MAIN OFFICE

Penton Building, Cleveland 13, Ohio

BRANCH OFFICES

New York 17 ..... 16 East 43rd St.
Chicago 11 ..... 520 North Michigan Ave.
Pittsburgh 19 ..... 2800 Koppers Building
Detroit 2 ..... 6560 Cass Ave.
Washington 4 ..... 956 National Press Bldg.
Cincinnati 2 ..... 2030 Carew Tower
Los Angeles 4 ... 130 N. New Hampshire Ave.
London ..... 2 Caxton St., Westminster, S.W. 1

• • •

Published by The Penton Publishing Co., Penton Bldg., Cleveland 13, Ohio, E. L. Shaner, President and Treasurer; G. O. Hays, Vice President and General Manager; R. C. Jaenke, Vice President; F. G. Steinebach, Vice President and Secretary; E. L. Werner, Assistant Treasurer.

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

Published every Monday. Subscription in the United States and possessions, Canada, Mexico, Cuba, Central and South America, one year $6; two years $10; all other countries, one year $12. Single copies (current issues) 25c. Entered as second class matter at the postoffice at Cleveland, under the Act of March 3, 1879.

STEEL

The Magazine of Metalworking and Metalproducing

VOL. 116, NO. 12 March 19, 1945

NEWS

TECHNICAL

FEATURES

MARKETS

NEXT WEEK...

Rehabilitating Veterans at Crile Hospital. (Part III)
Obtaining Stronger Die Castings by Proper Die Design
Automatic Arc Welding Air Compressor Tanks
What the Construction Industry Thinks About Welding
How Wickwire Spencer Draws Tungsten, Molybdenum Wire
Reproducing Drawings on Sheet Metal Photographically
Lubrication in Deep Drawing Steel. (Part II)

"Union HB Long Pitch Engineering Chain is made in a complete range of strengths and sizes, with a wide variety of attachments."

HELP IN HANDLING MATERIALS

☆ The proper and efficient handling of materials throughout the processes of production calls for many types of conveyors. All have one common feature . . . their operation must be constant or production stops. That is why many conveying systems are built around Union Chains.

Union is not a manufacturer of conveyors, or for that matter, of any machinery. The Union organization is composed entirely of specialists in the manufacture of chain, chain attachments and sprockets. Consequently Union Chains and members of the Union organization have a reputation with customers for "wearing well." Engineering service is available to anyone confronted with the task of designing and building conveying equipment to "Help in Handling Materials."

The Union Chain and Manufacturing Company ..... Sandusky, Ohio, U. S. A.

Union Chains for Every Application

Drive and Conveying Chains and Sprockets

- Bridge Chain
- Combination Malleable Iron and Steel Chain
- HB (hardened bearing) type chain
- BP (bar and pin) type chain

★

Finished Steel Roller Chains and Sprockets

- All manufacturer's standard, size ⅜ in. to 2½ in. pitch
- Single and Multiple Strands
- Extended Pitch Series in sizes 1¼ in. to 4 in. pitch

★

Silent Chain and Sprockets

- All sizes ⅜ in. to 1½ in. pitch

★

Flexible Couplings

- Roller chain type
- Silent chain type

Catalog A-2 covers Drive and Conveying Chain. 8-2 covers Finished Steel Roller Chain. FC-1 covers Flexible Couplings. Ask for your copies.

ARMY E NAVY

UNION CHAINS

STEEL
March 19, 1945

Wartime Privilege!

Testimony presented at the hearings in Detroit of the Mead war investigating committee of the Senate shows conclusively that labor productivity on war work in many plants of the automotive industry is from 25 to 50 per cent below the standards prevailing in 1939-1941. This conclusion is derived not only from evidence submitted by representatives of management; it is supported by statements of military authorities and by frank admissions of shop stewards and other representatives of unions.

Why has productivity declined so sharply and why is this sorry situation permitted to exist—particularly at a time when the government is appealing for more production?

Unfortunately, those who agree so readily that productivity is dismally low are in violent dispute as to the cause. Management claims that the low output of workers is chargeable to the abuse of power by the unions. Union spokesmen retort that the blame lies with management which, they charge, is resolved to wreck the unions, is responsible for wage inequalities and is "hoarding" labor. Incidentally the unions attribute part of the inequality in wages to the government's wage stabilization policy.

Exchanges of charges and countercharges between management and the unions will not bring a solution. Nor will this interesting observation by Matthew Smith, colorful secretary of MESA: "The only way 100 per cent war productivity can be achieved would be to have a Gestapo and I question whether the cost of obtaining the additional 40 per cent would be worth the effort. After all, we seem to be winning the war with 60 per cent."

This last sentence of Mr. Smith's statement is extremely significant. Who else, besides Mr. Smith and some other union officials, is perfectly content to win the war with 60 per cent labor productivity? Management is not, the military authorities are not, the fighting men are not and the public is not. Who is it, then, who sits so placidly in Mr. Smith's corner and condones this shameful 60 per cent situation?

It is the body of higher-ups in Washington who, after having created and fostered since 1933 a one-sided labor policy, now find themselves so thoroughly hog-tied by political commitments that they must follow an even more lop-sided policy as to war effort.

That policy is 60 per cent war effort for members of unions; 100 per cent for all other members of society, including fighting men!

FINDING 37,303 JOBS: Success or failure of the national objective of providing "full" employment after the war will depend largely upon the ability of local communities to solve their own problems. The better each hamlet, city and state handles its individual situation, the sounder will be the national economy.

Such is the reasoning of the Committee for Economic Development which has enrolled 2200 communities in a program to promote high-level, productive employment in the postwar period.

Cincinnati affords an excellent illustration of how CED works. Hamilton county, including the Queen city, had a population requiring 228,987 jobs in 1940. Assuming that in 1947 half of the abnormal gain in population will remain, that 43 per cent of the population will be in the labor force and that 95 per cent of it will be employed, the number of jobs required will be 266,290. This represents an increase of 37,303 above the 1940 level.

(OVER)

CED strives to increase the job potentialities to meet this need.

The goal presents a stiff challenge to Cincinnati initiative and resourcefulness, but it is scarcely more formidable than the severe tests of relief and flood which the city has met in the past decade.

Are you giving CED the support it deserves in your community? —p. 99

• • •

WAGE INEQUALITIES: These words uttered by George Romney at the Mead committee hearing are worth noting: "The war's greatest wage inequality is between those dying for us and those living in peace and comfort. The next most glaring inequality is the lack of differential in pay between the workers who do an honest day's work and the drones and militant hotheads who are destroying the industry's productivity."

Some American unions are repeating Russia's mistake. After the revolution all Russian workers were placed on a common wage level. The worst loafer received as much as the most productive worker. Gradually Russia has learned the error of this policy and today in Russia the pay differential between the poorest and best worker is greater than it is in the United States.

If our unions will heed Russia's lesson promptly, they will save themselves about 20 years of grief. —p. 77

• • •

ORE FLEET IS READY: If weather conditions continue favorable, the Great Lakes ore fleet should begin operations in about two weeks. Last year the first vessel locked through the Soo on April 10.

This year the goal set for the fleet is 83 million gross tons of iron ore, compared with 81.5 million tons actually shipped last year. The tonnages for coal and limestone remain unchanged from 1944, but the grain load has been upped to 340 million bushels from the 290 million carried last season.

Lake vessel operators are confident they can meet the tentative goals providing they do not encounter serious manpower shortages. Recent assurances by Selective Service that licensed vessel men will be granted military deferment has eased concern over licensed officers, but there still remains anxiety as to the supply of semi-skilled seamen.

Ice breakers are working now to open the channels by April 1, if weather will permit. —p. 81

LIGHT-GAGE SHAPES: As early as 1855, somebody conceived the idea of cold-forming wrought iron sheets into I-beam shapes, which were used in the construction of the Bank of the State of New York building. From this date, developments in light-gage steel construction lagged until early in the present century. Beginning in 1930 numerous systems of light gage steel came into being, but it remained for the pressure of World War II to present the greatest opportunity and challenge to light weight steel construction.

War made it necessary to erect buildings of many kinds as quickly as possible. Used in combination with structural steel framing for the larger structures or alone for the smaller ones, the light steel constructions saved precious time in constructing hundreds of such buildings.

In view of the impetus given this type of construction during the war emergency, it is to be hoped that codes and specifications may be developed or modified to encourage the proper application of light-gage steel in the postwar period. —p. 108

• • •

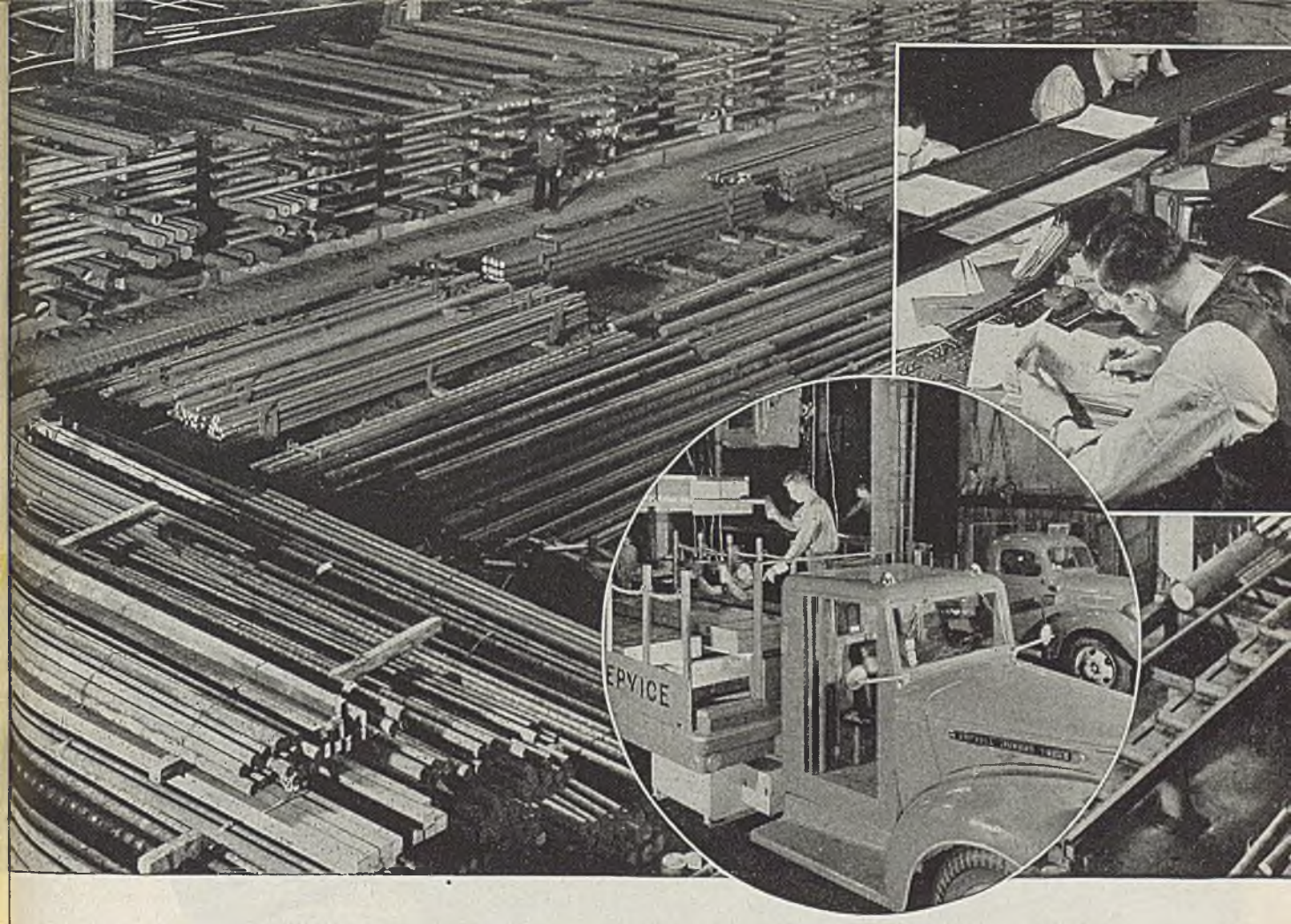
PROFITS DECLINING: If one thumbs through a few of the labor union newspapers, he is almost certain to see a bold headline asserting that industry is reaping exorbitant profits from the war.

The facts do not warrant this charge. Here are comparative figures for the steel industry for the years 1941 and 1944. In 1941, with an output of 82.8 million net tons of ingots and net sales of $3.8 billion, steel producers earned about $330 million. In 1944, with a record-breaking output of 89.6 million tons and with sales at $6.4 billion, the industry's earnings had dropped to an indicated $200 million.

Union publications often charge that corporations put aside, before taxes, extravagant reserves for contingencies. This is not true. The $200 million earnings figure indicated for 1944 is "after taxes" and any money put aside for a rainy day must come out of this amount. The unions are wrong when they say reserves come out before taxes, even though the audited income statements always would lead one to believe that is the case. —p. 80

E. L. Shaner

EDITOR-IN-CHIEF



Why Ryerson Means Immediate Steel

Ryerson delivers steel on time. One reason is large, diversified stocks. Another is the 11 Ryerson Steel-Service Plants, strategically located to quickly serve steel users. Still another is experienced personnel—in the field, on the order desks, in warehouses and shipping rooms and on the trucks.

Even under war's heavy burdens, steel users generally have learned that Ryerson service enables them to hold inventories at practical working levels—that on anything from a single piece to several carloads Ryerson service is personal, thorough, and, above all, dependable.

And Ryerson service goes further. Ryerson engineers and metallurgists are available for any problem of steel selection or fabrication. Cutting and other preparation equipment are unsurpassed. Alloy steels are selected and tested. Data as an aid to heat treatment are reported to users.

Ryerson Steel-Service is based on 102 years experience. It is available for maintenance, inventory fill-ins, regular production, or as the single, dependable source for all your Company's steel. Get in touch with your nearest Ryerson Plant.

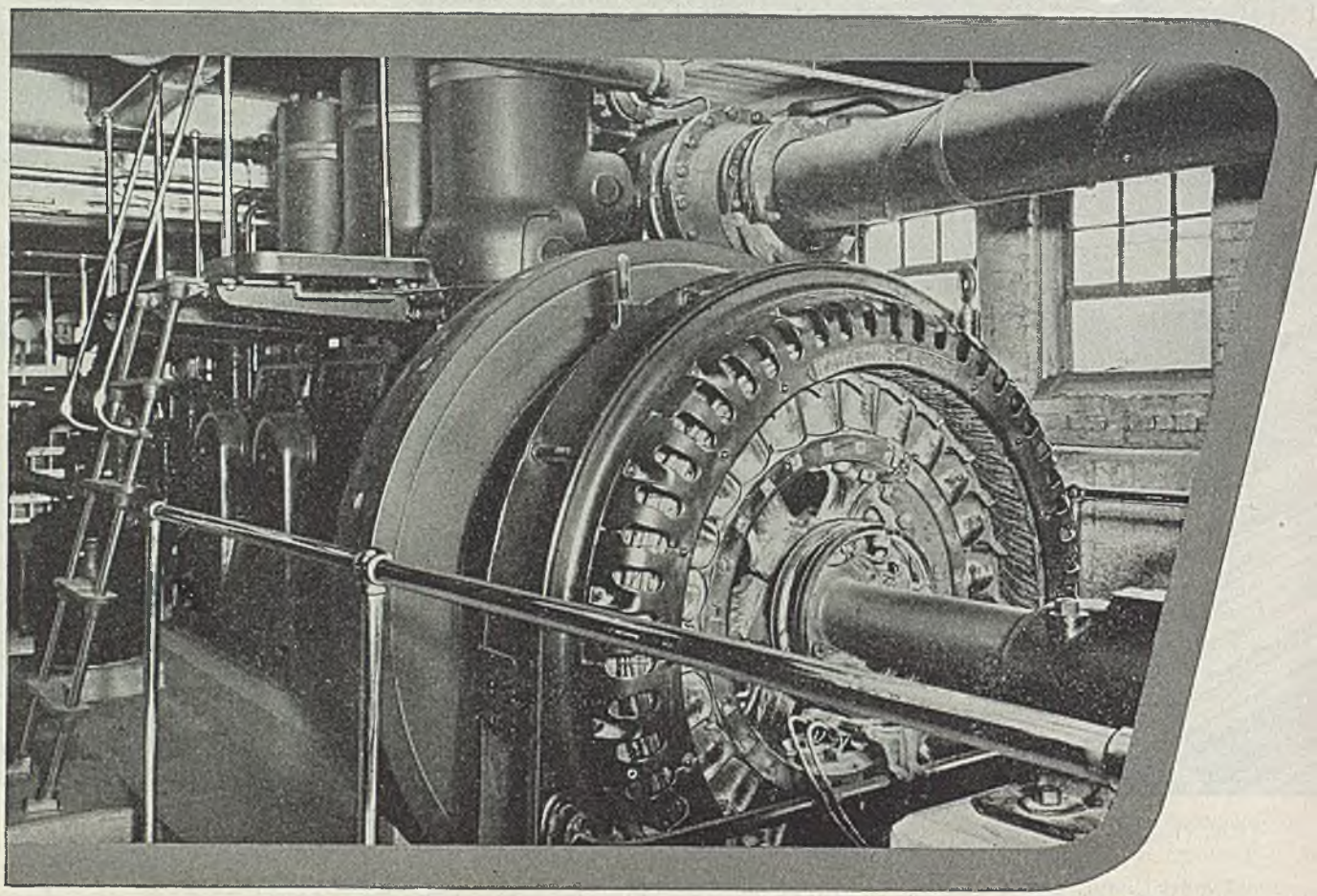
RYERSON CERTIFIED STEELS

Does your Company have the latest Ryerson Stock List?—includes more than 10,000 kinds, shapes and sizes of steel—Bars—Shapes—Plates—Sheets—Tubing—Structurals—Carbon and Alloy Steel—Tool Steel—Allegheny Stainless.

JOSEPH T. RYERSON & SON, Inc., Steel-Service Plants at: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston

RYERSON STEEL

Power Costs Drop 80% at Plating Plant



One of the two Fairbanks-Morse Diesels in operation at the Grand Rapids Plating Co.

By installing two Fairbanks-Morse Diesels, the Grand Rapids Plating Co. reduced its cost of power from $50 to $10 a day. The $10 includes fuel, lubrication, and operation and maintenance costs. This record was established in 20,000 hours of sustained service.

This means the Fairbanks-Morse Diesels have saved enough to pay for themselves. And, such dependable, low-cost power is available for your needs, too. Write Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

BUY MORE WAR BONDS

Fairbanks-Morse

A name worth remembering

Diesel Locomotives • Diesel Engines • Generators • Motors • Pumps • Scales
Magnetos • Stokers • Railroad Motor Cars and Standpipes • Farm Equipment

Auto Builders Hold Union's Misuse of Power Cuts Output

Documentary evidence presented to Mead war investigating committee showing union-imposed restrictions on productive efficiency. Need for revised national labor policy, with privileges withdrawn from unions, stressed

GEORGE ROMNEY

DETROIT

ALARMED over shocking declines in productivity or man-effort throughout industry in the past three years (see STEEL, Mirrors of Motordom, Jan. 29, p. 57) the 525 member plants of the Automotive Council for War Production, through their spokesman, George Romney, have ripped the shrouds from the manpower problem, presenting documentary evidence to support the logic of an immediate need for a revised national labor policy—strengthened, completed, balanced and modernized to establish a foundation for the management-labor relationship essential to the country's future.

Mr. Romney presented his testimony to the Mead war investigating committee of the Senate, which opened hearings here March 9 after several postponements of an official investigation of manpower utilization. In addition to speaking for the automotive industry, with its one million employes, Mr. Romney had the active support of the Automotive and Aviation Parts Manufacturers Association, Detroit Board of Commerce, Michigan Manufacturers Association and the Automotive Tool and Die Association, thus reflecting the views of industrial employers in 32 states with overall employment of 1,900,000. Importance of this group is attested by figures which show the automotive industry alone currently is accounting for 26 per cent of all war products made from metal.

Arbitrary leveling of union labor's productivity by from 25 to 50 per cent off the 1939-1941 standard is an accomplished fact, well known throughout many segments of industry. It is doubtless the greatest single deterrent to increased war production, if such increase is in truth needed, but more importantly in the viewpoint of many employers, it constitutes the greatest single menace to a high level of competitive postwar business.

Urging an end to the privileged status of unions and their representatives and their exemption from basic laws and principles with which other Americans comply, the motor industry stressed eight cardinal points to be embodied in a new and enlightened national labor policy: 1. Restoration to management of the right and ability to manage, and maintenance of the integrity and efficacy of collective bargaining by clearly and sharply defining which employes are representing management and which represent workers, with complete freedom of each group from control by the other.

2. Protection of employes from coercion on the part of management; protection from coercion by unions; and protection from governmental coercion by providing court review of administrative actions.

3. Imposition of penalties on any union which strikes before it has exhausted the grievance procedure provided in its contract and in governmental procedures; such penalties to take the form of forfeiting the right, for a specified period of time, to governmental consideration of demands.

4. Decentralization of the administration of labor union-management problems from Washington to local areas where administrators have a better understanding of local conditions. This would make autonomous the regional offices of the NLRB and WLB and increase their scope of activity and capacity to be of constructive benefit.

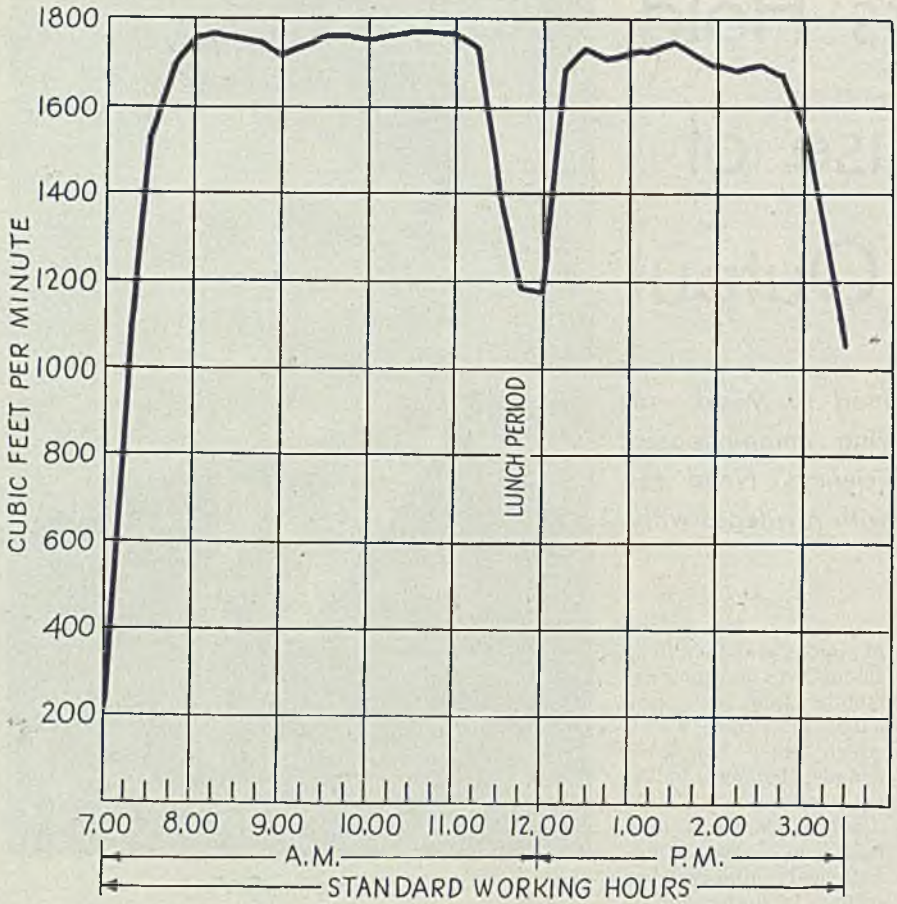
5. Decentralization of collective bargaining responsibilities from international union headquarters into the hands of local unions, thus putting responsibility for stable relationships where it belongs and permitting the working out of agreements on a basis mutually satisfactory to the parties directly covered, i.e. the local union and an individual employer. Executives and staffs of international union offices would provide economic research, reporting, technical, public relations and advisory services to their autonomous union members.

6. Provide separate local unions the same protection against undue concentration of power in international unions as individual companies in the industry

INTIMIDATION

Workers of Company C struck as a result of the discharge of a union employe who pulled a knife on a foreman, grabbed him by the throat and later threatened to hit him with a heavy bolt. The union committee, with a union international representative present, demanded reinstatement of the employe, taking the position that a three-day layoff was sufficient punishment. After agreement that the case should be turned over to an impartial umpire, the union struck anyway for a week. The umpire's decision upheld management's discharge of the offender. The 2000 strikers lost 80,000 man-hours of work on tank and aircraft parts.

AVERAGE PRODUCTION DURING WORKING HOURS FOR JAN., '45



Air compressor load chart, plotted at 15-minute intervals, showing the effects of late starting, early quitting and slack operations before and after lunch period

have in relation to their inter-industry and intra-industry trade organizations. Monopolistic and cartelization practices are just as bad for unions as they are for industries. Likewise the national interest requires that neither union nor management organizations should function in the political field.

7. Encouragement of the incentive pay system where feasible and particularly where it would increase critical production. Merits of the incentive system are clouded both by exaggerated claims and by exaggerated criticism, but the record shows properly designed systems do increase both wages and productivity.

8. Require unions themselves to pay stewards or committeemen or other officials for time spent on union business. The automotive industry figures it spent $7,200,000 in 1944 for wages of union representatives, covering only the time spent on alleged union business.

Such a constructive policy, it is felt, would have the support of most working people who admittedly want to do more and better work and want better discipline, of management, of the public in general, and of labor's true friends in Congress. Opposition could be expected from only two groups—those who have special interests to protect and those who are primarily interested in collectivization or cartelization of American industry and labor.

Barring the development of such a clarified national labor policy, what are the alternatives? As automobile executives see the picture, they are three:

1. Continuation of management-union disagreements as to the management of plants, which will mean more strikes and stoppages and a further wartime lowering of productivity (to say nothing at the moment of the disastrous effects on the normal civilian peacetime economy). Public disclosure of this issue has been made now only because of the progressive deterioration in productivity. Stopgap legislation has been of little help and in some cases has only promoted further strife.

2. Achievement by unions of their objectives in respect to management control. This can be accomplished in two ways; (a) Through the intermediate step of industry-wide collective bargaining which would make it necessary for industry to organize in the same manner that industrial unions are now organized—calling for a single industry agency to be empowered to negotiate wages, hours and working conditions of all its hundreds of members. (England has pursued this course and now organized employers and trade unions there are asking the government to give them jointly the power to fix production and fix prices—a major step toward the corporate state and cartelization). (b) The intermediate step might be avoided by union representation in the management of companies, leading to the interlocking management relationship in industry and eventually to monopolies and fixation of prices and production—trademarks of a tired economy.

3. Strengthening the collective bargaining function of unions by modernizing the national labor policy in the eight directions previously listed. With separate industrial unions bargaining with separate employers, both fully responsible for their acts, a healthy relationship necessary to full productivity and a higher standard of living can be effected.

As stated by Mr. Romney, "Great accomplishments require good organization. Good organization requires order and discipline. Order and discipline depend upon clearly understood and accepted functions, authority and responsibility. The functions, authority and responsibility of management have been diluted and confused. Continued and further division of the management responsibility will increase the magnitude and seriousness of wartime and postwar national problems."

To document his case, the automotive industry spokesman presented for the record a mass of supporting data, including 55 specific examples of flagrant violations of plant discipline, productivity standards and other labor regulations occurring during the past year, most of which led to strikes and lost time.

Stock union claims, based partially on

TOO HOT; TOO COLD

During the summer, employes in the melting department of Company AA knocked out the windows because they wanted more air. After the men were warned to discontinue breaking the windows, the panes were replaced. Employes broke them again. Breakage was repeated several times after replacements were made, and eventually the broken windows were not replaced. In November about 25 men on the day shift in the melting department complained of the cold, and would not continue work unless windows were put in at once. A work order for their replacement was in the process at the time. The men involved left the building and others on the molding line followed them when they had to be sent home for lack of metal. The stoppage continued on the afternoon shift and more employes walked out on the midnight shift. The stoppage involved 559 employes, resulting in a loss of 5298 man-hours.

the government's wage stabilization policy, are that company and industry wage inequalities (in a high-wage industry, too) provide the explanation for reduced individual output. Actually, as Mr. Romney expressed it, the war's greatest wage inequality is "between those dying for us and those living in peace and comfort."

"The next most glaring inequality," he continued, "is the lack of differential in pay between the workers who do an honest day's work and the drones and militant hotheads who are destroying the industry's productivity. Collective bargaining agreements forced on many companies no longer permit the reward of workers on the basis of what they produce, and interfere with the recognition and promotion of workers on the basis of merit and ability."

This leads to consideration of the value of wage incentive plans which despite concerted opposition from the UAW-CIO, have meant increased wages and productivity in the few instances where companies have been able to install them. The case was cited of a parts company which introduced a group incentive plan on July 1, 1942, covering workers producing machine guns. Productivity increased, from 80 per cent below standard, to 113.3 per cent of the standard. The rate held in the 110-115 per cent range until cutbacks in the fall of 1944 reduced output. Tabulation of nine other incentive plans shows, without exception, productivity increases ranging from 15 to 50 per cent.

Chart Shows Loafing

Silent testimony to late starting, early quitting and loafing is given by an accompanying air compressor load chart for an automotive company designated AF. Note how the normal production load is not reached until one hour after starting time, how it drops off precipitately 45 minutes before quitting time, as well as both 15 minutes before and after the lunch period. Thus, out of an 8-hour day, normal production is maintained only about 5¾ hours.

R. J. Thomas, president of the UAW-CIO, speaking before the Temporary National Economic Committee on April 10, 1940, and commenting on the so-called "speed-up," took credit then for having reduced automotive productivity between 5 and 10 per cent. He has been even more successful during wartime. Witness the following:

Three typical automotive foundry departments report declines in productivity from peacetime levels of 49, 49 and 45 per cent, respectively.

A parts company president estimates productivity in his plant only 50 per cent of prewar.

A carburetor company executive advises his plant's union stewards admit efficiency ranges from 40 to 65 per cent of prewar standards.

Another parts executive admits he is

(*Please turn to Page* 196)

Production Per Man Hour Gains Through Wage Incentive Plans

War Production Board's Management Consultant Division reports marked increase of about 40 per cent during first 90 days after institution of plans. Wages increased 15 to 20 per cent while unit labor costs decrease

USE of wage incentive plans in 1944 was marked by an increase in production per man hour of about 40 per cent during the first ninety days after institution of the plans, according to John W. Nickerson, director, War Production Board's Management Consultant Division.

Mr. Nickerson said wages also increased 15 to 20 per cent during the first ninety days that the extra-payment plans were in effect, while the unit labor cost of production decreased 10 to 15 per cent. He said about a million workers were affected by new incentive plans during the past year, and estimated the 40 per cent increase in productivity from new incentives resulted in addition of a rough equivalent of 400,000 persons to the working force.

According to War Labor Board reports, 2628 voluntary cases involving incentive plans were approved by the National and Regional boards in the six-month period from April to September, 1944.

The incentive activities of the Management Consultant Division during 1944 were concentrated largely on the segments of industry which are involved in critical war production. Typical were aircraft, shipbuilding, forge shops and foundries, and radio and radar plants in war production centers.

Forge and Foundry: The division assisted in setting up 144 new wage incentive plans which were concentrated in the most critical foundries and which involved 20,514 employes. Reports on 44 plans have been made available and these indicate an average increase in production per man hour of 35.3 per cent. Of these plans, 29 give figures indicating a decrease in unit labor cost of 10 per cent, and 31 show an increase in earnings of 16.1 per cent.

Shipbuilding: Acting as consultant to the Shipbuilding Commission of the National War Labor Board on matters involving wage incentives, the division prepared forty-two analyses on new plans. Many of the analyses were engineering reports advising how to make questionable plans more effective or to make them conform to wage stabilization policy. This work was done in the last half of the year and few reports on operation have been received.

Radio and Radar: The division participated in 64 cases involving installation of new incentive plans in radio and radar plants. These plans affected 27,200 employes and results reported to the War Labor Board indicated an increase of 51 per cent in production per man hour.

Aircraft: The division gave continuing attention to the aircraft industry during 1944, and the progress of several important plant-wide incentive plans in fighter plants was followed. Joint analyses were made by WPB management and labor consultants for the War Labor Board on 76 new incentive plans.

HOLD DOWN OUTPUT

In a plant operated by Company R, 27 welders on the second shift of one department refused to begin work and left the plant, stating they would not work with one welder who had a better production record than other welders. The next day, 48 welders on the first shift in the same department stopped work for 45 minutes in the morning, demanding the dismissal of this same man. At 2 the same afternoon, 52 welders in the same department stopped work and left the plant because management still refused to remove the man who was accused by them of working too hard. Two days later 27 welders on the second shift in the same department again left the plant for the same reason. Next day 58 welders in the same department stopped work for the fifth time in protest against the employment of this man. Following day 31 welders in the same department, following a vote in the union hall, again refused to work while this man was permitted to continue in the department. After these six demonstrations, in which a total of 1321 man hours was lost on the production of tanks, the workers apparently decided the management could not be intimidated. No further demonstrations were recorded, and the man was continued in the employ of the company.

Steel Earnings Drop Uninterrupted

Wartime slump in net income continued in 1944. First 23 producers to issue financial statements for year indicate earnings off 4.2 per cent from 1943. Industry's net indicated at $200 million compared with $330 million in 1941

IN SHARP contrast with the steady upward trend in output of steel ingots and finished products during the war period, the steel industry's earnings have declined from about $330 million in 1941 to an indicated total of $200 million last year.

During this same period the industry's net sales volume has risen from about $3.8 billion to $6.4 billion; while ingot production has increased from 82.8 million net tons to a new all-time record of 89.6 million tons.

Further rise in operating costs continued throughout 1944, reflecting more overtime payments due to growing labor shortage, revision in shift differential wage rates and vacation pay adjustments, plus continued upturn in raw material costs, and changed production emphasis to less profitable items under WPB allocations. The industry's total payrolls in 1944 reached a new record high of $1,745,019,700.

The first 23 steel producers to issue financial statements for 1944, presented in the table below and representing about 87.5 per cent of the industry's ingot capacity, had an aggregate net profit of $172,093,409 last year. This represents a decline of 4.2 per cent from the 1943 net profit $179,805,279 earned by the same group of companies. In 1942 and 1941 these steel producers reported earnings of $188 million and $278 million, respectively.

Most steel companies' earnings for 1944 are subject to renegotiation and final audit. However, on the basis of 1943 renegotiation results there is expected to be little adjustment in 1944 earnings due to this factor.

Reflecting lower earnings before taxes, the 20 steel producers to report so far estimated federal income tax provisions for 1944 had indicated tax commitment of $312,974,530, or 20.4 per cent less than the $393,721,153 paid out in taxes during 1943. This same group of companies reported aggregate tax liabilities of about $550 million in 1942.

