Operators

■ "No single government undertaking would have a more pernicious effect upon the general economy of our country and ruinous effect upon the great mining industry of our nation" than the St. Lawrence Seaway project. This declaration was made before the eighteenth Annual Coal Convention and Exposition in Cincinnati last week by B. D. Tallamy, chief engineer, Niagara Frontier Planning Board, Buffalo.

Mr. Tallamy estimated the coal industry would stand to lose sales of 30,000,000 tons of coal annually if the seaway were built and used to the extent claimed by its proponents. Loss to railroads and mine operators would amount to $120,000,000 a year.

Foreign vessels, he explained, would carry coal as ballast in coming to Canada and United States to load grain and similar materials for European countries. United States operators would lose much of the 17,000,000 tons now exported to Canada and also would lose a market as hydroelectric power was substituted for steam power.

Other papers before the convention dealt with technical and economic problems of mining.

MEN of INDUSTRY

L. H. Burnett

Wilfred Sykes

Philip D. Block

James H. Walsh

■ **WILFRED SYKES** has been elected president, Inland Steel Co., Chicago, succeeding **Philip D. Block.** Mr. Block, who has been president for 22 years, becomes chairman of the executive committee. **L. E. Block,** who was chairman of the board for many years until 1940, has been elected chairman of the finance committee. **James H. Walsh** was elected vice president in charge of steelworks. **Edward L. Ryerson** and all other officers were re-elected.

Mr. Walsh was elected a director in the place of **W. A. Kendrick.** All other directors were re-elected, except **Louis Kuehn** who has resigned.

Philip D. Block was one of the founders of the company in 1893, and with his brother, L. E. Block, is largely responsible for the company's growth and success.

Mr. Sykes has been assistant to the president in charge of operations since 1930, and a director since 1935. His association with Inland began in 1923 when he took charge of construction and engineering work. He was born in New Zealand and studied in Melbourne, Australia.

Mr. Walsh has been works manager of the Indiana Harbor Works since 1930.

♦

Samuel S. Bruce Jr. has been appointed sales representative, Duff-Norton Mfg. Co., Pittsburgh. Mr. Bruce has had broad experience in the marketing and servicing of lifting jacks, and formerly was identified with a contracting company that brought him into contact with executives in the maintenance of way departments of railroads and marine transportation companies in the eastern and middle Atlantic districts.

♦

L. H. Burnett, senior vice president, Carnegie-Illinois Steel Corp., Pittsburgh, has retired after 40 years' service. He was associated with Carnegie-Illinois and its predecessor, Carnegie Steel Co., since 1901, and was vice president in charge of legal matters since February, 1927. He was a director of United States Steel and Carnegie Pension Fund since its inception in 1911, and for many years a member of the industrial relations committee, American Iron and Steel Institute.

♦

Lowell M. Greenlaw, general counsel, Pullman Co., Chicago, has been elected vice president and general manager of the company.

♦

Roy S. Laird has been named sales manager, Ohmite Mfg. Co., Chicago. He has been identified with the company five years as sales engineer.

♦

Rebecca H. Smith, the past ten years active in the foundry industry as metallurgist and technical writer, has opened an office at 1920 Ford building, Detroit, for commercial microscopic work on metals.

♦

O. R. Wysong is no longer associated with the Ternstedt Mfg. Division, General Motors Corp., Detroit. Any correspondence pertaining to the purchasing department should be addressed to attention of **H. M. Stevens,** purchasing agent.

♦

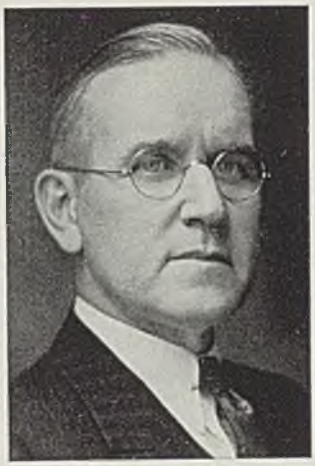
Sherman Barnes has been placed in charge of the western New York sales territory for Ampco Metal Inc., Milwaukee, with headquarters at 239 Burr street, Rochester, N. Y. He succeeds **W. B. McKenzie,** recently promoted to Ampco's Chicago office.

♦

David F. Rees Sr., assistant purchasing clerk at Carnegie-Illinois Steel Corp.'s Ohio works, Youngstown, O., has retired after 42 years' service. He began work in 1898 at the old Girard, O., mill and subse-

James R. White

J. Louis Reynolds



A. J. McFarland

W. W. Holloway

quently joined the Ohio works of Ohio Iron & Steel Co., remaining with the plant when it was absorbed by the former Carnegie Steel Co.

♦

James R. White has become associated with Clover Mfg. Co., Norwalk, Conn., maker of coated abrasives and lapping compounds, as director of sales. The past three years Mr. White has been president, Rickard & Co. Inc., New York, industrial advertising agency, and prior to that was vice president and director of sales and promotion, Jenkins Bros., Bridgeport, Conn.

♦

Robert T. Bowman has been appointed director of public relations, John A. Roebling's Sons Co., Trenton, N. J. He resigned as president, New Jersey State Chamber of Commerce, which position he held three years.

♦

Frank J. Zink, formerly professor of agricultural engineering, Kansas State College, and more recently associated with farm equipment companies in research and sales capacities, has been appointed to the headquarters' staff of the Farm Equipment Institute, Chicago.

♦

Austin W. Clark has been elected vice president, National Supply Co., Pittsburgh. He joined National Supply in 1940 as assistant vice president, after having been associated with Sears, Roebuck & Co., Chicago, as assistant comptroller for four years.

♦

W. F. Detwiler was elected chairman and **H. G. Batcheller,** president of Allegheny Ludlum Steel Corp., Pittsburgh, at a meeting of directors recently. Other officers elected were: Vice presidents, **V. B. Browne, J. O. Carr, E. B. Cleborne, A. F. Dohn, L. W. Hicks, F. B. Lounsberry,** and **F. H. Stephens;** vice president in charge of manufacturing, **W. A. Givens;** secretary-treasurer, **E. J. Hanley;** assistant treasurers, **W. L. Dankmyer** and **H. B. Pavitt;** assistand secretaries, **J. J. Coleman** and **S. A. McGaskey Jr.;** auditor, **J. J. Grogan.** All directors were re-elected.

♦

J. Louis Reynolds, vice president in charge of export sales, Reynolds Metals Co. Inc., has been appointed general sales manager of the company for the duration of the present national emergency, as announced by **I. P. Macauley,** vice president in charge of sales. Mr. Macauley has been located in Louisville, Ky., for some months, being occupied with the construction and operation of two of the company's newest and most important units. He will continue to devote his full time to these two plants.

Mr. Reynolds will make his headquarters at the home offices of the company at Richmond, Va., and also maintain offices in New York.

Basil T. Horsfield, manager, aluminum production division, Reynolds Metals Co., has been elected a director.

♦

L. Clayton Hill has been named vice president and general manager, Murray Corp. of America, Detroit. Graduate of the University of Michigan, he has had extensive experience in engineering and manufacturing in automotive and aircraft industries. He joined Murray in 1927 and was appointed works manager in 1933. Until recently he has been vice president in charge of manufacturing.

♦

Mark E. Zimmerer has been made general manager, Kingston Products Corp., Kokomo, Ind. He succeeds **Karl F. Johnson,** resigned. Mr. Zimmerer joined the company 20 years ago and has been vice president several years. **Charles Shewmon,** assistant treasurer and secretary, becomes secretary-treasurer.

♦

William W. Holloway, president, Wheeling Steel Corp., Wheeling, W. Va., has been elected chairman of the board. He succeeds the late Alexander Glass. **Archie J. McFarland,** heretofore executive vice president, has been chosen president.

Arthur C. Stifel, a director, has been elected to the executive committee, and **L. Woodward Franzheim,** vice president and treasurer, has been made a director.

♦

F. J. Whitgrove, superintendent of the DeKalb, Ill., works of the American Steel & Wire Co., Cleveland, retired April 30 after a half-century of service with the company and its predecessors.

Concrete Reinforcing Institute Elects Officers

■ Ralph F. Healy, Igoe Bros., Newark, N. J., was elected president, Concrete Reinforcing Steel Institute at its seventeenth annual meeting in The Homestead, Hot Springs, Va., April 24-25. Blair M. Boisseau, president, Virginia Steel Co., Richmond, Va., was elected first vice president; S. V. Taylor, president, Concrete Steel Fireproofing Co., Detroit, second vice president; and H. C. Delzell, executive secretary.

New directors elected to succeed those whose terms expired: A. S. Bennett, manager, building steel department, Alamo Iron Works, San Antonio, Tex.; W. C. Kiesler, president, Rosslyn Steel & Cement Co., Washington; James D. Maitland, president, Colorado Builders' Supply Co., Denver; J. H. Verschleiser, manager of sales, Construction Products department, Laclede Steel Co., St. Louis.

Windows of WASHINGTON

By L. M. LAMM
Washington Editor, STEEL

Moratorium on labor disputes recommended by United States Chamber of Commerce . . . Resignation of Secretary of Labor asked . . . OPM director believes steel capacity adequate . . . Molybdenum suggested as substitute for tungsten . . . Special preference ratings granted aircraft manufacturers . . . Steelmakers may be permitted to allocate orders

WASHINGTON

■ VOLUNTARY co-operation instead of antistrike legislation as a means of avoiding disruption of defense production was recommended by the United States Chamber of Commerce in annual convention last week. The chamber warned that an alternative might be restrictive laws harmful to individual rights and proposed to industrial and labor leaders a moratorium on industrial disputes.

The Treasury Department's program for raising an additional $3,500,000,000 was termed "severe and unrealistic" by Ellsworth C. Alvord, chairman of the chamber's finance committee. Mr. Alvord called for a $2,500,000,000 increase in taxation and a $2,000,000,000 decrease in nonmilitary spending.

Col. John H. Jouett, president, Aeronautical Chamber of Commerce, reviewed the progress of the aircraft industry in building military planes. On July 1, 1940, the industry was operating 17,216,410 square feet of floor space. Eight months later, on March 1, the industry had expanded to 31,383,967 square feet, an increase of 82 per cent. Employment increased 88 per cent in the same eight months.

Plane production rose from a value of $225,000,000 in 1939 to $544,000,000 in 1940, and is expected to reach $1,500,000,000 for 1941.

The industry, Colonel Jouett said, has been asked to build 44,000 planes, as follows: 16,500 for the Army; 8500 for the Navy; 16,000 for England and Canada; and 3600 bombers under the Knudsen plan.

"I am told by government sources, requirements under consideration will bring the total of planes on order from the present 44,000 up to 80,000."

Donald M. Nelson, director of purchases for the Office of Production Management, told the convention that it is "physically impossible" for the nation to carry on the defense program and continue "business as usual."

Increase in the national debt to $90,000,000,000 was predicted by Jesse Jones, Secretary of Commerce, and only cabinet member to appear on the program. "We have not yet made any sacrifices, but they are in store for us—plenty of them."

Roy C. Ingersoll, president, Ingersoll Steel & Disc Division of Borg-Warner Corp., Chicago, was wildly applauded when he called for the replacement of Secretary of Labor Perkins. "Businessmen and workers are wondering how long it will be until public opinion will become so aroused that it will demand the resignation of a Secretary of Labor who condones sitdown strikes, has prevented the deportation of alien Harry Bridges who through his activities cost hundreds of millions of dollars to our shipping and West coast business, who has refused to assign cases to the National Mediation Board at a time when such action would have saved millions of man-hours and when each hour means so much to our defense program."

Knudsen Foresees No Need for Additional Steel Capacity

William S. Knudsen, director general, Office of Production Management, said last week he does not foresee need for additional steel plants although defense output will soon require more steel.

Capacity of existing plants is adequate to meet the requirements, he indicated.

"That's what the Gano Dunn report said, and as far as I know we are still abiding by the report."

He declined to comment on the statement of Henry J. Kaiser, Pacific Coast construction engineer, that facilities for supplying steel to that section are inadequate.

Mr. Knudsen pointed out that press reports of the plant for which, Mr. Kaiser announced, he will seek a government certificate of necessity, gave the total tonnage of the contemplated plant as 1½ per cent of the national total. Knudsen indicated this output would not change the supply picture materially.

The program of Philip Murray, CIO president, to boost steel production by industry-labor control is still being studied by the OPM steel unit, Mr. Knudsen stated.

Princeton Professor Will Direct New Price Division

Dr. John Kenneth Galbraith, Princeton University economics professor, was appointed director of Price Stabilization Division, OPACS, and will be responsible for organizing data and developing a program for stabilizing prices. He formerly was associated with the Defense Commission's original price stabilization division. He is author of "Modern Competition and Business Policy."

Defense Commission Asks More Efficient Use of Freight Cars

To make the most efficient use of car capacity, all shippers and receivers of freight should make a daily check of their operations, the National Defense Advisory Commission recommended last week in a statement of policy. Insofar as possible shippers and receivers should:

Give advance notice of requirements but not order cars placed for

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The 30 page Bryant Series 5 Internal Grinder Catalog is profusely illustrated with photographs and line drawings that show how these machines can save time and money in the tool room and on production work. Many pages are devoted to instructions for set-up and operation which will prove of particular value to those already using Bryant Series 5 Grinders. One section shows chucks and holding fixtures for many types of jobs; another section shows the Bryant line of standard wheel heads.

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In industries where 5-day work week is in effect some plan should be worked out to provide at least 6-day basis for loading and unloading cars.

Jackson Explains Position on Allocation of Steel Orders

Implied assurances that steel companies will be able to allocate defense orders among themselves without facing antitrust actions was contained in a statement last week by Attorney General Jackson. Office of Production Management considers such allocations necessary to bring about peak production. Jackson said the Justice Department must clear requests for allocation of orders and specific actions in carrying out the program must be approved by OPM's general counsel or OPACS.

Mr. Jackson outlined a policy to be followed by the department on defense activities involving antitrust laws. He said industry committees may be formed at request of OPM or OPACS to co-operate in curtailment of some production, allocation of orders and establishment of priorities and price ceilings. The committees cannot, however, determine policies nor compel or coerce anyone to comply with any request or order, made by a public authority.

Special Preference Ratings Granted Aircraft Manufacturers

Special preference rating orders to manufacturers of airframes, engines and propellers for military airplanes were granted last week by OPM priorities division. The orders, E. R. Stettinius Jr., priorities administrator, said, will permit the manufacturers covered to extend preference ratings to deliveries from subcontractors quickly, without having each extension considered a separate and distinct case, involving considerable paper work. He said "the new system means virtually all products flowing into airplane construction, which are on the priorities critical list, will have a preferential status so they can be made available as promptly as possible."

Name Industry Consultants To Help Avoid Labor Disputes

A committee of industry consultants to work with OPM's labor division to help maintain effective industrial relations, avoid industrial disputes, and to assist the conciliation service was announced last week.

The consultants will be available to industries engaged in defense work for advice and assistance in arriving at prompt adjustments of disputes.

A standing committee of five, and ten consultants already have been appointed. Other appointments may be made later.

The standing committee: Chairman, E. D. Brandsome, Vanadium Corp. of America, Bridgeville, Pa.; Alexander R. Heron, Crown Zellerbach Corp., San Francisco; Fred A. Krafft, American Viscose Corp., Wilmington, Del.; L. C. Hill, Murray Corp. of America, Detroit; C. W. Bergquist, Western Electric Co., Chicago.

The consultants: Frank V. Bestrup, Associated Industries of Massachusetts, Boston; E. F. Blank, Jones & Laughlin Steel Corp., Pittsburgh; G. B. Bogart, Indian Refining Co., Lawrenceville, Ill.; Wade T. Childress, Columbia Terminals Co., St. Louis; James H. Greene, Pittsburgh Chamber of Commerce; George J. Kelday, International Harvester Co., Chicago; B. D. Kunkle, General Motors Co., Detroit; J. H. Madden, American Brass Co., Waterbury, Conn.; Dale Purves, John B. Stetson Co., Philadelphia; Robert B. Wolf, Weyerhaeuser Timber Co., Longview, Wash.

Personnel Changes in Defense Organization Are Announced

Defense Contract Service, OPM, last week announced appointment of four additional managers. They are:

Thomas S. McEwan, district manager in Chicago.

Frank J. McDevitt, district manager in St. Louis.

Robert R. West, district manager in Richmond, Va.

M. F. McOmber, area manager at Pittsburgh.

Emil Schram, chairman of the board, Reconstruction Finance Corp., has taken over his new duties as assistant director of priorities in charge of operations. He succeeds James F. Towers, executive vice president of Ford, Bacon & Davis Inc., industrial engineers, New York, who has had to return to his post.

Mr. Schram will continue to serve as chairman of the board of the RFC.

Two other appointments to the executive staff of OPM's priorities division have been announced by Director Stettinius. Dr. Harry S. Rogers, president, Polytechnic Institute of Brooklyn, N. Y., has been named chairman of the General Products Group, succeeding Dr. W. E. Wickenden who is returning to his post as president of Case School of Applied Science, Cleveland. Joseph L. Overlook, vice president, Continental-Illinois National Bank & Trust Co., Chicago, has been appointed to the staff and will work with Mr. Schram.

Mr. Stettinius also announced that William B. Eisendrath, president, Monarch Leather Co., Chicago, has been appointed as producers' representative of the hides, skins and leather priority committee.

Matthew J. Burns, Albany, N. Y. labor leader, has joined the Office of Production Management's labor division to develop plans for continuing employment in plants where production has been curtailed by mandatory priorities. He formerly was secretary and president of the International Brotherhood of Paper Makers, American Federation of Labor.

Joseph L. Weiner has been named assistant administrator in charge of civilian allocation of OPACS by Leon Henderson, administrator. Mr. Weiner formerly was director of the public utilities division of the Securities and Exchange Commission.

Suggests Molybdenum as Substitute for Tungsten

Molybdenum high-speed steels can be substituted for tungsten steels "rather sweepingly if the necessity arises," the advisory committee on metals and minerals of the National Academy of Sciences reported last week to the materials branch of the Office of Production Management.

Study was requested by the materials branch in an effort to be prepared should tungsten imports be curtailed.

The committee reported there are places in which a substitution of molybdenum high-speed steels for tungsten steels will result in an impairment of quality. "For most uses, however," the report adds, "the dislocation incident to substitution will not be caused by the inherent quality of the finished tools, if properly manufactured and heat treated, but in the heat treatment operation. Necessity may force many shops to acquire better heat treatment facilities."

In connection with alloy tool steels, the report makes suggestions for substituting molybdenum for tungsten but warns that such substitutions "should be approached with caution and usually only after trial."

The same qualification is attached to suggested substitution in the case of die steels for hot working.

Substitution of molybdenum for tungsten in valve and valve insert steel and in intake valves for aircraft engines is not recommended at the present time.

Salesmen's Responsibility Greater Than Ever, Machine Tool Men Told

■ AS GUEST speaker at the luncheon meeting of Associated Machine Tool Dealers of America in the Mayflower Hotel, Washington, April 28, Wendell E. Whipp, president, Monarch Machine Tool Co., Sidney, O., and past president, National Machine Tool Builders' Association, took occasion to stress the importance of continued contacts by sales engineers at a time when there is some tendency to consider such contacts as superfluous.

"I can assure you," said Mr. Whipp, "that machine tool builders need all the help they can get from you machine tool sales engineers. Remember, we manufacturers are back in our plants *making* machine tools. You are out in plants of the people who *need* those tools. It is your job to find out what those needs are.

"Therefore, you are 'the eyes of our industry,' and without you we would be manufacturing blindly. You represent the 'intelligence department' of the machine tool division of the national defense effort. This responsibility is far greater than during the last war, because then a great deal of production was carried out on standard machine tools.

"Today, however, practically every item required involves either special attachments on standard machine tools, or complete machines designed and built especially to produce certain parts.

"Today, a machine tool sales engineer must be able to step into the plant of a customer faced with a defense job, study the blue prints, production problems and bearing in mind delivery dates, make sound, definite equipment recommendations. That is a heavy responsibility."

A. G. Bryant, president, Bryant Machinery & Engineering Co., Chicago, and past-president of the association, took as his theme Roscoe Conkling's remark "Hew to the line, let the chips fall where they may!" He said:

"Machine tool dealers long ago realized that in addition to normal representation of their manufacturers' products, they must assume other responsibilities. Tasks of servicing machines, of counselling defense officials, of advising directors of plants producing armaments are being shouldered upon sales engineer organizations.

"It is commonplace these days for the sales engineers to be enlisted in the service of arsenals, navy yards, aircraft plants, armament plants. There is desperate need for their suggestions as to processes, types of equipment, and help in application of recommended machines.

"In the past 30 days it has been my privilege to visit the great armament producing centers from coast to coast. I have seen huge bombers rolled off the assembly floor and flown away over Puget Sound. I have walked among the shipbuilders on San Francisco bay, and have visited the gigantic work shops of southern California, producing aircraft on an unheard of scale. There, as in the great producing centers of the central states and in New England and the middle east, we have found machine tool salesmen with their sleeves rolled up working with those who have the job of producing things that will defend America."

Other speakers included Philip M. McKenna, McKenna Metals Co., Latrobe, Pa.; and L. B. Gillie, Plastics division, E. I. du Pont de Nemours & Co., Arlington, N. J.

Mr. McKenna predicted that use of new types of carbide tools for cutting steel will confound economists who think of production in terms of conventional methods. He pointed out that with these tools a given amount of tungsten will yield 20 to 60 times as much production as when employed in former ways.

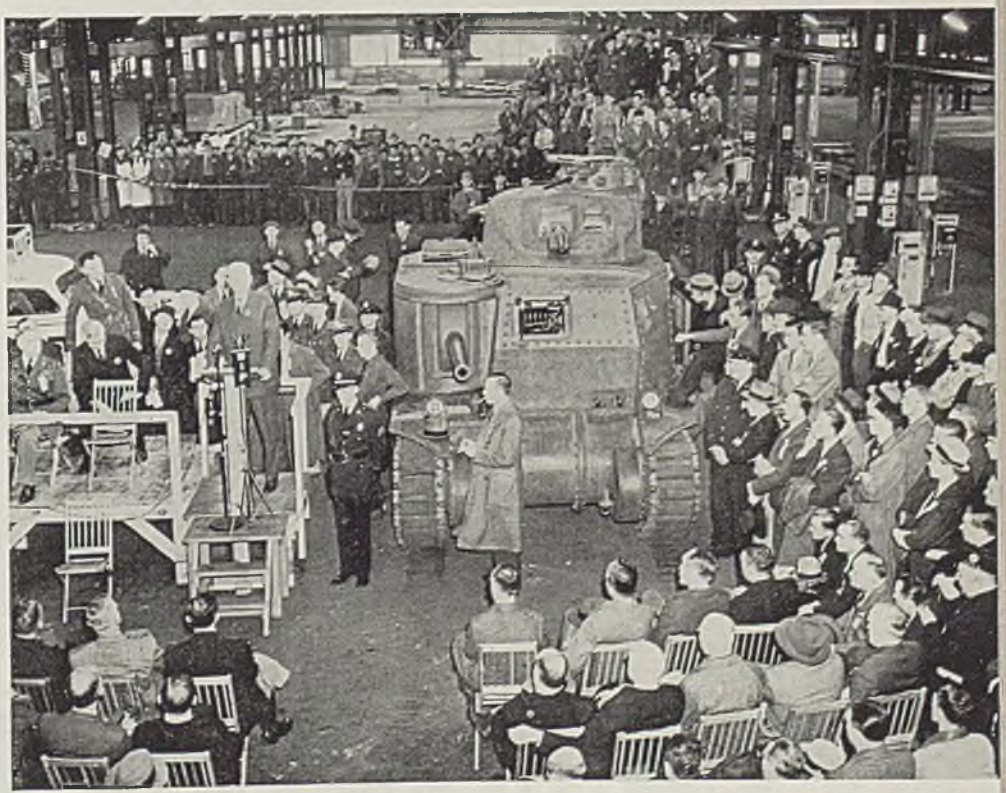
"Plastics will not take the place of metals," said Mr. Gillie. "Although 13 varieties are now in use, to the tune of 160,000,000 pounds annually, they supplement rather than replace metals in production. Their use entails millions of pounds of high-grade die steel and hundreds of precision machine tools for die making —hence this relatively new industry depends heavily upon metallurgists and machine tool builders for its continued development."

✦

M-3 Tanks Rolling from Three Assembly Lines

■ Presentations to the United States Army of the first heavy munitions units to be completed in private plants recently have been occasions for much fanfare and celebration. Within the past few days three companies have turned over the first M-3 tanks, designated "medium" but actually weighing close to 29 tons.

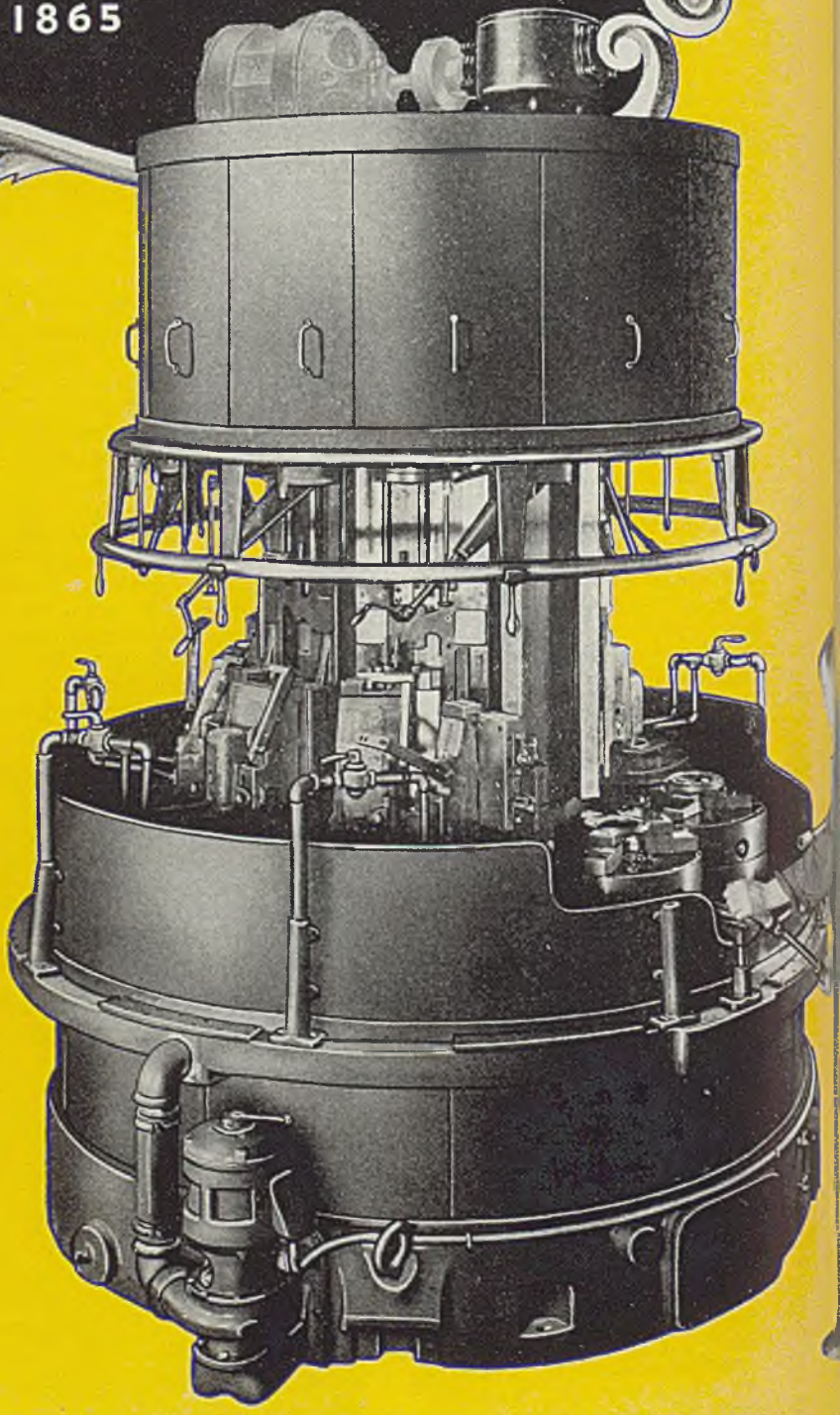
Accompanying photo shows Charles E. Brinley, president, Baldwin Locomotive Works, Eddystone, Pa., presiding at ceremonies when the first unit made by his company was presented to the Army. Chrysler Corp. and American Locomotive Co. also have completed tanks of this type. NEA photo.



"We reckon hours and minutes to be dollars and cents..."

"THOMAS CHANDLER HALIBURTON"

1796 - 1865



MR. HALIBURTON'S thought put the argument for Bullard Mult-Au-Matics into 10 short words. The Mult-Au-Matic Method does save hours and minutes because of the division of the machining operations of any given part between 5 or 7 working spindles, all operating simultaneously at varying speeds and feeds, according to the work being done at each spindle. Thus, the entire part is finished in the time necessary to complete the longest single operation plus a few seconds for indexing.

And as Mr. Haliburton's quotation points out, if the Mult-Au-Matic saves you *time*—it saves you *money*— and is a profitable item to have on your production line.

BULLARD

THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

Mirrors of *MOTORDOM*

By A. H. ALLEN
Detroit Editor, STEEL

Standardized identification and composition ranges for alloy steels a pleasant surprise to car builders. General adoption is considered likely . . . Strike danger in General Motors plants fading, with wage increases up to 5 cents an hour reported offered . . . Ford goes to six-day week temporarily, paying overtime to thousands . . . Deaf mutes operate machine shop . . . Nickel still a sore spot

DETROIT

■ ANNOUNCEMENT of a selected list of 76 standard alloy steels by the technical committee of the American Iron and Steel Institute last week took the automobile industry's metallurgists by surprise. They had known of the two-year study the committee was making and were anxiously awaiting results, but a check at midweek showed no general knowledge of the committee's findings. In fact one metallurgical group had been trying for several weeks without success to obtain a copy of the new alloy steel listings.

Little doubt exists that the industry will go along with the suggestions and revise its heterogeneous steel specifications to conform with the simplified list. Of the three large companies, General Motors comes the closest to conforming with S. A. E. steel numbers and the new standard composition ranges are patterned closely after the S. A. E. system, with a number of improvements. Revision of GM steel specifications will be comparatively simple.

Chrysler identifies steels, and all other materials used in production for that matter, by M. S. (materials standard) numbers. The numbers have no significance, merely being assigned in order as new specifications are evolved. At the moment there are 1865 such standards, several hundred being inactive or canceled because they are no longer in use. Difficulty of remembering what M. S. numbers identify certain steels should suggest to Chrysler the advantage of a change to the newer and simpler system.

Incidentally, Chrysler's Amola steels, used extensively in all of the Chrysler division cars and destined for even wider usage next year, are assigned to the 40xx range of numbers, a new series inasmuch as the S. A. E. never had such a group. Nine classifications are included, from 0.20 per cent carbon to 0.70 per cent. Hitherto Chrysler has listed 12 ranges of Amola, half of them electric furnaces and half open-hearth steels. Recently the electric furnace Amolas were made optional, so there have been in effect only six types, maximum carbon being 0.45 per cent. Thus the new listing adds three more types in the higher carbon ranges.

Ford's system of steel identification involves the use of the letters only—A, AA, E, EE, F, FF, FFF, etc. However, it should not be too difficult to change these to the new listings recommended by the institute.

Preliminary information indicates no listings for the low-alloy high-tensile steels, which are coming into ever widening use, even in the motor car industry. In one sense, these steels, because of their numerous different proprietary analyses, are hybrids and difficult to standardize. However, General Motors is understood to have assigned tentatively the 91xx series for such steels.

One General Motors metallurgist estimates some 300,000 tons of low-alloy high-tensile steels will be consumed this year. Particularly in the defense program are they finding applications, for example, in helmets and light armor plate. They are also being adapted to bus construction, where priorities have pre-empted aluminum sheet supplies. Silicon steels, such as GM 7003 and Ford V; and the chrome-nickel and straight chrome corrosion and heat-resisting steels likewise did not appear in the first published listing of the standardized alloys. It is likely the groups just cited will continue to be specified and identified as at present, constituting a special group of steels apart from the 76 standard types which include the high-manganese, nickel, nickel-chrome, Amola, chrome-molybdenum, nickel-chrome-molybdenum, nickel - molybdenum, low - chromium, chrome - vanadium and silicomanganese steels. Distinction between these two general groupings was outlined in *Mirrors of Motordom* for July 29, 1940.

Showdown on CIO Demands Soon, Believed Necessary

Another "surprise" was the certification of the General Motors labor dispute to the national mediation board, following which the UAW-CIO threat of a nation-wide strike against GM appeared to evaporate, or at least was deferred. The union's plan to pull men out of nondefense plants and keep them in other plants bordered on the ridiculous, since nearly all GM plants are operating on some phase of defense work, either in the planning, tooling or actual production. It would be virtually impossible to segregate workmen in nondefense projects, without interfering vitally with defense work.

Some observers sensed GM officials might, inwardly at least, welcome a strike, even though their plants had to be made the "goats." Some sort of a showdown on the CIO's unrelenting pressure for wage increases, closed shops and other

concessions will have to come before long, and this might have eventuated if the union had been successful in throwing 160,000 men out of work in plants of General Motors.

Negotiations on settlement of union demands have been proceeding here and were transferred to Washington last week. Obviously the corporation will never concede a closed shop, and is reported to have offered wage increases ranging up to 5 cents an hour to hourly rated employes, costing an estimated $12,000,000 annually. Increases demanded by the union would cost $35,000,000.

Olds division of GM at Lansing currently is studying processing details for manufacture of a 20-millimeter aircraft cannon, similar to the Hispano-Suiza type of gun. No inquiries for equipment have been released as yet, it is understood, but a production rate of four an hour is being discussed and equipment needs probably will be outlined shortly.

Ford Steel Plant Back at Near-Peak Operations

In the effort to catch up with schedules for both automobiles and defense work, thrown out of gear by the recent strike, Ford Motor Co. has gone to a six-day week for the first time in many years. Paying time and a half for the overtime involved, benefitting nearly all of the 85,000 workmen at the plant here, the company has scheduled 130,000 cars and trucks for May and likely will continue on the six-day week for several months.

Damage to the Ford open hearths apparently was remedied quickly, since eight of the plant's ten furnaces have been in operation for most of the last two weeks. Most seriously crippled was the 400-ton mixer furnace which "backfired" as the trouble in the plant was reaching its height.

Vanguard of nearly 1000 officers from army camps throughout the nation arrived at the Ford plant recently to inaugurate classes in the new Ford army service school. Thirty officers will be enrolled in a new class to arrive each week, purpose being to instruct officers in the operation and maintenance of military equipment Ford is building for the army, including midget reconnaissance cars, bomber service trucks and officers' staff cars.

Complementing this activity two mobile classrooms have set out on 5000-mile journeys to 16 army posts for training service personnel on the spot. Itinerary will be completed by June 9.

In an abandoned livery at Royal Oak, Mich., is one of the most unusual "industrial plants" in the country, supplying about 5000 water pump pulleys a day to Ford. It is operated and staffed by deaf mutes under direction of Leo H. Kuehn, a tool and die engineer at the Ford plant until 1933 when he opened the Oakland Machine Works to give employment to his fellow-afflicted. With 4000 square feet of floor space and 27 machines, built or reconditioned by Mr. Kuehn, the company finishes about half the daily Ford requirements for pulleys.

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
3 mos.	1,063,981	1,311,949	1,567,271
April	354,266	452,433	.....
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†
April 5	120,055	101,655
April 12	99,260	101,940
April 19	99,945	103,725
April 26	108,165	101,405
May 3	130,610	99,305

†Comparable week.

"Borrows" Nickel To Keep Plating Tank Going

Nickel shortage continues to amaze and belabor plant operators in this district as in all other industrial areas. It amazes because these people cannot understand how the shortage could develop so quickly and it belabors because many plants have come perilously close to shutdowns. One case was that of a company which uses only a small quantity of nickel to operate one plating tank. Recently, supplies of nickel were virtually exhausted, even pieces of scrap from the plant laboratory being pressed into service. Not so much as one pound of nickel could be purchased anywhere, and as a matter of fact $10 worth would have sufficed to keep the tank operating for several weeks. The problem was met by "borrowing" some nickel from a nearby plant. The latter company would not bill the material, but shipped it on the understanding that it would be returned when the recipient was allocated some additional material.

Revision of plating specifications, as outlined here two weeks ago, has been accomplished without much difficulty, the amount of nickel used being reduced from one half to two thirds. Actually, in some cases this has meant an improvement in quality with a reduction in cost—a rare achievement. Use of a high-speed copper plating bath, with reduced nickel, has provided a bright plate to receive the chromium, little or no buffing being required. Cost saving results from the lower price of copper compared with nickel.

Premium To Cancel Order

One explanation of the congestion of steel company order books is the following instance, names obviously being inadvisable. This consumer now has on order about $300,000 worth of steel and uses material at a rate of about 80,000 pounds a month. Shipments have been averaging only 20,000 to 30,000 pounds a month, the balance being made up out of stock. However, the company currently has on order four times the amount of steel needed for peak operations, hoping that each source may be able to ship 25 per cent of the material on order. An official of the company the other day actually was offered a "new hat" if he would cancel one of his steel orders.

Speaking of today's industrial problems, an executive declares, "Give me a depression any time. They are picnics compared to what's going on today." Which probably reflects the convictions of many a business man at the moment.

MEETINGS

Col. Johnson To Speak at Metal Trades Dinner

■ Col. Louis Johnson, former assistant secretary of war, and Leon Turrou, formerly with the Federal Bureau of Investigation, are to be the principal speakers at the annual dinner to be held in conjunction with the forty-third annual convention of the National Metal Trades Association, Palmer House, Chicago, May 8-9. Subjects dealing with priorities, international economic conditions, industrial harmony, employe training, labor and government, Far East conditions, etc., are scheduled for discussion.

Automotive Engineers To Study World's Petroleum Supplies

A feature of the six-day summer meeting of the Society of Automotive Engineers at the Greenbrier, White Sulphur Springs, W. Va., June 1-6, will be an evaluation of petroleum supplies of America and of belligerent countries. Meeting will include 14 sessions.

Conference on Metal Hardening To Be Held in Philadelphia

Conference on hardening of metals under sponsorship of the Philadelphia chapter, American Society for Metals, and the department of physics, University of Pennsylvania, will be held at the University of Pennsylvania, Philadelphia, May 16-17.

Government Financing $1,672,495,000 In New Defense Plants, Equipment

■ DIRECT government awards for new defense plants and equipment from June 13, 1940, to March 31, 1941, totaled $1,672,495,000, according to the National Industrial Conference Board. Awards during March were $126,000,000, of which $75,000,000 was placed by the Army and Navy and $51,000,000 by the Defense Plant Corp. and the Reconstruction Finance Corp.

Awards by the government already have exceeded the corresponding total for the whole World war period. It is estimated that two-thirds of all government-financed plants will eventually be government-owned. Approximately half the total expenditure has been for the production of arms and ammunition, practically all of which will remain government property.

Public and private investment in manufacturing during the first quarter will exceed the previous peak of $871,000,000, in the first quarter of 1920. Certificates of necessity, to permit the writing off of emergency facilities over 60 months, have been issued for $842,000,000 of facilities.

Office of Production Management officials have estimated the total cost of defense plants completed or building at $2,765,000,000.

Subjoined table and chart were compiled by the Conference board from government reports.

Naval Ordnance Spending To Pass $1,500,000,000 by June

During the first nine months of the current fiscal year the Navy's Bureau of Ordnance expended or contracted funds totaling $1,075,000,000, Secretary of Navy Frank Knox reported last week. By June 30, such expenditures will have passed $1,500,000,000.

Comparison of this figure with the 1939-40 total of approximately $185,000,000 and the five-year average of $115,000,000 indicates the expansion that has been necessitated. In addition, the bureau probably will receive allocation of $285,000,000 under lease-lend program.

To complete its expansion program the Navy will require 579,172 tons of steel and 383,660,020 pounds of brass for cartridge cases. Amounts of steel required for various applications: 379,500 tons for armor plate; 165,397 tons for projectiles in sizes from 3 to 16 inches in diameter; 15,250 tons for projectiles for antiaircraft machine guns; 7125 tons for bomb casings; 4400 tons for torpedoes; and 7500 tons for depth charges and mines. Of the brass, 122,366,020 pounds will be required for cartridge cases for navy guns of 3-inch caliber and larger, and 261,294,000 for machine guns and heavy automatic guns.

Following is a list of contractors who have financed expansions, costing $13,156,858.40, with their own funds under the amortization plan:

American Locomotive Co., New York, $500,000.

Danley Machine Specialties Inc., Cicero, Ill., $1,145,000.

Thomas A. Edison Inc., West Orange, N. J., $856,000.

Joshua Kendy Iron Works, San Francisco, $998,343.

Nordberg Mfg. Co., Milwaukee, $2,369,015.

Pennsylvania Forge Corp., Tacony, Philadelphia, $2,473,630.

Carnegie-Illinois Steel Corp., Mingo, O., $2,170,600.

Carnegie-Illinois Steel Corp., Munhall, Pa., $2,275,000.

General Motors Corp., Body Division, Detroit, $369,270.

Government owned plants where the government has provided the funds for new construction, costing $102,059,050, and the company supplies the management:

Hudson Motor Car Co., Detroit, $20,000,000.

Westinghouse Electric & Mfg. Co., Canton, O., $16,150,000.

Lukas-Harold Corp., Indianapolis, $7,500,000.

Reynolds Corp., Macon, Ga., $1,660,050.

Westinghouse Electric & Mfg. Co., Louisville, Ky., $4,750,000.

General Machinery ordnance plant, South Charleston, W. Va., $1,645,000.

Carnegie-Illinois Steel Co. armor plant, South Charleston, W. Va., $50,354,000.

Plants expansions financed directly by the government have totaled $69,990,729.20, as follows:

Bethlehem Steel Co., Bethlehem, Pa., $23,491,700.

Busch-Sulzer Bros., St. Louis, $706,059.

Camden Forge Co., Camden, N. J., $3,235,845.

Consolidated Steel of Los Angeles, Los Angeles, $128,000.

Crucible Steel Co. of America, Harrison, N. J., $2,341,512.20.

Danly Machine Specialties Inc., Cicero, Ill., $2,213,173.

E. I. du Pont de Nemours Inc., Indian Head, Md., $3,559,300.

Erie Forge Co., Erie, Pa., $1,136,124.

General Electric Co., Schenectady, N. Y., $18,367,706.

Goss Printing Press Co., Chicago, $505,490.

Midvale Co., Nicetown, Philadelphia, $12,970,200.

Struthers Wells-Titusville Corp., Titusville, Pa., $907,720.

Willys Overland, Toledo, O., $427,900.

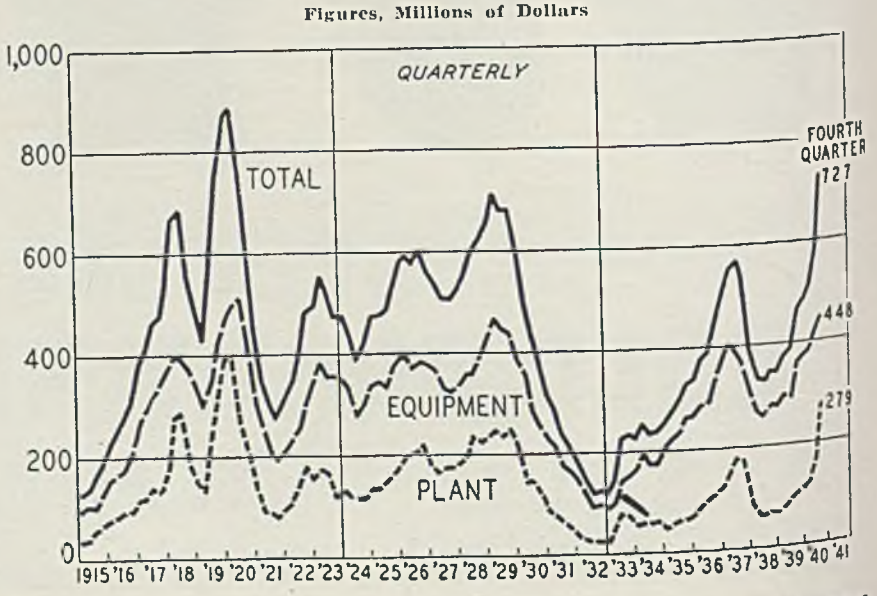
Government-Financed Expansions by Regions

(In Thousands of Dollars)

	Shipbuilding	Aircraft, Parts	Arms, Ammunition, Explosives	Tanks, Machine Tools	Miscellaneous	Total	Percentage Distribution
New England	21,240	26,789	9,955	1,386	3,509	62,879	3.8
Middle Atlantic	47,073	78,681	29,594	3,027	58,321	216,696	13.0
East North Central	2,241	281,337	275,473	32,750	59,567	651,368	38.9
West North Central	.....	44,281	177,585	.....	291	222,157	13.3
South Atlantic	14,239	2,730	110,755	.....	15,373	143,097	8.6
East South Central	4,500	2,505	71,763	.....	48,701	127,469	7.6
West South Central	6,854	28,985	8,007	.....	27,357	71,203	4.3
Mountain	.....	.....	28,862	.....	.....	28,862	1.7
Pacific	38,429	53,502	7,548	.....	4,285	103,764	6.2
Unnamed	.....	.....	35,000	10,000	.....	45,000	2.7
United States	134,576	518,810	754,542	47,163	217,404	1,672,495	100.0

Investment in New Manufacturing Facilities

Figures, Millions of Dollars



Plant Expansion, Shipbuilding, Plane Contracts Top Week's Defense Awards

■ EXPANSION of facilities for defense manufacture, aircraft and ship awards comprised the larger share of government defense contracts reported last week by the War and Navy departments. Total of contracts reported for the period was $190,467,854, somewhat higher than aggregate in most recent weeks. Purchases of the War department's ordnance division and the Navy's bureau of supplies and accounts were also heavy.

Contracts reported last week by the War department:

Boeing Aircraft Co., Seattle, $17,201,352 for airplanes and spare parts.

Curtiss Wright Corp., Buffalo, supplemental agreements to lease made Dec. 31, 1940, by the Defense Plant Corp. for expansion of airplane manufacturing facilities. Supplemental agreements total $4,503,494, are for additional machinery and equipment, for revision in construction and for land improvements at Curtiss Wright plants at Columbus, O., St. Louis, and Buffalo.

Goodyear Aircraft Corp., subsidiary of Goodyear Tire & Rubber Co., Akron, O., agreement to $3,642,280 lease by the Defense Plant Corp. for new plant facilities. Located at or near Akron, new plant will be for manufacture of airplane wings and control surfaces.

Metallurgical Products Inc., Shreveport, La., $125,000 for additional facilities for production of powdered iron carbonyl.

Pullman Standard Car Mfg. Co., Chicago, $1,108,901 for rehabilitation of existing buildings, erection of new structures, acquisition and installation of machinery and equipment for the manufacture of outer wing assemblies and spare parts for Douglas Aircraft Corp., prime contractor.

United Aircraft Corp., Pratt & Whitney Aircraft Division, East Hartford, Conn., aircraft engines, $1,749,639.

Air Corps Awards

Aluminum Co. of America, Pittsburgh, aluminum foil, $165,563.78.

Black Hawk Mfg. Co., Milwaukee, jack assemblies, $69,120.

Brown & Sharpe Mfg. Co., Providence, R. I., gages, $4720.

Case, J. I., Co., Racine, Wis., tractor-mowers, $165,060.

Chandler-Evans Corp., South Meriden, Conn., maintenance parts, $132,610.

Continental Electric Co. Inc., Newark, N. J., power plants, $154,998.

Curtiss-Wright Corp., Curtiss Propeller Division, Caldwell, N. J., blade assemblies, $147,434.

Dietzgen, Eugene, Co., Chicago, blueprint filing sections, $68,727.50.

Edgewater Steel Co., Pittsburgh, adapter assemblies, $158,492.75.

Fairchild Aviation Corp., Jamaica, N. Y., computer assemblies, $472,479.

General Motors Corp., Allison Division, Indianapolis, engines, $96,016.50.

Goodyear Tire & Rubber Co., Akron, O., wheel and brake assemblies, $822,510.

Hanson-Whitney Machine Co., Hartford, Conn., pipe gages, $57,832.32.

Hayes Industries Inc., Jackson, Mich., wheel and brake assemblies, $112,499.

Lindberg Engineering Co., Chicago, electric furnaces, $77,504.

Lufkin Rule Co., Saginaw, Mich., gages, $63,540.

Lyon Metal Products Inc., Aurora, Ill., steel shelving, $88,895.92.

Mallory, P. R., & Co., Indianapolis, shackle releases, $85,800.

Niles-Bement-Pond Co., Pratt & Whitney Division, West Hartford, Conn., pipe gages, $196,850.34.

Pump Engineering Service Corp., Cleveland, fuel and vacuum pumps, $470,265.74.

Quincy Compressor Co., Quincy, Ill., compressors, $68,917.20.

Republic Steel Corp., Berger Mfg. Division, Canton, O., boxes and racks, $81,439.67.

Ryerson, Joseph T., & Son Inc., Chicago, seamless steel tubing, $95,826.27.

Sperry Gyroscope Co. Inc., Brooklyn, N. Y., instruments, $116,000.

Standard Gage Co. Inc., Poughkeepsie, N. Y., pipe gages, $3541.10.

Corps of Engineers Awards

Aldrich, W. J., San Antonio, Tex., temporary buildings of hospital group, Randolph field, Texas, $47,732.

American Concrete & Steel Pipe Co., South Gate, Calif., reinforced concrete pipe and inlet stubs, Tucson municipal airport, Arizona, $9674.70.

American Instrument Co., Silver Spring, Md., heliotropes, $2113.20.

American Steel & Wire Co., Cyclone Fence Division, Newark, N. J., chain link fence and retaining wall, U. S. engineer storeyard, Albany, N. Y., $3791.50.

American Type Founders Sales Corp., Elizabeth, N. J., rotary presses, $16,661.

Berger, C. L., & Sons Inc., Roxbury, Mass., vertical collimators, $4255.50.

Bucyrus-Erie Co., South Milwaukee, Wis., well drilling machines, $9015.

Buda Co., Harvey, Ill., repair parts for earth auger, $25,913.92.

Caddell Dry Dock & Repair Co. Inc., Staten Island, N. Y., repairing U. S. steam lighter, $4983.

Carey Machinery & Supply Co., South Bend, Ind., bench lathes, $9913.08.

Castle, A. M., & Co., Seattle, structural steel, $2391.97.

Caterpillar Tractor Co., Peoria, Ill., tractors, diesel generating sets, $12,831.27.

Christy & Baskett, San Antonio, Tex., temporary warehouse, Brooks field, San Antonio, Tex., $15,390.

Consolidated Supply Co., Portland, Oreg., steel pipe, $4860.37.

Detroit Steel Products Co., Detroit, casement steel windows, Langley field, Virginia, $7276.56.

DeVilbiss Co., Toledo, O., paint spraying units, $9677.14.

Dominic Nero Construction Co., Cleveland, new runways and widening existing runways, Cleveland municipal airport, Ohio, $186,086.

Evans, George H., & Co., Philadelphia, hangar and control tower, Middletown air depot, Pennsylvania, $105,768.

Franceschi Construction Co., San Francisco, buildings, Bakersfield, Calif., $909,200.

Fruehauf Trailer Co., Kansas City, Kans., trailers, $4,286,506.

General Electric Supply Corp., Boise, Idaho, parkway cable, $5120.46.

Gulf Bitulithic Co., Austin Road Co., and Texas Bitulithic Co., Dallas, Tex., construction of aprons, Ellington field, Texas, $1,056,643.32.

Hobart Bros. Co., Troy, O., welding outfits, $8193.78.

Ingersoll-Rand Co., Athens, Pa., woodboring machines, $4823.60.

Kearney & Trecker Corp., West Allis, Wis., milling machines, $7420.

LeTourneau, R. G., Inc., Peoria, Ill., carryalls, $74,416.

Lo Prest, A. C., Co., Cleveland, metal ventilators, $2100.

Maloney Electric Co., St. Louis, transformers and current regulators, $8227.11.

Maple, John T., Tampa, Fla., electrical installations, MacDill field, Florida, $5240.

Marine Iron & Ship Building Co., Duluth, repairing dump scow, $1562.76.

National Builders Inc., Minneapolis, construction of hospital, Scott field, Illinois, $613,379.

Nelson, N. P., Iron Works Inc., Passaic, N. J., conveyor loaders, $4610.

Nielsen, Niels R., Denver, temporary school buildings, Lowry field, Denver, $47,981.

Okonite Co., Wilkes-Barre, Pa., copper cable, $19,770.

Potts Mfg. Co., Mechanicsburg, Pa., wrought iron railing, Washington national airport, Gravelly Point, D. C., $2375.

Roy, J. G., & Sons Co., Springfield, Mass., bridge street pumping station, West Springfield, Mass., $90,143; temporary service buildings, Westover field, Chicopee Falls, Mass., $79,900.

Saltzman, J. G., Inc., New York, aerophoto enlargers, $7020.

Schiemann, Charles A., Chicago, steam service line, Chanute field, Illinois, $22,689.

Seattle Steel Co. Inc., Seattle, steel bars, $2523.40.

Seerie, Peter, Denver, two temporary school buildings, Ft. Logan, Colorado, $57,927.

Sheets, W. A., & Sons Inc., Ft. Wayne, hangar and control tower, Ft. Wayne airport, Indiana, $103,227.

Sidney Machine Tool Co., Sidney, O., engine lathes, $4791.

Smith, William A., Construction Co., Houston, Tex., railroad tracks, Ellington field, Texas, $28,300.

Tovell, G. Walter, Inc., Baltimore, fire control towers, Kent and Sussex counties, Delaware, $46,480.

Twaits, Ford J., Co., Los Angeles, temporary buildings, Mather field, California, $1,311,015.

Vance Electric Service, Salt Lake City, Utah, power plant and electric distribution system, Wendover bombing range, Utah, $54,785.34.

Western Engineering Co., Portland, Oreg., heating and air conditioning plant, engineers cantonment, Glenhaven school, Portland, Oreg., $13,808.35.

Wilaka Construction Co., New York, construction of temporary buildings and utilities, Windsor Locks airfield, Connecticut, $919,000.

York Corrugating Co., York, Pa., corrugated pipe, $2850.

Zarkin Machine Co. Inc., New York, plate grainers, $5190.

Ziebarth, Fritz, Long Beach, Calif., pumping plant, Tucson municipal airport, Arizona, $28,890.

Quartermaster Corps Awards

Adams, S. G., Co., St. Louis, mess trays, $5700.

Aluminum Products Co., LaGrange, Ill., water pitchers, $8400.

Bellaire Enamel Co., Bellaire, O., frying pans, $1295.

Bootz, William R., Evansville, Ind., component parts, accessories and equipment for field ranges, $123,575.50.

Damascus Steel Products Corp., Rockford, Ill., butchers' cleavers, $5200.

Equitable Equipment Co., New Orleans, steel cargo barge, $14,850.

General Motors Corp., Chevrolet Division, Detroit, 1½-ton cargo trucks and chassis, $4,291,616.60.

Geuder, Paeschke & Frey Co., Milwaukee, dish pans, water pitchers, $29,249.25.

Guest Engineering Co., Chicago, cold storage walk-in cooler, Billings general hospital, Ft. Benjamin Harrison, Indiana, $10,653.

Harris-McBurney Co., Jackson, Mich.,

electric distribution system, Ft. Custer, Michigan, $12,000.
Hecker Products Corp., Indianapolis, tin containers, $500.
Jones, J. A., Construction Co., Charlotte, N. C., incinerator superstructures, Ft. Jackson, South Carolina, $6200.
Louisville Tin & Stove Co. Inc., Louisville, Ky., water heater shields, $520.
Randall Construction Co. Inc., Amarillo, Tex., radio transmitter building, English field, Amarillo, Tex., $6995.
Republic Steel Corp., Birmingham, Ala., steel for protective decking on cargo barge, $3135.40.
Rogers Electric Co., Birmingham, Ala., electrical distribution system, Atlanta general depot, Georgia, $73,282.
Savory Inc., Buffalo, skimmers and measures, $6135.
Singleton, Neill, Amarillo, Tex., clinical laboratory, Ft. Sill, Oklahoma, $14,700.
Stratton & Terstegge Co., Louisville, Ky., butchers' saws and tongs, $2280.
United States Gauge Co., Sellersville, Pa., air pressure gages, $6500.
Utica Cutlery Co., Utica, N. Y., boning knives, $3366.90.
Vaughan Novelty Mfg. Co., Chicago, can openers, $4785.
Walters Construction Co. Inc., Woodside, N. Y., gasoline and oil station, Ft. Tilden, New York, $4860.
Weinstein, S., Supply Co., New York, wrenches, $527.10.

Medical Corps Awards

Acme Shear Co., Bridgeport, Conn., scissors, $1100.
Blickman, S., Inc., Weehawken, N. J., hospital equipment, $149,030.97.
Clauss Shear Co., Fremont, O., scissors, $9000.
Comper Mfg. Co., Pittsfield, Mass., orthopedic and X-ray tables, $32,769.46.
Emmerich Schmid Inc., Indianapolis, nasal turbinate knives, $29,780.
Harris Hub Bed & Spring Co., Cicero, Ill., hospital equipment, $179,219.95.
Howe Scale Co., Rutland, Vt., physicians' scales, $8379.
Legion Utensils Corp., Long Island City, N. Y., mess equipment, $24,906.42.
McKesson Appliance Co., Toledo, O., anesthesia apparatus, $26,880.
Penn Surgical Mfg. Co. Inc., Philadelphia, surgical instruments, $16,592.50.
Pilling, George P., & Son Co., Philadelphia, mastoid retractors, $1804.80.
Sklar, J., Mfg. Co., Long Island City, N. Y., surgical instruments, $108,456.50.
Superior Sleeprite Corp., Chicago, nurses' desks, $36,794.84.
Vollrath Co., Sheboygan, Wis., irrigators, $10,040.20.

Signal Corps Awards

American Automatic Electric Sales Co., Chicago, telephones, $8550.
Bell & Howell Co., Chicago, motion picture projectors, $48,625.90.
Bendix Aviation Corp., Julian P. Friez & Sons Division, Baltimore, wind vanes, $6500.
Buckingham, W. H., Binghamton, N. Y., pole climbers, $18,550.
Empire Sound Service, Racine, Wis., interphone equipment, $646.31.
Flockhart Foundry Co., Newark, N. J., manhole tops, $8952.
Folmer Graflex Corp., Rochester, N. Y., cameras, $1822.37.
General Electric Co., Schenectady, N. Y., handle levers, $498.
Goulds Pumps Inc., Seneca Falls, N. Y., fuel pumps, $1144.65.
Highway Trailer Co., Edgerton, Wis., cable reel trailer, $582.30.
Homelite Corp., Port Chester, Pa., power units, $2926.34.
Janette Mfg. Co., Chicago, converters, $486.99.
Kaufman, H., & Co. Inc., Newark, N. J., casing assemblies, $1120.
Kellogg Switchboard & Supply Co., Chicago, equipment, switchboards, $4440.
Link, Fred M., New York, miscellaneous radio equipment, $588,760.
Manning, Maxwell & Moore Inc., Chicago, clamps, $5426.67.
Medo Photo Supply Corp., New York, printers and dryers, $2523.75.
Neumade Products Corp., Buffalo, film rewinders, racks, $3335.
Onan, D. W., & Sons, Minneapolis, electric plants, $2177.50.
Philco Corp., Philadelphia, storage and equipment batteries, $1205.45.
Standard Transformer Co., Warren, O., distribution transformers, $21,210.42.
Teletype Corp., Chicago, teletype equipment, $19,473.40.
Walter Bros. Co. Inc., Chicago, axles, $960.
Warren Foundry & Pipe Corp., Phillipsburg, N. J., manhole tops, $6325.
Webster-Chicago Corp., Chicago, interphone equipment, $1001.56.
Western Electric Co. Inc., New York, switchboard equipment, relays, $44,856.20.
Westinghouse Electric & Mfg. Co., Baltimore, transformers, $893.40.
Wilson, W. S., Corp., Cortland, N. Y., bolts, $633.

Ordnance Department Awards

Accurate Parts Mfg. Co., Cleveland, valve spring testers, $1959.20.
Accurate Tool Co., Newark, N. J., gages, $4755.
Acme Industrial Co., Chicago, gages, $3025.70.
Aetna Standard Engineering Co., Youngstown, O., pilot top carriage, $30,000.
Aluminum Co. of America, Cleveland, ingots, $9560.
American Brass Co., Waterbury, Conn., strip brass, $40,214.24.
American Foundry Equipment Co., Mishawaka, Ind., parts for wheelabrators, $2414.32.
American Steel & Wire Co. & Plymouth Cordage Co., Plymouth, Mass., wire rope, $2925.
Ames, B. C., Co., Waltham, Mass., gages, $6235.
Apex Tool & Cutter Co. Inc., Shelton, Conn., tools, $3636.
Austin-Hastings Co. Inc., Cambridge, Mass., precision lathes, $9444.
Automatic Machine Products Co., Attleboro, Mass., bodies for primer, $17,520.30.
Automotive Maintenance Machinery Co., North Chicago, Ill., tools, $6528.81.
Barker Tool Die & Gauge Co., Detroit, gages, $2530.
Beard, L. O., Tool Co., Lancaster, Pa., reamers, $2387.90.
Belmont Iron Works, Philadelphia, steel, $15,356.
Belmont Smelting & Refining Works Inc., Brooklyn, N. Y., solder, $3948.
Bendix Aviation Corp., South Bend, Ind., carburetor bodies, $2146.50; Eclipse Aviation Division, Bendix, N. J., parts for light tanks, $7063.75.
Benrus Watch Co., Waterbury, Conn., gears, $22,500.
Bliss, E. W., Co., New York, parts for hydraulic presses, $1226.
Boyar-Schultz Corp., Chicago, gages, $3870.
Brass Goods Mfg. Co., Brooklyn, N. Y., gilding metal, $135,965.
Breeze Corp. Inc., Newark, N. J., light tank parts, $6330.
Brown & Sharpe Mfg. Co., Providence, R. I., gages, grinders, $2658.68.
Brust Tool Mfg. Co., Chicago, gages, $1850.
Burroughs Adding Machine Co., Detroit, bookkeeping machines, $2005.20.
C. & G. Tool Co., East Orange, N. J., fixtures, $2880.
Carboloy Co. Inc., Detroit, tools, $1640.
Carpenter Steel Co., Reading, Pa., tool steel, $2243.50.
Challenge Machinery Co., Grand Haven, Mich., surface plates, $1017.90.
Chase Brass & Copper Co. Inc., Waterbury, Conn., bar brass, $2147.93.
Cincinnati Milling Machine & Grinders Inc., Cincinnati, grinders, $7667.45.
Clapp, E. D., Mfg. Co., Auburn, N. Y., crankshafts, drop forgings, $3832.
Cleveland Cutter & Reamer Co., Cleveland, tools, $1120.
Cleveland Twist Drill Co., Cleveland, drills and counterbores, $1188.
Colman, Frederick, & Sons Inc., Detroit, gages, $2110.
Colt's Patent Fire Arms Mfg. Co., Small Arms Division, Hartford, Conn., small arms materiel, $79,600.
Consolidated Steel Warehouse Co., Philadelphia, reinforcing steel, $1804.43.
Continental Motors Corp., Detroit, medium tank parts, $30,445.78.
Cortland Grinding Wheels Corp., Chester, Mass., grinding wheels, $1156.26.
Cowles Tool Co., Cleveland, tools, $14,035.
Crucible Steel Co. of America, New York, steel, $4490.78.
Cutler-Hammer Inc., Chicago, starter switches, $1008.
Daniels, C. R., Inc., New York, cases, $10,905.30.
Darwin & Milner Inc., Philadelphia, steel, $1254.
Derbyshire Machine & Tool Co., Philadelphia, tools, $4380.
Detroit Seamless Steel Tubes Co., Dearborn, Mich., seamless tubing, $1724.63.
Diamond Calk Horseshoes Co., Duluth, adjustable wrenches, $1523.81.
Donaldson Co. Inc., St. Paul, air cleaners, $5283.60.
Driver-Harris Co., Harrison, N. J., alloy baskets, $1102.
Ex-Cell-O Corp., Continental Tool Works Division, Detroit, broaches, tools, $5137.40.
Fellows Gear Shaper Co., Springfield, Vt., hobs, $2721.60.
Fidelity Machine Co., Philadelphia, die holders, $1155.
Finkl, A., & Sons Co., Chicago, blocks, $1363.65.
Firth Sterling Steel Co., Hartford, Conn., tools, bits, steel, $12,104.41.
Foster, L. B., Co., Chicago, equipment, $5104.78.
Fox Munitions Corp., Philadelphia, gages, plugs and pins, $8351.
Frick-Gallagher Mfg. Co., Wellston, O., rotabin units, $1435.20.
Gairing Tool Co., Detroit, tools, $2172.52.
General Electric Co., Davenport, Iowa, motor-generators, $1049.
General Mfg. Co., Detroit, straightening presses, $3775.
General Motors Corp., New Departure Division, Bristol, Conn., ball bearings, $2967.22.
Geometric Tool Co., New Haven, Conn., chasers, $5410.
Gleason Works, Rochester, N. Y., machines, $17,444.60.
Globe-Wernicke Co., Cincinnati, card record sections, $1645.92.
Gould & Eberhardt, Newark, N. J., shapers, $2507.
Greenfield Tap & Die Corp., Greenfield, Mass., gages, $1339.28.
Guiberson Diesel Engine Co., Dallas, Tex., parts for light tanks, $33,079.85.
Hampden Electric Supply Co., Springfield, Mass., electrical equipment, $1917.60.
Hanson-Whitney Machine Co., Hartford, Conn., gages, $1988.14.
Hartford Electric Steel Corp., Roxbury, Mass., steel castings, $10,137.60.
Hein-Werner Motor Parts Corp., Waukesha, Wis., hydraulic jacks, $1029.60.
Hoe, R., & Co., New York, artillery materiel, $97,697.89.
Illinois Tool Works, Chicago, cutters, $1054.80.
Independent Pneumatic Tool Co., Chicago, hammers, holders, grinders, $1640.
International Engineering Works Inc., Framingham, Mass., bronze clips, $1467.33.
JCH Automatic Machine Works, Philadelphia, knurls, $3775.
Jorgan Co., Rochester, N. Y., grinding machines, $1935.
Karp Metal Products Co. Inc., Brooklyn, N. Y., tool boxes, $31,796.50.
Kenly, Templeton & Co., Chicago, jacks, $2181.60.
Kingsbury Machine Tool Co., Keene, N. H., automatic indexing station machines, $11,162.
Landis Machine Co. Inc., Waynesboro,

Pa., high speed chasers, $22,040.50.
Lapointe Machine Tool Co., Hudson, Mass., broaching equipment, $18,026.
LaSalle Steel Co., Hammond, Ind., steel, $6527.75.
Latrobe Electric Steel Co., Latrobe, Pa., tool steel, $2498.08.
Lima Gear Shift Drive Co., Lima, O., drive units, $2594.20.
Lincoln Park Tool & Gage Co., Lincoln Park, Mich., gages, $4007.10.
Lite Mfg. Co., New York, tool rolls, $4418.70.
Louisville Electric Mfg. Co., Louisville, Ky., power hacksaws, $2903.75.
Lowell Wrench Co., Worcester, Mass., reversible wrenches, $38,600.50.
Lufkin Rule Co., Saginaw, Mich., gages, rules, $1411.60.
Lyon Metal Products Inc., Davenport, Iowa, tote boxes, $1620.
Manning, Maxwell & Moore Inc., Bridgeport, Conn., pressure gages, $19,560.
Mattison Machine Works, Rockford, Ill., sawing machines, $2348.
McArdle & Cooney, Philadelphia, steel panels, $1820.
McKenna Metals Co., Latrobe, Pa., tools, $11,630.
Merz Engineering Co., Indianapolis, gages, $5180.69.
Midwestern Tool Co., Chicago, gages, $2298.
Modern Tool & Die Co., Philadelphia, gages, $3745.
Moore Special Tool Co. Inc., Bridgeport, Conn., tools, $21,295.
Mueller Brass Co., Port Huron, Mich., brass rod, $1239.84.
Mutual Wheel Co., Moline, Ill., disc and rim couplings, $1743.20.
New Britain Machine Co., New Britain, Conn., bench legs, $2350.
New Process Gear Corp., Syracuse, N. Y., traversing mechanisms, $2500.
Niles-Bement-Pond Co., Pratt & Whitney Division, West Hartford, Conn., drills, $30,930.
Otis Elevator Co., Philadelphia, modify freight elevators at Frankford arsenal, Pennsylvania, $4382.
Parent Metal Products Inc., Philadelphia, cabinets, office equipment, $1488.49.
Peerless Tool & Engineering Co., Chicago, gages, $15,380.
Philadelphia Engineers, Philadelphia, tools, $3878.
Philco Corp., Storage Battery Division, Philadelphia, storage batteries, $1550.40.
Pipe Machinery Co., Cleveland, gages, $1878.40.
Poor & Co., Canton Forge & Axle Division, Canton, O., drop forgings, $1096.20.
Pope Trading Corp., New York, pig tin, $10,680.
Powers, E. C., & Son, Philadelphia, air supply systems, $2755.
Precision Mfg. Co., Philadelphia, gages, $2740.
Prentiss Vise Co., New York, vises, $16,266.50.
Putnam Tool Co., Detroit, countersinks and end mills, $4011.50.
Quality Tool & Die Co., Indianapolis, gages, $6605.15.
Reading Chandelier Works, Reading, Pa., lighting fixtures, $3670.40.
Remington Arms Co. Inc., Bridgeport, Conn., cartridges, $8139.60.
Republic Steel Corp., Cleveland, hot-rolled steel, cold-drawn steel, $51,013.43.
Rickert-Shafer Co., Erie, Pa., gaging machines, $1200.
Rivett Lathe & Grinder Inc., Brighton, Mass., bench lathes, $1819.85.
Roessler Machine Co., Elkins Park, Pa., tools, $37,991.
Russell, J., & Co. Inc., Holyoke, Mass., bench legs, $1256.
Rustless Iron & Steel Corp., Baltimore, steel, $13,471.52.
Ryerson, Joseph T., & Son Inc., Chicago, carbon steel, $4261.89.
Salem Engineering Co., Salem, O., annealing furnaces, $49,870.
Seamless Products Co. Inc., New York, oil cans, $4960.
Service Caster & Truck Co. of New England, Somerville, Mass., oil hydraulic lifts, $1575.
Shaw-Walker Co., Muskegon, Mich., filing cabinets, $1365.80.
Sheffield Gage Corp., Dayton, O., gages, $9773.49.
Silent Hoist Winch & Crane Co., Brooklyn, N. Y., electrical capstans, $1560.
Smith, J. B., Co., Philadelphia, lids for cans, $1407.
South Bend Lathe Works, South Bend, Ind., bench lathes, $8983.50.
Springfield Stamp & Die Co., Springfield, Mass., steel stamps, $1076.
Standard Pressed Steel Co., Jenkintown, Pa., office equipment, $1880.70.
Star Machine & Tool Co., Cleveland, gages, $1338.
St. Pierre Chain Corp., Worcester, Mass., forgings, $23,310.
Stedfast & Roulston Inc., Boston, drilling machines, $23,040.
Stromberg Time Corp., New York, recorders, $3925.
Swind Machinery Co., Milwaukee, milling machines, $8220.
Taft-Peirce Mfg. Co., Woonsocket, R. I., gages, $1006.
Talon Inc., Meadville, Pa., gages, $8186.50.
Threadwell Tap & Die Co., Greenfield, Mass., rifling heads, $4600.
Thurston Mfg. Co., Providence, R. I., cutters, $1400.
Titeflex Metal Hose Co., Newark, N. J., light tank parts, $2853.75.
Tools & Gages Inc., Cleveland, gages, $15,378.
Torq Electric Mfg. Co., Cleveland, motor drive attachments, $8323.
Torrington Co., Torrington, Conn., ball bearings, $1506.20.
Tungsten Electric Corp., Union City, N. J., tools, $10,325.
Union Hardware Co., Torrington, Conn., rifle cleaning rods, $10,762.50.
Union Twist Drill Co., Athol, Mass., cutters, tools, $13,320.20.
Vascoloy-Ramet Corp., North Chicago, Ill., tools, $1720.
Vulcan Mold & Iron Co., Latrobe, Pa., chill molds, $32,913.38.
Walker Mfg. Co. of Wisconsin, Racine, Wis., jacks, battery accessories, $3345.36.
Wallace Barnes Co., Bristol, Conn., lock wires, $6261.
Walter Bros. Co. Inc., New York, funnels, $1815.51.
Warner, George W., & Co. Inc., New York, wrenches, $3037.65.
Waterbury-Farrell Foundry & Machine Co., Waterbury, Conn., blanking and cupping presses, $2925.
Weiss, Albert, New York, compression machines, $3904.80.
Weldon Tool Co., Cleveland, holders, cutters, $1779.36.
Wellman, S. K., Co., Cleveland, facings, rivets, $2962.78.
Western Cartridge Co., Winchester Repeating Arms Co. Division, New Haven, Conn., cartridges, $2150.
West Virginia Rail Co., Huntington, W. Va., equipment, $1300.50.
White Motor Co., Cleveland, scout car parts, $1463.41.
Whitman & Barnes, Detroit, drills, $3762.
Wiedemann Machine Co., Philadelphia, gages, $9550.50.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill., oil gears, $11,500.
Wright Aeronautical Corp., Paterson, N. J., medium tank parts, $2921.42.
Yale & Towne Mfg. Co., Philadelphia, lift trucks, $2304.
Yellow Truck & Coach Mfg. Co., General Motors Truck & Coach Division, Pontiac, Mich., spare parts for service trucks, $22,125.34.

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Following awards were reported by the Navy department:

Atwood & Merrill Co., Salem, Mass., expansion of contractor's shipbuilding facilities at Salem, including structures and additional tools and equipment, $209,000.
Carrier Corp., Syracuse, N. Y., manufacture of ordnance equipment items, $1,088,986.
Edo Aircraft Corp., College Point, Long Island, N. Y., additional expansion of facilities for manufacture of aircraft parts and accessories, $43,326.
Electrol Inc., Kingston, N. Y., additional plant facilities for manufacture of aircraft parts and accessories, $393,462.
General Electric Co., Schenectady, N. Y., manufacture of ordnance equipment items on a cost plus fixed fee basis, $21,216,471.
Los Angeles Shipbuilding & Drydock Corp., San Pedro, Calif., three seaplane tenders at total cost of $39,750,000 on a cost plus fixed fee basis. Contract was a reassignment of one formerly held by Sun Shipbuilding & Drydock Co., Chester, Pa., and canceled by mutual agreement between the Navy department and the company that latter might undertake work for the Maritime Commission.
Midvale Co., Nicetown, Philadelphia, was awarded a $12,970,200 contract for acquisition and installation of special additional equipment and facilities at Midvale's plant at Nicetown. Contract to be fulfilled without profit or fee to the contractor.
Pollak Mfg. Co., Arlington, N. J., ordnance items, $1,156,932.
Tampa Shipbuilding Co. Inc., Tampa, Fla., three destroyer tenders at total of $40,257,000 on a cost plus fixed fee basis. Contract was a reassignment of one formerly held by Sun Shipbuilding & Drydock Co., Chester, Pa., and canceled by mutual agreement between the Navy department and the company that latter might undertake work for the Maritime Commission.
Titeflex Metal Hose Co., Newark, N. J., additional plant facilities for fabrication of airplane parts and accessories, $375,000.
United Aircraft Corp., Vought-Sikorsky Aircraft Division, Stratford, Conn., further expansion of facilities for manufacture of aircraft parts and accessories, $365,918.
Worthington Pump & Machinery Corp., Holyoke, Mass., additional facilities for manufacture of airplane parts and accessories, $129,700.

Bureau of Supplies and Accounts Awards

American Brass Co., Waterbury, Conn., copper-nickel alloy tubing, boat facings, $37,628.62.
American-LaFrance Foamite Corp., Elmira, N. Y., fire extinguishers, $18,678.31.
American Mason Safety Tread Co., Lowell, Mass., treads, $53,100.
American Steel & Wire Co., Cleveland, electric cable, $5743.
Anaconda Wire & Cable Co., New York, electric cable, $50,733.30.
Apollo Steel Co., Apollo, Pa., flat sheet steel, $84,444.
Atlas Car & Mfg. Co., Cleveland, industrial trucks, $11,324.
Babcock & Wilcox Tube Co., Beaver Falls, Pa., boiler tubes, $39,410.79.
Baldwin Locomotive Works, Baldwin-Southwark Division, Philadelphia, planing machines, $105,500.
Barber-Coleman Co., Rockford, Ill., gear hobbing machines, $9896.
Bendix Aviation Corp., Brooklyn, N. Y., equipment, spare parts and tools, $22,897.50.
Benson, L. A., Co. Inc., Baltimore, carbon and high speed steel countersinks and reamers, $46,846.78.
Bogue Electric Co., Paterson, N. J., motor generator set, $5629.
Brooklyn Metalware Corp., Brooklyn, N. Y., steel paint pots, $7168.80.
Brown & Sharpe Mfg. Co., Providence, R. I., grinding machine, milling machines, $82,599.06.
Budd, Edward G., Mfg. Co., Philadelphia, inner smoke pipe, $590,612.
Bullard Co., Bridgeport, Conn., turret lathes, $25,316.72.
Carnegie-Illinois Steel Corp., Pittsburgh,

(*Please turn to Page* 130)

Institute Lists 76 Alloy Steels as Standard, To Increase Efficiency

■ TO INCREASE efficiency in production of steel by encouraging a reduction in the number of kinds of steel ordered, the General Technical Committee of the American Iron and Steel Institute has selected a list of 76 standard alloy steels, the result of a two-year study of the needs of consumers. The list, with all pertinent information, has been published in the form of a manual, copies of which may be had from the institute, 350 Fifth avenue, New York, at 25 cents each. The manual sets forth the following definitions:

Carbon Steel—Steel is classed as carbon steel when no minimum content is specified or guaranteed for aluminum, chromium, columbium, molybdenum, nickel, titanium, tungsten, vanadium or zirconium; when the minimum for copper does not exceed 0.40 per cent; or when the maximum content specified or guaranteed for any of the following elements does not exceed the amounts noted: Manganese, 1.65 per cent; silicon, 0.60 per cent; copper, 0.60 per cent.

Alloy Steel—Steel is classed as alloy steel when the maximum of the range given for the content of alloying elements exceeds one or more of the following limits: Manganese, 1.65 per cent; silicon, 0.60 per cent; copper, 0.60 per cent; or, in which a definite range of a definite minimum quantity of any of the following elements is guaranteed within the limits of the recognized commercial field of alloy steels: Aluminum, chromium, up to 3.99 per cent; columbium, molybdenum, nickel up to 5.25 per cent; titanium, tungsten, vanadium or zirconium.

Many Analyses Costly

In the foreword it is stated that the manufacture of alloy steels, other than tool steels and stainless steels, to several thousands of different combinations of chemical elements, has been a matter of concern to steel producers because it increased manufacturing difficulties and slowed down production. The investigation showed that most of these variations are produced in very small quantities.

In 1940 approximately 96 per cent of the total output of tonnage alloy steels was accounted for by only 55 different varieties. If production can be concentrated on these standard steels, deliveries can be expedited and other advantages will accrue to both buyers and producers of alloy steels. In particular, deliveries will be speeded up to meet the defense emergency. In most cases consumers can use the standard steels to replace many nonstandard grades now used and without changing their manufacturing methods or impairing the quality of the article manufactured. The committee has taken as standards the ranges and limits of composition which have been widely used by steel producers and consumers in recent years for the various alloying elements such as nickel, molybdenum and chromium. The list of

Standard Composition Ranges for Basic Open-Hearth Alloy and Electric Furnace Carbon and Alloy Steels

Subject to Standard Variations for Check Analyses

Designation	Chemical Composition Limits, Per Cent							
	C	Mn	P Max.	S Max.	Si	Ni	Cr	Mo
A 1320	0.17/0.22	1.80/2.10	0.040	0.040	0.20/0.35	—	—	—
A 1321	0.18/0.23	1.60/1.90	0.040	0.040	0.15/0.30	—	—	—
A 1330	0.28/0.33	1.60/1.90	0.040	0.040	0.15/0.30	—	—	—
A 1335	0.33/0.38	1.60/1.90	0.040	0.040	0.15/0.30	—	—	—
A 1340	0.38/0.43	1.60/1.90	0.040	0.040	0.15/0.30	—	—	—
A 2317	0.15/0.20	0.40/0.60	0.040	0.040	0.15/0.30	3.25/3.75	—	—
A 2330	0.28/0.33	0.60/0.80	0.040	0.040	0.15/0.30	3.25/3.75	—	—
A 2335	0.33/0.38	0.60/0.80	0.040	0.040	0.15/0.30	3.25/3.75	—	—
A 2340	0.38/0.43	0.70/0.90	0.040	0.040	0.15/0.30	3.25/3.75	—	—
E 2512	0.09/0.14	0.45/0.60	0.025	0.025	0.15/0.30	4.75/5.25	—	—
A 2514	0.12/0.17	0.40/0.60	0.040	0.040	0.15/0.30	4.75/5.25	—	—
E 2517	0.15/0.20	0.45/0.60	0.025	0.025	0.15/0.30	4.75/5.25	—	—
A 3045	0.43/0.48	0.75/0.95	0.040	0.040	0.15/0.30	0.60/0.80	0.60/0.80	—
A 3115	0.13/0.18	0.40/0.60	0.040	0.040	0.15/0.30	1.10/1.40	0.55/0.75	—
A 3120	0.17/0.22	0.60/0.80	0.040	0.040	0.15/0.30	1.10/1.40	0.55/0.75	—
A 3130	0.28/0.33	0.60/0.80	0.040	0.040	0.15/0.30	1.10/1.40	0.55/0.75	—
A 3135	0.33/0.38	0.60/0.80	0.040	0.040	0.15/0.30	1.10/1.40	0.55/0.75	—
A 3140	0.38/0.43	0.70/0.90	0.040	0.040	0.15/0.30	1.10/1.40	0.55/0.75	—
A 3141	0.38/0.43	0.70/0.90	0.040	0.040	0.15/0.30	1.10/1.40	0.70/0.90	—
A 3145	0.43/0.48	0.70/0.90	0.040	0.040	0.15/0.30	1.10/1.40	0.70/0.90	—
A 3150	0.48/0.53	0.70/0.90	0.040	0.040	0.15/0.30	1.10/1.40	0.70/0.90	—
A 3240	0.38/0.45	0.40/0.60	0.040	0.040	0.15/0.30	1.65/2.00	0.90/1.20	—
E 3310	0.08/0.13	0.45/0.60	0.025	0.025	0.15/0.30	3.25/3.75	1.40/1.75	—
E 3316	0.14/0.19	0.45/0.60	0.025	0.025	0.15/0.30	3.25/3.75	1.40/1.75	—
A 4023	0.20/0.25	0.70/0.90	0.040	0.040	0.20/0.35	—	—	0.20/0.30
A 4024	0.20/0.25	0.70/0.90	0.040	0.035/0.050	0.20/0.35	—	—	0.20/0.30
A 4027	0.25/0.30	0.70/0.90	0.040	0.035/0.050	0.20/0.35	—	—	0.20/0.30
A 4032	0.30/0.35	0.70/0.90	0.040	0.040	0.20/0.35	—	—	0.20/0.30
A 4037	0.35/0.40	0.70/0.90	0.040	0.040	0.20/0.35	—	—	0.20/0.30
A 4042	0.40/0.45	0.70/0.90	0.040	0.040	0.20/0.35	—	—	0.20/0.30
A 4047	0.45/0.50	0.70/0.90	0.040	0.040	0.20/0.35	—	—	0.20/0.30
A 4063	0.60/0.67	0.70/0.90	0.040	0.040	0.20/0.35	—	—	0.20/0.30
A 4065	0.62/0.70	0.70/0.90	0.040	0.040	0.20/0.35	—	—	0.20/0.30
A 4119	0.17/0.22	0.70/0.90	0.040	0.040	0.15/0.30	—	0.45/0.65	0.20/0.30
A 4120	0.17/0.22	0.70/0.90	0.040	0.040	0.15/0.30	—	0.60/0.80	0.20/0.30
A 4130	0.28/0.33	0.40/0.60	0.040	0.040	0.15/0.30	—	0.80/1.10	0.15/0.25
E 4132	0.30/0.35	0.40/0.60	0.025	0.025	0.15/0.30	—	0.80/1.10	0.18/0.25
A 4134	0.32/0.37	0.40/0.60	0.040	0.040	0.15/0.30	—	0.80/1.10	0.15/0.25
E 4135	0.33/0.38	0.70/0.90	0.025	0.025	0.15/0.30	—	0.80/1.10	0.18/0.25
E 4137	0.35/0.40	0.70/0.90	0.025	0.025	0.15/0.30	—	0.80/1.10	0.18/0.25
A 4142	0.40/0.45	0.75/1.00	0.040	0.040	0.15/0.30	—	0.80/1.10	0.15/0.25
A 4143	0.40/0.45	0.75/1.00	0.040	0.040	0.15/0.30	—	0.80/1.10	0.30/0.40
E 4150	0.48/0.53	0.70/0.90	0.025	0.025	0.15/0.30	—	0.80/1.10	0.20/0.27

standard steels is largely based on these standard ranges and limits. Alloy steels other than the listed standard steels may occasionally be required by consumers for specialized uses, the manual states. Specifications for such non-standard steels will continue to be based on the standard ranges and limits of composition.

A system of symbols has been devised to identify the various classes of standard steels. Numerals are used to indicate the chemical composition of the different grades of steel, while capital letter prefixes indicate whether the alloy steel is made by the open hearth or electric furnace method. Letters suffixed to the numerals indicate special requirements affecting quality, such as guaranteed hardenability, nonmetallic inclusion tests, guaranteed heat treatment results.

The prefix letter A is used to designate basic open hearth alloy steels. The prefix letter E is used to designate electric furnace steels of both the carbon and the alloy types.

The use of numbers to designate different chemical compositions, that is, *grades,* in the classification of standard steels is explained. A four number series designates carbon and alloy steels specified to chemical composition ranges. The series is essentially like the system used originally by the Society of Automotive Engineers Inc., but is extended to include other grades of steel. Five numerals are used to designate certain types of alloy steels.

The basic numbers for the four-numeral series of the various grades of both carbon and alloy steel and their meanings are as follows:

Series Designation	Types and Classes
10xx	Basic open-hearth and acid bessemer carbon steel grades, nonsulphurized and nonphosphorized.
11xx	Basic open-hearth and acid bessemer carbon steel grades, sulphurized but not phosphorized.
12xx	Basic open-hearth carbon steel grades, phosphorized.
(The foregoing carbon steel grade designations are included for information only).	
13xx	Manganese 1.60 to 1.90 per cent.
23xx	Nickel 3.50 per cent.
25xx	Nickel 5.00 per cent.
30xx	Nickel 0.50 per cent—Chromium 0.50 per cent.
31xx	Nickel 1.25 per cent—Chromium 0.60 per cent.
32xx	Nickel 1.75 per cent—Chromium 1.00 per cent.
33xx	Nickel 3.50 per cent—Chromium 1.50 per cent.
40xx	Molybdenum.
41xx	Chromium-molybdenum.
43xx	Nickel-chromium-molybdenum.
46xx	Nickel 1.65 per cent—Molybdenum 0.25 per cent.
48xx	Nickel 3.25 per cent—Molybdenum 0.25 per cent.
50xx	Low chromium.
51xx	Medium chromium.
52xxx	Chromium, high-carbon.
61xx	Chromium-vanadium.
92xx	Silicon-manganese.

The last two digits of the four-numeral series are intended, as far as feasible, to indicate the approximate middle of the carbon range, i.e., 21 represents a range of 0.18 to 0.23 per cent. It is necessary, however, to deviate from this rule and to interpolate numbers in the case of some carbon ranges; and for variations in manganese, sulphur, phosphorus and chromium.

A 4317	0.15/0.20	0.45/0.65	0.040	0.040	0.15/0.30	1.65/2.00	0.40/0.60		0.20/0.30
A 4320	0.17/0.22	0.45/0.65	0.040	0.040	0.15/0.30	1.65/2.00	0.40/0.60		0.20/0.30
A 4337	0.35/0.40	0.60/0.80	0.040	0.040	0.15/0.30	1.65/2.00	0.60/0.80		0.30/0.40
E 4337	0.35/0.40	0.60/0.80	0.025	0.025	0.15/0.30	1.65/2.00	0.70/0.90		0.23/0.30
E 4340	0.40/0.45	0.60/0.80	0.025	0.025	0.15/0.30	1.65/2.00	0.70/0.90		0.23/0.30
	C	Mn	P Max.	S Max.	Si	Ni	Cr	Mo	V
A 4608	0.06/0.11	0.40 max.	0.040	0.040	0.20 max.	1.40/1.75	—	0.15/0.25	—
A 4615	0.13/0.18	0.45/0.65	0.040	0.040	0.15/0.30	1.65/2.00	—	0.20/0.30	—
E 4617	0.15/0.20	0.45/0.65	0.025	0.025	0.20/0.35	1.65/2.00	—	0.20/0.27	—
A 4620	0.17/0.22	0.45/0.65	0.040	0.040	0.15/0.30	1.65/2.00	—	0.20/0.30	—
E 4620	0.17/0.22	0.45/0.60	0.025	0.025	0.20/0.35	1.65/2.00	—	0.20/0.27	—
A 4621	0.18/0.23	0.70/0.90	0.040	0.040	0.15/0.30	1.65/2.00	—	0.20/0.30	—
E 4640	0.38/0.43	0.60/0.80	0.025	0.025	0.15/0.30	1.65/2.00	—	0.20/0.27	—
A 4815	0.13/0.18	0.40/0.60	0.040	0.040	0.15/0.30	3.25/3.75	—	0.20/0.30	—
A 4821	0.18/0.23	0.50/0.70	0.040	0.040	0.15/0.30	3.25/3.75	—	0.20/0.30	—
A 5045	0.43/0.48	0.70/0.90	0.040	0.040	0.15/0.30	—	0.55/0.75	—	—
A 5120	0.17/0.22	0.70/0.90	0.040	0.040	0.15/0.30	—	0.70/0.90	—	—
A 5130	0.28/0.33	0.70/0.90	0.040	0.040	0.15/0.30	—	0.80/1.10	—	—
A 5145	0.43/0.48	0.70/0.90	0.040	0.040	0.15/0.30	—	0.70/0.90	—	—
A 5150	0.45/0.55	0.70/0.90	0.040	0.040	0.15/0.30	—	0.90/1.20	—	—
A 5152	0.47/0.55	0.70/0.90	0.040	0.040	0.15/0.30	—	0.70/0.90	—	—
E 52095	0.90/1.00	*0.30/0.50	0.025	0.025	0.20/0.35	—	0.45/0.65	—	—
E 52098	0.90/1.05	*0.30/0.50	0.025	0.025	0.20/0.35	—	1.00/1.25	—	—
E 52099	0.90/1.05	*0.30/0.50	0.025	0.025	0.20/0.35	—	1.30/1.65	—	—
E 52100	0.95/1.10	*0.30/0.50	0.025	0.025	0.20/0.35	—	1.20/1.50	—	—
E 52101	0.95/1.10	*0.30/0.50	0.025	0.025	0.20/0.35	—	1.30/1.65	—	—
E 52107	1.00/1.15	*0.30/0.50	0.025	0.025	0.20/0.35	—	1.35/1.65	—	—
A 6120	0.17/0.22	0.70/0.90	0.040	0.040	0.15/0.30	—	0.70/0.90	—	0.10 min.
E 6150	0.47/0.53	0.70/0.90	0.025	0.025	0.15/0.30	—	0.80/1.10	—	0.15 min.
A 6152	0.48/0.55	0.70/0.90	0.040	0.040	0.15/0.30	—	0.80/1.10	—	0.10 min.
A 9255	0.50/0.60	0.70/0.90	0.040	0.040	1.80/2.20	—	—	—	—
A 9260	0.55/0.65	0.70/0.90	0.040	0.040	1.80/2.20	—	—	—	—
A 9262	0.55/0.65	0.70/0.90	0.040	0.040	1.80/2.20	—	0.20/0.30	—	—
A 9263	0.55/0.65	0.70/0.90	0.040	0.040	1.80/2.20	—	0.30/0.40	—	—

* These steels may be specified to either 0.30 to 0.45 per cent or 0.35 to 0.50 per cent manganese, but it is recommended that the full range be allowed wherever possible.

NOTE 1: The lowest standard maximum phosphorus or sulphur content for acid open hearth or acid electric furnace alloy steel is 0.05 per cent each.

NOTE 2: The lowest standard minimum silicon content for acid open hearth or acid electric furnace alloy steel is 0.15 per cent.

NOTE 3: For steels ordered to the above ranges, below the size and weight restriction, the average of all the chemical checks must be within the limits specified subject to check analysis variations.

NOTE 4: The ranges shown above are restricted to sizes 100 sq. in. or less or equivalent cross-sectional area 18 in. wide or under with a maximum individual piece weight of 7,000 lb. irrespective of size.

Will Aid Defense Drive

One table in the manual contains standard ranges and limits for chemical composition applicable to non-standard basic open hearth alloy steels and large sections, subject to standard variations for check analyses. Another similarly covers electric furnace carbon and alloy steels. The third table, reproduced herewith, lists the 76 standard alloy steels by designation and composition.

Other features of the manual are standard methods for sampling for check analysis and standard variations from specified chemical limits, manufacturing practice for individual products, physical properties and hardness value requirements, the A.S.T.M. tentative classification of austenite grain size in steels, and the A.S.T.M. grain size classification.

Regrets are heard in some quarters that a standard list of this sort was not compiled a long time ago. Had such a list existed when the present defense emergency first ap-

peared it would have permitted a better understanding as to future needs for nickel and other alloying materials. It is felt, however, that the list should prove distinctly helpful in the future.

As to how soon the new standards will be applied in actual transactions is not yet known. Steel companies are expected to begin immediately informing their customers as to how they may derive advantages by substituting standard for non-standard alloy steels. It also is possible that government sponsorship might be forthcoming in order to push steel production for defense.

Unfortunately the new standards cannot be adopted 100 per cent right now because of the shortage of nickel. With nickel available only for defense, it will be necessary to continue substituting to meet non-defense needs, and thus compromise with the ideal until adequate supplies of all alloying materials again are available.

The new list is not "frozen." The committee will study the matter of standardization continuously and undoubtedly will revise the list.

A feature of the list is its length. In some quarters it is believed that a smaller number than 76 standard alloy steels would suffice. Expectations are that when the committee completes its job for all steels the entire significant list will come to some 200 specifications. This compares with the list set up some years ago in Germany and the list recently promulgated in England. Practically all English steel requirements now are filled from a list of 82 significant steels and, on the basis of latest information available, practically all German requirements are filled from a list of 108 steels.

Pig Iron Classification To Improve Service and Expedite Deliveries

A new classification of pig iron by grades has been formulated by the General Technical Committee of the American Iron and Steel Institute and published in a manual entitled *Standard Pig Iron Compositions of the American Iron and Steel Industry and Their Grades, Chemical Compositions and Common Uses.* Copies of the booklet may be obtained from the institute, 350 Fifth avenue, New York, at 25 cents each.

"The ever-growing variety of chemical compositions and quality requirements of pig iron specifications has been a matter of concern in the iron and steel industry for years," reads the foreword, which explains the new list of standard compositions contains grades "of proven merit and in extensive use for a wide variety of purposes." The committee believes that from this list can be selected a composition that can be used satisfactorily for any purpose without impairment of the quality of the manufactured article.

The list contains 257 compositions. Included are 26 low-phosphorus, 24 intermediate low-phosphorus, 8 bessemer, 47 malleable, 6 basic, 42 Northern low-phosphorus foundry, 42 Northern high-phosphorus foundry, 14 Southern foundry and 48 silvery pig iron analyses. Each composition is identified by a prefix letter, six numerals which indicate the analysis and, in some cases, a suffix letter.

For convenience of reference, a prefix letter is used to designate grades in order of increasing phosphorus content, as follows:

Designation	Phosphorus content
A Low Phosphorus.	0.035 per cent max.
B Intermediate low-phos.	0.036 to 0.075%
C Bessemer	0.076 to 0.100%
D Malleable	0.101 to 0.300%
E Basic—Northern	0.400% maximum
F Foundry—Northern, low-phos..	0.300 to 0.500%
G Foundry—Northern, high-phos..	0.501 to 0.700%
H Foundry—Southern	0.700 to 0.900%
I Basic—Southern.	0.700 to 0.900%
S Silvery	0.300 per cent max.

Silicon and manganese contents are designated by a six-number system in which the first three numerals designate the average silicon content; average manganese content is similarly indicated by the last three numerals.

For example, A 113088 identifies an iron having phosphorus content of 0.035 per cent maximum, silicon content of 1.00 to 1.25 per cent (denoted by 113) and manganese content of 0.76 to 1.00 per cent (denoted by 088). The new system easily can be used with the aid of the manual.

The new standard list, it is expected, will enable pig iron producers to expedite deliveries and improve their service to consumers in general. It also will simplify the blast furnace stocking problem. One producer recently had more than 1200 different grades in storage in as many piles. Several others have had 900 to 1100 grades in stock. Under the new standard pig iron compositions setup stocks should not average more than some 100 different piles.

Zinc Ample for Defense and Some Civilian Needs

ST. LOUIS

■ DESPITE the present acute situation in zinc supplies, producers and the government are confident that all vital needs of the national defense program will be satisfied and that the more important civilian requirements can be met.

This was the opinion of representatives of the industry and governmental agencies expressed at the twenty-third annual meeting of the American Zinc Institute in Hotel Chase, St. Louis, April 28-29. More than 150 executives attended the two-day sessions.

In his opening remarks, President Howard I. Young, president, American Zinc, Lead & Smelting Co., St. Louis, pledged full support of the industry in the national defense effort.

Production of slab zinc in the United States was 478,000 tons in 1938 and 557,700 tons in 1939; in 1940, production reached 724,000 tons—an all-time high, according to the United States Bureau of Mines. The estimated production in 1941, together with anticipated imports, should make available for home consumption and export over 900,000 tons. In 1942, this figure is likely to be close to 1,000,000 tons. Thus, within a period of four years the zinc industry will have provided for almost double the average normal rate of consumption.

Demand Greatly Increased

The industry is meeting increased demands by (1) expanding capacity of present plants; (2) rehabilitating unused or dormant plants; and (3) constructing new plants.

Causes for the unprecedented demand for zinc, according to the institute, are: (1) the national defense program; (2) British defense needs; (3) increased demands from producers of nondefense materials; and (4) demands from other nations whose source of zinc has been cut off by the war and who are now seeking supplies in this country.

The institute goes into some detail to explain how zinc enters into the national defense program. For instance, brass contains a substantial proportion of zinc and is used for cartridges, shells, fuses, and other ordnance purposes. In addition, zinc is required in certain other nonferrous alloys of aluminum, copper, magnesium and manganese, which are used for propellers and propeller shafts, bearings, castings,

forgings and various aircraft applications. In the aggregate, these requirements will amount to many thousands of tons.

Similarly, zinc is used for galvanizing or coating iron and steel for rust-proofing. Large quantities will be needed for ship construction, barbed wire, transmission equipment, powder containers, fuel cans and drums, and similar products. Tons of galvanized marine hardware and miles of galvanized pipe will be used in ships, not only for the navy, but for the tremendous expansion of our merchant marine which is under way.

Zinc die castings, large and small, are essential elements in the assembly of aerial cameras, radio and signal equipment, tractor, truck and tank carburetors, hand grenades and other pieces of defense equipment whose parts must be dimensionally accurate.

Zinc in sheet form is indispensable in battery cans, in linings of ammunition cases, in marine boiler and hull plates, and even in lithographers' plates for the making of maps and charts.

The institute points out that Great Britain has her own smelters, which undoubtedly are being worked to utmost capacity; Canada, Australia and South Africa are shipping their entire surplus, above pressing home needs, to the United Kingdom; but even this is not sufficient to meet the heavy demand arising from many battle fronts—Britain is looking to the United States for ever-increasing quantities of zinc. The tonnage which we may be called upon to furnish in 1941 is likely to exceed greatly the 46,000 tons which we shipped to the United Kingdom and British India in 1940.

In addition to British requirements, the United States is being called upon to furnish necessary zinc to China, Greece, Turkey and South America, since no other source of supply is available. However, as all exports of slab zinc were put under government license regulation early in 1941, Washington will control the export situation.

During the years 1935-1939, average annual consumption was 540,000 tons of slab zinc per year. Addition of the national defense program, covering needs of both United States and Great Britain, has admittedly put a strain on the industry's production capacity, but this should be relieved, states the institute, by the scheduled and contemplated increases already mentioned.

Regarding the supply of zinc ore, some increase in domestic mine production may develop in 1941, but under present conditions it is not likely to greatly exceed the previous year's output. Much ore of foreign origin, which previously moved to augment the smelter output of Europe, is now being smelted in the United States. The scheduled increase in smelter production is predicated upon the continuous flow of foreign concentrates which have been reaching the United States from Mexico, Canada, Newfoundland, Peru, Argentina and Bolivia, as well as, to some extent, from Spain and Australia.

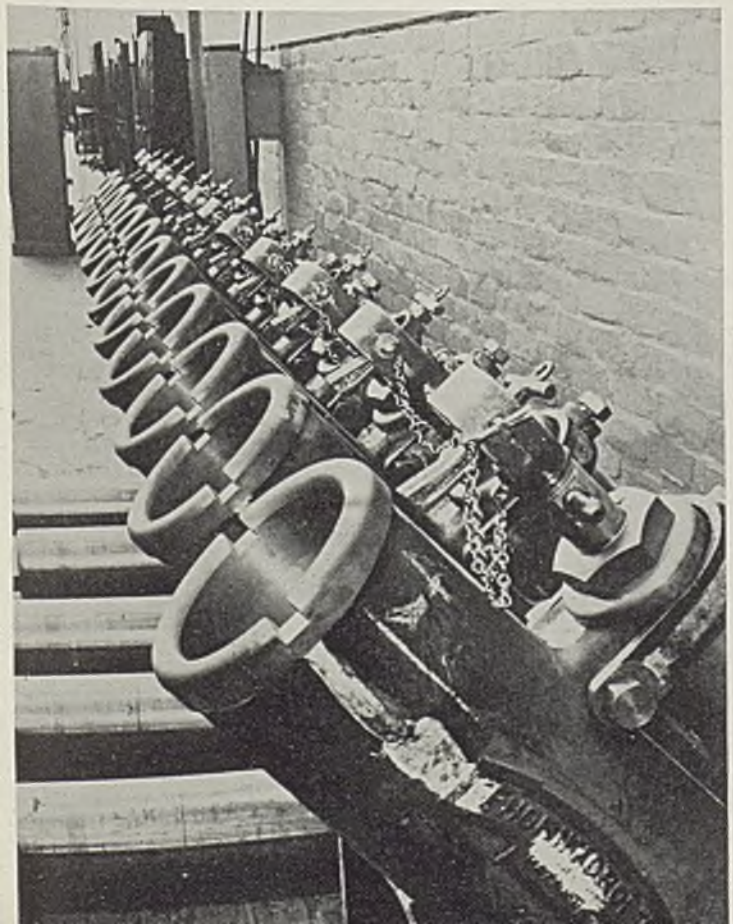
Viewing the distribution problem for zinc in the months ahead, the institute's traffic committee sees a railroad car shortage possible by midsummer. Problem is what priority has priority among priorities. It was pointed out that movement of tremendous grain crops from the west and midwest likely will interfere seriously with movement of freight beyond expectations of the carriers.

John A. Church, consultant on copper and zinc, Office of Production Management, Washington, complimented the zinc industry on its cooperation in national defense and stated that war is a struggle of metals, principal among which are steel, aluminum, and cartridge brass. By the middle of 1942, the bulk of zinc

(*Please turn to Page* 74)

Their Aims the Same

United States Army's new 8-inch field gun, shown at right during maneuvers at Fort Bragg, N. C., is capable of hurling a 200-pound projectile containing 35 pounds of high explosive 10.2 miles. At left, a consignment of depth charge throwers, manufactured in Australian ordnance factories, awaits shipment to England to combat submarines in the Battle of the Atlantic. NEA photos



Simplification in Steel Rounds Out Preparedness

■ Every producer, distributor and consumer of alloy steels (other than tool steels and stainless steels) and of pig iron should give immediate attention to the standards proposed last week for these materials by the general technical committee of the American Iron and Steel Institute.

This committee, after two years of painstaking work, has selected 76 alloy steels and 257 grades of pig iron as representing compositions of proved merit which will serve a wide variety of purposes. These selections now are proposed as standards, with the hope that industry will adopt them as soon as possible.

• • •

It would be difficult to overemphasize the importance of the work this committee has performed. It has studied the production and consumption of varieties of alloy steel and pig iron and has found that a relatively few grades account for a high percentage of total annual output.

For instance, out of the several thousands of varieties of alloy steel now offered, 55 account for 96 per cent of the total production. In other words, the remaining thousands of varieties of less popular steels amount in the aggregate to only about 4 per cent of the output.

• • •

A similar situation exists in relation to pig iron. Specifications for 1500 or more grades of iron are in use today, yet 99 out of 100 requirements of pig iror users probably can be met satisfactorily by the 257 grades which the committee has nominated for standards.

If industry will start at once to put into effect the recommended standards, it will be richly rewarded. Producers will benefit from economies in production and from the reduced amount of money tied up in slowly moving stocks of infinite varieties of iron and steel. Distributors will be able to handle the same volume of business with smaller inventories than under the old system. Consumers will benefit by more prompt deliveries and better service from their suppliers.

These advantages, while extremely important in normal times, should be doubly welcome under the trying conditions of the present emergency. Sooner or later the demands of the defense program will force the government to inaugurate arbitrary rules for the standardization and simplification of materials and products —just as a division of the War Industries Board did in 1918.

• • •

By fortuitous circumstance, the general technical committee has performed a service which has the effect of anticipating this necessity. Its forehandedness has given the producers and consumers of alloy steel and pig iron a head start over other branches of industry which later on may be compelled to start from scratch in standardizing and simplifying their products.

The committee has shown the way to real economies and lasting benefits. It is up to buyers, dealers and sellers to capitalize upon the committee's fine achievement.

E. L. Shaner

EDITOR-IN-CHIEF

The BUSINESS TREND

Order Backlogs in Many Lines Still Expanding

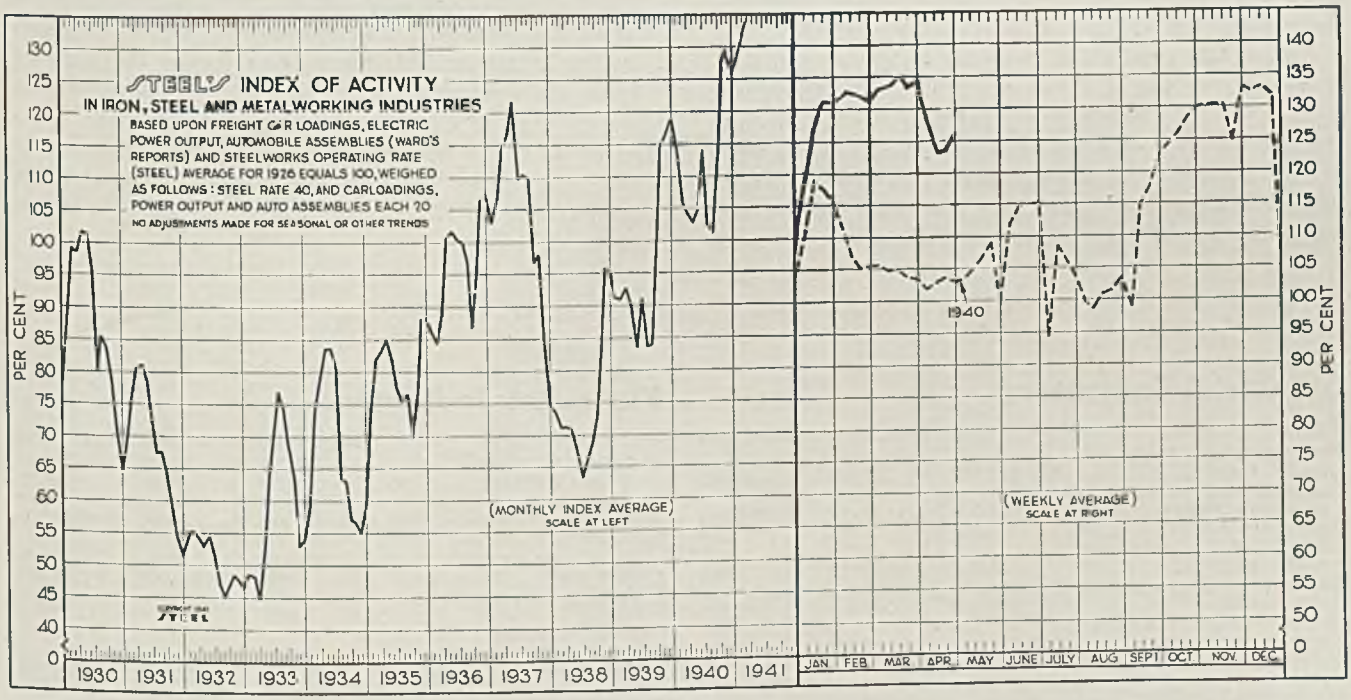
■ NEW demand continues unabated. Order backlogs in many industrial lines are still mounting, in some instances deliveries are extended into early 1942.

Indications are for an upturn in production over the coming months as defense industries swing into mass production on armament orders. Some plants are already well under way on large scale output, while tuning up programs are near completion in others. Sub-contracting of orders is expected to play an increasingly important role in meeting defense needs.

Currently industrial output is still feeling the effect of the bituminous coal strike settled last week.

During the week ended April 26, STEEL's index of activity climbed 2.3 points to 126.5. The increase in revenue freight carloadings, electric power output and automobile production offset a further decline in the national steel rate. However, the index remains well below the peak of 135 recorded during the week ended March 15. At this time a year ago it stood at 102.8, in 1937 at 122 and 1929 at 125.3.

Bituminous coal strike was the chief factor in the steel rate decline to 96 per cent during the week of



STEEL'S index of activity gained 2.3 points to 126.5 in the week ended April 26:

Week Ended	1941	1940	Mo. Data	1941	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930
Feb. 8.....	132.7	107.2	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. 15.....	132.3	105.1	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
Feb. 22.....	131.2	105.4	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
March 1.....	133.0	105.6	April	.....	102.7	89.8	70.8	116.6	100.8	85.0	83.6	52.4	52.8	81.0	101.7
March 8.....	133.1	104.7	May	.....	104.6	83.4	67.4	121.7	101.8	81.8	83.7	63.5	54.8	78.6	101.2
March 15.....	135.0	104.9	June	.....	114.1	90.9	63.4	109.9	100.3	77.4	80.6	70.3	51.4	72.1	95.8
March 22.....	133.5	103.7	July	.....	102.4	83.5	66.2	110.4	100.1	75.3	63.7	77.1	47.1	67.3	79.9
March 29.....	133.9	103.2	Aug.	.....	101.1	83.9	68.7	110.0	97.1	76.7	63.0	74.1	45.0	67.4	85.4
April 5.....	128.9	101.8	Sept.	.....	113.5	98.0	72.5	96.8	86.7	69.7	56.9	68.0	46.5	64.3	83.7
April 12.....	123.8	102.7	Oct.	.....	127.8	114.9	83.6	98.1	94.8	77.0	56.4	63.1	48.4	59.2	78.8
April 19.....	124.2	103.4	Nov.	.....	129.5	116.2	95.9	84.1	106.4	88.1	54.9	52.8	47.5	54.4	71.0
April 26.....	126.5	102.8	Dec.	.....	126.3	118.9	95.1	74.7	107.6	88.2	58.9	54.0	46.2	51.3	64.3

April 26 and a further drop occurred last week. It is expected that it will take at least two or three weeks before the steel industry can regain the former peak operating level of 99.5 per cent recorded during the latter part of March.

With precautionary measures regarding coke supplies no longer necessary, a number of blast furnace interests have blown in some of the furnaces banked because of the coal strike. As coal begins to come into the various producing districts blast furnaces will be put back into operation. Beehive coke production will not begin for a week or ten days.

Revenue freight carloadings under the impetus of a steady increase in loadings of iron ore advanced to 721,702 cars during the week of April 26. Further gains are indicated over the coming weeks, reflecting the resumption of the soft coal movement.

Automobile production recorded an encouraging increase during the week of April 26 to 108,165 units, compared with 99,945 the preceding week. Through the first 20 days of April retail automobile sales were at the highest level for the period in the industry's history except for 1929, and the 1929 record undoubtedly would have fallen if Ford Motor Co.'s dealers could have placed their usual 20 to 25 per cent share of the total demand. Unless unforeseen circumstances occur, automobile output should continue to rise steadily over the coming weeks.

The United States Department of Commerce states that increasing demands for defense and civilian goods lifted the department's new orders index 12 points during March to 201, more than double the January 1939 average. Index of the value of shipments in March was 163 of the January 1939 average, compared with 159 in February and 121 in March a year ago. Inventories' index for March was placed at 121.8, compared with 121.0 in February and 109.6 in March 1940.

Where Business Stands

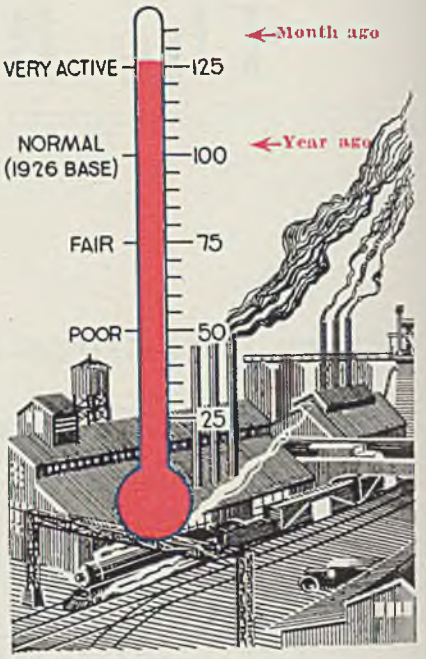
Monthly Averages, 1940 = 100

	Mar., 1941	Feb., 1941	Mar., 1940
Steel Ingot Output	125.9	121.9	77.3
Pig Iron Output	118.4	118.0	82.3
Building Construction	143.8	81.0	131.9
Auto Output	136.6	130.2	112.5
Freight Movement	109.5	102.5	89.0
Wholesale Prices	103.8	102.7	99.9

Industrial Weather

TREND:

Sidewise



The Barometer of Business

Industrial Indicators

	Mar., 1941	Feb., 1941	Mar., 1940
Pig iron output (daily average, tons)	151,707	152,044	105,502
Iron and steel scrap consumption (tons)	4,662,000	4,172,000	2,728,000
Gear Sales Index	288	262	114
Foundry equipment new order index	315.2	281.1	183.2
Finished steel shipments (Net tons)	1,720,360	1,548,451	931,995
Ingot output (average weekly; net tons)	1,613,177	1,562,603	990,991
Dodge bldg. awards in 37 states ($ Valuation)	$479,903,000	$270,373,000	$272,178,000
Automobile output	533,912	509,233	440,232
Coal output, tons	48,250,000	41,695,000	35,244,000
Business failures; number	1,211	1,129	1,197
Business failures; liabilities	$13,444,000	$13,483,000	$11,681,000
Cement production, bbls.	10,600,000	8,368,000	7,918,000
Cotton consumption bales	854,179	793,626	627,194
Car loadings (weekly av.)	765,596	716,634	622,037

Commodity Prices

	Mar., 1941	Feb., 1941	Mar., 1940
Steel's composite average of 25 iron and steel prices	$38.27	$38.22	$36.83
U. S. Bureau of Labor index	81.5	80.6	78.4
Wheat, cash (bushel)	$0.95	$0.888	$1.075
Corn, cash (bushel)	$0.755	$0.69	$0.663

Financial Indicators

	Mar., 1941	Feb., 1941	Mar., 1940
30 Industrial Stocks†	122.52	121.68	147.13
15 Public Utilities†	19.56	19.37	24.26
20 Rail Stocks†	28.03	27.54	30.45
Bank clear'gs (000 omitted)	‡$22,687,000	$26,155,000	$20,641,000
Commercial paper rate (N. Y., per cent)	½–¾	½–¾	½–¾
*Com'l. loans (000 omitted)	$9,828,000	$9,495,000	$8,596,000
Federal Reserve ratio (per cent)	91.2	91.0	87.8
Capital flotations (000 omitted)			
New Capital	$181,711	$77,056	$71,388
Refunding	$224,892	$264,381	$170,850
Federal Gross debt (millions of dollars)	$47,173	$46,090	$42,559
Railroad earnings	$80,627,172	$58,478,869	$37,034,270
Stock sales, New York stock exchange	10,124,024	8,969,195	16,268,868
Bond sales, $1,000,000 par value‡	$123.9	$230.8	$120.6

‡February, January and February respectively.
*Leading member banks Federal Reserve System.
†Dow-Jones Series.