Fourth quarter net profit for 19 steel producers is estimated to have totaled $48,501,325. In most instances final quarter figures had to be estimated from nine months and year-end reports. The profit figure for the final quarter last year was up moderately from the $44,-

Steel Producers' Earnings and Taxes Summarized

	Fourth Quarter		Year		Federal Taxes	
	1944	1943	1944	1943	1944	1943
United States Steel Corp.	$10,985,624	$13,389,673	$60,292,513	$62,631,742	$63,000,000	$84,316,804
Bethlehem Steel Corp.	16,379,398	12,707,797	36,167,723	32,124,592	112,000,000	129,600,000
Republic Steel Corp.‡	3,659,504	3,554,456	10,130,296	12,011,057	31,400,000	39,300,000
Jones & Laughlin Steel Corp.	2,041,634	2,451,647	7,519,668	9,512,228	8,050,000	19,650,000
Youngstown Sheet & Tube Co.‡	2,691,768	1,534,209	7,944,922	8,037,442	11,375,000	18,400,000
National Steel Corp.	2,670,396	3,279,885	10,751,369	11,698,362	17,200,000	26,350,000
Inland Steel Co.‡	2,578,486	2,063,133	10,249,395	10,801,564	17,560,000	19,325,000
Wheeling Steel Corp.‡	1,240,341	1,205,680	4,384,791	4,339,246	.....	.....
American Rolling Mill Co.‡	1,707,159	693,669	5,065,000	6,098,074	.....	.....
Crucible Steel Co. of America‡	588,169	55,734°	3,926,893	4,949,696	18,221,531	18,585,895
Colorado Fuel & Iron Corp.	611,710	446,705	1,672,061†°	1,351,529†°	1,651,820†°	1,266,000†°
Lukens Steel Co.	36,774	115,586	682,957§	1,317,281§	440,000§	4,693,649§
Sharon Steel Corp.‡	595,190	318,312°	1,070,323	891,035	2,250,000	3,863,000
Alan Wood Steel Co.‡	475,554	268,295	136,991	699,230	None§§	262,808
Midvale Co.	.....	.....	1,832,647	2,475,843	9,496,000°°	5,746,881°°
Allegheny Ludlum Steel Corp.‡	1,016,240	1,042,926	3,607,814	3,932,898	9,950,000	11,082,880
Continental Steel Corp.‡	64,759	280,992	508,661	762,610	350,000	414,000
Laclede Steel Co.	.....	.....	318,966	46,023	312,000	61,088
Keystone Steel & Wire Co.	481,003	490,568	1,528,034	1,361,932	2,998,078	1,493,126
Wickwire Spencer Steel Co.	.....	.....	1,536,991	1,516,613	.....	.....
A. M. Byers Co.	240,800	779,400	888,170††	1,004,525††	1,720,000††	2,000,129††
Rustless Iron & Steel Corp.‡	436,816	372,221	1,831,780	2,236,492	4,757,000	7,306,393
Barium Steel Corp.	.....	.....	45,444	5,265	243,101°°	3,500
Totals	$48,501,325	$44,302,796	$172,093,409	$179,805,279	$312,974,530	$393,721,153
FINISHING CAPACITY ONLY						
Acme Steel Co.	556,274	578,874	1,909,663	1,994,646	5,870,665	5,636,428
Eastern Stainless Steel Corp.	.....	.....	131,798	254,623	.....	.....
PIG IRON CAPACITY ONLY						
Sloss-Sheffield Steel & Iron Co.‡	166,853	79,755	668,142	727,831	255,000	365,860
Interlake Iron Corp.‡	434,161	447,679	1,034,000	1,064,784	.....	.....
Woodward Iron Co.‡	251,159	163,656	843,767	1,008,472	287,717	935,711
Struthers Iron & Steel Co.	.....	.....	156,505°	8,776	None	40,000

‡Fourth quarter figures estimated, based on nine months and year-end reports. §For period ended Oct. 7. †°For period ended June 30. ††For period ended Sept. 30. °°Includes provision for renegotiation of war contracts. °Loss. §§Company had credit of $71,000 after providing for postwar refund of excess profits tax.

302,796 earned by the same group in the corresponding 1943 period, but fell below the $54.5 million reported in the like 1942 quarter.

Earnings of those companies having steel finishing capacity only, and also pig iron producers' profits followed the general pattern established by steel ingot producing interests in 1944. Aggregate net profits of these two groups also were below the 1942 showing, with tax provisions reduced accordingly.

Rotary Electric Stock Not Held by Atlas Corp.

Holdings of the Atlas Corp. in the Rotary Electric Steel Co., Detroit, which represented approximately 99 per cent, were sold last July to W. E. Hutton & Co., New York, and in turn have been sold to the public, there now being about 800 stockholders. In STEEL, page 81, March 12 issue, it was erroneously stated that Atlas Corp. owned a sizable interest in Rotary Electric.

Plans Rushed for Opening Lake Navigation Season on April 1

Manpower shortage presents threat to maximum vessel operation during 1945 season but operators are confident schedules will be met. Ore movement set at 83 million gross tons. Lower lake stocks equal to two months' consumption

DESPITE manpower difficulties, Great Lakes vessel operators are confident they will be able to maintain 1945 iron ore shipping schedules as preparations are rushed for the opening of lake navigation April 1.

Tentative goals established for the movement of bulk freight on the Great Lakes in the 1945 season are: Iron ore, 83 million gross tons compared with 81.5 million shipped in 1944; bituminous coal, 60 million net tons, unchanged from the 1943 movement; limestone, 17 million net tons, unchanged from last year's shipments; and 340 million bushels of grain, against 290 million in 1944.

Greatest concern of the lake vessel operators as the opening of the shipping season approached concerned manpower, chiefly licensed officers. To some extent, however, this concern was eased last week by assurances from Selective Service and manpower authorities that all licensed vessel men will be granted military deferments.

Critical shortage of semi-skilled seamen, however, is threatened.

To crew the 400 ships of the companies in the Lake Vessel Committee, there are required 14,000 men, of whom 3700 are licensed officers, 6800 skilled seamen and 3500 unskilled. Seamen within the ages of 18 to 37 total 6550.

With the aid of the Coast Guard's new ice breaker MACKINAW and other similar equipment, it is believed the bulk of the 312 vessels in the American Great Lakes ore fleet will be able to open the 1945 navigation season on schedule. Weather conditions have been favorable in recent weeks. Last year the first vessel locked through the Soo on April 10, and in 1943 on April 19. The latest opening of the iron ore season in recent years occurred April 29, 1938, while earliest was March 23, 1942.

Lake Superior iron ore stocks at lower lake ports and furnaces April 1 are expected to total around 17.5 million gross tons, or equivalent to 2.5 months supply at the current consumption rate. On April 1, 1944 and 1943 ore stocks amounted to 21.3 million and 25.1 million tons, respectively.

Present, Past and Pending

■ NEW SCRAP COLLECTION DRIVE IS URGED

WASHINGTON—The Iron and Steel Scrap Advisory Committee met last week and recommended to WPB that it institute a new scrap drive throughout the country.

■ SLOWDOWN CAUSES LOSS OF 20,200 TONS PLATES, SHEETS

CHICAGO—In a three-day slowdown on the pickling line of Carnegie-Illinois Steel Corp. sheet and tin mill at Gary, Ind., 56 men have been laid off for insubordination and 500 others made idle. Production loss has been 20,200 tons of plates and sheets. Slowdown resulted from inauguration of an incentive plan approved by War Production Board but rejected by the union.

■ MERCHANT SHIP PROGRAM TO BE NEARLY COMPLETED IN '45

WASHINGTON—Vice Admiral Vickery of the Maritime Commission last week disclosed that the merchant shipbuilding program will be virtually completed by the end of the year and the 521,000 persons now employed in commission yards will be transferred to other war jobs.

■ BRAZIL TO BUY 1000 LOCOMOTIVES, 20,000 CARS

RIO DE JANEIRO—Brazil plans to acquire a minimum of 1000 locomotives and 20,000 freight cars in the next five years, according to the Minister of Transportation.

■ PHILADELPHIA LABOR "DRAFT" PLAN EFFECTED

PHILADELPHIA—War Manpower Commission has launched a program for transferring 10,921 men from less essential industry to highly critical war work. The program is somewhat similar to the Allentown, Pa., plan.

■ NATIONAL TUBE STARTS SECRET PROJECT AT McKEESPORT

PITTSBURGH—National Tube Co. will import more than 100 skilled workers to its McKeesport works for a special secret government project. Permission has been asked of the city council to erect barracks to house the men.

■ CANMAKERS STEEL ALLOCATIONS TO BE LIMITED

WASHINGTON—Second quarter allocations of steel for the can manufacturing industry will be considerably less than requested. WPB Requirements Committee has allocated 591,500 tons of prime material and 15,000 tons of rejects to the industry; more than 700,000 tons of prime material had been requested.

■ IRON ORE PRICES FOR 1945 STILL UNDETERMINED

WASHINGTON—Iron ore prices heretofore in effect will apply on 1944 shipments it was stated in official circles here last week. Prices on iron ore to be moved in the 1945 season, however, remain to be determined.

Industry, Labor Members Clash on Wage Policy

Clashing opinions on the recommendation of the public members of the War Labor Board against changing the Little Steel wage formula have been filed with the President by the industry and labor members of the board.

The industry group held that not only must the formula be retained but that "fringe" issues must be brought under control.

CIO members of the board argued that increases in basic wage rates are necessary now to guard against deflation.

AFL members in an earlier opinion had asked for a flat 11 per cent increase.

Crile Program Conditioned to Need

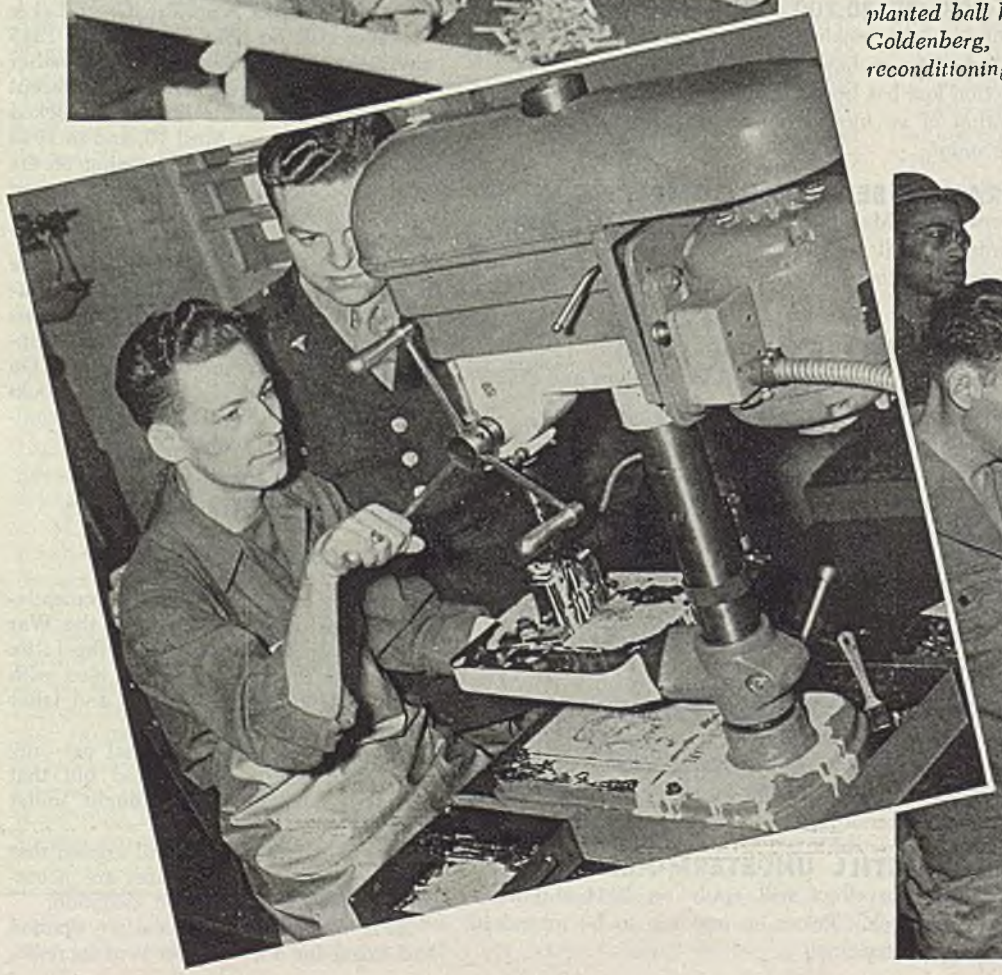
Rehabilitation project, co-sponsored by industry and government, provides for adjustments in machinery to give most beneficial exercise to patients. Production speed ignored as primary aim is restoring veterans to health

By VANCE BELL
Assistant Editor, STEEL

REBUILDING battle-scarred bodies is the cardinal objective of the veterans rehabilitation program at Crile General hospital, Cleveland, outlined in STEEL last week. The project, co-sponsored by the government and private industry, aims to restore wounded servicemen to health by medical treatment and occupational therapy which permits the patients to do

A bedridden patient, upper left photo, pauses from work of assembling nuts on bolts to receive from Supervisor H. William Mordell a pay check from Lamson & Sessions Co. Photo by Howard Meserve

To aid patients in operating the drill press, lower left photo, right angle handles have supplanted ball knob grips on the feed. Capt. Max Goldenberg, chief of Crile General hospital's reconditioning service, looks on. Photo by Howard Meserve



# of Wounded

light war production jobs while healing.

That the paramount objective—rehabilitation—may be attained, the supervision, machinery and equipment, and working conditions are conditioned to best fit the needs of the veterans. Dual controls have been installed on machinery to give the operator exercise where most needed. One of the supervisors, employed by a private company, is an honorably discharged marine who saw service in the South Pacific and who understands the problems of the wounded men. Working hours are limited to what the patients can stand. If the patients are unable to go to the work, the work is taken to them. Production speed is ignored in the interest of the program's primary aim. The patient-workers are assigned only to those tasks which will give them the type of exercise needed. Often the patient will not be able to attain the production on the assigned job that he could on some other type of work, but it is the exercise he needs that determines what he does.

Lamson & Sessions Co., the first company to co-operate in the program, installed a number of light machines in the hospital's "war plant." These included six nutting machines (all of which assemble bolts and nuts), one bolt pointer, two bolt countersinking machines, two upright drilling machines, two reamers, a bench lathe for machining aircraft bolts, and die filing equipment. Each of these provides a certain type of exercise needed by the patients. Five of the nutters provide the operator with exercise for foot and leg and hand and arm. Use of a table spinner nutter provides exercise for the fingers. The bolt pointer and bolt countersinking machines require use of the legs, while the drilling machines provide arm exercise and the reamers and die filing equipment exercise hands and arms.

Adjustments have been made on some machines to lighten the pressure necessary to operate foot pedals to facilitate their use by the patients. A bolt pointing machine which originally had a right foot pedal now is equipped also with a left foot pedal so that a patient who should exercise his left leg can do so. Ball knobs that were original equipment on the feed levers of a drilling machine have been replaced with special right angle handles to enable a patient who needs arm exercise, but who can not grasp ball knobs readily, to catch hold of and operate the feed. In installing two motor-driven reamers, one was positioned to enable patients to use their right hands and the other for a left-hand operation.

Demonstration of a nutting machine is given servicemen in Crile hospital's "war plant" by Supervisor George Dennerle of Lamson & Sessions Co. Photo by Howard Meserve

Ward work for patients unable to work in the shop includes sorting, gaging and inspecting for Lamson & Sessions. Reliance Electric & Engineering Co., which recently has entered the program, will provide wire bending work for ward patients.

Supervision of the worker-patients at Crile has been carefully arranged to preserve harmony between the two phases of the program—the medical and therapeutic treatment and the war production work. Army officials at the institution purposely do little supervising in the shop work. The hospital officials want the patients to experience a shop atmosphere and to forget as far as possible hospital and Army life. It is this mental conditioning that Capt. Max Goldenberg, chief of the hospital's reconditioning service, believes is a distinct aid in helping patients recover through occupational therapy. In fact, the mental conditioning attained through working in a shop atmosphere doing vital work for an assured financial income is what differentiates Crile "war plant" occupational therapy from ordinary physical therapy.

Civilians Are Supervisors

Supervision in the Crile workshop is in charge of civilians. The supervisor is George Dennerle, employed by the Lamson & Sessions Co. for over 50 years at the time of his retirement five years before Pearl Harbor. He felt it his duty at that time, in view of his good physical condition, to go back into industry and aid the war effort in every way possible. Mr. Dennerle's long experience in handling men and his philosophy on life fit him ideally to take over the job of supervising injured veterans and aid them on their way back to normal life.

H. William Mordell, 24-year old honorably discharged marine, employed by Lamson & Sessions, has been acting as supervisor in charge of gage inspection and other work done by patients unable to work in the shop.

To make the atmosphere as shop-like as possible, Army rank is ignored. A man is addressed by name, not by rank; and a commissioned officer may be working under the direction of a noncom.

Adding realism to the shop atmosphere (and this surely must do it) is the deduction of withholding tax and social security tax from the boys' pay checks.

Adding further to the shop atmosphere is the straightforward manner with which the patients are treated; they are permitted to "stand on their own feet." Every effort is made to avoid extending sympathy which would make them more conscious of their disabilities. This policy on the part of supervisors is making the patients more self-confident and self-reliant.

This is the second of three articles on the veterans rehabilitation program at Crile General hospital; the first appeared in the March 12 issue. p. 73; the third will appear in the March 26 issue.

Curb Placed on Directives in Ordering Steel

Will be used only for immediate emergencies, WPB rules in move to restore order to mill scheduling

PLANS to stop the excessive use of steel mill directives were outlined by War Production Board officials to the Steel Products Industry Advisory Committee at a recent meeting. At the same time the committee was informed of an estimated $1 billion replacement demand for liquid-cooled internal combustion engines and parts added to the mushrooming demand for rockets and shells.

While it is agreed that the resurgent steel demands since the first of the year required heavy use of directives to assure early deliveries, it was pointed out many claimant agencies have used directives excessively, with the steel mills accentuating the situation in many cases by insisting on directives.

Under the new rules directives will be used only to remedy immediate emergencies and to place orders or anchor advance orders in mill schedules, as outlined in the Steel Division's instructions to the mills on March 1, 1945.

As an alternative to directive action the steel mills were advised to refer claimant agencies to the Steel Division, recognized as the only source of complete information on the overall picture.

J. A. Krug, director of WPB, last week in a communication to steel producers said the WPB, the War Manpower Commission and procurement agencies are enlisting every possible effort to increase output of steel. He said where manpower shortages are impairing output such shortages will be eliminated. However, in order to make the best use of the manpower now available to the steel plants he said it is imperative to use all the workers now employed on as long a work week as it is possible to persuade them to undertake. He urged the steelmakers to make arrangements with their employes to work the maximum number of hours each week that can be mutually agreeable in order that no ton of steel is lacking for war production.

Heavy Steel Shipments in January Reflect War Needs

Steel shipments in January, as reported by the American Iron and Steel Institute, totaled 5,435,647 net tons, compared with 5,458,133 tons in December.

While total shipments were lower in January, various steel products in greatest need for the war program showed gains. Plate shipments were 787,846 tons in January; 864,807 in December. Steel not converted into plates apparently was supplied to mills turning out more needed products. Thus hot-rolled bar shipments in January were 802,070 tons against 797,684 tons in December; drawn wire 184,368 tons against 179,781 tons; hot-dipped tin plate 179,433 tons against 172,844 tons; hot-rolled sheets 539,675 tons against 508,791 tons; cold-rolled sheets 196,039 tons against 194,157 tons; galvanized sheets 138,830 tons against 129,108 tons; hot-rolled strip 138,221 tons against 130,511 tons; cold-rolled strip 109,309 tons against 103,253 tons.

In addition to the smaller shipments of plates, heavy structurals declined from 302,462 tons in December to 258,786 tons in January; standard rails from 195,200 tons to 184,324 tons; reinforcing bars from 67,455 tons to 62,845 tons.

Corporation Shipments Off

Shipments of finished steel by the United States Steel Corp. in February totaled 1,562,488 net tons, decrease of 6627 tons from January shipments of 1,569,115 tons and a decline of 193,284 tons from the total of February, 1944. For two months this year shipments were 3,131,603 tons, compared with 3,486,559 tons in the comparable period last year the Steel corporation's report shows.

February Ingot Output Lower But Rate Gains

Production drops below that of last year as a result of manpower shortage, weather, and fewer days in month

CALCULATED weekly production of steel ingots during February was back almost to the December level after the January drop but total output for the month was about 500,000 tons lower than in January, according to the American Iron and Steel Institute, New York. Fewer working days in February, manpower difficulties and storms interfering with transportation were factors in this loss.

February production was 6,657,703 net tons, against a revised total of 7,204,303 tons in January and 7,188,317 tons in February, 1944. Operations averaged 90.9 per cent of capacity in February, compared with 88.8 per cent in January and 96.9 per cent in February, 1944. Calculated weekly production in February was 1,664,426 tons, against 1,626,253 tons in January and 1,736,308 tons in February, last year.

STEEL INGOT PRODUCTION STATISTICS

	Estimated Production—All Companies								Calculated weekly production, all companies Net tons	Number of weeks in mo.
	Open Hearth		Bessemer		Electric		Total			
	Net tons	Per cent of capac.	Net tons	Per cent of capac.	Net tons	Per cent of capac.	Net tons	Per cent of capac.		
Based on reports by companies which in 1943 made 98.3% of the open hearth, 100% of the bessemer and 87.9% of the electric ingot and steel for castings production										
1945										
Jan.	6,468,814	90.5	379,062	76.0	356,427	76.8	7,204,303	88.8	1,626,253	4.13
Feb.	5,966,501	92.4	347,202	77.0	344,000	82.2	6,657,703	90.9	1,664,426	4.00
1944										
Jan.	6,769,438	97.2	439,551	85.4	377,751	83.3	7,586,740	95.6	1,712,582	4.43
Feb.	6,409,981	98.4	409,781	85.2	368,555	87.0	7,188,317	96.9	1,736,308	4.14
March	6,976,450	100.1	455,368	88.5	388,408	85.7	7,820,226	98.5	1,765,288	4.43
1st qtr.	20,155,869	98.6	1,304,700	86.4	1,134,714	85.3	22,595,283	97.0	1,738,099	13.00
April	6,788,433	100.6	437,472	87.8	362,118	82.5	7,588,023	98.7	1,768,770	4.29
May	6,878,251	98.7	437,444	85.0	380,960	84.0	7,696,655	97.0	1,737,394	4.43
June	6,462,108	95.8	419,699	84.2	347,028	79.0	7,228,835	94.1	1,685,043	4.29
2nd qtr.	20,128,792	98.4	1,294,615	85.6	1,090,106	81.9	22,513,513	96.6	1,730,478	13.01
1st hlf.	40,284,661	98.5	2,599,315	86.0	2,224,820	83.6	45,108,796	96.8	1,734,287	26.01
July	6,742,830	96.5	415,543	80.9	334,710	73.7	7,493,083	94.2	1,695,268	4.42
Aug.	6,714,857	95.9	429,672	83.5	348,901	76.6	7,493,430	94.0	1,691,519	4.43
Sept.	6,500,997	96.1	398,058	80.0	330,837	75.2	7,229,892	93.9	1,689,227	4.28
3rd qtr.	19,958,684	96.2	1,243,273	81.5	1,014,448	75.2	22,216,405	94.1	1,692,034	13.13
9 mos.	60,243,345	97.7	3,842,588	84.5	3,239,268	80.8	67,325,201	95.9	1,720,112	39.14
Oct.	6,859,922	98.0	420,105	81.6	335,526	73.7	7,615,553	95.6	1,719,086	4.43
Nov.	6,571,497	96.9	403,908	81.0	298,503	67.7	7,273,908	94.3	1,691,966	4.29
Dec.	6,677,488	95.6	373,323	72.7	310,380	68.3	7,361,191	92.6	1,665,428	4.42
4th qtr.	20,108,907	96.9	1,197,336	78.4	944,409	69.9	22,250,652	94.1	1,693,353	13.14
2nd hlf.	40,067,591	96.5	2,440,609	80.0	1,958,857	72.6	44,467,057	94.1	1,692,693	26.27
Total	80,352,252	97.5	5,039,924	83.0	4,183,677	78.0	89,575,853	95.4	1,713,387	52.28

The percentages of capacity for 1944 are calculated on weekly capacities of 1,572,755 net tons open hearth, 116,182 net tons bessemer and 102,350 net tons electric ingots and steel for castings, total 1,791,287 net tons; based on annual capacities as of Jan. 1, 1944 as follows: Open hearth 82,223,610 net tons, bessemer 6,074,000 net tons, electric 5,350,880 net tons. Beginning July 1, 1944, the percentages of capacity operated are calculated on weekly capacities of 1,580,042 net tons open hearth, 116,182 net tons bessemer and 102,757 net tons electric ingots and steel for castings, total 1,798,981 net tons; based on annual capacities as follows: Open hearth 82,604,600 net tons, bessemer 6,074,000 net tons, electric 5,372,150 net tons.

For 1945 percentages are calculated on weekly capacities of 1,614,338 net tons of open hearth, 112,658 tons of bessemer and 104,640 tons of electric ingots and steel for castings, total 1,831,636 tons; based on annual capacities as of Jan. 1, 1945 as follows: Open hearth 84,171,590 net tons, bessemer 5,874,000 tons, electric 5,455,890 tons.

San Francisco Schedules Congress To Map Pacific Basin Development

Engineering, shipping, banking, machinery and trade associations asked to hold 1946 conventions on West Coast and devote programs to consideration of proposed projects for western Americas and Orient

A POSTWAR congress of trade, engineering, industry and finance for the development of lands of the Pacific basin is being planned by the San Francisco Convention and Tourist Bureau, to be held in San Francisco in 1946.

About two dozen national engineering, banking, machinery, trade and shipping associations are being asked to participate by holding their annual conventions in San Francisco. They also are being asked to devote their convention programs to hearing specific proposed projects for both sides of the Pacific.

Typical of the invitation letters is the one sent to the American Society of Refrigerating Engineers Jan. 22. This letter said the society would be expected "to feature on its program Australian, Chinese, Philippine, East Indian and perhaps Central and South American speakers, each to propose a specific refrigeration need of his particular city, province, country or company."

Already two organizations, the American Society of Mechanical Engineers' and the American Society of Metals, have accepted the invitation.

Three other associations, the American Foundrymen's Association, the American Road Builders Association and the American Society of Civil Engineers, have named members to the congress' exploratory committee.

Others receiving invitations include the American Bankers Association, American Chemical Society, National Foreign Trade Association and Propeller Clubs of the U. S.

The congress, its sponsors hope, will allow American businessmen to examine Oriental and other projects, engineering problems and financial possibilities without investing in costly exploration or leaving this country. To obtain authorized information, the San Francisco convention bureau is suggesting to the State and Commerce departments that missions representative of the participating associations be sent out in advance of the congress year to Pacific basin countries to seek projects and speakers to present them at the meetings in San Francisco.

Portland Firm To Build Aluminum Bridge Pontoons

Oregon Shipbuilding Co., Portland, will soon begin construction of a large number of half pontoons for the Army's new M-4 aluminum floating bridges under a $12 million contract. Col. Ralph A. Tudor, U. S. engineer, Portland, says this material is capable of faster construction, is lighter and can be fabricated to wider dimensions so as to carry increased loads. Capacity is a 50-ton vehicular load in a current as swift as 10 feet a second. The three major parts of aluminum are the hollow deck balk, removable gunwales and half pontoons. The half ponts are 30 feet long and weigh 1700 pounds each. They are locked stern to stern with connector pins to form a complete bridge. The hollow deck balk, replacing both stringers and chess flooring in the older type wooden deck bridges, is an innovation in bridge engineering. The balks are each 15 feet long, 9 x 9 inches in cross section and 215 pounds in weight. A single balk can easily be carried by four men.

36 New Factories Started In Los Angeles This Year

Thirty-six new manufacturing enterprises were launched in Los Angeles county during January and February, according to the Los Angeles Chamber of Commerce.

Capital invested in the new enterprises and in expansions to existing enterprises during the first two months this year totaled $5,498,000, a sharp decrease from the $17,525,000 invested in the same months in 1944.

The lower capital investment in industrial expansion this year includes a trend that started in mid-1944. Analysts believe it indicates a return to the prewar pattern of a larger number of small enterprises, as contrasted to the small number of larger enterprises of the war era.

POSTWAR PREVIEWS

LABOR PRODUCTIVITY— Need for modern revised national labor policy indicated by testimony before Mead War Investigating Committee, indicating automotive industry is producing only 60-70 per cent of its potential due to decline in man-effort. See pages 77, 93.

REHABILITATING SERVICEMEN— Co-operative project undertaken by industry and government at Cleveland hospital rebuilding wounded veterans. See page 82.

WEST COAST— Development of markets in Pacific basin to be aim of San Francisco conventions in 1946. See page 85.

LIGHT METALS— Senate Small Business Committee hearings explore postwar future of aluminum and magnesium; study disposition of government-owned plants. See page 86.

PLANNING— Jobs for all who want to work is aim of Committee for Economic Development plan in Cincinnati area. See page 99.

AIRCRAFT— Public policy will be important factor in determining postwar plane production and aircraft industry's consumption of light metals, Senate group told. See page 100.

LIGHT-GAGE STEEL— Experience in World War II with large-scale building, using light steel sections, indicates this type of construction will encounter wide usage after the war. See page 108.

LUBRICATION IN DEEP DRAWING— Considerable part of the mystery surrounding what happens in lubricating steel during drawing and forming on presses now has been lifted. Comprehensive data now available very likely will result in wider use in the future. See page 112.

COPPER BRAZING— Assembly of parts into finished products by copper brazing in a continuous controlled atmosphere furnace has reduced fabricating costs, speeded production and turned out a better product in a regular production line operation. Simultaneous hardening and brazing affords important short-cut in assembly. Many advantages of this technique point to widespread postwar installations. See page 114.

Cost To Be Determining Factor in Postwar Consumption of Light Metal

Recommendations for disposition of government-owned plants advanced by producers. Transportation equipment manufacturers say more aluminum and magnesium will be used if prices can be lowered

USE of light metals in the transportation and other fields will increase during the postwar years, but the extent of such increase will depend largely on the cost of such metals in relation to iron and steel. This was the consensus of witnesses representing consuming industries before the Senate Small Business Committee during its current study of light metals.

Representatives of the light metal producing industries appeared before the committee with recommendations for the disposition of government-owned plants. Scientific surveys to determine how these plants could best supply the metals needed in the postwar economy and bolster employment were urged.

Dr. Willard H. Dow, president, Dow Chemical Co., Midland, Mich., when asked for recommendations on the liquidation of the government-owned plants, suggested:

"The national interest demands that the facilities be liquidated in such fashion as to give the greatest possible return to the taxpayers consistent with the long-range promotion of what is now an infant industry. It is unthinkable that the facilities be simply scrapped and sold, for the salvage would be trifling. It is equally unthinkable that the producing and fabricating facilities should be owned and run by the government. If private industry could find customers for magnesium, it could buy these facilities and run them at a profit, and that would benefit everyone. The only thing that government management can do which private management cannot do is to keep on producing without customers and at the expense of the taxpayers. That would eventually get around to devising ways of destroying magnesium as fast as it was produced."

Dr. Dow recommended magnesium producing plants be surveyed by the Army and Navy in collaboration with the National Academy of Sciences and the National Research Council "to the end of setting aside and keeping in a standby condition such plants as would be necessary to provide an ample supply of magnesium for purely munitions purposes in the event of war. We would guess that an ample war requirement capacity would run somewhere between 200 million and 300 million pounds and, of course, the plants so set aside would be selected for strategic as well as for economic reasons. Provision could be made for these plants to be leased to private industry on proper terms in the event that the demand for magnesium grew to such proportions that private industry wanted them.

"We suggest further that these scientific bodies survey the remaining plants and put values on them and that these remaining plants be then put up for lease or for sale upon terms to promote the industry. We do not care to make any specific suggestion as to terms because we have no adequate data on the efficiency of plants other than those we manage, and also because the conditions at the time will govern the terms."

"Keep Fabricators in Business"

Fabricating plants and the government-owned machinery in private plants, he recommended, should be disposed of in the same manner. "We think the rule should be to keep as many fabricators in business as want to stay in business, for without fabricators the producing plants will be useless." Dr. Dow suggested that much of the magnesium in the existing stockpile be set aside as insurance against future emergencies; sale of this entire stockpile, he said, would kill all private production for several years and at the same time would kill all technological progress.

Dow officials believe the country will use about 63 million pounds of magnesium annually by the fifth year after the close of the war. This figure, he warned the committee, was not submitted as an estimate; it was merely a guess. "We are planning on the basis of what I call a reasoned guess," he said. The breakdown follows:

	Pounds
Aircraft and airborne	28,000,000
Textile	6,000,000
Manually handled equipment	5,000,000
Oil field industry	5,000,000
Automobile (die castings)	5,000,000
Buses, trucks, trailers	2,000,000
Printing industry	1,000,000
Other automatic machinery	1,000,000
Consumer goods (die castings)	5,000,000
Alloying with aluminum	3,000,000
Chemical and deoxidizer	2,000,000
Total	63,000,000

DR. WILLARD H. DOW

Dow does not regard magnesium merely as a metal that will win its place in the sun by forcing out other metals, said Dr. Dow. "For each use," he said, "there is one best metal and, where magnesium is the best, it will take up what has been waste and thereby create opportunities in other fields.

"For instance, we have for the past five years been working with magnesium in the cathodic protection of steel in contact with earth or water. Corrosion under these circumstances is an electrical phenomenon. If we can divert the electrical action from the article to be protected to what is called an anode, the corrosion will be diverted to the anode. It has been developed that magnesium has advantages over all other known materials as an anode and that may mean an immense market for magnesium—it would take 60 million pounds a year to protect only the pipe lines. An unprotected pipeline will last three to five years before leaks begin to develop and when the repairs become too heavy the line has to be replaced. With cathodic protection the pipeline will last indefinitely.

New Market Would Open Up

"In an operation of that sort everyone benefits by the elementary process of stopping waste—the cutting down of repairs and the lengthening of the life of the pipeline make the transport of oil cheaper, cheaper pipelines mean more pipelines and hence more steel and more employment, and last, but not least, a new market is opened up for magnesium and probably for scrap magnesium, which is now something of a problem."

Dow has been able, said Dr. Dow, to reduce the price of magnesium ingots from $5 a pound in 1916 to 20½ cents at the present time. Production costs should decrease as much as 5 per cent a year for five years after the war, and eventually magnesium should sell as cheaply as aluminum by weight and much more cheaply by volume.

Dr. Dow vigorously defended the position of his company in fabricating magnesium products as well as producing the primary metal. "If we had stayed only in the producing field," he said, "there would be no use of the metal today. In the early days we tried to interest foundries and other shops but they showed little interest in magnesium."

Dr. Dow presented to committee members copies of a book specially prepared

The Strangers

It happened in France the other day. One of the bitterest ironies of our age of war . . . An American soldier— whose father had died in Flanders' fields without ever having seen his infant son — gave his life for the future of an infant son he in turn had never seen.

Three generations of strangers . . . and now what of the third generation? Will this child, too, grow up to inherit all the old lies, the mistakes, the weaknesses that go to make up war? What is it that his father and his father's father died for?

Already, we're dusting off the solemn aphorisms about not having died in vain, and we'll build a bright new marble cenotaph to his unknown father. But it isn't enough. Brother, it isn't enough!

We will emerge from this war the most powerful nation on earth. Our Navy and our Air Forces will be twice the size of all others combined — our manufacturing productivity will equal half the world's total capacity. If we can't enforce peace with that kind of club — and if we can't make jobs building houses for our sons to live in as well as by building tanks for them to die in — then God help us!

Today, the engineers of the basic machine tool producers stand ready to help the men of government and of industry to plan *now* for reconversion to a strong and prosperous America.

One of these is a Bryant man. We urge you to call him in today, for time is running out!

BRYANT CHUCKING GRINDER COMPANY SPRINGFIELD VERMONT, U.S.A.

for presentation at the hearings. Entitled "35 Opportunities for Small Business with Magnesium," it described 35 magnesium products whose manufacture would require capital investment ranging from $5000 to $50,000. Included were truck bodies, garden tools, trailers, skis, die castings, portable conveyors, dock boards and portable platforms, portable boats, sand castings, dollies, wheelbarrows, camping equipment, bicycles, griddles and steak platters, air express shipping containers, film handling containers, lawn chairs, baggage trucks, portable dishwashers, ladders, awning frames, pruning shears, baby carriages, tennis rackets, tool handles, inside hardware, mangles, model building kits, baby cribs, portable clothes driers, toys, novelty items, lawn mowers, and hand trucks.

Testimony of J. P. Margeson Jr., vice president, International Minerals & Chemical Corp., Chicago, was featured by questioning on the part of Sen. Claude Pepper (Dem., Fla.) as to what the government should do about magnesium plants which were not taken over by private industry but whose product was needed for the public interest.

Mr. Margeson explained why his company is not interested in acquiring the Defense Plant Corp. plant it operated at Austin, Tex., until it was shut down on Oct. 31, 1944, because of the accumulation of excess stocks of the metal. Not only will there be insufficient markets to absorb the full magnesium production after the war, said Mr. Margeson, but competitors are in a much more favorable position to look forward to doing business in the postwar period. Dow Chemical Co., for example, has lower raw material assembly costs, and lower power costs than is possible at Austin. In addition, he said, Dow has "know-how" which his company cannot hope to develop, and Dow also has large fabricating capacity which his company cannot duplicate.

Believes Risk Is Not Warranted

"It would require $10,000,000 to $12,000,000 capital to operate the Austin plant," said Mr. Margeson, "and we cannot take that risk under the circumstances."

Senator Pepper suggested that a good many companies might feel the same way about acquiring government plants. He wanted to know what the government could do to help in these cases where the product of these plants would be needed to provide employment and elevate the scale of living. Should the government help with a subsidy to enable small companies to compete with big companies? Should the government itself undertake the operation of these plants after they are declared surplus?

"Our company would not accept a subsidy from the government," responded Mr. Margeson. "We think the only companies that should be in the magnesium producing business are those companies who are able to produce at a cost lower than the market price."

C. C. Loomis, president, New England Lime Co., Canaan, Conn., submitted some interesting testimony about the Pidgeon process which, he said, "was something of an afterthought in the war expansion of magnesium production." It still is a question whether this process can survive in competition with the electrolytic process; "there have been no funds and little time for research and development work on the process, and there has been little chance to develop by-products or side lines."