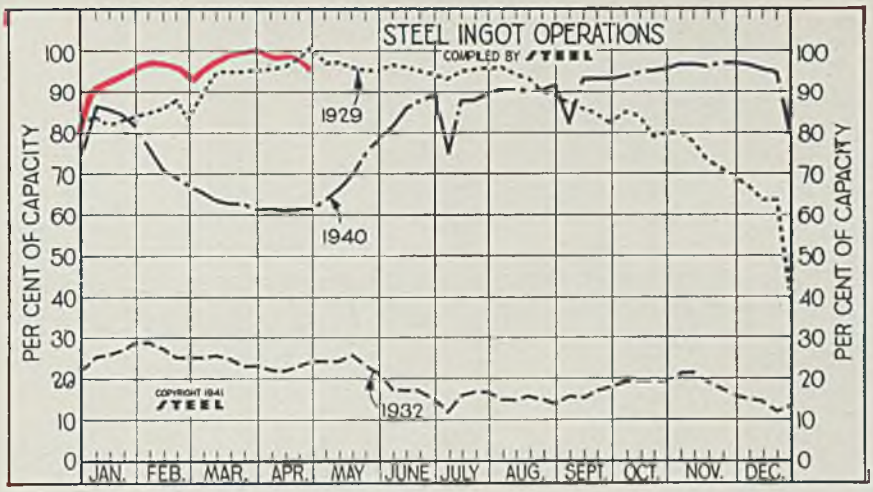
Foreign Trade

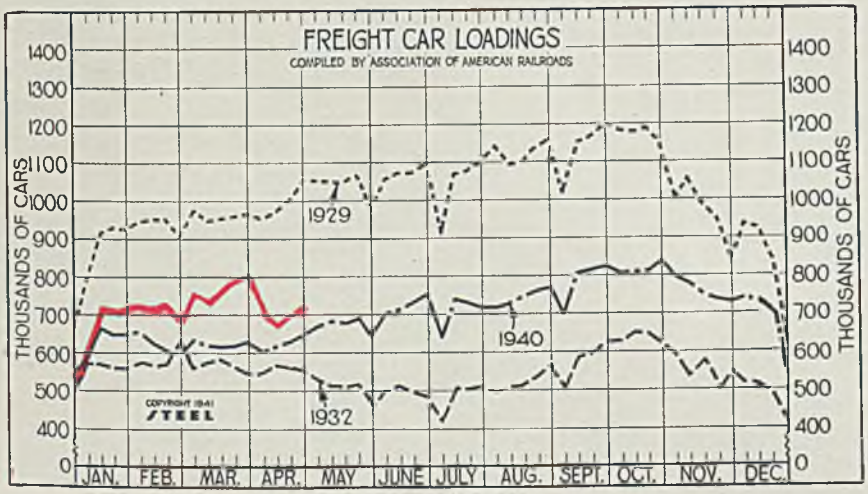
	Feb., 1941	Jan., 1941	Feb., 1940
Exports	$303,413	$325,355	$347,106
Imports	$233,702	$288,671	$200,068
Gold exports	$6,000	$4,000	$53,000
Gold imports	$108,615	$234,246	$201,475

Steel Ingot Operations

(Per Cent)

Week ended	1941	1940	1939	1938
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
Feb. 8....	97.0	71.0	54.0	30.0
Feb. 1....	97.0	76.5	53.0	31.0
Jan. 25....	95.5	81.5	51.5	33.0
Jan. 18....	94.5	84.5	51.5	30.5





Freight Car Loadings

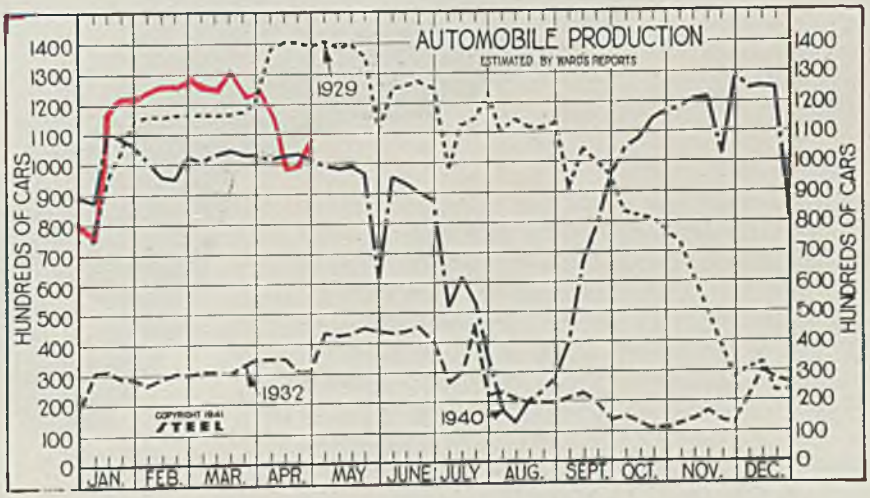
(1000 Cars)

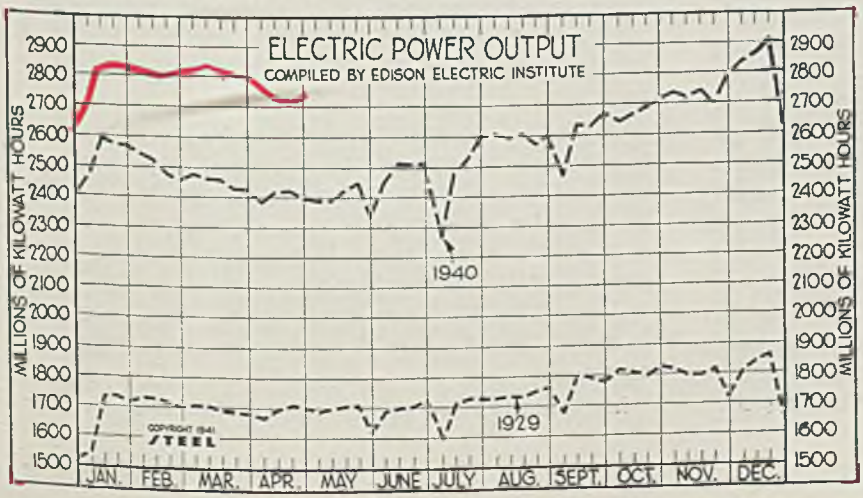
Week ended	1941	1940	1939	1938
April 26.....	722	645	586	543
April 19.....	698	628	559	524
April 12.....	680	619	548	538
April 5	682	603	535	522
March 29....	792	628	604	523
March 22....	769	619	605	573
March 15	759	619	595	540
March 8.....	742	620	592	557
March 1.....	757	634	599	553
Feb. 22.....	678	595	561	512
Feb. 15.....	721	608	580	536
Feb. 8.....	710	627	580	543
Feb. 1.....	714	657	577	565
Jan. 25.....	711	649	594	553
Jan. 18.....	703	646	590	570

Auto Production

(1000 Units)

Week ended	1941	1940	1939	1938
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
Feb. 8....	127.7	96.0	84.5	57.8
Feb. 1....	124.4	101.2	79.4	51.4
Jan. 25....	121.9	106.4	89.2	59.4
Jan. 18....	124.0	108.5	90.2	65.4





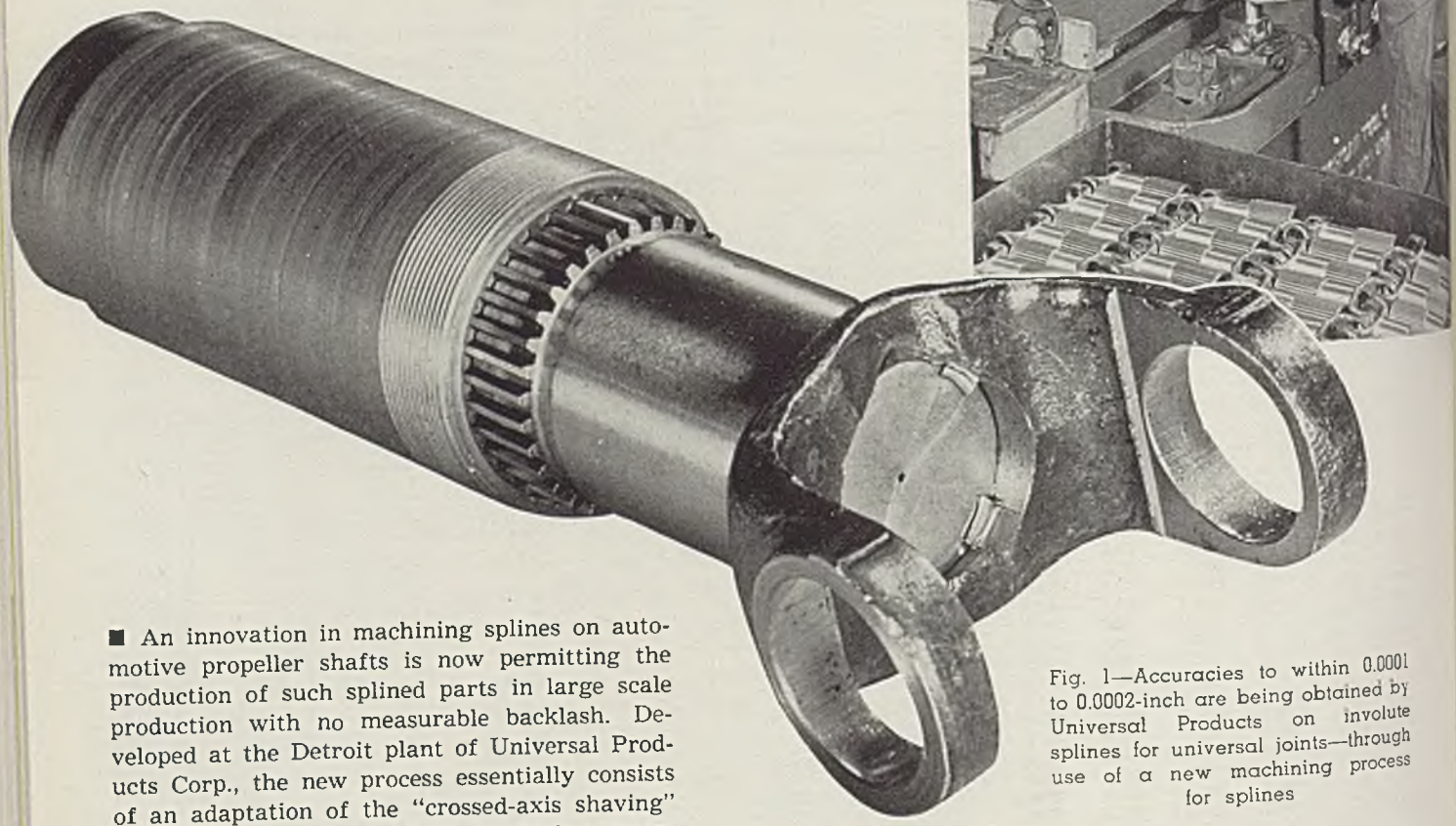
Electric Power Output

(Million KWH)

Week ended	1941	1940	1939	1938
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
Feb. 8...	2,824	2,523	2,268	2,052
Feb. 1. .	2,830	2,541	2,287	2,082
Jan. 25...	2,830	2,566	2,293	2,099
Jan. 18...	2,844	2,572	2,290	2,109

INVOLUTE SPLINES

made by gear shaving process



■ An innovation in machining splines on automotive propeller shafts is now permitting the production of such splined parts in large scale production with no measurable backlash. Developed at the Detroit plant of Universal Products Corp., the new process essentially consists of an adaptation of the "crossed-axis shaving" process extensively used in producing gears. Equivalent accuracy of female part is obtained through the use of high precision broaches, Fig. 1.

Fig. 1—Accuracies to within 0.0001 to 0.0002-inch are being obtained by Universal Products on involute splines for universal joints—through use of a new machining process for splines

According to Universal Products, the savings made on the hobbing operation offset the expense of the shaving operation.

To permit the use of this type of equipment, the "splines" are actually developed involute teeth. From 26 to 38 "splines" are used on the three standard sizes of shafts produced, giving the appearance of a series of serrations around the stub end of the propeller shaft. Diameter of the latter is around 2 inches.

Rack-type Michigan gear shaving equipment, Fig. 2, is used. The machines are the series 900 type in which the "gear" is mounted between live centers. A generating rack is reciprocated in mesh with the "gear" while the head of the machine, carrying the work, is fed downward. With this type of equipment, accuracy of tooth profile is almost entirely dependent on the accuracy of the serrated blades of the cutting rack.

A production rate of some 70 to 80 pieces per hour is obtained in spite of the extremely high accuracy required. The rack itself has approximately 100 teeth, giving from three to four revolutions of the part for each stroke of the rack. In practice, some 12 to 16 strokes of the shaving rack are used to finish the splines. Two Michigan machines are used, identical in design, to take care of production requirements on all sizes.

Incidentally, the splines are so designed that the

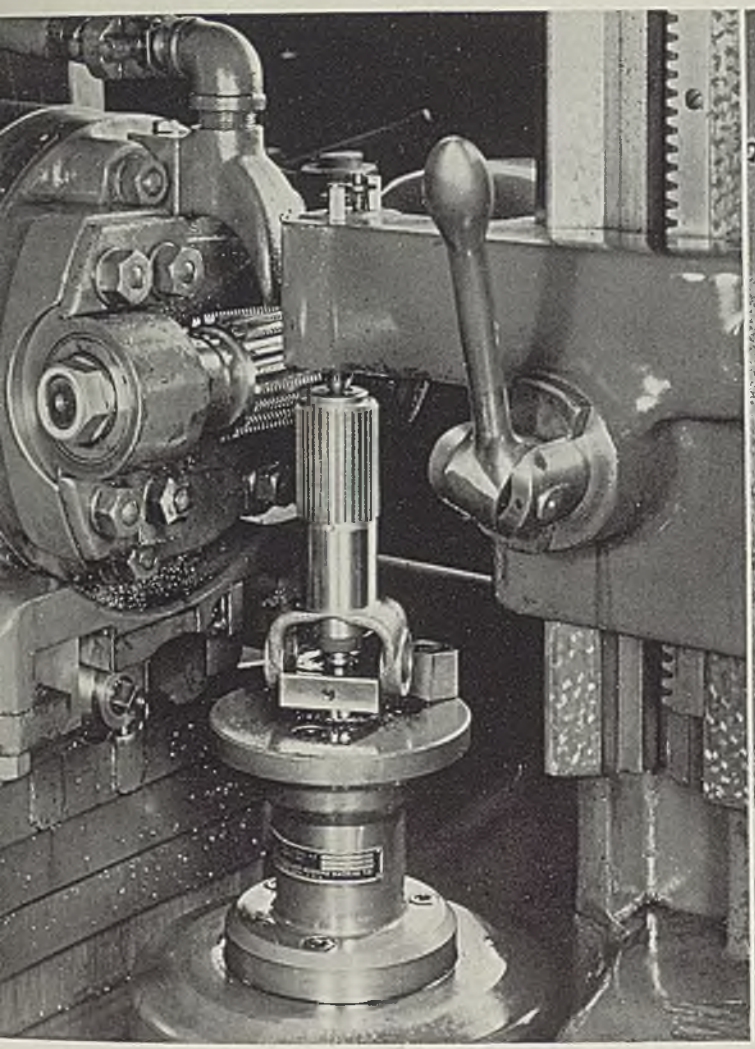


Fig. 2—Series 900 Michigan rack-type gear shaving machines finish the splines on universal joint yokes made by Universal Products Co., Detroit. See top view opposite page

Fig. 3—Splines are semifinish hobbed on Cleveland single-spindle machines with some 8-spindle rotary hobbing machines also used for this operation. Hobs are Mitco 3-thread type. Due to the use of shaving equipment for finishing, Class B hobs can be used. Note view directly above

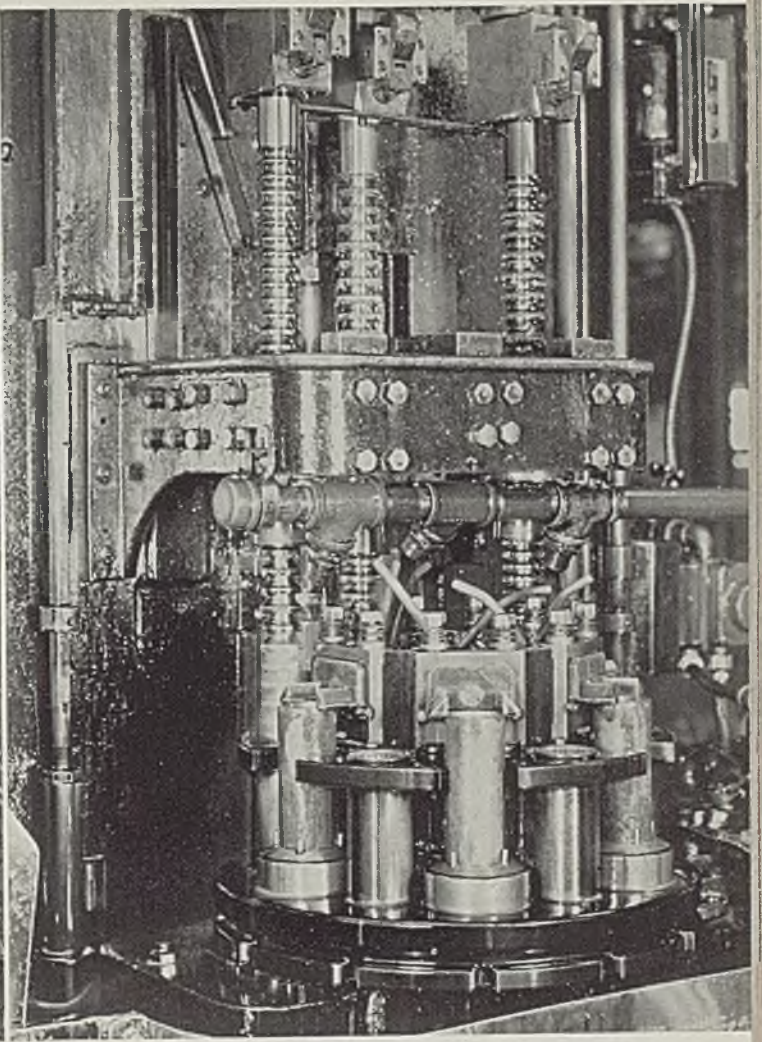


Fig. 4—The propeller shaft ends which mate with the splined ends of the universal joint yokes are broached to similarly close tolerances. Three Colonial, hardened and ground, precision, high-speed steel type broaches successively broach the hole, semifinish and finish the splines on a rotary table

same rack can be used for finishing all parts, all splines having the same pitch and pressure angle. The rack differs from conventional gear shaving racks mainly in the larger number of blades required for the fine pitch.

Prior to the shaving operation, the stub ends are semifinish hobbed in Cleveland single-spindle and 8-spindle rotary machines, Fig. 3. Each shaving machine takes care of the output from four or more single-spindle hobbing machines. Mitco 3-thread hobs are used. Due to the use of shaving equipment for finishing, Class B hobs can be utilized. The hobbing shape of "spline" formed is roughly indicated by specifications for the hob which, for the 38-spline stub end, is 21.111 pitch, 20 degree pressure angle, 2 degrees 14 minutes thread angle, lead 0.192-inch. Feed is 0.10-inch per revolution of the work. Length of splined end is approximately 3 inches.

To check the spline dimensions in production after both hobbing and gear shaving operations, an 0.080-inch diameter wire is inserted between the teeth on opposite sides of the spline, the size being such that the wires do not "bottom" in the splines. Following the hobbing operation the limits are from 1.915 to 1.917 inches across the wires. After the shaving operation the limits are from 1.9075 to 1.9085 inches. Actually the limits are much closer than these figures in both cases, due to the contour of the teeth on the splines, which multiplies any variation in dimensions several times. Accurate gaging of the tooth dimensions shows that they seldom vary more than 0.0001-inch and never exceed 0.0002-inch.

The mating part—the propeller shaft end—is broached to similarly close tolerances. This operation is performed on a broaching machine, equipped with three broaches and rotary table, as shown in Fig. 4. Broaches are Colonial, hardened and ground, precision, high-speed steel type and successively broach the hole, semifinish and finish the splines. When assembled over the spline, this part slides smoothly from end to end without either measurable backlash or "wobble." Due to the method of producing the parts, the type of fit secured is identical regardless of the relative rotational positions in which the mating parts are assembled. The fit is frequently checked with master internally splined gages to maintain this condition in all shaft assemblies produced by this company.

Factors To Be
MAKING

BY G.W. BIRDSALL
Engineering Editor

Fig. 1—General view of tank assembly bay at Rock Island Arsenal, Rock Island, Ill., showing light tanks, Type M2-A2, and combat cars, Type M1, completed and in production. Bay is 600 feet long, effective height under crane hooks is 65 feet

■ THE PRINCIPAL feature which differentiates tank manufacture from making similar track laying vehicles, such as large caterpillar tractors with continuous treads, is the fact that the tank is built of armor plate.

To be effective, a tank must carry as heavy armor as possible in view of the use to which it is to be put. Since the protection afforded by armor plate depends more or less directly upon its thickness, hence its weight, it is necessary to make a compromise between weight or protection, maneuverability, range of action, fire power, speed, climbing ability and similar factors in designing a tank. All these factors vary in importance according to the purpose for which the tank is to be used. Design, however, is beyond the scope of this article.

This matter of weight influences greatly the structure of the tank itself. The tank is built by joining sections of armor plate together with structural angles and flats to form a box which constitutes the main frame or hull of the tank. There is no chassis with engine, wheels and the like mounted on it as in an ordinary truck or tractor.

Since armor plate and angles thus form the framework (and actual structure as well) all fabricating operations must be adapted to working with this material. In fabricating a structure from armor plate such as a tank, the characteristics of the armor plate itself thus influence the methods which can be used in handling it.

What Is Armor Plate? For these reasons, it is well to know how armor plate is produced and to be familiar with some of its characteristics. Briefly, armor plate is an alloy steel which is heat treated to form an extremely hard surface (surface hardened type) or hardened throughout the entire thickness (homogeneous type). Surface hardened type is used primarily in positions subjected to the punching action of high velocity shell as contrasted to homogeneous type which is used where deformation of the structure from heavy gun fire must be prevented, in addition to resisting penetration. Thus homogeneous armor plate is found in some tank turrets with

Here is shown how tank construction differs from that of any other type of vehicle, how armor plate influences its construction, how to handle the manufacturing problems involved in making structures containing armor plate. Ordnance Department specifications and how they are set up for manufacturing tanks and similar equipment also are discussed. A pictorial story of tank manufacturing and assembly methods at Rock Island Arsenal will be presented as the second section of this article next week

Considered When TANKS

surface hardened material used on sides of the tank hull. Since the material must be heat treated and straightened, requiring special facilities, the armor plate is usually made to exact dimensions at the steel mill.

How Is It Made? Sequence of operations employed by one manufacturer of armor plate is about as follows:

The steel mill delivers to the armor plate department plates cut to approximate dimensions. The steel must be of exceptional quality and uniformity, so the manufacturer of armor plate really starts with making the steel. Plates are paired. The side not to be hardened is coated with a material which prevents absorption of carbon during the carburizing process. When coated, plates are placed back to back and tack welded together for ease of handling through heat treating.

To produce the exceptionally hard surface needed, the plates are deep carburized by packing with compound in large boxes, followed by heating to about 1700 degrees Fahr. for a sufficient period of time to increase the carbon content of the metal near the surface; the amount and depth depend upon the carburizing cycle employed. After cooling, plates are shot blasted to remove scale and samples are taken to the firing range for ballistic tests as these are the only means of determining the acceptability of the material.

Upon acceptance, the material is torch cut to exact outline dimensions, allowing metal for machining, which then follows after the plate has been annealed. All holes are drilled through drilling templets so centers will all be exactly positioned. Careful work at this stage is necessary as there is no way to correct errors in the finished plate, due to the extreme toughness and hardness of the heat-treated material.

Straightening Is Tricky: After machining to exact dimensions and drilling all holes, plates are given their final heat treatment. This is a heating and quenching cycle designed to produce maximum surface hardness and maximum strength and toughness of the backing material. Since distortion from heat treating is usual, straightening becomes the next important step. This work is very critical for while the plate can be bent a certain amount, it must be done carefully or the hardened surface will develop cracks, making the plate useless. Straightening is done on heavy presses, some rated up in the thousands of tons for plate several inches in thickness. The plate is placed on dies and hammered back to a perfectly flat surface by hits at full tonnage capacity of the press, some units running at rates up to 40 or more strokes per minute. Final acceptance is based on more ballistic tests on the firing range.

IT MUST FIT: Much work has been done to improve armor plate production. The important thing from the tank manufacturer's point of view is that the plates reach him cut and drilled to exact dimensions and perfectly flat. Otherwise, great difficulty is encountered in assembling the work. The extreme toughness and hardness of armor plate means that there is no means of correcting errors in location of holes or dimensions except by grinding off excess material or drifting holes by grinding them to a larger diameter. This is the primary consideration for which proper provision must be made.

To make it more difficult, no shims are permitted in assembling armor plate or attaching equipment to it. Thus the plates sent to the fabricator to build into a tank must be drilled and cut to exact size to fit together properly during assembly.

The method usually employed to assure proper fit is somewhat as follows: After a tank has been designed and all detail drawings worked out, each portion to be made from armor plate is first made as a wooden pattern to exact size and with rivet and bolt holes drilled the same as the actual armor plate is to be. Then these wooden parts are assembled to see if they fit together properly. At this time any adjustments found necessary can be made and the original detail drawings revised.

When the armor plate producer has been given the final detailed drawings, a trial set of plates is first produced. These then are assembled and checked by the fabricator to see if everything fits properly

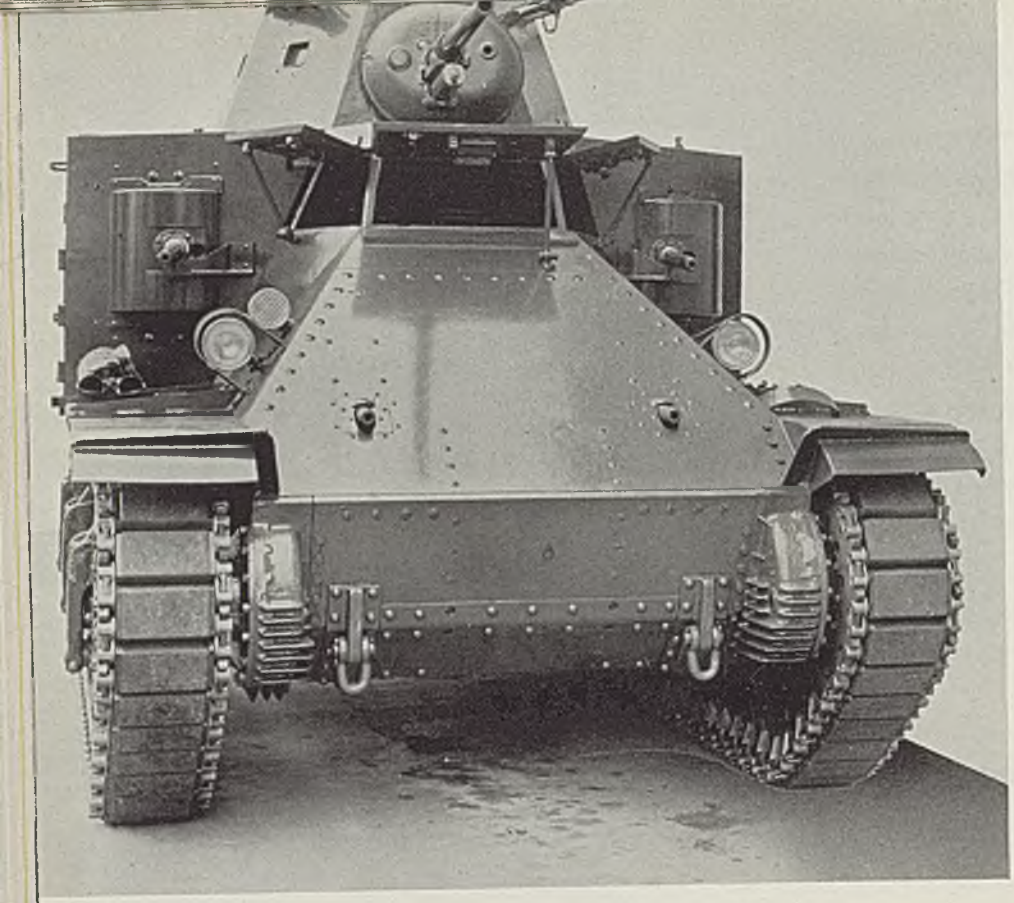


Fig. 2—Front view of medium tank, Type M2. All hull plates are riveted except those few which are bolted to permit access to interiors. Front end plate and sloping front deck are bolted for access to transmission units which extend across extreme front end of tank just inside the armor. Final drive units to sprocket wheels are seen as ribbed housings, extreme front, right and left

within the close tolerances necessary. Then and then only does the maker of armor plate go into production. And to assure that subsequent work "fits," each and every piece is tested by the fabricator upon receipt at the tank plant, using specially prepared templets to check all dimensions as well as each rivet and bolt hole.

Why "Cubical" Design: This brings up another point. During heat treatment—a necessary step in making armor plate—the plates usually become warped and must be straightened as was mentioned. Flat plates can be straightened without too much difficulty, but curved plates. . . . For this reason few if any curved armor plate (surface hardened) shapes are used. Three-dimensional curves are almost impossible due to the impracticability of heat treating and straightening them to the exact shape desired. This is the reason for the "cubical" appearance of most tanks and other equipment fabricated from armor plate.

Bullet "Splash": While it is true that practically every joint is covered by a structural member on the inside of the tank, close-fitting joints are absolutely essential to prevent bullet "splash." Otherwise, a projectile striking the joint at high velocity would force some metal through the opening. For this reason, all joints must fit within 1/64-inch or less, no visible crack being permitted. This is the portion of the assembly work which causes difficulty.

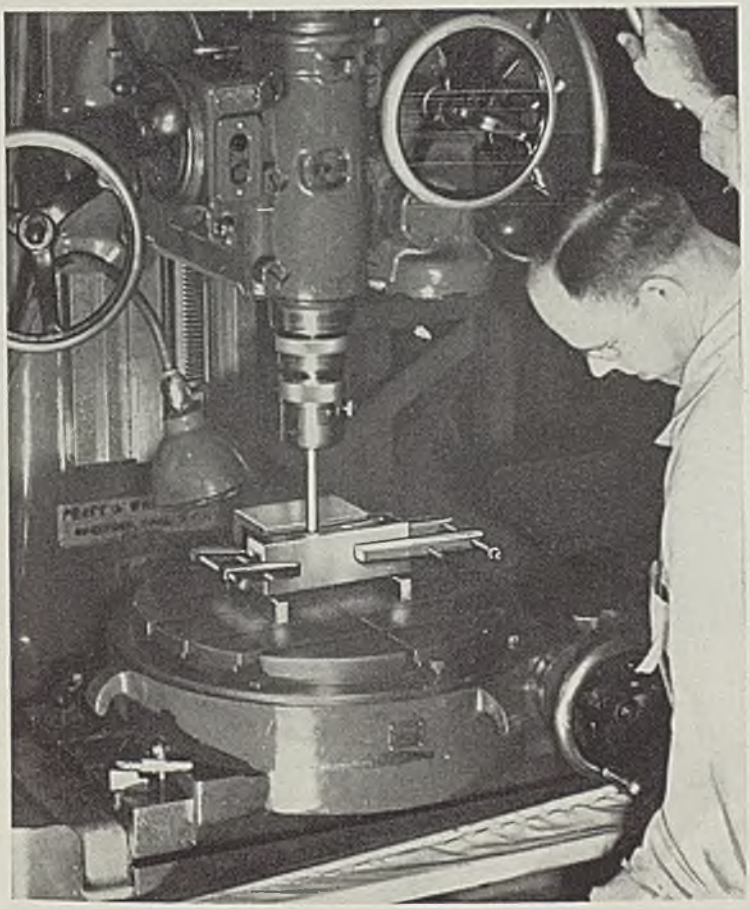
No "Forcing": The second specification that is involved here is that all joints must come flush and tight without the necessity for forcing or jacking the plates into place other than a reasonable amount that is permitted by use of erecting bolts. Forcing or bending of plates to fit during assembly may induce strain or cause cracking or deformation of other components and absolutely is not permitted.

Outside of the considerations just pointed out, any manufacturer who could handle the construction of heavy caterpillar tractors or trucks should have no difficulty in constructing tanks. Of course certain elements, such as the drives and transmissions, involve much exacting work but nothing much beyond the scope of modern automotive work.

Meeting Government Specifications: Many manufacturers have a wholly erroneous idea of government specifications. Contrary to a much held belief, specifications for many parts do not go into extreme detail as to chemical composition, heat treatment and method of fabrication. In fact, a good many parts specifications, such as the few typical ones which will be detailed further on, leave these factors entirely to the discretion of the contractor furnishing the parts. The specification for the part is based upon the characteristics of the part *as furnished* and not *how* these characteristics are obtained.

Specifications for wrought steel armor plate are an example. Ordnance Department, United States Army, tentative specification AXS-54K- Revision 4, dated Nov. 20, 1939, specifies in paragraph C-1A—Material—"The composition of the steel used, the heat treatment and method of fabrication of the plate shall be at the option of the manufacturer. Finished plates, however, shall be in accordance with the requirements specified herein and on the applicable detail drawings." Then these same specifications continue to point out the requirements as to workmanship, interchangeability, samples for checking and methods of testing including shock tests, resistance-to-penetration tests as well as tests of hardness, toughness and ductility. Methods of inspection and of making the tests as well as test

WHAT IS THE TRUE MEASURE OF TOOL PERFORMANCE?



IS it the *life* of the tool in pieces? Or is it the total output of the machine or press *over a period of time*?

It is not how many pieces a tool will make that counts—but how *quickly* it will make them. Almost anyone could make a blanking die so heavy that with frequent pauses for regrinding, it could produce a million pieces. The trick is to make a million-piece die requiring *no* regrinds—or only one or two. The real secret of high production is *uninterrupted* production.

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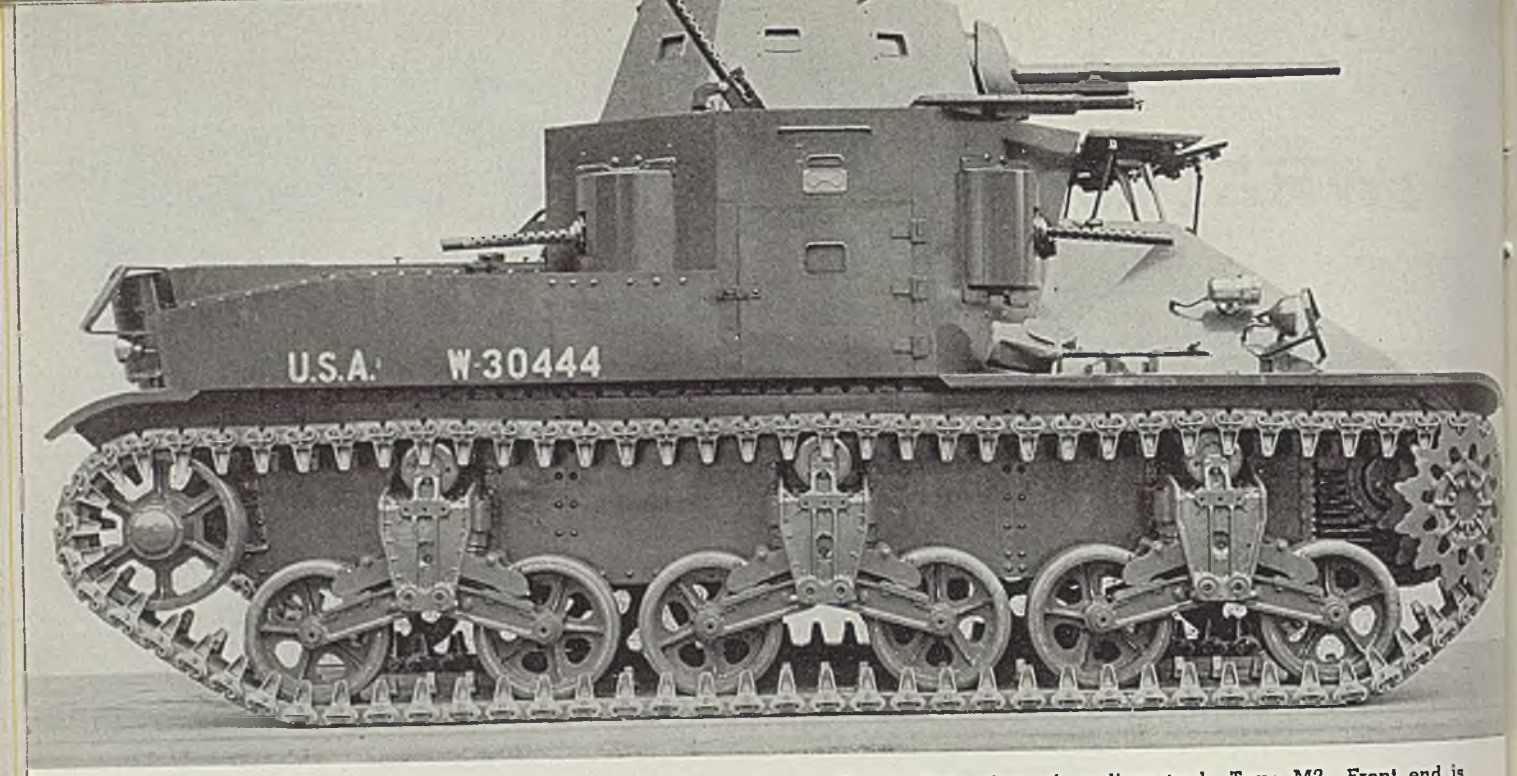


Fig. 3—Side view of medium tank, Type M2. Front end is at right. Hull is supported on track by three bogies on each side, each bogie having two wheels and pivot-linkage system. Each track is driven at both inner and outer edges by two sprocket wheels at right end here

requirements for various types of armor plate are specified.

The same holds true for a similar specification for cast armor plate—Rock Island Arsenal tentative specification R1XS-72C, which states: "The chemical composition, heat treatment and methods of fabrication are left to the discretion of the contractor. . ." One of the specifications for armor plate requires that one piece from every heat be given the ballistic tests.

Machining Cast Armor Plate: Of course cast armor plate and other shapes designed to meet ballistic requirements are extremely hard and tough to machine. However, these parts can be and are machined in ordinary equipment and with usual tools but this is only possible by reducing speeds and feeds to about one-third the values that ordinarily would be used to machine steel castings.

Armored Division: A tentative armored division of the United States Army includes 272 light tanks, 110 medium tanks, 201 scout cars. The term "tanks" has come to include the light vehicles formerly designated as "combat cars"—a term still employed but going out of use.

Tank designs include many types. The new armored field force of the United States Army has taken from the infantry the M2-A1, M2-A2, M2-A3, and M2-A4 light tanks as well as the M2 and M2-A1 medium tanks and some of the T-4. From the cavalry has come the combat car, now known as the light tank and similar to the M2-A1. The general trend is constantly toward greater weight. The M2-A1 light tank first built in 1935 weighed about 10 tons; the M2-A4 about 12 tons. The M2 medium tank weighs about 17½ tons, the M2-A1 medium tank about 19 tons. Accompanying illustrations, Figs. 1, 2 and 3, are views of the M2 tank.

Some idea of the engineering preparations involved in tank construction can be had by noting that approximately 10,000 individual drawings are required for a light tank. Heavier tanks with more armament and more driving elements involve, of course, a greater number—up to 20,000. That in itself represents a tremendous amount of work.

Design of M2 Tank: Typical of those tanks being built in large numbers at the present time is the M2 or medium tank. Fig. 2 is a front view; Fig. 3 a side view. This unit is a full track laying combat vehicle, has a revolving turret on top and barbette or fighting compartment below.

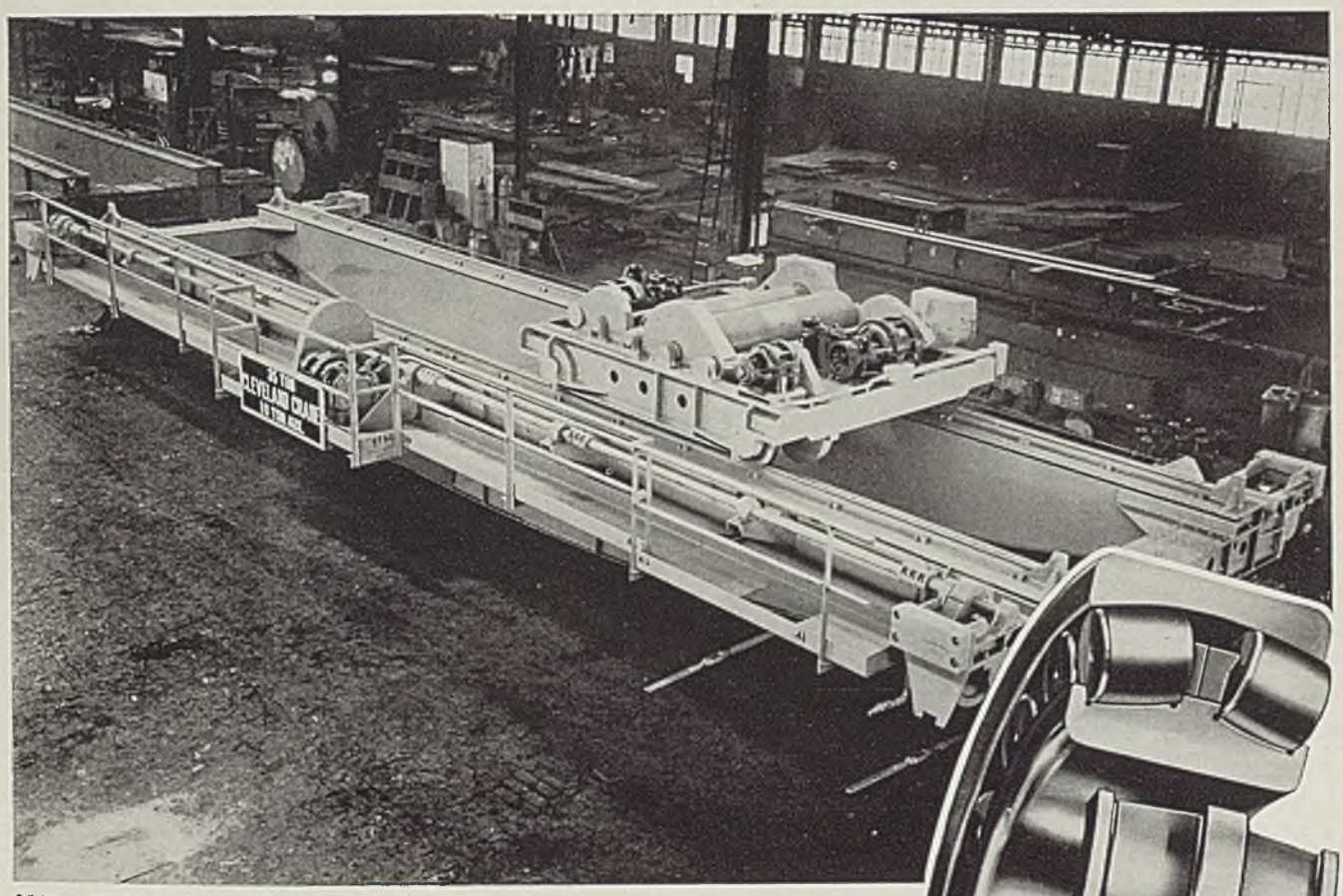
Next week, the second part of this article will detail construction and manufacturing operations in making light tanks at Rock Island Arsenal.

Device Tests Ability of Rubber in Hard Service

■ A novel testing device that determines the heat-generating properties of rubber, furnishing vital data for developing products destined for combat service, is reported by B. F. Goodrich Co., Akron, O. According to James W. Schade, research director, the machine, known as the Flexometer, has already furnished data required to develop stronger tires for combat cars and trucks, rubber tracks for crawler-type vehicles, and special bogie tires for the operating mechanism of heavy tanks.

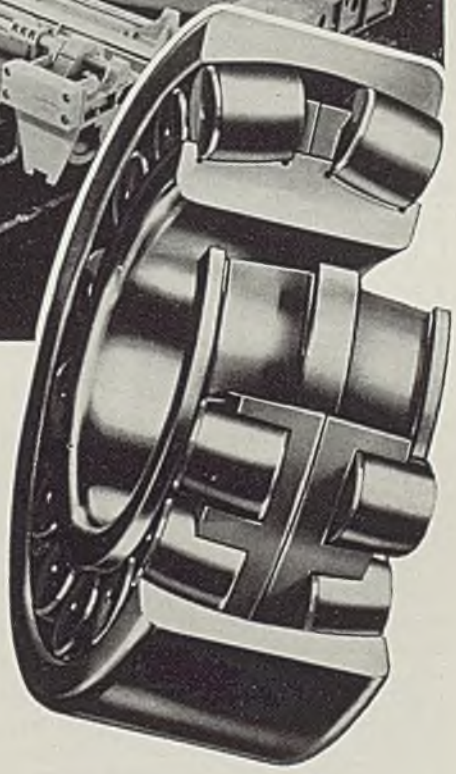
"With this device," he said, "we can determine the heat generated in rubber when subjected to repeated impacts or shaken by vibration—a phenomenon which science calls 'hysteresis'."

Energy imparted to the tire by impact against the road is transformed into heat to a greater extent in some rubber tire compounds than in others, he explained. The testing machine simulates service conditions by submitting small cylinders of rubber or rubber and fabric cut from tires, to the pounding vibrations of 1800 impacts a minute, while delicate instruments chart the rise in temperature. Under heavy loads, rubber, changed by heat to a liquid may blow out.



35-Ton All-Welded Crane built by The Cleveland Crane & Engineering Co. Its bridge axles are equipped with SKF Spherical Roller Bearings.

Rolling Alignment



COMES WITH SKF BEARINGS

Crane manufacturers and users like the ROLLING SELF-ALIGNMENT of SKF Spherical Roller Bearings. They like it because it offsets frame distortion and bridge truck deflection under heavy loads. They also like the low coefficient of friction in SKF's that assures easy starting and running . . . the simplified, fool-proof design, pioneered by SKF, that insures *economical manufacture* and *ease in assembly without the necessity of bearing adjustments* and *with minimum maintenance.* No wonder, then, that so many of them *use* SKF Sphericals. 4804

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ROLLER SKF BEARINGS

Blast Furnace, Coke Ovens Faced With Operating Readjustments

■ REQUIREMENTS of national defense seem destined to force operating readjustments upon blast furnaces and coke ovens, for even at this early stage in the war emergency shortages of raw materials are developing, thereby causing sacrifices in quality of product. Thus, much of the discussion at the two sessions of the Blast Furnace and Raw Materials Committee, American Institute of Mining and Metallurgical Engineers, on April 23, at the Palmer House, Chicago, centered on these problems. Attendance at the meeting was over 100.

Demand for coke is requiring use of shorter coking time with its attendant sacrifice of uniformity. To throw light on the effect of coke quality upon blast furnace operation, H. W. Johnson, superintendent of blast furnaces, Inland Steel Co., East Chicago, Ind., reported upon a lengthy investigation on this subject. Conclusions were that coking time and temperature are the two important factors influencing coke quality and altogether some 15 characteristics of the coke are affected. Each characteristic leaves its imprint on furnace operation. The paper served to illustrate the individualistic behavior of blast furnaces and the impossibility of laying down definite rules to apply to all units under a given set of conditions.

Requirements Are Exacting

Roy A. Lindgren, superintendent, blast furnace department, Wisconsin Steel Co., South Chicago, Ill., asserted that merchant iron producers are being confronted with unusual specifications for foundry iron of low silicon and manganese of 0.40 to 0.50 per cent. Ores for making this iron are low in alumina content—6 to 8 per cent—thus furnace practice is not good. Sulphur control is difficult when alumina decreases. Normal furnace operation, however, can be obtained by using a high magnesia slag in the neighborhood of 20 per cent magnesia.

Several instances of cracking of stove shells under extremely severe cold weather conditions were related by G. T. Williams, superintendent, blast furnace and coke plant, Youngstown Sheet & Tube Co., Indiana Harbor, Ind. This introduced a lengthy discussion of causes of cracking in both stove and furnace shells. Consensus was that pressure of refractories against shells, created either by heat expansion of refractory impregnation expansion, produces this bursting. Current practice is to allow adequate space between shells and refractories.

Necessity of regulating dome temperatures of hot blast stoves was emphasized by G. E. Steudel, division superintendent, blast furnaces, Carnegie-Illinois Steel Corp., South Chicago, Ill. Experience at his plant indicates that 2100 degrees Fahr. is the maximum which should be permitted. Purpose of control is to reduce maintenance, in spite of the fact that the lower temperatures decrease blast temperatures and consequently increase coke consumption in the furnace. Control is effected by thermocouples placed in the dome. Some difficulty has been experienced in obtaining accuracy and satisfactory tube and couple life. Tubes usually last nine months and couples four weeks.

Much discussion arose as to the probable cause of blast furnaces hanging shortly after being blown in. This was precipitated by an experience related by W. E. Brewster, assistant general superintendent, Wisconsin Steel Co., South Chicago, Ill. Theory advanced by most speakers was that the stack gets too hot too high up, causing formation of a seal which even an excessively high blast will not break. Solution appears to be removal of blast for a period, then to resume with normal blowing.

Present heavy demand for coke is forcing the use of high-sulphur coal, thereby resulting in high-sulphur coke. When the latter is used in the blast furnace, high sulphur iron is produced. How, then, to desulphurize the iron before charging to the open hearth becomes a real problem if normal steelmaking operations are to be maintained. Notable success in desulphurizing the iron by soda ash treatment has been achieved in England and recently investigational work has been pursued in this country.

A research program undertaken at Pittsburgh Steel Co., Monessen, Pa., late last year, in co-operation with the Blast Furnace and Raw Materials Committee, was outlined by Maurice Wheldon and Glenn Hanna, respectively superintendent and assistant of blast furnaces, and C. L. Labeka, plant metallurgist, of that company. Iron of over 0.05 per cent sulphur is desulphurized by tapping into ladles with soda ash in the bottom. A part of the sulphur rises to the top as slag and this is removed as completely as possible before the metal is poured into the mixer. The iron was produced in the blast furnace by using coke of 0.95 to 1.35 per cent sulphur content.

Results in Increased Yield

The authors pointed out that blast furnace yield increases when high-sulphur iron is made and a lean slag is employed. It appears that desulphurization with soda ash is entirely practical and capable of giving uniform iron quality. Tests showed that iron containing only about 0.03 per cent sulphur could be delivered to the open hearths consistently. Ladle refractories showed some deleterious effect from the use of soda ash, but the destruction was not regarded as excessive.

Operation of blast furnace on 100 per cent steel scrap charge is entirely feasible, according to C. L. T. Edwards, Bethlehem Steel Co., Bethlehem, Pa., who described the practice of that company in 1919 utilizing some 22,000 tons of alloy steel turnings and borings. The probability that similar practice may have to be resorted to again in the near future as large tonnages of alloy turnings and borings, unsuitable for open-hearth charging, accumulated during national defense acceleration.

Point emphasized by the author was that blast furnace charging of 100 per cent scrap is a smelting operation and not a melting operation as many foundrymen declare. Iron produced is a perfectly normal iron.

That blast furnaces some day may be lined with carbon blocks is a distinct possibility. It is said that 75 per cent of all blast furnaces in Germany use this type of lining. No extensive efforts to use this type lining in this country

Committee's Deliberations

At a meeting of the Open-Hearth Executive Committee, held at the Palmer House, Chicago, April 24, the following action was taken:

The 1942 Open-Hearth conference will be held in Cincinnati, April 22-24.

A committee was appointed to draft a constitution and by-laws and to provide for the rotation of directors and officials.

Continuance of the Open-Hearth scholarship at the Massachusetts Institute of Technology was authorized.

A committee was appointed to help prepare and finance the writing and publishing of a book on open-hearth practice.

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Yoloy is ready for military service today, because six years ago Youngstown research was already at work to further improve those qualities needed to meet the strict requirements of national rearmament. Now, democracy is using Yoloy steel for defense equipment where it is desirable to eliminate dead weight and clumsy bulk without sacrificing strength or durability.

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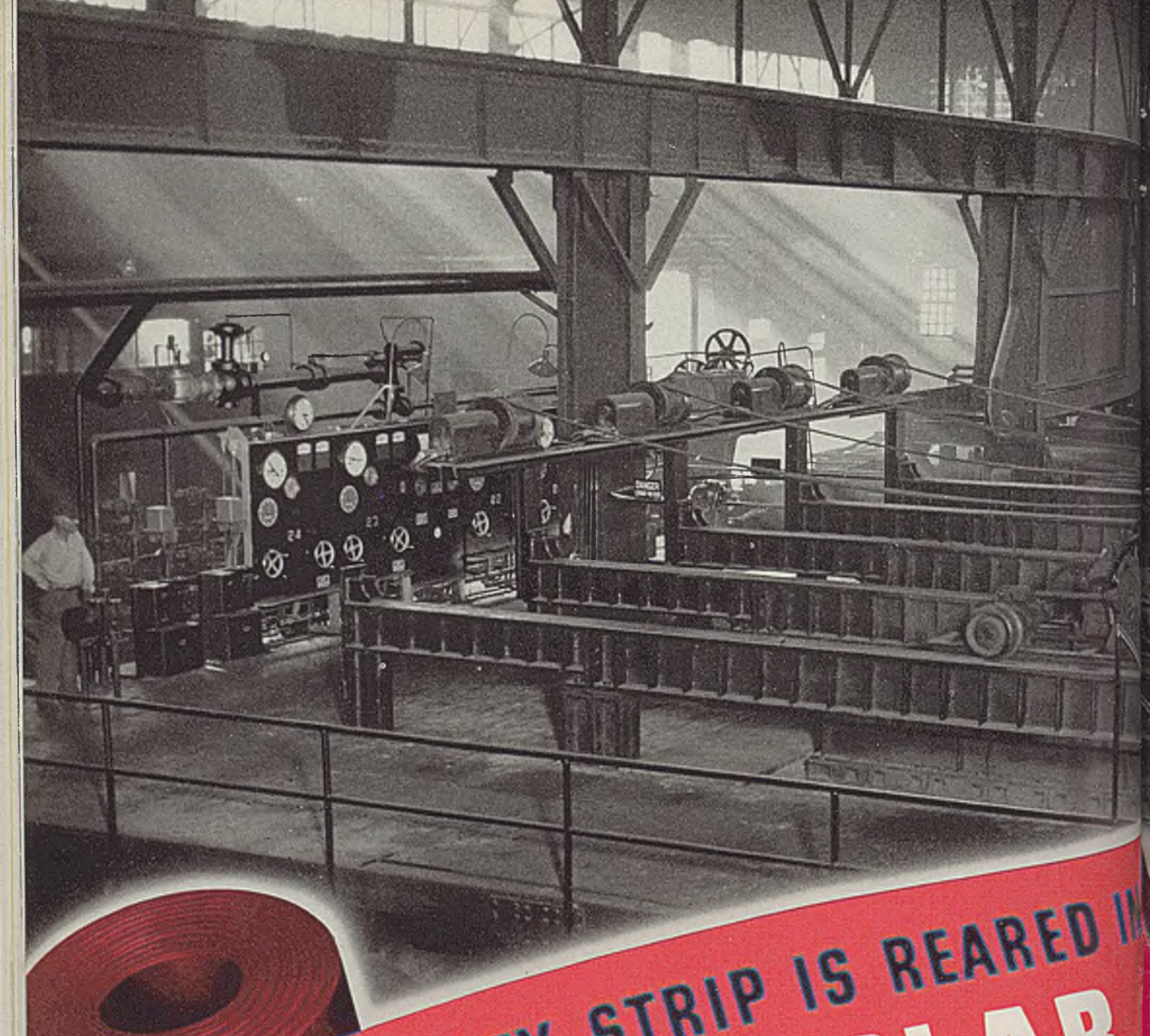

GRANITE CITY STRIP IS REARED IN

SC PITS AND SLAB FURNACE

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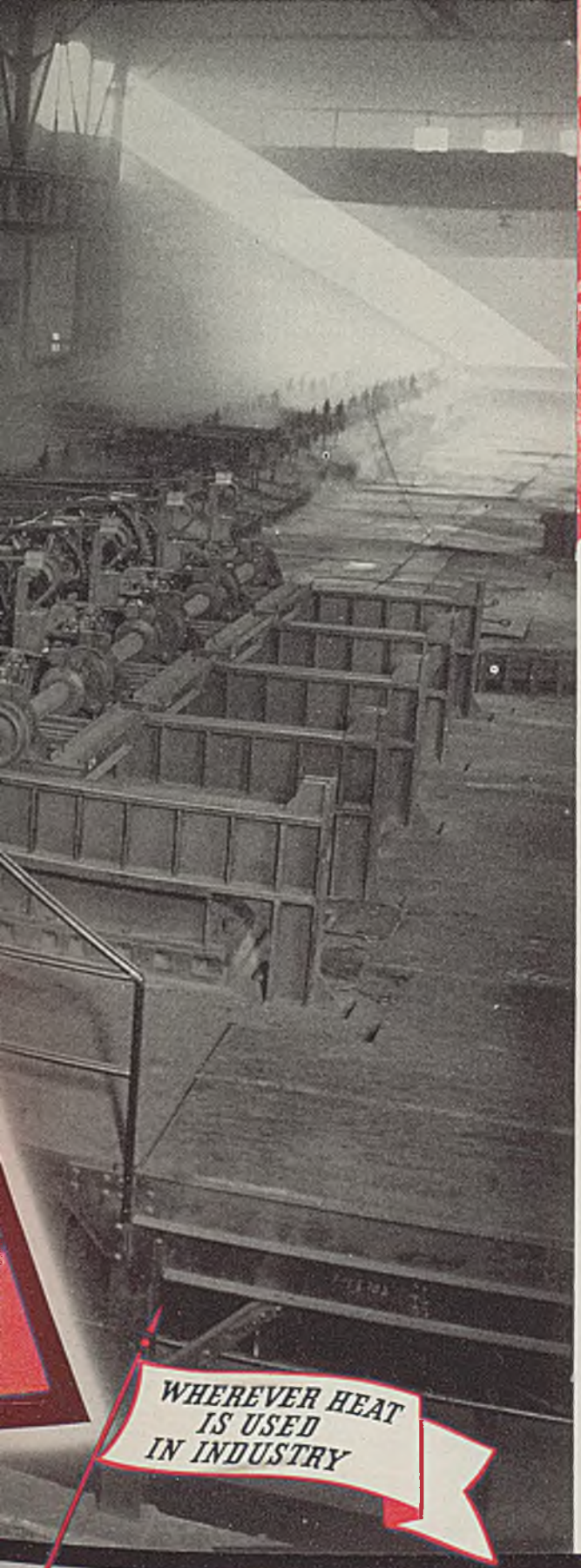

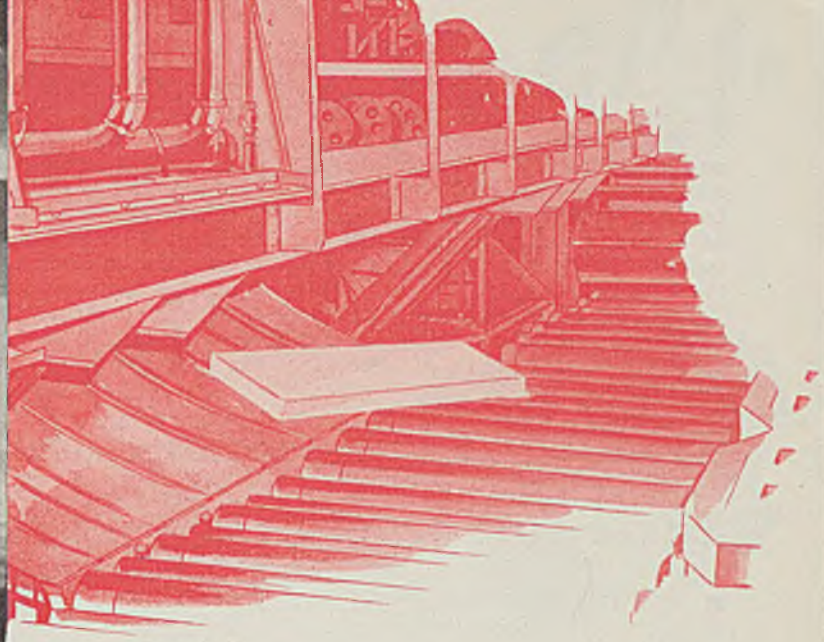

AS IN MAN, early environment plays a crucial part in the later life of steel. In the initial stages of manufacture (the soaking pit and slab furnace) qualities are imparted to steel which remain with it during all subsequent stages of production into the finished part.

Strip from the Granite City Steel Company owes an appreciable part of its fine reputation to the uniform heating received in the SC One-Way Fired Soaking Pits and Slab Furnace. It is here that the inherent properties which make possible uniform gage and good drawing properties are imparted.

In the soaking pits, completely automatic control of temperature, pressure and atmosphere assures uniform heating. Regardless of ingot condition or required heating rate—whether hot or cold alloy or low carbon—the controls can be quickly adjusted for predetermined consistent and uniform results.

After reduction to slabs, the steel is heated for rolling in an SC Triple-Zone Slab Furnace. Complete automatic combustion and temperature control in all three zones assures uniform heating with a minimum of attention.

We think that you will agree that uniform heating plus controlled scale is essential in the reduction of ingots to slabs and slabs to plates or continuous strip. Ask an SC engineer how those qualities you so carefully control in the open hearth can best be protected and developed during heating. Write to

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have been made. F. J. Vosburgh, manager, new products division, National Carbon Co. Inc., New York, and M. R. Hatfield, research laboratory, same company, Cleveland, attempted to indicate the suitability of a carbon lining by presenting a paper on temperature gradients in the material.

Through laboratory experiments with experimental columns made up of 12 inches of carbon, a layer of cement, 12 more inches of carbon, 2 inches of granular carbon and 1 inch steel plate, they found that with a 3000-degree Fahr. temperature maintained at the bottom, temperatures as low as 400 degrees were obtained at the plate. By water-cooling the outside temperature was dropped to 200 degrees. Next question is to determine suitability of carbon in actual blast furnace service.

Trained Men Recommended for Instrumentation System

■ THE IMPORTANCE of placing all instruments in a plant under the complete jurisdiction of trained men was emphasized by R. A. Weikel, Brown Instrument Co., Philadelphia, at the annual Spring conference of the Association of Iron and Steel Engineers, Ohio Hotel, Youngstown, O., April 28.

The type of men that should be considered as specialists along this line should have at least two years of technical education or the equivalent in practical experience. With some additional training these men become well qualified to handle the instrumentation system. The time to train them will vary. Some men are exceptional and are able to learn quickly. However, for the average man one year may be required before he becomes efficient.

Other important factors cited by Mr. Weikel were that the instrument men must work in close cooperation with plant operators, the instrument department should specify all instruments, various groups of instrument men should have their own shop where records are filed, a complete set of testing equipment should be provided, all instruments should be checked periodically, and the methods for testing should be developed by the instrument department itself.

Discussion brought out that strip charts have been greatly overdone in the steel industry and that there should be more circular charts employed showing 24-hour operations.

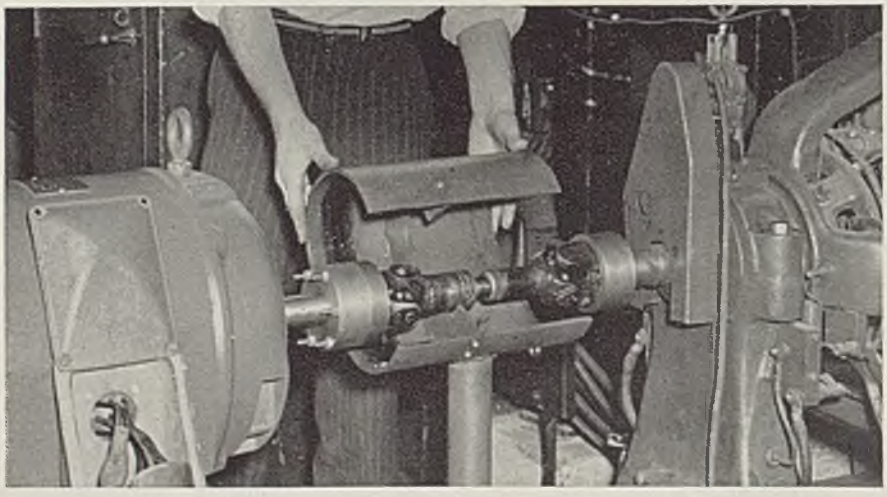
W. H. Bennett, superintendent, Gautier department, Bethlehem Steel Co., Johnstown, Pa., in speaking on operating problems in bar mills at the evening session cited the importance of the human element in the operation of finishing mills. Practice has shown that roll passes ideal on one particular mill cannot be used efficiently on another mill. He stressed the importance of variable-speed motor drives for bar mill operations and warned that with the strict surface requirements being demanded by the customer all mills may be obliged to install high-pressure spray systems which operate under 1000 pounds per square inch.

Without good guides on the entering and delivering side of the mill it is impossible to roll good products, the speaker explained. Scratches on the product can be traced to poor guides. The function of the cooling bed is to keep the bars straight while cooling. Regardless of how efficient the cooling bed is, it requires attention. It must contain sufficient notches to hold enough bars to cool effectively and should be designed for pack annealing if flat spring steel is a product of the mill.

In preparing stock for shipment a considerable amount of lumber is used for blocking in the car. A surprising amount of paper is used for protection from weather.

Considerable good has resulted in programs of accident prevention, Mr. Bennett said in conclusion. The most effective method of making workmen safety conscious, he contended, is by means of group meetings of the workmen. In these meetings the individual workman feels that he is an important member of the family and therefore becomes more interested in the safety program. This system, the speaker pointed out, has reached further down the line than any other method yet suggested.

Speeding Up Test Work



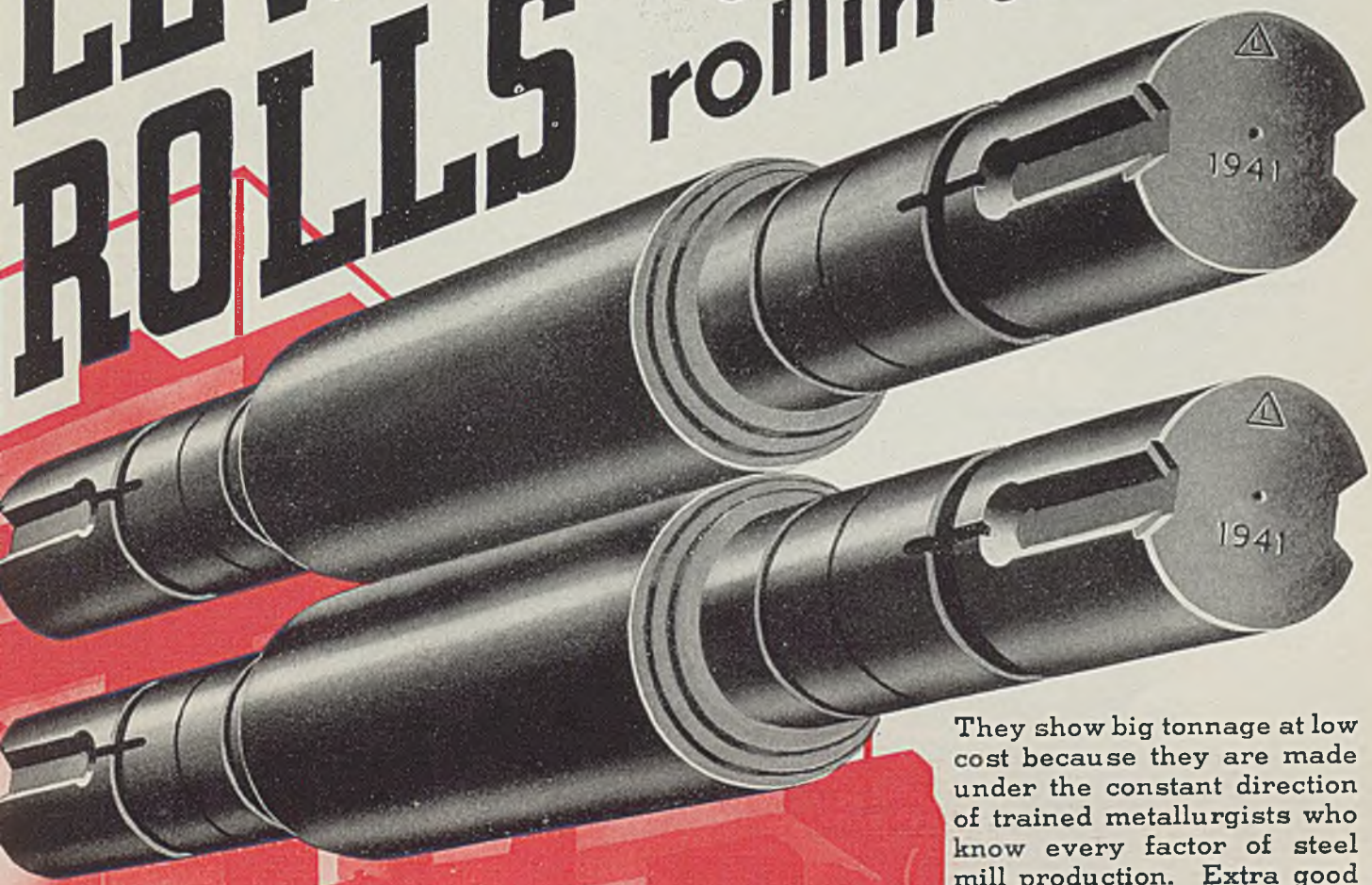
■ Time consuming close alignment of machines before operating them under test is no longer necessary at Reliance Electric & Engineering Co., Cleveland. Motors now are coupled by a flexible connection (shown above) which quickens work of testing greatly. Here standard automotive universal joints with shortened torque tubes are used for the connection. These are joined in pairs by splines welded into tube ends. Adapters bolted to opposite ends of joints are in turn bolted to whatever size flange is required for use with diameter of motor shaft involved. Protection against a coupling "flying apart" is afforded by a steel plate safety cover

Consider New Standards For Metallic Coatings

■ Formulation of specifications and methods for testing electrodeposited metallic coatings on steel, with the exception of zinc and cadmium, is included in work mapped out for a new standing committee on electroplating organized by the American Society for Testing Materials. Personnel includes E. M. Baker, chairman, professor of chemical engineering, University of Michigan, Ann Arbor, Mich.; E. A. Anderson, vice chairman, New Jersey Zinc Co., Palmerton, Pa.; and Gustaf Soderberg, secretary, technical director, Udylite Corp., Detroit.

The committee is considering standards that have been under development in Committee B-3 on corrosion of nonferrous metals and alloys and it is proposed to recommend at the annual meeting in June new specifications.

LEWIS ROLLS ..."just keep rollin' along!"



They show big tonnage at low cost because they are made under the constant direction of trained metallurgists who know every factor of steel mill production. Extra good finish, low frequency of roll changes, uninterrupted production are extra values, that make these rolls preferred by mill operators.

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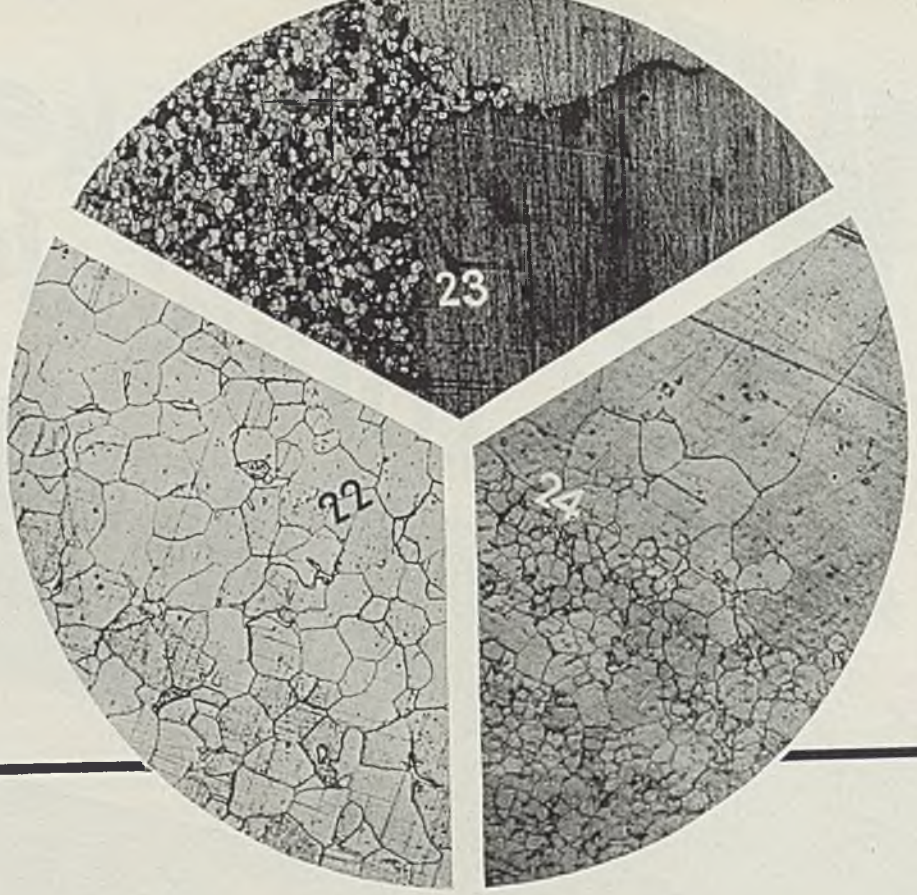

Fig. 22—Exaggerated grain growth typical of straining at too low rolling temperature. Fig. 23—Example of abnormal grain growth caused by springs of pinch rolls

Fig. 24—Photomicrograph of same material shown in Fig. 22 and 23. The sample was obtained between roughing and finishing mills. Temperature was 1990 degrees Fahr.

Improving the Quality of Hot Rolled Strip

Use of steel rolls in roughing and first two finishing stands affords improvement in surface of product and increase in roll life per dressing. Identical grain and physical characteristics are duplicated when strip is finished at proper temperature whether it is coiled hot or cold or bed-cooled

■ MANY DEFECTS in hot strip products arise either in the slab or in the hot strip department. Hence it should fall within the jurisdiction of the metallurgical department to maintain proper supervision in steelmaking, pit heating and breakdown rolling, so that a suitable quality slab is delivered to the strip unit.

Many defects, however, originate in the hot strip mill such as guide rubs where the strip rides a guide and gathers scale or steel and embeds it in the strip, and guide scratches which usually are imparted by rough places on the guides. The latter can be detected by watching the bands while rolling and when sparks are noted these areas can be ground off. Reel digs usually are traceable to the mechanical electrical feature due to lack of proper electrical and mechanical synchronization, such as mill to reels, table rolls to reels or mill, and table rolls and reels.

Another defect often encountered in hot bands is known as "snowballs" which are caused by one lap of strip tightening over another thereby damaging the piece and often resulting in its ultimate rejection. When this is first noticed, the reels are changed. The practice at most strip units is to change one reel unit every two weeks.

"Checked" surface condition may be traced to the slab or to the heating furnace atmosphere. Scaling frequently is due to the initial heating of the slab although sometimes it can be traced to ingot heating, to the steelmaking procedure, or to alloys especially copper either in open-hearth scrap or that used as "cheapeners" in the blast furnace burden. Another feature characteristic of improper furnace atmospheres is that under a more oxygen condition where the scale will be loose or blister at much lower finishing temperatures.

Another most important phase of hot strip rolling practice and one affecting extensively surface quality is that of rolls. Initial cost of the rolls, total life and life per dressing must be considered. The life per dressing is of paramount importance because of roll changes. Cost for delay is generally calculated between $150 and $250 per hour varying for different plants or units; hence, as the number of roll changes increase a rapid increase in delay cost follows.

The general accepted work roll for hot strip mills is made of chilled cast iron possibly because of the success of the old-style sheet mill roll. The manufacture of gray iron

By PAUL J. McKIMM
Cleveland

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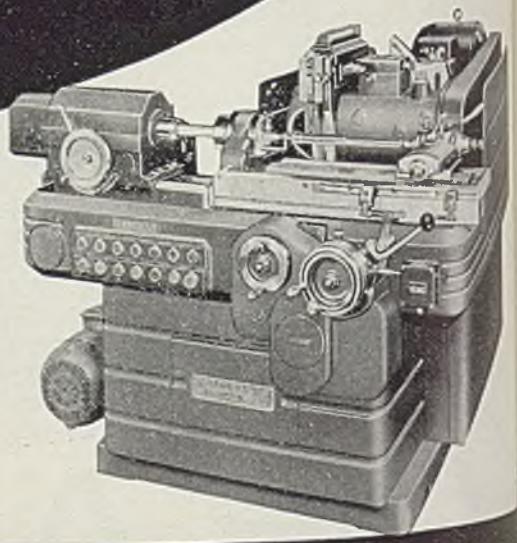

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chilled rolls remains an art in foundry practice and requires a careful selection of raw materials. These are usually made from air furnace iron although large quantities are produced from open-hearth steel. The best gray chilled iron rolls require the greatest care in the selection of the component parts of the mix which may include several grades of charcoal irons, or high-grade iron and discarded rolls. Sometimes four or five different irons constitute 50 per cent of the charge while the remainder may be scrap rolls. The main reason for using the several grades of iron is because if one grade is off-quality the chances of spoiling the heat are far less. Other features of importance are the shaking out time, the type of chill whether smooth or heavily fluted, and its location. While this type of roll has adequately served its purpose other types have been found superior in many respects.

Assisted in Freeing Scale

The first departure from this type of roll was that of a gray iron roll not chilled and used only in the roughing mill stands. This type of roll after a short time in service roughened with a grain pattern and was successful principally because its roughness assisted in freeing the scale better. Another advance was that of etching with hydrochloric and nitric acids the chilled rolls used in the last roughing and/or the Nos. 1 and 2 finishing stands. This gave excellent results but in due course it outlived its life of usefulness.

The next move, which was purely experimental, was that of using a forged steel work roll in No. 1 finishing stand, this being accomplished by utilizing a worn-out forged cold strip mill roll. Of course the initial cost would prohibit the use of such a roll because the life could not be extended sufficiently to offset the cost. Nevertheless the life per dressing was about 3:1 over that of the chilled iron roll. It developed a roughness similar to corrugations in the circumferential direction due to fine oxide from the scale breaker being carried into the rolls with the water.

A steel roll cast with chill blocks in the mold is most successful, the chills increasing the density of the surface. The analysis may be of a wide range of elements, both carbon and varying alloys. The initial cost over chilled iron rolls is several hundred dollars more. The life in Nos. 1 and 2 finishing stands varies at different plants from 2:1 up to 5:1 per dressing and in the roughing stands from 5:1 up to as high as 15:1 per dressing. In fact, the roughing rolls have been used for much higher tonnage.

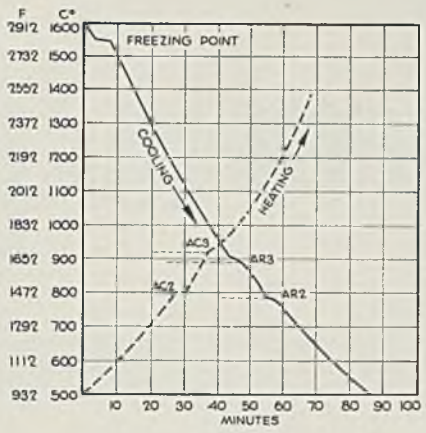


Fig. 25—Chart showing the critical points of iron (Goerens)

The original objective is not to lower roll cost nor decrease roll changing time but to improve the surface of the product. As far as known the steel work roll has not been successful beyond No. 2 finishing stand. Usually the steel roll has considerable lower scleroscope hardness than the chilled iron roll.

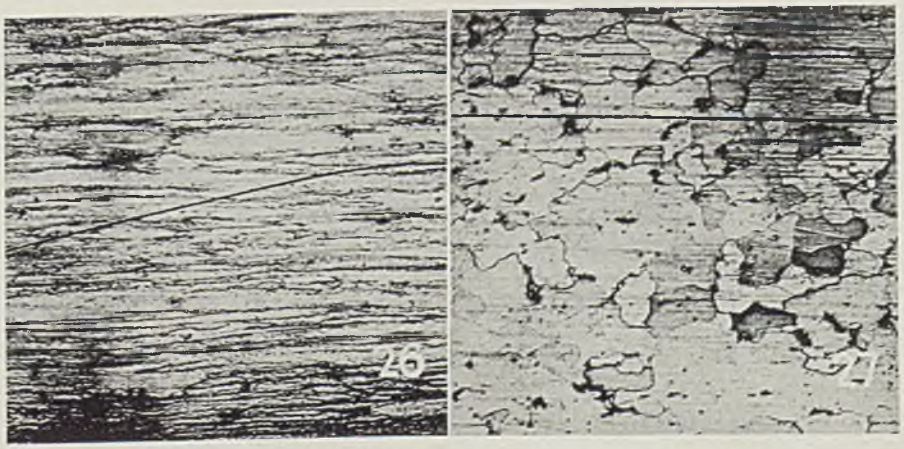
Relation of roll surfaces to that of hot strip surface may be understood from the fact that with some of the early hot strip mills the schedule was split in two sections. When a complete new mill, including the roughing unit, is installed all rolls are smooth. The cold strip schedule is processed first, followed by hot strip. The cold strip surface is far inferior to that of hot strip inasmuch as many rejections are encountered such as open-surface, scale streaks, and scale pattern. On many occasions it is customary to produce 500 to 1000 tons of the wide widths of hot strip and then pull several sets of the finishing rolls from their housings and utilize them in the last roughing and first and/or second finishing stand when working severe surface specifications. The most satisfactory practice is to roll tonnage of an ordinary grade to obtain some roughness in the early hot finishing pass and also not to change the roughing rolls until necessary. The roughing rolls work better when rough and this roughness is intensified by the pickup of roll scale. In other words a set of rough rolls in this unit assists freeing any primary scale carried through or any secondary scale that may develop between stands. Some plants roughen these rolls by sand (shot) blasting or other means.

With backup rolls the case is a little different in that they may mark the work rolls which, in turn, would mar the surface of the band. The generally accepted backup roll is that of a cast-steel mandrel with a forged steel sleeve, usually of alloy quality.

Processing strip steel is accomplished by heating the steel to its plastic state so that the crystals are rearranged when the metal flows along previously established lines. Hot working is assumed to be that of heating the steel to temperatures above the blue brittle range, approximately 700 degrees Fahr. As the heating temperatures increase there is a constant decrease in the strength of the metal and an increase in its plasticity until the temperatures reach a point where the lowest melting constituent of the steel starts to melt. At this point the strength greatly decreases as well as the plasticity and mechanical work cannot be accomplished because the steel will break up and crumble under the rolls.

The logical temperature for heating steel for hot work is that which makes for a balance between decreasing strength and increasing plasticity. It should be subjected to a thorough soaking in a suitably reducing atmosphere so that the ultimate hot strip, whether cooled on the bed or in coils, will possess all the physical characteristics and microstructure to fully and amply

Fig. 26—(Left) Fibrous microstructure of low-carbon strip finished at 1355 degrees Fahr. Fig. 27—(Right) Same steel as shown in Fig. 26 but finished at 1415 degrees Fahr.



How to speed up production

THE regular grinding and conditioning of rapidly increasing numbers of tools and dies is a task that is severely taxing the tool rooms of industry. If this is a problem in *your* plant, here are two simple steps you can take to speed up work in your tool room:

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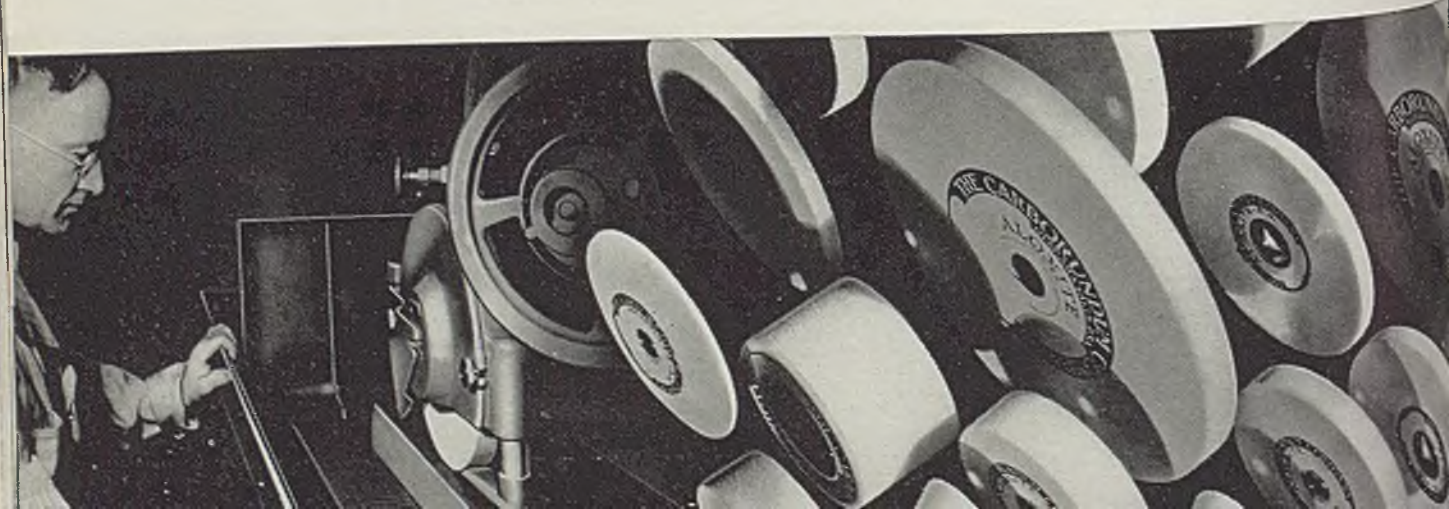

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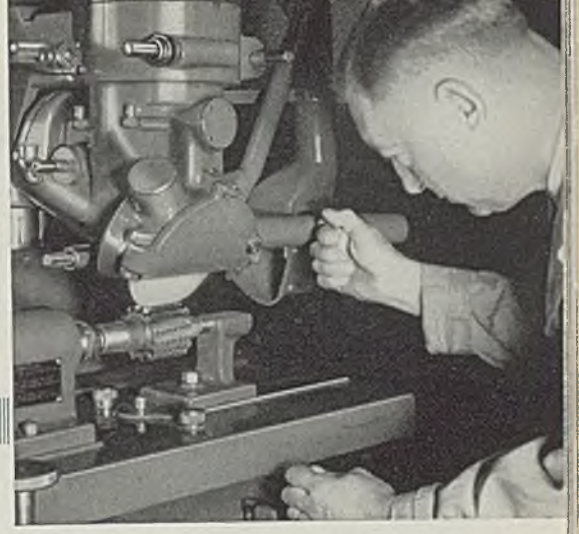

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meet specification and hence, perform successfully on its required ultimate use without further processing or heat treatment.

Hot strip today is finished at such temperatures that no anneal or normalization is necessitated. Until the installation of the 60-inch mill all producers had to resort to heat treatment, either a normalizing, box annealing and in some cases both in order to produce commercial hot strip. However, roughing mills were regeared so that predetermined temperatures could be constantly maintained and production increased.

A chart showing the critical points of iron is presented in Fig. 25. Temperatures at which equilibrium changes take place are obtained by heating and cooling curves both as to time-temperature. The jogs in both the heating and cooling curves at the Ac and Ar points are due to heat producing and heat absorbing because at these points transformation is taking place; otherwise, the curves would be smooth. Hysteresis or lag is indicated on the chart by the critical points. They occur at higher temperatures on heating than they do

Fig. 28—Bed-cooled strip with microstructure and physical values comparable to normalized material

on cooling and are due to passive resistance.

Critical temperatures are considerably altered in the presence of combined carbon. Steel when heated will expand except through the critical points where it contracts and the color darkens. Upon cooling steel contracts except through the critical point where expansion occurs and a brightening due to heat evolution. These features are not noticeable to the naked eye in low-carbon steels as they are in high-carbon grades. If steel is finished somewhat above the upper critical, that is where no load or stress is applied at lower temperatures, it will yield grain and physical values identical to a normalized steel. If the critical is 1585 degrees Fahr., a temperature of 1625 degrees would suffice where the strip is bed cooled.

Some hot strip mills have the temperature gun located between the last two finishing stands while others have them placed at varying distances from the delivery side of the last stand. All finishing temperatures stated here were taken or calculated to be approximately 8 to 10 feet from the delivery side of the last stand.

The factor controlling physical values and ferrite grain size is solely the temperature at which stress is applied and not the amount of load. That is, if the temperature is suitable the per cent of reduction can be 10 or 50 per cent but as the temperature drops to a critical point then any load or stress causes strain which changes the germination point. The grain continues to grow until low temperatures, even below 1100 degrees Fahr., arrest further growth; physical value deteriorates correspondingly. When extremely or abnormally large grains are present generally along the surface areas it frequently is maintained that decarburization has taken place but evidence does not bear this out.

Procedure in Annealing

Sheets of the conventional 2-high hot mill can be annealed at high temperatures, say 1400 degrees Fahr. or higher, without incurring extremely large grains. The usual practice for autobody sheets is to normalize, pickle, cold pass to flatten and then box annealed, the annealing temperatures ranging from 1180 to 1220 degrees Fahr., to avoid too large a grain. With cold reduced strip which has had a reduction from 50 to 65 per cent, high temperatures are necessary to promote grain growth; in fact, temperatures up to 1370 degrees Fahr., have been reached with no appreciable growth. If cold reduction between 7 and 37 per cent causes critical strain the grains will grow to abnormal proportions at annealing temperatures around 1200 degrees Fahr. These same characteristics hold true in hot strip rolling and no heat treatment.

Exaggerated grain growth typical of straining at too low a temperature in the last passes of the hot strip mill is shown in Figs. 22 to 24. Extremely large surface grain and sharp demarcation between the abnormal grain and the extremely fine grain of the interior is shown in Fig. 22. This sample was obtained in regular practice by placing a piece of cold hot strip on the breakdown mill for a few seconds, thus causing a sharp chilling of the surface to a slight depth. The cold piece of steel was removed and the breakdown rolled through six finishing stands and allowed to cool on the cooling bed.

Some metallurgists contend that chemical segregation is the cause for large surface grains but this cannot be true because samples exist where the large grain is in the core area and a fine grain in the top and bottom surface area. In this sample, the ladle analysis (killed test) was 0.03 per cent carbon whereas a killed sample averages about 0.02 per cent higher. The segregation analysis of the slab showed 0.03 per cent carbon in the wall and 0.05 per cent in the core of the top prime slab. Checks of the final strip also showed the same per cent of carbon.

Fig. 23 is another example of abnormal grain growth. This material was finished at suitable temperatures so that when cooling was done on the bed a grain comparable to a normalized grain was obtained. However, instead of being passed over the cooling bed the material was run through pinch rolls and piled at the end of the runout table. The temperature had dropped sufficiently so that the stress imparted by the springs on the pinch rolls caused sufficient critical strain and grain growth at the temperature existent in the pile. This same material when piled at the same temperatures with the springs on the pinch rolls lightened and normal conditions existing, possessed normal grain structure. This merely indicates that extremely light loads applied at a critical temperature promote excessive grain growth.

Fig. 24 is a photomicrograph of the same material as that shown in Figs. 22 and 23. The sample was obtained between the roughing and finishing units. The temperature leaving the roughing unit was 1990 degrees Fahr.

Coilers Are Relocated

Experiments were started during 1929 with material processed on a 60-inch hot strip mill, and either cooled on a cooling bed or coiled on coilers located approximately 50 feet from the last stand. At that time it was usual to locate the coiling equipment fairly close to the finishing stand but because of wide variations in physical values and microstructures the reels were placed approximately 170 to over 300 feet from the mill. These irregular grain conditions could only be remedied by normalizing. The fundamental cause was ignored, namely, the critical temperature at which the steel was subjected to stresses previous to coiling. This is the only apparent reason for the re-engineering of this section of the hot strip units.

When a strip is finished at its suitable temperature it may be

Increased Heat-treating Capacity

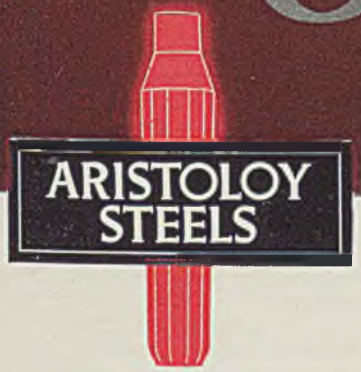

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Fig. 29—Same steel as shown in Fig. 28 but coiled 300 feet from mill at 1320 degrees Fahr.

coiled hot or cold or even bed-cooled and have identical grain and physical characteristics. These characteristics are solely controlled within the immediate area of the last few roll stands.

Fig. 26 is a photograph at 100X of an 0.08 per cent carbon, 0.31 per cent manganese steel rolled to a thickness of 0.065 to 0.075-inch and coiled. The finishing temperature was 1355 degrees Fahr. The fibrous microstructure is similar to that obtained in the hot band mill sheets. The structure may be remedied by a simple box anneal or the more costly normalizing treatment without box annealing. Fig. 27 is a sample of the same steel but finished at 1415 degrees Fahr. and coiled.

Finishing temperature is the controlling factor for promoting grain characteristics. The higher gages have large uniform cross-sectional grain, the intermediate gages have mixed and most generally a large surface grain, while the heavier gages have a small uniform grain. These conditions hold true irrespective of coiling temperatures. When bands are finished at temperatures somewhat above their critical, say for example bands having a theoretical critical of 1585 degrees and finishing at 1625 degrees Fahr., and then cooled on the bed, they will possess microstructure and physical values comparable to a normalized material as shown in Fig. 28. However, if the same steel finished at the same temperatures is coiled about 300 feet from the mill at approximately 1320 degrees Fahr. (see Fig. 29), it will possess a uniform grain throughout but of a larger size than that exhibited in Fig. 28.

Correction

■ Through a typographical error, the article "A Cure for Variable-Voltage Ills in Strip Rolling", April 7, p. 76, was credited to R. W. Wright instead of R. H. Wright. Our apologies for any confusion this may have caused.

Zinc Ample for Defense And Some Civilian Needs

(*Concluded from Page 47*)

production will be going into cartridge brass.

Mr. Church was confident that there is sufficient zinc now and will be in the future to satisfy all essential needs; however, it is necessary to distinguish sharply between requirements and demands. Higher wages of workmen in general constitute an almost irresistible buying power; therefore, it is imperative that directional governmental control be exercised.

An increase in what is commonly called "the general price level" is no justification for an increase in the price of any particular commodity, declared P. M. O'Leary, OPACS, Washington.

Pointing out that "controlling the behavior of prices" rather than of "stabilizing prices" leaves room for some flexibility, Mr. O'Leary said that certain price changes may be accepted as serving the general welfare while others are inimical to that welfare.

"Only when the preferred method seemed inadequate or unavailable have we turned to the other," Mr. O'Leary continued. "The zinc industry has been genuinely cooperative, so far as could be reasonably expected in expanding its output. Without such expansion either the price of zinc would have been much higher than at present or government price control and rationing of zinc would have been much more drastic.

"Price of zinc at East St. Louis increased by about 23 per cent from August, 1939, until May, 1940, and by an additional 24 per cent from May, 1940, until the present time. Thus, the rise in the price of zinc has been large both relatively and absolutely. It seems likely that most of the stimulus to greater production to be expected from a higher price has already taken place. While there is a shortage of zinc with a consequent need for rationing of available supplies, there is probably no one in the industry who would seriously contend that competitive bidding and soaring prices should be left to do the rationing.

"In view of these circumstances, it seems doubtful that the general public welfare would now be served by any further increase in the price of zinc. No appreciable increase in the output would be likely to result from any reasonable increase in price. Only private interests would benefit. Speaking very frankly, I do not see that they are in genuine need of benefits to be obtained at the expense of the consumer of zinc including in a large and growing way the taxpayer who pays for the rearmament program."

Surveying the available supply of zinc concentrates at home and abroad, Elmer W. Pehrson, acting chief, economics and statistics branch, United States Bureau of Mines, Washington, sees no shortage in 1941 despite what happens to ocean shipping. He made it clear that capital is unwilling to invest in expansion beyond reasonable needs for the future. Increased production by overtime work is uneconomical under present labor laws, which require overtime wage penalty, with zinc selling at 7.25 cents a pound. Best guarantee for increased production, he said, is higher prices and government aid.

President Young reviewed the slab zinc situation at considerable length. Average consumption of all grades for the five year period, 1935-1939, was 540,000 tons a year. Assuming requirements indicated for defense are correct as estimated, and taking into account the completion of new plants and additions, it appears that metal available for purposes other than defense will be equivalent to 70 to 80 per cent of the average requirement for the five-year period.

All officers of the institute were re-elected as follows: President, Howard I. Young, president, American Zinc, Lead & Smelting Co., St. Louis; vice presidents, C. Merrill Chapin Jr., St. Joseph Lead Co., New York, John A. Robinson, Eagle-Picher Mining & Smelting Co., Miami, Okla., and J. O. Elton, International Smelting Co., Salt Lake City, Utah; treasurer, John L. Good, Eagle-Picher Lead Co., Hillsboro, Ill.; and secretary, Ernest V. Gent, 60 East Forty-second street, New York.

Retiring directors were re-elected to continue for three years as follows: Kenneth C. Brownell, American Smelting & Refining Co., New York; F. F. Colcord, United States Smelting, Refining & Mining Co., New York; C. H. Crane, St. Joseph Lead Co., New York; Benno Elkan, National Zinc Co., New York; Edward W. Furst, Grasselli Chemicals department, E. I. DuPont de Nemours & Co., Wilmington, Del.; J. R. Robbins, Anaconda Copper Mining Co., New York; John A. Robinson, Eagle-Picher Mining & Smelting Co., Miami, Okla.; E. H. Snyder, Combined Metals Reduction Co., Stockton, Utah; F. C. Wallower, Evans-Wallower Lead Co., Joplin, Mo.; and B. N. Zimmer, American Metal Co. Ltd., New York.

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If the millions of bolts and nuts used annually in the automobile industry alone took just one-half of a second longer to spin down, the industry would be set back thousands of man-hours . . . and would lose thousands of dollars. And this, mind you, is based only on the time of that one man who spins down the nut . . . takes no account of tightening it up, or the slowing of entire assembly lines.

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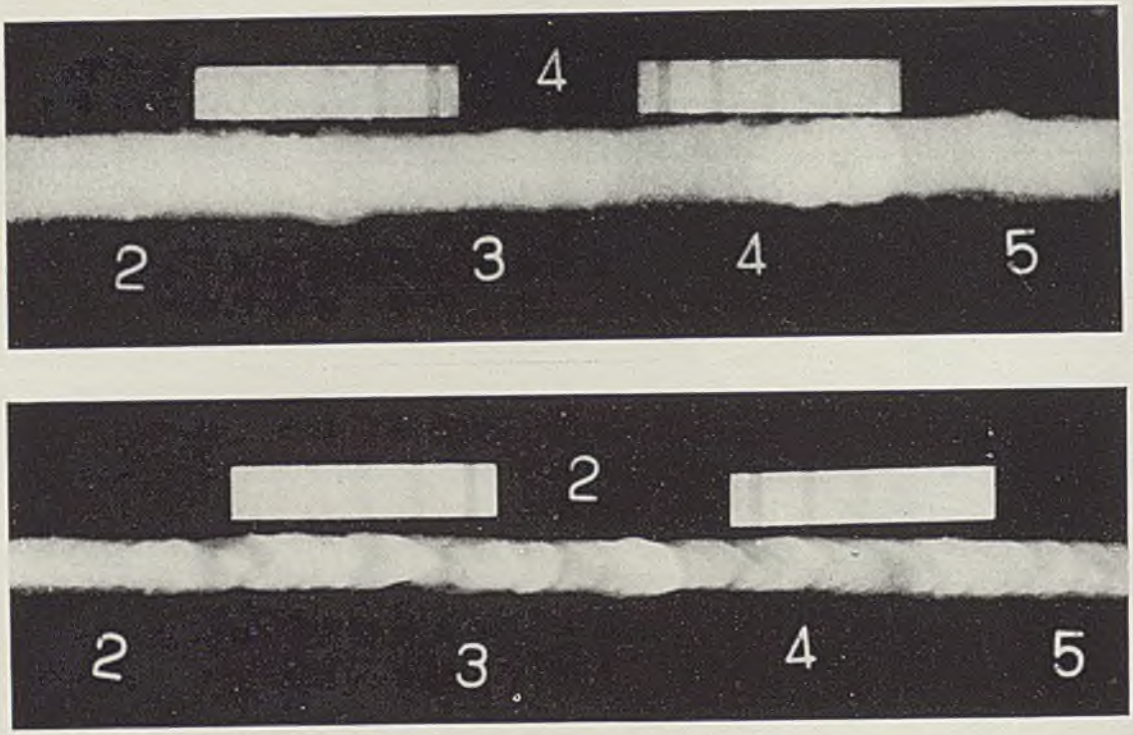

Fig. 1—A perfect butt weld, top, in ¾-inch plate as seen by the X-ray camera.
Fig. 2. (Below)—This is an X-ray view of a perfect butt weld in ¼-inch plate

How To Make

X-Ray Perfect Welds

Making welds which show up as perfect joints under X-ray examination is a problem now confronting many companies not familiar with this highest type of welding. With much defense work involving such examination, Mr. Lawrence, metallurgist and welding engineer for a large fabricator, here begins a series of three articles detailing what his company learned about doing this type of work—learned in the hard and costly school of experience. You can learn the same things easily and at slight cost if you will follow these discussions

By HAROLD LAWRENCE
Metallurgist

■ INTENSIVE demands for production for defense work place a new emphasis upon X-ray perfect welds. Many companies are entering the welding field with little or no previous experience. Few indeed are those who have first hand experience with the techniques involved in making this highest type of weld. Therefore the several simple steps involved in making perfect welded joints will be outlined here as a recipe for those unfamiliar with this type of welding and as a handy reference for welding engineers.

Modern war equipment in addition to requiring fabrication to very close tolerances places a premium on sound joints. Tremendous stresses and impact or shock loadings explain the importance of strict test procedures of the nondestructive type. Under the severe service conditions encountered, small defects may easily increase to dangerous proportions. Both magnaflux and X-ray inspection become increasingly important in ferretting out and repairing of all imperfections as well as "putting the finger" on faulty procedures. Fortunately, there now exists a sound backlog of experience in X-ray exploration of castings and welds upon which the newcomer can draw.

The primary consideration in any welding process is the correct choice of electrodes. No welder, no matter how skilled he may be, can make a proper joint without adequate tools —in this case, the correct electrodes. One of the first duties of management thus becomes the selection of electrodes designed for the thickness of steel to be welded and the position in which the welding is to be done.

That the thickness of the material to be welded influences the final decision with regard to type of electrode has been recognized of late. The fluid electrodes conforming to AWS-ASTM Specification A233-40T for iron and steel welding electrodes, grades E6020, E6030, E7020 and E7030, as well as others of the same general classifications require large heat capacity in the base metal for best results. The quick-setting electrodes of the same specification in grades E6010 and E7010 along with others of the same type can be used with base materials possessing much less heat capacity. For butt welds, the dividing line between the "hot" fluid electrodes, generally recognized as mineral coated rods, and the "cold" fast solidifying electrodes, usually known as organic coated rods, occurs at a plate thickness of from ¼ to ⅜-inch. Butt welds in the thicker plates may be made with a fluid electrode, those in the thinner plate with a "colder" organic electrode.

No doubt one important factor leading to slow adoption of "cold" electrodes for sound welds in light plates is the universal feeling among welding engineers that beads made with such electrodes were always porous. But in the trained hands of present day welding operators this fear is unfounded. To prove the point, consider the two exo-

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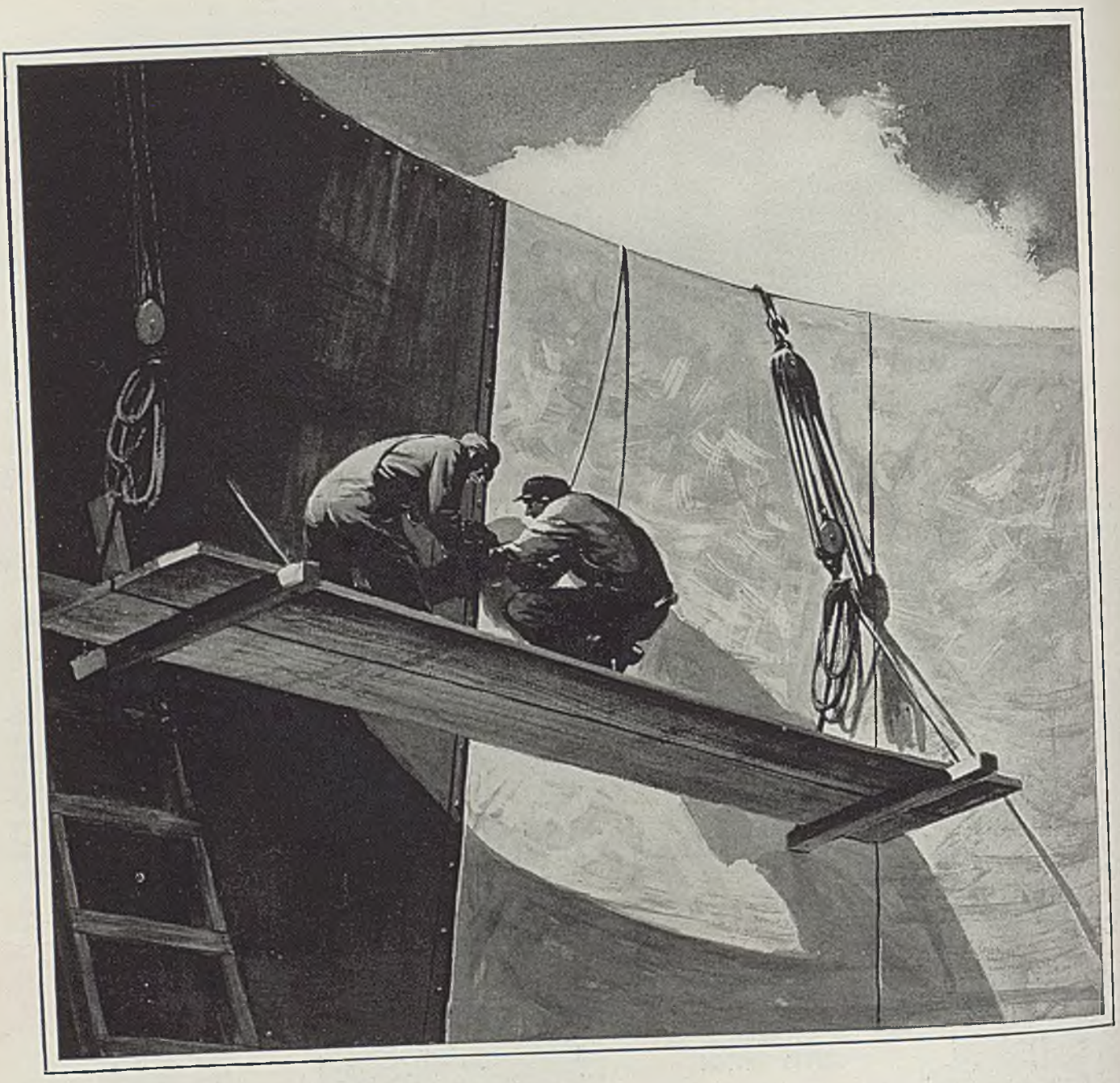

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graphs in Figs. 1 and 2. The first is a butt weld in ¾-inch plate made with a very fluid mineral coated electrode at a high current. The X-ray shows this weld to be flawless. Fig. 2 shows a butt weld in ¼-inch plate employing a cold, somewhat viscous organic coated electrode at a moderate current setting. This weld is every bit as good as that in Fig. 1. As a matter of fact, it is easier to make a good weld under these latter conditions, cold electrode for light plate, than it is to attempt to apply a hot electrode in the same setup.

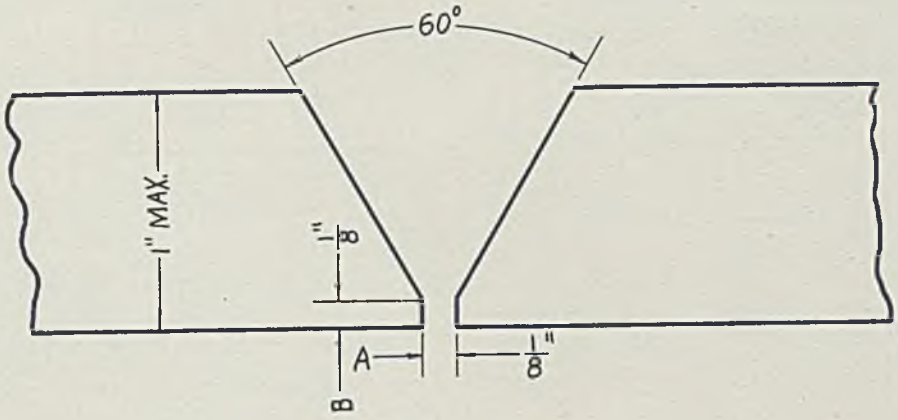
All Joints Positioned

In addition to butt welds, ordnance work calls for a goodly number of T-welds. The same fundamental considerations apply to these joints with the selection of electrodes being based upon the thickness of the thinner of the two base plates being welded. The greater heat capacity of the heavier plate in the pair allows a little more leeway with the dividing line between the two types dropping to a plate thickness of 5/16-inch with safety.

Almost all joints in ordnance work are positioned for economy and ease of welding. Many devices supplement ready-made positioners so the number of welds to be made in the horizontal, vertical and overhead positions is quite small. Nevertheless there are some, and hundreds of feet of nonpositioned welds are being made each day with the amount of X-ray cut-outs no greater than encountered in flat position welding.

Two reasons have led to success in out-of-position welding subject to radiographic examination. First, the engineers in charge have recognized the importance of specifying small-diameter electrodes for these joints. Surely electrodes no larger in size than 5/32-inch should be adopted for the usual run of thickness, although 3/16-inch sizes can be used by expert welders on material over 1 inch thick. Second, the amount of oscillation or weaving must be restricted. Some plants hold the width of these beads to no more than two diameters of the electrode while others report good results with beads as wide as four diameters of the electrode. The basic idea is to keep the bead narrow enough to allow the welder control over his deposit. The pool must be kept sufficiently fluid to allow the ready elimination of gas from the weld.

Butt and T-joints predominate with V, U and J-joints of appropriate dimensions being included as a means of holding the deposited weld metal. Joints of generous proportions are needed if good welds are to result. Two schools of



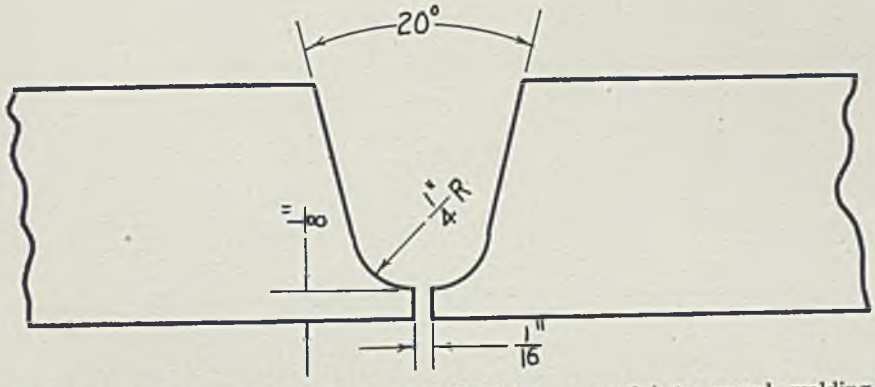


Fig. 3. (Top)—A correctly proportioned V-joint is essential to sound welding. Fig. 4. (Bottom)—This U-joint is based upon X-ray welding experience so its proportions should be followed

thought prevail. One school attempts to make joints as narrow as possible to restrict shrinkage and economize on weld metal. When fitup is perfect, this procedure works satisfactorily. Should there be any trouble with the fitup or preparation of narrow joints, however, the X-ray difficulties that result are sure to cost much more than the additional weld metal that might be required as will be shown later. Furthermore, the selection of a narrow groove automatically leads to more passes per joint with greater stress concentrations or warpage as these effects are in direct proportion to the number of beads per inch of thickness.

The second school uses generous, but not too large, joint contours and depends upon peening to reduce shrinkage and distortion. Wider joints facilitate cleaning and allow the use of larger electrodes. The number of passes thus is reduced. Simultaneously the cost of welding, with labor the major item, is lowered. Greater speeds also lower overhead costs as more work is completed in a shorter time. With the growing shortage of experienced welders, any means of speeding up the amount of welding done by each operator merits study.

Figs. 3, 4 and 5 present recommended joint designs developed from actual X-ray welding experience. As all welding should be sound, whether subjected to rigid examination or not, the illustrated joints may be used on all classes of work. In general the single bevels shown are for thicknesses of 1 inch or less with double V's, U's and J's being employed for thicker joints wherever possible. The joints shown are for flat and overhead work. Greater included angles (a minimum of 45 degrees) are more advantageous in the horizontal and vertical positions.

Both machining and flame preparation of joints may be used. Because of a growing shortage of machine tools, many plants are turning a flame cutting with good success. Whatever the method, care must be exercised in making the groove. Plate planers are capable of consistent accuracy when sufficient control is exercised. That equally good results are possible with oxygen cutting and gouging methods is a tribute to the development work pioneered by the makers of flame cutting equipment. The operating costs of these latter devices may be higher, but lower initial cost frequently offsets this disadvantage.

Some fear has been expressed

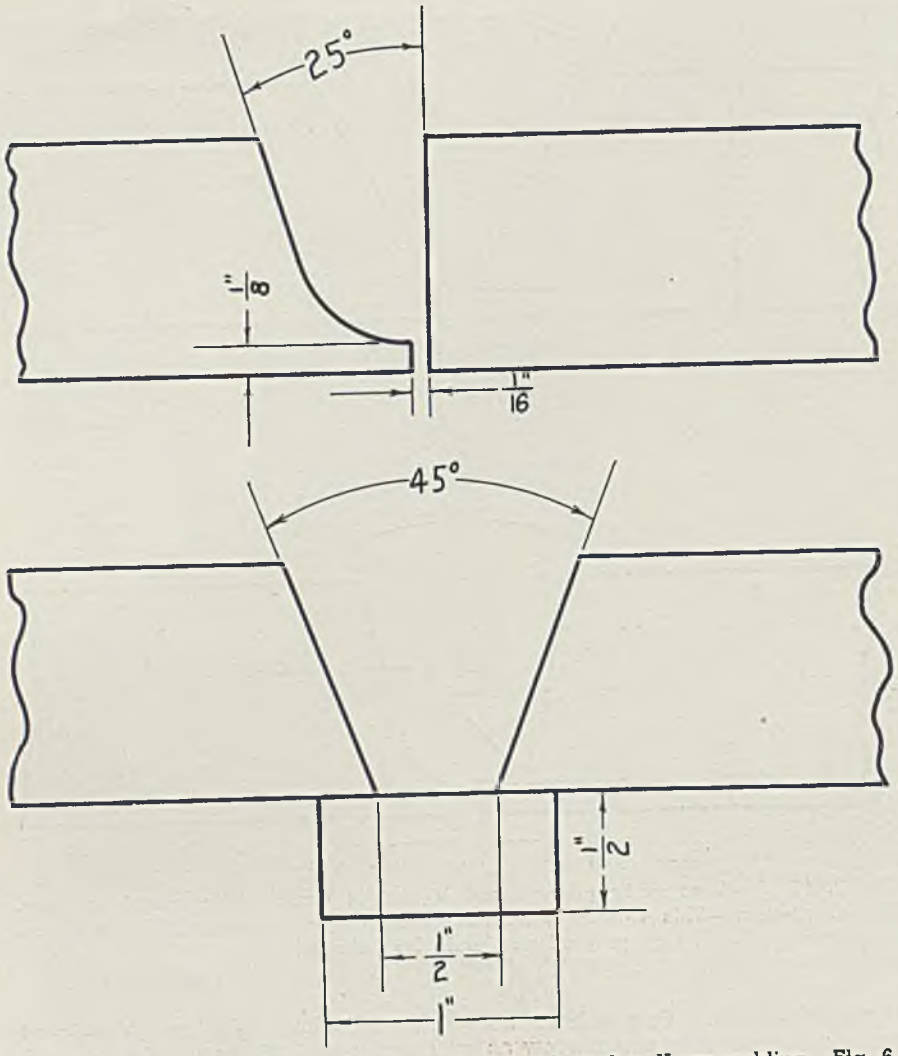


Fig. 5. (Above)—The J-joint of this type is well adapted to X-ray welding. Fig. 6. (Below)—Ample heat capacity in the backing strip and proper root spacing eliminate costly cut-outs

regarding the advisability of welding over flame-cut surfaces without grinding to clean metal. Experience has shown these fears to be groundless. The fluxing properties of modern electrode coatings are sufficient to take care of the thin oxide film found on oxygen cut surfaces. The joint preparation must be smooth, though, or slag may be trapped in any indentation caused by improper cutting procedure. Correctly trained cutters or gas machine operators working with up-to-date well-regulated equipment can produce cuts that rival the best machining practice for smoothness of finish.