But the Pidgeon process has certain advantages which merit serious thought, said Mr. Loomis. The only raw materials required are sand, scrap iron or iron ore, coke and dolomite lime; the only sizable power requirement is around five kilowatt hours per pound of ferrosilicon used. Chief requirements after raw materials are fuel and labor. "No other metal has such cheap or widespread ore as is required for producing magnesium by this process;" this is of importance to future military security since the process can be placed in operation at many widely scattered points. A peacetime consideration is that the process can be set up in small units, avoiding centralization in big industrial centers; also the operation is flexible in that furnace units can be started or stopped with little time loss and at low cost.

A distinct advantage is that the product produces metal of exceptional purity, an angle that may prove of importance in finished magnesium products in the future. It also produced metal in crystal form, suggesting uses in process industries or in powder metallurgy. To encourage use of the Pidgeon process, said Mr. Loomis, ferrosilicon should be available at lower than the existing price, and some further technological improvements should be made in it; there is already sufficient knowledge, as a result of operating experience, on which to work out such improvements, he said.

Faltering and delay in disposing of surplus plants were assailed by Henry J. Kaiser Co. Inc.

"One manufacturer has been dickering four months for one of these plants with no termination in sight. Another manufacturer told me he felt it is no use to try to buy a plant, as it would take 20 years to make a deal.

"You can't blame the surplus property administrator for this condition," said Mr. Kaiser, "because the Surplus Property act needs simplification. In one place the act lays emphasis on employment and in another place on recovering the high dollar. Congress should declare a policy, with the emphasis on quick action.

"Surplus plants should be disposed of now," said Mr. Kaiser, "so that the buyers can make plans to put them to work as soon as they are declared surplus."

The sole criterion on which the government should base its price in disposing of a surplus plant, Mr. Kaiser believed was the degree of assurance as to the

DOWN PAYMENT: Check for $40 million as an installment on outstanding billings was paid to Leo T. Crowley, foreign economic administrator, by Christian Valensi, representing the French provisional government, recently. The check was a partial payment for shipments of materials to French North and East Africa during the last two years

amount of employment the buyer would provide in that plant after the war. Surplus plants should not be shut down with the war's end, he said, but should be made busy on peace production without delay. If necessary, the price could be fixed at a later date. "You can determine the price more intelligently after you have seen the plant in operation over a period," said Mr. Kaiser.

A questionnaire addressed to typical industrialists all over the country would be advisable, said Mr. Kaiser, asking them what is wrong with the Surplus Property act as now written. The replies, he felt, would help to re-write the act effectively.

Mr. Kaiser spoke optimistically about the future of magnesium. When Senator Murray interrupted to ask whether substitution of magnesium would have a "disastrous" effect on the use of steel, Mr. Kaiser replied in the negative. When you reduce magnesium capacity from pounds to tons, said Mr. Kaiser, it comes to some 300,000 tons; that production, he said, could not cause "disaster" to steel or any other material. Mr. Kaiser said he preferred to look at it in another way; finding peacetime uses for some 300,000 tons of magnesium would cause a lift to business and employment generally.

Mr. Kaiser looks for a big use of magnesium in construction of truck and trailer bodies, based on his experience in operating a diesel truck with two trailmobile trailer units so equipped. The two trailers have empty weight of 29,150 pounds and carry total payload of 47,170 pounds. Weight saving by using magnesium is 8214 pounds, which increases the payload capacity by 4.1 tons.

"Estimated cost for the magnesium truck bodies is $3750 each or $7500 for the pair. Steel bodies would cost $1750 each or $3500 for two. The extra cost of magnesium over steel of $4000 will be amortized in four months for the additional truck revenue due to the increased payload.

"The Permanente trucks are hauling magnesium oxide from Moss Landing to Permanente, Calif., each three trips a day. The extra four tons per trip or 12 tons per day hauled legally on the California highways by each unit, at the regular truck rate of $2.60 per ton represents a net saving of $31.20 per day. This means that the increased cost of magnesium over steel of $4000 is amortized in 128 days or about four months, after which time the daily saving is a net benefit not possible to realize by conventional means."

E. E. Wilson, vice chairman, United Aircraft Corp., and president, Aeronautical Chamber of Commerce of America, outlined the probable uses of light metals in aviation (see Wing Tips, p. 100).

Farm implements offer limited opportunities for the use of aluminum, and iron and steel could be displaced in this field at most by a few per cent, according to A. W. Scarrett, vice president, International Harvester Co., Chicago. Tillage implements, grain drills and planters require all of their present weight for soil penetration. Weight reduction would not be a factor in connection with stationary machinery, such as threshers, corn shellers, ensilage blowers, etc. Weight is not a matter of great importance in such implements as harvesting machinery, while in horse-drawn mowers the weight of the machine provides traction for the operation of the cutting knife.

ARRANGE AID FOR FRANCE: Lend-lease and reverse lend-lease agreements, designed to multiply French contribution to the United Nations' war effort and to give new life to the French domestic economy, have been concluded. Shown above formally signing the agreements are, left to right: Henri Bonnet, French ambassador; Joseph Grew, acting secretary of state; and Jean Monnet, French finance minister. NEA photo

Exceptions might be made in the case of machines operated by tractors, said Mr. Scarrett. Use of tractor-mounted harvesters, he said, has been somewhat hampered by the fact that they are often too heavy for the tractor to carry; "opportunity for the use of aluminum to lighten the weight is greater in this type of machine than in any other implement, and a reasonable increase in cost here would not be justified," said Mr. Scarrett. The same reasoning, he said, might apply to design of tractor-mounted mowers.

Aluminum Has Limited Applications

The corrosion-resistant quality of aluminum might warrant added cost in some cases, he said, but not in all. It would not do for plow bottoms, he said, because aluminum is too soft for this use.

Best possibilities for use of aluminum in farm implements, said Mr. Scarrett, appear to be the following: In die-cast grain feed cups on drills to replace cast iron feeds which are not sufficiently accurate without expensive machining; in valves on checkrow planters to reduce the inertia forces and permit planting at higher speeds; in fertilizer hoppers and feeds for protection against corrosion; in certain rapidly reciprocating parts, such as harvester straw racks and shaker screens, to cut down vibration and inertia forces, as well as resist corrosion; in construction of tractor-mounted units, to reduce their weight.

In the field of refrigeration, said Mr. Scarrett, the postwar use of aluminum will depend entirely on the cost of this metal; the substitution, in case of substantially lower price on aluminum, would be at the expense of cold-rolled steel sheets.

"Superior thermal conductivity of aluminum as compared with steel," said Mr. Scarrett, "is more than outweighed by some added difficulty in welding, its tendency to form dangerous gases in contact with some refrigerants now in use, and added problems in finishing." Aluminum castings or forgings could be used as hardware but costs would have to be lowered to compete against drawn steel and zinc die-cast parts now used.

In reference to commercial motor trucks and trailers, Mr. Scarrett felt that "a truck operator is not justified in making the additional investment for lightweight equipment unless he operates his equipment close to 100,000 miles per year or more."

In general, said Mr. Scarrett, a change to the use of aluminum entails extensive changes in manufacturing equipment.

"An aluminum foundry," he said, "requires different melting furnaces than the cupolas used for cast iron, also different flask and cleaning equipment and often special furnaces for normalizing or heat treating the aluminum castings. Aluminum can be machined at much higher speed than steel and iron, but to obtain the greatest efficiency requires entirely new milling machines, lathes and boring ma-

chines than are now used in the farm implement industry. Where aluminum is forged or formed hot it requires heavier hammers and presses than used for steel. For spot welding aluminum, machines of higher amperage capacity are required than for sheet steel. It is no simple task to change from steel and iron to aluminum."

There will be little change in the relative quantities of steel, iron, aluminum and magnesium when Ford Motor Co. resumes production of automobiles, Dr. J. S. Laird, in charge of the Research and Development Division of that company's Chemical Engineering Department, told the committee.

Low modulus, softness, and poor corrosion resistance, he said, rule out magnesium in many uses. Where magnesium castings might be used, as in oil pans, cover plates and other lightly stressed parts, they must compete with steel stampings or aluminum castings; greater ease of machining does not compensate for the higher cost of the magnesium castings. Use of magnesium sheet in body work, he said, is hampered by lack of suitable welding processes.

With reference to aluminum, cylinder blocks, cylinder heads, oil pans, pistons, timing gears and other parts have been made of aluminum with success in the past but "under present conditions the use of aluminum castings even on the same scale as prewar will be predicated on a supply of suitable aluminum alloy ingot at a price not over 6 cents a pound," he said. "Any extensive use of aluminum in transmission or chassis parts appears to be highly improbable . . . Use of aluminum sheet in body work is hampered by lack of satisfactory processes of fabricating into bodies as now designed. Adequate welding techniques are not available, nor have we any reason to expect them in the near future. With no advantage to be gained by use of aluminum sheet except its weight, its price would have to be very close to that of steel sheet to permit its use in automobile bodies."

At the same time, Dr. Laird assured the committee, Ford Motor Co. will continue its studies of light metals to insure utmost utilization of their economic possibilities.

Auto Engineer Testifies

Another witness who asserted the price of aluminum would have to be reduced substantially to permit its expanded use by the automobile industry was W. S. James, chief engineer, Studebaker Corp., South Bend, Ind. For purposes of illustration, he discussed a 1942 Studebaker Champion. Of approximately 3200 pounds of material that went into this car, he said, some 3000 pounds were iron and steel and just a little over 6 pounds were aluminum.

Of this 3000 pounds of iron and steel, approximately 1900 pounds might be of aluminum. "Taking into consideration the difference in the physical properties of the

W. S. JAMES

two metals," said Mr. James, "I believe that some 1100 pounds of aluminum would be required to replace the 1900 pounds of iron and steel. By making this substitution we would reduce the gross weight of all materials going into the Champion to approximately 2400 pounds.

"At 15 cents a pound, the aluminum we would use would cost us $165 as against a cost of $47.50 for the steel replaced—using 2½ cents a pound as the steel price. The cost of materials would thus be increased by $117.50 by the substitution. Incidentally, the resultant increase in the cost of materials would exceed the total cost of all the basic materials actually used in the present automobile. To make the increase without an increase in the total cost of the basic materials used, aluminum would have to be purchased for less than 4½ cents a pound.

"My statement," he explained, "should not be taken to mean that the automobile industry will not increase its use of aluminum until such a time as its price is reduced to less than 4½ cents a pound. On the contrary, a price of 7½ cents a pound, approximately three times that of steel, would encourage the use of aluminum wherever its physical properties would permit taking full advantage of its weight saving—in other words, wherever one volume of steel could be replaced by one volume of aluminum. A reduction in the aluminum price of 7½ cents a pound or lower unquestionably would lead to increased experimentation by automobile manufacturers in an effort to determine to what extent they might reduce automobile transportation costs by substituting aluminum for steel.

"It is my opinion that no automobile manufacturer is likely to consider the substitution of aluminum for steel if such a substitution would necessitate an increase in the selling price of his product.

The only important use in which the industry has found it possible to use aluminum to advantage, said Mr. James, is in pistons. In this case cost is of little consideration.

Mr. James explained that aluminum has certain deficiencies which prevent its use in other parts of the automobile engine.

Future use of aluminum and magnesium in transportation equipment, as against ferrous metals, will be determined largely by prices of the two groups, and by questions of design, Brig. Gen. C. D Young, deputy director, Office of Defense Transportation, told the committee.

The outlook for aluminum in hopper cars appears favorable because this metal stands up much better than steel under the attack of sulphuric acid in the transportation of coal. Weight also will be a factor here because it takes 11,000 pounds of aluminum as against 25,000 pounds of low-carbon steel to construct a 70-ton hopper car. The trend toward substitution probably will be gradual rather than sudden, he thought. A disadvantage of the aluminum car, General Young said, is that aluminum sheets are not as resistant to blows and abrasion as steel.

While less-than-carload shipping containers should offer a field for light metals, said General Young, comparatively little progress is being made in this direction despite the fact greater use is being made of containers at this time.

Steam and diesel locomotives probably will have more aluminum (cabs, running boards and trim) to meet weight limitations due to axle load. Aluminum also, he thought, should find use in some locomotive auxiliaries such as pumps, feed water heaters, brake apparatus and cab fittings.

Marine Use Should Expand

Water transport was an expanding outlet for aluminum before the war, but principally for outboard motors and pleasure and luxury craft. These uses should be expanded. Little use has been made of aluminum in construction of commercial inland waterway craft aside from some special barges for transportation of certain chemical liquids.

It is probable more aluminum will be used for trucks and buses after the war, said General Young, but this trend will depend to a considerable extent on a number of factors. Among these are restrictions imposed by the states on the gross weight of vehicles operated on their highways; cost per gallon of gasoline or other motor fuel; mileage cost of tires as influenced by weight of the vehicles; and the burden of taxation under state licensing provisions as it is affected by the light and gross weight of the vehicles.

Railroads fully appreciate that there is no profit in hauling unnecessary dead weight and that their profit comes from the freight and passengers carried in their equipment, V. R. Hawthorne executive vice chairman, Mechanical Division, Association of American Railroads told the committee.

"On the other hand," he said, "there is no economy in paying too much of a premium for weight saving either in higher first cost, increased maintenance or in reduced life of the equipment Present types of railway equipment have

a relatively long, useful life, ranging from 25 to 30 years or more.

"Before railroads can generally justify recommending that large numbers of freight cars be constructed of aluminum alloys, it seems necessary that the price of this material be reduced.

"Magnesium has never been used to any extent by the railroads and not at all for equipment construction. From our limited knowledge of this metal, it seems very doubtful that it will be very seriously considered for the construction of post-war railroad equipment."

Another factor, said Mr. Hawthorne, is that it so far has been impossible to obtain as high as 18 to 20 per cent braking ratio for fully loaded freight cars.

In passenger car equipment, said Mr. Hawthorne, aluminum will be in competition with both stainless steel, and also with low-alloy, high-tensile steel.

"There is a considerable field for the use of light weight metals in railroad equipment specialties such as running boards, car-seat frames, crosshead shoes and other car and locomotive items," concluded Mr. Hawthorne. "Another place where aluminum alloys might be attractive is in the construction of locomotive tenders where the capacity of the tender can be materially increased within the present allowable axle loads. Other promising fields for the light metals are baggage trucks, freight station ladders, shop ladders, permanent scaffolding, roundhouse jacks, tools, tool boxes, etc."

To Make Car Parts of Aluminum

Bettendorf Co., Davenport, Ia., plans to manufacture aluminum car parts and other railroad specialties after the war, W. E. Bettendorf, president of that company, told the committee.

"With the important advances that have been made during more recent years in the strength, corrosion resistance and other characteristics of aluminum alloys," he said, "we believe the evolution will require the use of these lighter materials in railroad equipment; the extent to which their use will prove desirable will have to be left for future determination. It will depend on economies which the railroads will experience from actual use of such equipment.

"Our present opinion is that aluminum alloys will not entirely replace steel in such equipment, particularly at the present costs of these materials, and that the introduction of some of the equipment made from light-weight materials will be a gradual process.

"Use of extruded shapes of aluminum alloys is an important contribution because it permits the more economical use of metal in the structural sections," added Mr. Bettendorf. "Shapes can be had from this process which would be impossible to produce by rolling. As a result of being able to introduce metal into the section at places where it will be of the greatest benefit mechanically, shapes of equal strength to rolled sections are produced with a lesser amount of metal."

PRIORITIES–ALLOCATIONS–PRICES

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

L ORDERS

ICE REFRIGERATORS: Revised production quotas for domestic ice refrigerators have been established for the period Jan. 1, 1945 through March 31, 1945, setting total authorized production for first quarter, 1945, at 75,000 units in 17 plants. (L-7-c)

M ORDERS

STEEL: Order M-126 has been amended to bring it in line with other WPB regulations and changes. The amended order also includes some minor revisions and some clarifications of previous rules. The order was originally issued May 5, 1942 to provide an immediate overall iron and steel conservation measure. Since then other orders and regulations have been issued which adequately control use of iron and steel in a number of products and accordingly reference to 86 such products has been deleted from the amended order.

The order also states that iron and steel for maintenance, repair and operating supplies for products prohibited under the order may only be used to replace parts of a product if the parts are to be used for maintenance and repair of such a product. The manufacture of a complete product which has been prohibited under the order is not permitted through the use of MRO.

Another change provides that iron and steel for water tanks and water tank towers (required in connection with authorized construction projects important to the production of war materials and highly essential civilian products and the development of public utilities facilities) authorized by the appropriate WPB subdivision on form GA 1456 or form WPB 2274 may now be obtained without an appeal under M-126.

The appeals clause also has been modified to correspond with the provisions of Priorities Regulation No. 25 (spot authorization plan). Other important revisions include: 1. Sixteen items changed to conform to other orders; 2. Three items changed to delete references to orders that have been revoked; 3. Eight items changed to delete reference to the Steel Recovery Corp. which is no longer in existence. Under this revision the products mentioned are now permitted to use steel from idle and excess inventories in accordance with existing regulations. (M-126)

ZINC: Zinc for products previously authorized under Priorities Regulation No. 25 (under which spot authorizations are allowed) will be subject to restrictions of the zinc order after April 1, 1945. New appeals subsequent to March 7, 1945, should be filed with WPB field offices. (M-11-b)

TIN: Revised Order M-43 specifies that a retailer may purchase products shown on List A by relying on his supplier's certification that these products contain no tin in any form. Use of tin in the manufacture of automobile solder, and also use of any solder containing tin in the repair of automobile bodies and fenders, is prohibited. The revised order enumerates allowed uses of tin in coating or retinning certain utensils for processing or cooking of food by institutions or by industrial or commercial establishments. Use of tin plate has been limited to baking pans for institutional and commercial bakers. The revised order requires that certifications be furnished by retailers to their suppliers that they will only sell such items to institutions, industrial or commercial establishments and bakers. Also, it is required that suppliers must not sell such products to other than institutional and commercial users. Definite restrictions have been placed on the retailer governing purchases and sales of solder. The order's babbitt metal schedule has been reworded, most important change being that users of fabricated bearings containing babbitt of more than 12 per cent tin by weight must furnish the manufacturer with a use certification. Tin or tin alloys used to repair gas meters must be derived from scrap from old meters brought in for repairs or salvage. (M-43)

COPPER: New restrictions have been placed on use of copper in the manufacture of fasteners of many types, including slide fasteners. Exceptions are made for fasteners for industrial safety equipment and for machine-attached snap fasteners for nurses' uniforms. Copper may no longer be used in production of such miscellaneous products as door-operating devices and deodorizing dispensers. The revised order clarifies the fact that products on the prohibited list of M-9-c may not be made from scrap, fired cartridge cases and certain other copper raw materials. (M-9-c)

CHLORATE CHEMICALS: Order M-171 has been revoked and chlorate chemicals affected by that order (now defined as potassium chlorate, sodium chlorate and potassium perchlorate) have been transferred to Schedule 97 under the general chemicals order M-300. Only substantial change in allocation control is raising of small order exemption from 25 pounds for each chlorate chemical to 250 pounds for potassium chlorate, 300 pounds for sodium chlorate, and 100 pounds for potassium perchlorate. (M-300)

MINOR CHLORATES: Minor chlorates such as barium chlorate and barium perchlorate have been removed from allocation controls because of adequate supply.

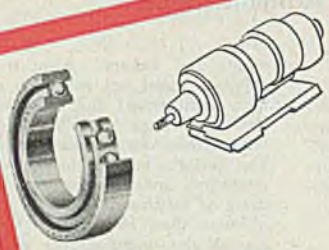
PRICE REGULATIONS

FARM EQUIPMENT: In amendment to regulations governing manufacturers' and wholesalers' maximum prices for farm equipment the section applying to persons manufacturing farm equipment for the first time has been clarified, provisions governing approval or disapproval of proposed manufacturers' maximum prices for new or modified items has been modified, pricing methods are provided for persons desiring to enter the field of wholesale distribution of farm equipment, and transfer is made of grain bins to coverage by the general maximum price regulation. This is effective March 15, 1945. (Amendment 15 to MPR 246)

REFRACTORY PRODUCTS: Resellers are allowed the same percentage increases recently granted manufacturers of fireclay and silica brick refractory products in Colorado, Utah, Missouri and all states east of the Mississippi, provided these two conditions are met: (1) Sales by the reseller and shipment to the customer are made direct from the manufacturer's plant, and (2) the manufacturer and reseller customarily sell to the same purchaser in the same area at the same price. Effective March 9, 1945, the increase applies to all refractory products manufactured in Colorado and Utah; in Missouri and all states east of the Mississippi it applies also to ladle brick, sleeves and nozzles, runner brick, hot tops, super clay and high alumina brick, ground fireclay, silica cement and other low temperature mortars. (Amendment 73 to Order A-1 under Section 1499.159b of MPR 188)

FOR A WORLD OF USES

POST WAR



FOR

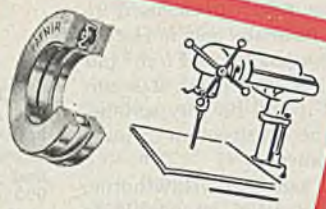
Space Saving
High Speeds
Super-Precision Operation
Moderate Radial Loads
Thrust in one direction

SELECT

FAFNIR MM 9000 Series
SPINDLE BEARINGS

Bore sizes:
20 Mm to 200 Mm

RADIAL
THRUST



FOR

Heavy Thrust Loads
Moderate Speeds
Axial Rigidity

SELECT

FAFNIR THRUST BEARINGS
(Rigid or Self-aligning Types)

Bore sizes:
10 Mm to 140 Mm

THRUST

FOR

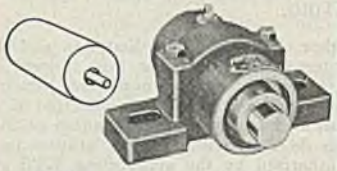
Light Radial Load
Moderate Thrust Load
(Either Direction)
Normal Speed
Intermittent Service

SELECT

FAFNIR 200 Series
RADIAL BEARING

Bore sizes:
10 Mm to 110 Mm

RADIAL
THRUST



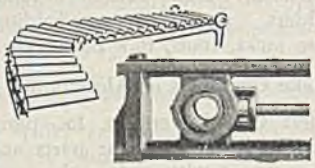
FOR

Combinations of Heavy
and Extra-Heavy Loads
Medium Speeds
Positive Sealing against
Dust and Dirt
Easiest-of-all Application

SELECT

FAFNIR DOUBLE
PILLOW BLOCKS
with exclusive Wide Inner
Ring Ball Bearings

For shaft sizes:
$1\frac{3}{16}$" to $6\frac{15}{16}$"



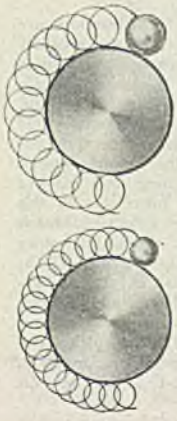
FOR

Shaft Adjustment or Belt
Tightening Conveyors
Self-alignment within the
housing
Friction-free operation

SELECT

FAFNIR BALL BEARING
TAKE-UP UNITS

For shaft sizes:
$\frac{3}{4}$" to 4"



1,000,000 LESS REVOLUTIONS!

These simple diagrams make it easy to understand why Fafnir Ball Bearings stay on the job longer and provide greater radial and thrust capacity.

Here are two ball bearings identical in size and type. But the balls in the Fafnir are $\frac{17}{32}$", those in the others are only $\frac{15}{32}$". These smaller balls must revolve faster per shaft rotation. In 24 hours at 2000 R.P.M. the Fafnir balls make *over a million less revolutions.* Obviously, fewer revolutions within the Fafnir Ball Bearings mean less wear, longer life.

This Fafnir Balanced Design brings race depth, ball size and ring thickness in proper balance for top performance. The Fafnir Bearing Company, New Britain, Conn.

★ 2170

FAFNIR

BALL BEARINGS

By A. H. ALLEN Detroit Editor, STEEL

MIRRORS of MOTORDOM

Mead committee investigation reveals motor industry is producing only 60-70 per cent of its potential for war. Prospects for improvement in productive efficiency are slight until national labor policy is changed

DETROIT

IT APPEARS an accepted fact, among both union and management, that the motor industry is producing only 60-70 per cent of its potential (See p. 77), but whether anything can be done about moving this percentage any higher remains doubtful. Management has stated its case, union leaders have had their say, and it all simmers down approximately to what Matthew Smith, national secretary of the Mechanics Educational Society of America, told the Mead committee here:

"The only way 100 per cent war productivity can be achieved would be to have a Gestapo, and I question whether the cost of obtaining the additional 40 per cent would be worth the effort. After all, we seem to be winning the war with 60 per cent."

Smith, always a colorful character on the witness stand in his wrinkled clothes and general state of disarray, proved to be a star witness for management in his testimony before the inquisition supervised by Sen. Homer Ferguson, a former judge who is an old hand at grand jury investigations. A British citizen who has had his innings with the War Labor Board in Washington, Smith likes to explode with the unusual, and he ran true to form last week. He said he did not believe in the no-strike pledge, now or at any other time, adding that he came from England which has had 91 wars in 100 years, and "it has disillusioned me."

Would Abolish Controls

Prefacing his testimony with the statement he wished his remarks to be brief "to minimize this silly waste of time," Smith tossed out a few other choice nuggets, such as the suggestion that he was opposed to wage stabilization and believed all wages should be set by collective bargaining, with all price controls removed, and that his union (now numbering about 64,000) was willing to organize anybody except stockholders because he regards dividends as a form of economic theft.

Smith further asserted that a 5 per cent cutback in contracts will almost always result in a 20 per cent cut in production because of its effect on the mental attitude of workers. And on the question of idle machinery in certain automotive plants—a point which the leaders of the UAW-CIO had made much of in their testimony—he said with considerable truth, "much of this equipment is so highly specialized that it cannot be used more than a couple of days a month and even that much use is not very efficient."

Not in years has any news made the headlines with the impact of the Mead investigating committee's inquisition. Those who attended were unanimous in observing that it was the greatest comic opera staged in Detroit in its history, except for the tragic connotations as far as the war is concerned. A long line of witnesses appeared before the committee, and their conflicting testimony made it difficult to draw any definite conclusions.

On the serio-comic score, for example, the committee paid a surprise visit to the Packard plant on Saturday afternoon, and apparently the word had not been forwarded sufficiently in advance, for Senator Ferguson surprised a negro worker who was fast asleep on a conveyor an hour or more in advance of quitting time (Packard shifts work 8 hours at regular rates and 2 hours overtime). The senator nudged the dozing employe who was considerably taken aback at his rude awakening. Next day he was summoned to the committee hearing, and testified that his daily quota of production was two supercharger wheel cases, after completion of which he was accustomed to easing off until the end of the shift.

Yawning, he said,"I sat down for a few minutes to read the paper, and then I lay down for a few seconds, but I wasn't asleep, but I was surprised when some fellow (Senator Ferguson) jabbed me in the side."

Considerably annoyed, Senator Ferguson demanded, "Are you sleepy now. I notice you yawning. Do you want us to give you a recess. You know we don't want to work you harder here than you are accustomed to working on your job."

The somnolent Brother Watson concluded, "No, sir, it's not that I'm sleepy, but I'm just not a very good hand at talking."

Substantiation of the ridiculous show of productivity at the Packard plant was supplied by a colonel in the Air Forces, resident representative at the plant. He testified that scheduled production has been met for only a few months on Rolls-Royce aircraft engines, that he had made regular reports to the company and to his superior officers of the poor productivity, without results. Time studies in some departments had resulted in slight improvement, but in other departments time study engineers were threatened with being thrown out of the plant if they attempted to make analyses. The colonel said part of the blame was due to what he described as "bumping." Specifically, this means that when one man is laid off from a certain job, he may be entitled to take the job of someone with less seniority—a process continued all down the line to the person with the least seniority. Meanwhile, each of the men in a new job must be trained for his new work, causing delay in production, and a turnover as high as 40 per cent.

All this bickering over the situation at Packard, which indicated an efficiency

SPEEDING THE JOB: American Seabees increased the capacity of their dump trucks by adding airway matting to the beds of the trucks, permitting them to haul larger loads of crushed coral used in building runways for B-29s at a Guam base. NEA photo

of the company's aircraft engine division somewhere between 70 and 75 per cent, against charted efficiency of 96 per cent in the Marine Engine Division, was a major headache for Packard's doughty president, George T. Christopher, who also participated in the hearings, and who has been spending a major portion of his time in recent months on labor problems. He summed the trouble up by pointing out there are two factions in the Packard union local which are each trying to elect their own representatives as president. He continued, "There has been nobody who controlled the group. There is no way to settle with two groups. I had publicly stated that I hoped we would so conduct ourselves that after the war neither of us would feel we would have a score to settle."

Some loose charges had been hurled by UAW-CIO representatives, accusing management of the Ford Motor Co. of deliberately refusing contracts for the company's steel and gray iron foundries at the Rouge plant, also trying to prove that idle capacity at the Rouge foundry departments was ample to make up for the critical shortage of castings in war production programs. The allegations were based entirely on half-truths and lack of knowledge of foundry production. In the effort to refute these claims, four Ford executives prepared a 15-page brief on true conditions in their foundry departments, which they proposed to present to the Mead committee last Wednesday.

It is doubtful if the Mead committee expected anything like the deluge of testimony with which it has been inundated, but after you boil it all down the conclusion is inescapable that unions are beginning to realize that they have sown the tempest and are now reaping the whirlwind as far as their locals are concerned. To put it mildly, the situation is out of hand, and they are making frantic efforts to salvage something from the mess.

On the other hand, managements have been pressed to the point where something had to be done, conditions were becoming intolerable. It was impossible to expect even nominal productivity, discipline was a joke, plant rules meant nothing. The Mead investigation may prove to be a fuse which will touch off a showdown on just who is going to do what to whom and for how much. Certainly, if Washington has been listening at all to what is going on in Detroit the last few days, the proposed work-or-fight manpower legislation will be given the old heave-ho.

Showing Not Too Convincing

From management's side, it must be admitted its showing before the Mead committee was not too convincing. Whether it fails to appreciate intricacies of public relations and dealing with governmental investigating agencies, or whether it is just too busy to concentrate on these subsidiary problems, are questions that remain to be answered. Perhaps the explanation lies in the fact Senate investigators might logically be expected to "throw the needle" into management more vociferously than into labor as a matter of political expediency.

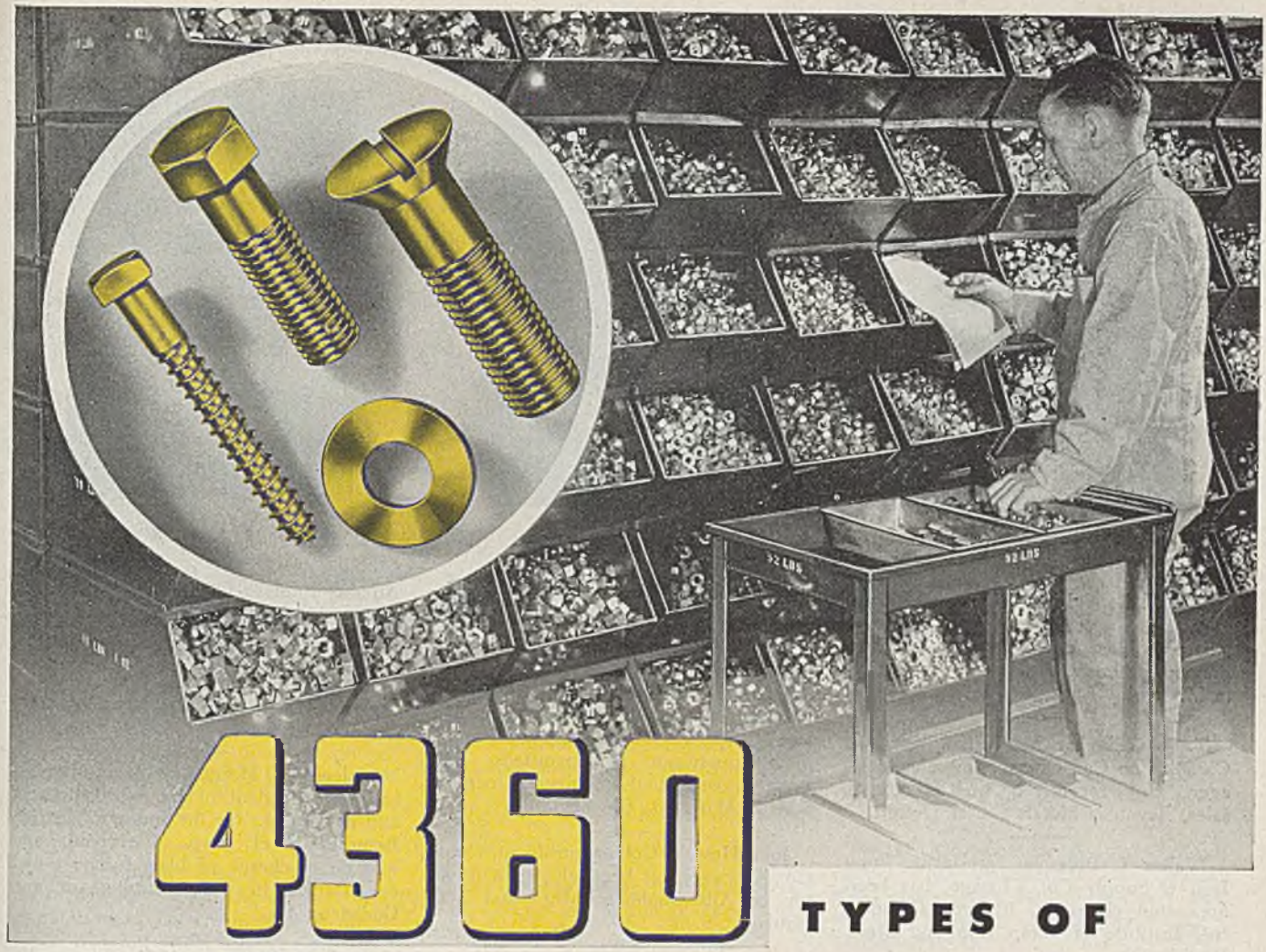
Although production of liquid-cooled internal combustion engines, other than for airplane use increased 22 per cent in 1944 over the previous year, output must be boosted still further to meet demands of the armed services, according to information from the local WPB office. To meet the problem, plans have been developed for controls on engine scheduling, closer screening of order boards to eliminate less essential orders, tightening of controls on distribution of spare parts, and plans for early construction of new facilities.

Truck production by 37 companies for military and civilian use amounted to 743,750 in 1944. This figure differs from "factory sales" figure accepted as an index of production before the war.

Jeeps, military ambulances, and wheel-drive personnel carriers are included, and half-tracks, armored cars and integral buses are excluded. Production figures follow:

1944	Total All Sizes Civilian	Military	Total
Jan.	2,528	56,068	58,596
Feb.	2,766	52,905	55,671
March	4,628	51,731	56,359
April	8,151	47,568	55,719
May	9,298	47,622	56,920
June	11,926	49,260	61,186
July	11,243	50,297	61,540
Aug.	12,511	56,034	68,545
Sept.	12,277	52,765	65,042
Oct.	13,075	51,054	64,129
Nov.	14,677	54,336	69,013
Dec.	16,001	55,029	71,030
Total	119,081	624,669	743,750

BUILDING LEDO ROAD: Military trucks were as much in evidence in building the Ledo Road from India to China as they now are in hauling vitally important supplies over it. Above, tough, powerful equipment, including bulldozers and General Motors 6-wheel trucks are shown helping Army engineers construct the highway through the swamps, jungles and mountains of Burma. Diagram below shows the route of the road which stretches for 1000 miles between Ledo, India, and Kunming. From there it continues to Chungking, China. The entire highway is officially known as the Stilwell road in honor of Gen. Joseph W. Stilwell, and it combines part of the old Burma road with the new Ledo road



4360 TYPES OF EVERLASTING FASTENINGS *in Stock*

BECAUSE of these large and varied stocks, Harper is known as "Headquarters for Everlasting Fastenings" . . . "Your Logical Source" of non-ferrous and stainless bolt and nut products.

At Harpers the buyer finds three unique and distinct advantages. First, large stocks of all types of fastenings such as bolts, nuts, screws, washers, rivets and specials; second, fastenings in all the commercial non-ferrous and stainless alloys except aluminum, e.g. brass, copper, naval bronze, silicon bronze, Monel and stainless steel; third, large stocks of metals in bars, rods, wire, strip and other basic forms from which special fastenings can be quickly made according to specifications.

1945 CATALOG AVAILABLE. New in usefulness to the metal industries. 104 pages, 8½" x 11", 4 colors.

THE H. M. HARPER COMPANY
2646 Fletcher Street, Chicago 18, Ill.

BRANCH OFFICES: New York City • Philadelphia
Los Angeles • Milwaukee • Cincinnati • Houston
Representatives in Principal Cities

HARPER

EVERLASTING FASTENINGS

ARMY E NAVY

BRASS • BRONZES • COPPER • MONEL • STAINLESS

MEN of INDUSTRY

C. C. GOBDEL

EUGENE J. REARDON

R. P. TYLER

Carl C. Gobdel has been named manager, special steels department, Philadelphia plant, Joseph T. Ryerson & Son Inc. Previously, he was sales representative in Missouri.

—o—

T. J. Gallagher has joined Edw. S. Christiansen Co., Chicago, as sales manager. Until recently he was director of sales, Reynolds Metals Co. at Detroit.

—o—

Walter I. Bregman, president, Price Iron & Supply Co., Chicago, has been appointed chairman, Brokers' Committee, Institute of Scrap Iron and Steel, Washington.

—o—

E. E. Potter has been elected a commercial vice president, General Electric Co., Nela Park, Cleveland. **P. D. Parker** replaces Mr. Potter as general sales manager, Eastern Division, which post Mr. Potter had filled for the past 14 years.

—o—

Leonard C. Crewe Jr. has been made works manager, Johnson Steel & Wire Co. Inc., Worcester, Mass.

—o—

W. G. Swigert, president, Pacific Bridge Co., has been elected a director of Joshua Hendy Iron Works, Sunnyvale, California.

—o—

Howard L. Stilley has been appointed general manager, Soule Equipment Co., San Francisco. Formerly, he was central sales manager of R. G. LeTourneau, Inc.

—o—

Fred J. Beckmann, formerly assistant superintendent, Saucon Division roll shop, Bethlehem, Pa. plant, Bethlehem Steel Co., has been made superintendent, succeeding the late Harry K. Maxwell.

—o—

Donald H. Dalbeck has been made controller, Reed-Prentice Corp., Worcester, Mass.

—o—

D. O. Thomas, president, Bendix-Westinghouse Automotive Air Brake Co., Elyria, O., is relinquishing his post of vice president, Bendix Aviation Corp., South Bend, Ind., to devote full time to the former company.

—o—

Eugene J. Reardon has been elected vice president and director, Superior Steel Corp., Pittsburgh, to assume complete supervision of operations. Mr. Reardon was chief engineer, American Steel & Wire Co., Cleveland.

—o—

John Howard Collier, president, Crane Co., Chicago, has been elected a director of Allis-Chalmers Mfg. Co., Milwaukee.

—o—

Leroy F. Keely, formerly of Louis Allis Co., Milwaukee, has been made general sales manager, Howell Electric Motors Co., Howell, Mich.

—o—

A. J. Gariepy has been made assistant to the president, Lawrance Aeronautical Corp., Linden, N. J. Prior to his promotion, Mr. Gariepy was contracts and service manager.

—o—

Don E. Miller has been appointed executive assistant to John J. Prindiville, Jr., vice president and works manager, Lapointe Machine Tool Co., Hudson, Mass., having formerly been factory manager, Garfield Division, Houdaille-Hershey Corp., Detroit.

—o—

James E. Guillet has been named operations manager, Pipe Engineering Co., Stockton, Calif.

—o—

Harold C. Lenfest has been appointed vice president in charge of the New York office, Enterprise Engine Co., San Francisco.

—o—

Edmund A. Pratt has joined the staff of American Standards Association as director, Inter-American department, New York city.

—o—

Ralph S. White, former chief, power plant section, Civil Aeronautics Authority, Washington, has been made manager, engineering development, Ranger Aircraft Engines Division, Fairchild Engine & Airplane Corp., Hagerstown, Md.

—o—

R. P. Tyler, formerly sales manager, A. Leschen & Sons Rope Co., St. Louis, has joined Macwhyte Co., Kenosha, Wis., as sales manager.

—o—

Malcolm E. Morgan has been appointed superintendent of the blast furnaces and coke works for the southern district, Republic Steel Corp., Cleveland, and will be in charge of blast furnaces and coke works in both Birmingham and Gadsden, Ala.

—o—

R. O. Herbig, since 1921 Chicago district sales manager, Reliance Electric & Engineering Co., Cleveland, has been appointed central western sales manager.

—o—

Guy S. Peppiatt has been elected executive vice president in charge of manufacturing and related activities, Federal-Mogul Corp., Detroit. **Samuel E. MacArthur** has been appointed controller, and **William R. Waddell**, manager of the Federal-Mogul Service Divi-

H. F. SEYMOUR

Who has been made president, Columbian Vise & Mfg. Co., Cleveland, noted in STEEL, March 5, p. 109.

sion, has been made assistant secretary of the corporation.

—o—

William E. Coakley has been elected vice president and director of Pressed Steel Tank Co., Milwaukee. He has been production manager of the company since 1919.

—o—

A. R. Patterson has joined Sta-Rite Products Inc., Delavan, Wis., as vice president in charge of engineering.

—o—

Wilton O. English has been appointed manager of the Drop Forging Division, National Lock Washer Co., Newark, N. J

—o—

O. A. Redhair has been named manager of accounting of the Transformer Division plant in Sharon, Pa., of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. He succeeds **C. A. Jones** who has been appointed assistant to the works manager.

—o—

Donald J. Reese, who has been with the Steel Division, War Production Board since April, 1942, has resumed his duties with the Development and Research Division, International Nickel Co., New York.

—o—

G. E. DuCharme, formerly sales manager of the New York district, has been appointed manager of paint and chemical container sales, Continental Can Co., New York.

—o—

Harry D. Fenske has been appointed director of transportation and **William H. Owen**, traffic manager for the Great Lakes Steel Corp., Detroit, its N-A-X Alloy Steel and Stran-Steel Divisions, and Hanna Furnace Corp., Buffalo.

—o—

H. A. Warren has been made manager of the newly-formed central district of General Electric Co. appliance and

V. E. GUMBLETON

J. L. GRIFFIN

merchandise department with headquarters in Kansas City, effective April 1.

—o—

V. E. Gumbleton has been appointed director of purchases for Timken-Detroit Axle Co., and **J. L. Griffin**, purchasing agent for all the firm's Detroit axle plants. Formerly purchasing agent and with that department since 1918, Mr. Gumbleton fills the vacancy left by the late F. H. Maisonville. Mr. Griffin joined Timken in 1919.

—o—

Henry Harnischfeger has been elected a director of Harnischfeger Corp., Milwaukee.

—o—

R. J. Benkart has been appointed to represent the Ajax Electric Co., Inc., Philadelphia, in West Virginia, western Pennsylvania and southeastern Ohio.

—o—

Henry P. Wood has joined the staff of Clayborne Distributors, Ltd., Chicago, and in his new position will assist manufacturers of plant equipment with their sales, service and installation problems.

—o—

E. A. Seffing, formerly secretary and controller, Cleveland Tractor Co., Cleveland, has been elected assistant treasurer, Oliver Corp. He will continue at the Oliver Cleveland plant.

—o—

Captain John J. Healy, assigned to inactive duty after 33 months with the Army Air Forces, has returned to Copperweld Steel Co. as northwest representative with headquarters in Chicago.

—o—

W. H. Alderdice has been appointed district sales manager for the Pacific coast and western region for the Commercial Shearing & Stamping Co., Youngstown, O.

—o—

P. L. Fett has been made general purchasing agent, Doehler-Jarvis Corp., New York.

—o—

Thurlo F. Johnson has been appointed national service manager, Norge Division, Borg-Warner Corp., Chicago.

—o—

G. H. Smith has been appointed vice president and general manager, Deep-freeze Division, Motor Products Corp., Detroit.

—o—

A. F. Scharer has been named to direct the International Division of Servel Inc., Evansville, Ind.

—o—

Milton W. Allen has been appointed sales representative in Colorado, Montana, New Mexico, Utah and Wyoming for Columbus McKinnon Chain Corp., Tonawanda, N. Y., with headquarters in Denver. He will also represent Chisholm Moore Hoist Corp. in Colorado and New Mexico.

—o—

Captain James D. Mooney, United States Navy, has returned to General Motors Corp., Detroit, as vice president, group executive of the overseas operations of the company, and member of the administration committee and board of directors. Captain Mooney served successively in the Bureau of Aeronautics, Advanced Base Division, 11th Amphib-

S. B. HEPPENSTALL

Who has been elected chairman of the board, Heppenstall Co., Pittsburgh, as mentioned in STEEL, Feb. 19, p. 94.

ARTHUR R. C. MARKL

Who has been appointed chief research engineer, Tube-Turns Inc., Louisville, Ky., as announced in STEEL, Feb. 19, p. 95.

L. F. CAMPBELL

Who has joined Foote Bros. Gear & Machine Corp., Chicago, as vice president, noted in STEEL, Feb. 19, p. 95.

J. RAYMOND SMITH

Who has been made assistant to the general sales manager, Rustless Iron & Steel Corp., Baltimore, noted in STEEL, Feb. 19, p. 95

ious Force in Europe and on the staff of chief of naval operations.

—o—

H. J. Detterich, veteran automotive and industrial advertising man, has been appointed account executive for Florez, Phillips & Clark, Detroit. In addition to broad technical advertising experience Mr. Detterich spent two years in production, research and technical writing.

—o—

John D. Watson, who has been with the Hein-Werner Motor Parts Corp., Waukesha, Wis., for the past ten years, has been elected treasurer of the company succeeding the late E. R. Estberg. Other officers elected were: President, **G. G. Hein**; vice president, **L. D. Harkrider**; secretary, **Harvey J. Frame**.

—o—

Glen W. Shetler has been appointed vice president in charge of sales and promotion of new products, Barium Steel Corp., Canton, O. **John P. Fleming**, formerly with American Locomotive Co., New York, has been named general manager.

—o—

Walter Beinecke, has been elected a director of Graham-Paige Motors Corp., Detroit, succeeding **Joseph B. Graham**, resigned.

—o—

Edward H. Grumich has been appointed vice president in charge of manufacturing and plant operations, Siewek Tool Division, Domestic Industries Inc., Detroit.

—o—

Dr. H. C. Greenewalt has been appointed assistant director, development department, in charge of technical activities, E. I. du Pont de Nemours & Co., Wilmington, Del. **H. E. Ford**, assistant director, has been placed in charge of commercial activities.

—o—

Carl F. Oechsle has been appointed assistant vice president and manager, construction equipment department, Worthington Pump & Machinery Corp., Harrison, N. J., and **George Steven** has been made executive engineer of the company's Buffalo Works. **Harold W. Whiting**, formerly Mr. Steven's assistant, succeeds him as chief engineer, Buffalo Works Compressor Division.

—o—

Walter A. Onorato has been elected president, General Dry Batteries Inc., Cleveland, and also president, General Dry Batteries of Canada, Ltd., Toronto, succeeding the late C. P. Diebel, founder.

—o—

Henry Davis, for several years connected with the Hardware Sales Division, has been placed in charge of the newly organized market research department of the Wickwire Spencer Steel Co. with headquarters in New York.

—o—

Fred M. Echoff, Chicago branch manager, Remington Rand Inc., Buffalo, has been made regional director, Smaller War Plants Corp., in the Chicago area.

—o—

J. A. Cronk has been appointed Atlanta branch manager, Electric Storage Battery Co., Philadelphia, succeeding Mark C. Pope Jr.

—o—

Daniel M. Viergever, formerly with the Detroit regional office, War Production Board, has become associated with the Detroit office of Luria Bros. & Co., Philadelphia.

—o—

Roland D. Doane has been named general sales manager, Ingersoll Steel & Disc Division, Borg-Warner Corp., with headquarters in Chicago. Mr. Doane will continue his work with the Ingersoll amphibious tank program for the Bureau of Ships, U. S. Navy, undertaken when he was put in charge of the Borg-Warner Washington office in 1942.

—o—

W. O. Robertson has been made manager, Philadelphia district, Armco Railroad Sales Co. James L. Turvey is returning to the company's New York office as salesman, having served at the home office since 1942.

OBITUARIES . . .

Lester C. Klein, 58, assistant to vice president, U. S. Steel Corp. of Delaware, New York city, died there March 10.

—o—

Frank A. Frey, 56, president and treasurer, Geuder, Paeschke & Frey Co., Milwaukee, died recently in that city.

—o—

Harry Fuller, for many years vice president, King Bridge Co., Cleveland, died March 8 at Beverly Hills, Calif.

—o—

Howard W. Raymond, 57, president, Charles P. Hull Co. Inc., and Seaboard Metal Corp., New York, died at Montclair, N. J., March 8. Mr. Raymond was also president, H. A. Watson Co., Liverpool, England. Until 1918 he had been in charge of the Crooke works, National Lead Co., Brooklyn.

—o—

John W. Jacobsen, 70, retired mining engineer and former executive, Johns-Manville Corp., New York city, died there March 10.

—o—

Raymond H. Filsinger, purchasing agent, Crucible Steel Co. of America, New York, died March 5 in that city.

—o—

Albert L. Horr, 58, president, Vulcan Mfg. Co., Fond du Lac, Wis., died there March 6.

—o—

Charles K. Davis, 60, president, Athey Truss Wheel Co., Chicago, was killed in an automobile accident in that city, March 7.

—o—

Arthur S. Hamlin, 68, who retired in 1943 as secretary-treasurer, General Time Instruments Corp., New York, died March 8 in a hospital at Summit, N. J.

—o—

Robert McMillan, for 20 years purchasing agent, Pittsburgh Steel Co., Pittsburgh, died in that city recently. Mr. McMillan retired in 1931.

—o—

Frank T. Walsh, 61, who retired last year as superintendent of the sheet mill, Cleveland plant, Chase Brass & Copper Co. Inc., died March 13 in that city. He had been with the company 43 years.

Cincinnati's Goal Is Jobs for All Who Want Work

Community planning now for high level, productive postwar employment. Formula can be adopted by other cities

Scene in the Ohio plant of the Wright Aeronautical Corp. in the Cincinnati district. Plants like this will present serious postwar problems of adjustment of facilities to production of goods for the civilian economy. It is the hope of Cincinnati industrialists that much of the war industrial capacity can be adapted to peacetime utilization

A JOB for everyone who needs and wants work is the goal of Cincinnati which is hard at work today to make it possible for its people to keep at work tomorrow.

Like every other great industrial center, this industrial area of 650,000 population has known grave economic problems. In the ten years starting with 1934 the city and Hamilton county, of which it is part, spent more than $38 million of public funds in direct relief, not including private charity.

This relief load reached its peak in 1935, when more than 36,000 families in the county were depending upon public relief. Today Cincinnati is determined that its 50,000 men and women in the armed services shall not return to such conditions. It also is determined to continue at work in the community as many civilian employes of the present huge force of 225,000 as is possible.

To do this, the community is planning now for high level, productive employment after the war.

Just as the community plans in a big way to prevent repetition of its 1937 flood loss, so too it seeks now to guard against unemployment after victory. Its formula is simple, and one which any community may well adopt.

Cincinnati, like 2200 other communities, has a local unit of the Committee for Economic Development. Heading the unit is Frederick V. Geier, president, Cincinnati Milling Machine Co. Working in close co-operation with the Chamber of Commerce and other organizations, the CED is encouraging industrial and business managers to plan now to ease the employment problem which must be faced during the postwar transition.

Business is responding to that appeal. It began by getting all the facts. First step was to find out how many workers Cincinnati's larger business enterprises had in 1940, how many they were employing at the peak of war production, how many they hope to use after victory and what they consider a normal working force.

The total available working force in Hamilton county in 1947 is estimated at 266,290, assuming that 43 per cent of the population will be in the labor force.

The study didn't stop there. Upwards of 800 business and industrial firms were asked to reveal their present and prospective construction programs.

Contractors estimated that each $5000 of expenditure for construction results in one man-year of employment. On this basis the building program indicated by the survey means 4037 man-years of employment. These figures are representative only of the larger companies.

Cincinnati needs other construction, schools, sewers, playgrounds, highways, a dozen public projects. As part of its forward planning the community submitted 12 bond issues in November, 1944, after a Citizens Committee for Jobs and Progress was organized to obtain public acceptance of the program. All of the issues passed.

The city's 34 technical and engineering societies and other organizations were asked to help speed postwar planning. One of the results is that the Citizens Planning Association joined with the Cincinnati Chapter of the Institute of Architects and the University of Cincinnati in sponsoring a course on "Our City of Tomorrow."

Some firms have gone well beyond the planning stage in looking into the future. One industry which had increased its employment from 2500 to more than 7500 between 1940 and 1943 found more than 90 per cent of its workers would like to remain with the company if assured postwar jobs. Today that company is setting up manufacturing and merchandising programs as the basis of postwar jobs for all of its present workers plus all of its service men and women who will want employment.

Cincinnati's planning for the postwar period is humane and economically sound, states the CED. Its citizens are determined to demonstrate that free enterprise accepts the challenge of postwar planning. That is why they are plunging so wholeheartedly into the task of providing high level, productive postwar employment.

EMPLOYMENT, HAMILTON COUNTY, YEAR V+2 (1947)

	See * Numbers	%	See † Numbers	%	See ‡ Numbers
Population of Hamilton County	621,987		675,000		
Total number of jobs needed	228,987	100.0	266,290	100.0	37,303
Manufacturing	77,517	33.8	92,669	34.8	15,152
Construction	12,316	5.4	15,822	5.9	3,506
Transportation, communication and public utilities	18,698	8.2	19,633	7.4	935
Wholesale & retail trade	45,770	20.0	53,231	20.0	7,461
Finance, etc.	10,223	4.4	10,734	4.0	511
Business and repair service	4,987	2.2	5,800	2.2	813
Personal service	22,544	9.8	26,219	9.8	3,675
Amusements, etc.	2,408	1.1	2,801	1.1	393
Professional & related services	20,029	8.7	23,294	8.7	3,265
Government	7,673	3.4	8,924	3.4	1,251
Miscellaneous	6,822	3.0	7,163	2.7	341

*Employment in 1940.

†ASSUMPTIONS: That V+2 will be 1947; that we will lose half of our abnormal population gain; that 43% of the population will be in the labor force; that 95% of labor force will be employed.

‡Increase in jobs required in 1947, over 1940.

WING TIPS

Light metals are of basic importance to aircraft development, authority tells Senate Small Business Committee. Reduction in structural weight permits equal increase in pay load, provided structural strength is not decreased

By E. E. Wilson*

THE FUTURE of air transport, civil and military, is more dependent upon light alloys than is that of any other industry. Unlike a surface vehicle where weight is supported against the force of gravity by the surface on which it runs, the airplane is supported in its medium by the expenditure of power. Excess weight is immediately convertible into excessive operating costs.

The reduction of one pound in structural weight will permit an increase in the payload by one pound, provided the structural strength is not decreased. And one added pound of useful load is worth approximately $600 a year, according to airline operators.

But the heavy loads imposed in aircraft structure call for maximum strength. Thus materials are chosen which have the maximum strength per unit of weight. And this factor is so vital as to justify high unit construction costs. These are repaid in a short period of operation.

In the case of rotor wing aircraft, that is, helicopters and the like, the use of light metals is expected to be even more significant because of the extreme sensitivity of this type of craft to the weight factor.

Certainly, all types of aircraft may be expected to utilize the most efficient raw material, the material that best combines light weight with structural strength. It is not possible to forecast with any degree of accuracy to what extent this most efficient raw material will continue to be a light metal alloy, as has been the case for some years. A progressive industry is continually experimenting with the new alloys and other materials. This research may uncover new materials from which can be fabricated planes of far superior performance.

These, however, are imponderables. At present most aeronautical engineers assume that aircraft of the early postwar years will continue to utilize about the same proportion of light metal alloys as do present military craft. For this reason the industry feels the opportunity to employ light metals in the aircraft field is great indeed, provided present aircraft industry opportunities are permitted to be realized.

One other factor of special importance needs emphasis. The aircraft industry has accumulated greater experience in the fabrication of aluminum and magnesium than all of the other metal-fabricating industries combined. This experience will pay rich dividends in the development of superior postwar airplanes, but it will also be reflected in the development of certain other new metal products to enable Americans to perform their everyday tasks more cheaply, conveniently and comfortably. Some aircraft companies have announced formally their intentions to apply the techniques of light-metal fabrication to the production of home appliances and other consumer goods.

Undoubtedly, other aircraft companies plan to bring out totally new products formed from light metals, provided they are able to finance the purchase of the necessary facilities, and provided that economic conditions, including tax laws and other regulations, operate to encourage the assumption of risks inherent in the expansion into new fields.

In summary then, the opportunity for the continued utilization of the light metals by the aircraft industry appears to be truly promising, for (1) barring radically new developments in the laboratories, aircraft of the future will continue to be fabricated largely from light metals, and (2) some members of the industry will apply their manufacturing "know-how" in the light metal field to the development of new consumer products—if financial conditions permit.

Perhaps in no other branch of the economy is a forecast of probable postwar demand so hazardous. The uncertainties are to some extent indicated by the range of predictions by the prognosticators. Some have predicted that aircraft output in the first postwar years would total only a few thousand annually—others have put the total at several hundred thousand a year.

Future Aircraft Production Unpredictable

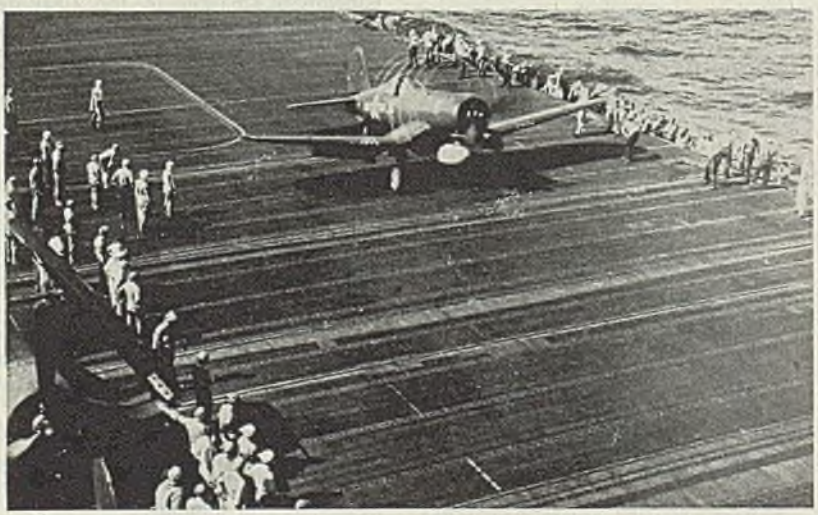
The aircraft industry itself is unable to formulate any prediction whatsoever, since the factors that will largely determine how many planes this industry will sell are "unknown quantities". Most of these factors depend on public policy and the industry has no basis for gaging which of various alternative policies the public will direct its elected representatives to follow. Until those policies are decided and put into effect, forecasts of the future volume of aircraft production are most difficult to develop and justify.

The nature of policies which will largely determine the course of aircraft production after the war can be brought out by reviewing conditions which will determine postwar demand for the three principal categories of planes.

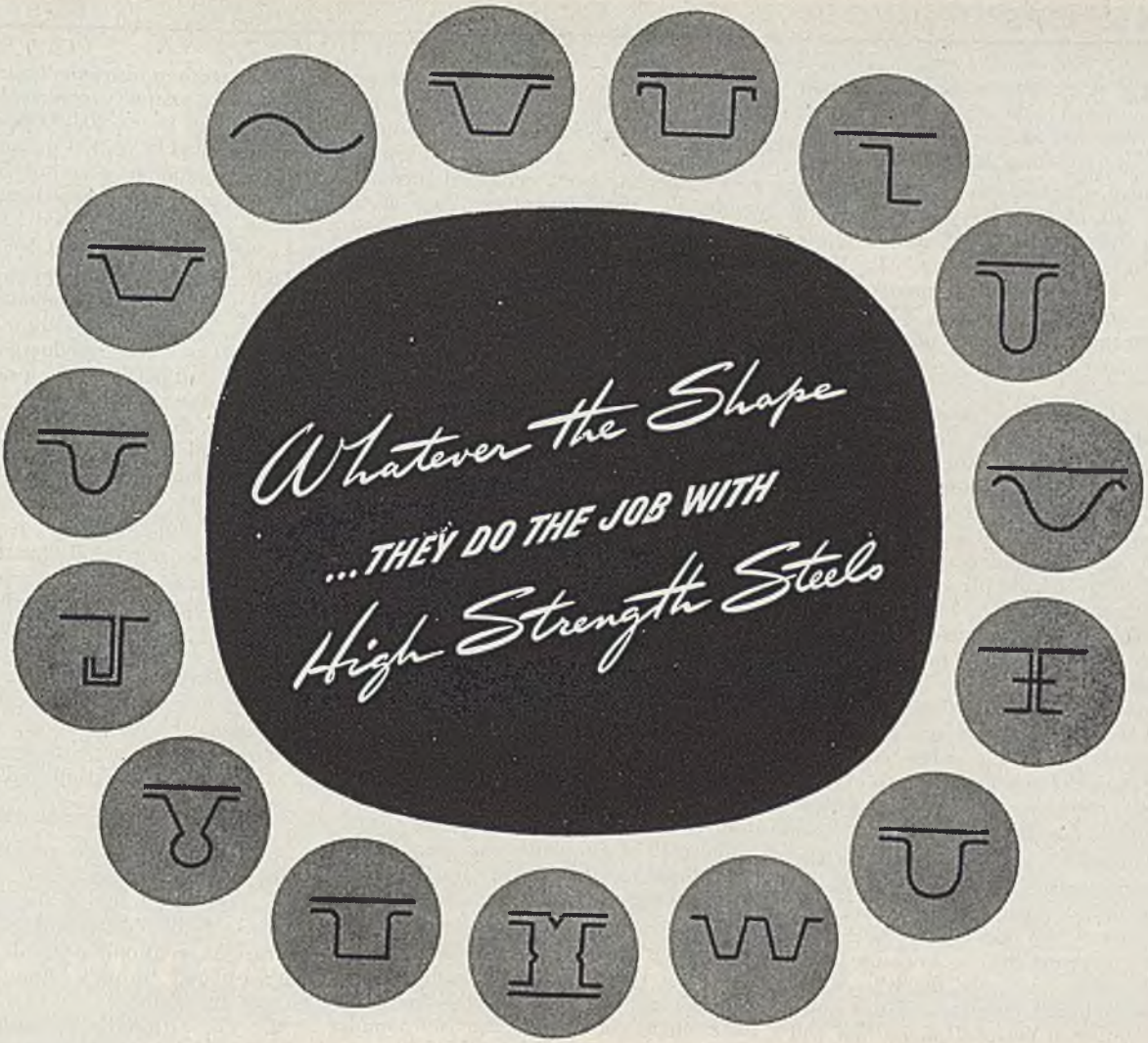
By far the most important factor in determining the outlook for consumption of light metals in the aircraft field is the prospect for production of military craft. The average weight of military planes produced in December was 10,600 pounds. This contrasted with an average weight of roughly 850 pounds for personal planes in 1940. From the viewpoint of light metals consumption production of one thousand military planes is the equivalent of 12,470 personal planes.

What are the prospects for production of military aircraft? That question can be answered only by the Congress. Throughout the nation today the dramatic lessons of airpower are fresh in every one's mind. A Gallup poll would un

*Vice chairman, United Aircraft Corp., and president of the Aeronautical Chamber of Commerce of America. Abstracted from testimony before the Senate Small Business Committee, March 7.



CORSAIR INTO THE FRAY: Vought Corsair fighter taxis down the flight deck of an Essex-class carrier before taking off on a war mission in the Pacific. United States Navy photo



Teamed with ARMCO Low-Alloy High Strength Steels these stiffeners (and many variations of their basic design) help engineers create lighter, stronger structures. They cut "dead-weight" and increase efficiency of transportation equipment and other products as well.

Through the use of stiffeners and other improved designs, the sheet steel shell of the product now bears an ever-increasing part of the total load. This is made possible by steels like ARMCO 50Y and 55Y — with minimum yield strengths of 50 and 55 thousand psi. respectively. Designers can increase the load the members will stand or use lighter gages with the same loads.

For some uses, lighter-than-conventional gages can be employed without reinforcement of any kind. This helps save steel and cuts costs.

Besides these advantages, ARMCO Low-Alloy High Strength Steels are easily fabricated and have excellent welding properties. Corrosion resistance of ARMCO 50Y and 55Y is considerably greater than that of ordinary steel. Where extra rust resistance is needed, zinc or aluminum coatings can be applied.

Write us for complete data on ARMCO Low-Alloy High Strength Steels. It may help you design your new or improved peacetime products with less weight and greater efficiency. The American Rolling Mill Company, 621 Curtis Street, Middletown, Ohio.

EXPORT: THE ARMCO INTERNATIONAL CORPORATION

THE AMERICAN ROLLING MILL COMPANY

ARMCO HIGH STRENGTH STEELS

doubtedly reveal that most persons favor the maintenance of air power, the air power that has won victories in every theater of war—over land and sea.

Production of military planes dropped from a rate of 20,000 a year in 1919 to 532 in 1926 and to 466 in 1933, the year Hitler came to power. In 1939, as the war got underway, production of military planes totaled only 2141. The Japs have lost that many planes in just three or four strikes by U. S. carrier task forces.

The perpendicular increase in performance of aircraft that has been brought about during the war certainly points to a great increase in air transportation efficiency and air travel.

Along with the higher performance, passengers, mail, and cargo too will be carried in these new planes at rates well below those in effect in 1939.

Best of all, the impressive safety records already achieved by the airlines will be left far behind.

What then will possibly retard the production of these great new sky giants? The answer is: Public policy. Will the public policy of this nation be to encourage the expansion of air travel to every community that can support it?

Another field in which the opportunity for utilization of light metals is virtually unlimited is personal aviation. Here, too, realization of the opportunity facing the industry depends in large measure upon public policy. Actually, the wide range in the published estimates of the probable number of personal planes that will be sold in the postwar years reflects to a major degree varying convictions as to the utility of these planes.

The aviation industry can promise remarkable achievements from its engineering staffs, provided those engineering and productive teams can be kept together as teams. It has taken years of careful combing of the engineering schools, and additional years of training to develop such organizations. Further, their value has been enhanced immeasurably by the experience they have gained in completing history's greatest engineering and production assignment. Now, however, there is danger that such staffs may be decimated by the operation of Selective Service. We in industry can conceive of no way in which these staffs could better serve their countries than by continuing to speed the production of warplanes and the development of new aerial weapons. If they are taken from their assignments, the teams will be destroyed, and the technological leadership this industry has built up—which is so vital to the preservation of our national supremacy in the air—will be jeopardized.

Low Raw Materials Prices Desirable

The aircraft industry is no different from any other industry in desiring to purchase its raw materials at the lowest possible price consistent with the maintenance of stable sources of supply and available technological assistance. Naturally, this applies with especial force in the case of aluminum and magnesium since those metals together are the chief raw materials utilized by the industry.

Simple arithmetic demonstrates the importance of price of the light metal, especially in the field of small planes. A thousand-pound all-metal personal plane might conceivably use 700 pounds of aluminum. A differential of 5 cents a pound would thus make a difference of $35 in the cost of such a plane. The selling price of such a plane before the war ranged from $1775 to $2500.

However, in the case of the much larger transport, equipped with complex radio and other instruments, changes in metal costs assume appreciably smaller significance. For a 20,000 pound plane costing around $100,000 or so, a reduction in aluminum price of 5 cents a pound would result in a reduction in raw material costs of $800 or less than 1 per cent of the $100,000 selling price.

The aircraft industry opposes government operation of light metal producing facilities. It is equally opposed to the subsidization of the production of light metals at artificially low prices. The industry is aware of no reason why the disposal of these government-owned facilities should be handled in a manner distinct from other government-owned plants designed for the production of steel, ships and aircraft.

It has been suggested that the maintenance of an artificially low price by subsidy will result in the development of many new markets that could absorb the output of existing light-metal plants. This industry feels that such a subsidy would pose many difficult problems almost impossible of solution, in addition to the dangerous impetus it would give to government ownership and control.

Subsidy Would Create Problems

Among some of the problems raised by such a subsidy are these:

1. How great should the subsidy be? If a subsidy of 5 cents will encourage an increase in consumption, will not a 10-cents-a-pound subsidy bring about a greater increase?

2. The artificially low price will result in widely-varying increases in utilization of the light metal in new and old products.

The differing effects of the subsidy would surely foment misunderstanding among both producers and consumers alike.

3. Development of new alloys or other materials, such as plastics, that might improve aircraft design and performance, could be retarded by the maintenance of an artificially low price for the light metals.

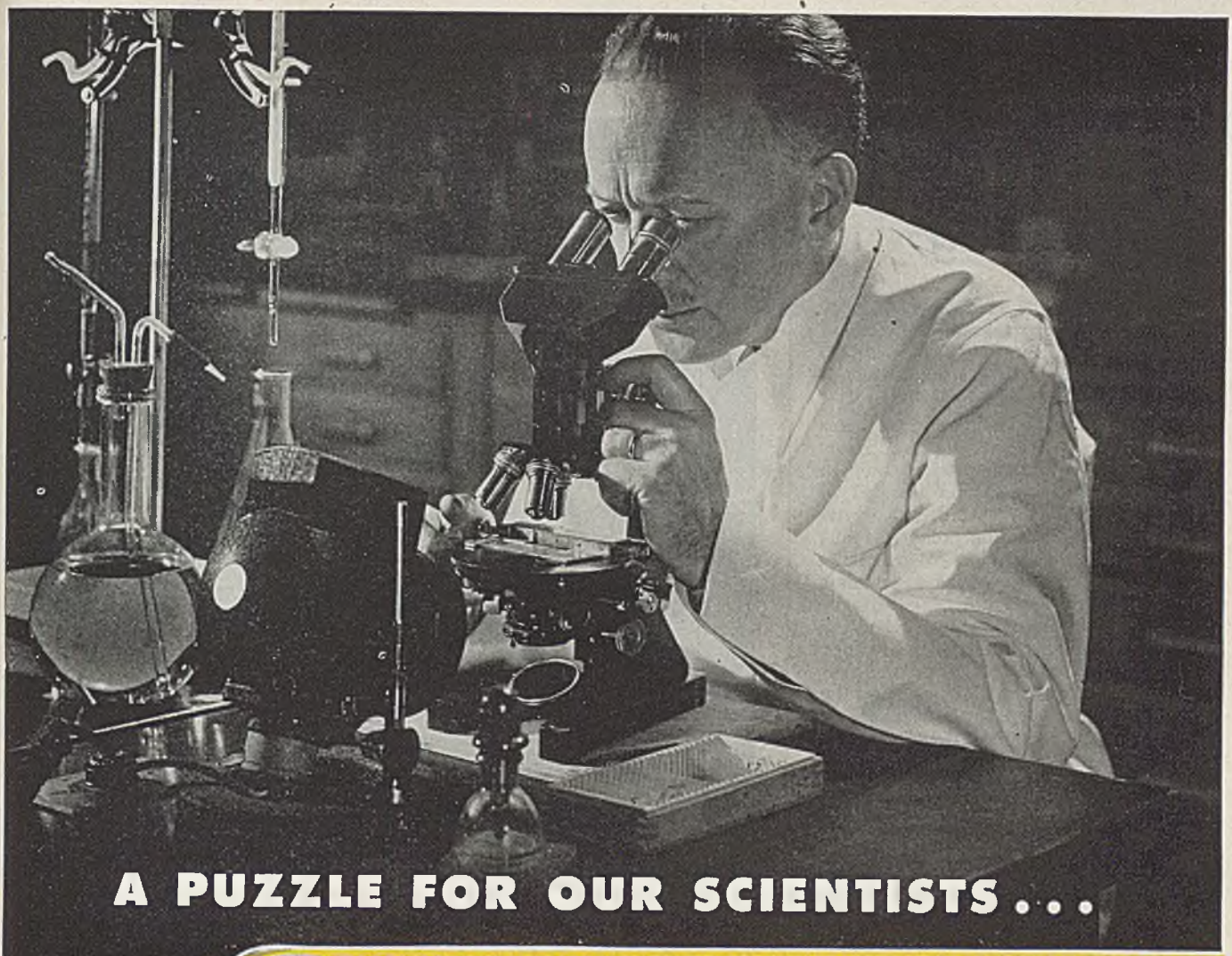
The "freezing" of light metals as the chief raw material—which is what the maintenance of an artificially low price implies — would automatically remove one of the great spurs to competitive aviation research.

In experimental development for the national defense, our armed services and our industry should not be hindered by government policies of fostering this or that metal or material.

4. This industry frankly feels that subsidization of the raw material might all too easily lead to an extension of further controls over the processing and fabrication of that material.

With regard to plant disposal policies, the aircraft manufacturing industry can only assert that in general it feels that disposal of government-owned aluminum and magnesium plants should be handled similarly to the disposal of steel, shipbuilding, or aircraft plants.

NEW NAVY DREADNAUGHT: The Privateer PB4Y-2 is the latest land-based patrol bomber built for the Navy by Consolidated Vultee Aircraft Corp., San Diego, Calif., which has orders for $40 million worth of the craft. The fuselage is 7 feet longer than the original B-24 Liberator. Top speed is 250 miles an hour, range more than 3000 miles, and gross weight varies from 62,000 to 65,000 pounds



A PUZZLE FOR OUR SCIENTISTS . . .

Weatherhead

Firsts

Solving Problems for Industry

★

ERMETO FITTINGS

★

Q-A HOSE END FITTINGS

★

BRAZED STEEL FITTINGS

★

HYDRAULIC BRAKE LINES AND BRAKE FITTINGS

★

FIRE-RESISTANT HOSE ASSEMBLIES

★

THE WEATHERHEAD T-RING PACKING

HOW TO SAVE YOU A PENNY

HAVE you thought much about performance of small parts in new peacetime products—and how much these parts cost?