Sometimes the dictates of equipment design bring forth the need for welding against a permanent backing strip. Here the problem of the thickness of backing strip presents itself along with the need for ample root spacing. Fig. 6 is a typical single welded V-joint against a fixed steel backing strip.

Next week in the second section of this series, the different joints represented in Figs. 3, 4, 5 and 6 will be discussed with reference to each step in the welding of a perfect joint. Electrode selection has been made and joint contours have been fixed. Each joint will be reviewed thoroughly before undertaking a discussion of typical X-ray defects and their causes.

(Continued Next Week)

Tests Aircraft Engines For High Altitudes

■ A stratospheric testing laboratory capable of providing air testing temperature down to 67 degrees Fahr. below zero is now being completed by the Army Air Corps at Wright Field, Dayton, O., with the aid of York Ice Machinery Corp., York, Pa. The laboratory is expected to simulate severe conditions—equivalent to the higher altitudes at which aircraft engines are expected to operate today.

To carry out the testing it was first necessary to install equipment to cool the carburetor air supply down to a minimum of minus 67 degrees Fahr. and the gasoline supply to zero degrees Fahr. In cooling the gasoline, the company is using three horizontal, shell and tube coolers, each capable of handling the full load alone, hooked up to an 8 x 8-inch ammonia compressor.

Cooling of the air supply to the carburetor, however, presented a real problem. The system had to be able to cool huge quantities of air to a minimum temperature of minus 67 degrees Fahr., operating with any inlet air temperature from maximum down to minus 10 degrees Fahr.

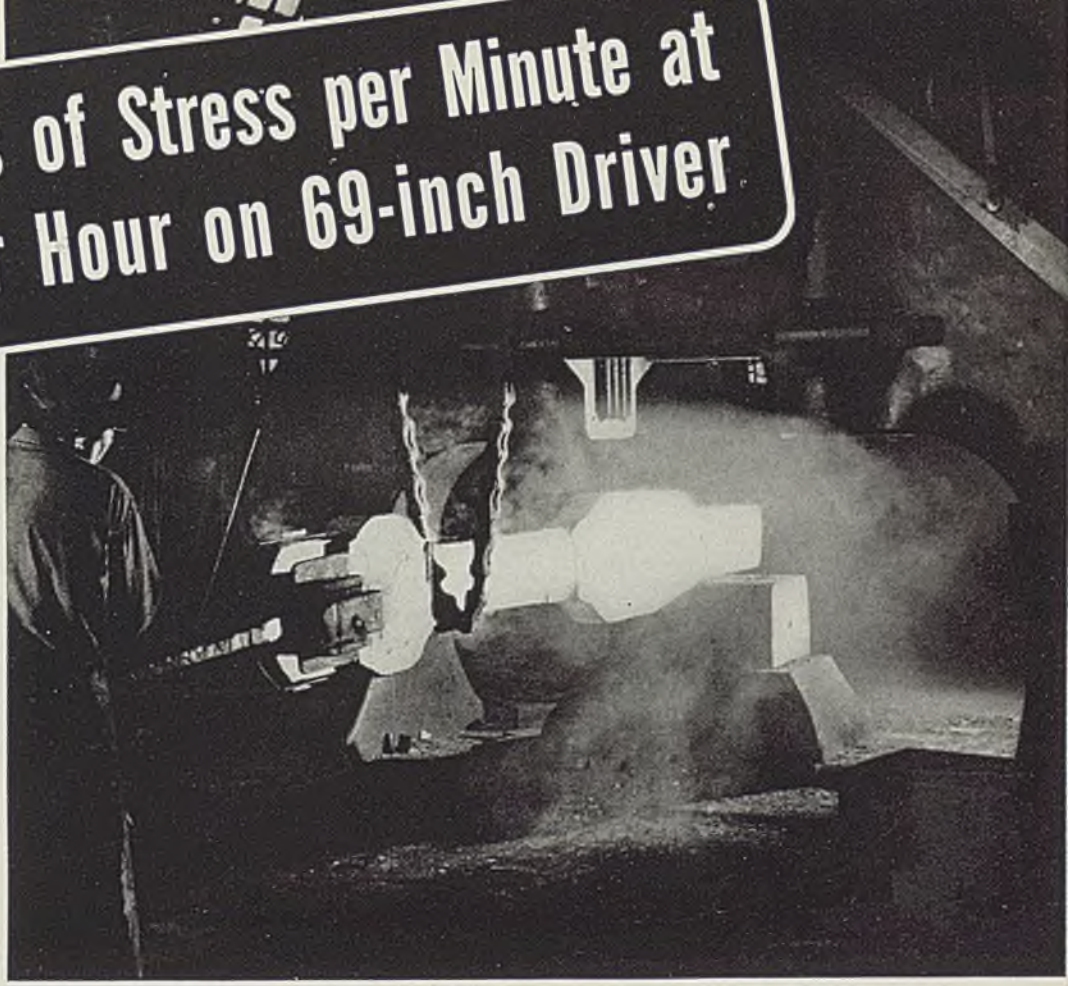
This job is being handled in three stages. In the first stage the air is cooled from 100 degrees Fahr. to 35 degrees Fahr. This is done in a spiral-finned coil evaporator, containing water sprays, connected to an 11½ x 10-inch ammonia machine operating at 45 pounds suction pressure. In the second stage the air is cooled from 35 to minus 13 degrees Fahr. This evaporator is identical to that of the first stage except that a solution of ethylene glycol prevents frost accumulation and the moisture picked up by the ethylene glycol, which would otherwise turn to frost, is boiled off in a "concentrator" before respraying. One 10 x 10-inch 4-cylinder ammonia compressor and one 11½ x 10-inch 4-cylinder ammonia compressor supply refrigeration at 3 pounds suction pressure. Eight nests of trombone coils arranged in an air tunnel cool the air down to 67 degrees below zero Fahr. in the third stage.

The entire casing surrounding the three air stages is air-tight and insulated with cork. A fan located between the second and third stages pulls air through the first two stages and pushes it through the third. At this point secondary fans pick up the air and distribute it through heavily insulated duct-work to the separate airplane engine testing rooms, one or all of which may be in use at any given time. The third wind tunnel is divided into two sections so that hot gas may be used to defrost one-half of the tunnel while the other is still operating.

Auto Bearing Life Increased 300 Per Cent

■ A new type babbitt bearing, which is reported to increase the life of main and crankshaft bearings of new Chrysler cars from 300 to 500 per cent, has been developed by Chrysler Corp. engineers. The thickness of the babbit in these bearings has been reduced to 0.003-inch, as against the former 0.016 to 0.025-inch. It is reported the thinner babbit is not subject to heat transference difficulties nor cracks.

782 Reversals of Stress per Minute at 80 Miles per Hour on 69-inch Driver



Forging a carbon-vanadium alloy steel rod for a locomotive.

Stress reversals in locomotive main and side rods require the impact-resistance that only alloy steels can provide. That's why Republic carbon-vanadium alloy steels are so widely used for locomotive forgings. The alloy content increases tensile strength, elastic limit and yield point values without loss of ductility. It also gives a high resistance to impact and permits lighter weight-saving sections in reciprocating parts. And these steels are easy to forge, heat treat, normalize and draw.

In the "Republic Alloy Steel Handbook" you will find only practical information—specific alloy recommendations for many applications—heat treating charts—suggestions for normalizing and carburizing. Write for your copy.

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Alloy Steel Division, Massillon, Ohio; General Offices, Cleveland, Ohio

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REPUBLIC STEEL DEFENSE FOR AMERICA

IN THIS EMERGENCY

Paraphrasing an old operatic lyric—"A steelman's lot is not a happy one." When business is at low ebb, the struggle is to get enough tonnage to produce steel economically. When the tide of business swings to the other extreme, the big job we all have is to satisfy the customer who is unable to get all the steel he needs.

Believe me when I say that this is one time when the wheel that squeaks the loudest is not getting the grease. We are doing everything humanly possible to be helpful in this emergency and to be fair in the apportioning of our output—and to assist you further we are constantly setting new records in all our plants in our production of *steel—first line of national defense.*

R. J. Wysor
PRESIDENT

REPUBLIC *Alloy Steels*

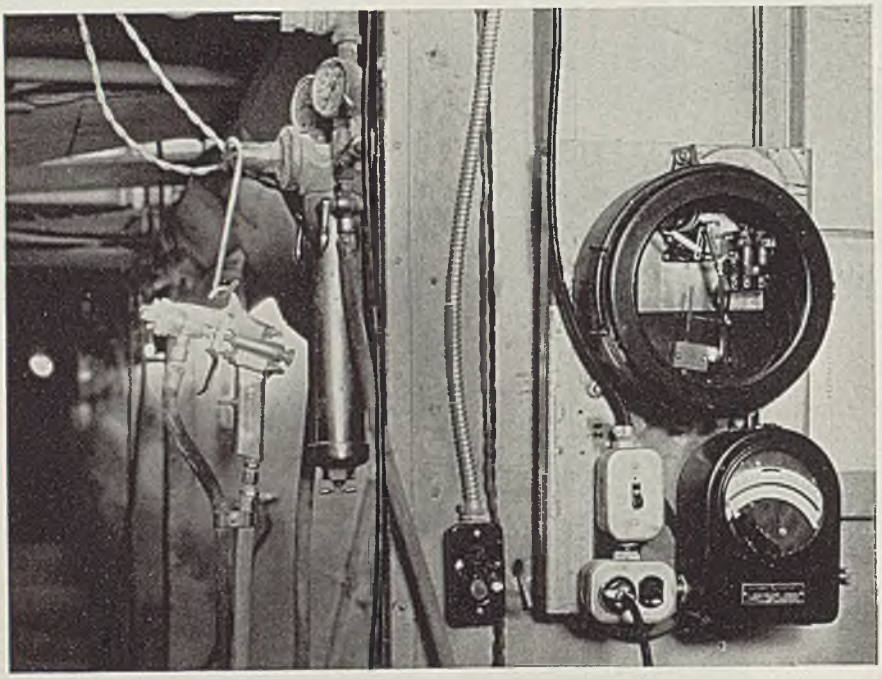

Fig. 1—This timer works a set of signal lights which help the operator control amount of enamel sprayed to within exact limits —an important aid in control of uniformity

How One Plant Handling Large Bulky Items

Holds Porcelain Enamel Rework Below 3 Per Cent

Numerous control methods and special devices described here will assure almost any porcelain enameler of better results. One device aids operators to spray exact amount of material on the work. Scrapped enamelware is negligible. Waste enamel is held below 5 per cent. Quality of finished product is exceptionally high and still improving

■ SPOILAGE control at General Electric Co. plants is an established principle. Every reject is a challenge to the skill and ingenuity of the organization because it is recognized that adequate control of waste and spoilage may often mean the difference between profit and loss. This is especially true in highly competitive products such as electric refrigerators.

The manufacture of refrigerator cabinets is divided into four broad divisions — fabrication, organic finishing, inorganic finishing and assembly. Analysis of manufacturing losses in these various divisions shows that the most critical is the inorganic finishing or porcelain enameling. There are two reasons for this. First, in magnitude the losses are generally higher than in the other departments. Second, the possibility of these losses becoming two or three times their normal magnitude is tremendous. It is not surprising that advantage is taken of every means to keep operations in this department under strict control.

Fabrication of enamel parts follows normal practice. There are the usual drawing and forming operations on punch presses followed by welding, and finally the metal finishing. This consists of burring, grinding, sanding, buffing, and so on. Enameling-grade iron is used exclusively as a base. Welding operations must be sound since the heat in the enameling furnace will show up any weakness.

Pickling takes place in automatic machines. The ware is hung on racks about 10 feet wide which are carried progressively through the various pickling solutions by a conveying system. Two hot alkaline cleaners start the process, followed by a rinse. Then comes the pickle proper in hot sulphuric acid; then a rinse and neutralizer and finally a sodium cyanide rinse. From there the racks are carried through electrically heated driers to the unloading end of the machine. The movement of racks from one tank to another is automatic and is controlled by time switches so there is no chance for an over anxious operator to slight any operation.

The enamel laboratory has complete charge of the various solutions used in the pickle process. Each tank is titrated daily. Any necessary additions to the tanks are ordered in writing only by the laboratory. This affords control of the pickling process.

Ware moves from pickle directly to the enamel department for ground coating. Pickled ware is not stored for any length of time. Pickle schedules are set up to match those of ground-coat dipping

By J. A. BATES

Material Utilization Section
Refrigerator Cabinet Division
General Electric Co.
Erie Works, Erie, Pa.

WISSCO WIRE
FOR NATIONAL DEFENSE

IN times like these when maximum production is all-essential and tool makers and machines are at a premium, the uniform high quality of Wissco Wire takes on a new importance. It enables greatest speed with less tool breakage and fewer rejects. The next time you order specify WISSCO.

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WISSCO WIRE
BY WICKWIRE SPENCER

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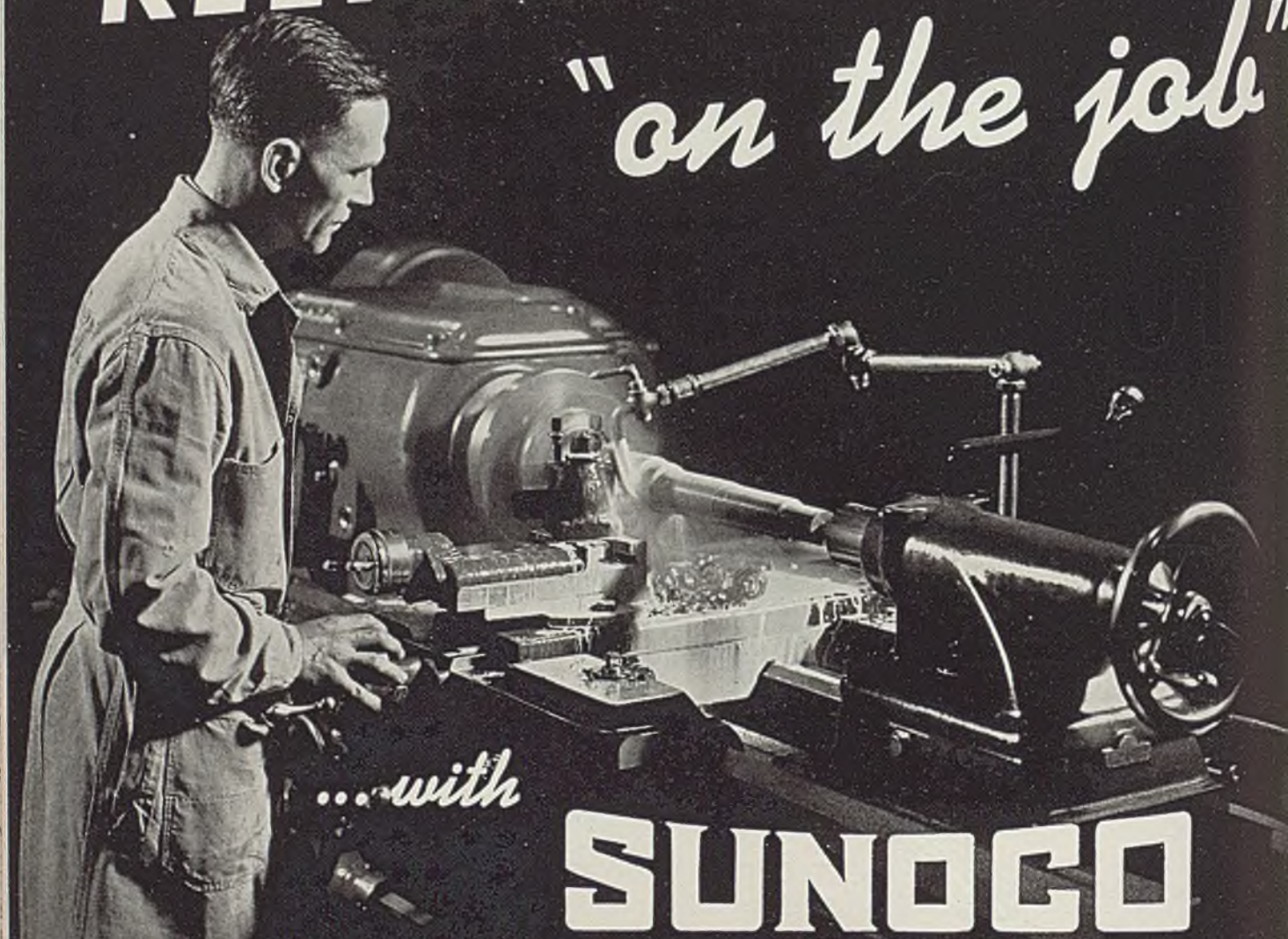

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DEEP CUTS WITH HIGH SURFACE SPEED

PERFORMANCE DATA

OPERATION—Turning forged spindle.
MACHINE—Monarch 16" model "W" engine lathe.
MATERIAL—S. A. E. 2350 steel.
CUTTING SPEED—250 S. F. P. M.
DEPTH OF CUT—3/16 inch.
FEED—.017 inch.
TYPE OF TOOL—Cemented Carbide.
CUTTING LUBRICANT—1 part Sunoco to 10 parts water.

Courtesy of
THE MONARCH MACHINE TOOL CO.

Greater production . . . without sacrificing accuracy and finish! This is the challenge the overburdened machine-tool must meet to accomplish our national defense program.

The place to meet this requirement is at the edge of the cutting tool with the right cutting lubricant to reduce friction and dissipate heat. And that's where the high lubricating and heat absorbing qualities of Sunoco Emulsifying Cutting Oil can really help you and your machines answer production demands.

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so that there is never any great amount of pickled ware standing around to collect shop dirt—thus eliminating another source of trouble.

Enameling itself starts with the mill room. Milling is done in five ball mills of 2000-pound capacity, as well as a number of smaller mills. Frit, clay and other raw materials are stored over the mill room. The mills are loaded from here through closed wooden chutes to reduce the chance of contaminating the charge. The tops of these chutes are screened to prevent large foreign objects from accidentally falling into the mill while it is being charged.

Standard mill additions are specified by the laboratory and any deviations from them are only at the written instructions of the laboratory. In loading mills, all bags from which material has been dumped are saved. Then these empty bags are counted as a check on the quantity of material used.

Wash all Materials: Some raw materials are not as clean as we would like. Hence, all clay, bantonite and magnesium carbonate are thoroughly washed in a mill and passed through a 150-mesh screen before they are added to the mill. We have found this operation to be very profitable. It is sometimes surprising to find the amount of foreign matter remaining in the screen after this operation.

During hot weather, the ground-coat mills are cooled by flowing water over the outside. At present our cover-coat material is premilled and artificial cooling is unnecessary.

Every Step Checked: After milling is completed, a sample is drawn from the mill and tests are made for specific gravity, viscosity and fineness. Then a sample panel is fired with the material. This date and panel is submitted to the laboratory and if approved, the enamel slip is pumped into wooden storage tanks, each of which holds enamel from several mills. These tanks are provided with power driven agitators to keep the enamel in suspension until it is used.

A sample of this slip from the storage tanks must again be checked for specific gravity and fineness and a fired sample made and approved before it is finally released for production. All material is passed through a rotospray and a magnetic separator before it is finally ready to be taken to the floor in spray barrels or in covered containers for the dip tanks. The purpose of milling control is to deliver to floor absolutely clean enamel slip of standardized characteristics.

Ground-coat application takes place in an air-conditioned booth. All parts are dipped with the exception of outer cases, which are sprayed because of their size and shape. Previous to ground coating, all ware is rigidly inspected.

Thickness of Deposit Controlled: The amount of enamel to be applied is specified by the laboratory in standing instructions. The object of the ground-coat control men is to see that this amount is applied. Ground-coat slip in the dip tanks is set up by means of a flat test panel. The slip is thinned or thickened so that the test panel on drying carries the proper weight of enamel per square foot. This pickup on the test panel is usually less than the actual ware picks up, but from experience it is known how much less the test panel must pick up in order that the ware will have the correct application.

Then as production starts on each part, a few of the first parts are weighed to check actual pickup and any necessary adjustments made to the slip. From then on, control is by means of thickness of the fired ground coat, measured by an electromagnetic enamel gage. One man is assigned to this job and he checks pieces continuously throughout the day. Set limits are furnished this man, and any variation from these limits is immediately reported and corrected.

Cover coat is applied as soon as possible after the ground coat is fired. No ware is allowed to stand around where there is a chance of contamination by shop dirt.

Cover-coat application is by spraying. Since the only purpose of the cover coat is appearance, application standards are based entirely in reflectance. That is, we apply enough material to give the finished ware a constant whiteness. With any particular type of enamel this means the application of a constant weight per unit area.

Maintain Constant Weight per Unit of Area: Spraying operations are set up with this air. The operation is all conveyorized, and each sprayer has a certain area to cover. Knowing the chain speed and the number of operators, it is first necessary to break the work down into the areas to be covered by each sprayer. Then depending on the

Fig. 2—Continuous electric enameling furnace, 1200 kilowatts rating, interior view of outgoing side. Heating elements are divided into 12 sectons; 52 thermocouple locations are provided

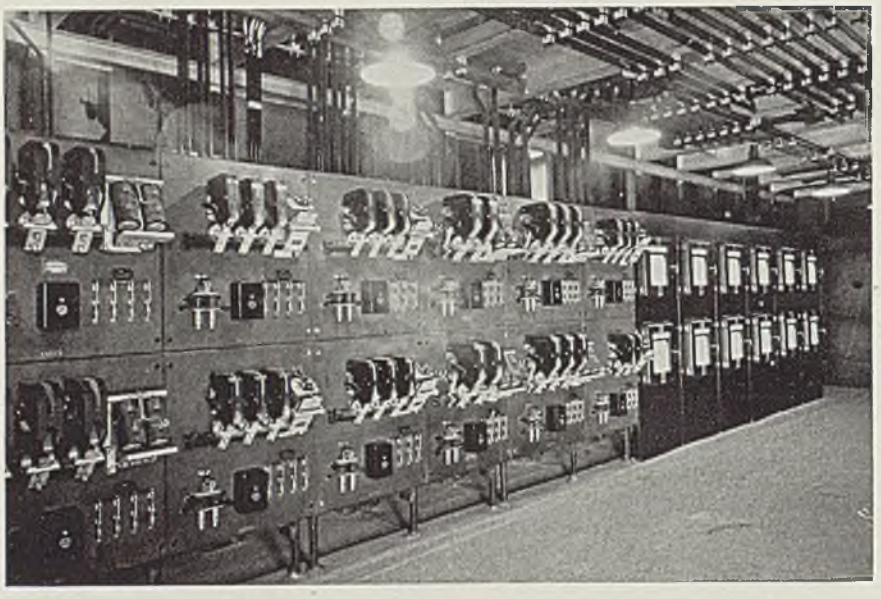


Fig. 3—Heating control equipment and bus work under the 1200-kilowatt continuous electric enameling furnace, part of which is shown in Fig. 2. Cuts loaned by Ferro Enamel Corp., Cleveland

shape and size of the area to be sprayed, each gun is adjusted accordingly.

For example, a man spraying edges has a gun adjusted to give a narrow spray and accordingly the enamel pressure is reduced to give a comparatively slow flow. These gun adjustments and the layout of the different operations are a matter of experience. In general we try to apply the enamel in as few strokes and as slowly as possible since we can get more even distribution and less waste in this way.

Number and Placement of Strokes Specified: Before spraying starts on each type of part, the control man checks all guns. Fan width is adjusted and enamel pressure regulated to give the predetermined flow from the gun. Then each sprayer is instructed as to exactly the number of strokes to be used and where each is to be placed.

A reflectometer designed and constructed by the company is used after the cover-coat firing as a final check on the application. All exterior pieces are checked with the reflectometer and are not passed unless they are within set limits. These limits are so set that any parts which pass will show a satisfactory color match with each other.

Interior parts are checked frequently with the reflectometer and deviations from standard are reported for correction. With the detailed setup of the spraying operation, however, variations in reflectance are generally not serious.

Acid resisting enamel is applied over the cover coat before firing, and both coats are fired together. Each day several parts are set aside for acid resistance tests. These are made by applying to each part 10 per cent solutions of acetic, citric, tartaric and lactic acids and a 2 per cent solution of butyric acid. These are allowed to stand for several hours and are then examined for staining or etching.

Timer and Lights Help Control: The maintenance of a constant high acid resistance means applying a uniform coat of the proper thickness of the acid-resisting enamel. Since it is sprayed on top of the wet cover, it is very difficult to see, so a small percentage of methylene blue is added to all acid-resisting enamel during milling. This color disappears on firing, but shows up very plainly during the spraying operation on the white cover coat and so enables the sprayer to apply a uniform film. The total quantity applied is governed by the flow of the gun and an automatic timing device, Fig. 1. Each size part is known to require a certain number of seconds to receive the required amount of enamel with the spray gun set at a certain rate of flow. The timer is set for this interval. This is connected to two lights in the spray booth. As soon as the sprayer pulls the trigger of the gun one light lights. At the end of the predetermined interval the second light goes on and the sprayer knows he has applied enough enamel.

From the spray booths the ware passes through steam heated driers at a temperature of about 200 degrees Fahr. Ground coated ware coming out of the driers has black reinforcing applied to the edges while it is still hot. The reinforcing dries almost immediately. All fresh air fed into the driers is filtered through oiled steel wool filters to keep foreign material from ware.

Throughout the department all overhead conveyor hooks have a wide offset in them. This offset passes around fixed shields which are directly under the chain. Thus any dirt or oil dropping from the conveyor chain is caught by the shields and prevented from reaching the ware.

Firing is done in four General Electric continuous electric enameling furnaces. There is no question but that this type of furnace with its inherently clean atmosphere and ease of accurate control has contributed to the good performance. Several years ago when starting to develop continuous enameling furnaces for refrigerator cabinets, it was realized that uniform heating was a serious problem—especially when firing so large a piece in production as a refrigerator cabinet and still retaining a minimum of rejects.

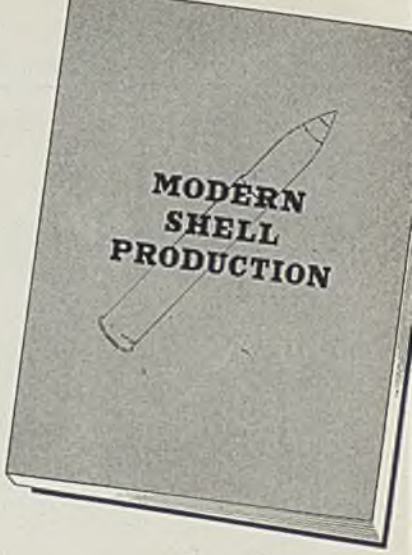
Heating must be uniform from top to bottom of the piece and at a definitely controlled rate. Otherwise the unequal heating would cause warping of the case, strain lines in the enamel and other troubles. To meet these requirements, the industrial heating department of General Electric designed and built the present type furnace. Heating elements are divided into 12 sections, see Fig. 2, each controlled individually. Since it is desirable to be able to move the thermocouples, 52 different locations are provided for them. Heat seal doors decrease the heat loss from the firing chamber during down periods.

Obviously there was a big job to do after the furnace was built, finding out which combination of all the variables gave the best results. Scores of heat distribution curves were made during this period. These were made by attaching a thermocouple to a case going through the furnace. The thermocouple leads were of heat-resisting material and long enough to go completely around the furnace chain. An automatic recorder was attached to the leads so that the actual curves were drawn automatically. Several such runs were made of each condition with the thermocouple moved to various locations from top to bottom of the case. After a good many trials and experimental production runs, we finally arrived at the proper control settings to give the uniformity and smoothness required for the efficient firing of cases.

Power consumed in operating the furnaces is metered separately for each furnace and is checked daily by the enamel control section. Any deviations from standard performance are carefully investigated. Such daily variations are generally not important. The most important factor is the scheduling of furnace

(*Please turn to Page* 104)

NOW AVAILABLE



A 76-page reprint handbook on "MODERN SHELL PRODUCTION", consisting of the series of articles on high explosive shell by Professor Arthur F. Macconochie, Head, Department of Mechanical Engineering, University of Virginia; F. G. Schranz, General Manager, Baldwin-Southwark Division, Baldwin Locomotive Co.; and Professor W. Trinks, Department of Mechanical Engineering, Carnegie Institute of Technology, appearing in recent issues of STEEL. Also included is an article by Engineering Editor, G. W. Birdsall on the production of shrapnel shell at the Frankford Arsenal.

This handbook represents a wealth of information on modern shell production not available elsewhere in printed form. It is intended to assist manufacturers—many of whom still are to be mobilized—in swinging effectively into the production of armament. It is intended also to stimulate creative thinking and thus help enlist the full resources of American inventive and productive genius in the defense of our country.

In addition to the series of articles contained in this handbook, other articles appearing currently, or shortly to appear in STEEL will cover the technique of manufacturing tanks, range-finders, cartridge cases for large shell, gun carriages, fire-control apparatus, fuzes, aerial bombs, depth bombs, torpedo propulsion mechanisms, automatic rifles and machine guns, anti-aircraft guns and ammunition, heavy guns, small arms and small arms ammunition.

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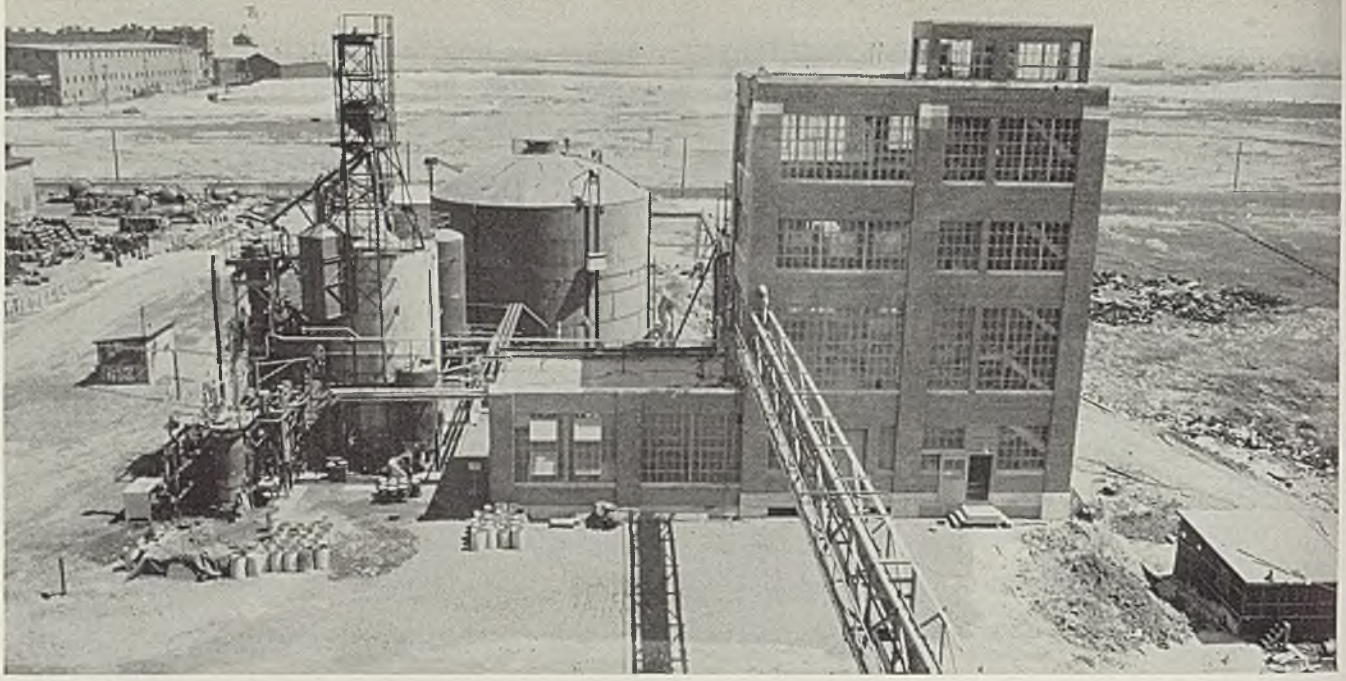


DOMESTIC IRON POWDER

now made from liquid iron carbonyl

By GREGORY J. COMSTOCK
Metallurgical Consultant
66 Park Avenue
New York

■ PRIOR to the advent of the European war, a certain amount of iron powder produced by the decomposition of liquid iron carbonyl was applied in the electrical industry of this country. Its chief use was in the manufacture of radio high-frequency cores and similar applications. This material was made exclusively in Germany, and its importation to this country was stopped with the beginning of hostilities.

After the imported stock of this powder was exhausted, other materials were employed as substitutes. Among these were hydrogen-reduced iron oxide and specially treated sponge iron powder. For certain types of cores, magnetite was employed. While the electrical properties of some of the substitutes were good, in no case were they as good as iron from carbonyl.

There remained, therefore, the necessity for producing this material in this country. This was undertaken by the General Aniline Works which has constructed a plant at Grasselli, N. J., for the production of approximately one ton a day of iron powder from iron penta-carbonyl. A plant for this production is complicated and its erection has been subject to delays which are now unavoidably incident to the delivery of parts and material. Fortunately, however, the plant which was visited just recently shows every indication of now being complete. The General Aniline Works has the advantage of being the holder of the American patents corresponding to German patents for the process.

There has been considerable speculation as to how soon commercial quantities of carbonyl iron powder will be produced. The recent visit was made with the idea of determining just when this supply would be available. The liquid has been prepared in quantity and the process of decomposition will be started in the near future. There seems to be every indication that in the near future a supply of carbonyl iron powder will be available for the core manufacturers in this country. From this time forward the plant will produce a sufficient quantity to meet adequately the previous demand and to allow for a normal expansion for new applications.

New Catalog Aids Defense Workers

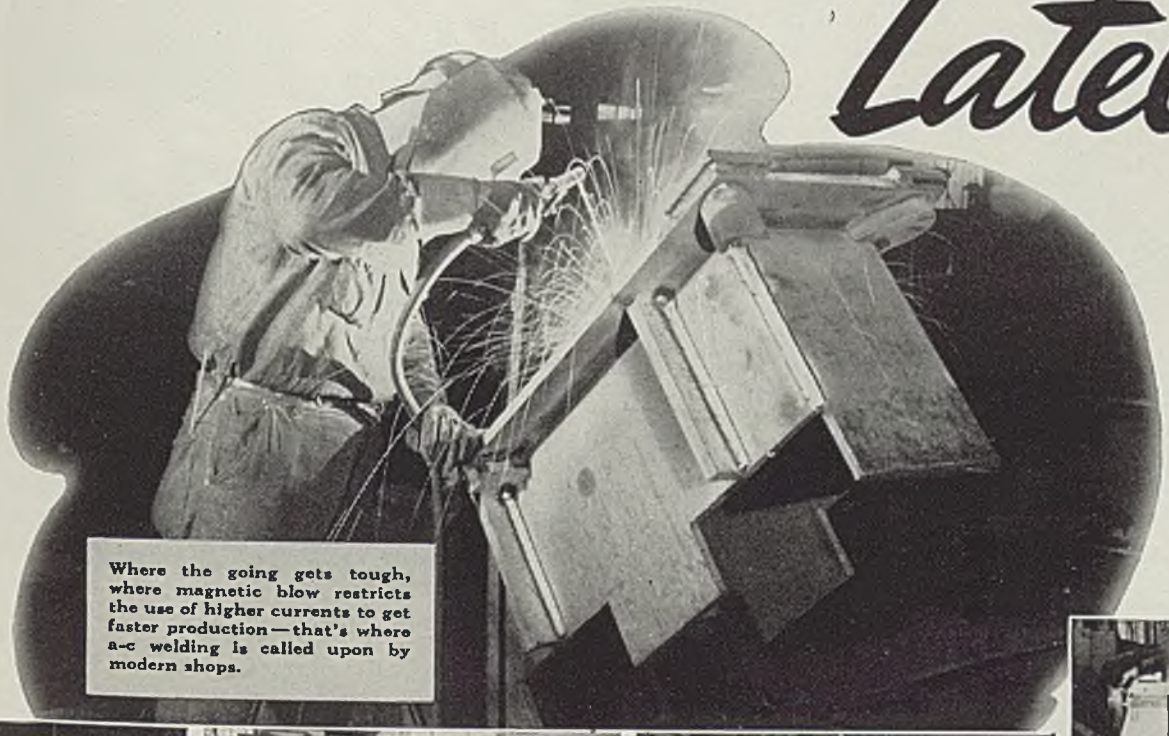
■ A complete line of turret lathe tools for use on ram and saddle types of turret lathes is described in a new 168-page loose-leaf catalog just published by Gisholt Machine Co., 1217 East Washington avenue, Madison, Wis. It contains 164 tools (many of them not previously announced), built in more than 500 sizes, illustrated in three colors and accompanied by short descriptions.

Nearly 500 illustrations are employed to show pictures of each tool, its application and its principal dimensions. Dimension drawings are large enough to permit direct scaling to layout sheets, and the individual file-sized pages may be removed from the book for reference.

Such features as suggested standard sets of tools for a specific size of machine and type of work, a cross-referenced 10-page index of all tools, and a separate section devoted to attachments which may be added to present turret lathes, make the catalog particularly valuable to turret lathe users in the present defense emergency. Copies of the catalog will be supplied only to those who write direct to the company. Turret lathe users can secure the publication free by writing on company letterhead listing make and model of machine used and the writer's title or occupation. All others, including students and teachers, can secure a copy by accompanying their request with a remittance of $2.50.

Although no credit sales can be accepted, a 10-day inspection period is granted, at the end of which time the book may be returned and the purchase price refunded.

Have You Cut Your Welding Costs 10% Lately?

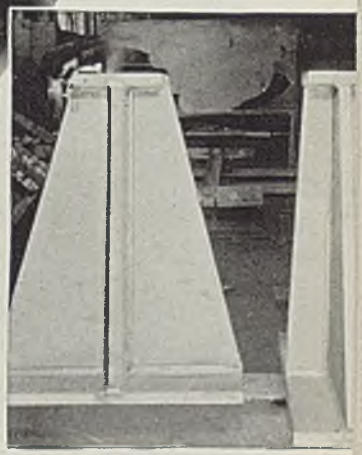


Where the going gets tough, where magnetic blow restricts the use of higher currents to get faster production—that's where a-c welding is called upon by modern shops.

Mr. Wm. E. Hendricks, Plant Mgr., Belmont Iron Works, Philadelphia, says, "the use of a-c welding has simplified the application of welded design to structural work, and—

"In many cases, inaccessible seams, such as bases of columns with shear plates and seams with bad fit are more easily welded with an a-c arc. Another thing—there's less arc blow and less tendency toward undercutting—

"As for our welding operators, it is safe to say that they're all better satisfied with their work because a-c gives their jobs a smooth appearance, free from blow-holes, undercut, and starting and stopping craters—



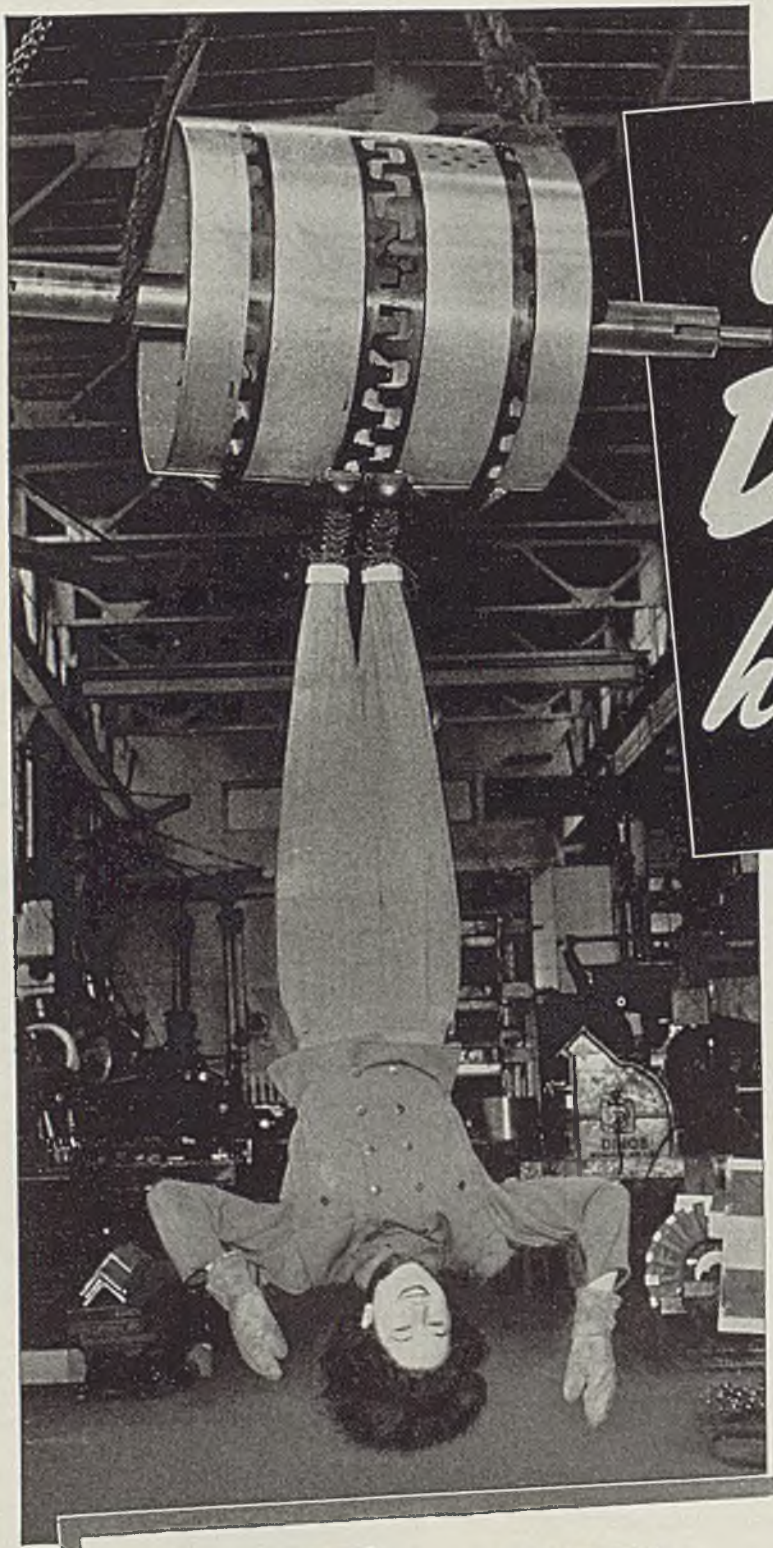
"All in all, a-c welding has been everything they said it was! Our type of work is heavy, we're a production shop—we must get it out—and a-c does just that. It helps us get it out, on time, and welded right!"

IF you're pressed for production—if you're bothered by magnetic blow slowing down your operators and adding to your costs—why not investigate a-c welding? Your nearest G-E arc welding distributor will be glad to demonstrate a-c on your work, at no obligation. You can depend on his recommendations because he handles the G-E line of welders, the most complete line on the market, including a-c, d-c, atomic-hydrogen—in fact, 'most any kind of an arc welder you're likely to need. (He doesn't have to "push" *any particular* type of welding.)

For reliable and unbiased information, therefore, on the type of welding for the kind of work you do, see your G-E arc welding distributor today —or write direct. General Electric Company, Schenectady, New York.

Wm. E. Hendricks

GENERAL ELECTRIC



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THIS girl is held upside down in space from a Dings *High Intensity* Magnetic Pulley by the powerful lines of magnetic force pulling on the iron in her ski boots!

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New Metal Industries Catalog describes 10 types of Dings machines for separating ferrous and non-ferrous scrap (*including steel and brass turnings*), removing iron from foundry sand, handling metal. Photographs, diagrams, principles of operation, applications, etc. A valuable guide. Send for it *today!*

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MAGNETIC SEPARATION
HIGH INTENSITY

More Efficient Materials Handling

Through Motion Study and Methods Engineering

Motion economy principles applied to machine design result in machine with almost double output, built at about half the cost of former design. Motion economy principles applied to processing operations cut number of movements and operations in one instance from total of 82 to only 34; total distance traveled in processing cut from 1618 feet to 606 feet. How do you know such improvements can not be made in your own plant?

By G. B. CARSON
Associate Professor
Industrial Engineering
Case School of Applied Science
Cleveland

(Concluded from Last Week)

■ ANOTHER important trend is the application of motion study to fields other than those mainly concerned with mechanical assembly of parts. Examples of developments here may be found in the excellent work of O. W. Habel and G. G. Kearful Saginaw Steering Gear Division, General Motors Corp. In a paper (ref. 8) they showed noteworthy savings in production costs through the redesign of machine tools in their plant, using only motion economy as the guiding factor in such redesign.

In a rethreading operation on a ball stud for which a standard two-spindle threading machine costing $1336 was used, it was possible to obtain 600 parts per hour. When the necessity arose for another machine, the master mechanic, who with his more highly skilled toolmakers had recently completed a motion economy course, asked to be allowed to build an additional machine which incorporated motion study principles. The machine was built for $786 and could produce 1100 parts per hour with less effort on the part of the operator.

In one other case a hand-operated lever was replaced with a properly designed air-operated device with conveniently located control station. This machine change saved 71 per cent of the time per piece, and cost $850 for two machines. The first annual return was $1782.

Returns $10 for $1: In still another case, the elimination of barriers in the machine operation and the relocation of controls to keep the operator within a normal work area saved 80 per cent of the time per piece, and returned to the company $3375 the first year on a two-machine one-man station. The cost of the improvement was $300 for the two machines.

That such savings were possible should long have been evident—but until recently there have been no systematic industry-wide attempts to recover them.

The advent of cheap and good motion picture film

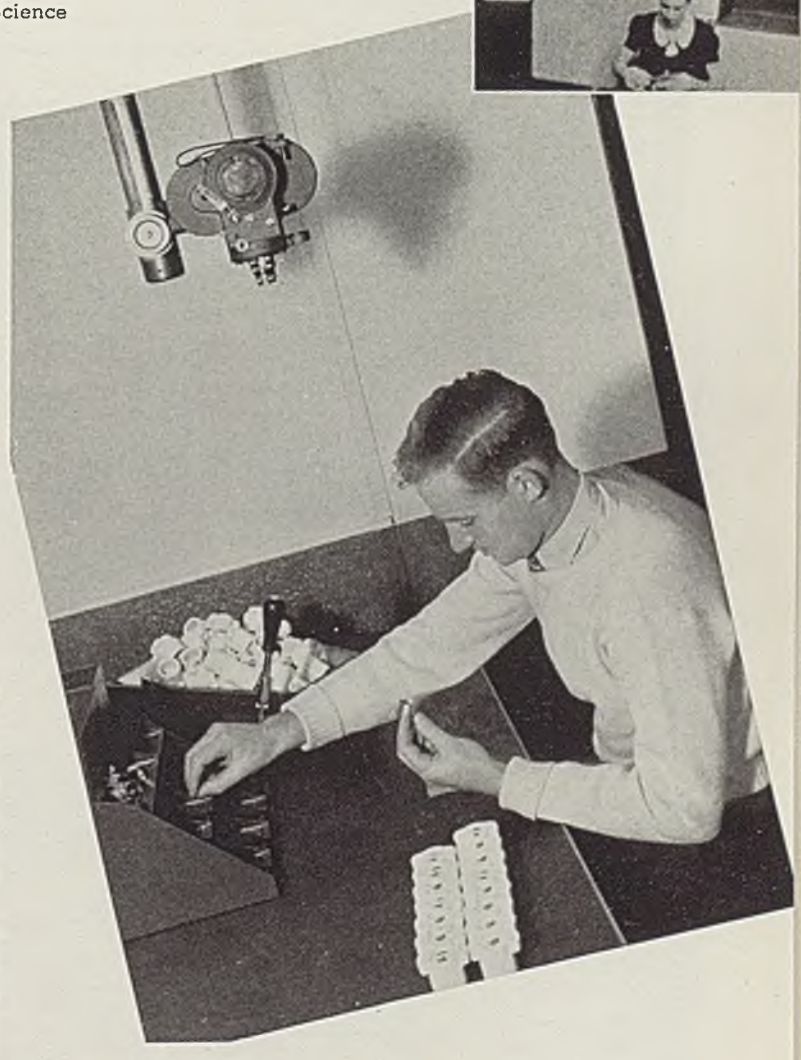


Fig. 1—Typical group, top view, taken from motion picture film of a job involving hand assembly operations. Note the microchronometer in the field of view to give time. Large hand turns 20 times a minute, small hand twice. Consequently each division on the dial represents 0.0005-minute—a unit known as a "wink" in motion study work. Fig. 2—Camera crane is utilized here to obtain motion pictures from directly above the operator. Note lower view

Fig. 3—Here the author, Professor Carson, is adjusting the camera crane to the proper angle to record both vertical and horizontal movements of the operator

TABLE I—Motion Study Laboratory Equipment

Item	Description	Purpose
1.	A hand cranked, spring-driven or electric driven 16 mm motion picture camera with speeds of 16, 32 and 64 frames per second (or more variations) and a film capacity of at least 100 ft.	Taking motion pictures in the plant.
2.	A standard 1" focal length lens with a speed of at least f.1.9 (f.1.5 is better). (Also useful is a 3" telephoto lens for close-ups without moving the camera, and a 15 mm wide angle lens for obtaining large area of coverage at short range.)	Taking pictures.
3.	A motion picture tripod with universal tilting and panoraming head.	Holding the camera during "shots".
4.	A good photoelectric cell type of light meter.	Measuring light intensity for proper adjustment of camera lens.
5.	At least 6 No. 2 Photoflood lamps of the reflector type, or 6 plain photofloods together with metal reflectors (life: 6 hrs.)	Adequate and shadowless workplace lighting.
6.	At least 3 tripod stands for holding lights mentioned in No. 5 above.	
7.	A good quality coiled steel tape measure.	Obtaining accurate distance for lens focusing.
8.	Several sheets of white cardboard and 1 roll of 1½" Scotch tape.	For placing behind workplace or operator to give proper background, or for covering bench tops where dark parts are involved.
9.	A 500-1000 watt 16-mm motion picture projector with 1" and 2" lenses and a variable speed drive.	For projecting pictures taken, to large groups of employes.
10.	One or more 100 watt motion picture projectors with 1" lens and both motor drive and hand crank. Should have a single aperture shutter so that there will be no interruption of light except as each frame is shifted.	For film analysis and micromotion study (frame by frame viewing of the film).
11.	A 40 x 60 glass bead screen.	For auditorium showings.
12.	A 10 x 12 hooded screen.	For film analysis.
13.	A 16 mm film editor and splicer.	For film repair, and for cutting and splicing film to make a continuous "before and after sequence". Also for removing poor shots.
14.	Film storage cabinet and humidifier.	For indexed film storage and rehumidification of black and white film (color film should not be humidified artificially).
15.	Miscellaneous data boards, tables, film analysis forms, and other incidental supplies best purchased after each individual laboratory's needs are ascertained by actual operation.	

has extended the use of the motion picture projector and camera as a tool of any motion economy program. Fig. 1 shows a typical scene of an assembly job. Such pictures serve their best purpose as aids to instruction, "before" and "after" pictures being the most convincing evidence one can obtain of the benefits of motion economy if the films are properly shot and edited.

Another important trend is the establishment of motion study laboratories to take their place alongside of gaging laboratories, fuel laboratories, and the like. Here special equipment and apparatus can be set up to afford more exhaustive study of any troublesome process. The worker and engineer both, being removed from the diversions of the plant, often can concentrate their energies more fully on the problem at hand and thus arrive at an earlier and sometimes more complete solution.

Table I is a list of equipment which is necessary or desirable for satisfactory motion study laboratory programs.

Sees Machine "Going to Material"

Fig. 2 is a glimpse into one corner of the motion study laboratory at Case School of Applied Science, Cleveland. Note the camera is supported by a special crane which allows the taking of much more revealing pictures than could be obtained by conventional methods in the shop proper.

Finally, the permeation of the principles of motion economy into plant engineering and layout as a systematic effort is a most encouraging development. The old idea of fastening a machine permanently into place is passing. Electrical systems allowing the flexibility of the well known 110-volt duplex receptacle on heavy power lines have made their appearance. The day is not far off when the machines will in large part (exceptionally heavy operation excluded) be brought to the optimum positions for production of a particular product, rather than bringing the product to the machines, wherever they may be found.

An example of universal plant flexibility may be found in Gustav R. Maass' report of developments (ref. 9) at the Adler Mfg. Co., Louisville, manufacturers of radio cabinets for Sears, Roebuck & Co. The product necessitated changes in the style of cabinet being run as often as twice a week. This in turn required a change in the sequence of operations. Judging from such circumstances of production one might easily fall into the usual rut of thinking in terms of a functionalized, fixed plant layout.

A careful study brought out the fact that not only would bi-weekly

machinery rearrangements be desirable, but that they were quite possible. To further complicate the picture, each machine not only had to be reconnected to a power source in its new position, but had to be hooked to an exhaust system as well.

The power supply difficulty was solved by overhead bus ducts with frequent outlets, and by the use of flexible armored power cables from the duct to each machine. Flexible exhaust ducts also were literally "plugged in" to frequent inlets (6-inch nipples at 3-foot intervals) to main duct runners solving the exhaust problem.

Total Travel Reduced

Instead of using trucks to move the parts, conveyors and wooden chutes or slides are used to carry the product through processing.

Typical of the savings made possible is the case of the most important sub-assembly, where the total travel is now 290 feet by conveyor and slide. If the assembly had been done in the old functionalized departmental layout, it would have travelled 5670 feet in 13 truck and 8 elevator moves on three floors.

We often have heard that "nothing succeeds like success", and in this quotation we have the essence of the method by which the motion study movement will grow into one of industry's foremost enterprises. Above a few case histories have been given. As more are released from confidential company files, it will begin to dawn on those reluctant to consider seriously this phase of scientific management, that dollars are slipping out from under their grasp each day that improvable setups are operated. Then, and only then, will motion study and methods engineering occupy its proper place in the industrial scene.

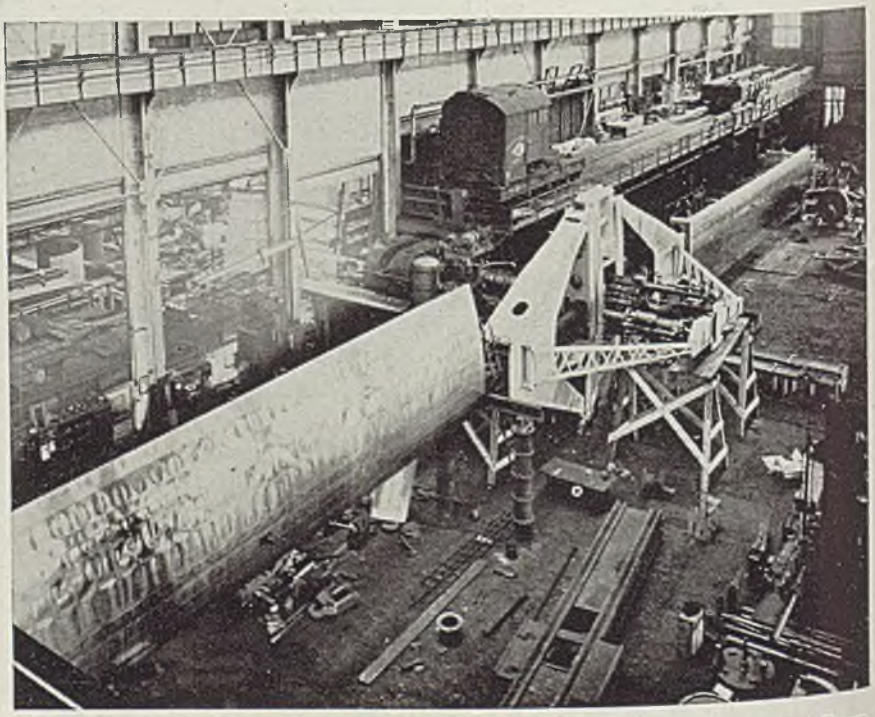
Bibliography—Part III

8. Mechanical Engineering, December 1939, page 897-899; Machine Design and Motion Economy" by O. W. Habel and G. G. Kearful.
9. Factory Management and Maintenance, September 1939, page 50-51, 122; "Short Runs Go Straight Line" by Gustav R. Maass.

See other references end of previous sections of this article.

Aids Beginners in Reading Blueprints

■ A booklet embodying information for aiding the newcomer in industry and the engineering student in reading blueprints is announced by George Boland, Box 154, Detroit. Entitled "Blueprint Reading Handbook," it explains to the reader in simple terms and with the aid of illustrations the various devices used in making a mechanical drawing and what they mean. The booklet is well planned, containing some 78 pages. It is ideal for those wishing to have a reference book at their finger tips for information of this kind.



■ Building the giant aero-electric generating turbine to be installed in the Green Mountains near Hubbardtown, Vt., for producing commercial power. Mechanical and structural parts for this turbine, other than the blades, were fabricated by the Wellman Engineering Co., Cleveland, for the S. Morgan Smith Co., York, Pa.