Countless times since 1919 Weatherhead has been assigned the job of saving "a penny a part" for a manufacturer—and has solved the puzzle and delivered a finer part in the bargain. At Weatherhead this kind of thinking begins at the beginning—in the laboratory—where a steadily growing staff is trained to consider engineering, production and marketing factors all as interlocking parts of each job at hand.

One of many examples:—When hydraulic brakes were adopted for the automobile, Weatherhead developed a hydraulic brake line only one-half the size of those previously used, and produced it for less cost to the automotive industry.

That's why we can say, "Look ahead with Weatherhead." We invite you to write our Sales Engineering Department for assistance in solving your postwar parts problems now.

Look Ahead with

FREE: *Write on company letterhead for "Seeds Of Industry" — 24-page illustrated story of Weatherhead facilities and products ready to serve you.*

Weatherhead

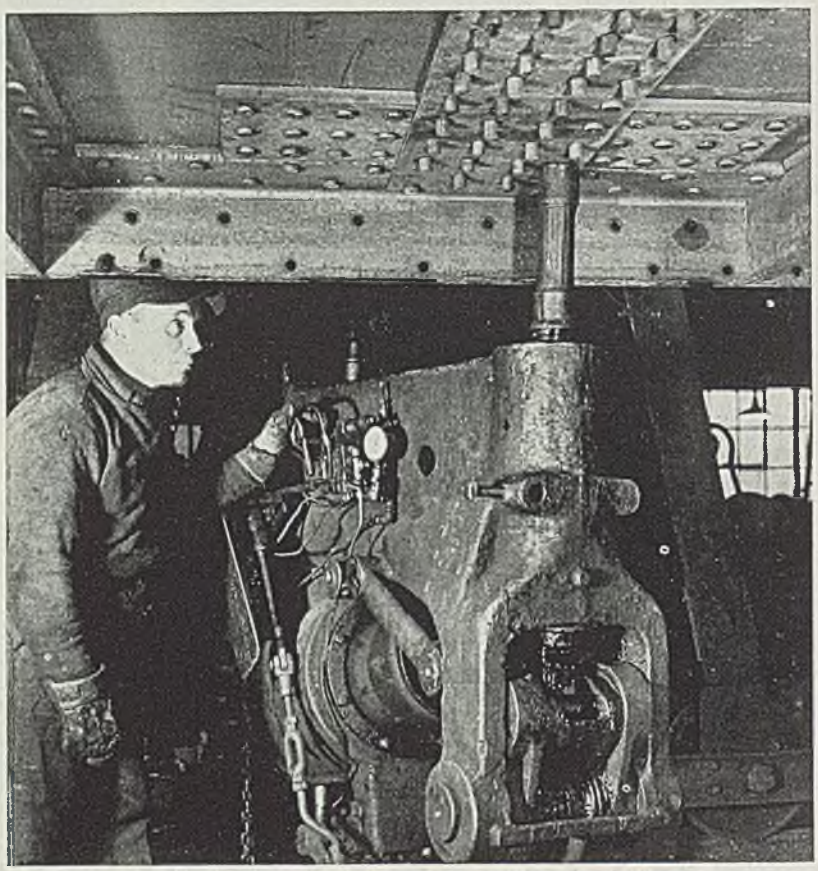
THE WEATHERHEAD COMPANY, CLEVELAND 8, OHIO
Plants: Cleveland, Columbia City, Ind., Los Angeles
Canada—St. Thomas, Ontario

Mills Find Spare Parts Problem Is Increasing

MAINTENANCE of a proper balance of repair parts for steel mills is becoming increasingly difficult, the WPB Steel Mill Maintenance and Repair Industry Advisory Committee believes.

Under normal conditions many items that are considered emergency and insurance spares have a long production cycle. Now, this cycle has been doubled or tripled, which with extended deliveries serves to complicate the problem. Frank A. Weidman, Steel Division, War Production Board, and government presiding officer at a recent meeting of the advisory committee, suggested that it is incumbent upon the industry to anticipate its requirements, make due allowances for delays in delivery and place purchase orders far enough in advance to insure procurement by the time required. He cited as a specific illustration that the present production cycle for large mill bearings is six months.

A poll of committee members indicated that inventories of spare parts has not changed materially during the war years. The only deviation is the significant increase in the number of spares on hand that have failed in service and have been reclaimed by welding and remachining. Committee members pointed out that such spares are not as dependable as new equipment and formerly were held to back up new spares rather than as the first or only spare. Members agreed that improvement in welding technique in recent years makes it possible to place increased reliance on parts so repaired.



COLD-DRIVEN RIVETS: Fort Pitt Bridge Works, Pittsburgh, is using cold-driven riveting in the fabrication work on heavy mill buildings. Above view shows cold riveting in process on a finished girder for a large mill building

Taxes Cut Operating Profit Of Basic Refractories Inc.

Basic Refractories Inc., Cleveland, reports that although its sales volume reached an all-time high and operating profits increased in 1944 its net profit showed a slight decline from 1943 as a result of increased taxes.

For 1944, taxes totaled $245,000, nearly one and one-half times the earnings figure of $176,967. In addition, the company paid the federal government another $173,715 as rent on a Defense Plant Corp. kiln plant built on its property.

Increased sales are a result, to some degree, of the beginning of a new program for expanding the company's markets for its refractories over the general industrial furnace field, according to H. P. Eells Jr., president.

Because of its outstanding safety record, the company has received an award designating it as the best of all similar industries in Ohio.

BRIEFS . . . .

Paragraph mentions of developments of interest and significance within the metalworking industry

Standard Transformer Co., Warren, O., has appointed A. P. Dearing & Co., Youngstown, O., as its sales representative for Trumbull, Mahoning and Columbiana counties in Ohio, and Mercer and Lawrence counties in Pennsylvania.

—o—

Overland Supply Co., San Francisco, has been appointed sales representative of the Symington-Gould Corp., New York.

—o—

Moltrup Steel Products Co., Beaver Falls, Pa., has named Howard H. Heinz Inc., Detroit, as sales representative for Michigan.

—o—

Nox-Rust Corp., Chicago, has devised a combined rust preventive and lubricant which meets Army and Navy specifications.

—o—

Sterling Alloys Inc., Woburn, Mass., has appointed Glidden Engineering & Equipment Co., Houston, Tex., as engineering service representative for Texas, Oklahoma, New Mexico, Louisiana, Mississippi and western Tennessee.

—o—

General Motors Corp. at its Guide Lamp Division, Anderson, Ind., has delivered the 500,000th M-3 sub-machine gun to the Ordnance Department.

—o—

Bureau of Mines announced that in the first year of operation its Cunningham, Kans., helium plant produced more than twice as much helium as world output in any fiscal year preceding Pearl Harbor.

—o—

Division of Simplified Practice, National Bureau of Standards, has approved for promulgation a simplified practice recommendation for pipes, ducts, and fittings for warm air heating and air conditioning.

—o—

Westinghouse Electric & Mfg. Co. East Pittsburgh, Pa., will publish a Port-

uguese translation of its Spanish edition of *El Ingeniero Westinghouse*, technical magazine for Latin America.

—o—

Greeley & Hansen, Chicago, sanitary engineers, will survey for Inland Steel Co., Chicago, the problem of controlling sewage disposal at its Indiana Harbor plant to prevent lake pollution.

—o—

Ministry of Munitions and Supply, Canada, has announced placement of orders for 17 additional transport ferries.

—o—

Rock Island Stove Co., Rock Island, Ill., is closing its 75-year-old business. The company's 17 buildings and site have been sold to Gerald H. Falder and H. H. Cleveland Jr., who will terminate the business.

—o—

Despatch Oven Co., Minneapolis, has opened a sales and field engineering office in LaSalle Wacker building, 221 North LaSalle street, Chicago.

—o—

Briggs Clarifier Co., Washington, has expanded its sales activities and has appointed the following distributors: Manning Packing & Supply Co., Portland, Oreg.; Hendrie & Bolthoff Mfg. & Supply Co., Denver; M. F. Hampton Co., Tulsa, Okla.; and Hoffman Supply Co., Abilene, Tex.

—o—

Eagle-Picher Lead Co., Cincinnati, has acquired production and distribution facilities of Southern Lead Co., Dallas, Texas.

—o—

Bell Aircraft Corp., Buffalo, will remain entirely in the aviation business after the war, Lawrence D. Bell, president, told members of management of the firm's Niagara Frontier division at a dinner meeting.

—o—

General Motors Corp., Detroit, has offered to reacquire the aviation engine parts plant its Chevrolet Division is operating at Tonawanda, N. Y. The plant was turned over to the Defense Plant Corp. early in the war.

—o—

Wickwire Spencer Steel Co., New York, has placed Henry Davis in charge of its newly formed market research department. He has been with the sales department of the firm's hardware division.

—o—

Thomas Machine Mfg. Co., Pittsburgh, has appointed sales agencies in 16 major cities to handle its equipment for all of the United States east of the Mississippi river.

—o—

Victor Animatograph Corp., Davenport, Iowa, found in a survey that nearly every major manufacturer of war materiel is using 16-millimeter sound motion pictures for job training, to teach new techniques, and to put general operational problems in visual form.

—o—

Titanium Alloy Mfg. Co., Niagara Falls, N. Y., recently announced its space for research and engineering tests has more than doubled since the beginning of the war.

—o—

Formica Insulation Co., Cincinnati, is adding to its plant space and installing new equipment.

AWARDS . . .

Recent awards of the Army-Navy "E" for excellence in the manufacture of war materials have been made to the following:

The American Fork & Hoe Co., ordnance works, Ashtabula, O.
Aurora Electric Co., Brooklyn, N. Y.
Belden Mfg. Co., Chicago plant, Chicago, and Richmond plant, Richmond, Ind.
Buchman Mfg. Co. Inc., Manayunk plant, Manayunk, Pa.
S. Buchsbaum & Co., Chicago.
Cole Electric Products Co. Inc., Long Island City, N. Y.
Economy Pumps Inc., Hamilton, O.
General Cable Corp., Buffalo plant, Buffalo, and St. Louis plant, St. Louis.
General Products Corp., Jackson, Mich.
Grosfield House Inc., Brooklyn, N. Y.
International Silver Co., factory F, Florence, Mass.
Morris P. Kirk & Son Inc., Los Angeles.
Ma mon-Herrington Co., Indianapolis, Ind.
Monburt Co., Brooklyn, N. Y.
National Carbon Co. Inc., Charlotte works, Charlotte, N. C.
Remington Rand Inc., propeller division, Johnson City, N. Y.
Roscoe Mfg. Co., Minneapolis.
Special Machine Tool Engineering Works, New York.

AFA Awards Go to 5 Leaders In Foundry Field

FOR distinctive contributions in the field of cast metals, the board of awards of the American Foundrymen's Association, Chicago, has awarded gold medals and honorary life memberships in the association to five outstanding leaders of the foundry field.

Those honored are: Robert E. Kennedy, secretary, AFA; C. E. Sims, supervising metallurgist, Battelle Memorial Institute, Columbus, O.; M. J. Gregory, retired, former factory manager of the Foundry Division, Caterpillar Tractor Co., Peoria, Ill.; Rear Adm. A. H. Van Keuren, U. S. Navy, director, Naval Research laboratory, Anacostia, D. C.; and Ralph J. Teetor, president, Cadillac Malleable Iron Co., Cadillac, Mich.

Mr. Kennedy receives the Joseph S. Seaman gold medal of AFA "for outstanding meritorious service to all branches of the foundry industry," and Mr. Sims gets the John A. Penton gold medal of AFA "because of his outstanding contribution to the steel casting industry."

Mr. Gregory and Rear Admiral Van Keuren are awarded life memberships for their contributions to the foundry industry. Mr. Teetor, Mr. Kennedy, and Mr. Sims were awarded honorary life memberships in the AFA.

SIGN UNION CONTRACT: C. R. Hook Jr., left, secretary, Rustless Iron & Steel Corp., Baltimore, and Albert Atallah, official of the United Steelworkers of America-CIO, sign a collective bargaining contract to run to Feb. 1, 1947. Although Rustless was not included in the 86 companies directed to grant wage increases in the War Labor Board's directive of Nov. 25, the provisions of the directive are included in the contract

Supply Curtailments Hit Vital Civilian Services

CONCERN is growing over possible serious bogging down of the civilian economy in certain directions with consequent adverse effect on war production. Curtailment of raw materials supply to the Office of Defense Transportation and other essential civilian agencies is viewed with alarm in some quarters as a threat to maintenance of necessary services at minimum requirement levels. There is little possibility however, that (barring sudden collapse of Germany) more of the badly needed materials and parts for repairs will be available for the strained civilian economy until late in the year.

Industrial indicators registered only slight fluctuation during the latest period, with electric power consumption, bituminous coal and petroleum production, engineering construction awards, truck assemblies, and revenue freight traffic showing little change.

STEEL CASTINGS — November shipments of steel castings totaled 196,475 net tons, compared with 197,772 tons shipped in October and represented a decline of 3 per cent from the November, 1943 output total. Electric furnaces accounted for 90,014 tons of the overall November shipments.

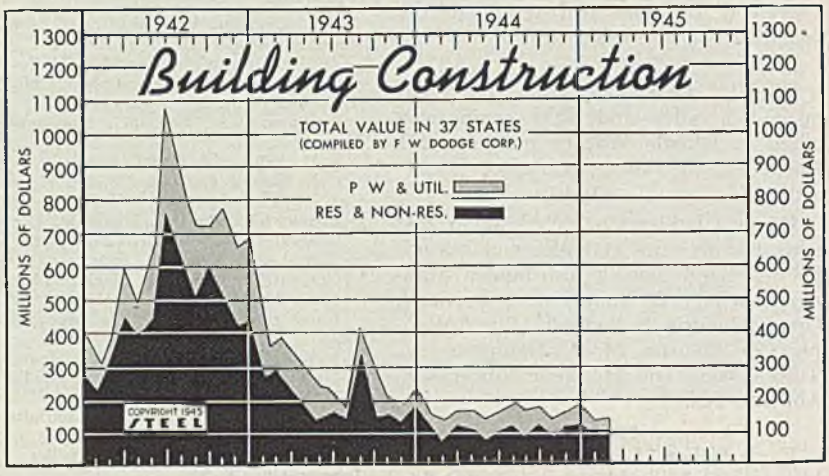
Unfilled orders on Nov. 30 last amounted to 922,105 tons, of which 634,332, or 69 per cent, were orders for carbon steel castings.

Production of steel castings for sale during November totaled 146,411 tons, or off 3 per cent from the October total. About 75 per cent of the November production went into commercial channels.

CONSTRUCTION—Building awards in the 37 eastern states turned slightly upward during February to $147 million, and also topped the $137.2 million construction awards valuation reported in comparable month last year. Construction in the public works and utilities classifications continued to decline during February, but improvement in the residential and non-residential group more than offset this decline.

FOREIGN TRADE—Except for the slight upturn recorded during November the United States export trade has declined steadily since last August. The January export shipments totaled $901 million, compared with $934 million in December and $1,124 million in January a year ago. The all-time monthly export peak was $1,419 million during May, 1944.

Imports of goods into the United States also declined during January, totaling $333 million, against $336 million in the preceding month and $300 million for the corresponding period last year. Peak in imports also occurred in May, 1944, amounting to $386 million.



Construction Valuation In 37 States

(Unit—$1,000,000)

	Total		Public Works-Utilities			Residential and Non-Residential		
	1945	1944	1945	1944	1943	1945	1944	1943
January	140.9	159.2	39.8	50.3	85.8	101.2	108.9	264.3
February	147.0	137.2	32.0	55.1	112.9	115.0	82.1	280.5
March	.....	176.4	.....	61.3	123.0	.....	115.1	216.7
April	.....	179.3	.....	72.0	127.7	.....	107.3	175.6
May	.....	144.2	.....	55.8	95.8	.....	88.4	138.6
June	.....	163.9	.....	70.7	73.3	.....	93.1	156.8
July	.....	190.5	.....	80.5	50.0	.....	110.0	133.7
August	.....	169.3	.....	69.4	73.4	.....	99.9	340.8
September	.....	175.7	.....	64.1	175.1	.....	111.6	125.0
October	.....	144.8	.....	52.2	63.5	.....	92.6	150.0
November	.....	164.9	.....	48.0	59.0	.....	116.9	125.4
December	.....	188.5	.....	66.6	67.4	.....	121.8	184.9
Total	.....	1,993.9	.....	746.0	1,106.9	.....	1,247.2	2,106.4

FIGURES THIS WEEK

INDUSTRY	Latest Period*	Prior Week	Month Ago	Year Ago
Steel Ingot Output (per cent of capacity)	95	96	89.5	98.5
Electric Power Distributed (million kilowatt hours)	4,446	4,472	4,505	4,426
Bituminous Coal Production (daily av.—1000 tons)	1,892	1,988	1,893	2,019
Petroleum Production (daily av.—1000 bbls.)	4,768	4,765	4,729	4,381
Construction Volume (ENR—unit $1,000,000)	$41.9	$39.0	$20.6	$44.6
Automobile and Truck Output (Ward's—number units)	20,235	18,545	20,960	19,105

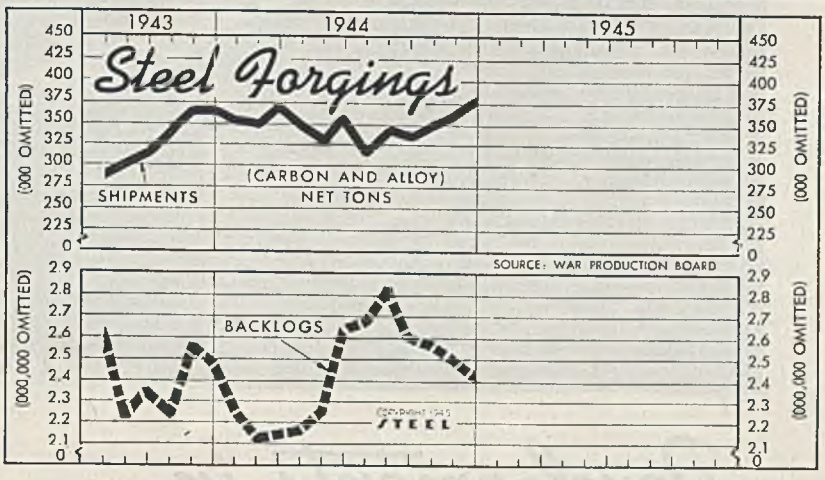
*Dates on request.

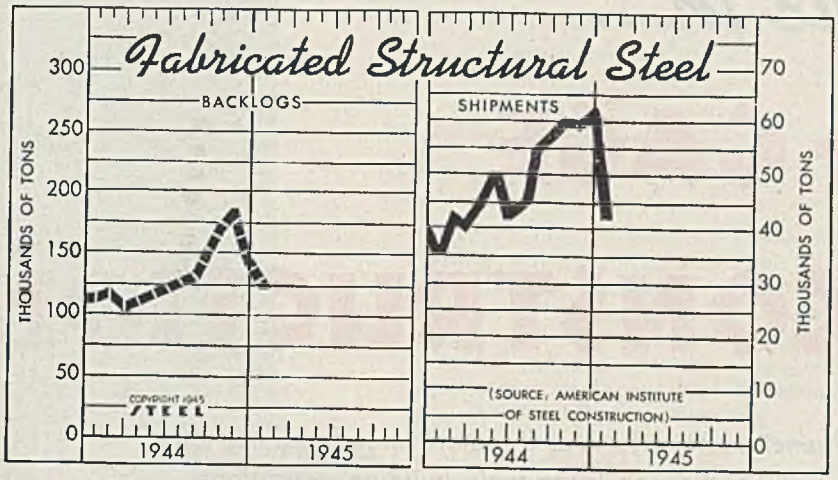
TRADE				
Freight Carloadings (unit—1000 cars)	780†	785	755	782
Business Failures (Dun & Bradstreet, number)	21	18	14	17
Money in Circulation (in millions of dollars)‡	$25,864	$25,750	$25,411	$20,963
Department Store Sales (change from like week a year ago)‡	+20%	+24%	+17%	−10%

†Preliminary. ‡Federal Reserve Board.

Steel Forgings
(000 omitted)

1944	Shipments	Backlog	Consumption
Jan.	355	2,256	521
Feb.	350	2,132	509
March	370	2,142	521
April	347	2,166	494
May	330	2,252	453
June	359	2,637	487
July	315	2,670	441
Aug.	341	2,821	483
Sept.	336	2,602	463
Oct.	348	2,564	488
Nov.	360	2,510	488
Dec.	377	2,403	506
1943			
Nov.	365	2,570	532
Dec.	367	2,487	517





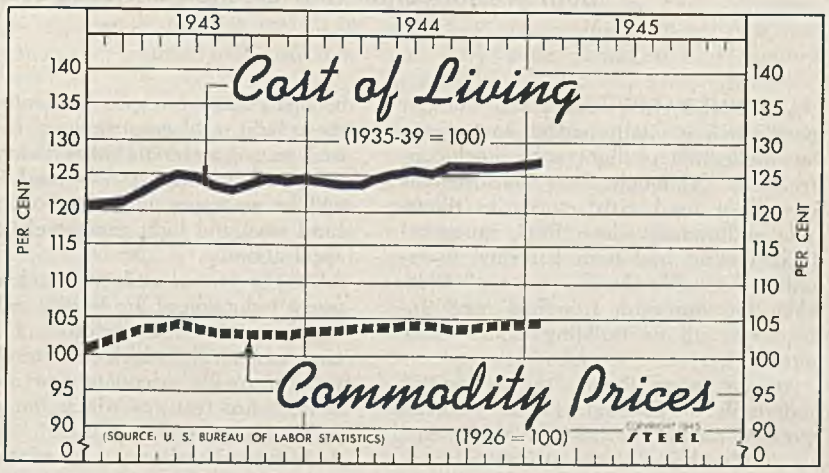
Fabricated Structural Steel
(1000 tons)

	Shipments 1945	Shipments 1944	Shipments 1943	Backlogs 1945	Backlogs 1944	Backlogs 1943
Jan.	42.0	35.2	91.9	124.4	113.1	339.1
Feb.	...	42.9	90.8	....	117.6	321.0
Mar.	...	41.4	94.0	....	106.3	299.8
Apr.	...	44.5	86.6	....	111.2	272.5
May	...	50.7	78.9	....	116.3	220.6
June	...	43.0	68.4	....	122.7	207.1
July	...	45.3	56.8	....	125.4	201.8
Aug.	...	55.2	50.2	....	130.4	195.6
Sept.	...	57.5	51.8	....	151.1	208.1
Oct.	...	61.6	80.1	....	174.4	274.0
Nov.	...	59.4	42.7	....	184.2	134.6
Dec.	...	61.3	39.6	....	142.5	113.0

Source: American Institute of Steel Construction. Figures represent members' reports only.

Wholesale Commodity Price—Cost of Living Indexes

	Commodities (1926=100) 1945	1944	1943	Living Costs (1935-39=100) 1945	1944	1943
Jan.	104.9	103.3	101.9	127.1	124.2	120.6
Feb.	....	103.6	102.5	....	123.8	120.9
Mar.	....	103.8	103.4	....	123.8	122.8
Apr.	....	103.9	103.7	....	124.6	124.1
May	....	104.0	104.1	....	125.1	125.1
June	....	104.3	103.8	....	125.4	124.8
July	....	104.1	103.2	....	126.1	123.8
Aug.	....	103.9	103.1	....	126.4	123.2
Sept.	....	104.0	103.1	....	126.5	123.9
Oct.	....	104.1	103.0	....	126.5	124.4
Nov.	....	104.4	102.9	....	126.6	124.1
Dec.	....	104.7	103.2	....	127.0	124.1
Ave.	....	104.0	103.2	....	125.5	123.5



FINANCE

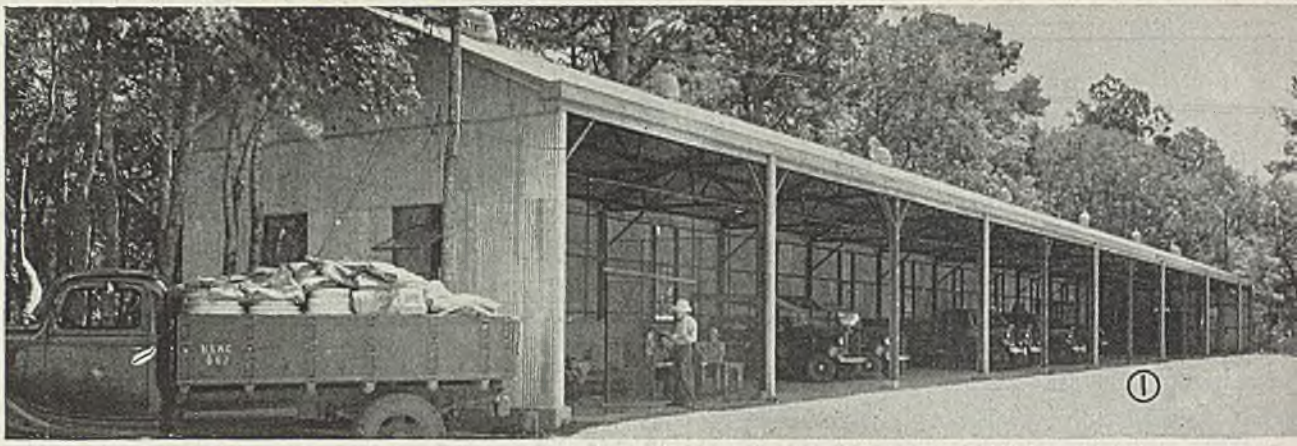
	Latest Period*	Prior Week	Month Ago	Year Ago
Bank Clearings (Dun & Bradstreet—millions)	$10,929	$9,412	$11,016	$9,417
Federal Gross Debt (billions)	$235.0	$234.9	$233.9	$187.4
Bond Volume, NYSE (millions)	$53.3	$56.1	$48.5	$54.0
Stocks Sales, NYSE (thousands)	8,966	8,939	8,112	6,413
Loans and Investments (millions)†	$58.5	$58.8	$59.2	$53.3
United States Gov't. Obligations Held (millions)†	$43.9	$44.1	$44.3	$38.9

†Member banks, Federal Reserve System.

PRICES

STEEL's composite finished steel price average	$57.55	$57.55	$57.55	$57.55
All Commodities†	105.0	104.8	104.7	103.4
Industrial Raw Materials†	116.2	115.7	115.3	113.2
Manufactured Products†	101.6	101.6	101.6	100.6

†Bureau of Labor's Index, 1926 = 100.



Developments in...

LIGHT-GAGE STEEL CONSTRUCTION

Systems fostered by exigencies of World War II feature speed and economy both in fabrication and erection on large-scale building operations

A GENERALLY acceptable design specification is vitally needed to increase the application of light gage steel construction. Although these constructions have been used satisfactorily in thousands of buildings since 1897, no co-ordinated effort had been launched to establish a suitable specification until 1938, when the American Iron and Steel Institute set up its Building Codes Committee.

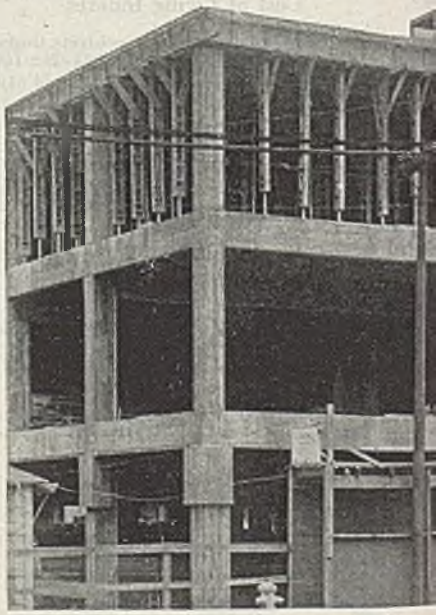
Among other things, the committee undertook to develop: (1) A standard specification for the base metal; (2) data on the durability of the structural members as related to the intended life of a building; and (3) a specification for the design of structural elements formed from light gage steel.

The industry is not unduly concerned about the possibility of substantial inroads by competitive materials, such as wood or aluminum, on the markets for structural steel in buildings, but is confident about the prospect for widening the market for lighter systems of construction as a working partner of structural steel.

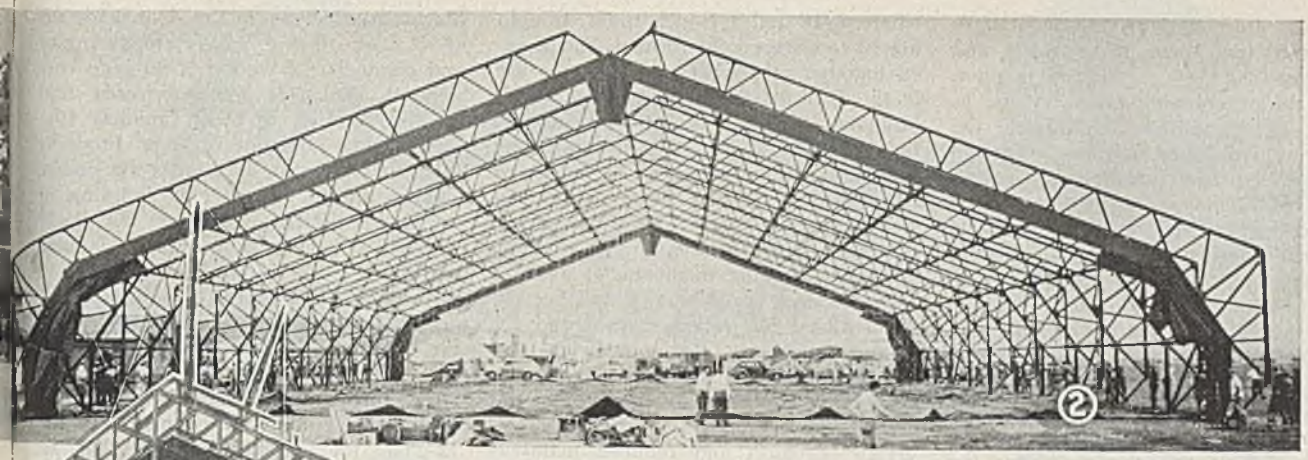
Three main reasons for believing that light-gage steel construction will become increasingly popular are:

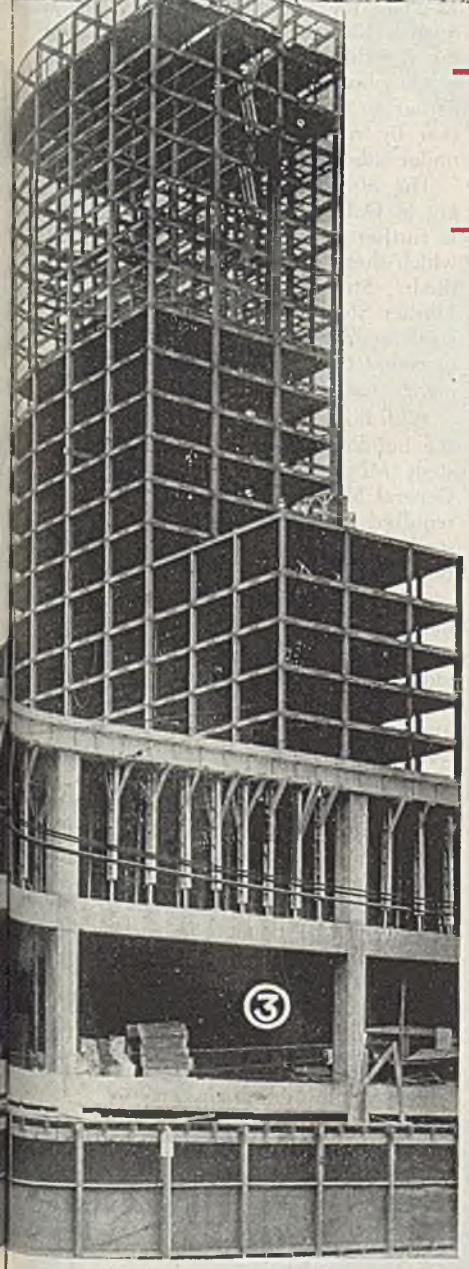
1. Loads and spans found in residences, schools, institutions, and buildings for business or light commercial occupancies are especially suited to these light steel constructions. In most such cases, materials other than steel, principally wood, are now used. There will be an opportunity for both structural steel and light-gage steel in such applications.
2. Steel's incombustibility, and consequent reduction of fire hazard in building construction, in addition to relative ease with which collateral materials provide adequate fire resistive ratings, are features which the public is beginning to demand.
3. Increased labor cost, relative to materials, is favorable to the greater use of lighter forms of structural steel, primarily because of the factors of economy of shop fabrication due to the easy workability of steel, lower cost of freight and handling provided by its light weight, and speedy and economical erection as a result of its uniformity.

In the field of heavy structural shapes one of the largest contributing factors to their universal acceptance and use has been the confidence engendered in them by their production to an ASTM standard. Designers and code officials entrusted with seeing to the safety of construction can, with certainty, work to prescribed unit stresses based on definite minimum properties of the steel.



In the case of light gage, flat rolled steel, whose properties for structural purposes had not yet been standardized, expedients were the order of the day. An element of uncertainty was therefore injected because until a designer knew the strength of the actual material to be used for structural members, he could not know what unit stress to use. Ac-





By MILTON MALE
Research Engineer
United States Steel Corp.
New York

tually, he either insisted on material with properties comparable to heavy structural steel, or he set some inordinately low figure for strength that could be more than met by the softest material that might be furnished. In the latter case, the competitive advantages of steel often were lost.

Producers of flat rolled steel put the problem before the American Society for Testing Materials, with the result that in 1941 there were issued two tentative standards for the material. One for the thicker material principally used, A245-T, calls for the same ductility and yield point as structural steel, but 5000 pounds per square inch less tensile strength. Another, A246-T, for the thinner material less frequently used, requires the same yield point as structural steel, but 4 per cent less elongation in 2 inches, and 8000 pounds per square inch less tensile strength.

Light gage steel constructions are not usually exposed to outside weather unless special protective treatment or coatings are provided, or unless there is definite assurance that repainting will be performed periodically. Where members are enclosed within a building and their protective paint coating is not exposed, conditions of course are somewhat different. Since it often is impracticable to apply a field coat of paint to the light steel types of construction which are generally used as secondary framing in buildings, it has become standard practice to require only shop painting of them.

To determine whether painting has provided effective protection, AISI, in 1940, engaged Pittsburgh Testing Laboratory to make an inspection survey and to report on the condition of painted light steel constructions that have had years of actual service in some of the older buildings. Survey included only constructions enclosed within buildings and not steel members exposed directly to the weather. Report showed that the installations generally are in excellent condition and structurally sound.

Concurrent with the development of a material specification, and data on durability, work was progressing on a specification for the design of light-gage structural steel for buildings. In the absence of any data on which to predicate a satisfactory specification, the Committee on Building Codes in 1938 organized a technical subcommittee to develop those data. It initiated a research program at Cornell University. This work has provided sufficient data for the presentation soon of a specification to those who wish to have a sound and rational basis upon which to design with light gage sheet and strip steel.

The testing program, under the general supervision of Professor W. L. Malcolm, director of Cornell's School of Civil Engineering, and Professor George Winter, with the support of Dean S. C. Hollister, involved 621 structural specimens, ranging in thickness from 0.1532 to 0.0245-inch, and flange widths from 1 to 16 inches. Structural members included beams, studs or light columns, and deck constructions. Results of the test work were paralleled and supplemented by the Cornell investigators by extensive theoretical investigations of strength and behavior of members. Design specifications were based on this evidence, both experimental and theoretical.

Although design procedures for light gage structural members are superficially familiar to those employed for heavier hot rolled sections, it is important to recognize certain limitations inherent in their use. Members are generally characterized by uniform thickness throughout each part. In contrast to hot rolled shapes, whose flanges are normally considerably thicker than the web, formed members of light gage steel usually have flanges of the same thickness as the web, and in some cases, the web is twice the thickness of the flange. Consequently, it is important to give consideration in the design procedure to the prevention of local instability or buckling of the compression flanges. This feature is adequately provided for in the specification by a distinction between the behavior of stiffened and unstiffened flanges, and their relative load-carrying capacities.

In many cases the sound and economical design of thin members is facilitated by the use of the concept, "effective design width" of elements of the member. Where, for example, the width of a flange is large as compared with its

thickness, areas next to the web carry more stress than those further away, and if designed in the conventional manner, the beam or column would not be as strong as computed. Therefore, the specification requires that in the design of certain types of members, the actual width of the flange be replaced by a reduced width, such that the reduced cross-section gives a correct valuation of the maximum stress and strength. It is this reduced width of flange that is called the "effective design width."

In the design of steel wall members, the specification takes cognizance of the bracing effect of collateral wall sheeting material on the strength of the steel sections and provides for evaluating the lateral restraint required from and supplied by these wall materials and their attachments.

The Committee on Building Codes approaches its objective by seeking to remove outmoded or obsolete restrictions from codes as well as to recommend the adoption of functional requirements based on sound engineering principles. Where well established industry standards are available, they are incorporated in the committee's recommendations; where none are available, the committee assists in formulating them.

Commercial Developments

Except in some few and minor instances where overlapping interests are bound to occur, light gage steel is not, under normal peacetime conditions, a competitor of structural steel, but rather of wood. In carving their own niche in the market, the lighter forms of construction will serve to stimulate the demand for, and increase the application of structural steel which possesses inherent advantages as compared with other materials.

The earliest recorded application of light formed shapes dates back to 1855, where 1/16 and 1/8-inch thick wrought iron sheets were cold formed, and riveted together into I-beam shapes, for use in the Bank of the State of New York's building. There was little advance in the art until about 1910. Light steel construction then began to be employed more extensively and the trend gained steady momentum. Generally speaking, the light gage members were used as secondary framing members, or as floor and roof deck panels, supplementing the conventional hot rolled shapes used for primary members. Beginning with 1930 a great variety of systems of light gage steel came into being. They offered the advantages of increased fire protection, greater strength and reduced maintenance costs. Furthermore, in large scale building operations, economy and speed in construction were achieved through standardization of structural units and through quantity production.

The exigencies of the present World War offered an opportunity and challenge to these light weight constructions to prove their worth (See Figs. 1, 2, 4 and 5). Buildings of many kinds had to be built, as quickly as possible. Used in combination with structural steel framing for the larger structures (Fig. 3) or alone for the smaller ones, the light steel constructions saved priceless time in constructing hundreds of such buildings.

Accompanying illustrations give some idea of the variety of applications which have opened up for light-gage construction. Shown are:

Task Force hospital building appearing in Fig. 5 was fabricated for the Navy by Butler Mfg. Co., Kansas City, Mo., and features portability, minimum shipping space and ease of erection. Plywood floors on light channel-shaped sections are supported on 16-gage floor members. Most of roof and wall framing is 16-gage material.

Frame of the shed at Parris Island Marine base, shown in Fig. 1, is made up of 8 and 10-gage cold-formed angles and channels. Covering is 26-gage corrugated steel. It was fabricated and erected by Iron & Steel Products Co., (now Armco Drainage & Metal Products Inc.) New Orleans, La., faces the ocean, and is said to be the only building at the base which withstood the 1940 "blow," which caused serious damage elsewhere, with no damage.

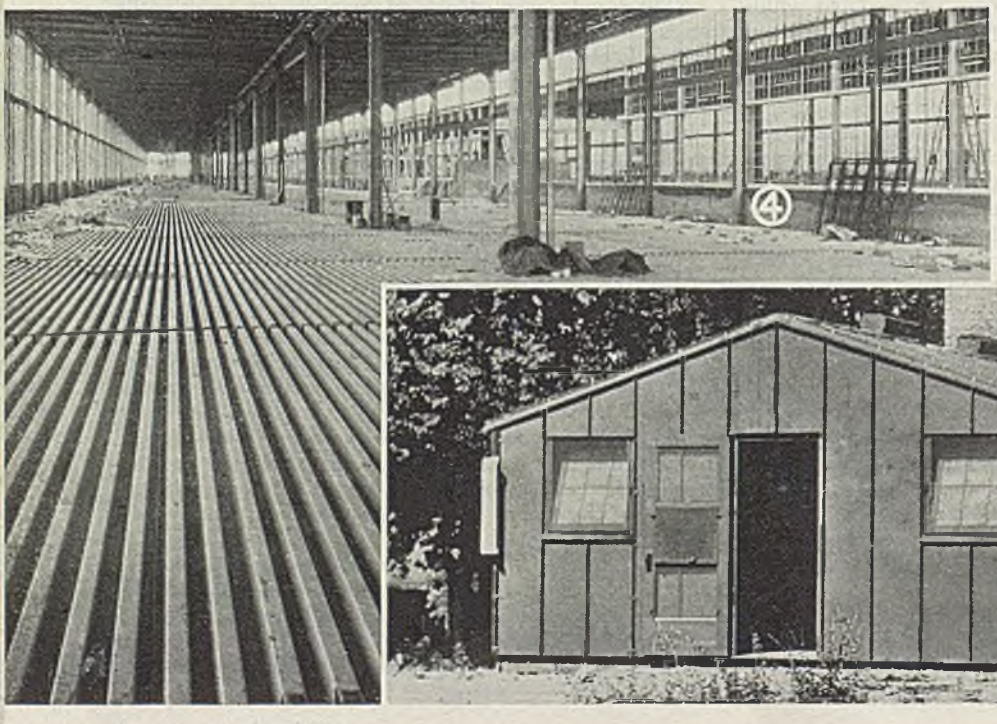
Most of the structural members in the portable combat hangar illustrated in Fig. 2 are cold-formed from strip steel. By varying the gage of metal, design requirements are closely met. Bottom chords are ¼-inch; top chords, 10 and 12-gage; bracing members are 14-gage. Span is 130 feet, height 39 feet. Covering for this Butler company fabrication is composed of canvas strips laced together on the ground and raised to position by ropes and pulleys attached to under side of hangar.

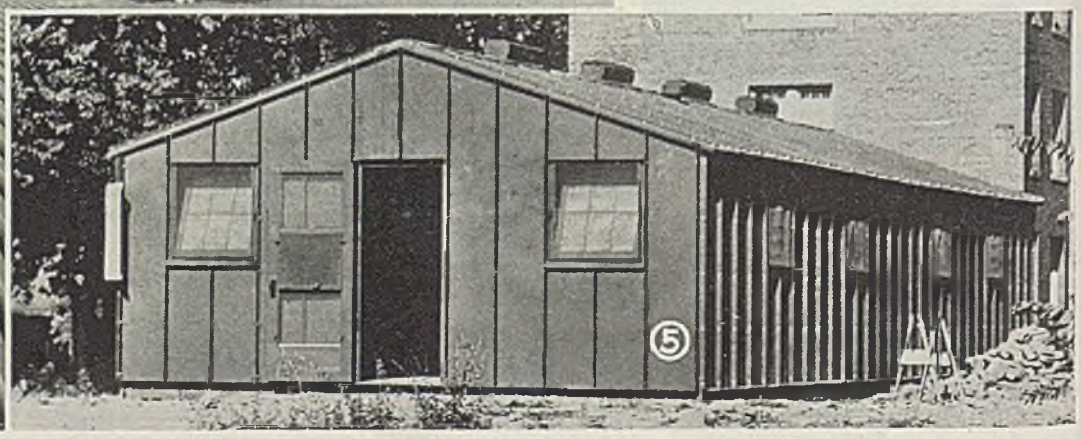
The 30-story Mercantile Bank building in Dallas, Tex., appearing in Fig. 3 is further evidence of the facility with which these structural materials are handled. Structure was topped out by Mosher Steel Co. with H. H. Robertson steel products in the same time required to complete the pouring of 3-story parking garage in foreground.

With floor area of 162,000 square feet, the building shown in Fig. 4 for Ternstedt Mfg. Co., Fisher Body Division, General Motors Corp., of Trenton, N. J., required 585 tons of 16 and 18-gage steel. Material was fabricated by H. H. Robertson Co., Pittsburgh.

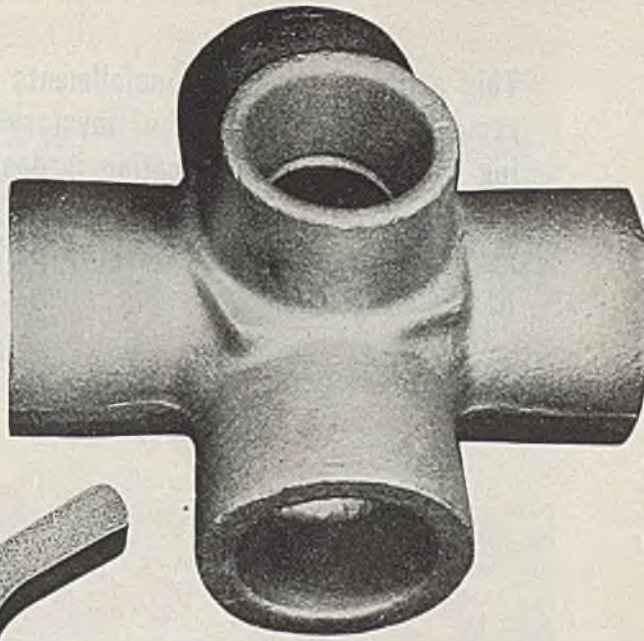
As the illustrations indicate, these modern types of light steel construction usually consist of sections used individually or preassembled into large framing panels before erection at site. They are installed at relatively close spacing, 24 to 48 inches on centers, or thereabouts, for floors and walls, and 30 inches for roofs, primarily because materials applied to them require close spacing. Depending on conditions, thicknesses range from 10 to 16-gage (about ⅛ to 1/16-inch thick). Other types, usually referred to as panel construction, have large surfaces with integrally formed structural ribs at close spacings, the sheet thickness being about 16 or 18-gage (1/16-inch thick). Certain types

(*Please turn to Page* 146)





Forging PROPELLER HUBS



By L. E. BROWNE
Associate Editor, STEEL

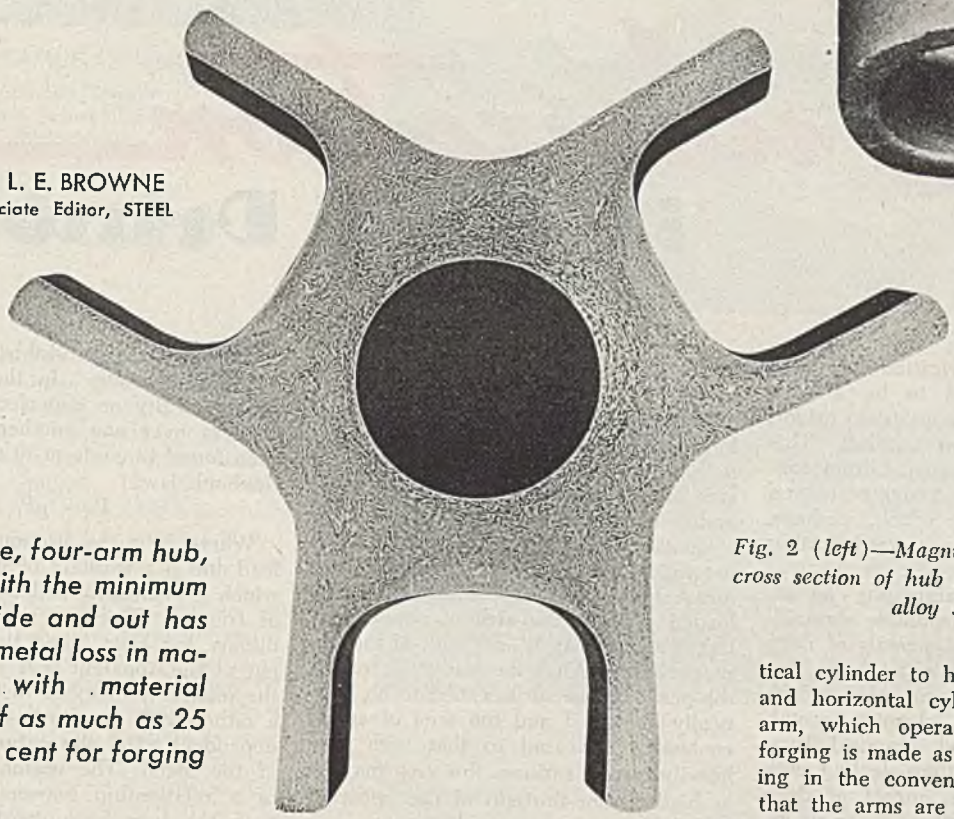


Fig. 1 (above)—Solid or one-piece type propeller hub forging with four extruded arms

Fig. 2 (left)—Magnified cut-out of the cross section of hub forged from X4340 alloy steel

One-piece, four-arm hub, forged with the minimum finish inside and out has reduced metal loss in machining, with material savings of as much as 25 to 30 per cent for forging

TWO types of hubs are used by manufacturers of controllable pitch aircraft propellers in this country. One is the two-piece or split type hub, which consists of two half barrels forged and machined separately and then bolted together for final assembly. The other is the solid or one-piece type, similar to that shown in Fig. 1.

It was originally furnished as a solid forging without any material removed from the arm bores. This necessitated considerable machining and a large waste of material. Furthermore, the solid forging was so heavy and its sections so large that it was necessary to start with large size billets which received relatively little work in the interior during the forging operations. The solid forging, therefore, besides involving a waste of material and machine hours, was less desirable as far as its internal structure was concerned.

Because of this fact and the increasing war program, which made the saving of material more important than ever, Wyman-Gordon Co., Worcester, Mass., developed a method of forging this type of hub with pierced arms. This company now is furnishing approximately 90 per cent of all of the propeller hub forgings being used in this country, of both the split and one-piece types.

In the development of this job, experimental work was carried on, piercing one arm at a time in order to determine the power necessary, together with the most satisfactory die materials and design. After completion of experiments and consideration of possible types of equipment, it was determined that the piercing of the arms had to be done at one heat. Because of the impossibility of designing a satisfactory mechanically operated machine, the hydraulic method was decided upon.

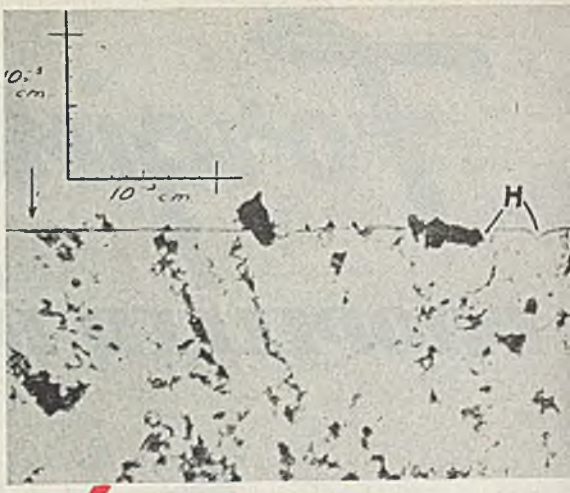
Present equipment is a large hydraulic press weighing in excess of 750 tons and capable of exerting a pressure up to 3500 tons. It consists basically of a vertical cylinder to hold the dies together and horizontal cylinders, one for each arm, which operate the punches. The forging is made as a solid hammer forging in the conventional manner except that the arms are shorter than required in the finished part. After the usual preliminary or breakdown operations, the piece is finish forged and trimmed. Then it is transferred to the hydraulic press. The lower die is stationary and the top die actuated by the vertical cylinder.

After the forging is placed in the lower die, the top die is lowered and held in position by constant pressure of the top cylinder. Horizontal punches, each actuated by its own cylinder, then enter holes in the sides of the dies and extrude the arm bores in one operation.

The result is a one-piece hub forging, forged with the minimum finish inside and out and with a structure which has been thoroughly worked throughout. Development of this forging has resulted in material savings of, in some cases, as much as 25 to 30 per cent per forging. In terms of weight, this varies according to the size of the particular hub and runs from 75 to 125 pounds per forging. This has resulted in a total saving of alloy steel of more than 4,000,000 pounds. Material forged

(*Please turn to Page* 148)

This article, with three installments to follow, removes much the cloak of mystery surrounding the subject of lubrication in deep drawing operations and sets up a framework of fundamentals into which individual experience will fit and have meaning



Lubrication in Deep Drawing

DEEP drawing lubrication has generally been considered to be a very complicated one and, to a certain extent, this viewpoint has been justified. This has fostered attitudes ranging from contempt to despair among engineers and production supervisors which, perhaps, have been detrimental toward further progress in this field.

In the following paragraphs, an attempt will be made to provide a rounded picture of the fundamentals of deep drawing lubrication with the hope that a framework will be provided which will enable physicists, chemists, metallurgists, engineers and practical shop men to make contributions dealing with their specialties. The subject of deep drawing lubrication is of necessity multiphased and information from each of these fields is necessary for the solution of its problems. It may be this aspect of lubrication problems that has caused the impression of almost hopeless complexity.

Theoretical Background

Nature of Metal Surfaces: Metals, in general, are crystalline materials and their surfaces are similar to the bulk of the metal in many respects and dissimilar in many others. Depending upon the method of preparation of the surface, this will consist of many irregularities and fragmented crystals (Fig. 1) of irregular shape in the case of ordinary machined surfaces, while in the case of superfinished surfaces prepared by one of the finest grinding techniques, many of the jagged edges and the fragmented material are removed and surface then consists of a series of broad plateaus and shallow valleys [1] (Fig. 2). In any event, the surfaces of machined or ground metals are not exactly plane and consist of a series of elevations and depressions of greater or lesser magnitude, depending upon the method of manufacture.

This being the case, when metal surfaces are pressed together or are allowed to slide over one another, the actual area of contact between them is considerably smaller than the apparent area of contact. Bowden and Tabor [2] have determined, by means of conductivity measurements, that in the case of lightly loaded surfaces the area of actual contact is as small as 1/170,000th of the apparent area. When the load is increased, the peaks on the surface tend to be plastically deformed and the area of actual contact is increased so that with very heavily loaded surfaces this area may be as high as one-thirtieth of the apparent area.

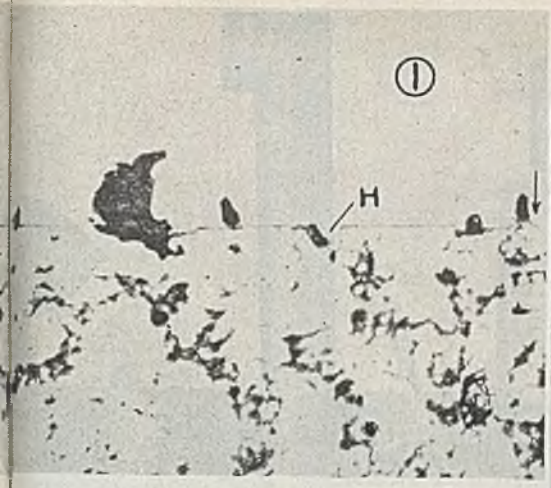
When the machining or grinding process is performed with tools or abrasives that are dull or glazed (loaded), there is a tendency for the metal to flow or be smeared over the surface rather than cut off. This results in the formation of a layer of amorphous material which is frequently referred to as the "Beilby layer" [1, 3]. When the amount of metal which has been caused to flow in this manner is small, this has the effect of increasing the area of contact that may be realized when such metal surfaces are pressed together. On the other hand, when a considerable amount of metal has been deformed in this manner, there is a tendency for this metal to flake off when subjected to repeated sliding motions under high pressure. This is generally detrimental to the applications contemplated [1]. This amorphous layer has properties that are considerably different from the bulk of the metal, some of these being greater hardness, brittleness, and chemical reactivity. It has been reported that this amorphous layer is frequently transparent so that scratches below this layer are visible.

Sliding Friction: In the case of the sliding of dry or imperfectly lubricated surfaces over one another, friction has been found to conform to the Amontons-Coulomb law:

$$F = \mu P$$

Where F is the friction, P, the total load and μ a constant of proportionality, which is commonly called the coefficient of friction. Friction, under these conditions, has been found to be independent of the apparent area of contact and the relative velocity of the surfaces, over a rather wide range of velocities, but is dependent upon the nature and surface of the metal. The reason for this lack of a relationship between friction and area has long been considered a mystery but is probably explained by the small area of actual contact between sliding metal surfaces mentioned.

At one time it was considered that friction was due to an interlocking of the hills and valleys which constitute metal surfaces [4, 5], but this view has been superseded by a more modern and logical concept based on the theory of molecular attractions [4, 6, 7]. According to this concept, when portions of one metal come into very close proximity with another metal surface, the force of intermolecular attraction becomes very large. This results in welding portions of the metal surfaces that are in contact to form a homogeneous region having similar properties to the metal in bulk form. Because of the irregular shape of most surfaces, this welding can only occur over the limited area in which the elevations are in contact, unless the surfaces are pressed together by very high unit pressures. In the latter case the metal flows and larger areas make contact and then weld. When welding takes place only at the elevations, the



By SAMUEL SPRING
Associate Chemist
Frankford Arsenal Laboratory
Philadelphia

Metals

force required to break the welds is not necessarily very large, so that when metals are caused to slide upon one another, in the absence of very efficient lubrication, these welds form and are broken with extreme rapidity. The life of one of these welds, under conditions in which metals are caused to slide over one another at relatively high speed, has been estimated at 10^{-4} seconds [4].

The work of Bowden and Leben [8] has indicated that, as a consequence of this welding, relative motion of surfaces sliding over one another takes place by means of a "stick-slip" process in which motion is momentarily arrested as each weld is formed and then proceeds as the weld is broken. This takes place so rap-

(*Please turn to Page* 150)

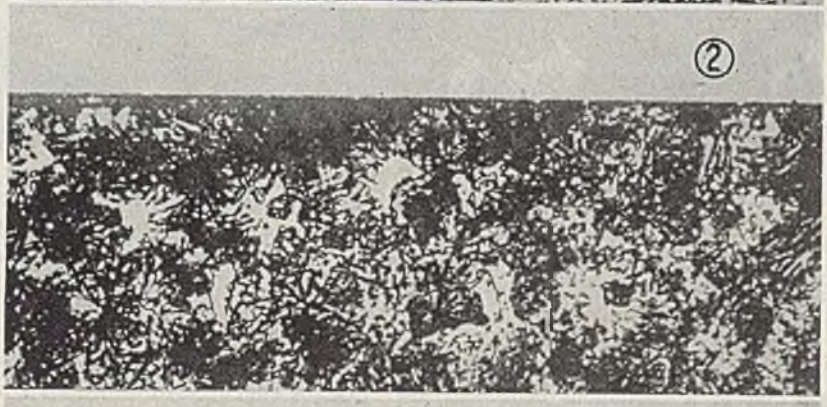


Fig. 1—In the case of ordinary machined surfaces, photomicrographs reveal many irregularities and fragmented crystals of metal

Fig. 2 (Top)—Surface profile comparable to that on ground surface of crankshaft bearings shows peaks and projections enabling oil films to be punctured with metal-to-metal contact and wear resulting. (Center) Superfinishing for 5 seconds removes some of the objectionable material. (Bottom) Great increase in bearing area after complete superfinishing is evident in this profile photomicrograph. Magnification X750

Fig. 3—Profile of finely turned steel surface will have appearance shown in this photomicrograph at X750. Figs. 2 and 3 from "Story of Superfinish," by A. M. Swigert Jr.

TABLE I

COMPARISON AMONG TYPES OF FRICTION*

	Condition of Surfaces	Type of Friction	Coefficient of Friction Range	Average
1.	Unlubricated†	Dry friction	0.10 to 0.40	0.16
2.	Boundary lubricated	Boundary friction	0.01 to 0.10	0.03
3.	Perfectly lubricated	Fluid friction	0.0001 to 0.01	0.006
4.	Ball bearings	Rolling friction	0.001 to 0.003	0.002
5.	Roller bearings	Rolling friction	0.002 to 0.007	0.005

* From "The Story of Superfinish."

† Surfaces covered with oxide and possible water vapor. Bowden and Hughes have reported that values are increased to approximately 2.0 when surfaces are "outgassed" to remove oxide and friction is determined in a vacuum.

By G. W. BIRDSALL
Associate Editor, STEEL

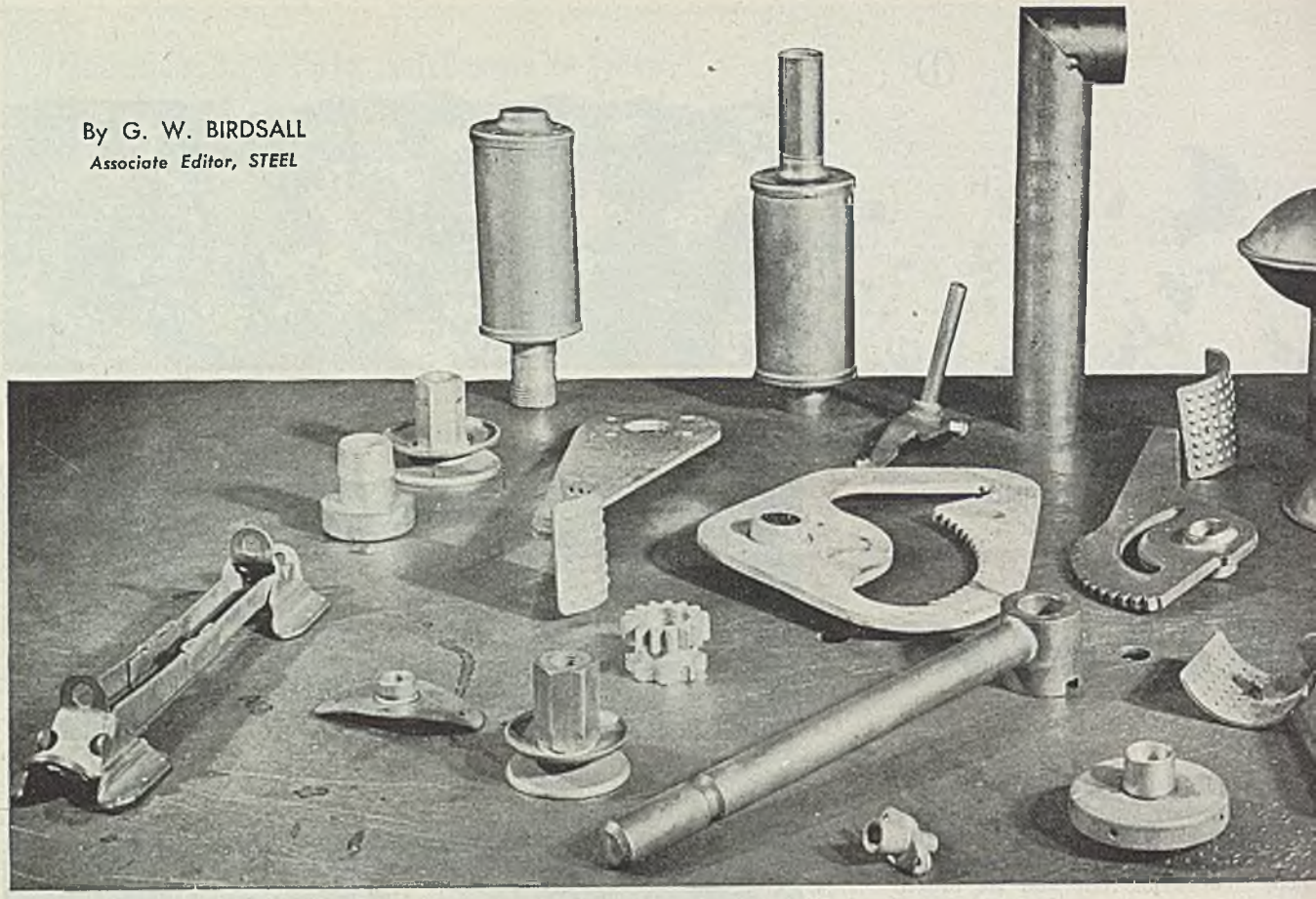


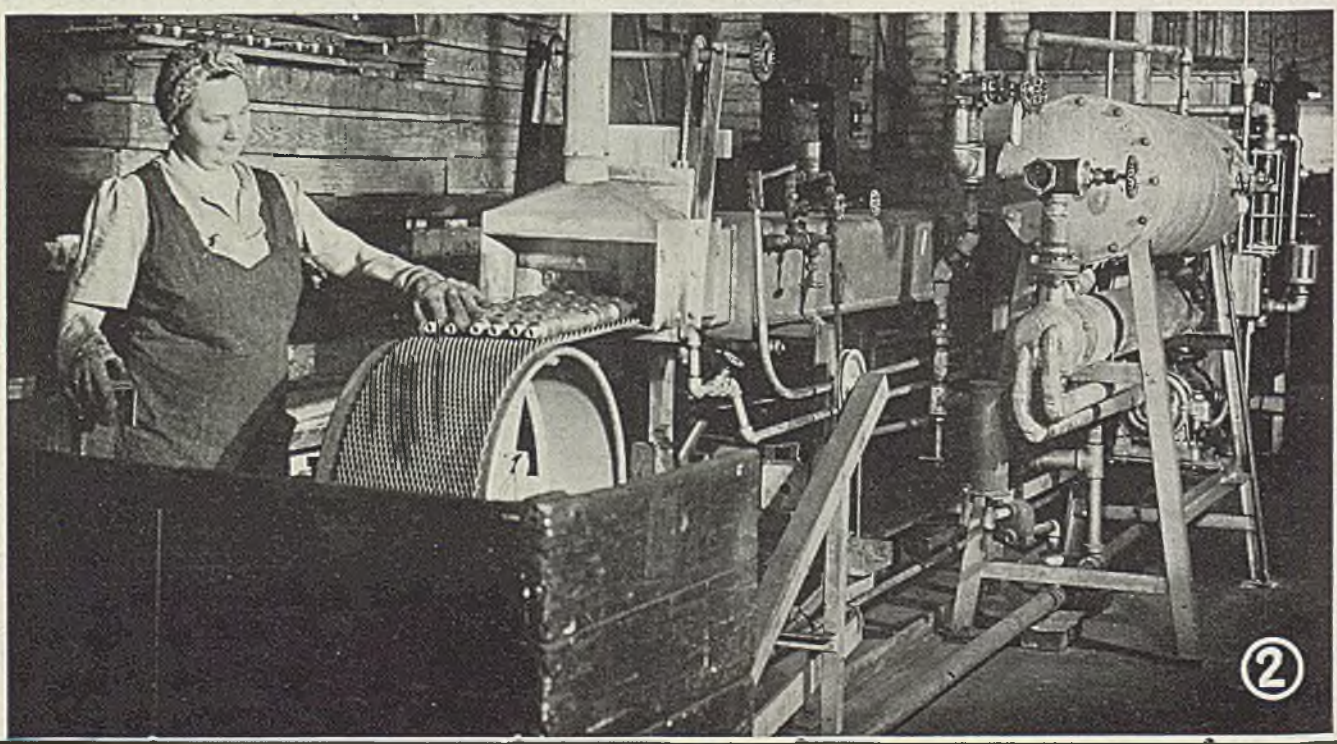
Fig. 1—Parts copper brazed at Briggs & Stratton include several types of mufflers (seen at rear and made of sheet metal) as well as heavy stampings for pedals and sectors; also assemblies of screw machine parts made from bar stock, such as the crank in center foreground

JOINING assemblies by copper brazing in a continuous controlled atmosphere furnace has been found a very advantageous fabricating method, report engineers of Briggs & Stratton Corp., Milwaukee. This joining method is being employed in production of many items that go into this company's line of 4-cycle single-cylinder air-cooled gasoline engines, 2/3 to 6 horsepower.

While most of the assemblies that are copper brazed consist of sheet metal parts, a good many heavy stampings, automatic screw machine parts, as well as parts made from tubing and bar stock are joined by the method.

High Production: Chief advantage of the method is the large volume of work that can be handled. The continuous furnace in which the brazing work is done has a built-in mesh belt conveyor that easily accommodates a large number of assemblies. See Fig. 3.

No Decarburization: The furnace is



Continuous Copper Brazing....

Proves Valuable Production Tool at Briggs & Stratton

Fabricating costs are reduced, production is speeded and better products often result when assemblies are designed for copper brazing. Pre-placement of copper for brazing is simplified in some assemblies by copper plating one or more parts to be joined. Simultaneous hardening and brazing affords another important production short-cut

supplied with a protective atmosphere so that the surface condition of the material being joined is not adversely affected. Parts come from the unit with the same clean bright appearance they possessed when they entered the furnace.

Another advantage is that the copper used to make the joints becomes so fluid that it makes smooth fillets at all corners, the surface tension of the melted copper automatically rounding it off at all joints and corners. This is valuable in minimizing the amount of work necessary to completely finish an assembly as there is no rough accumulation of metal to be ground off where the joints are made. Neither is there any "spatter" of molten metal to disfigure the surrounding surface. The flow of molten copper can be controlled quite closely.

High Strength: Copper brazed parts exhibit surprisingly high strength, for under correct conditions the copper actually alloys with surface layers of the metal to produce a joint that has same strength as the metal joined, for all practical purposes. About the only critical factor in producing high-strength joints is provision of proper clearance between the surfaces to be joined. (Surfaces must be clean, also.)

Investigation has shown that for greatest strength, close press fits should be provided, less than 0.003-inch clearance being desirable where greatest strength is wanted. Although good results are had with smaller clearances, there appears some tendency to reduce the desired capillary action that assures proper flow of the copper throughout the entire joint when fits are too tight.

On the other hand, too great a clearance also reduces the strength of the joint because then the copper itself must bridge the space between the joined members and copper by itself has relatively low physical properties. A correctly brazed joint appears to get most of its strength by having the joined surfaces so close together that the copper present is in the form of copper-and-base-metal alloys which have excellent physical properties.

Great Versatility: Equally important is the fact that the method is extremely versatile for once the furnace is adjusted for proper heating and atmospheric conditions, it is possible to braze a great variety of assemblies without changing the settings.

For instance, a number of different sized and shaped assemblies of sheet metal parts can be brazed under identical furnace settings. Likewise a number of assemblies of stampings and screw machine parts can be brazed with these same furnace conditions.

And the change to accommodate larger or heavier parts involves only adjusting the chain belt conveyor speed

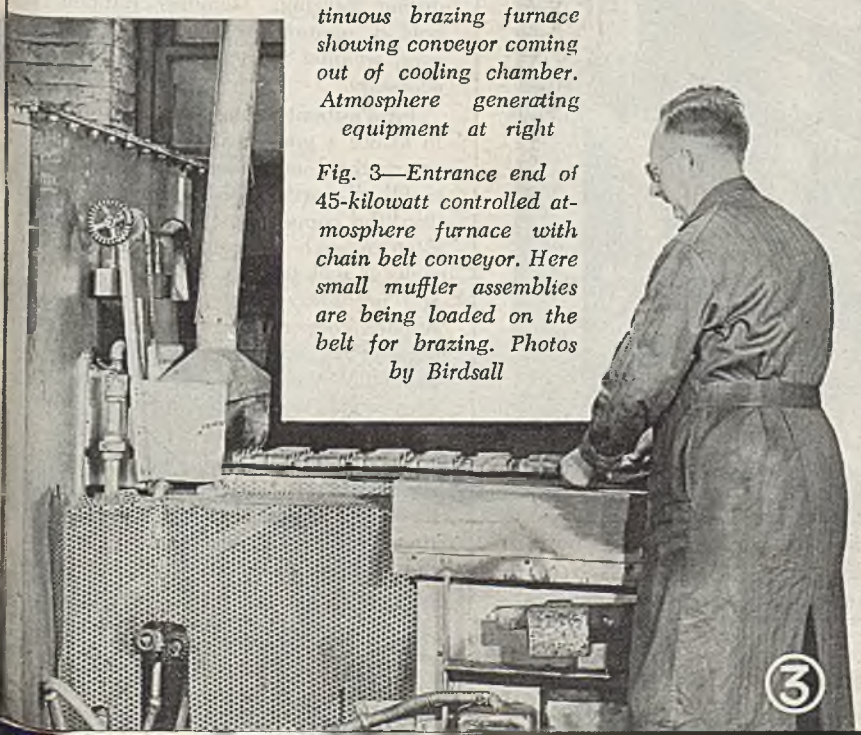


Fig. 2—Exit end of continuous brazing furnace showing conveyor coming out of cooling chamber. Atmosphere generating equipment at right

Fig. 3—Entrance end of 45-kilowatt controlled atmosphere furnace with chain belt conveyor. Here small muffler assemblies are being loaded on the belt for brazing. Photos by Birdsall

so that sufficient time is allowed for the work to come up to heat. Of course it is necessary to bring the entire part up to brazing temperature, around 2000 degrees. When that temperature is reached, the copper applied at the joint in the form of wire clips or an electroplated layer melts and flows throughout all portions of the joint. Examination of photomicrographs shows it actually flows in between grains of the metal parts joined to form alloys with the metal of these parts.

Application at Briggs & Stratton: Here a member of the engineering department describes some of the typical assemblies that are copper brazed by Briggs & Stratton. Every engine is fitted with an exhaust muffler made from sheet metal stampings. Several designs of mufflers are employed, including the four shown in the back row of Fig. 1.

The small tubular muffler seen at extreme right rear is made from 16-gage sheet steel stampings. It is 4 inches long, 1½ inches in diameter. The two shell halves are made from 0.037-inch stock. The shell fits over a stamped baffle inside and a curled-up stamped tube. The nipple on the end is a screw machine part. All of these parts are joined by plating the tube with 8/10.000-inch thick layer of copper which melts and flows throughout all joints when the assembly goes through the furnace.

Other sheet metal parts range in thickness up to the heavy stamped sector seen in central portion of Fig. 1. This part is made from stock 3/32-inch thick. A hub made on an automatic screw machine from cold rolled bar stock is brazed to this sector.