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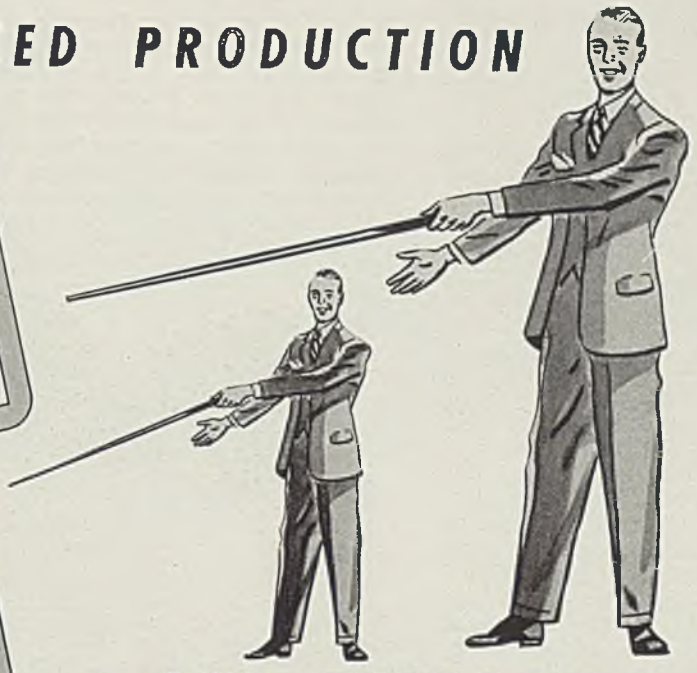

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Industrial Equipment

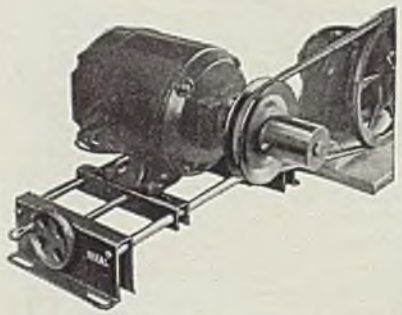
Roughing Lathe

■ Heppenstall Co., Forty-seventh and Hatfield street, Pittsburgh, has developed a heavy duty roughing lathe for use on forgings and large sections. Including a number of new and patented features, the machine is believed to fill the need for heavy duty machining facilities. Manufacturing and sales rights for this unit have been awarded to Lewis Foundry & Machine Division, Blaw-Knox Co., Post Office Box 1586, Pittsburgh. Features of the machine include a hydraulic feed, live tailstock center and selective stepless speeds and feeds. The machine has a simplified carriage, with hardened wear plates on the bed and cross feed slide. Dimensions and production rates of the new lathe are: Maximum overall length, 32

feet; maximum width, 56 inches; maximum distance between centers, 20 feet; height of centers above bed, 16 inches; width of bed, 32 inches; depth of bed, 30 inches; diameter of main feed screw, 3 inches; and diameter of cross feed screw, 1¾ inches. It has a main spindle speed of 10 to 40 revolutions per minute and 40 to 160 revolutions per minute. A small hand lever controls the direction of feed, latter being provided by a hydraulic drive through V belts from the back gear shaft. Any selected feed can be maintained regardless of a change in the main headstock speed. A start and stop button for the main motor and start button for the rapid traverse are incorporated on the carriage. Electrical equipment includes a main drive motor of 25 to 30 horsepower running at 300/1200 revolutions per minute; a 1200 revolutions per minute, 3 horsepower—power rapid traverse motor; a 1/3 horsepower lubricating pump motor; and a Gleason reel and main control for the large drive motor.

Motor Pulley

■ Ideal Commutator Dresser Co., 5076 Park avenue, Sycamore, Ill., announces a new variable speed pulley for light inexpensive machinery. It is mounted directly on the motor shaft and requires only standard V-belts. Its features include short overhang, forced lubrication, balanced sheave and all metal construction. Both halves of



the sheave move giving accurate belt alignment at all times. The pulley faces are curved so that the belt has full contact at all pitch diameters. Speed ratios up to 2¾ : 1 are available and sizes up to ¾-horsepower. Complete unit includes variable pitch pulley and adjustable sliding motor base. By turning the handwheel of the base, the motor moves backward or forward causing an increase or decrease in belt tension. Speed changes are made while drive is running.

Babbitted Bearing

■ Link-Belt Co., 2410 West Eighteenth street, Chicago, announces a new "modernized" series 2-1200 babbitted bearing for moderate speed and power requirements. Available in 24 sizes, for shafts of ½ to 3 inches diameter, it is compact, its

sloping surfaces between cap and base maintaining concentricity and relieving the cap bolts of direct strain from side thrust. Adjustment is provided by removable shims between base and cap, and cap bolts do not protrude above top of bearing. Bearing ends are finished to provide accurate bearing surfaces for collars, pulleys, gears, sprockets or other limiting devices. Also the base is recessed to compensate for inaccuracies in surface of the structural support. Elongated holes for base holding-down bolts provide adjustment for shaft alignment.

Developing Machine

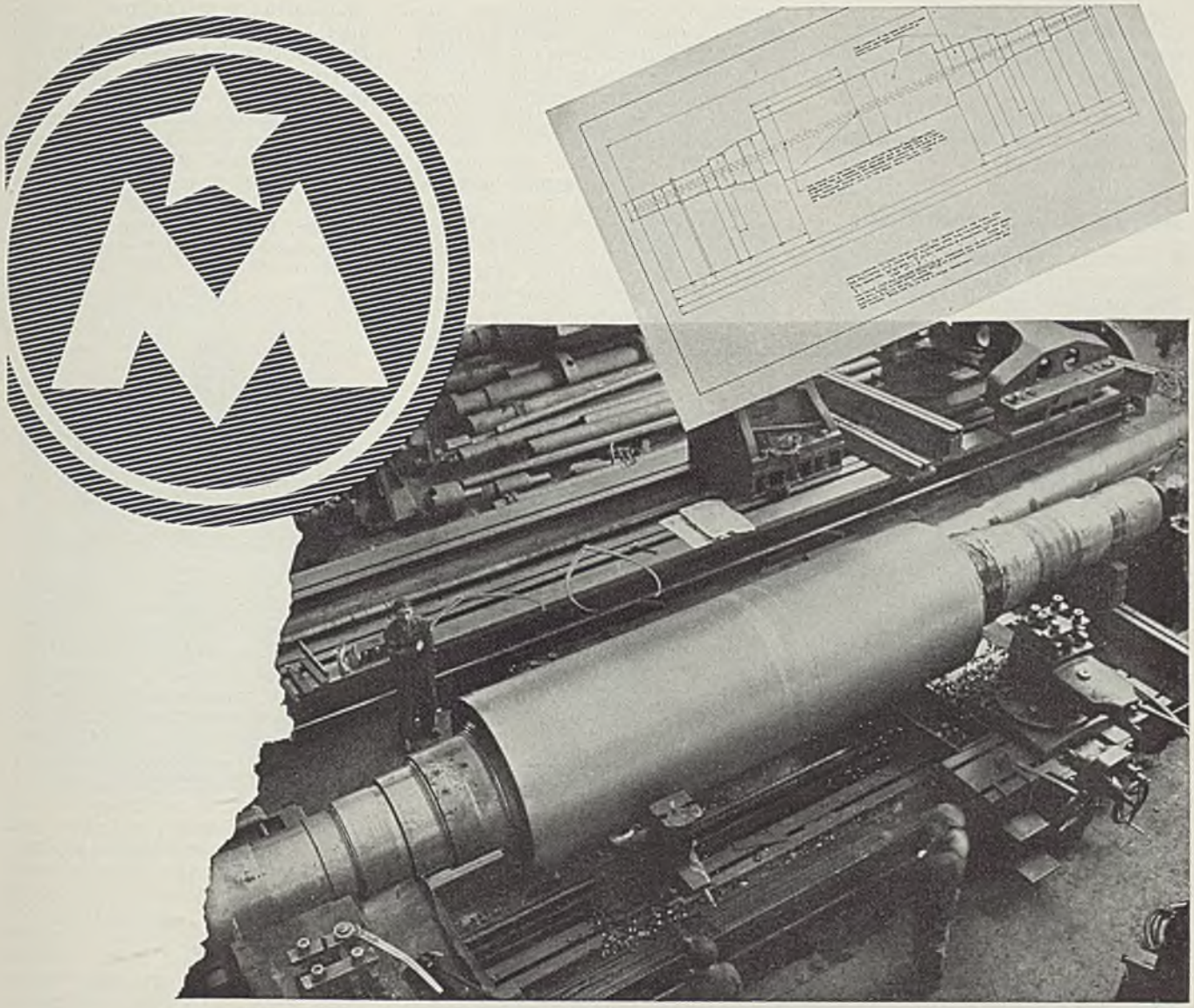
■ Charles Bruning Co. Inc., 100 Reade street, New York, has placed on the market a new high speed No. 159 Volumatic developer designed to be used with the model 75 BW printer. In using this unit the sensitized paper and tracings are fed into the machine at the front, where they are exposed immediately in the printer section. A vacuum separator roll at the discharge point of the printer separates the tracings from the exposed prints, allowing the latter to pass automatically to the developing and drying sections of the developer. The tracing is returned to the operator while the completely developed print is delivered dry and in flat position at the rear of the machine. The developer itself consists of a

separator roll, water roll, and a series of bands which carry the developed prints through the drying section. The developing section is driven by the printer and is synchronized to operate at exactly the same printing speeds.

Steam Cleaners

■ Homestead Valve Mfg. Co., Coraopolis, Pa., announces two new super-capacity Hypressure Jenny steam cleaners which provide faster and more thorough cleaning of automotive parts, chassis, motors, machinery, floors, walls, exteriors of buildings, etc.

Known as models J-L and J-M they feature a new simplified automatic compound feed, greater portability through the elimination of



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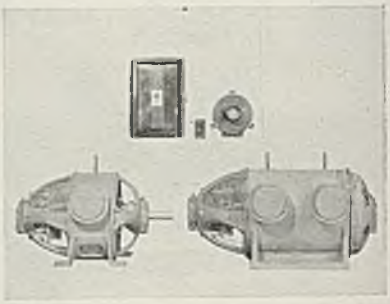
dead weight, and greater simplicity of construction and operation. Both units are self-starting and provide instant steaming. Operating pressure and solution feed on both are controlled by means of dial valves. The cleaners have a 13-gallon tank, for holding solution.

Adjustable Speed Drive

■ Westinghouse Electric & Mfg. Co., Department 7-N-20, East Pittsburgh, Pa., has placed on the market a new 10:1 adjustable-speed alternating-current drive for industrial applications requiring smoothly adjustable speeds over wide ranges with constant torque, in locations where only alternating current is supplied. Available in ratings from 1 to 15 horsepower with a standard speed range of from 175 to 1750 revolutions per minute, for 2 or 3-phase operation on 220, 440, 550-volts, 60-cycle systems, it utilizes a series circuit without the usual exciter. The drive has five parts, including control; (1) a single-unit motor-generator set, consisting of a squirrel cage induction motor driving a series direct-current generator which supplies operating voltage for (2) a direct current series motor coupled to the driven load. In parallel with the generator series field is (3) a rheostat which controls the driving motor speed. Control apparatus consists of (4) an across-the-line starter for the squirrel-cage motor, and (5) a pushbutton station. More flexible than the wound-rotor motor, the drive is more efficient because it has no exciter rotational losses. High-torque characteristics of the direct



current series motor are combined with the flat-speed properties of the shunt motor to give good speed-torque characteristics. Optional features include dynamic braking and inching. Dynamic braking requires no external braking resistor, but employs a braking field wound right into the motor. Horsepower ratings are based on top speed of 1750 revolutions per minute at 40 degrees Cent. continuous operation. Open frames are standard—splash-proof and totally-enclosed frames can be furnished.

Gravity Oiler

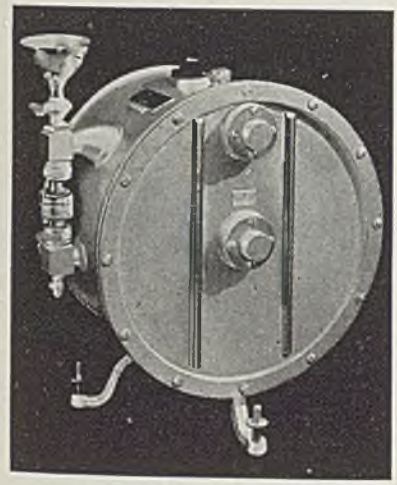
■ Trico Fuse Mfg. Co., 2948 North Fifth street, Milwaukee, has introduced a new, visible, unbreakable dust-proof oiler for all applications of gravity feed type oilers. It features a removable filter that can be extracted for cleaning. The oiler is mounted at the top of the part to be lubricated and any pre-

determined number of drops of oil per minute can be obtained by adjusting the needle valve. The shut-off lever at the top, when in a vertical position as shown, feeds oil, and when tilted to the side stops the flow. Made in four styles, the unit is available with removable filter, with removable filter and vent-tube; with removable filter and

drain cock; with removable filter, vent tube and drain cock. All are available in 1, 2, 4 and 8-ounce capacities.

Removable Back Head For Wet Test Meters

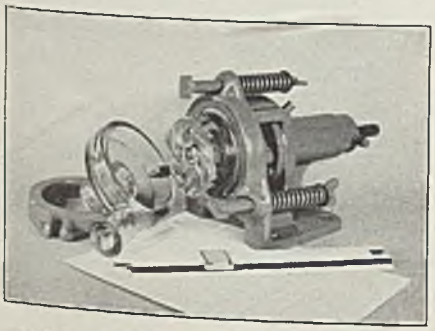
■ American Meter Co., 60 East Forty-second street, New York, has introduced a removable back head for its wet test meters in order to facilitate cleaning and to provide easier access to the drum. Its use is especially convenient where gas conditions make periodical wash-



ings advisable. First-hand inspection also is simplified so that corrosion and other effects may be observed more readily and the need for repairs lessened. The back head assembly may be attached not only to new models but also to meters (with either flat or convex back heads) already in service.

Glass Pump

■ Nash Engineering Co., South Norwalk, Conn., reports a glass pump of smaller capacity for laboratory and pilot plant service. Measuring ¾ x 1-inch, its capacity is 10 gallons per minute. Like the larger pump, this new size is actually constructed of glass, including volute, head and rotating impeller,



and is fully transparent having the same advantages where corrosive liquids or liquids which must be kept chemically uncontaminated are to be handled. A unique mechanical seal replaces the conventional stuffing box, and a safety unloading device eliminates the possibility of fracture of the glass casing. This pump handles hot acids or brine-cooled liquids with equal facility.

Motor Clutch

■ Rockford Drilling Machine Division, Borg-Warner Corp., 1315 Eighteenth avenue, Rockford, Ill., has placed on the market a new LMC clutch for use with gasoline or other motors, and in other applications up to 6 horsepower. Compact and powerful, it is easily installed and adjusted to running conditions. It can be utilized in conjunction with saws, conveyors, loaders spraying equipment, tool grinders, etc.

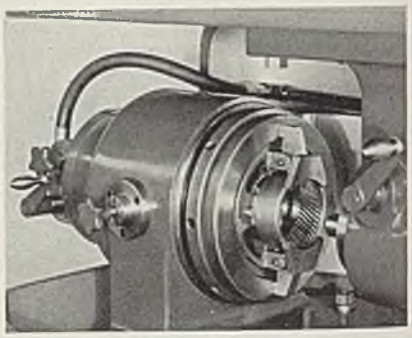
Its symmetrical body is well machined and the operating links, pins and rollers are all hardened steel. Toggle action goes "over-center", locks clutch in driving position and provides easy engagement plus powerful pull. Clutch plates are steel. The pressure for driving is uniformly distributed and applied directly opposite facing where it is most effective.

No oiling is necessary for the metal bushing which carries driven sprocket, pulley sheave, flange, or

other part of machine in which clutch is installed. Steel end-plate of the unit is threaded for fine adjustment. It also has a fiber protecting plug and slotted locking screw.

Internal Gear Finisher

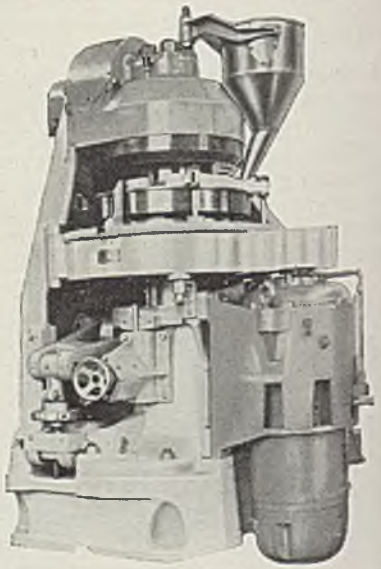
■ Michigan Tool Co., 7171 East McNichols road, Detroit, reports a new type crossed axis gear shaver for finishing internal gears. Closely resembling, in appearance, the 860-B rotary gear finishers for spur and helical gears, it (model No. 860-B-I) finishes internal gears through a combination of work rotation cutter reciprocation and vertical feed for the work. The cutter is mounted on the head of the machine while the work is located in a special driving fixture on the knee. This permits lateral reciprocation of the cutter through the drive to the head while the work is being rotated and fed into the cutter. The work head in this unit is driven by a V-belt from the base of the machine. Special provision also is made to locate the work accurately in the combination chuck and clamp prior to the shaving operation. Illustration shows spindle with cutter removed to give better view of work and locator in operating position. Two crank handles control movement of the spindle—one to move it into and out of the work, and the other to lock it in either position. During shaving operation, work is rotated while the cutter spindle reciprocates simultaneously, carrying the cutter back and forth over the gear teeth. Cutter and work axis are "crossed". A unique method of carrying coolant to the work is provided. The spindle of the gear locator is hollow, the coolant entering it from the tube shown



at the left in the illustration. Six diagonally drilled holes in the face of the locator carry the coolant directly against the teeth of the gear to be shaved when the locator is in the retracted or operating positions.

Compressing Machine

■ F. J. Stokes Machine Co., Philadelphia, offers a new and larger rotary tablet compressing machine capable of applying 30 tons pressure and producing parts with a maximum diameter of 2½ inches. Having a maximum die fill of 4 inches, it is arranged for making cored and special-shaped pieces. It

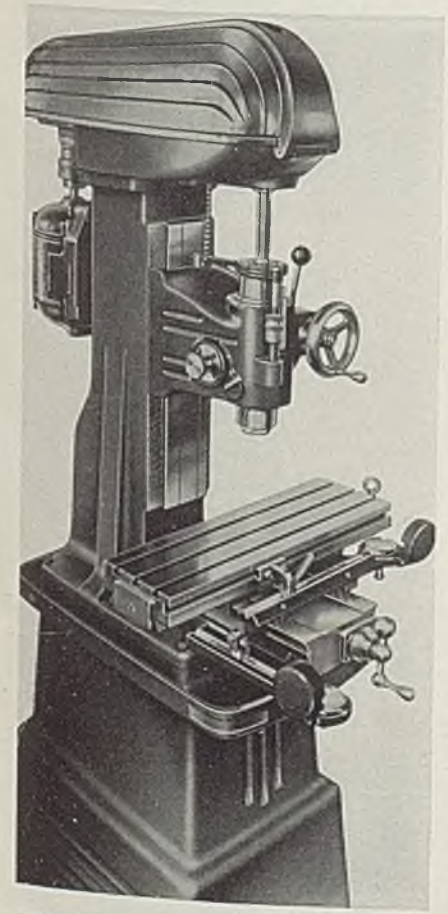


also is equipped with ten sets of punches and dies and applies pressure from both top and bottom simultaneously. Constructed of steel and semisteel throughout, the machine weighs 16,000 pounds and has a direct motor drive. A combined pressure equalizer and automatic

excess pressure release is provided to spill overloads and prevent jamming or breakage. The machine produces 150 pieces per minute when the full number of punch and die sets are used. Machines of this type are used for compressing oilless bearings, iron core magnets, valve seats, iron gears, pump seal rings, motor brushes and many similar products of powder metallurgy. They also can be used for compressing chemicals, explosives, dry cell plates, salt sticks and salt cakes, ore briquettes, molding powder preforms, and other materials and products.

Vertical Mill And Jig Borer

■ Machinery Mfg. Co., 1915 East Fifty-first street, Vernon, Los Angeles, has introduced a Vernon vertical mill and jig borer on which dial indicators and measuring rods are furnished as a standard extra for jig boring operations. Where both large and small jig boring work is done in a shop, this provides the perfect complementary tool, relieving larger, higher priced jig borers for the heavier work and



permitting the smaller jobs to be turned out speedily and economically. The standard set consists of two dial indicators with jewel bearings, 1-inch range, double dial and tell-tale hand. The dials are large and easily read, being 2½ inches in diameter. Graduations are in 0.001-inch and the ample space between graduations permits "visual splitting", making it possible for the operator to work readily to fractions of a thousandth of an inch. There are seven assorted sized measuring rods, 1 to 4 inches in length, and necessary troughs are provided for holding and attaching this equipment to the machine. The unit is equipped with two feeds to quill—fine feed by means of hand-wheel and rapid one-to-one traverse with hand-lever. The spindle is mounted in preloaded, ball bearings, its collet end being carburized, hardened and ground. Other features include balanced drive pulleys, mounted in sealed ball bearings and fully enclosed in helmet head, and tapered gibs throughout.

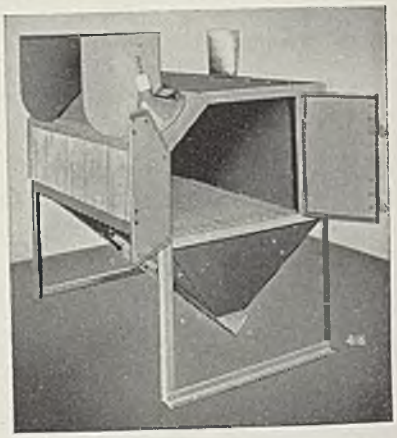
Exhaust Head

■ Cochrane Corp., Seventeenth street and Allegheny avenue, Philadelphia, has introduced a new exhaust head which insures the separation of condensate and oil from steam discharged to atmosphere preventing raining of water and oily condensate upon the roof or ground below. It also discharges clean, dry steam noiselessly. Available in eight sizes, it incorporates the principles of the baffle-type

separators used for removing oil and moisture from steam lines. The port area produces low steam velocity and minimizes pressure loss. Steam is whipped sidewise and causes projection of entrainment against ribbed baffle surfaces. The high ribbed baffles in turn exert a scrubbing action in addition to the centrifugal purging force. Of one piece semisteel for 4 to 12-inch sizes, the head is of welded plate for larger sizes.

Blast Cabinet

■ W. W. Sly Mfg. Co., 4702 Train avenue, Cleveland, has placed on the market a new model blast cabinet which enables the operator to see the castings better in order to effect a more thorough cleaning job. Clear illumination is provided by two lights mounted at the front. Vision of the operator is further improved by a protective hood which shields the operator's view, shutting off the light at top and sides. Large doors at both ends of the unit provide access to the interior for insertion and removal of the castings on the grating. The particular cabinet shown is one of a complete line. Its blasting cabinet proper is 36 inches deep by 72 inches long by 30 inches high. Compact and inexpensive, this cabinet is used extensively for cleaning of small or intricate parts; tools, gears, screw machine products, heat treated parts for the automotive and aeronautical industries. The cabinet can be furnished with an induction type blast gun attached to bottom of the cabinet hopper or with positive pressure blast tank below the cabinet, or with bucket elevator and pressure blast tank on floor level.



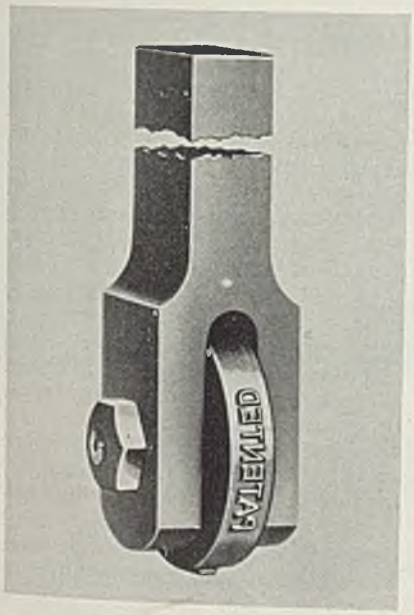
Portable Vacuum Cleaner

■ Breuer Electric Mfg. Co., 5100 North Ravenswood avenue, Chicago, has introduced a new Tornado noiseless model 230 portable vacuum cleaner for heavy-duty service. It is equipped with a full horsepower motor, mounted on grease-sealed ball bearings which require no oiling. Its multistage, turbine fan has ample suction for fast, thorough cleaning, and the large tank and filter provide plenty of space for dirt accumulation. Light in weight, the machine easily can be rolled about on its large casters or picked up and carried. Attachments and cleaning tools are available for cleaning floors, rugs, carpets and upholstery. In addition, there are also available a wide variety of attachments for various types of industrial cleaning, among them the cleaning of walls, overhead pipes

and so forth; removing dust, chips, and litter from units in the course of assembly; and the cleaning of boiler tubes and boiler tops in the power plant.

Roller Marking Die

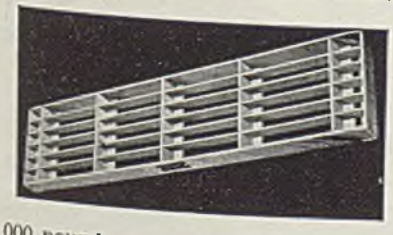
■ Acromark Corp., Elizabeth, N. J., announces a new combination steel roller die and holder to fit in the tool post of standard lathes enabling operators to mark products or parts quickly without waiting for the delivery of marking equipment. The roller die can be engraved with any numbering, lettering or design and, when assembled, it is a simple matter to clamp the part in the lathe



chuck, then rotate the lathe by hand rolling in a perfect marking. If interchangeable lettering or numbering is to be done then the roll can be made to receive segment interchangeable steel type. For continuous marking where the part must rotate completely for applying graduations to a ring for example, then a larger fixture is furnished so the part and the die can be synchronized by meshing gears.

Aluminum Gratings

■ Aluminum Ladder Co., 154 Adams street, Tarentum, Pa., announces a new type grating made entirely of Aluminum Alloy 61 ST, which has a tensile strength of 48,-



000 pounds per square inch. Being fireproof and nonsparking, it is ideal for use aboard ships carrying volatile cargoes and in plants where fire hazards exist. All welded construction insures against bending and buckling. The weight of the grating is only 2 pounds per square foot, and it is available in all lengths and widths. At present it can be supplied only for use under government defense contracts.

Arc Welder

■ Eisler Engineering Co., 740 South Thirteenth street, Newark, N. J., has placed on the market a new model A. C. transformer type arc welder for operation on 220 volts, 60 cycles alternating current, single phase, or any single phase of a polyphase circuit. Available from 100 to 400-ampere capacity, the welder's current is controlled by a conveniently located knob. Both the value of current and size of welding rod to be used are indicated for each dial setting. The machine also features noninflammable and heat-proof insulation, and does not incorporate rotating parts requiring upkeep. The unit is mounted on rubber-covered swivel casters for manueverability. Standard equipment included with welder are lightweight helmet, electrode holder, 25-foot heavy duty flexible cables and large bundle of assorted electrodes.

Holds Enamel Rework

(*Concluded from Page* 86)

operation for various production loads. For example, during periods of increasing load there are times when it proves more economical to add a partial third shift than to start an additional furnace. Whenever changes in production rates are contemplated, furnace operation is always considered in planning enamel department setup.

Inspection Is Rigid: Efficient control of spoilage requires rigid inspection. As mentioned before, the pickled ware is inspected before applying ground coat. Next it is inspected after drying, then after ground-coat firing. Cover coat is inspected after drying and finally there is the inspection of the finished ware. However, each individual is in effect an inspector. Some of these individuals have a better opportunity than the regular inspectors for locating certain types of defects.

For example, small dents may show up clearly on the wet metal to the ground coat dipper, whereas the bare metal inspector would have difficulty seeing them. All this means that defective work is caught before additional operations are performed, and it is much easier to locate the source of trouble.

Losses Broken Down Daily: All spoilage throughout the factory is reported daily. Inspectors' reports are priced and the results of the previous day's operations are known early the following day. Losses are presented as "cost per cabinet produced". This is a more tangible base than percentages of one thing or another. The daily report indicates the loss at each inspection station caused by each department. Further, these losses are broken down into the responsibility of each particular foreman. Thus every penny of loss must be accounted for by some particular man.

Large charts of these losses are posted each week in a conspicuous place in the shop. It is not unusual for a workman, finding his section showing up poorly, to ask his foreman why. The answers given by the foreman to questions about spoilage give an indication of the progress which has been made recently.

Several years ago it was, "Yes, we have a lot of trouble." Then we advanced to, "We sprayed only 20 outer doors yesterday." Now the answer is likely to be, "One door had a bad wipe on the top corner and the other had a couple of blisters around the nameplate."

Improvement Pyramids: Reduction of spoilage has a cumulative effect, since the less rejects there are, the more time may be spent investigating each. This results in a better opportunity of licking it so each improvement usually brings an opportunity for still more improvement.

Such interest as this in spoilage control is not spontaneous. It is also apt to lag during periods of stress. Hence it must be stimulated continually. Early each week the superintendent meets with department heads and foremen. Results of the previous week are discussed and plans made for the current week. Later a similar meeting is held with the assistants of the various sections. Control performance is followed through the display of posters and charts. These, together with the elaborate spoilage control setup are expensive, but money spent in this way is a good investment. It has shown profitable returns in all departments, but in none as much as the enamel department. Here the losses now average less than a fifth of what was considered good performance a few years back.

Efficiency Contingent Upon Many Factors: Control is not limited to spoilage. Labor efficiency is equally well controlled. Workers are paid a straight hourly wage and their efficiency is calculated against time study standards; but the maintenance of efficiency is directly up to the foreman. In a conveyorized shop, this means, for one thing, that the lines must be kept moving. Hence all delays, no matter how trivial, are reported together with their cause, and steps are taken to prevent a recurrence.

The use of material is also under constant vigilance. Standing instructions specify the amount of material to be applied to each piece. Each week the actual consumption of material is checked against this specified amount and the difference reported as waste. Every effort is made to reduce this to a minimum.

As a result, losses in the enamel department are gratifyingly low. More than 97 per cent of all ware passes through the plant with no re-operations.

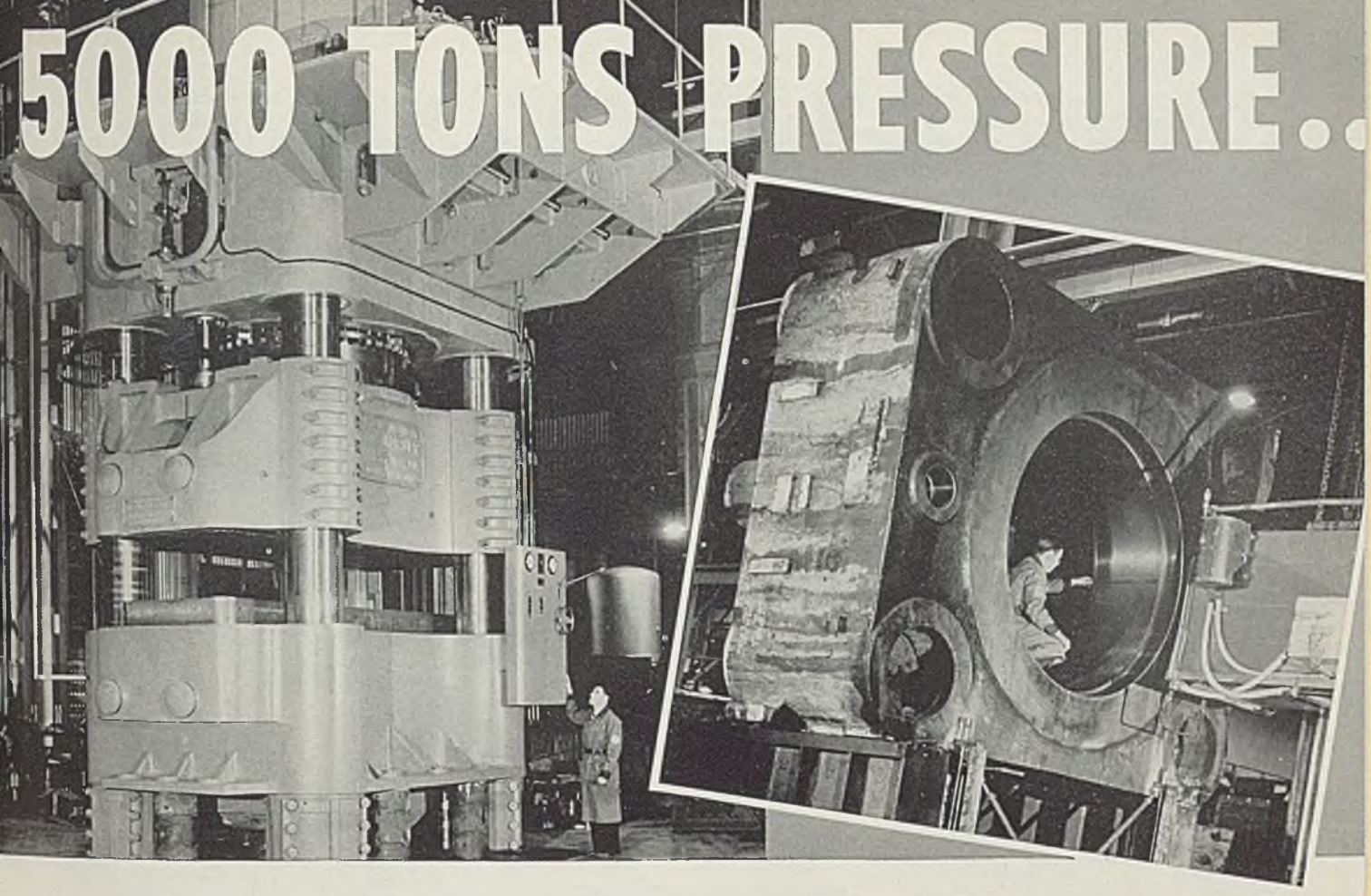
Enameled ware scrapped is negligible. Waste enamel amounts to about 5 per cent. Delays are infrequent and labor efficiency is high. Most important of all is the fact that the quality of the finished product is unusually high and continually improving.

New Roofing Material Has Many Applications

■ Roofloy, an improved type of roofing sheet lead is announced by Revere Copper & Brass Inc., 230 Park avenue, New York. Because of its improved properties, it can be used for roofing with practically every type building regardless of architectural style. Its blue-gray color blends with all building materials. Furthermore, it will not stain adjacent materials, even under severe conditions.

The material features high creep resistance, is light in weight and resists acid attack. It can be stamped or formed, providing a good reproduction of detail especially when used for ornamental constructions.

5000 TONS PRESSURE..



and STEEL CASTINGS *take it!*

Do you know why one of America's largest builders of self-contained hydraulic presses specifies steel castings for all major press parts, cylinder, platen, and bed? It is because steel castings do the job best!

The H-P-M press illustrated here weighs 700,000 pounds and has a pressure capacity of 5000 tons. It is used to cut and form many different metal aircraft parts at a single pressing. Aircraft parts must be made interchangeable, therefore, precision press operation is required.

H-P-M engineers say—"We do not believe that any other material could possibly stand up as well as cast steel under the tremendous pressures and strains involved, still maintain precision alignment, give adequate rigidity and resist fatigue.

"And certainly no other material or process would contribute so much saving of time, work and cost in building the press itself."

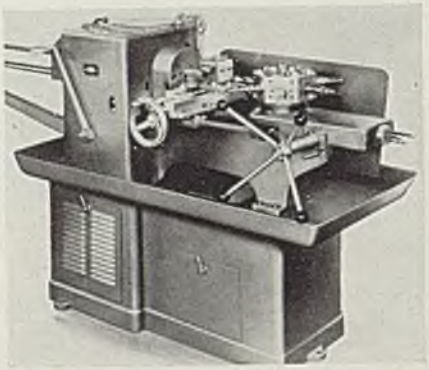
Whatever *you* make, look into steel castings when writing your specifications and planning your production. Steel castings bring you strength where you want it, without excess weight. They bring you a wide choice of mechanical properties, ease of machining and finishing, combinations of parts that save handling and assembly time—all contributing toward a better finished product at lower cost.

For more information, consult your local foundry, or write to Steel Founders' Society of America, 920 Midland Bldg., Cleveland, Ohio.

FOLLOW THE EXAMPLE OF THE MODERN PRESS BUILDER — MODERNIZE YOUR PRODUCT WITH

STEEL CASTINGS

screw machine which does not require a highly skilled operator. The turret is hand operated and hand indexed with the saddle stops automatically synchronized with the revolution of the turret. The radial thrust of the turret is taken by a massive ball bearing, and an adjustable turret locking stud is provided for maximum rigidity. Each

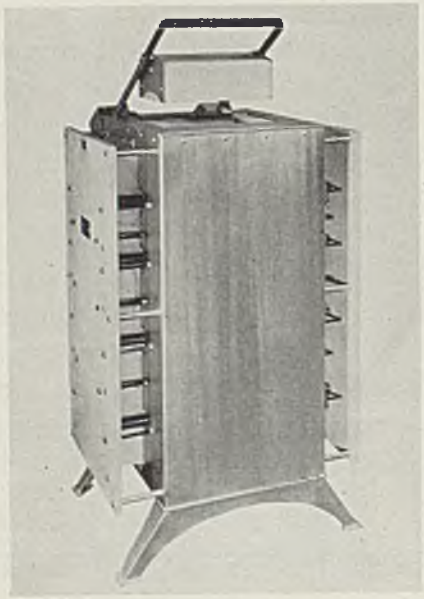


turret face has six tapped holes for mounting certain sizes of tool holders. Either a lever or screw-fed cross slide can be furnished.

In this unit multiple V-belts from the 2-speed motor to worm shaft or spindle is the method of drive —speed changes being obtainable through quick-change sheaves giving spindle speeds from 140 to 1000 revolutions per minute in the worm driven machine and from 900 to 3000 in the direct drive.

Pit-Type Furnace

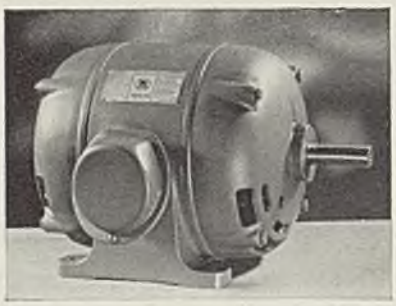
■ Sentry Co., Foxboro, Mass., has introduced a controlled atmosphere pit-type furnace for high tempera-



ture hardening of high speed steel. Its design allows the hardening of long tools in a vertical position, eliminating tendency of tools to warp or change shape when hot. Diamond blocks assure an automatically controlled neutral atmosphere. This furnace has a maximum rating of 32 kilowatts; normal operation will run from 8 to 20 kilowatts per hour. It will heat from cold to 2350 degrees Fahr. in about 75 minutes, and is equipped with a steel shell and ample insulation for 2500 degrees Fahr. operation. Heating elements on either side of the removable silicon-carbide muffle, in four positions, assure uniform temperatures throughout the chamber. Shielded electrical terminals of a patented air-cooled design eliminate necessity for water cooling. The furnace is 52½ inches high, 28⅞ inches wide and 21½ inches deep.

Motor for General Drive Applications

■ Westinghouse Electric & Mfg. Co., Dept. 7-N-20, East Pittsburgh, Pa., has placed on the market new smaller alternating-current, squirrel-cage, ball-bearing induction motors designed especially for general purpose industrial machinery drive applications. These are available in ratings from ½ to 5 horsepower with speeds from 875 to 3600 revo-



lutions per minute for operation on 110, 220, 440 and 550 volts, 2 and 3 phase alternating current. Greatest improvement incorporated in these CS motors is the new Permanently Sealed ball-bearings which require lubrication only once every three years. Also a new plastic wire coating gives maximum dielectric strength, toughness and flexibility. Reinforced cuffs at slot edges protect windings from abrasion, and coil ends are taped to brace them against the strains of full voltage starting.

The motor's one-piece cast frame assures a stiff support for the rotor and overall structural rigidity.

Weld Controller

■ Weltronic Corp., 3080 East Outer drive, Detroit, announces a new weld Timer-Contactor to be used with any 15 to 35 kilovolt-ampere manually or mechanically timed spot welder. Available for 220, 440 or 550 welding voltages and for 25, 40, 50 or 60 cycles frequency, the model 108-53 is adjustable over a range of timing of from 2 to 30 cycles. Its two control knobs provide adjustment to conform with the work being welded. The con-

tacts of both contactor and relay are readily removable for replacement.

By means of a simplified wiring diagram the unit may be installed by any electrician. It consists of an electronic tube, relay and magnetic contactor enclosed in a compact spring hinge cover case, the latter measuring approximately 11 x 13 x 30 inches.

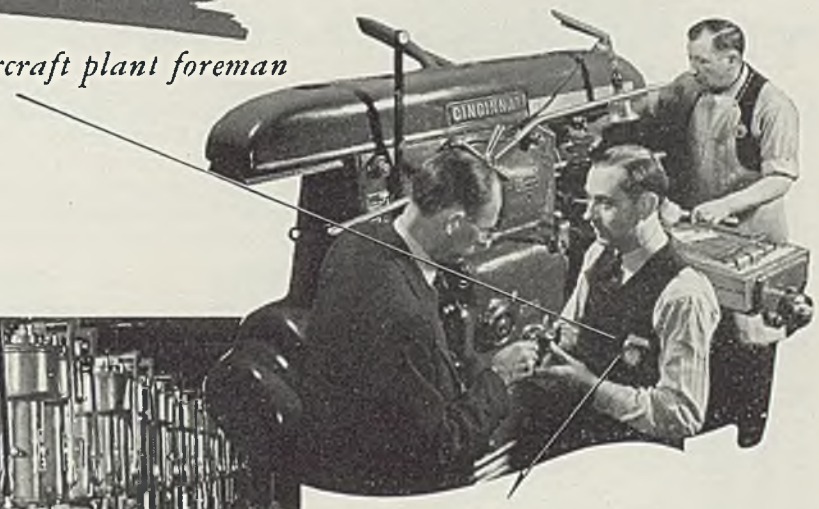
Infra-Red Heat Lamps

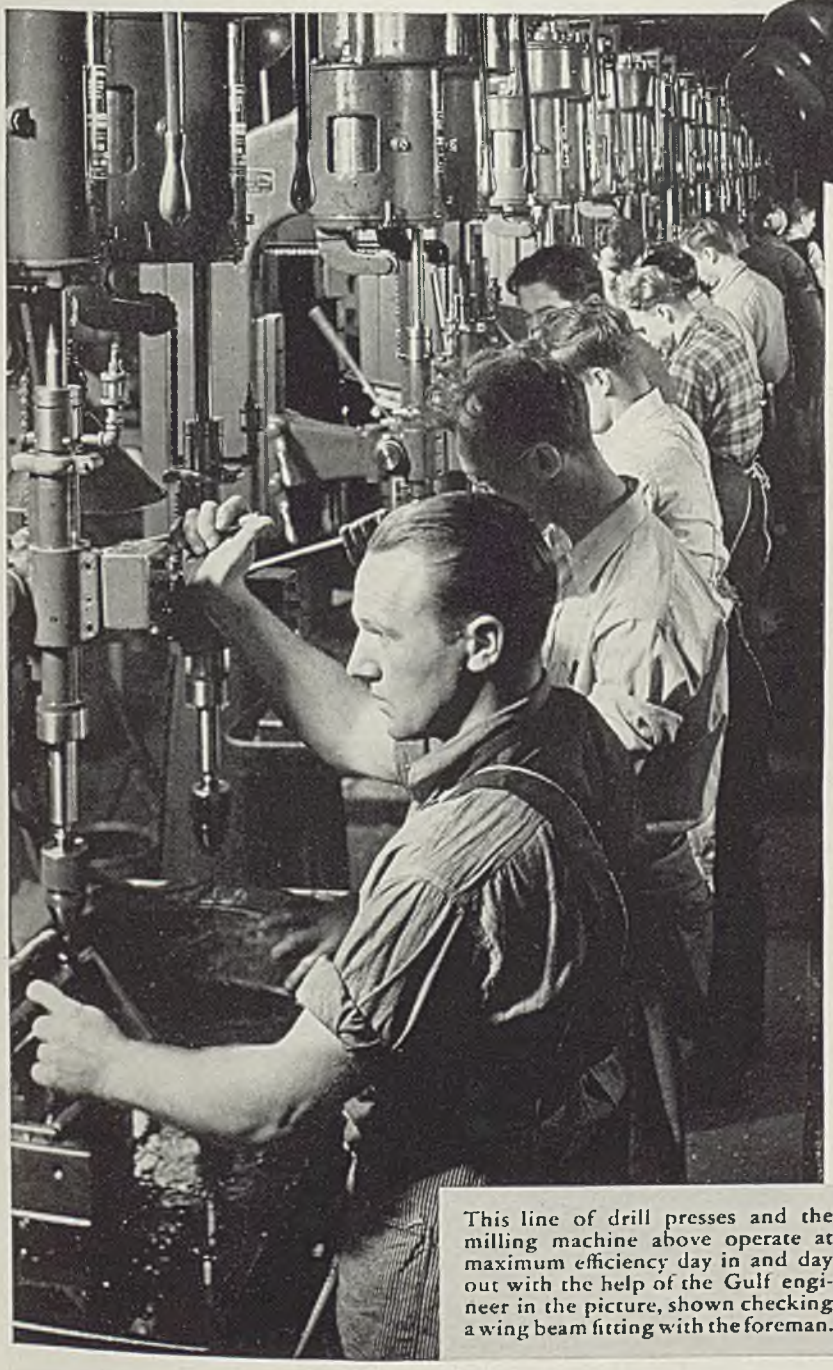
■ Birdseye Division, Wabash Appliance Corp., 345 Carroll street, Brooklyn, N. Y., announces three new infra-red heat lamps—two for use with gold-plated or Alzac reflectors, and one that does not require any

separate reflector since it incorporates its own reflector lining sealed inside to keep it free from oxidation and the collection of dust, dirt and fumes. The latter, according to the manufacturer, will keep heat-reflect-

"With Gulf Quality Lubricants we get Sustained Peak Production."

says this aircraft plant foreman





This line of drill presses and the milling machine above operate at maximum efficiency day in and day out with the help of the Gulf engineer in the picture, shown checking a wing beam fitting with the foreman.

"By following the Gulf engineer's recommendations, we get continuous top-notch performance from our equipment."

"THE quality oils recommended by the Gulf engineer not only help us attain maximum production, but help us *sustain* that production day in and day out," says this aircraft plant foreman. "We credit Gulf Periodic Consultation Service for some very effective assistance to our defense efforts."

The quality lubricants and advanced application methods recommended by Gulf engineers are helping many metal-working plants maintain maximum output by avoiding equipment failures and delays caused by faulty lubrication. Ask a Gulf engineer to suggest the proper lubrication of *your* equipment. His one big aim is to help you get continuous output from your plant.

Gulf quality lubricants are quickly available to you through more than 1200 warehouses in 30 states from Maine to New Mexico. Write or phone your nearest Gulf office today.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION · GULF REFINING COMPANY · PITTSBURGH, PA.

ing value for the 6000-hour life of the bulb because it is made of pure solid silver sealed inside the gas-filled bulb. Differing from incandescent lamps used for lighting, the filaments of these new units operate at lower temperatures, developing infra-red radiant energy at wave lengths which have high penetration.

Ball Bearing Grinders

■ Baldor Electric Co., 4351 Duncan avenue, St. Louis, has developed a new No. 612 6-inch grinder for precision work. Rated at 1/3-horsepower, it features fully-enclosed guards and adjustable shatter-proof

eye shields. Its tool rests, which are adjustable horizontally and vertically, may be tilted for angle grinding. Power is supplied with capacitor type motor, guaranteed against burn out for two years.

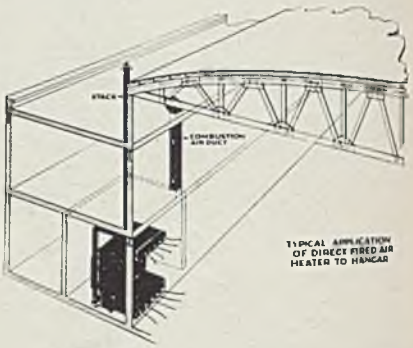
Press Features Slow-Closing Control

■ F. J. Stokes Machine Co., Plastics Division, Philadelphia, is now offering Standard semiautomatic presses with a new "slow-closing" control feature which regulates the final closing of the mold under compression. Thus the closing speed of a press is timed automatically and duplicated exactly in each cycle. The control mechanism makes the press automatic in operation, except

for the actual loading and removal of finished pieces. The control adjustments can be set so that the slow closing action starts at any desired point in the ram travel. The speed can even be adjusted while the ram is in motion. When in the clear the press closes at normal high speed.

Air Heater

■ Dravo Corp., Neville Island, Pittsburgh, has introduced a large-capacity floor-type direct-fired air heater which gives an output of 1,500,000 B. t. u. per hour. The illustration shows the unit in a typical application. It is fired with either oil or gas. One of its features is the application of a tubular economizer. This acts to reduce the flue gas temperature to the lowest practicable limit. Of steel construction throughout, the heater is designed to conserve floor space. Although an air heater, in many respects it reflects the latest boiler construction and design practice. For example, considerable so-called "black surface" is provided for absorbing the radiating effect of the flame, thus performing a function equivalent to that performed by the water walls in a modern boiler. The combustion chamber is of welded steel plate,



heavily corrugated to which a large steel fin surface is welded. The fans are located below the heater, taking the air at floor level where it is coldest. The combustion chamber is jacketed at every point with a rapidly moving stream of air. The heater is provided with the latest safety controls and its operation is automatically controlled in accordance with the outlet temperature or the temperature in the building. Discharge nozzles on top of the unit can be adjusted to discharge the air in any given direction.

Fan-Cooled Motor

■ Century Electric Co., 1806 Pine street, St. Louis, announces a new totally enclosed fan cooled motor for Class II, Group G atmospheres. It guards motor against explosions of grain dust in suspension and carries the underwriters' label of approval for this type of service.

Besides improved appearance, the motor features an efficient cooling

Advertisement

MAY, 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*

Filter Withstands Corrosion and Heat

All-brass construction prevents corrosion or electrolytic action in Cuno Auto-Klean Type DS Filters, manufactured by The Cuno Engineering Corporation, Meriden, Conn. By employing brass throughout, these filters for domestic and small industrial oil burners avoid the possibility of electrolysis caused by dissimilar metals in contact with acid-containing fuel oils.

Brass, moreover, has proved that it can readily withstand the abnormally high temperatures that exist locally in many small industrial oil burners, accompanied by pressures up to 125 lbs. per sq. inch. Other metals, it was found, were unable to endure these conditions.

Bridgeport Brass, with its combination of excellent strength, workability and uniformity, is used for drawn brass sump, cartridge spindles, and support rods.

1940 Index Now Ready

The 1940 index to the COPPER ALLOY BULLETIN is now ready for distribution, and copies will be sent free on request on your company letterhead. The index contains references to all subjects covered during 1940, including items in the New Developments column. A comprehensive plan of cross-reference facilitates use of the index. Write Bridgeport Brass Company for your copy.

Worn Piston Surfaces Built up With Bronze

Resurfacing with bronze offers a simple, economical means of building up worn pistons, valves, shafts, and similar parts. The method can also be applied to broken gear teeth and stripped threads, and makes it possible to salvage many parts that would otherwise have to be scrapped. A special advantage of rebuilding with bronze is that the bronze surface is often stronger than the original metal.

Of Bridgeport's comprehensive line of welding rods, Bridgeport Bronze and Bridgeport Manganese Bronze are especially suitable for building up wearing surfaces. A booklet describing bronze welding processes and giving detailed information on Bridgeport Welding Rod is available on request.

Substitution of Copper for Brass Weighed Because of Zinc Shortage

Differences in Strength, Ductility, and Melting Point Among Factors to be Examined in Considering Substitution

The demands of the national defense program have produced a temporary scarcity of certain essential metals. The large quantity of zinc required in defense work has made it increasingly difficult to obtain brass for ordinary commercial uses. As a result, considerable interest has arisen in the possibility of substituting alternative materials for brass during the emergency period. This is particularly true in the case of high brass, because of its high zinc content.

While the use of other copper alloys containing a lower percentage of zinc is helpful, it is better from the broader material outlook to consider the use of pure copper. The use of copper eliminates both the need of another alloying metal and the necessity of re-melting to produce the alloy. Up to the present time, the shortage of copper is only less acute than that of zinc.

This is the first of a series of three articles on the factors involved in the substitution of copper for high brass, and deals specifically with comparative properties in the annealed condition. The second article will deal with the materials in the cold worked condition, and the third with problems involved in specific substitutions.

Comparison of Properties

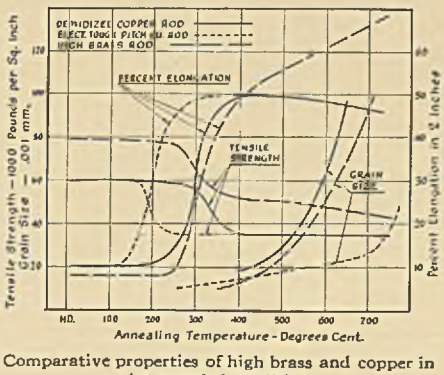
In attempting to substitute copper for high brass, it is necessary to consider carefully the differences in properties between the two materials. Certain of these differences are advantageous in some cases; others offer difficulties which may need to be overcome by changes in methods employed in product manufacture. *These changes should always be worked out on a small scale in actual use before an attempt at wholesale substitution is made.*

The accompanying curves illustrate some of the differences between copper and high brass in the annealed state. In considering the use of copper, it must be remembered that there are a number of types of relatively pure copper, which vary slightly in certain specific characteristics. These differences center in the presence or absence of oxygen in the copper. Commercial copper tubes are almost always of the deoxidized or non-oxygen-bearing type, while wire and rod are usually of the tough pitch or oxygen-bearing type. Sheet copper may be of either type, although it is usually oxygen-bearing. In annealing, the principal differences between the two types are in the temperature at which softening takes place, and in the rate of grain growth after softening and recrystallization. (The various types of copper were discussed in detail in the February, March, April, May, and July, 1939, issues of the COPPER ALLOY BULLETIN.)

Mechanical Strength of Copper

All types of pure copper are much softer and have less strength than high brass in the same condition. While this may be an advantage in reducing power requirements, it may be a source of difficulty in the finished state. The strength of high brass is approximately 30 or 40% higher than that of copper, and its yield strength is 150 to 200% higher. The yield strength is probably a better indication of the relative strengths of the materials in the annealed condition.

The tendency to flow or creep under sustained loads is also greater in copper than in brass. Hence, when materials have to be finished in the annealed condition, copper is at a distinct disadvantage because of its lower strength. This drawback can be overcome in some cases by the use of heavier metal sections or of material finished by a cold working operation.



Comparative properties of high brass and copper in the annealed condition.

Copper also has a lower ductility than

(Continued on page 2 col. 2)

COPPER ALLOY BULLETIN

ALLOYS OF COPPER

This is the twenty-third 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 NICKEL TO COPPER-ZINC ALLOYS

Additions of nickel to the copper-zinc alloys have been made for years. The resulting alloys have been known as German Silver or Nickel Silver. These alloys, however, contain appreciable quantities of nickel, and for this reason they might properly be considered as being basically copper-nickel alloys as well as copper-zinc alloys.

The most pronounced effect of additions of nickel to the copper-zinc alloys is the change in color. This effect was perhaps the original reason for the nickel additions. It is more pronounced in the case of the higher zinc alloys than in those of higher copper content, because increased zinc content in itself tends to produce a lighter-colored material, making the effect of the nickel less noticeable.

Proportions of Nickel Used

The amount of nickel required to produce a decided color change is about 10%, and alloys are manufactured with nickel contents ranging from this quantity up to as much as 30% of nickel.

As the quantity of nickel is increased, there is an increase in the tensile strength of the alloy. This is accompanied by an increase in the softening point or recrystallization temperature. Thus, the alloy containing about 65% copper, 18% nickel, and the remainder zinc, requires higher softening temperatures and higher annealing temperatures than any of the other types of copper-zinc alloys.

Effect on Conductivity

The addition of as much as 10% nickel to a 60% copper alloy lowers the electrical conductivity to such an extent that the alloy becomes a high-resistance one. This fact, combined with resistance to oxidation, has resulted in the extensive use of Nickel Silver wire and strip as resistance elements. More recently, however, this use has decreased as a result of the development of other alloys better suited for this purpose.

At present, Nickel Silver is used chiefly where color is an important factor, as in basic materials for silver-plated ware and in the gold plate industry. Its combination of good tensile strength and spring characteristics has made it a useful alloy in the electrical instrument field.

Substitution of Copper

(*Continued from page 1 col. 3*)

high brass, as indicated by their comparative elongation curves. As a result, copper cannot be stretched in one operation as well as high brass, and practical experience shows that copper cannot be cupped as deeply from sheet as high brass in the same tools. On the other hand, copper can be worked more severely between annealing operations if the successive working operations are such as to flow the metal in the same direction in each operation. If copper is first to be drawn in one operation and then flattened or severely headed in the next, an annealing operation is desirable, as in the case of brass subjected to the same operations.

In deoxidized or non-oxygen-bearing copper the grain growth is more rapid than in tough pitch copper. However, the maximum ductility is attained at considerably lower temperatures than in brass, so that lower annealing temperatures can be used without sacrificing ductility. It is interesting to note that while the curves for copper rod do not show any appreciable loss in ductility or strength with increased grain size, there is a sufficient decrease in the case of thin-walled tubes or sheet to make the lower temperatures for process annealing almost a necessity.

The differences in softening point between high brass and the two general types of copper are very important. High brass and deoxidized copper in the cold worked condition can be tinned and soldered without loss of strength. Therefore, in cases where these requirements must be met, the use of standard electrolytic tough pitch copper must be avoided, unless elements are specifically added to the copper to make it suitable for the purpose. 10 to 20 ounces of silver per ton of copper may be added in such cases to obtain the desired results.

Copper Arose from The Earth's Depths

The copper-containing ores seem to have been squeezed up from under the earth's crust in a manner resembling tooth paste being forced from a tube, according to a recently proposed geologic theory.

Indication that this actually happened is found in the fact that wherever copper ore bodies occur, they are associated with cracks, fissures and other varieties of severe breaks in the earth's surface, as might result from the squeezing action.