Other assemblies that are copper brazed include various models of foot starter pedals, three of which appear in Fig. 1. All have a curved pad with raised anti-skid spots. This pad is usually stamped from ⅛-inch stock and is brazed to the other member of the pedal which is of heavier stock.

The larger mufflers range up to one which is 4 inches in diameter and 8 inches long. The shell of this unit is made from two stampings, each 0.050-inch thick. They fit over a 1-inch diameter pipe at one end. The inner baffle is also made from 0.050-inch sheet steel. All mufflers and most other sheet metal parts employ SAE-1010 or 1015 steel.

The hand starter crank shown in center foreground of Fig. 1 is typical of the heavier assemblies that are joined by copper brazing. Made from AISI-1112 screw stock, the 1½-inch outside diameter hub has one end of the ¾-inch diameter handle pressed into it and brazed.

The company reports that altogether, more than 30 different assemblies are joined by copper brazing in the controlled atmosphere continuous conveyor belt furnace shown in Figs. 2 and 3.

Now Briggs & Stratton engines are being widely used for powering portable equipment for lubricating jeeps, tanks, trucks, aircraft engines; for inflating tires, pumping gasoline, spray painting, preheating and starting aircraft engines; for lighting emergency landing fields, hospitals and field quarters; for energizing communication equipment; and for a hundred and one other important war uses.

It has been pointed out that these engines do not differ from those already doing so much to lighten the burden of the farmer by pumping water, operating washing machines, running small cultivators, powering milking machines, coolers, separators and the like. Industry, too, finds wide use for them. Roadways are kept in repair by gasoline-powered pumps, cement finishers, line markers, mixers, compressors and other man-saving equipment. Railroads use them to replace human brawn in operation of utility cars, rail saws and grinders, tampers and weed burners.

The point that is emphasized by the above is that the copper brazing applications described are not wartime developments but have been engineered to provide better products for peacetime use as well. . . .

Preparation of Parts: Let's examine typical processing operations to see exactly how continuous copper brazing is employed here. The foreman of the company's brazing department explains that it is necessary to carefully clean all parts to be brazed, for the required capillary action that draws the molten copper throughout the joint will not be reliable unless the surfaces being joined are clean.

For this reason, first step is to put all parts through an automatic washing machine. The work is placed in perforated metal baskets and carried through a hot alkaline bath in the machine. This is followed by thorough rinsing under hot water sprays.

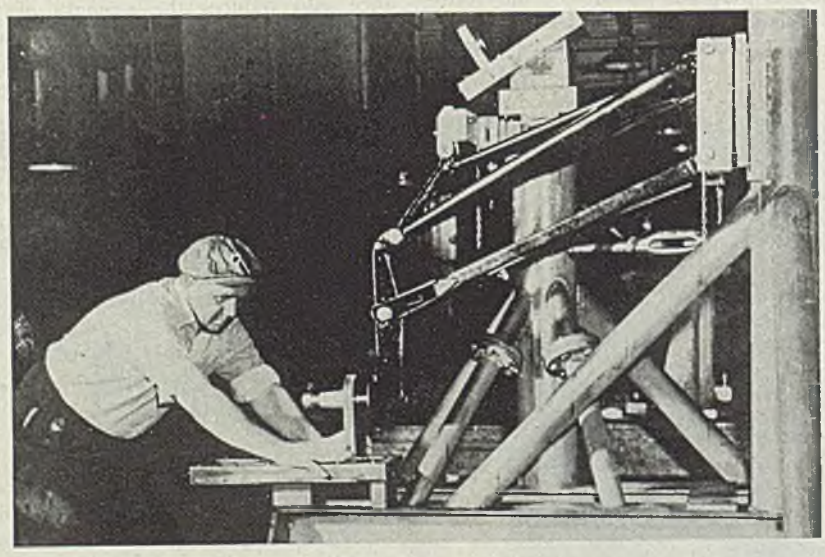
Assembly: Cleaned parts are now put together to form sub-assemblies. Most sub-assemblies involving screw machine parts are made by use of press fits, closely fitting parts being forced together in power presses or hand operated presses. Certain assemblies are staked together, the parts being held in position by bending, crimping or otherwise mechanically interlocking them securely, such as with pins.

Large sheet metal parts or stampings may employ press fits if the members are of such size and shape that they can be relied upon to retain their relationship during brazing. Members difficult to hold in position are spot welded. However, welding is used only where really necessary.

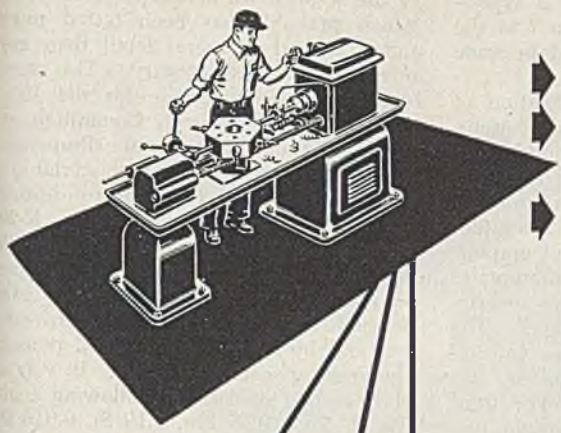
Pre-Positioning the Copper: In order to assure a good brazed joint, it is necessary that enough copper be provided to fill all portions of the joint properly. Too, the copper must be applied to the joint in such a position that when it melts it will tend to flow into the joint and not away from it. Incorrectly positioned copper will run over large portions of the adjacent surface. While not damaging the parts mechanically, this does waste copper that may be needed to assure a good joint.

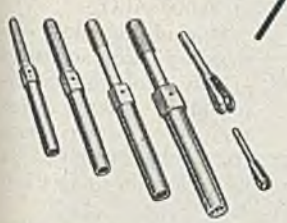
Two methods of supplying copper to the joints are employed at Briggs & Stratton. Copper wire in the form of rings or clips (hairpins) is slipped around the parts at the joint. Wire sizes range

(*Please turn to Page* 156)



TEST STAND: More than 3500 landing gears produced for the Navy's Grumman fighter by Willys-Overland Motors have been tested without a single failure on this test stand. Structure of plane's hydraulic mechanism for operating gear in and out of fuselage is simulated as worker checks position of axle forging





THESE AIRCRAFT cable terminals require clean turning, threading, drilling and milling. The uniformity of Carpenter Stainless #3 (Type 303) was a big factor in maintaining volume production on these parts.

THIS FINNED aircraft spark plug is an excellent example of the results obtainable with Carpenter Stainless #5 (Type 416).

HERE'S ANOTHER good example of vital parts for war equipment made from Carpenter Free-Machining Stainless bar stock. Rejects on close tolerance Stainless parts such as these, used in a torpedo directional mechanism, are reduced to a minimum when Carpenter Stainless #8 (Type 303) goes on the job.

YOU GET CORROSION RESISTANCE

PLUS

EASY, LOW COST MACHINING WITH CARPENTER STAINLESS

If you're like a lot of product designers we know, you've said to yourself; "Of course, I'd like the corrosion protection and other advantages of Stainless for my new or redesigned products. But what about the machining cost?"

Our answer is "Try Carpenter Free-Machining Stainless and then take another look at the cost sheet." Others have found by using Carpenter Free-Machining Stainless that they can speed output, cut rejects and often eliminate further finishing operations.

Here's why. Carpenter Free-Machining Stainless bar stock is consistently uniform. It cuts free and clean and works the same, bar after bar. That means longer tool life between grinds, less tool breakage, lower tool costs. It means faster easier production right down the line.

If you haven't already tried Carpenter Free-Machining Stainless Steels, be sure to do so. Through their use, you can obtain all the advantages of Stainless at less cost.

Your nearby Carpenter representative would like to tell you more about these easy-to-machine Stainless Steels. Why not call him in today?

GIVE YOUR PRODUCTS THESE ADVANTAGES WITH CARPENTER STAINLESS

- Strength and Rigidity
- Heat Resistance
- Weight Saving
- Freedom from Rust
- No Plating to Peel
- Ease of Assembly
- Longer Product Life
- Sales Appeal

THE CARPENTER STEEL CO., 139 W. BERN ST., READING, PA.

Carpenter STAINLESS STEELS

BRANCHES AT
Chicago, Cincinnati, Cleveland, Detroit, Hartford, Indianapolis, New York, Philadelphia, St. Louis

GRAPHITIZATION

Of Low-Carbon and Low-Carbon-Molybdenum Steel

Controlled graphitization tests develop much information on the service behavior of materials used in elevated temperature applications. Molybdenum additions to a steel found to exert a very definite resistance to graphitization of that steel. McQuaid-Ehn test described as valuable criterion of the graphitizing tendency of carbon and carbon-molybdenum steels in this ASME report

By H. J. KERR
And
F. EBERLE
Babcock & Wilcox Co.
New York, N. Y.

WHILE MUCH information has been published on the graphitization of cast iron and high carbon steels, only a few cases of graphitization in low carbon steels and no case of graphite formation in low carbon-molybdenum steels had been reported until after the failure of the steam pipe at the Springdale Station of the West Penn Power Co. early in 1943.

Babcock & Wilcox Co. has manufactured many large oil refining vessels of carbon-molybdenum steel, also high temperature and high pressure boiler drums together with a very considerable number of superheaters of the same material. Therefore, the failure of the pipe at Springdale due to graphitization in service was of great importance to the authors' company and to its customers, notwithstanding the fact that the failed material had not been furnished or fabricated by them. (*Graphitization refers to formation of graphite particles in the steel. Such particles weaken the material and cause mechanical failure.* — THE EDITORS.)

We had carried out many high-temperature tests of long duration with carbon-molybdenum steel and with welds of the same material, without encountering any trouble. It was therefore natural to raise the question of why these tests did not give any warning of the graphitization danger. Subsequent to the failure at Springdale, we, in co-operation with the operators of many installations, have examined a great many samples of welded pipe, plate, castings and forgings removed from installations, and have also considered the results of examinations made by other investigators. In all, some 80 weld joints have been carefully studied, these including samples from the highest temperature (975-990 degrees Fahr.) and pressure unit with the longest service in the country.

Examination of these field samples from service installations showed very quickly, as reported before the Joint High Temperature Committee last year, the important fact that the steels found affected by graphitization were those which had received considerable quantities of aluminum in the deoxidation practice.

In the course of their investigations, the authors found that steels which displayed in the McQuaid-Ehn test a totally normal case with a grain size of 1 to 5, did not graphitize in service. Steels which were abnormal and fine grained (7 to 8) in the McQuaid-Ehn test, did graphitize, though in the case of castings some have and some have not. The degree of graphitization among the graphitized wrought steels varied considerably. Steels of the intermediate type, that is steels which showed only slight abnormality—No. 2 type—and a grain size of about 4 to 7 in the McQuaid-Ehn test, graphitized in some cases and did not in others.

In parallel with the investigation of materials from service installations, many tests were carried out in the authors' laboratory which had a threefold purpose. The first objective was to graphitize under controlled conditions the type of steel which did not graphitize in service. However, all attempts to do this failed, in spite of the severity of the applied testing conditions. The second goal was to graphitize the intermediate type of steel, and in this some success was achieved. The third objective was to gain some insight into the mechanism of graphitization of these low-carbon and low molybdenum steels.

No attempt will be made here to present detailed reports of investigations of materials from service installation. However, some typical conditions will be described as they illustrate pertinent facts. With respect to the laboratory experiments, the testing procedure will be described and the results obtained given together with the comments of the authors. Finally, a summary of the conclusions at which the authors arrived, will be presented.

Carbon Steels: A very interesting case which the authors encountered is that of the well-known committee steel K-20 which probably has been tested more and described in more detail than any other steel in this country. This steel had been specially made for the Joint ASTM.-ASME. Research Committee on Effect of Temperature on the Properties of Metals to serve as test material for standardizing high-temperature testing methods and equipment. This K-20 steel had been furnace-deoxidized with 80 per cent ferro-manganese and 50 per cent ferro-silicon, followed by a ladle deoxidation with 50 per cent ferro-silicon and by the addition of 1.2 pounds aluminum per ton of melt. It was a plain carbon steel of the following analysis: 0.35 C., 0.55 Mn, 0.19 Si, 0.016 P, 0.030 S, 0.025 Al, 0.006 Al_2O_3.

One of the most outstanding characteristics of this steel was its uniformity. After fabrication into 1-inch round bar stock, it received the following heat treatment:

Heated to 1550 degrees Fahr. in 2 hours, held 1 hour and furnace cooled to 1000 degrees Fahr. from which temperature the bars were air cooled. Reheated to 1280 degrees Fahr. in [illegible] hours, held 2 hours and cooled in the furnace to 1000 degrees Fahr., then air cooled.

We participated in the creep testing of this material at 850 degrees Fahr. and at the completion of the standard test permitted the specimen to remain under load (7500 psi) for a total time of 75,237 hours, that is about 8½ years. Subsequent examination of the coupon in the authors' laboratory revealed that the steel had uniformly graphitized. Due to the heat treatment this steel was predominantly spheroidized before the testing. In the McQuaid-Ehn test, the steel was found to be slightly abnormal (Type II) and of a mixed grain size (No. 6-7 and 3).

It was quite interesting to note the arrangement of the graphite in this specimen. The fact that the nuclei were so few and had become effective at about the same time seemed to favor the hypothesis preferred by the authors namely that nucleation took place on the slow cooling through the A_1 temperature during the atomic rearrangements accompanying the allotropic transformation.

The formation of randomly scattered graphite nodules did not affect the mechanical properties of the steel seriously in any way.

Another very instructive instance concerned an 8-foot length of a 4½-inch outside diameter by 3½-inch inside diameter oil-refinery tubing removed from an installation because of changes in construction. This tube consisted of three sections, joined by welding, which will be designated as T_1, T_2, and T_3, appearing in succeeding paragraphs.

PORTER Diesel-Electric SWITCHERS

80-Ton PORTER Diesel-Electric Switcher

Custom Built POWER!

You can order a PORTER Diesel-Electric Switcher with the assurance that it will be engineered, designed and built to fit the requirements of your own particular switching or hauling job. An expert knowledge of switching problems accumulated over a period of 78 years enables PORTER Engineers to design switching power that will give you the utmost in service at the lowest cost for operation and maintenance. Let us analyze your switching requirements and recommend the type of unit best fitted for the job. Such an analysis may reveal possibilities for substantial savings.

PORTER Better Built Equipment Established 1866

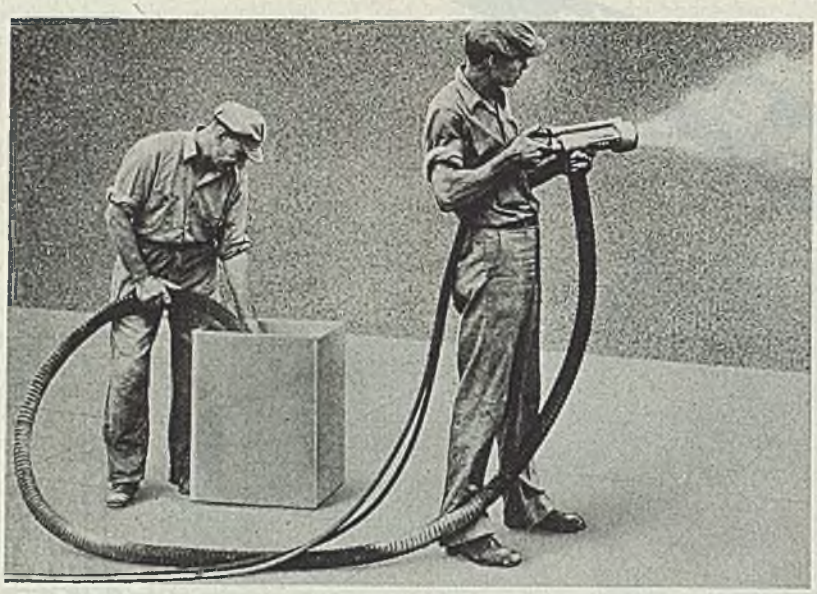
"CUSTOM-BUILT POWER"

This 20min kodachrome sound film showing the building of a PORTER Diesel-Electric Switching Locomotive is available for exhibition at clubs, meetings, etc. Applications for booking may be addressed to the Advertising Dept.

H. K. PORTER COMPANY, Inc.

PITTSBURGH 22, PENNSYLVANIA

Factories: Pittsburgh, Pa. • Blairsville, Pa. • McKeesport, Pa. Mt. Vernon, Ill. • Newark, N. J. • New Brunswick, N. J.



SPRAY GUN: Designed to speed up the sealing and insulating of open-hearth walls and bulkheads, this new gun syphons dry Therm-O-Flake insulation made by the Illinois Clay Products Co., Chicago, direct from the shipping carton, mixes with water and sprays to the refractory wall in one operation. Application is six to eight times faster than by manual methods. The gun operates on standard air and water pressures and weighs only 4 pounds. Units are equipped with 15 feet of air, water and vacuum hose and all necessary valves and fittings

	T_1	T_2	T_3
Carbon	0.21	0.16	0.19
Manganese	0.46	0.43	0.42
Silicon	0.14	0.20	0.19
Phosphorus	0.015	0.013	0.012
Sulphur	0.034	0.025	0.022
Molybdenum	nil	nil	nil
Chromium	0.04	0.39	0.02
Nickel	0.04	0.13	0.06
Aluminum	0.019	0.001	0.002
Alumina Al_2O_3	0.003	0.002	0.001

In the McQuaid-Ehn test, tube T_1 was found to be fine-grained and abnormal, while tubes T_2 and T_3 were medium to coarse-grained and normal. This composite tube had been for 8¾ years at a temperature of 1000 to 1020 degrees Fahr. Examination revealed that the two McQuaid-Ehn normal tubes T_2 and T_3 had not graphitized either in the weld-affected metal or in the weld-unaffected body, while widely scattered very large graphite nodules were found throughout the abnormal tube T_1. The weld metal joining these tubes showed no graphite.

The noteworthy feature of the graphitized tube T_1 was first, that there were only very few, but exceedingly large graphite nodules, and secondly, that graphitization apparently was not preferentially influenced by the heat of welding. One cannot help asking the question why had not more graphite nuclei been formed during those long years, if one assumes that nucleation took place at the service temperature.

Let us now compare the above steels with the behavior of another carbon steel which we may call steel "B." This steel "B" represents a drum with 12 years' service at a temperature of about 850 degrees Fahr. After 6 years, a stainless steel liner was attached to the drum by welding. We failed to observe any sign of graphite in either drum or liner. This steel was a straight silicon-killed steel with 0.25 per cent carbon which had received no aluminum in the deoxidation practice. In the McQuaid-Ehn test, it showed a coarse-grained and normal structure.

The lamellar condition of the pearlite had remained preserved. This steel, too, had been annealed, that is, slow furnace-cooled prior to installation, but, apparently there was not sufficient time for the beginning of carbon precipitation from solid solution during the cooling through the A-1 temperature, or, there were no nuclei present, or at least not effective, on which carbon could precipitate and crystallize. The above are typical examples of graphitizing and apparently nongraphitizing low-carbon steels.

Carbon-Molybdenum Steels: The following presents typical cases of carbon-molybdenum steel chosen from many joints after long time in service:

Plant S: This instance concerns a pipe which had been in service at 930 to 950 degrees Fahr. for 5½ years. This pipe had been furnished in the normalized and drawn condition. The end of the pipe was subsequently upset at about 2000 degrees Fahr. and then welded without intermediate heat treatment. However, the welded joint had been preheated and stress-relieved at 1200 degrees Fahr. When this pipe joint was cut out and examined, the following was found:

Weld Metal: No graphite.

High Temperature Zone of Weld-Affected Upset Pipe: No graphite. Coarse Acicular Widmanstatten Structure.

Low Temperature Zone of Weld-Affected Upset Pipe: Chain Graphite. Carbide Diffused and Spheroidized.

Weld-Unaffected Upset Pipe: No Graphite. Medium to Coarse Widmanstatten Pearlite.

Forge-Spheroidized Transition Zone From Upset to Non-upset Part: Scattered Graphite Nodules. Small Grain Size Carbide Spheroidized.

Forge Heat-Unaffected Non-Upset Pipe: No Graphite. Fine-Grained Widmanstatten Pearlite.

This steel had received 1.75 pounds aluminum per ton in the deoxidation practice and was fine-grained and abnormal in the McQuaid-Ehn test. There was nothing unusual in the chemistry of this material, as follows: 0.15 C, 0.55 Mn, 0.16 Si, 0.012 P, 0.026 S, 0.54 Mo, 0.034 Al, 0.02 Al_2O_3, 0.01 Cr.

Plant F: This instance deals with a similar pipe "F" which differed from the previously discussed pipe principally in the heat treatment which it had received prior to welding. This pipe "F" had been furnished normalized from 1650 degrees Fahr. and drawn at 1200 degrees Fahr. Prior to installation, the end of the pipe was upset at some high temperature and then normalized again at 1750 degrees Fahr. and drawn at 1300 degrees Fahr. The upset end was then welded and stress-relieved at 1200 degrees Fahr.

Examination of the weld joint after 4½ years' service at 910 degrees Fahr. revealed scattered graphite nodules not only in the low-temperature end of the weld-affected base metal, but also in the upset and non-upset part of the pipe. The graphite in the weld-affected zone was not of the chain type, but more concentrated than in the body of the pipe. No graphite was found in the weld metal. The steel from which the pipe was made had been deoxidized with 1.9 pounds aluminum per ton, but otherwise differed little from that of the previously described pipe. Its chemistry was as follows: 0.13 C, 0.45 Mn, 0.17 Si, 0.015 P. 0.018 S, 0.52 Mo, 0.062 Al, 0.013 Al_2O_3, 0.01 Cr.

The McQuaid-Ehn test revealed a fine-grained and abnormal structure.

Plant C: The example considered here presents the case of a carbon-molybdenum steel which received an intermediate amount of aluminum, say 0.75-pound per ton. Over six years ago the authors' company built a reaction chamber of such a steel which we may identify as steel "C," and which analyzed as follows: 0.17 C, 0.60 Mn, 0.22 Si, 0.13 P, 0.020 S, 0.45 Mo, 0.002 Al, 0.008 Al_2O, 0.01 Cr.

This material was in the normalized stress-relieved condition. After 6 years' service at 870 degrees Fahr., numerous samples were removed and examined, but no trace of graphite was found, either in the weld-affected zones, weld metal, or in the weld-unaffected base metal. The latter appeared to be to-

(*Please turn to Page* 160)

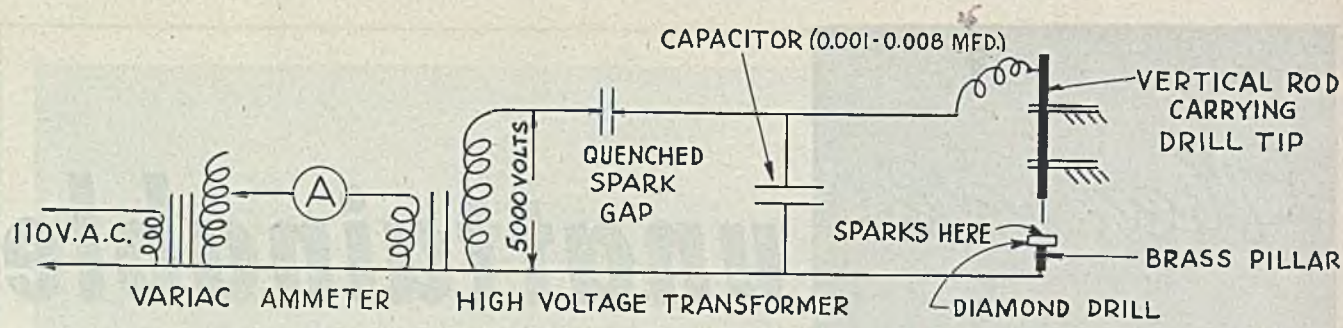


Fig. 1 (above)—Schematic diagram of setup for high-voltage electrical foredrilling in air. Electric spark in air does drilling

DIAMOND DIES

. . . . for fine wire drawing now made by new electric drilling methods which promise to make United States self-sufficient in this important strategic item. Here are presented results of work at National Bureau of Standards sponsored by the War Production Board Board in developing improved methods for producing dies for superfine wire, an essential requirement for radio and radar equipment

MANUFACTURE of many essential electronic products is dependent upon superfine wires drawn through small diamond dies which formerly were available only in Europe. Due to the war, developing an improved method of producing these dies domestically was extremely important, not only to fill our immediate war needs but to bring about the development of methods that would offset the higher cost of American labor.

While the process as described here has not yet been reduced to a standard commercial practice, and while it is not possible to predict just when the method will supersede the present more costly and perhaps less perfect process of mechanical drilling, it is certain that the work so far done is of immense value in indicating the way to complete solution of this problem.

Indicative of the progress already made in improving wire drawing methods is the fact that production of superfine drawn wire (0.0015-inch and smaller) increased about 11 per cent in the first six months of 1944, over same period in 1943, although only 58 per cent of the number of dies was required to draw this greater quantity of wire.

Briefly, the new electrolytic method of diamond drilling employs an electric spark shot from the end of a platinum needle at the diamond while both are immersed in a chemical solution.

At the request of the War Production Board, the National Bureau of Standards undertook an investigation of small sized diamond dies for the purpose of improving domestic manufacturing processes so that dies of higher quality could be produced in shorter time and at less cost.

For testing diamonds, finished dies and fine wire, equipment already available in the petrographic and interferometry laboratories was employed. Strains and inclusion in diamonds were determined with the polarizing microscope. The orientation of the die and crystal axes was measured with the X-ray microscope. Dies with windows were first inspected with the binocular microscope and then a careful examination was made of the contour, finish, bearing and orifice under direct and cone illumination with a higher powered microscope. For permanent records, photomicrographs were taken of the die contour and orifice.

In order to determine the relative merits of dies of various forms and finish of foreign and domestic make, more than 1000 sample dies were obtained from all available sources and tested. From these data it was concluded that the principal cause of early failure of dies was the complete lack of polish or finish in the secondary cone, bearing and back surface. This condition led to rapid wear and the formation of fractures at the orifice. Occasionally flaws or cracks in the die stone caused failure.

A diamond die laboratory was installed at the National Bureau of Standards for the purpose of studying and testing existing die drilling and wire drawing machines and processes and for developing new methods and equipment with the object of reducing the production time and costs, and improving the quality of domestic dies.

The various types of die drilling and polishing machines were operated according to established procedures, time required to perform each operation was recorded and the results obtained were investigated. Other methods for performing the various operations, the most

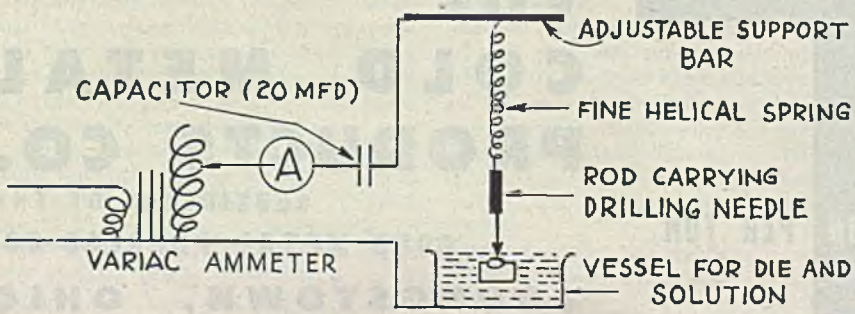


Fig. 2 (left)—Schematic diagram of setup for low-voltage electrolytic drilling by means of combination of mechanical, electrical and chemical forces used in producing the secondary cone of the diamond die aperture

noteworthy being the introduction of electrical current, were devised and investigated. By combining these novel procedures with the established drilling technique, it is believed that very satisfactory methods for fine die production have been evolved. The description of the die production phase of the project is reported here.

Inspection: After the three facets have been cut, the diamond should be examined under the microscope. Flaws or carbon spots in the outer portion are not objectionable but the central part, about one millimeter in diameter, should be perfectly clear.

European Methods: The methods and equipment developed in Europe for drilling diamond dies essentially employ a star drilling action. The drilling machine has a horizontal, single spindle that rotates at about 3500 revolutions per minute and carries a sewing needle for the drill. The diamond is mounted on a second spindle that oscillates the die against the sharpened end of the drill. Diamond powder of different grades mixed with alcohol or oil is used as the abrasive.

Domestic machines operate on the same principle as the European design but usually have ten vertical spindles which greatly conserve space.

The blank is mounted and centered in a small disk which is rotated in a bench lathe. A small conical hole is spotted or bruted in one of the flat surfaces of the stone with a diamond chip held in a pair of pliers. This cavity acts as a starting point for the drill.

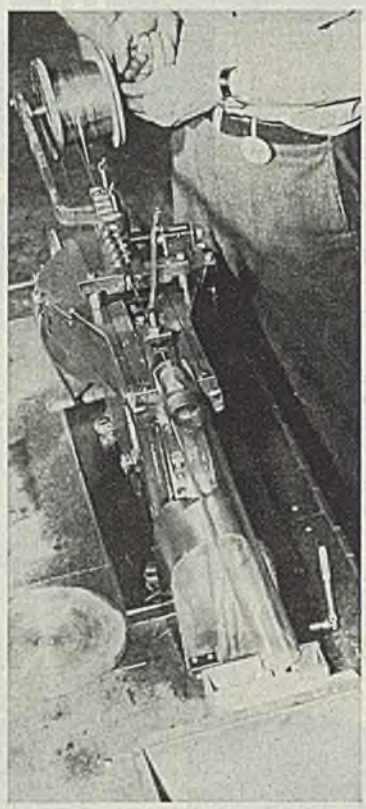
The die blank is placed on the rough drilling machine in drilling the bell or primary cone. A sewing needle of about 0.040-inch diameter is ground to a rather blunt point. Diamond powder of about 60-micron grade is used for the first part of the operation and about 30-micron grade for the finish. The bell should be a 60-degree cone of about 1 millimeter or 0.040-inch depth.

A lighter drilling machine is used for drilling the secondary cone. A fine needle is ground to approximately the shape of the desired cone. Grade 30 micron powder is used at the start followed by grades 12 and 6 as drilling progresses. Frequent re-grinding of the needle is required as the pecking action soon blunts the sharp tip. If after many tedious hours the apex of the cone is found to be 0.001-inch or less in diameter the drilling is considered complete.

After the fine drilling is completed, the die in the casting is returned to the chuck of the bench lathe for counter drilling. A spherical hole in line with the die axis is bruted into the back surface of the die with diamond splints held in sharp-nosed pliers until it reaches the point of the secondary cone. In some shops the bruting is discontinued when the sphere comes within 0.003-inch of the cone. The final opening is then made on the drilling machine using a needle sharpened to a hemisphere about 0.010-inch in diameter and 6-micron powder to obtain a polish.

The fine polish of the cone and bearing is performed on a light drilling or oscillating polishing machine. The needle is sharpened to a long taper and fine diamond dust in oil is the abrasive.

Time in hours required for the operations listed above as obtained from foreign reports and experience gained in our laboratory using similar equipment is given. These data are for dies of about 0.0007 to 0.0010-inch diameter.



WIRE GUN: Takes fine wire from spool, straightens it between horizontal and vertical rolls, cuts it to length and "shoots" it through the glass tube to the receiving tray. Made by North American Philips Co. Inc. at Dobbs Ferry, N. Y., it speeds production of leads for electronic tubes.

	Holland	British	N.B.S
Preparation	1½	...	2
Bell Drilling	15	50	12-26
Cone Drilling	75	120	80-100
Opening	6	...	8
Polishing	15	...	20

From this it appears that 115 to 170 hours may be required to produce a die of 0.001-inch or less using the established methods and equipment.

Bureau of Standards Procedure: The diamond die drilling methods developed at the bureau parallel established machine and instrument shop practice for the drilling of metals. A pilot hole is foredrilled through the diamond by means of an electric spark. To complete the operation a light commercial drilling machine is the only equipment required. The point of the drill follows the pilot hole without being dulled by contact with the diamond. The conical surface of the drill, which has considerable peripheral speed, acts as a countersink or reamer for shaping the contour of the cones and applying the polish to the cone and bearing surfaces. Thus the tedious and time consuming star drilling operation which is the basis of previous methods is eliminated.

Drilling The Bell: The electrical method is used for foredrilling the bell. The equipment required consists of Variac, rheostat, transformer, alternating current ammeter, capacitor, quenched spark gap and a support for the diamond and electric drill. Fig. 1 shows the setup.

The leads from the 110-volt, 60-cycle outlet are connected to the primary terminals of a 0 to 120V output Variac. The secondary of the Variac is connected to the primary of a 5000-volt, 300 volt ampere power transformer. In one of the primary connecting leads, about 70 ohms resistance is placed and in the other an ammeter of 2-ampere range. A capacitor of about 0.001 to 0.008-microfarad is connected across the secondary leads of the transformer. The rheostat can be dispensed with if a current limiting transformer such as 12,000-volt, 20-milliampere neon sign lighting transformer is used instead of the power transformer. Control and speed of drilling is improved by inserting a quenched spark gap in the secondary lead between the transformer and capacitor. If this is done, however, the apparatus should be enclosed in a metallic shield to avoid radio interference.

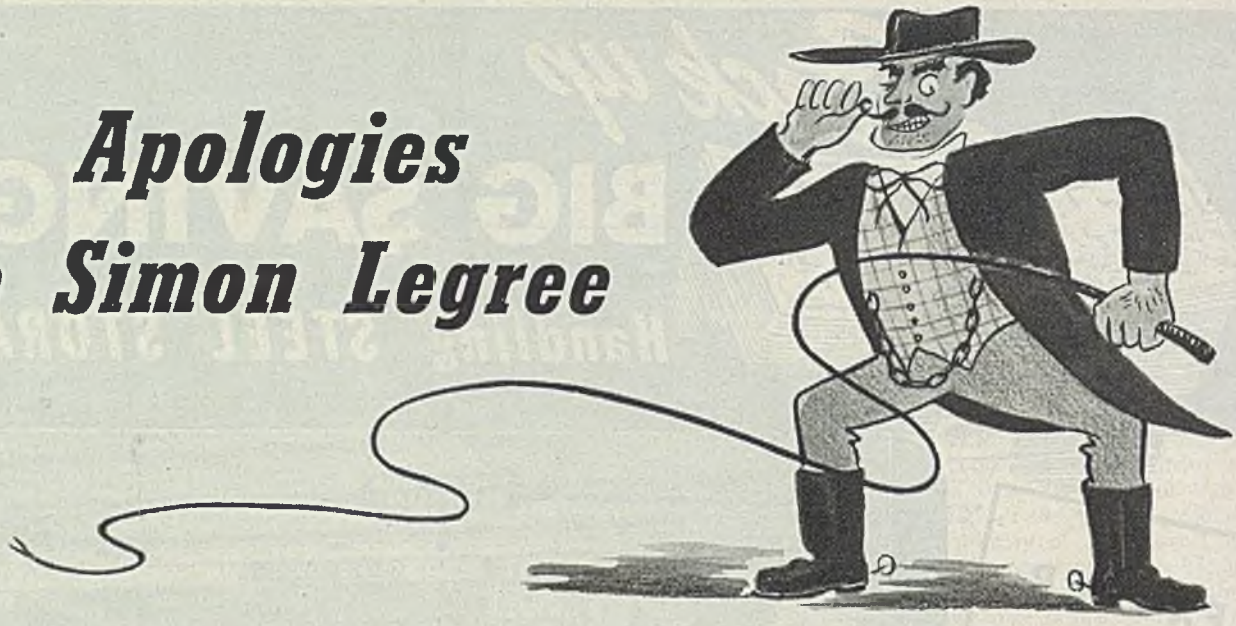
Two 3-inch brass angle pieces are fastened to a wooden pillar which is supported on a wooden base. A small brass rod of 5 to 10 grams weight slides closely but with minimum friction through two holes drilled in the brass angle pieces. Into the lower end of the rod is fastened the drilling needle which is made from 0.020-inch diameter, 70 per cent platinum—30 per cent iridium wire. A brass block having a small brass pillar at the center supports the diamond die blank. This block is connected to one of the secondary terminals of the transformer and the rod to the other.

The end of the drill needle is ground to a cone of about 20 degrees and the point is brought into contact with the center of the flat surface of the die blank.

The current is then applied and adjusted by means of the Variac until a white spark extends from the needle to the brass pillar. This should occur when the ammeter reads about 1 ampere. If the end of the drill becomes red, the current should be reduced until the color disappears. The current should, however, be sufficient to maintain the white spark between the drill and the pillar.