NEW DEVELOPMENTS

A device for inspecting screw machine parts has a wide lens, which permits both eyes to be used for critical examination of pieces. Provides almost instant focus on large and small fields, flat and curved surfaces, it is stated. **(No. 190)**

A spinning lathe is now available in 16, 20, 24 and 30-inch sizes, with either plain bed or carriage. Various step cones are said to provide spindle speeds of 1200, 1600, 2000, and 2400 rpm. Hand feeding carriage has compound swivel rest and tool holder. High thrust capacity roller bearings are used on headstock spindle. **(No. 191)**

A file for use on non-ferrous metals has slots which pass through the file body from the back face to the recesses between the teeth on the working face. These slots provide clearance so chips can pass through body. Turnbuckle can be tightened to make file slightly concave or convex, it is said. **(No. 192)**

An abrasion tester permits varying pressures of the abrading wheels in accordance with the nature of the specimen. Lacquered and electroplated surfaces are among the finishes which can be accurately measured on this compact device for resistance to rubbing abrasion, it is stated. **(No. 193)**

Bar stock feed unit used with screw machine, lathe or cut-off machine is reported especially valuable for use with polished brass and thin tubing because its design prevents marring of the finish. The device operates automatically by air pressure. It is self-contained and may be used with a variety of machines. **(No. 194)**

An atomizing spray nozzle, made largely of brass, is said to give an exceptionally wide spray angle, which is a highly desirable feature when spraying the inside of cylindrical objects, for example. **(No. 195)**

A tapping machine capable of tapping holes of different depths without changing the stop gage is announced. The machine is said to be 90 per cent automatic and operates at high speeds. It is also applicable to drilling use, according to the manufacturer. **(No. 196)**

A tilting tumbling barrel, designed specially for non-ferrous metal finishing, has a speed of 36 revolutions per minute, according to the manufacturer. It is said to insure highly finished parts entirely free of nicks and scratches because of its heavy kiln-dried maple construction and low speed. **(No. 197)**

A padding material is said to protect the finished surfaces of any product from damage as well as to insulate delicate objects against shock. It comes in rolls or sheets with an assembled thickness of about ⅛-inch, prior to compression and before wrapping around the object. **(No 198)**

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.

Strike Effect on Steel To Be Long Protracted

Full operations of March may not be duplicated until fall. Coke prices up 50 to 75 cents

MARKET IN TABLOID ★

Demand
Characterized by large defense tonnages.

Prices
Some companies apply for exceptions to freezing.

Production
Down 1 point to 95.

■ FAR-REACHING inventory controls on steel and nonferrous metal producers, dealers and consumers are announced from Washington. The new order is aimed against the accumulation of artificially large inventories and involves filing of monthly affidavits covering all deliveries, starting June 10, with OPM's priority division. Included under the ruling are "iron and steel products, rolled, drawn, forgings, castings and pig iron.

Control is based on a patriotic appeal and if cooperation in carrying out the control is not given OPM lets it be known that strict mandatory systems will be put into effect. It will be an honor system with judgment of the supplier determining what inventories are reasonable. A field staff will be created to audit inventories and make sudden spot checks in plants.

The coal strike damage to the steel industry will be felt for many months to come, it being predicted that the industry cannot again reach the March peak of virtually 100 per cent practical capacity until fall. Shortage of coal made scarcity of coke; that in turn of pig iron and lack of pig iron caused greater drain on scrap, making that scarce.

Steel ingot production last week dropped 1 point to 95 per cent.

A large producer which operated at 106 per cent of rated capacity in March dropped to 94 per cent for April and may sag further in May because of lost momentum. Several blast furnaces which blew out because of fuel shortage will remain shut down for several weeks for relining. Moreover, it is recognized that the coal strike could not have come at a more inopportune time or when the need for quickened defense has become desperate because of unfavorable turns to the Allied cause.

Despite these problems many consider the price situation the major problem because of freezing of prices without previous refrigeration of wages. The attitude of one steelmaker in being willing to go along for three months at frozen levels without protest is by no means typical of the industry. One of the smaller nonintegrated producers has announced withdrawal from the market pending approval at Washington of his plea for an exception in his favor; such has already been granted to at least one maker.

Several makers observe that though the number of orders is fewer larger tonnages per order, usually for defense, keep the volume maintained, forcing deliveries farther behind. Fairly fantastically large tonnage inquiries and sales are noted. A plate maker was awarded 120,000 tons of plates following an order for 50,000 tons the week before for the Maritime Commission. A pending inquiry is for 187,000 tons of tungsten steel bars for fabrication into airplane gun bullets to pierce light armor, to be fabricated on automatic screw machines. A structural contract for 26,000 tons for an aircraft assembly plant at Fort Worth, Tex., was awarded to Bethlehem, with a twin plant at Tulsa, Okla., reported virtually awarded to another fabricator. Allocation soon on 197,000 tons of X 1335 cold drawn steel bars for shells is expected, against an eventual purchase of 600,000 tons.

In several cases consumers of steel, including railroad car builders, are considering adaptation of bessemer steel in place of open-hearth steel to their needs. For many months bessemer production has lagged behind open-hearth and in bessemer lies virtually the only chance of expanded production.

Some Mid-West pig iron producers are now selling f.o.b. furnace, into outside districts, refusing hereafter to absorb the freight. This means an increased cost to such consumers of about $1.50 per ton.

As a result of the coal strike by-product coke prices were advanced 50 to 75 cents per ton, with the Atlantic seaboard generally observing the higher figure.

A sharp increase in automobile assemblies was scheduled for last week, up 22,445 units to 130,610, compared with 99,305 in the corresponding week of 1940.

Steel ingot production rose in three districts: New England by 3 points to 95 per cent, Detroit by 9 points to 88 and Cleveland by ½ point to 92½. Four districts dropped: Pittsburgh by 3 points to 93, eastern Pennsylvania by 1 point to 95, Youngstown by 5 points to 89 and Cincinnati by 2 points to 90½. Unchanged were: Chicago at 96, Wheeling at 88, Buffalo at 90½, Birmingham at 90 and St. Louis at 98.

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 3	Apr. 26	Apr. 19	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 3, 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 5/32-inch, Pitts.	2.00	2.00	2.00	2.00

Pig Iron

	May 3, 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	30.34	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....	$5.50	$5.50	$5.50	$4.75
Connellsville, foundry, ovens....	6.00	6.00	6.00	5.75
Chicago, by-product fdry., del...	11.75	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
Sparrows Point, Md.	2.10c
Claymont, Del.	2.10c
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	68 off
Do., ⅞ and ⅝ x 6-in. and shorter	66 off
Do., ¾ to 1 x 6-in. and shorter	64 off
1⅛ and larger, all lengths	62 off
All diameters, over 6-in. long	62 off
Tire bolts	52.5 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	60 off
Plow bolts	68.5 off

Nuts

Semifinished hex.	U.S.S.	S.A.E.
½-inch and less	66	70
⅝-1-inch	63	65
1⅛-1½-inch	61	62
1⅝ and larger	60	--

Hexagon Cap Screws

Upset 1-in., smaller	68 off

Square Head Set Screws

Upset, 1-in., smaller	74.0 off
Headless set screws	64.0 off

Piling

Pitts., Chgo., Buffalo 2.40c

Rivets, Washers

F.o.b. Pitts., Cleve., Chgo., Bham.

Structural	3.40c
⅞-inch and under	65-10 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, cut-lengths 4 to 24 feet; f.o.b. Pittsburgh, base price per 100 feet subject to usual extras.

Lap Welded

Sizes	Gage	Steel	Charcoal Iron
1½"O.D.	13	$ 9.72	$23.71
1¾"O.D.	13	11.06	22.93
2" O.D.	13	12.38	19.35
2¼"O.D.	13	13.79	21.68
2¼"O.D.	12	15.16	....
2½"O.D.	12	16.58	26.57
2¾"O.D.	12	17.54	29.00
3" O.D.	12	18.35	31.36
3½"O.D.	11	23.15	39.81
4" O.D.	10	28.66	49.90
5" O.D.	9	44.25	73.93
6" O.D.	7	68.14	....

Seamless

Sizes	Gage	Hot Rolled	Cold Drawn
1" O.D.	13	$ 7.82	$ 9.01
1¼"O.D.	13	9.26	10.67
1½"O.D.	13	10.23	11.79
1¾"O.D.	13	11.64	13.42
2" O.D.	13	13.04	15.03
2¼"O.D.	13	14.54	16.76
2¼"O.D.	12	16.01	18.45
2½"O.D.	12	17.54	20.21
2¾"O.D.	12	18.59	21.42
3" O.D.	12	19.50	22.48
3½"O.D.	11	24.62	28.37
4" O.D.	10	30.54	35.20
4½"O.D.	10	37.35	43.04
5" O.D.	9	46.87	54.01
6" O.D.	7	71.96	82.93

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 ⅜-inch incl. (per 100 lbs.)	$2.00
Do., over ⅜ to ⅝-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.	$5.00- 5.75
Connellsville, fdry.	5.25- 6.00
Connell. prem. fdry.	6.00- 6.60
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.	11.85-12.30
Chicago, outside del.	11.50
Chicago, delivered	12.25
Terre Haute, del.	11.25
Milwaukee, ovens	12.25
New England, del.	13.75
St. Louis, del.	11.75
Birmingham, ovens	7.50
Indianapolis, del.	11.25
Cincinnati, del.	11.00
Cleveland, del	12.05
Buffalo, del.	11.75
Detroit, del.	11.50
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.	$27.00
Pitts. dist. fur.	23.50	do., del. Chicago	30.34
		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	52.50

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. $2.60
200-lb. kegs, lb. 2.75
Do., 100-200 lb. lots. 3.00
Do., under 100-lb. lots

Molybdenum Oxide Briquets, 48-52% molybdenum, per pound contained, f.o.b. producers' plant 80.00c

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	5.68	3.75	....	4.50	....	4.39	....	....
Tulsa, Okla.	4.44	4.34	4.34	4.49	4.49	6.09	4.19	....	5.54	....	4.69	....	....
Birmingham	3.50	3.70	3.70	3.55	3.55	5.93	3.45	....	4.75	....	4.43	....	....
New Orleans	4.00	4.10	4.10	3.80	3.80	5.75	3.85	....	4.80	5.00	4.60	....	....
Houston, Tex.	3.75	5.95	5.95	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; 300-4999 pounds in Portland; 300-9999 Seattle; 400-14,999 pounds in Twin Cities; 400-3999 pounds in B'ham., Memphis.

Cold Rolled Sheets: Base, 400-1499 pounds in Chicago, Cincinnati, Cleveland, Detroit, New York, Omaha, Kansas City, St. Louis; 450-3749 in Boston; 500-1499 in Buffalo; 1000-1999 in Philadelphia, Baltimore; 750-4999 in San Francisco; 300-4999 in Portland, Seattle; any quantity in Twin Cities; 300-1999 Los Angeles.

Galvanized Sheets: Base, 150-1499 pounds, New York; 150-1499 in Cleveland, Pittsburgh, Baltimore, Norfolk; 150-1049 in Los Angeles; 300-4999 in Portland, Seattle; 450-3749 in Boston; 500-1499 in Birmingham, Buffalo, Chicago, Cincinnati, Detroit, Indianapolis, Milwaukee, Omaha, St. Louis, Tulsa; 3500 and over in Chattanooga; any quantity in Twin Cities; 750-1500 in Kansas City; 150 and over in Memphis; 25 to 49 bundles in Philadelphia; 750-4999 in San Francisco.

Cold Rolled Strip: No base quantity; extras apply on lots of all size.

Cold Finished Bars: Base, 1500 pounds and over on carbon, except 0-299 in San Francisco, 1000 and over in Portland, Seattle; 1000 pounds and over on alloy, except 0-4999 in San Francisco.

SAE Hot Rolled Alloy Bars: Base, 1000 pounds and over, except 0-4999, San Francisco; 0-1999, Portland, Seattle.

EUROPEAN IRON, STEEL PRICES

Dollars at $4.02½ per Pound Sterling

Export Prices f.o.b. Port of Dispatch—

By Cable or Radio

	Gross Tons	BRITISH 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%	68.00-70.00
Brazilian, 46%	63.00-65.00
Chilean, 47%	65.00
Cuban, 50-51%, duty free	67.50

Molybdenum

Sulphide conc., lb., Mo. cont., mines	$0.75

IRON AND STEEL SCRAP PRICES

Quotations are those of Price Stabilization Board on grades covered by announcement.

Corrected to Friday night. Gross tons delivered to consumers except where otherwise stated; †indicates brokers prices

HEAVY MELTING STEEL

Birmingham, No. 1.	17.00
Bos. dock No. 1 exp.	14.00-14.50
New Eng. del. No. 1.	†13.50-14.00
Buffalo, No. 1	19.25
Buffalo, No. 2	18.25
Chicago, No. 1	18.75
Chicago, auto, no alloy	18.25
Cincinnati, No. 1	18.50
Cincinnati, No. 1	†16.00-16.50
Cleveland, No. 1	19.50
Cleveland, No. 2	18.50
Detroit, No. 1	17.85
Detroit, No. 1	†16.50-17.00
Detroit, No. 2	16.85
Detroit, No. 2	†15.50-16.00
Duluth No. 1	18.00
Duluth No. 2	17.00
Eastern Pa., No. 1.	18.75
Eastern Pa., No. 2.	17.75
Eastern Pa. (R. R.)	19.75
Los Ang., No. 1	14.50
Los Ang., No. 2	13.50
New York No. 1	†15.75
New York, No. 2	†14.75
N. Y., No. 1, exp.	†15.25
N. Y., No. 2, exp.	†14.25
Pitts., No. 1 (R. R.)	21.00
Pittsburgh, No. 1	20.00
Pittsburgh, No. 2.	19.00
St. Louis, No. 1 R. R.	18.50
St. Louis, No. 1	17.50
St. Louis, No. 2	16.50
San Fran., No. 1	14.50
San Fran., No. 2	13.50
Seattle, No. 1	14.50
Toronto, dlrs., No. 1	12.25-12.50
Valleys, No. 1	20.00

COMPRESSED SHEETS

Buffalo	19.25
Chicago, factory	18.75
Chicago, dealers	17.75
Cincinnati	17.50
Cincinnati	†15.00-15.50
Cleveland	19.50
Detroit	17.85
Detroit	†16.50-17.00
Duluth	18.00
E. Pa., factory No. 1	18.75
E. Pa., dealer No. 1	17.75
E. Pa., dealer No. 2	16.75
Los Angeles	14.50
New York, old	†14.25
Pittsburgh	20.00
St. Louis, No. 1	17.50
St. Louis, No. 2	15.50
San Francisco	14.50
Valleys	20.00

BUNDLED SHEETS

Buffalo, No. 1	18.25
Buffalo, No. 2	17.25
Cleveland	16.00
Cincinnati, No. 1	†15.00-15.50
Cincinnati, No. 2	†14.00-14.50
Duluth No. 1	17.00
Duluth No. 2	16.00
Pittsburgh	19.00
St. Louis	13.50
Toronto, dealers	10.00-10.50

SHEET CLIPPINGS, LOOSE

Chicago	15.50-16.00
Cincinnati	14.25
Cincinnati	†12.00-12.50
Detroit	†13.00-13.50
St. Louis	12.00-12.50
Toronto, dealers	8.50- 8.75

BUSHELING

Birmingham, No. 1.	16.50
Buffalo, No. 1	18.75
Chicago, No. 1	18.25
Cincin., No. 1	18.00
Cincinnati, No. 1	†15.50-16.00
Cincin., No. 2	14.00
Cincinnati, No. 2	†10.00-10.50
Cleveland, No. 2	15.00
Detroit, No. 1 new.	17.35
Detroit, No. 1 new.	†16.00-16.50
Duluth No. 1	17.50
Duluth No. 2	13.50
Eastern Pa., No. 1	18.25
Eastern Pa., No. 2.	14.25
Valleys, new, No. 1.	19.50
Toronto, dealers	7.00- 7.50

MACHINE TURNINGS (Long)

Birmingham	12.50
Buffalo	14.75
Chicago	14.25
Cincinnati	14.00
Cincinnati	10.00-11.00
Cleveland, no alloy.	15.00
Detroit	13.35
Detroit	†10.00-10.50
Duluth	13.50
Eastern Pa.	14.25
Los Angeles	10.00
New York	†10.75-11.75
Pittsburgh	15.50
St. Louis	13.00
San Francisco	10.00
Toronto, dealers	†8.75- 9.00
Valleys	15.50

SHOVELING TURNINGS

Buffalo	15.75
Cleveland	16.00
Chicago, specl, anal.	16.25-16.75
Cincinnati	10.50-12.50
Detroit	14.35
Detroit	†12.00-12.50
Duluth	14.50
Pitts., alloy-free	16.50
St. Louis	14.00

BORINGS AND TURNINGS

For Blast Furnace Use

New England	11.00
Buffalo	14.75
Cincinnati	14.00
Cincinnati	†10.00-11.00
Cleveland	15.00
Eastern Pa.	14.25
Detroit	13.35
Detroit	†12.00-12.50
Duluth	13.50
New York	†10.75-11.25
Pittsburgh	15.50
St. Louis	13.00
Toronto, dealers	†8.75- 9.00

AXLE TURNINGS

Buffalo	17.00-17.50
Boston district	†12.50-13.00
Chicago, elec. fur.	20.00-20.50
East. Pa. elec. fur.	19.50-20.00
St. Louis	15.50-16.00
Toronto	†7.75- 8.00

CAST IRON BORINGS

Birmingham	12.50
New England, chem.	11.00
Buffalo	14.75
Chicago	14.25
Cincinnati	14.00
Cincinnati	†10.00-11.00
Cleveland	15.00
Detroit	13.35
Detroit	†12.00-12.50
Duluth	13.50
Eastern Pa.	14.25
E. Pa., chemical	17.50-18.00
New York	†10.75-11.25
St. Louis	13.00
Toronto, dealers	†8.75- 9.00

RAILROAD SPECIALTIES

Chicago	23.50-24.00

ANGLE BARS—STEEL

Chicago	23.50-24.00
St. Louis	21.50-22.00

SPRINGS

Buffalo	24.25-24.50
Chicago, coil	24.75-25.25
Chicago, leaf	23.50-24.00
Eastern Pa.	23.75
Pittsburgh	26.75-27.25
St. Louis	23.25-23.75

STEEL, RAILS, SHORT

Birmingham	21.00
Buffalo	23.75
Chicago (3 ft.)	22.75
Chicago (2 ft.)	23.25
Cincinnati, 3 ft.	†22.00-22.50
Cincinnati, 2 ft.	†22.50-23.00
Detroit	21.85
Detroit	†22.00-22.50
Duluth, 3 ft. & less	22.00
Duluth, 2 ft. & less	22.50
Duluth, 18-in. & less	23.00
Pitts., 2 ft. and less	24.50
St. L. 2 ft. & Less.	22.00

STEEL RAILS, SCRAP

Birmingham	19.00
New England	17.50
Buffalo	21.50
Chicago	20.75
Cleveland	21.50
Cincinnati	†20.00-20.50
Duluth	20.00
Eastern Pa.	20.75
New York	†17.25
Pittsburgh	22.00
St. Louis	19.50
Seattle	16.50

PIPE AND FLUES

Chicago, net	14.50-15.00
Cincinnati, dealers.	14.50

RAILROAD GRATE BARS

Buffalo	14.50-15.00
Chicago, net	14.00-14.50
Cincinnati	†14.00-15.00
Eastern Pa.	20.50-21.00
New York	†17.50
St. Louis	15.00-15.50

RAILROAD WROUGHT

Birmingham	16.00
Boston district	†11.75-12.25
Eastern Pa., No. 1.	20.50-21.00
St. Louis, No. 1	14.25-14.75
St. Louis, No. 2	16.50-17.00

FORGE FLASHINGS

Boston district	†12.75-13.00
Buffalo	18.25-18.75
Cleveland	18.50-19.00
Detroit	†16.00-16.50
Pittsburgh	20.00-20.50

FORGE SCRAP

Boston district	†12.75-13.00
Chicago, heavy	24.00-24.50

LOW PHOSPHORUS

Buffalo	25.50
Cleveland, crops	24.50
Detroit	†19.00-19.50
Duluth	23.00
Eastern Pa., crops.	23.75
Pitts., billet, bloom, slab crops	25.00
Toronto, dealers	13.50-14.00

LOW PHOS. PUNCHINGS

Buffalo	24.25
Chicago	23.75
Cleveland	24.50
Eastern Pa.	23.75
Pittsburgh	25.00
Seattle	19.50

RAILS FOR ROLLING

5 feet and over

Birmingham	20.50
New England	†19.50-20.00
Chicago	22.25
Cincinnati	†21.50-22.00
Duluth	21.50
New York	†18.75
Eastern Pa.	22.25
St. Louis	21.00

STEEL CAR AXLES

Birmingham	18.00
Boston district	†20.00-20.50
Chicago, net	26.00-26.50
Eastern Pa.	27.50-28.00
St. Louis	25.50-26.00

LOCOMOTIVE TIRES

Chicago (cut)	23.50-24.00
St. Louis, No. 1	20.00-20.50

SHAFTING

Boston district	†18.50-18.75
New York	†21.00-21.50
Eastern Pa.	24.50
St. Louis, 1¼-3¾"	19.75-20.25

CAR WHEELS

Birmingham iron	18.00
Boston dist., iron	†16.50-17.00
Buffalo, steel	24.25-24.75
Buffalo iron	21.50-22.00
Chicago, iron	20.50-21.00
Chicago, rolled steel	23.00-23.50
Cincinnati, iron	†17.00-18.50
Eastern Pa., iron	24.00
Eastern Pa., steel	23.75
Pittsburgh, iron	22.00-22.50
Pittsburgh, steel	26.75-27.25
St. Louis iron	21.75-22.25
St. Louis, steel	22.50-23.00

NO. 1 CAST SCRAP

Birmingham	19.50
Boston, No. 1 mach.	†19.00-19.50
N. Eng., del. No. 2.	19.25-19.50
N. Eng. del. cupola.	23.50
Buffalo, No. 1	20.50
Buffalo, mach.	22.50
Chicago, agri.	22.60
Chicago, auto	22.60
Chicago, railroad	22.60
Chicago, mach.	22.60
Cincin., No. 1 cupola.	†20.00-21.00
Cleveland, mach.	22.50
Detroit, cupola	†21.50-22.00
Eastern Pa., cupola.	23.69-24.39
E. Pa., No. 2	23.00-23.50
Los Angeles	16.50-17.00
N. Y., No. 1, cupola.	†21.00
Pittsburgh, cupola.	22.50-23.00
San Francisco	14.50-15.00
Seattle	14.00-15.00
St. L., agri. mach.	20.00-20.50
St. L., No. 1 mach.	22.00-22.50
Toronto No. 1 mach., net dealers	17.75-18.00

HEAVY CAST

Boston dist. break.	†17.50-18.00
New England, del.	22.00
Buffalo, break.	20.50-21.00
Cleveland, break	21.00
Cincinnati, break	†18.00-19.50
Detroit, auto	†21.50-22.00
Detroit, break.	†17.50-18.00
Eastern Pa.	22.34-23.03
Los Ang., auto, net.	13.00-14.00
New York break.	†18.80

STOVE PLATE

Birmingham	13.50
Boston district	†14.50-14.75
Buffalo	17.00-17.50
Chicago	17.60
Cincinnati	†14.00-15.00
Detroit	†15.00-15.50
Eastern Pa.	18.84-19.58
New York fdry.	†17.50
St. Louis	17.00-17.50
Toronto dealers, net.	14.00-14.25

MALLEABLE

New England, del.	22.00-23.00
Buffalo	24.50-25.00
Chicago, R. R.	24.50-25.00
Cincin. agri., deal.	18.00-18.50
Cleveland, rail	25.00-25.50
Eastern Pa., R. R.	23.00-23.50
Los Angeles	12.50
Pittsburgh, rail	26.00-26.50
St. Louis, R. R.	21.50-22.00

SHEET SCRAP?

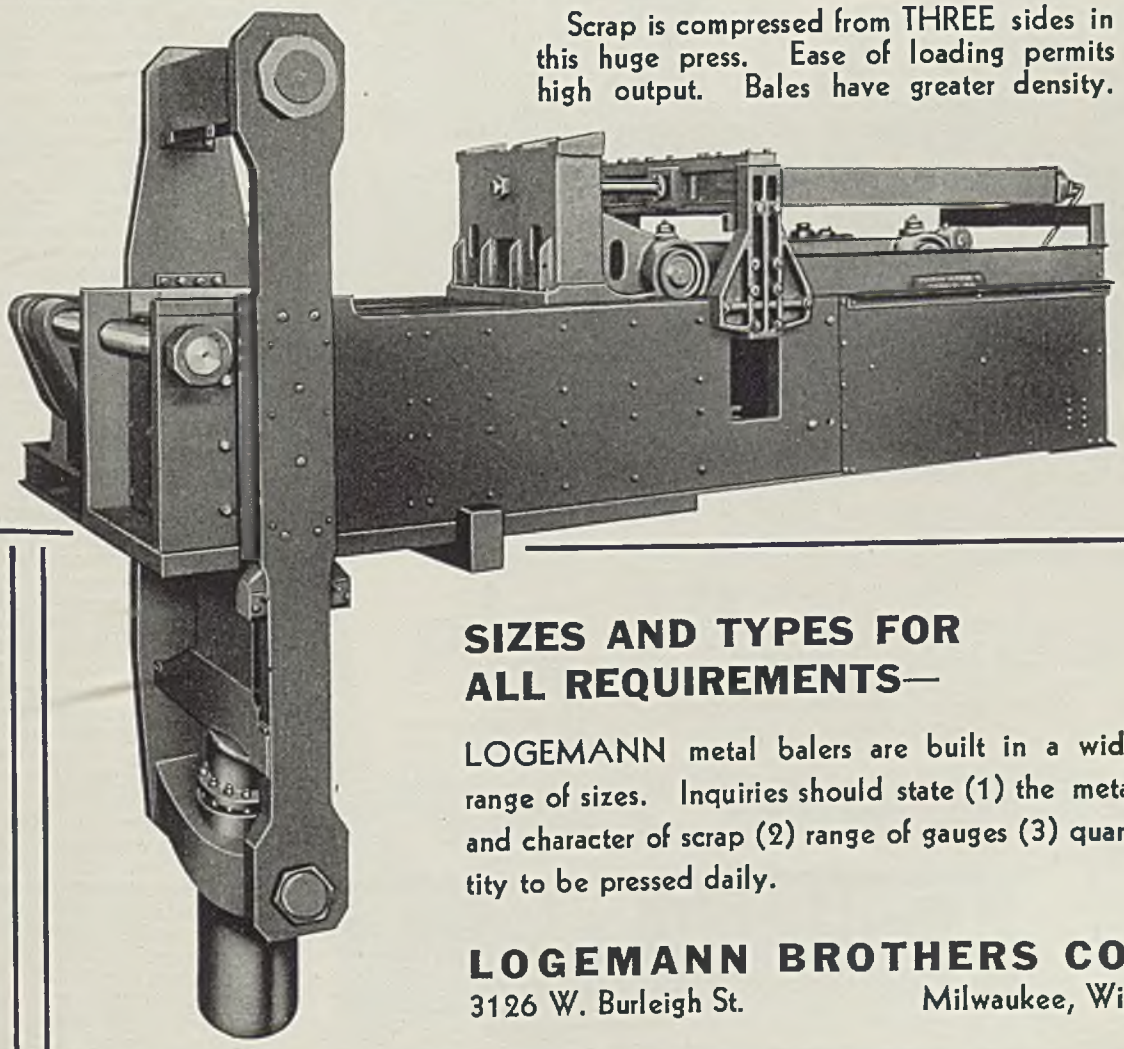
Bale it in a

LOGEMANN SCRAP PRESS

"Hydraulic-compressed" scrap pressed in LOGEMANN metal balers, commands the best price at all times. It can be more conveniently stored and more economically handled.

It can be readily held for favorable markets. It practically eliminates corrosion, saves much heat in remelting. It easily loads cars to capacity.

Scrap is compressed from THREE sides in this huge press. Ease of loading permits high output. Bales have greater density.



SIZES AND TYPES FOR ALL REQUIREMENTS—

LOGEMANN metal balers are built in a wide range of sizes. Inquiries should state (1) the metal and character of scrap (2) range of gauges (3) quantity to be pressed daily.

LOGEMANN BROTHERS CO.
3126 W. Burleigh St. Milwaukee, Wis.

Sheet, Strip—(Prices Pages 108-109)—Sheet deliveries continue to recede and some makers recently quoting first quarter, 1942, on hot and cold-rolled and galvanized, now promise no better than second or third quarter. Strip mill sizes of sheets have been deferred from 5-6 months to 6-7 months and alloy sheets from 4-5 months to 6-8 months.

Automotive users are specifying heavily, apparently seeking to build inventory before production reduction goes into effect. Some mills now are accepting commitments for first quarter. Rigid control of nickel is causing some substitution in specifications and this may be holding back some business that otherwise would be out. As a rule, consumers are fabricating material faster than it is being received.

Mills are unable to make headway against sheet backlogs and supplies of some grades, including galvanized and stainless hot-rolled, are falling far short of demand. Automotive curtailment this summer would not affect some of these grades but some relief would be obtained through increase in raw steel supply and rolling capacity for other products.

Considerable interest attaches to substituting other analyses for nickel-bearing sheets, particularly straight chromes. Mills are being called on for data, which are being furnished, but specific recommendations are not being made. No important instances of such substitution on a production basis have occurred but investigation is proceeding. In deep-drawing sheets it is admitted substitution will be difficult. Meanwhile no difficulty appears in supplying nickel-bearing steel for defense work. Some trade interests expect the nickel situation to ease during the next few months, with supplies available in fair amounts for commercial use. Others believe enlarged defense requirements are about to be formulated.

Some producers have not yet accepted business for 1942 delivery and a few will book nothing beyond third quarter. Some galvanized producers are sold only four to five months on account of shortage of zinc. If zinc becomes available they probably will open books for further delivery.

Plates—(Prices Page 108)—Steel plate deliveries now run close to 20 or 25 weeks, subject to schedule interruptions by defense orders during the intervening period. With government work representing a growing proportion of total shipments a pinch in supplies available for non-defense purposes appears likely to become more pronounced soon.

Shipyards are the largest consumers of plates with shipbuilding facilities being expanded. Four major shipyards in the East are increasing their capacity. New York Shipbuilding Corp., Camden, N. J., will have practically tripled its capacity by the end of the year. Sun Ship Building & Dry Dock Co., Chester, Pa., which is adding 12 shipways, is rushing construction of 72 tankers, which will soon be coming off the ways at the rate of three per month. This has necessitated relinquishing contracts for three destroyers and three aircraft tenders, which have been reallocated to two other yards.

Plate mills await a definite government ruling on some phases of the recent price fixing order. These include the question whether producers will be allowed to quote f.o.b. their own base for middle western delivery rather than to name the base closest to delivery point. Central Iron & Steel Co., Harrisburg, Pa., is petitioning for relief from the fixed price edict.

Demand for floor plates is heavy and deliveries are better than for ship plates, some mills offering about six weeks. Fabricating shops are getting better deliveries than warehouses, some of which are hard pressed to maintain replacements. Some mills can deliver flanged and dished heads in 8 to 10 weeks and plate specifications with such orders are better than the average.

Tank builders are taking all the tonnage they can get, underground air field fueling systems accounting for considerable tonnage. These tanks are usually of 25,000 gallons capacity, about 40 feet long, 11 feet in diameter.

A steelmaker has booked 120,000 tons of plates for the Maritime Commission, following placement of 50,000 tons for the same buyer the week bef[illegible].

PLATE CONTRACTS PLACED

160 tons, 130-foot standpipe, state hospital, Willowbrook, Staten Island, N. Y., to Graver Tank & Mfg. Co., East Chicago, Ind.; Consolidated Contracting Co., New York, contractor.

100 tons, 350,000-gallon elevated steel water tank, Fort Benning, Georgia, to R. D. Cole Mfg. Co., Newnan, Ga., $22,445.

PLATE CONTRACTS PENDING

Unstated, ninety-six 10,000-ton freighters for joint account Canadian and British Governments, placed as follows: 38 to Burrard Drydock Co. Ltd.; 28 to North Vancouver Shipyards, Vancouver, B. C.; 10 to Victoria Machinery Depot Ltd., Victoria, B. C.; 10 to Yarrows, Ltd., Esquimalt, and 10 to Prince Rupert Drydock Co., Prince Rupert, B. C.

Bars—(Prices Page 108)—Merchant bar buying continues heavy, close to volume of shipments in some cases, as buyers seek forward positions on books. Delivery promises are lengthening and there is little probability of the situation being better for a long time. Capacity for the remainder of the year is being filled rapidly and on some sizes nothing is available this year. Armament needs, particularly in shell steel, are increasing, crowding nondefense tonnage further back. Some sellers believe that by the end of the year buyers of bar products for other than defense use, including small shapes and reinforcing bars, will be allocated only a portion of their normal supply.

No important bar mill expansion is now planned as present capacity has proven able to finish all semi-finished material available. Merchant mills could handle larger billet supply if it could be obtained.

Warehouse bar stocks are in fair condition, ample in some sizes but deficient in others, particularly in larger sizes and in alloy steels. Sizes over two inches are relatively scarce.

Curtailment in alloy analyses is seen as a benefit to production without hardship on consumers in most cases.

Alloy bar consumption is mounting, notably for defense contracts, small arms accounting for a substantial tonnage. Deliveries on current orders extend into fourth quarter and beyond. Most of this is covered by priorities, deliveries being sufficient to maintain production, though inventory stocks are called on to bridge delivery gaps. Forge shops are working off alloy billets faster than deliveries are made, but reserves have been sufficient to this time. Some forge shops normally consuming 4000 tons annually now are operating at the rate of 10,000 tons. Some instances are met of small subcontractors on defense work finding it difficult to obtain alloys in even limited monthly shipments from nearby suppliers.

One of the largest inquiries now current is for 187,000 tons of alloy bars for production of airplane-gun bullets for piercing light armor plate. It is a question where there is sufficient automatic screw machine capacity to handle so large a tonnage.

Pipe — (Prices Page 109) — Merchant pipe sales were about 8 per cent lower in April than in March in the experience of a leading maker, demand being considerably heavier in the last two weeks and continuing brisk into May, promising a better total this month. Three weeks' delivery is now being made in most instances.

Merchant pipe mills generally are accepting business only from regular customers, who have been placed on quotas, based on normal purchases. Most mills can make warehouse replacements in three to four weeks and in some instances can supply galvanized as well as black within such limits. Resale prices are stronger than for several months, although not entirely firm. Greater strength is expected as steel demand in general increases.

Line pipe and casing pipe are in good demand and conduit pipe is fairly brisk, delivery in three weeks being possible. Cast iron pipe buying is mainly in small diameters. Cast pipe shops are operating at a good rate, usually five days a week.

Westinghouse Electric Supply Co., San Francisco, has been awarded by lot more than 1,500,000 feet of thin-wall steel tubing by the Department of the Interior, identical bids being received. It will be delivered in 210 days and used for cooling concrete in Shasta dam. Contract includes 910,000 feet of half-inch, 270,000 feet of one-inch and 370,000 feet of 1½-inch.

CAST PIPE PLACED

350 tons, various sizes, Panama, schedule 4981, to United States Pipe & Foundry Co., Burlington, N. J.

CAST PIPE PENDING

140 tons, various sizes, Panama, schedule 5025; United States Pipe & Foundry Co., Burlington, N. J., low; bids April 22, Washington.

STEEL PIPE PENDING

Unstated tonnage, 10,200 boiler tubes, navy yard, Norfolk, Va.; Pittsburgh Steel Co., Pittsburgh, $88,324.02, low; 5100 for Mare Island, Calif., $45,836.84; Western yard, same number, $46,120.60, schedule 6169; bids April 22.

Wire—(Prices Page 109)—Wire products offer prompter deliveries than the average in steel. Wire rope can be obtained in three weeks, nails in four to six weeks and some grades of manufacturers' wire in six to eight weeks. Demand is holding up well. Consumption of wire rope for merchant and naval ships is expected to reach record proportions as shipbuilding progresses. The buying season for farm wire products, fencing and nails, is considered over and was in normal volume.

Rails, Cars—(Prices Page 109)—Already under heavy pressure from railroad equipment makers, steel sellers look for still much heavier demand soon. Washington reports indicate a lively interest on the part of OPM officials in the railroad equipment situation and problems of equipment makers in steel and other raw materials.

These reports point to need of 50,000 new cars by October, to meet the peak traffic demands which usually develop around that time and which this year will be particularly emphasized by conversion of coastwise marine shipping to other than its normal needs. Car builders believe it will be impossible for them to deliver 50,000 cars by early fall, although taking into account cars now on order it may be possible to supply as many as 35,000.

CAR ORDERS PLACED

American Locomotive Co., two 100-ton steam boiler transfer flat cars, to American Car & Foundry Co., New York.

American Refrigerator Transit Co., 150 refrigerator cars, to own shops.

Ann Arbor, 25 hoppers; to own shops.

Atlantic Coast Line, 1500 fifty-ton box cars, equally between Pullman-Standard Car Mfg. Co., Bessemer, Ala., and American Car & Foundry Co., New York; 700 fifty-ton box, to American Car & Foundry Co., New York; 300 fifty ton furniture to Mt. Vernon Car Co., Mt. Vernon, Ill.; 200 high-side gondolas and 100 covered hoppers, to Bethlehem Steel Co., Bethlehem, Pa.

Canadian Pacific, 250 hoppers, to Magor Car Corp., Passaic, N. J.

Erie, 70 cabooses; to own shops.

Illinois Central, two streamlined diners, to Pullman-Standard Car Mfg. Co., Chicago.

New York, Chicago & St. Louis, 18 seventy-ton covered hopper cars to American Car & Foundry Co. New York.

Norfolk & Western, 1000 forty-foot box cars, to Ralston Steel Car Co., Columbus, O., 200 fifty-foot cars to Greenville Steel Car Co., Greenville, Pa.

Pere Marquette, 25 seventy-ton hopper cars, to American Car & Foundry Co., New York.

Portugese Government Railways, 19 coaches for Mocambique, Portugese East Africa, to Pullman-Standard Car Export Corp., New York.

CAR ORDERS PENDING

Delaware & Hudson, 300 fifty-ton hopper cars, 200 fifty-ton gondola cars, and 50 seventy-ton hopper cars, bids asked; an indefinite number was previously noted as contemplated.

Philadelphia Transportation Co., 90 trolley cars; bids May 9.

Southern Railway, 3100 cars, bids asked; include 2340 fifty-ton box cars, 50 fifty-ton automobile, 500 seventy-ton flat cars, 100 seventy-ton mill-type gondolas, 100 seventy-ton covered hoppers.

United Electric Co., Providence, R. I., five trolley coaches to Pullman-Standard Car Mfg. Co., Chicago.

Western Pacific, 350 fifty-ton box and 300 fifty-ton flat cars; bids asked.

LOCOMOTIVES PLACED

Chicago, Milwaukee, St. Paul & Pacific, six 380-horsepower switchers to Whitcomb Locomotive Co., Rochelle, Ill.; two 360-horsepower to General Electric Co., Schenectady, N. Y.

Chicago, South Shore & South Bend railroad, Michigan City, Ind., three 100-ton electric locomotives, to Iron & Steel Products Inc., Chicago.

Houston Shipbuilding Corp., three 30-ton diesel-electric locomotives, to Whitcomb Locomotive Co., Rochelle, Ill.

Navy, one 50-ton diesel-electric locomotive, to General Electric Co., Schenectady, N. Y.

Walsh Construction Co., one 300-horsepower diesel-electric locomotive, to Whitcomb Locomotive Co., Chicago.

LOCOMOTIVES PENDING

Alaska Railroad, one 4-8-2 type locomotive, bids to be opened May 10 by United States Interior department, Seattle.

Navy, bureau of supplies and accounts, four diesel-electric locomotives and spares, delivery Sewall's Point, Va., schedule 6477; bids May 6.

New York, New Haven & Hartford, three to five diesel-electric locomotives; contemplated.

RAIL ORDERS PLACED

Wabash, 5000 tons, 112-pound rails, divided among Carnegie-Illinois Steel Corp., Pittsburgh, Inland Steel Co., Chicago, and Bethlehem Steel Co., Bethlehem, Pa.

Cold-Finished Steel—(Prices Page 109)—Allocation of 197,000 tons of X-1335 cold-drawn steel bars for shells is expected to be made soon by the War Department, in conjunction with the Office of Production Management. This is expected to be followed by additional tonnages, to at least 600,000 tons.

Cold-finished bar capacity might be increased, except that alloy steel for drawing is less than capacity of present draw benches.

The government is distributing 187,000 tons of tungsten steel bars to be used in production of small arms bullets. Some difficulty may be met in obtaining coverage on a tonnage of this size.

Tin Plate—(Prices Page 108)—Tin plate mills may be forced to

increase hot mill output later this year and substitute hot-rolled plate for cold-reduced in some instances. Immediate cause of this action, if it comes, will be a cut in supplies of black plate from continuous strip mills. Official sources have indicated there will be increasing demand for mill time for production of light plates as defense program builds up. This necessarily will be taken from sheet output.

The steel problem is not critical, in that additional facilities are available should necessity force their use. Many tin mills are idle or only partially active which could be used in the production of hot-rolled plate.

Operations are maintained at 85 per cent, virtual peak output with many mills running over 100 per cent of rated capacity.

Structural Shapes—(Prices Page 108)—Defense work is still 80 per cent or more of current inquiry and sales and the end is by no means in sight. With arrival of spring some states are putting out inquiries for groups of county bridge work. Deliveries still average five months and fabricators are gaining speed with greater experience on rush jobs. The second largest award of the year was 26,000 tons for an aircraft assembly plant at Fort Worth, Tex., awarded to Bethlehem Steel Co., with a twin project at Tulsa, Okla., said to have been awarded to another large fabricator.

Pittsburgh reports more of a tendency to sell plain material on f.o.b. mill basis and less under a basing point system. In some cases even established customers have been forced to pay mill price, particularly on jobs close to the producer's home basing point, resulting in higher costs to the fabricator in some cases.

Fabricators in eastern Pennsylvania report a breathing spell in inquiries though a fairly large volume is still pending. There shape deliveries hold at an average of 12 weeks or more, but continuation of reduced orders should result in freer supplies of plain material.

Unexpected demand comes through enlarging ordnance plants. The TNT plant near Sandusky, O., is to be doubled, it was announced last week, and $4,000,000 worth of additional construction is to be carried on at the shell-loading plant at Ravenna, O.

Bookings of fabricated structural steel in March were 187,143 net tons, against 165,371 tons in February and 128,321 tons in March of last year, states the American Institute of Steel Construction, New York. For first quarter bookings were 619,108 tons, against 308,892 tons in the same period, 1940. Shipments in March were 163,053 tons, compared with 158,745 tons in February and 95,915 tons in March of last year. For first quarter shipments were 476,053 tons, against 303,991 tons in 1940. March shipments were highest since September, 1937, but 93,700 tons less than in March, 1929.

SHAPE CONTRACTS PLACED

26,000 tons, aircraft assembly plant, Consolidated Aircraft Corp., Fort Worth, Texas, to Bethlehem Steel Co., Bethlehem, Pa.

6127 tons, 30-caliber ammunition factory, St. Louis ordnance plant, Western Cartridge Co., St. Louis, to Mississippi Valley Structural Steel Co., Decatur, Ill.; Fruin-Conlon Contracting Co., St. Louis, contractor.

5500 tons, 50-caliber ammunition factory, St. Louis ordnance plant, Western Cartridge Co., St. Louis, to American Bridge Co., Pittsburgh; Fruin-Conlon Contracting Co., St. Louis, contractor.

1300 tons, engineering and service building annex, Cincinnati Milling Machine Co., Cincinnati, to American Bridge Co., Pittsburgh.

1000 tons, reserve basin storehouse, Philadelphia navy yard, to Bethlehem Steel Co., Bethlehem, Pa.

1000 tons, two state bridges, Hartford-Wethersfield, Conn., to American Bridge Co., Pittsburgh; direct bids.

SHAPE AWARDS COMPARED

	Tons
Week ended May 3	49,393
Week ended April 26	15,490
Week ended April 19	30,911
This week, 1940	13,409
Weekly average, 1941	33,935
Weekly average, 1940	28,414
Weekly average, April, 1941	28,441
Total to date, 1940	299,715
Total to date, 1941	610,826

Includes awards of 100 tons or more.

850 tons, by-pass bridge, Hartford, Conn., for state, to American Bridge Co., Pittsburgh.

700 tons, addition, bottling house, Pabst Brewing Co., Peoria, Ill., to Mississippi Valley Structural Steel Co., Decatur, Ill.

650 tons, addition, public school No. 21, Bronx, New York, to Harris Structural Steel Co., New York, through John T. Brady Co., New York, contractor.

600 tons, addition, Millard Fillmore hospital, Buffalo, to Bethlehem Steel Co., Buffalo, through C. H. Everitt, same city.

550 tons, reconstruction bridge A-140, Los Angeles division, Atchison, Topeka & Santa Fe railway, to American Bridge Co., Pittsburgh.

454 tons, state bridge, contract 2141, Columbus, Ind., to Bethlehem Steel Co., Bethlehem, Pa.

415 tons, sheet piling, Fisk street station, Commonwealth Edison Co., Chicago, inquiry ED-1133, to Bethlehem Steel Co., Bethlehem, Pa.

350 tons, grade crossing elimination, New York Central railroad, Miller Ave., Buffalo, to Bethlehem Steel Co., Buffalo.

300 tons, girder spans, various locations, Union Pacific railroad, to American Bridge Co., Pittsburgh.

275 tons, state bridge, Looney Creek, Harlan county, Kentucky, to Vincennes Steel Corp., Vincennes, Ind.

260 tons, bridge, Bronx river parkway, Fleetwood, N. Y., to Jones & Laughlin Steel Corp., Pittsburgh.

250 tons, state highway bridge, Vassar, Mich., to Wisconsin Bridge & Iron Co., Milwaukee.

250 tons, hangar and shop, Wold Chamberlain field, Minneapolis, to Minneapolis-Moline Power Implement Co., Minneapolis.

244 tons, state bridge, contract 2140, Columbus, Ind., to Bethlehem Steel Co., Bethlehem, Pa.

215 tons, state highway bridge, Hagerstown, Md., to American Bridge Co., Pittsburgh.

212 tons, grade crossing elimination, Chicago & Eastern Illinois railroad, Ellis, Ill., for state of Illinois, to Hansell-Elcock Co., Chicago; bids April 11.

202 tons, state bridge, contract 2143, Lafayette, Ind., to Central States Bridge & Strucural Co., Indianapolis.

200 tons, bridge for Omaha bomb assembly plant, Ft. Crook, Neb., for government to Omaha Steel Works, Omaha, Neb.

185 tons, state bridge, contract 2146, Lawrenceburg Junction, Ind., to American Bridge Co., Pittsburgh.

170 tons, five state stringer bridges, Yakima county, Washington, to Isaacson Iron Works, Seattle; Hawkins & Armstrong, Seattle, contractor.

165 tons, three bridges, Jordan and Helena, Minn., for Minneapolis & St. Louis railroad, divided between American Bridge Co., Pittsburgh; Minneapolis-Moline Power Implement Co., Minneapolis; and Pittsburgh-Des Moines Steel Co., Pittsburgh.

161 tons, state bridge, contract 2146, Dearborn county, Indiana, to Pan-American Bridge Co., Newcastle, Ind.

151 tons, state highway overpass, Chicago Eastern Illinois railroad, South Holland, Ill., to American Bridge Co., Pittsburgh; bids March 14.

136 tons, state bridge, contract 2144, Portland, Ind., to Pan-American Bridge Co., Newcastle, Ind.

111 tons, state bridge, route FA-12, section Q-1-VF, Bond county, Illinois, to Missouri Bridge & Iron Co., St. Louis; bids March 14.

110 tons, R.O.T.C. drill hall, City College, New York, to American Bridge

Co., Pittsburgh, through state procurement division, treasury department New York.

100 tons, floor support, Frankford arsenal, Philadelphia, to Belmont Iron Works, Philadelphia.

100 tons, extension open-hearth department, Republic Steel Corp., Canton, O., to Fort Pitt Bridge Works, Pittsburgh.

100 tons, 40 trestles, pontoon bridge, 25-ton, model 1940 with chests, Chief of Engineers, Washington, to Flour City Ornamental Iron Co., Minneapolis, $32,680; Commercial Shearing & Stamping Co., Youngstown, O., awarded 200 outboard motor brackets for pontoon bridge equipment.

SHAPE CONTRACTS PENDING

26,000 tons, aircraft assembly plant, Consolidated Aircraft Corp., Tulsa, Okla.; tentatively, Virginia Bridge Co., Roanoke, Va. low on 12,000 tons and American Bridge, Gary, Ind. low on 14,000 tons, final allocations depending on freight rate.

1600 tons, additional facilities, Memorial hospital, Hines, Ill., U. S. Veterans administration.

1200 tons, core plant building, Western Cartridge Co., St. Louis, Mo.

1000 tons, courthouse, Dauphin county, Pennsylvania; bids May 27.

950 tons, service building, Philadelphia navy yard.

866 tons, Richmond county, Mansfield, O.; bids May 16.

775 tons, reserve basin storehouse 2, Philadelphia, for navy.

700 tons, machine shop extension to service building, Chrysler Corp., Detroit.

550 tons, warehouse, Pennsylvania Salt Co., Wyandotte, Mich.

525 tons, grade elimination, Chesapeake & Ohio railway, Wood county, Ohio, for state.

500 tons, alterations and additions to building 10, Armstrong Cork Co., Millville, N. J.

497 tons, bridge, Le Moine, O., Wood County, Ohio; bids May 16.

466 tons, state highway bridge 5907, Little Falls, Minn.; Minneapolis-Moline Power Implement Co., Minneapolis, low.

450 tons, press shop addition, Chrysler Corp., Detroit.

430 tons, highway bridge, Highland Park, Detroit, for Wayne county, Michigan.

400 tons, bridge 979.58, Weber river, Wyoming division, Union Pacific railroad.

400 tons, grade crossing elimination, Erie railroad, state project, Jamestown-Ashville, N. Y.; Boyer Construction Co., New York, low, $161,556.65, bids April 23, Albany; contract held in abeyance.

365 tons, bridge, Lake county, Painesville, O.; bids May 16.

350 tons, building, Old Virginia Packing Co., Front Royal, Va.

350 tons, building, Massachusetts Mutual Insurance Co., Cleveland, bids May 2.

350 tons, bridges, 30.27, 32.31 and 28.11, Folger and Opal, Idaho, Union Pacific railroad.

330 tons, bridge, Fall creek, Ithaca, N. Y.

325 tons, defense plant, airplane engine parts, Jack & Hinz, Bedford, O.

320 tons, grade elimination, Norfolk & Western railway, Scioto county, Ohio, for state.

318 tons, bridge, Franklin Furnace, O., Scioto county, Ohio.

300 tons, building, Park Drop Forge Co., Cleveland.

300 tons, hangar and boiler house, Ft. Louis, Wash., war department.

295 tons, state highway bridge, Riffinburg, Pa.

280 tons, (also 25 tons concrete bars) aircorps army hangar, Fort Lewis, Wash.; Sound Construction & Engineering Co., Seattle, low.

260 tons, bridges, 1.61 and 5.33, Donovan and Moxa, Idaho, Union Pacific railroad.

250 tons, addition, Cleveland clinic, Cleveland.

250 tons, U. S. Armory, Syracuse, N. Y.; bids May 8.

230 tons, boiler house, Timken Roller Bearing Co., Canton, O.

220 tons, landward lock, lock and dam 2, Hastings, Minn., for government.

210 tons, manufacturing building, Sweets Co. of America, Hoboken, N. J.

200 tons, bridge, Pennsylvania railroad, Mercer county, Pennsylvania.

200 tons, radio shop, Puget Sound navy yard, Wash.; Henrik Valle Co., Seattle, contractor, low at $163,000.

190 tons, building, Oneida Ltd., Oneida Castle, N. Y.

185 tons, beam spans, Toppenish, Wash., for state.

175 tons, trusses for machine shop, Chesapeake & Ohio railway, Clifton Forge, Va.

150 tons, plate girder bridge, R-19067, Columbia county, Pennsylvania; bids to state highway department, Harrisburg, Pa., May 9.

133 tons, bridge, route 6, section 21A, Denville relocation, Morris county, New Jersey; bids May 16, E. Donald Sterner, state highway commissioner, Trenton.

120 tons, warehouse, building 38-A, Pennsylvania Salt Co., Wyandotte, Mich.

110 tons, bridge, East Clinton street Ithaca, N. Y., for city.

100 tons, building, W. T. Grant Co., Youngstown, O.

100 tons, bridge, route 1, Fairview, N. J.; bids May 16, E. Donald Sterner, state highway commissioner, Trenton; also 40 tons reinforcing steel.

Unstated, roundhouse, Northern Pacific railway, Easton, Wash.; bids at Seattle April 29.

Reinforcing Bars—(Prices Page 109)—Inquiries and sales continue in large volume and deliveries are far extended so that there is little purpose in substituting bars for fabricated shapes. Members of a large church at Cleveland, for instance, who had planned a building involving much concrete, revised plans in favor of wood when prompt deliveries were found impossible.

Defense work still is the major outlet for reinforcing bars but the usual amount of highway improvement is being superimposed on defense work, but there is increasing uncertainty as to how long strictly civilian needs can be filled.

REINFORCING STEEL AWARDS

1368 tons, superstructure, airplane engine parts plant, Studebaker Corp., Chicago, to Bethlehem Steel Co., Bethlehem, Pa.; S. N. Neilsen Co., Chicago, contractor, bids April 9.

1100 tons, TNT and DNT plant, Weldon Springs, Mo., for Atlas Powder Co., 550 tons to Joseph T. Ryerson & Son Inc., Chicago, and 550 tons to Laclede Steel Co., St. Louis.

500 tons, building, Curtiss Wright Aeronautical Corp., Beaver, Pa., to Bethlehem Steel Co., Bethlehem, Pa.; Hughes-Foulkrod Co., Philadelphia, contractor.

400 tons, Fisk street station, Commonwealth Edison Co., Chicago, inquiry ED-1133, to Bethlehem Steel Co., Bethlehem, Pa.

350 tons, plant, Hartford Electric Light Co., Hartford, to Joseph T. Ryerson & Son Inc., Chicago, through Stone & Webster Corp., Boston.

300 tons, building, Connecticut Light & Power Co., Devon, Conn. to Bethlehem Steel Co. Bethlehem, Pa.

266 tons, superstructure, airplane engine parts plant, Studebaker Corp., South Bend, Ind., to Ceco Steel Products Corp., Chicago; 1666 tons still to be placed; Consolidated Construction Co., Chicago, contractor; bids April 2.

220 tons, bridge, Wethersfield, Conn., to Truscon Steel Co., Youngstown, O., through Mariani Construction Co., New Haven, Conn.

175 tons, highway construction, Westfield-Chicopee, Mass., to Bethlehem

CONCRETE BARS COMPARED

	Tons
Week ended May 3	5,534
Week ended April 26	20.775
Week ended April 19	14,596
This week, 1940	7,859
Weekly average, 1941	12,033
Weekly average, 1940	9,661
Weekly average, April, 1941	18,035
Total to date, 1940	145,262
Total to date, 1941	216,590

Includes awards of 100 tons or more.

Steel Co., Bethlehem, Pa.

170 tons, nurses home, LaCrosse, Wis., to Bethlehem Steel Co., Bethlehem, Pa.; bids April 16.

143 tons, state highway construction, Bartholomew county, Indiana, to Bethlehem Steel Co., Bethlehem, Pa., St. Clair Construction Co., Wheaton, Ill., contractor; bids April 15.

130 tons, U. S. engineer, Providence, R. I., to Bethlehem Steel Co., Bethlehem, Pa.

110 tons, housing project, Newport, R. I., to Morrison-Stevens Co., Boston.

100 tons, refinery, Socony-Vacuum Oil Co., East Chicago, Ind., to Joseph T. Ryerson & Son Inc., Chicago; Lummus Co., Chicago, contractor.

100 tons, road paving, Northumberland county, Pennsylvania, to Bethlehem Steel Co., Bethlehem, Pa.; Kessler Construction Co., Mt. Carmel, Pa., contractor.

100 tons, state highway construction, route 23, section 27A and 28A, Sycamore, Ill., to Laclede Steel Co., St. Louis; Milburn Bros. Inc., Mt. Prospect, Ill., contractor, bids April 15.

REINFORCING STEEL PENDING

2200 tons, housing projects, Boston; taking bids now.

800 tons, pier Puget Sound navy yard; bids April 30.

618 tons, substructure, bridge over Mississippi river, Dubuque, Iowa-East Dubuque, Ill., for Dubuque bridge commission; bids May 14.

466 tons, Ohio state highway projects; bids May 6 as follows; 106 tons, project 25, Athens county, W. P. McCarren, Walhonding, O., contractor; 160 tons, proj. 26, Delaware county, Christ Beatty, Hamilton, O., contractor; 200 tons, proj. 28, Portage county, Hollinger Davidson Co., Akron, O., contractor.

268 tons, bridge 5875, Minnesota State highway commission; Feller Bros., low; bids April 18.

265 tons, paving and bridge, route 4, section 1B, South Amboy-Cheesequake, N. J.; bids May 16, E. Donald Sterner, state highway commissioner, Trenton; also 85 tons, structural steel for bridge.

200 tons, addition, Swift & Co., St. Paul, Minn.; bids May 5.

185 tons, paving and bridge, route 6, section 21A, Denville relocation, Morris county, New Jersey; bids May 16, E. Donald Sterner, state highway commissioner, Trenton.

135 tons, control house, Covington, Wash., Bonneville project; C. F. Davidson, Tacoma, low, $137,112.

100 tons, highway project, route 25, section 7B, Woodbridge cloverleaf, New Jersey; bids May 16, E. Donald Sterner, state highway commissioner, Trenton.

Unstated, five silos, warehouse and distributing plant, Lehigh Portland Cement Co., Spokane, Wash.; bids in.

Unstated, 90-foot state viaduct, Washington county, Oregon; bids at Portland, May 9.

Pig Iron—(Prices Page 110)—The pinch in pig iron supply resulting from coke scarcity seems likely to be relieved in time to prevent reduction in foundry operation, although many melters have dipped dangerously low into stocks of pig iron and coke. However, effects of the coke shortage will be felt for months, as it caused inroads to be made into practically all raw material stocks, including scrap, which was used in larger measure, to conserve pig iron.

For most part merchant iron deliveries have been sufficient to keep foundries operating, although some which neglected months ago to obtain forward protection meet some difficulty in getting desired grades. With the coal strike now past the situation will ease somewhat, in any event.

Numerous steelworks blast furnaces which a week ago were scheduled for banking will be able to operate until new coke supply arrives. Several furnaces scheduled for relining later in the year have been blown out earlier because of the fuel situation and their product will be missed until after mid-year when they can be returned to service. Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., has placed its last furnace in blast after repairs, giving that district 100 per cent production.

While no change has been made in pig iron prices some producers have discontinued the former practice of absorbing freight charges on tonnage shipped out of the district, charging the full price at their basing point, plus carriage charges to destination. This compensates in some measure for increased costs resulting from higher fuel and labor costs.

Ferroalloys—(Prices Page 110)—The current reduction in steelmak-

ing operations, due to the recent coal strike, is resulting in a little less pressure on sellers of ferroalloys. This does not mean that consumers are not anxious to take in all the ferroalloys available but they are not in such pressing need.

As a matter of fact, the actual movement of ferroalloys in the month recently ended was possibly the heaviest this year, even though there was some slight decline in steelmaking during the last two weeks of that period. Increased production facilities had not been brought into play to any particular degree, but ferroalloy producers had been able to utilize existing facilities a little better.

This will probably be a factor again this month, but the expectation is that steelmaking production will not average quite as high as in April. Some producers, who had been adversely affected by the coal strike declare that it will take them two weeks and probably longer to get their production back to where it was around the third week in April.

Prices are unchanged, ferromanganese holding at $120, duty paid, Atlantic and Gulf ports, and spiegeleisen, 19 to 21 per cent, at $36, Palmerton, Pa.

Scrap—(Prices Page 112)—Principal interest in the steel and iron scrap market, aside from completion of shipments by May 10 on contracts entered into before April 3 at prices above the ceiling, is centered on possible adjustments to the government order. Various inequalities have developed that threaten normal supplies and efforts are being made to adjust these. Institute of Scrap Iron & Steel Inc. has been holding conferences with dealers and consumers in the effort to formulate recommendations for adjustments.

Pittsburgh consumers seek permission to pay above the maximum for shipments to plants outside the switching district, delivered price to be the Pittsburgh base plus freight charges. This is to put these melters on an equality with those whose shipments are subject only to a switching charge. Without this permission plants outside the district would be shut out almost completely.

Considerable difficulty is experienced in obtaining scrap and several mills are complaining of the small supply available. Shipments against old contracts are slow, indicating difficulty later in obtaining sufficient supply under the present price system. Cast grades are becoming progressively scarcer, particularly in better grades, price seemingly not being a factor, as the supply is not to be had. Some buying is being done at the new prices but shipments against these orders is limited.

Water shipments from the upper lakes may not be as heavy as anticipated as fixed prices have removed the speculative element usually present in consignments to lower lake ports, which can be held for opportune sales at a profit.

Railroad lists are moderate. The

Pennsylvania, opening May 7, includes 15,215 tons, 4000 tons being No. 1 heavy melting steel. Baltimore & Ohio will open bids May 5, on 2500 tons of melting steel, 190 tons of cast and 1000 tons of rerolling rails.

Open-hearth operators cannot expect to obtain old rails for their charges much longer. Whatever tonnages of rails that will be available for the market are, under government direction, to be apportioned to the various rerolling mills, thereby releasing more billet steel for national defense purposes.

Open-hearth shops also will be obliged to use more of the light and cheaper grades of scrap from now on, according to the opinion of many operators. Carefully prepared No. 2 bundles come under this category and melters feel that some more of this grade will be going through charging doors than ever before. At one plant where the scrap charge was composed of 1½ up to 27 per cent of No. 2 bundles there were no more defects, such as seams, scabs, etc., than when heavier grades were used. Some plants already are spending money in bundling light scrap in their finishing mills.

Coke Oven By-Products—(Prices Page 109)—Distributors of phenol and naphthalene are sold through the balance of the year as a rule, with spot supplies scarce. Demand and consumption of the former by the plastics and chemical industries is notably heavy. Other coke oven by-products are also active, including distillates. Shipments to the lacquer trade against contracts are heavy with little spot material available while toluol requirements for munitions are growing. Effects of the coal strike may be felt later, due to production lost, but supplies have been but slightly affected currently, producers dipping into crude inventories to maintain output. Prices are steady and unchanged.

Iron Ore—(Prices Page 111)—A record Lake iron ore shipment for the first month of the season is reported by the Lake Superior Iron Ore Association, Cleveland, 6,954,793 gross ton, railroad weights, for April, against 464,669 tons in the corresponding 1940 month. This is perhaps the sharpest change over a like month of a preceding year in history.

Shipments from upper lake ports, in detail, are as follows:

	Gross Tons	
	April 1941	April 1940
Escanaba	491,525	60,378
Marquette	768,448	100,710
Ashland	758,426	38,456
Superior	2,081,341	230,584
Duluth	1,675,322	.....
Two Harbors	1,143,852	34,541
U. S. Ports, total	6,918,914	464,669
Michipicoten Algoma Central	35,879	.....
Grand Total	6,954,793	464,669

Metallurgical Coke—(Price Page 109)—Resumption of coal mining promises renewed coke supply, which will avoid further shortening of pig iron production, though several days will be required to bring appreciable tonnages from coke ovens. A number of blast furnace stacks scheduled for banking early last week will be able to continue production, though in some cases at less than capacity until heavy coke shipments have been received.

Numerous trade deals had been arranged among blast furnace operators, to spread coke supply equitably and utilize tonnage to best advantage. These arrangements will aid in bridging the gap before new coke shipments arrive. Some by-product ovens had reached close to the end of their coal supplies and have been operating at low capacity. Resumption of full production will await coal shipments.

Reflecting advanced costs, particularly on coal, by-product coke producers are advancing prices 50 to 75 cents per ton. The increase is expected to be general by the end of this week.

Pacific Coast

Seattle—Award for building ninety-six 10,000 ton steel freighters to British Columbia yards, for joint account of Canadian and British governments, featured the market last week. Of the total, 66 went to two Vancouver yards, the others to

plants at Victoria, Esquimalt and Prince Rupert. Quantities and subcontracts were not announced.

Expansion of plant facilities by industrial firms is pronounced as increased production is essential to the defense program. Northern Pacific has opened bids for a large roundhouse at Easton, Wash., and Lehigh Portland Cement Co. is building five concrete silos, warehouse and distributing plant at Spokane, Wash.

Increasing inquiry for small tonnages features the concrete bar market. Contractors offering small lots find difficulty in placing business as rolling mills have impressive backlogs.

Aside from shipyard construction, no large tonnages of plates are moving but shops report a good volume of small jobs.

Prospects for cast iron pipe are improved as several important projects are scheduled for award soon. Business pending is in excess of 1500 tons. Cantonment and housing awards are in the market. Pendleton, Oreg., has a $28,670 WPA allotment and West Linn and Empire, Oreg., also have funds available for improvements. King County water district 36, Seattle, has a $52,285 grant. Seattle plans a $34,000 expansion job on Oberlin avenue and Forty-fourth avenue N. E. Puyallup, Wash., plans a $29,698 project.

Alaska Railroad will require 1500 tons or more of 70-pound rail for the cutoff to Passage Bay, bids to United States engineer, Seattle, after May 12 but whether new or relay will be used has not been announced.

The scrap market is adjusted to the new price ceiling of $13.50 and $14.50 for No. 2 and No. 1 steel, top prices being paid by mills. Supplies are ample for increased consumption. Cast scrap continues scarce and in strong demand. Dealers recently raised price of this material to $20 and foundry buyers countered by buying direct from collectors, at a much lower level. Foundries consider $16 about a fair price under existing conditions, the maximum being fixed at $2 under No. 2 pig iron, quoted here at $26.95. Dealers are rapidly clearing contracts signed before the new list became effective.

Canada

Toronto, Ont.—Further increase in steel demand is indicated by the new shipbuilding program announced by the government, involving construction of 96 cargo ships, work to be started immediately. Arrangements also are under way directed toward speeding up various other war materials production, which will involve steel consumption at a rate well in excess of previous records. This increased activity, it is stated, will result in substantial gain in imports of steel from the United States to provide necessary raw materials. Officials of Canadian steel mills report production and operations at capacity, with orders pouring in rapidly and backlogs sufficient to maintain cur-

Behind the Scenes with STEEL

Yeh, Probably

■ We notice in one of our contemporaries (which is always the polite way to say it) where a Detroit consumer of cold-drawn steel, with $300,000 worth of material now on order, has been offered "a new hat" by one steel sales representative if he would *cancel* his order for steel. Then, as the height of understatement, the paper cautiously continues: "Offer of a premium to cancel an order probably is indicative of current problems of supply and demand in steel." Confidentially, we hear it rumored also that business is really quite active, especially in several branches of the steel and metalworking industries.

Defense Passes

■ And with all this rumored increase in activity, Graflex identification units are clicking out hundreds of pictures, and newly-appointed fingerprint "experts" are smearing up thousands of already dirty hands. All of which heaps more worries on the typical "Wild Bill's" department in charge of plant entrances throughout the country. Wild Bill's office is usually a small shack, but he runs it officiously (and efficiently, too), all dolled up with a big badge and a bright new chauffeur's cap. And believe you us, your picture had better look like you, even if you have to go home and shave, before he'll let you in. Poor Bill says when he finally hits the hay after a hard trick, he just lies there and counts pictures, pictures, pictures—instead of sheep.

Tops

■ Scan through that whole stack of magazines you have there, and we make the advance claim that in not one will you find a job that approaches the coverage STEEL's engineering pages are giving on the manufacture of armament and munitions. This week it's tanks (and we refuse to sneak in a pun). In coming issues you'll learn the details on aerial bombs, automatic rifles and machine guns, small arms and small arms ammunition, torpedo propulsion mechanisms and many other pieces of equipment that fit into modern war. If you haven't done so already, tear out that coupon on page 87 and get your copy of Modern Shell Production while they last.

Pittsburgh's Best?

■ It takes a lot of nerve to repeat editor Hartford's quip but he reports the termite said to the bartender, "Beat me, Daddy, I ate through the bar."

Lost, Strayed or Stolen

■ STEEL, you know, goes to press with its late forms on Friday night, is in the mail by Saturday noon and comfortably reaches subscribers' desks in the Monday morning mail. Once in a while of course it may get tangled up with a few homeward bound draftee's letters and show up late and even once in a great while go the way of all flesh and not show up at all. And thus writes reader Earle W. Magness from St. Louis: "This week was the first time in my three years as a subscriber that STEEL failed to appear. It is rather as though a faithful friend had severed fraternal relations." The Readers Service Dept. moved in like a flash, new copy, fraternity grip and all.

Reader Comments

■ Another reader heard from this A. M. sounds suspiciously like our own promotion man, but W. H. Morris is, instead, general storekeeper of the Reading Co. He writes: STEEL *is very well written and contains a lot of interesting and useful information, and in addition, it is easy to read.* Beyond that it is hard to go.

Scanning the Ads

■ Best headline of the week: *Teaching Hungry Acid Table-Manners.* By National Lead Co. on page 78. Most fraught with possibilities for discussion: Page 90 by Dings Magnetic Separator. To stand a girl on her head and get her hair all mussed up seems downright mean.

SHRDLU.

rent rates well into 1942. Some labor troubles developed in this country during the past week, involving the Dominion Steel & Coal Corp., Algoma Steel Corp., Dominion Steel & Foundries and several other companies associated with the steel industry, but so far those troubles have had no drastic effect on steel production, and it is expected the situation soon will be righted.

There is no abatement in new orders for sheets and plate, the two materials being somewhat allied in Canada's war production program. Heavy demand is reported from shipbuilding companies, and backlogs carry well into the coming year. The automotive industry also has been a heavy buyer in recent weeks and it is stated that additional large tonnage contracts are pending.

Merchant bar sales continue to expand. Local steel interests state that specially heavy call is being received for reinforcing bars in connection with war projects, and also for private construction.

Structural steel awards show improvement, after a minor lull. While most awards are connected with war activities, some good booking has been done in the past week or ten days on other construction work.

Little change is reported in merchant pig iron, sales gradually running to higher tonnages. Melters are continually in the market for spot needs, with current orders 100 to 200 tons. Some melters still are trying to obtain foundry pig iron to offset shortage of cast scrap.

Activity on a broader scale has developed in the iron and steel scrap market. Despite increased supply to dealers there are no surplus stocks in local yards and demand exceeds supply.

Nonferrous Metals

New York — Inventory controls which placed producers, dealers and consumers of 16 metals and metal classes under constant supervision of the OPM's priority division were ordered last week. This order is intended to prevent acmumulation of artificially large inventories. Defense work is increasing and until metal production is increased more metal will have to be diverted from consumer goods to armaments. Maximum prices are expected to be established in additional metal markets.

Copper — Metals Reserve Co., RFC subsidiary, will buy all Latin American copper output during the next year or so and orders already placed aggregate 300,000 tons. At present the United States consumes 137,000 tons of copper per month but our crude copper output is only 85,000 tons per month. OPACS still seeks a 12-cent maximum price for all new and secondary copper and proportionately lower prices for brass ingot and red metal scrap.

Lead—There has been some inventory lead buying, based on fear of rising prices, labor tieup in smelters, lack of freight cars, and

Nonferrous Metal Prices

Apr.	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
26	12.00	12.00	12.25	52.00	51.37½	5.85	5.70	7.25	17.00	14.00	35.00
28	12.00	12.00	12.25	51.75	51.12½	5.85	5.70	7.25	17.00	14.00	35.00
29	12.00	12.00	12.25	51.75	51.12½	5.85	5.70	7.25	17.00	14.00	35.00
30	12.00	12.00	12.25	52.00	51.37½	5.85	5.70	7.25	17.00	14.00	35.00
May											
1	12.00	12.00	12.25	52.25	51.50	5.85	5.70	7.25	17.00	14.00	35.00
2	12.00	12.00	12.25	52.25	51.62½	5.85	5 70	7.25	17.00	14.00	35.00

F.o.b. mill base, cents per lb. except as specified. Copper brass products based on 12.00c Conn. copper

Sheets

Yellow brass (high)	19.48
Copper, hot rolled	20.87
Lead, cut to jobbers	9.10
Zinc, 100 lb. base	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	9.00-9.25
Cleveland	9.00-9.50
Chicago	8.75-9.00
St. Louis	9.00

Heavy Copper and Wire

New York, No. 1	10.00-10.25
Cleveland, No. 1	10.00-10.50
Chicago, No. 1	9.75-10.00
St. Louis	10.00

Composition Brass Turnings

New York	8.75-9.00

Light Copper

New York	8.00-8.25
Cleveland	8.00-8.50
Chicago	7.75-8.00
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	4.55-4.80
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

ships. Demand remained active last week at the 5.85-cent level which is favored at present by the government.

Zinc—Consumers' stocks at the end of March totaled 67,289 tons, a drop of four per cent during the month. This causes many interests in the trade to believe OPM will take over the entire domestic production soon for allocation. The 7.25-cent level is likely to continue for many months, however, since Metals Reserve Co. has contracted at that price for the entire output from American Smelting & Refining Co.'s projected plant at Corpus Christi, Tex., for delivery over about a two-year period, starting with initial production in mid-1942.

Tin—Exercise of inventory control is the first step in the government's plan to have full direction of the tin market in the event war disrupts the Singapore tin market. Prices advanced fractionally during the week, closing at 52.25c compared with sales at 52.50c early Friday.

Steel in Europe

London—*(By Cable)*—Iron and steel production in Great Britain is increasingly reserved for war materials. Deliveries are being accelerated, assisted by American arrivals of semifinished and finished products. Heavy structurals are now in stronger demand. Tin plate is active within a limited scope with South American demand good. The attempt is being made to divert some business to American mills.

■ Steel welding wire production in 1940 reached a new high at 238,795,000 pounds, according to the American Iron and Steel Institute. This represented a 30 per cent increase over the 183,436,000 pounds produced in 1939, the highest total previously recorded.

Tin Smelter Contract in Three to Four Weeks

■ Name of the Tin Processing Corp., New York, has been changed to the Mining Equipment Corp., with headquarters at 2300 RKO building, Rockefeller Center. The company is a subsidiary of N. V. Billiton Maatschappij, Dutch East Indies.

Last February the United States government entered into a contract with it to construct a tin smelting plant in Texas City, Tex. Preparations have been under way since then, and the general contract for the plant is expected to be awarded in three or four weeks.

Allegheny Ludlum Builds Los Angeles Warehouse

■ Allegheny Ludlum Steel Corp., Brackenridge, Pa., recently completed a combined office and warehouse building at 4915 Pacific boulevard, Los Angeles. Special storage facilities are provided for each of the company's products.

The company's best known products, Allegheny Stainless and Ludlite, keynote the building's decorative scheme. Main body of the building is reinforced concrete, remainder steelweld construction. Total floor area is 11,200 square feet. Office facilities comprise about 1600 square feet.

Defense Subcontracts Offered at Cleveland

Cleveland office of the Defense Contract Service has issued inquiries for subcontractors for production of army tank and aircraft parts and tank armor plate. Details follow:

Fifty-seven different parts for M-3 tanks, each requiring one or more operations on combinations of one to five of the following machine tools: No. 5 horizontal milling machine; No. 5 vertical milling machine; 2½-inch to 6-inch horizontal boring mills; 36-inch to 84-inch vertical boring mills; 3-foot to 6-foot radial drills; 16-inch to 20-inch engine lathes; 36-inch to 60-inch planers; turret lathes up to 6-inch bar capacity; multiple drills; profiling machines; duplicator machines; honing machines; 10-inch cylindrical grinders; No. 3 broaching machines.

Small screw machine capacity for production of a variety of small aircraft fittings, such as tapered pins, ferrules, nipples, plugs, coupling parts, unions, etc., from brass and steel bar stock, diameters from about ⅜-inch to 1¾ inches, tolerances about .003 to .010; long production runs.

Tank armor plate, 2-inch thickness, irregular shape, all edges to be beveled, large vertical milling machine and medium size planer required, piece about 41 inches wide,

weight 700 pounds, plate will be furnished to subcontractor, burned to rough contour with ⅝-inch allowed for machining, 18 to 20 finished plates per month required.

Herman H. Lind is Cleveland district manager of the Defense Contract Service with offices in the Federal Reserve Bank building, Cleveland. Mr. Lind or his assistant, Charles R. Terry, may be reached at Cherry 2800.

Equipment

New York—With new plant facilities, those first started under the defense program, now in full production, and others rapidly being completed and tooled, output by the machine tool industry has already attained records in a single year hitherto considered impossible. An outstanding factor is co-operation among machinery builders in equipping each other. Orders for equipment are unabated and contracts for machine tools to be installed on ships have been made for delivery into 1945. Sellers in practically all cases are quoting only on tools accompanied by priorities. Steady and ample flow of materials, including special steels, is accompanying mounting production. Although there have been a few delays in procurement of small tool accessories, in few instances have they been serious, the pressure for drills, cutters, chucks and to some extent motors giving most concern. Strong demand for gages is also evident, and, to meet this, three producers have substantial plant extensions under way, two in the east and one in Ohio.

Boston — Machinery and equipment for tooling of a gun carriage plant being constructed in the Cleveland district is being purchased through the Watertown, Mass., arsenal in heavy volume. Contracts are being widely distributed, with a substantial share going to New England shops. Numerous machine tool builders are also concentrating on machine tools for additional facilities at the Hartford, Conn., plant of the United Aircraft Corp. Manufacturers of gages in this area have the largest backlogs in the history of the industry and two are building additions for increase in production. Machine tool builders continued to operate three shifts in most instances, and, although deliveries are extended and backlogs heavy, shipments are generally better than expected on most lines considering the demand. Practically all volume is on a priority basis.

Cleveland — The tendency is to sell machinery and machine tools which do the most precise work in the first operations so as to leave little work for finishing operations. Typical is a fairly recent installation in a plant in this area which uses normally cold-sawing and burning equipment. Its installation is now 98 per cent cold-sawing, which leaves work smooth, without burrs and defects and cut to exact length. Moreover, it is pointed out that one man can tend to three

or four saws, while three men are needed for one burning machine.

Seattle—Volume of sales is at high levels, automotive units, road building machinery, electrical items and heavy construction equipment in strong demand. Ohio Brass Co., Mansfield, Ohio, and General Electric Supply Co., Portland, Oreg., submitted identical bids to Bonneville project for cross-arm fixtures. General Electric is low for furnishing five transformers, Westinghouse low, $14,924, for carrier capacitators and potential devices. Independent Iron Works, Portland, is low for building four 10,000-gallon oil storage tanks. Same agency will open bids May 9 for nine-ton machinery trailer, Spec. 1875. Seattle opened bids April 30 for Model AX 5-ton rotating crane. Tacoma will open bids May 5 for 20 tons condenser tubes. Seattle has called bids May 6 for 30,000 feet of copper tubing.

Week's Defense Awards

(*Concluded from Page* 43)

sheet steel, $36,520.50.

Caswell Strauss & Co. Inc., New York, grade "A" pig tin, $291,200.

Chase Brass & Copper Co. Inc., Waterbury, Conn., copper-nickel alloy tubing, $9122.80.

Clyde Iron Works Inc., Duluth, steam-driven winches and spare parts, $10,540.

Collyer Insulated Wire Co., Pawtucket, R. I., electric cable, $14,596.

County Supply Co., Plainfield, N. J., bars, anvils, flatters and fullers, $5014.15.

Dana Tool-D Nast Machinery Co., Philadelphia, machinists' swivel base bench vises, $5763.15.

DeLaval Steam Turbine Co., Trenton, N. J., motor-driven pumps, spare parts, tools and wrenches, $461,950.

Diagraph Bradley Stencil Machine Corp., St. Louis, stencil cutting machines, $12,650.

Electro Metallurgical Sales Corp., New York, ferromanganese, $27,320.

Fairchild Aviation Corp., Jamaica, N. Y., aircraft cameras, $69,300.

General Cable Corp., New York, cable, $10,564.

General Electric Co., Schenectady, N. Y., electric cable, $5788.50.

Gleason Works, Rochester, N. Y., bevel gear, motor-driven generators, $11,321.62.

Graybar Electric Co. Inc., New York, shackles, $16,464.70.

Hardie Tynes, Mfg. Co., Birmingham, Ala., high pressure air compressors, $220,120.

Ingersoll-Rand Co., New York, air compressors, $390,380.

Intertype Corp., Brooklyn, N. Y., typesetting machines, $10,321.82.

Jones & Lamson Machine Co., Springfield, Vt., grinder machine, $23,014.50.

Lees-Bradner Co., Cleveland, thread milling, heavy-duty machines, $17,299.56.

Lodge & Shipley Machine Tool Co., Cincinnati, engine lathes, extra tools and equipment, $14,979.

Maine Steel Inc., South Portland, Me., shackles, $24,798.52.

Matthews Co., Port Clinton, O., motor launches, $65,150.

Mercer Tube & Mfg. Co., Sharon, Pa., steel pipe, $206,494.93.

Mergenthaler Linotype Co., Brooklyn, N. Y., type-setting machines, $10,195.26.

National Electric Products Corp., Pittsburgh, electric cable, $5720.

Nicholson File Co., Providence, R. I., files, $150,404.23.

Niles-Bement-Pond Co., Pratt & Whitney Division, West Hartford, Conn., radial drilling and tapping machines, $22,648.

Okonite Co., Passaic, N. J., electric cable, $46,784.50.

Phelps Dodge Copper Products Corp., Habirshaw Cable & Wire Division, New York, electric cable, $105,145.43.

Pittsburgh Steel Co., Pittsburgh, boiler tubes, carbon steel, $71,199.18.

Providence Mill Supply Co., Providence, R. I., machinists' swivel base bench, and combination bench and pipe vises, $73,558.88.

Republic Steel Corp., Massillon, O., sheet steel, $28,234.

Revere Copper & Brass Inc., Baltimore, type F strip copper, condenser tubes, $159,070.08.

Rockbestos Products Corp., New Haven, Conn., electric cable, $6033.50.

Rockford Machine Tool Co., Rockford, Ill., hydraulic shaper-planer, $12,869.

Sperry Gyroscope Co. Inc., Brooklyn, N. Y., auxiliary equipment, $5025.

Sullivan Machinery Co., Michigan City, Ind., air compressors, $21,497.50.

Taylor-Parker Co. Inc., Norfolk, Va., carbon steel, countersinks and reamers, $12,831.28.

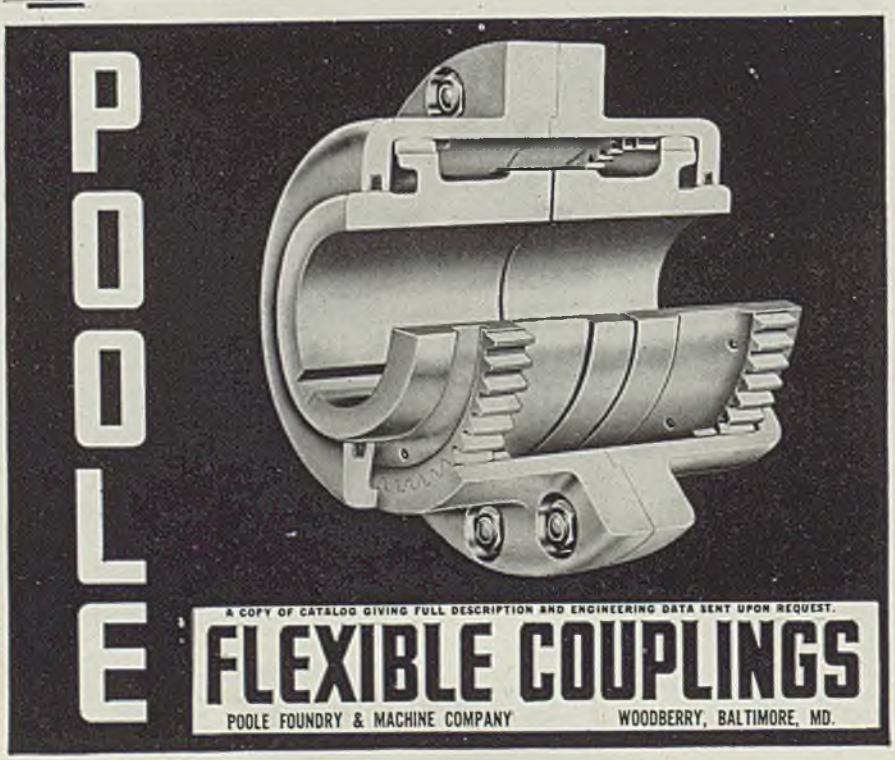
U. S. Tool Co. Inc., Ampere, N. J., milling machines, $11,310.

Wah Chang Trading Corp., New York, antimony, $5711.

Walworth Co., New York, steel valves, tube fittings and pipe flanges, $1,866,024.60.

Woodward Wight & Co. Ltd., New Orleans, carbon and high speed steel countersinks and reamers, lathes, $40,486.99.

Wooster Products Inc., Wooster, O.,



treads, $18,450.

Worthington Pump & Machinery Co., Harrison, N. J., centrifugal type pumps, air compressors, $351,561.76.

Bureau of Yards and Docks Awards

American Laundry Machinery Co., Cincinnati, laundry equipment at naval medical center, Washington, $19,978.

Chicago Bridge & Iron Co., Los Angeles, improvements to water supply at eleventh naval district, Pt. Loma radio station, San Diego, Calif., $13,345.

Louden Machinery Co., Philadelphia, monorail traveling cranes for extension to machine shop at navy yard, Philadelphia, $14,254.

Murphy Elevator Co., Louisville, Ky., elevators for extension of gun assembly shop at navy yard, Washington, $52,433.

White, J. G., Engineering Corp., New York, improvement of power plant at navy yard, New York, $3,860,000 on a cost plus fixed fee basis.

Woolston Woods Co., Philadelphia, heating and electrical work, machine shop extension, navy yard, Philadelphia, $26,943.

CONSTRUCTION and ENTERPRISE

Ohio

BEDFORD, O.—Lempco Products Inc. has plans for a second story addition to its plant, an increase of 100 per cent in office facilities and 200 per cent in its assembly space, to handle increasing business. Company manufactures automotive service equipment, crankshaft and surface grinders, electric and hydraulic presses and internal and external grinders.

CLEVELAND—Warner & Swasey Co., 2059 East Fifty-fifth street, will make further improvements to its plant, installing two 400-horsepower boilers, stokers, replacement of stack and other work. John Paul Jones, Carey & Millar, Terminal Tower, are engineers in charge of boiler plant work.

Additional Construction and Enterprise leads may be found in the list of Shapes Pending on page 120 and Reinforcing Bars Pending on page 122 in this issue.

CLEVELAND—Morton Machine Tool Co., 12327 Edwin court, is being incorporated by Henry L. Morton, to operate a jobbing machine shop. Mr. Morton has been engaged in rebuilding machinery.

CLEVELAND — Upson Walton Co., Clarence H. Mathews, president, 740 Superior avenue, will build several additions to plant at 12500 Elmwood avenue, one story, 20 x 20, 20 x 60 and 17 x 66 feet. These are in addition to factory and warehouse under construction for cable plant.

CLEVELAND—Carey Machine Co., 9520 Cassius avenue, Louis W. Greve, vice president, will build one-story tool shop addition 90 x 172 feet. Sam W. Emerson Co., 1836 Euclid avenue, has general contract.

CLEVELAND—Brehm Machine & Tool

Co., 3115 Croton avenue, A. L. Brehm, vice president, formerly a partnership, has been incorporated. James G. Thomas will become president.

CLEVELAND—Mall Machine Products Inc., 1240 West Fourth street, recently incorporated, will operate a machine shop to manufacture airplane parts. Max Kaplan is in charge.

CLEVELAND—Modern Hanger Corp., 4722 Hough avenue, is increasing manufacturing space by an addition 29 x 117 feet. W. F. Bach is president.

CLEVELAND — Dickey Grabler Co., 10302 Madison avenue, Daniel A. Miller, president, is building a one-story 40 x 120-foot addition. Company manufactures metal stampings.

CLEVELAND—Pioneer Alloy Products Co. Inc., 16601 Euclid avenue, O. J. Houck, president, alloy and heat resisting castings, is building two additions, 25 x 45 and 25 x 60 feet.

CUYAHOGA FALLS, O.—Lange Welding Machine Shop, 1700 Front street, is having plans prepared for an additional machine shop building.

LEBANON, O. — Production Plating Works Inc., W. L. Enghauser, president, will build an addition 161 x 180 feet to add to office and factory space. Company manufactures gas range manifolds and other metal products.

WARREN, O.—Mullins Mfg. Co., University street, will build two additions, 60 x 160 feet and 80 x 450 feet.

Connecticut

HARTFORD, CONN.—Fenn Mfg. Co., 1841 Broad street, will build a one-story 75 x 80-foot airplane parts manufacturing plant, to cost about $40,000. General contract let to L. Hogblom, Simsbury, Conn.

NEW HAVEN, CONN.—American Tube Bending Co. Inc., 5 Lawrence street, will build a one-story 100 x 110-foot plant addition. General contract has been given to Fuco-Amatruda Co., 59 Amity road, at about $45,000. D. Orr, 96 Grove street, is architect. (Noted Jan. 13.)

STAMFORD, CONN. — Perkins-Elmer Corp., 90 Broad street, New York, manufacturer of optical equipment and allied products, has bought 2½ acres at 523 Hope street, Stamford and will build plant with 18,000 square feet floor space for expanded production. Fletcher-Thompson, Bridgeport, Conn., is architect.

WALLINGFORD, CONN.—Plastics division, American Cyanamid Corp., West Main street, has let general contract to Miller Davis Co., 1919 Factory street, Kalamazoo, Mich., for two three-story plant units each 100 x 250 feet.

Massachusetts

ATTLEBORO, MASS.—Metals & Controls Corp., Forest street, has let contract to Rowley Construction Co., 260 Central avenue, Pawtucket, R. I., for a one and two-story plant addition, to cost about $50,000.

New York

SYRACUSE, N. Y.—Central New York Power Corp., J. L. Haley, 300 Erie boulevard, will build a gas producing plant, general contract to United Engineers & Constructors Inc., 1401 Arch street, Philadelphia, costing about $1,100,000.

New Jersey

JERSEY CITY, N. J.—Vimalert Co., manufacturer of marine engines, has bought a three-story factory building at 86-92 Forrest street, containing 40,000 square feet of floor space, to provide for expanded defense production.

NEWARK, N. J.—Pittsburgh Plate Glass Co., 4 Chester avenue, will build a manufacturing plant. J. H. & C. W. Ely, 744 Broad street, are architects.

NORTH BERGEN, N. J.—Grand City Container Corp., with plants in Manhattan and Brooklyn, N. Y., has bought 12 acres here for a one-story plant covering about 300,000 square feet. District operations will be consolidated in the new plant, as well as those of the G. & B. Bakers' Supplies Co. and Federal Carton Co., subsidiaries. Capital City Container Co., Albany, N. Y., a branch, will continue operations there.

Maryland

BALTIMORE—H. C. Weiskittel Co. Inc., 4901 Philadelphia road, will build a one-story 75 x 137-foot foundry addition, general contract to E. Eyring & Sons Co., 808 South Conklin street, at about $40,000.

Pennsylvania

BEAVER, PA.—Curtiss-Wright Propeller division, J. H. McKee, plant manager, Neville Island, Pittsburgh, will build a propeller plant, general contract to Hughes-Foulkrod Co., Koppers building, Pittsburgh, at cost of about $5,000,000. Defense Plant Corp. will finance.

CREIGHTON, PA.—Pittsburgh Plate Glass Co., H. S. Wherrett, president, Grant building, Pittsburgh, will let contracts soon for a four-story safety glass

manufacturing plant, costing about $100,000. R. D. Bole, Grant building, Pittsburgh, is chief engineer.

Michigan

DETROIT—Industrial Heat Treating Co., 810 Ford building, has been incorporated with $25,000 capital to deal in tools and machinery, by Fred C. Tinsey, 18495 Santa Rosa avenue.

DETROIT—Parke, Davis & Co., will wreck and rebuild its power plant at foot of Guion street. Smith, Hinchman & Grylls, Detroit, are architects.

DETROIT—Stinson Aircraft division, Vultee Aircraft Inc. will build a manufacturing building, powerhouse and office. Gordon B. Kaufman, Los Angeles, is architect.

DETROIT—Aeronautical Products Inc. will build an addition to its Ryan road plant, 95 x 200 feet.

DETROIT — National Cold Forging Corp. will build a factory and office building in Dearborn, Mich.

DETROIT—Dalzen Tool & Mfg. Co. will build a plant and office building on Eight Mile road, general contract to Haberkorn-Barry Co. H. E. Beyster Corp., Detroit, is engineer.

DETROIT—Huron Steel Co. Inc., 1113 West Philadelphia avenue, has been incorporated with $30,000 capital, to deal in copper, brass and metal alloys, by William F. Drevant, 15763 Ardmore avenue, Detroit.

DETROIT—Die-Typing Corp. has been incorporated with $45,000 capital, to deal in tools and dies, by William F. Weed, 3-135 General Motors building.

DETROIT—Oak Tool & Die Co. Inc., has been incorporated with $50,000 capital to manufacture tools and dies, by Rupert S. Rose Sr., 19207 Yacama avenue.

GRAND RAPIDS, MICH.—Duraplast Inc., 1217 Monroe avenue, has been incorporated with 5000 no par shares, to manufacture plastic products, by William H. Hardy, 2740 Lake drive S. E.

KEEGO HARBOR, MICH.—Keego Die Casting Co., Box 85, has been incorporated with $50,000 capital to manufacture tools and dies, by George F. Schreiner, 727 East Farnum avenue, Royal Oak, Mich.

MARQUETTE, MICH.—City council, M. A. Hogan, clerk, has approved plans for a sewage disposal plant costing $300,000. Shoecraft, Drury & McNamee, Ann Arbor, Mich., are engineers.

Illinois

AURORA, ILL.—Western United Gas & Electric Co. starts work in May on superstructure of addition to its steam-electric generating plant, providing space for a new turbo-generating unit.

CHICAGO—Carl Hussman Engineers, 3628 North Lincoln avenue, manufacturer of vibration insulation will build a one-story factory building, with second story offices, containing about 10,000 square feet, nearly doubling present space. New plant will be at Wellington street and Oakley avenue. G. Kehl Sons, 1225 Maplewood avenue, has been given general contract.

DE KALB, ILL.—Englander Spring Co. has purchased west warehouse of American Steel & Wire Co. and will remodel it for manufacturing purposes, practically tripling present capacity. S. J. Blaha is superintendent of operations at De-Kalb.

Missouri

JEFFERSON BARRACKS, MO.—United States engineer, 816 Custom House, will take bids until May 6 for two steel elevated water tanks, 300,000 and 500,000 gallons capacity.

ST. LOUIS—Walsh Refractories Corp., 4070 North First avenue, is building a one-story addition, 32 x 80 feet at its plant, 4328 Oak street.

ST. LOUIS—Niedringhaus Steel Co., 5739 Natural Bridge avenue, will build a one-story plant addition costing $7500. Gale Henderson. Wainwright, building, is architect. General contract has been given to C. Rallo Contracting Co., 4541 St. Louis avenue.

ST. LOUIS—Lustre Co., 3443 North Broadway, manufacturer of electroplating and polishing supplies and equipment, has leased a larger plant at Nineteenth street and Delmar boulevard and will move there about May 15.

ST. LOUIS—Joleco Fluorescent Fixture Corp., 2513 Baldwin street, George Ledbetter, president, has been incorporated with $20,000 capital to manufacture electrical fixtures and is spending $6500 for new equipment.

ST. LOUIS—Modern Kitchens Inc., 2862 Gravois avenue, Richard L. Teich, agent, has been incorporated with $2500 capital to manufacture kitchen cabinets.

ST. LOUIS—Whitefield Aircraft Corp. 315 North Seventh street, J. R. Kauffmann, secretary, has been incorporated with $25,000 capital to build airplanes. First plane will be completed by June 1.

ST. LOUIS—Pomona Pump Co., Po-

mona, Calif., Thomas A. Hodges, St. Louis branch manager, 4301 South Spring avenue, is building a crane bay at its plant, costing about $10,000.

ST. LOUIS—Becker Iron & Metal Co., Hyman Becker, president, 2316 Biddle street, is building a one-story warehouse with 3750 square feet floor space, costing about $5000.

Texas

CORPUS CHRISTI, TEX.—American Smelting & Refining Co., 120 Broadway, New York, will establish an electrolytic zinc refining plant costing $5,200,000, with monthly capacity of 2000 tons.

Wisconsin

BLAIR, WIS.—Village, Milton Fredrixen, clerk, has applied for WPA funds to finance a sewage disposal plant and sewer system costing about $85,000. S. P. Hall, Eau Claire, Wis., is consulting engineer.

CUDAHY, WIS.—Ladish Drop Forge Co., 5405 South Packard avenue, will build a plant addition to cost about $375,000.

GRANTSBURG, WIS.—Public service commission has granted permission to Clam River Dam Co., to build hydroelectric power plant with two generators on Clam river, 19 miles northeast of here, to cost about $85,000. Herman T. Hagestad, River Falls, Wis., is consulting engineer.

KAUKAUNA, WIS.—Thilmay Pulp & Paper Co. has given contract to Permanent Construction Co., Milwaukee, for a one-story addition.

LA CROSSE, WIS.—City, F. L. Kramer, clerk, will take bids soon for an iron removal plant costing about $16,000. J. H. Barth is city engineer.

MENOMONIE, WIS.—City, Alice Kenney, Clerk, will take bids soon on equipment for its sewage disposal plant now under construction, including collection equipment, valves, motors, controls, chlorinating equipment and pipe, costing about $60,000. S. P. Hall, Eau Claire, Wis., is consulting engineer.

NEW LISBON, WIS.—Chicago, Milwaukee, St. Paul & Pacific railroad, 80 East Jackson boulevard, Chicago, E. W. Holmgren, La Crosse, Wis., division engineer, will take bids soon for a steel water tank of 100,000 gallons capacity.

WEST ALLIS, WIS.—Kempsmith Machine Co., manufacturer of milling machines, has given contract to Charles Maier & Son Co., Milwaukee, for a one-story shop addition 58 x 85 feet.

WEST ALLIS, WIS.—LeRoi Co., manufacturer of air compressors and gasoline engines, has let contract to Bentley Construction Co., Milwaukee, for a shop addition 91 x 119 feet.

Minnesota

MINNEAPOLIS—Paul Pufahl & Son Foundry Co., steel castings, will build a two-story plant 90 x 154 feet, to increase defense production. General contract to W. A. South Co.

MINNEAPOLIS — Minneapolis Honeywell Regulator Co., manufacturer of heat regulators, etc., has let contract to Northwestern Construction Co. for a one-story plant addition 30 x 84 feet.

MINNEAPOLIS—Modern Pattern Co., Ralph C. Hitchcock, manager has given general contract to R. H. McGuffie for a one-story plant addition.

MINNEAPOLIS—City has given general contract to Madsen Construction Co. for a two-story airplane repair shop 30 x 140 feet and hangar 130 x 147 feet at the municipal airport, to be leased by the Mid-Continent Air Lines Inc., which is moving main repair and maintenance work from Kansas City, Mo.

RED WING, MINN.—American Rock Wool Corp., James R. Addington, president, Chicago, will let contract soon for two-story plant 80 x 250 feet, including two cupola-type furnaces. First unit will cost $250,000, with equipment.

RED WING, MINN.—Chicago, Milwaukee, St. Paul & Pacific railroad, 80 East Jackson boulevard, Chicago, E. W. Helmgren, LaCrosse, Wis., division engineer, will ask bids soon for a steel water tank of 50,000 gallons capacity.

ST. PAUL—Presto Mfg. Co., die maker, has let contract to the Builders Co. for a one-story machine shop at 770 Cromwell avenue.

WINONA, MINN.—Mississippi Valley Public Service Co. plans improvement of its steam-electric power station and extension of transmission lines, including new high-tension crossing over Mississippi river. Mead, Ward & Hunt, State Journal building, Madison, Wis., are engineers.

Kansas

EMPORIA, KANS.—City, E. T. Mendel, clerk, takes bids to May 6 for improvements to its sewage disposal plant, to cost about $75,000. Robert W. Cunningham, Emporia, is consulting engineer.

PHILLIPSBURG, KANS. — Kansas-Nebraska Natural Gas Co. plans 8-inch gas pressure pipe line from the Hugoton, Kans., gas field to Cambridge, Nebr., to cost about $1,000,000.

SCOTT CITY, KANS.—City, Harley Hoover, mayor, has applied for WPA

funds for construction of complete sewage disposal plant costing $66,000. Paulette & Wilson, Public Utilities building, Salina, Kans., are consulting engineers. (Noted March 24.)

Nebraska

LINCOLN, NEBR.—City plans special election in May on $3,000,000 bonds to finance purchase or construction of municipal light and power plant. Theodore H. Berg is city clerk.

Iowa

DES MOINES, IOWA—Marquette Cement Mfg. Co., 140 South Dearborn street, Chicago, has awarded general contract to A. H. Neumann & Bros., 514 Hubbell building, for a warehouse costing about $280,000, at Fifty-second street and Park avenue. (Noted April 28.)

FORT DODGE, IOWA—City, H. R. Sittig, clerk, is making plans for improvement of sewage treatment plant at cost of $150,000. Buell & Winter, 508 Insurance Exchange building, Sioux City, Iowa, are engineers.

GRAETTINGER, IOWA—City is preparing plans for bidding in May for complete electric distribution system costing about $100,000. Buell & Winter, 508 Insurance Exchange building, Sioux City, Iowa, are engineers. (Noted Feb. 24.)

HAWARDEN, IOWA—City, Elmer L. Ericson, clerk, is preparing plans for improvement of municipal electric light plant, including 1000-kw generator. Buell & Winter, 508 Insurance Exchange building, Sioux City, Iowa, are engineers.

LAKE MILLS, IOWA — City has awarded contract for municipal power plant building 22 x 40 and 18 feet high, including diesel engine generating unit and auxiliaries to Fairbanks, Morse & Co., Omaha, Nebr., at $33,860.

LORIMOR, IOWA—Village, E. E. Kirkhart, clerk, will vote May 14 on construction of a waterworks plant costing about $10,000. (Noted April 7.)

Idaho

POCATELLO, IDAHO—City has sold $82,500 worth of bonds to finance a sewage treatment and disposal plant.

California

HUNTINGTON PARK, CALIF.—L. & F. Machine Co., 2104 Belgrave avenue, has been organized by Ralph E. Larrabee.

INGLEWOOD, CALIF.—Allied Sheet Metals, 1220½ North LaBrea avenue, has been organized by Joseph and Griffith Bartholic and associates.

LAWNDALE, CALIF.—Pacific Aero Development Co., 14529 Hawthorne boulevard, has been formed by Harold E. Goodell and associates.

LONG BEACH, CALIF.—Ocean Machine Products Inc. has been incorporated with $25,000 capital, by Claud A. Blatt, South Gate, Calif., and associates. L. A. Whitcomb, 306 Heartwell building, Long Beach, is representative.

LOS ANGELES—Berlin & Russell Aircraft Machine & Mfg. Co. has been incorporated with $500,000 capital, by Arthur H. Diebert, Subway Terminal building, Los Angeles, and associates.

LOS ANGELES—Defense Welding & Engineering Co. has been incorporated with $25,000 capital, by E. H. McDonnell, E. M. Peters and M. V. Cox. Hanna & Morton, Pacific Mutual building, are representatives.

LOS ANGELES—Allied Engineering & Shipbuilding Corp. has been incorporated with $250,000 capital, by James G. Short, Fred E. Engstrum and Joseph A. Gallagher. Henry F. Pevet, 112 West Ninth street, Los Angeles, is representative.

LOS ANGELES—Newport Ship Building Co. has been incorporated with $75,000 capital, C. A. Krebs, 4602 Worth street, and associates.

LOS ANGELES—California Well Tool & Machine Works, 1033 Alhambra avenue, has been formed by George L. Gartling, William Croft and Dorothy J. West.

LOS ANGELES—National Wire Works, 824 Wall street, has been organized by J. J. Zimlich and P. C. Silbernagel.

SANTA MONICA, CALIF.—Oceana Tool Mfg. Co. Inc., has been incorporated with $25,000 capital, by H. T. Hansen, Fletcher McKnight and J. N. Snarma. Marchall Hickson, Central Tower building, is representative.

Washington

SEATTLE—Alaska Copper Works, 3600 East Marginal way, is making a $10,000 plant addition and improving existing plant.

SEATTLE—Washington Chromite Co. has leased chromite properties at Sister mountain, Whatcom county, to A. H. Wild, San Francisco, who plans immediate development operations.

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
Ceilcote 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-47, 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.

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-47, 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., 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.
*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.

BEARINGS (Brass, Bronze)
Ampco Metal, Inc., Dept. S-47, 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., Metalline Co., P. O. Box 1, Long Island City, N. Y.

BEARINGS (Quill)
Bantam Bearings Corp., South Bend, Ind.

BEARINGS (Radial)
Ahlberg Bearing Co., 3015 W. 47th St., Chicago, Ill.
American Roller Bearing Co., 416 Melwood St., Pittsburgh, Pa.
Bantam Bearings Corp., South Bend, Ind.
Bower Roller Bearing Co., 3040 Hart St., Detroit, Mich.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Link-Belt Co., 519 No. Holmes Ave., Indianapolis, Ind.
New Departure Div., General Motors Corp., Bristol, Conn.
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.

BENZOL AND TOLUOL RECOVERY PLANTS
Koppers Co., Engineering and Construction Div., 300 Koppers Bldg., Pittsburgh, Pa.
Koppers Co., Tar & Chemical Div., 901 Koppers Bldg., Pittsburgh, Pa.
Western Gas Div., Koppers Co., Fort Wayne, Ind.
Youngstown Sheet & Tube Co., The, Youngstown, O.

BILLETS (Alloys and Carbon Steel)
Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Firth-Sterling Steel Co., McKeesport, Pa.
Republic Steel Corp., Dept. ST, Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Stanley Works, The, New Britain, Conn. Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton, O.
Washburn Wire Co., Phillipsdale, R. I.

BILLETS (Forging)
Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Copperweld Steel Co., Warren, O.
Heppenstall Co., 47th & Hatfield Sts., Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
Midvale Co., The, Nicetown, Philadelphia, Pa.
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. 35, 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., Inc., 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.

WHERE-TO-BUY

BOLTS (Track)—See TRACK BOLTS

BOOKS
International Correspondence Schools, Box 9372-B, 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, 2700 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)
Broslus, 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-47, 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 Pearing 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-47, 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-47, 3830 W. Burnham St., Milwaukee, Wis.
Bartlett-Hayward Div., Koppers Co., Paltimore, 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., 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-47, 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.

WHERE-TO-BUY

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, 2700 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, 2700 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. 35, 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 9372-B, Scranton, Pa.

COTTER PINS
American Chain & Cable Co., Inc., York, Pa.
Hindley Mfg. Co., Valley Falls, R. I.
Hubbard, M. D., Spring Co., 429 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, 2700 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

COUPLINGS (Pipe)—Con.
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. 35, 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. 35, 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. 35, 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. 35, 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. 35, Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

CRANES (Traveling)
Reading Chain & Block Corp., Dept. 35, 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.

DIE BLOCKS
American Shear Knife Co., 3rd & Ann Sts., Homestead, Pa.
Ampco Metal, Inc., Dept. S-47, 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., Inc., 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, 2700 E. 79th St., Cleveland, O.
Fairbanks, Morse & Co., Dept. E75, 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.
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.
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. E75, 600 S. Michigan Ave., Chicago, Ill.

ENGINES (Gas, Oil)
Fairbanks, Morse & Co., Dept. E75, 600 So. Michigan Ave., Chicago, Ill.
Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES (Kerosene)
Fairbanks, Morse & Co., Dept. E75, 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.

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., 432 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-317, 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
Brosius, 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-47, 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, 1528 E. Third St., 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, 1528 E. Third St., 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-47, 3830 W. Burnham St., Milwaukee, Wis.
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
King Fifth Wheel Co., 2915 No. Second St., Philadelphia, Pa.
National-Erie Corp., Erie, Pa.
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.

GEARS (Steel Laminated)
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. E75, 600 So. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee, Wis.
Reliance Electric & Eng. Co., 1081 Ivanhoe Rd., Cleveland, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

GENERATORS (Acetylene—Portable and Stationary)
Linde Air Products Co., The, 30 E. 42nd St., New York City.

GENERATORS (Electric)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Dept. E75, 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-47, 3830 W. Burnham St., Milwaukee, Wis.
National-Erie Corp., Erie, Pa.
Youngstown Alloy Casting Corp., 103 E. Indianola Ave., Youngstown, O.

GUNS (Blast Furnace Mud)
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

GUNS (Steam, Hydraulic, Electric)
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh, Pa.
Brosius, Edgar E., Inc., Sharpsburg Branch, Pittsburgh, Pa.

HAMMER BUSHINGS
Steel Conversion & Supply Co., P. O. Box 537 (Castle Shannon), Pittsburgh, Pa.

HAMMERS (Drop)
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.

WHERE-TO-BUY

HANGERS (Shaft)—Con.
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. 35, 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. 35, 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. 35, 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.
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, 861 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, 861 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., 2135-4 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.
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., 2700 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 Nickelold 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.

WHERE-TO-BUY

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, 2699 Atwater St., Detroit, Mich.
Reading Chain & Block Corp., Dept. 35, 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. E75, 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, 6017 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
Ceilcote 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., Philadelpha, 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., 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.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
National Tube Co., Frick Bldg., Pittsburgh, Pa.
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., Inc., 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., 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., 429 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.

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. E75, 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. E75, 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. E75, 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. E75, 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. E75, 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. E75, 600 S. Michigan Ave., Chicago, Ill.
Worthington Pump & Machinery Corp., Harrison, N. J.

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.
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, 2700 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.
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, 2700 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.
Mollrup 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)
*Mildvale 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.

RODS (Drill)
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis, Ind.

RODS (Rounds, Flats and Shapes) (*Also Stainless)
*Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh, Pa.
*American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco, Calif.
*Copperweld Steel Co., Warren, O.
*Firth-Sterling Steel Co., McKeesport, Pa.

RODS (Rounds, Flats, Shapes) (*Also Stainless)—Con.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh, Pa.
Laclede Steel Co., Arcade Bldg., St. Louis, Mo.
*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. Springfield, O.
Pittsburgh Rolls Div. of Blaw-Knox Co., Pittsburgh, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh, Pa.

ROLLS (Steel and Iron)
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Roll & Steel Fdry. Co., E. Chicago, Ind.
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, 2700 E. 79th St., Cleveland, O.

SALT TABLETS
Fairway Laboratories, Div. The G. S. Suppiger Co., 1530 Hadley St., St. Louis, Mo.
Morton Salt Co., 310 So. Michigan Ave., Chicago, Ill.

SAND-BLASTING NOZZLES (Borium)
Stoody Co., 1134 W. Slauson Ave., Whittier, Calif.

SAND CONDITIONING AND PREPARING MACHINERY
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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.
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. E75, 600 So. Michigan Ave., Chicago, Ill.
Kron Co., The, Bridgeport, Conn.

SCALES (Dial & Recording)
Fairbanks, Morse & Co., Dept. E75, 600 S. Michigan Ave., Chicago, Ill.

SCALES (Laboratory)
Fairbanks, Morse & Co., Dept. E75, 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. E75, 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 9372-B, 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, 2648 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.
Pheoli 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.

WHERE-TO-BUY

SCREWS (Sheet Metal, Recessed Head)—Con.
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, 2700 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.
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-17, 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., 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 & 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 (Perforated)
Harrington & King Perforating Co., 5634 Fillmore St., Chicago, Ill.

SHEETS (Reinforced)
Erdle Perforating Co., 171 York St., Rochester, N. Y.

SHEETS (Roofing)—See ROOFING AND SIDING

SHEETS (Stainless)
Allegheny Ludlum Steel Corp., 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)
Broslus, 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., 429 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.

WHERE-TO-BUY

SPRINGS (Oil Tempered—Flat)—Con.
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., 429 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, 2700 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., 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.

STEEL (Corrosion Resisting)—Con.
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.
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., 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., 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., 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.
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., 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.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown, O.

STEEL (Tool)
Allegheny Ludlum Steel Corp., 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.
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, 2700 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 Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.

TANK LININGS
Ceilcote Co., 750 Rockefeller Bldg., Cleveland, O.
Goodyear Tire & Rubber Co., 1144 E. Market St., Akron, O.
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.
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., Inc., 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., Inc., 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., 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. 35, 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., 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.

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.
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)
Airgrip Chuck Div., Anker-Holth Mfg. Co., Port Huron, Mich.
Bristol Co., The, 112 Bristol Rd., Waterbury, Conn.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
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., 429 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. ST51, 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.
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. ST51, 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. ST51, 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.

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.
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.
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.
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.
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 (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.

WHERE-TO-BUY

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., 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.
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., 429 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., 429 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.

WRENCHES (Drop Forged)
Williams, J. H., & Co., 400 Vulcan St., Buffalo, N. Y.

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ZINC ALLOYS
New Jersey Zinc Co., 160 Front St., New York City.

ZINC (Rolled Sheets, Strips, Coils)
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Motor can be reconnected for 2300 Volt service.

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4—100 HP 900 RPM 440 VOLT CS 754C Westinghouse
1—100 HP 1200 RPM 2200 VOLT Type I Form K G. E.
1—125 HP 720 RPM 2200 VOLT KT 562 G. E.
1—150 HP 720 RPM 2200 VOLT KT G. E.
1— 75 HP 900 RPM 2200 VOLT Type I Form K G. E.
2— 75 HP 1200 RPM 440 VOLT CS Westinghouse
1— 75 HP 690 RPM 550 VOLT CS Westinghouse
1— 75 HP 900 RPM 440 VOLT Ball Bearing Fairbanks
2— 75 HP 1200 RPM 440 VOLT New Westinghouse Drip Proof
1— 75 HP 900 RPM 440 VOLT KT G. E.
1— 60 HP 1200 RPM 2200 VOLT CS Frame 664 C Westinghouse

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2—150 HP 900 RPM 440 VOLT MT G. E.
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Both of above in excellent working condition.

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GEAR PLANERS, 54" Gleason, bevel, M.D. (2)
GEAR CUTTER, 84" Newark, M.D.
LEVELLER, Plate, 84" Bertsch, 7 Rolls, M. D.
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PLATE SHEAR, 10' x 3/8" United, M.D.

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ADVERTISING INDEX

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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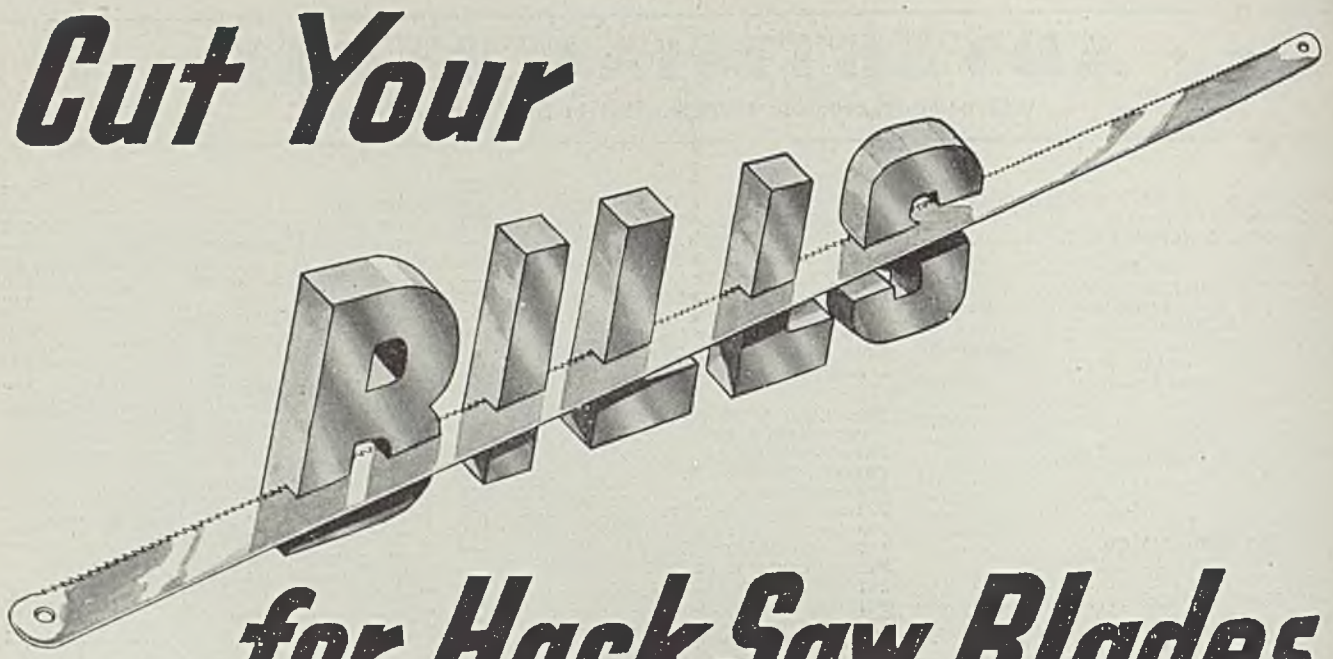

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