In about 20 minutes' time a roughly cylindrical hole, about 0.5-millimeter deep and 0.2-millimeter in diameter is drilled in the diamond and the end of the drill is disintegrated. Very little progress is made at this point by repeating the drilling operations with a resharpened needle. It is necessary to re-

Apologies to Simon Legree

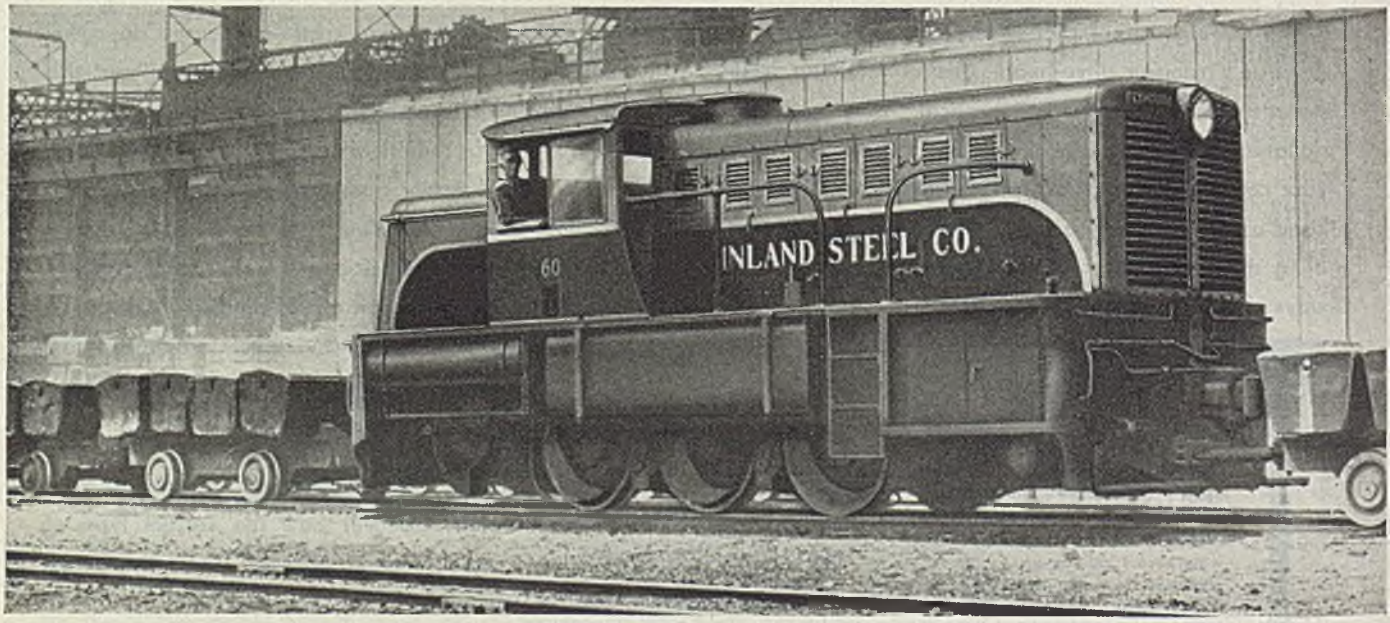


Sorry to belittle your reputation, Simon. As a taskmaster you were tough — in your time. But man you should take just one look at the war-time work schedule of that Cooper-Bessemer powered switcher! You'd gnash your teeth for fair.

There are hundreds like it, Simon, working around the clock week after week, handling incredible loads without complaint . . . and whips aren't needed any more!

Yes, old ideas of work output are regularly being shattered by Cooper-Bessemer Diesels . . . on land, on sea, and on the rails . . . in normal service and in war's most gruelling tasks. For one thing, engineers and industrialists are always finding new uses for these efficient engines, taking more and more advantage of inherent diesel economies. Equally important, Cooper-Bessemer is never content with "just a good diesel". Refinements, new features, new ideas are constantly being developed to insure even longer life . . . greater economy . . . still higher efficiency.

No matter whether your diesel assignment is tough or easy, mobile or stationary, you want the greatest output, the utmost reliability your money can buy. Check your needs with Cooper-Bessemer.



At Inland Steel Company's Inland Harbor plant, this 70-ton Plymouth Fleximotive switcher helps assure a fast, dependable flow of materials to and from the open hearths and blast furnaces. The switcher's direct-connected diesel is a 340 hp Cooper-Bessemer. In this same plant eight (?) additional Cooper-Bessemer powered Fleximotives are hard at work.

THE Cooper-Bessemer CORPORATION

Mt. Vernon, Ohio • Grove City, Pa.

NEW YORK WASHINGTON HOUSTON DALLAS TULSA SHREVEPORT LOS ANGELES ST. LOUIS SEATTLE

turn the die surface to as near a plane as possible before further drilling takes place.

To do so, the blank is mounted on the light drilling machine and the drilling carried on with a No. 10 drill needle sharpened to a 90-degree cone, with hand grinder. Using grade 45 micron powder in alcohol, the bell cone is countersunk to the bottom of the foredrilling in about 45 minutes' time.

Repeating the electric drill, the foredrilling is now extended an additional 0.5-millimeter in 20 minutes. Returning to the drilling machine, the needle is ground to a 60-degree cone. Using grade 20 micron powder at the start and grade 6 micron powder to finish, a smooth 60-degree cone about 1.0 millimeter deep is obtained in 1 hour.

At this point about 0.2-millimeter of the blank thickness should be left for the secondary cone. If the blank is more than 1.2 millimeters thick, say 1.6 millimeters, a third drilling of the bell is required.

For the electrical drilling the diamond must be unmounted. For convenience in machine drilling, the blank is mounted in a small window nib and held in place by a close fitting plug provided with a conical reservoir to hold the dust-alcohol mixture. A thin layer of wax between the blank and plug prevents leakage. With this unit the blank can be mounted or unmounted in a few moments.

Drilling The Secondary Cone: The equipment required for this operation is a Variac, alternating current ammeter, capacitor and a support for the diamond and the electric drill. The leads from the 110-volt, 60-cycle outlet are connected to the primary terminals of 0 to 270-volt output Variac. One secondary lead of the Variac is connected to a capacitor of about 20 microfarads, and an ammeter of 1-ampere range. See Fig. 2.

A wooden base and pillar form the support. For raising and lowering the drill, a 5-inch rack is attached to the pillar. The rack carries the horizontal support bar and flexure strip for fine adjustment. A glass plate placed in a shallow evaporating dish is supported on the base. A small flat plate cemented to the center of the larger plate forms the supporting pillar for the die blank.

Into the lower end of a small rod is fastened the drilling needle, which is made from the 0.020-inch diameter, 70 per cent platinum—30 per cent iridium wire. This rod is hung from the flexure strip by a light coiled spring. The end of the drill is ground to a cone of 10 degrees having a 0.002 to 0.003-inch spherical tip. The drill is lowered by means of the rack and screw until the tip comes into contact with the apex of the bell cone. The spring is lowered an additional 2 to 3 millimeters until the load on the needle tip is one gram or slightly less. A 5 per cent aqueous solution of commercial KNO_3 (saltpeter) is poured into the evaporation dish until the lever is about 1 millimeter above the top surface of the diamond. The lead from the ammeter is connected to the flexure strip, and the lead from the capacitor to a platinum electrode which dips into the solution.

With the Variac set for 210 volts, the current is applied. Under the existing condition the ammeter should record about 0.5-ampere. If current is greater than that, the liquid level is lowered; if less, the level is raised. Under these conditions a secondary 16-degree cone, 0.003-inch deep, 0.0015-inch diameter at bottom is drilled in 8 minutes.

For the final drilling of the secondary cone the capacitor is by-passed, the Variac is set at 80 volts and the drill resharpened. Under these conditions the drilling is extended an additional 0.005-inch in about 45 minutes. By this procedure a 16-degree secondary cone, 0.008-inch diameter at the top and 0.0003-inch to 0.0005-inch diameter at the bottom is usually produced in less than 1 hour.

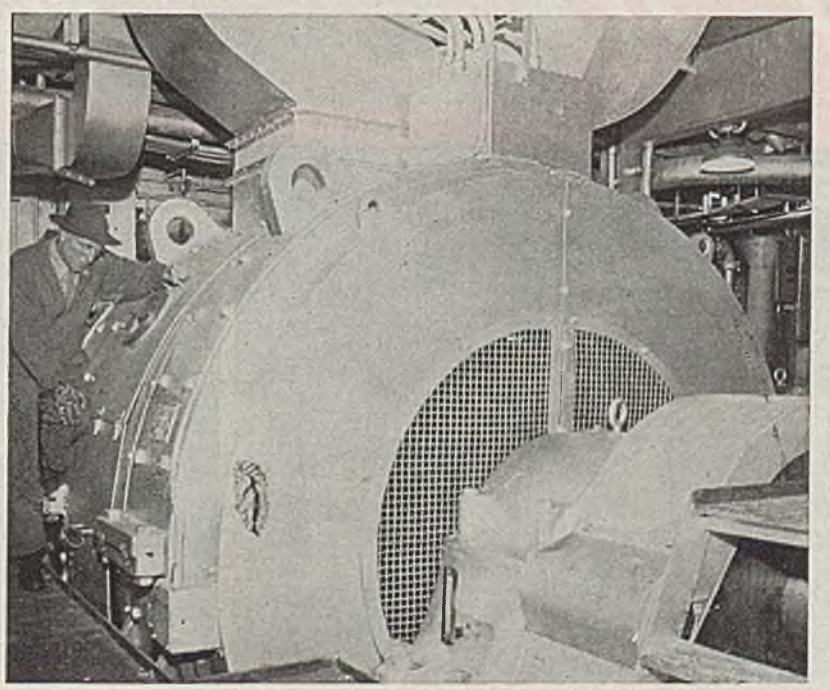
If the original distance from the apex of the bell cone to the back face of the die blank exceeds 0.010-inch, the bell and secondary cones are blended and polished on the standard rotary drilling machine using grade 3 micron powder. The die is then back opened on the flat diamond lap or on the drilling machine using a needle ground to a hemisphere. If the distance from the bell apex to the back face of the die blank is from 0.007 to 0.010-inch, the die is drilled through electrically.

Polishing Secondary Cone And Bearing: Since it is evident that the life of a die, free from flaws, will be proportional to the perfection of the finish of the bearing, relief and reduction portion of the secondary cone, the greatest amount of time should be devoted to this last procedure. Inspection and tests in the laboratory of more than 1000 foreign and domestic commercial dies showed that little or no attention was given to this vital part of the work. This probably resulted from the fact that a financial premium was placed on smallness of the die size regardless of the finish.

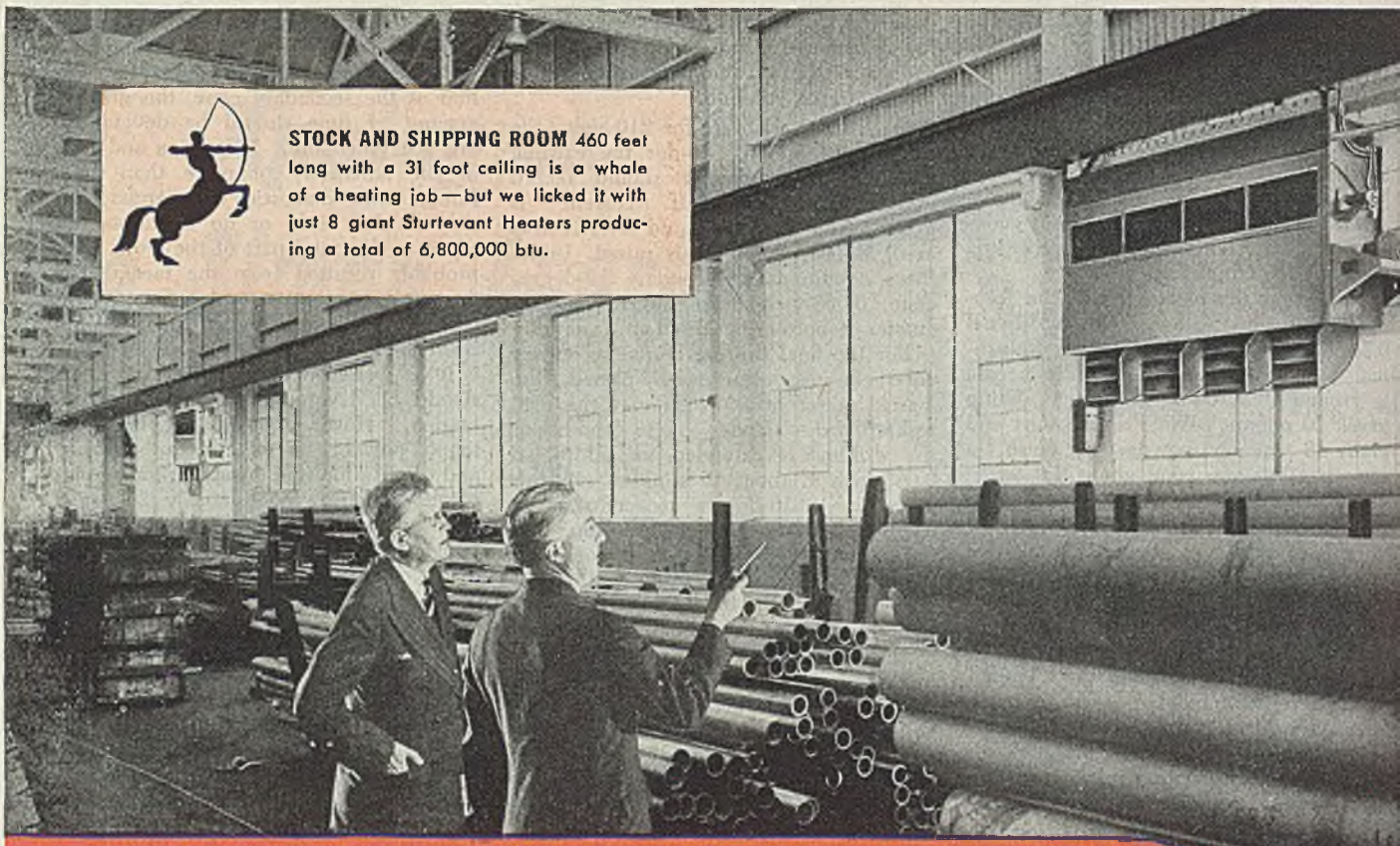
It is believed that about 20 hours should be devoted to the polishing operation. However, by using fine diamond powder in oil for the abrasive and light multiple-head drilling machines operating continuously 24 hours per day and requiring attention only twice during that period, the cost per die is very small.

For blending the bell and secondary cones, the die is mounted on the light drilling machine and the needle ground to a long taper. Grade 6 micron powder is used for fast cutting and grade 3 micron powder to produce the final polish. Polishing the lower part of the secondary cone and the bearing is performed with a short piece of 0.003-inch tungsten wire and grade 3 micron powder. The polishing operation is continued until the cone is well polished and a bearing of about 0.001-inch length and 4-degree taper is produced. This usually occurs by the time the diameter

(*Please turn to Page* 166)

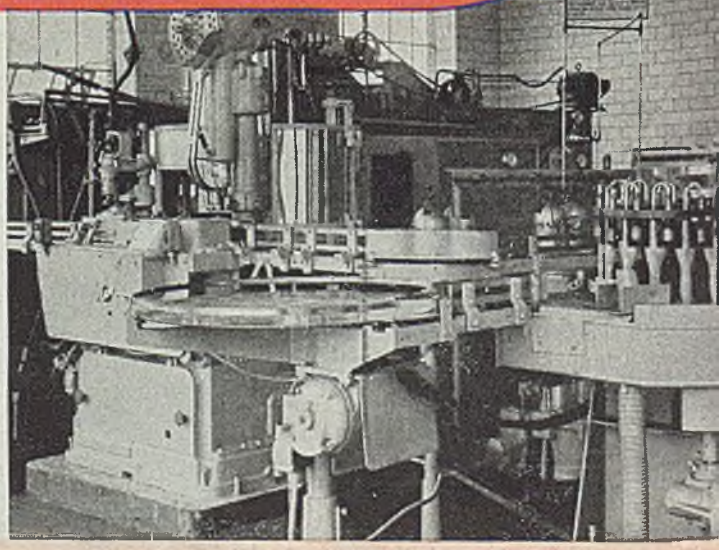


NAVY MULE: Built for 205-foot seagoing fleet tugs, this double-armature motor has 3000 shaft horsepower. Direct connected to the main shaft, with 750 volts direct current for each armature, these Westinghouse motors installed by United Engineering Co. Ltd. rotate at 140 revolutions per minute, full speed. Shaft speed when towing is reduced to 112 revolutions per minute due to load thrust



STOCK AND SHIPPING ROOM 460 feet long with a 31 foot ceiling is a whale of a heating job—but we licked it with just 8 giant Sturtevant Heaters producing a total of 6,800,000 btu.

Last month we SAVED FUEL for 217 customers like you...

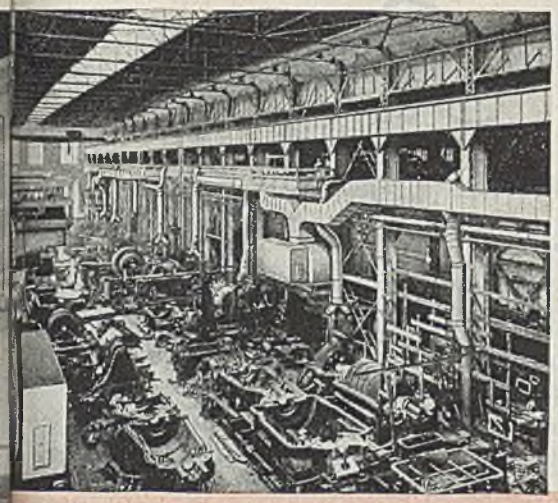


PEPPERELL FABRICS

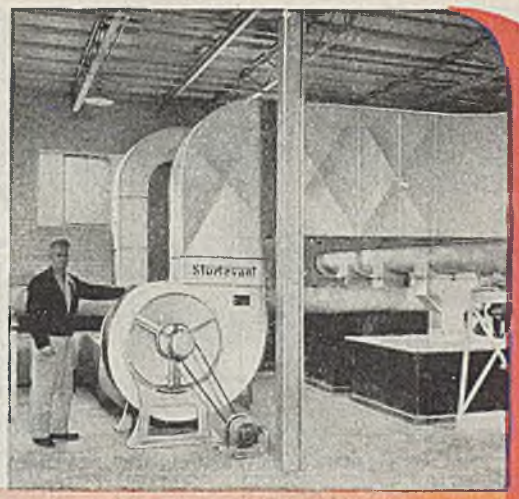
DYEHOUSE ranges and other vapor-producing processes create a tricky heating problem—that Sturtevant solves—cuts fuel bills in the bargain with a Unit Heater and Vapor Absorption System.

Coca-Cola

BOTTLING PLANT hands the job of heating the entire plant to Speed Heaters—producing *balanced* heat and making every ounce of steam pay off.

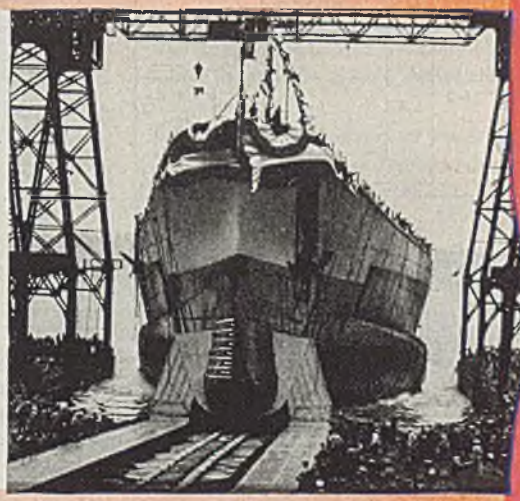


MACHINE SHOP heating job is handled by two large Sturtevant Systems—on opposite walls—special nozzles distribute heat efficiently, fuel costs are minimized.



SEWAGE PLANT calls for a combined heating and ventilating system where recirculated room air is blended in the outside air to minimize heat load.

ASSEMBLY PLANT with high saw-tooth roof conserves heat when Speed Heaters are strategically located in accordance with size and shape of the area, proper paths of heat travel.



N. Y. NAVY YARD makes use of almost every type of heating strategy—from a hot blast central system to special portable heaters used during ship construction.

Another Product of STEWART WARNER

AIR CONDITIONING

DRYING

MECHANICAL DRAFT

VENTILATING

HEATING

DUST AND FUME CONTROL

The important question to ask about any heating installation is "Will it pay?"... That's why we talk heating with this basic concept in mind — *that every Sturtevant job must profit the user.* No wonder business leaders everywhere call us in on heating problems — and say "ace high" to Sturtevant's economy-minded engineering. Sturtevant makes *all* types of heating units and systems — so we play no favorites. Our advice is always based on what's most economical for you. And Sturtevant is ready now to work with your planning committee to get engineered air recommendations down in black and white — ready for budget approval — and ready for action on conversion day.

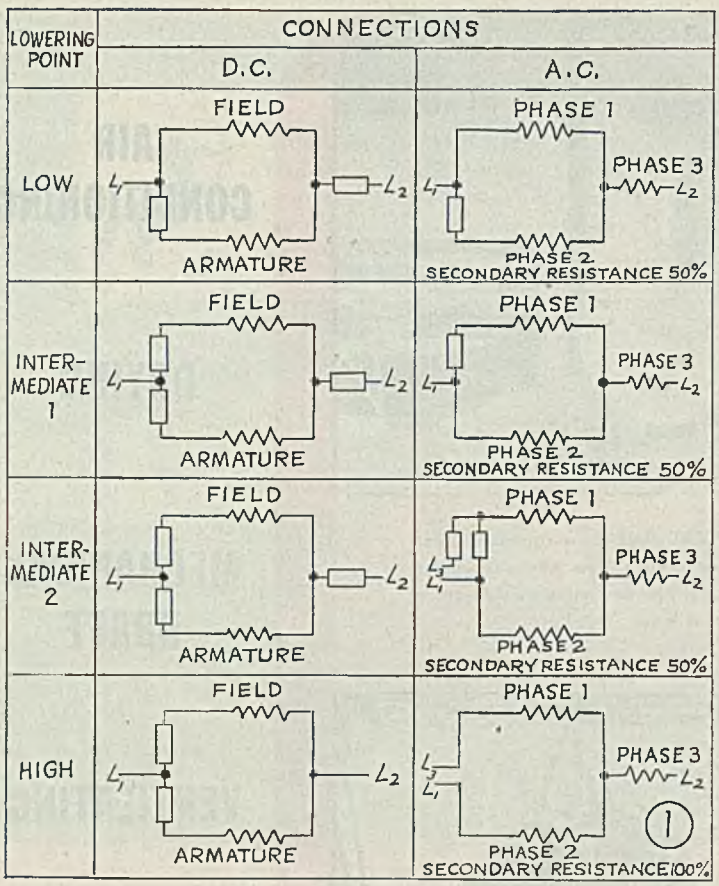
B. F. STURTEVANT COMPANY
Hyde Park Boston 36, Mass.

Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work

Crane Controls

Unbalanced, unsymmetrical alternating-current dynamic lowering system recently originated shows close analogy to direct-current systems, providing speed torque characteristics which eliminate the need for friction type load brakes

By R. B. HUNTER
Supervising Engineer
Cutler-Hammer Inc.
Milwaukee, Wis.



CLOSE analogy between alternating current and direct current dynamic lowering controllers as applied to crane hoists is perhaps not generally appreciated. With both types of control we use a motor the inherent characteristics of which cause it to operate symmetrically, that is, to provide identical speed torque characteristics when operated in either direction. The motors under discussion are the series wound direct current and the slip ring alternating current types. These speed torque characteristics answer the requirements of a motor for driving the hoist motion on a traveling crane.

The speed torque characteristics are not applicable when operating a hoist motor in the lowering direction since under these conditions the motor is required to develop a high counter-torque at speeds below full low speed to restrain the load and preventing runaway speeds from being attained. Engineers have developed control systems for both direct current and alternating current which unbalance the motor in the lowering direction and so change the speed torque characteristics as to make them provide dynamic lowering eliminating the necessity for using a friction type load brake.

The direct-current unbalanced, unsymmetrical dynamic lowering circuit was perfected many years ago. The analogous unbalanced, unsymmetrical alternating-current dynamic lowering circuit is of recent origin. The close analogy between the two will be outlined here.

Fig. 1 shows in parallel columns the direct-current and alternating-current connections on various lowering points. Referring to "Low-D.C.", showing direct-current low speed dynamic lowering connection, it will be seen that we have two circuits connected in a closed loop across the line in series with a common resistance, with resistance in one branch of the loop. Similarly for alternating current we have two of the motor phases connected in a closed loop, across one line phase in series with the third phase of the motor, with resistance in one branch of the loop. On intermediate point 1 for direct-current we have the same connection except that we introduce weakening resistor into the field circuit, whereas in alternating-current we shift the resistor from one phase to the other thus doing the same thing that we do in the direct-current circuit, that is, weakening one phase relative to the other phase, thus providing a reduced field and a higher lowering speed than on point 1.

On intermediate point 3, direct current, we have the same connections as in intermediate point 2, except that the resistance in the field circuit is further increased to provide for still weaker

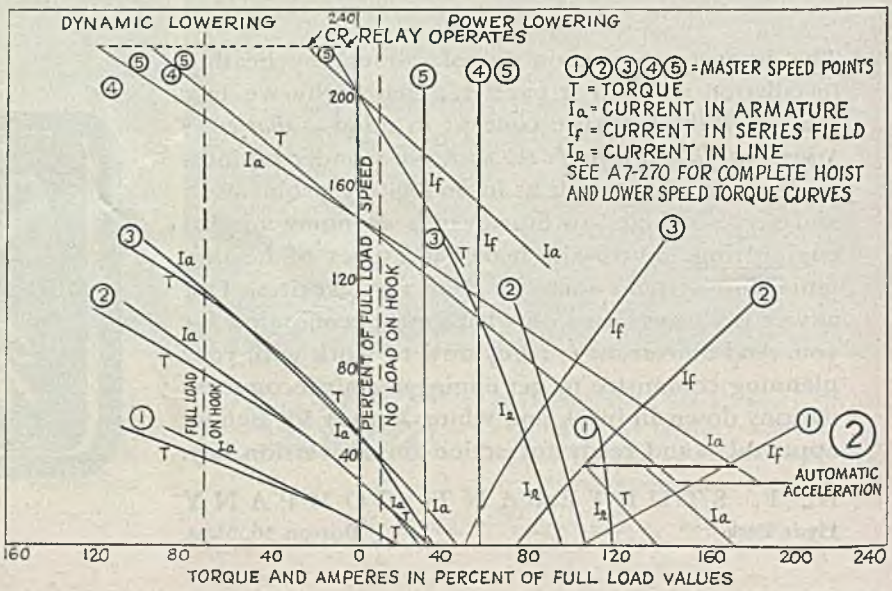
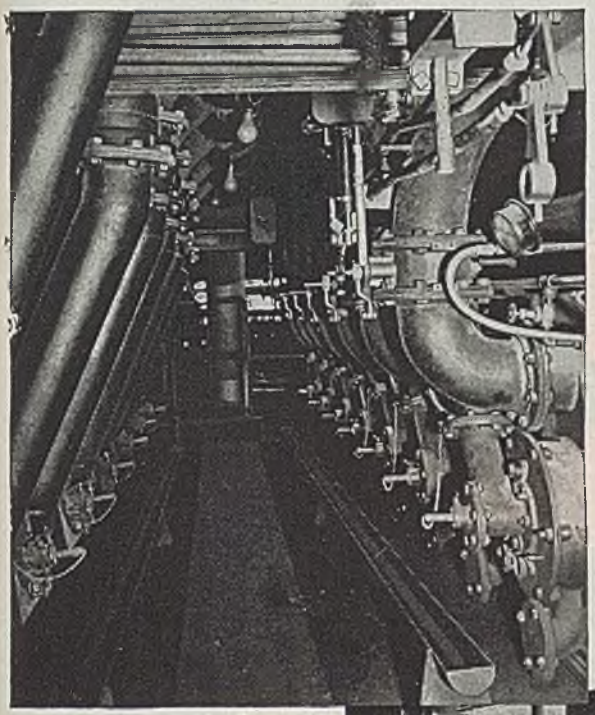


Fig. 1 — Direct current and alternating current connections on various lowering points

Fig. 2—Relation between speed, torque and current in circuits for direct current dynamic lowering

SIMPLIFIED FIRING FOR METALLURGICAL FURNACES . . .

SAVES FUEL AND SPACE INCREASES PRODUCTION



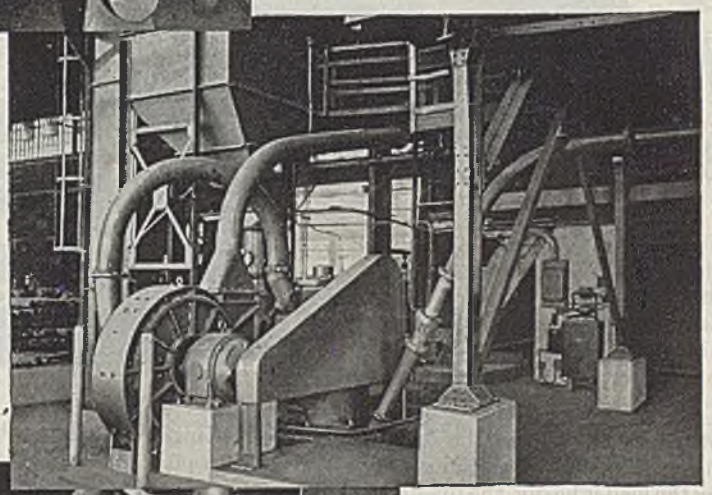
Dependable and economical pulverized-coal firing of multiple metallurgical furnaces requires only ONE pulverizing unit with the B&W Direct-Firing Circulating System. Thus, many substantial savings on installation, production, and maintenance over other methods of firing are obtained.

Simplicity of the system eliminates multiple piping and coal handling equipment, saves floor space around the furnaces, and eliminates interference with product handling at the furnaces.

Adequate fuel distribution and capacity of this system on single or multiple furnaces is assured by automatic control of coal-to-air ratio, by selection of the proper sizes of pulverizers, fan, burners, and distributing line.

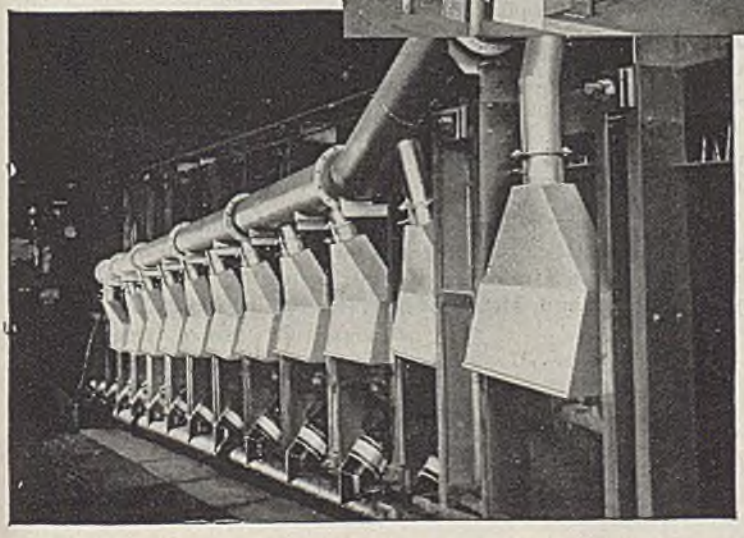
The operating ease and flexibility of this system, as well as its cost-saving features, have been clearly demonstrated by the performance of existing installations.

A few of the advantages of the B&W Direct-Firing Circulating System are illustrated here. More detailed information is contained in Bulletin 3-333. Send for your copy.



1 Multiple burner installation on single large furnace of double heating zone type. Burners at right firing heating zone and first group of burners in the circuit. Burners at left fire soaking zone and last group in the same circuit, which also serves a second large furnace of the double heating zone type.

2 The single, compact pulverizer unit can be conveniently located away from the furnaces, keeping floor space at furnaces clear for product-handling operations.

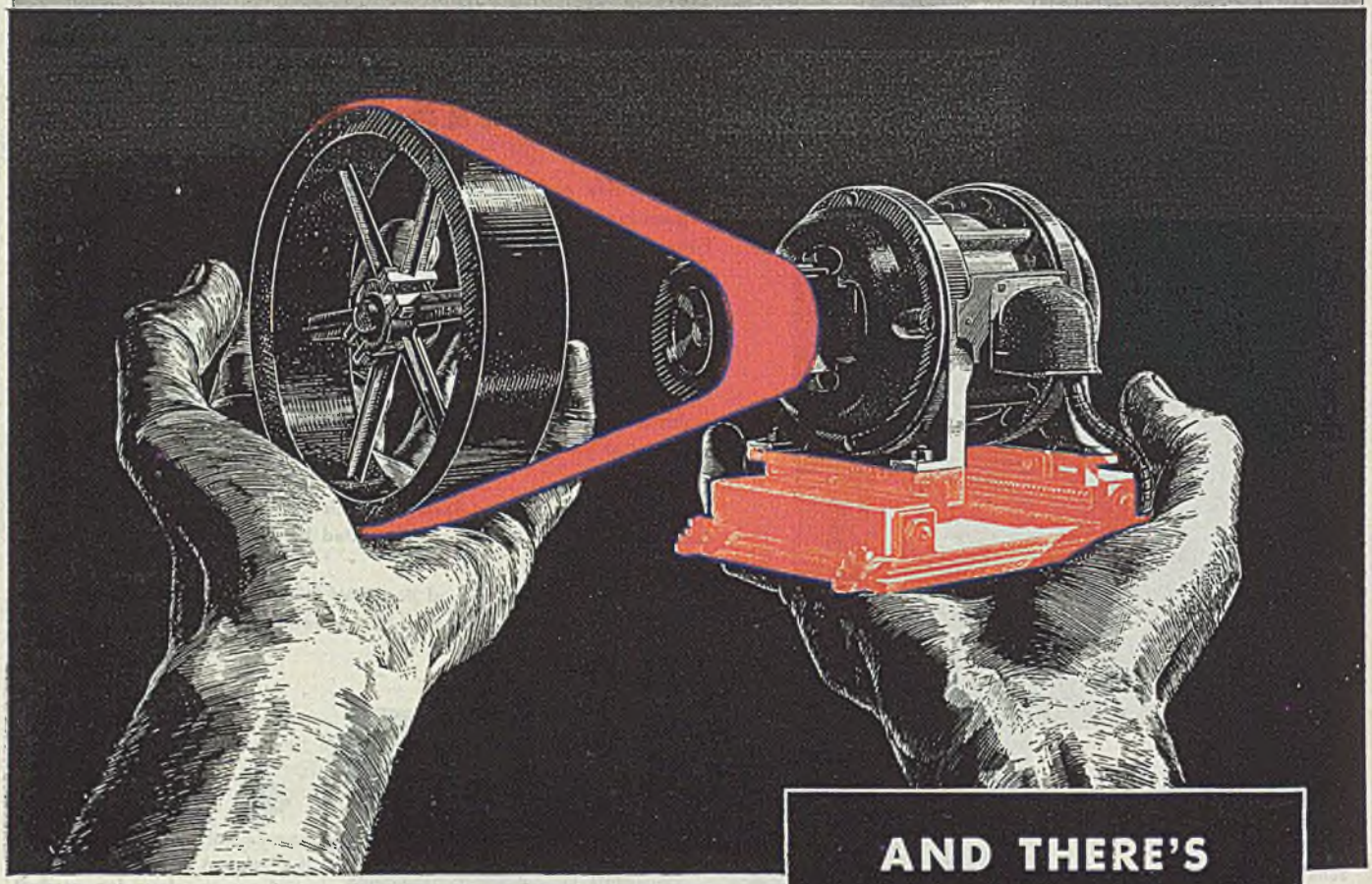


3 Hoods and ash sluicing systems eliminate dust nuisance ordinarily resulting from firing pulverized coal in heating furnaces with inadequate draft provision.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
85 LIBERTY STREET
NEW YORK 6, N. Y.

HERE'S THE ONLY BELT DRIVE THAT DOESN'T DEPEND ON TENSION!



AND THERE'S ONLY ONE BELT FOR THAT DRIVE

The high but often unsuspected costs of over-tensioned or under-tensioned belts *can* be eliminated. With the Flat Leather Automatic Tension drive, there is no need to *over-stress* tension to make sure of handling peak loads . . . no need for frequent maintenance to correct slippage due to *under-stressed* tension.

It is the action of the pivoted base that keeps the drive delivering — not the initial tension on the belt. Tension is always right, automatically. When the load is heavy, the pivoted base *tightens* the belt. When the load is light, the pivoted base *relaxes* the belt. Belt and bearings work hard *only* when the load is heavy.

There is no pulley realignment problem. If the base ever has to be adjusted, it can be done while the motor is running, and alignment is not critical.

Save maintenance . . . on belts, on bearings. Let the pivoted base do your worrying for you. Install the Flat Leather Automatic Tension drive—with "Research" Leather Belting.

Graton & Knight's "Research" Belt has the ideal qualities for service with pivoted bases:

- Highest coefficient of friction and flexibility so that it hugs the small pulley with minimum slip, thus reducing tension needed.
- Least stretch, guaranteeing long, uninterrupted performance.

A "Research" Belt on Flat Leather Automatic Tension drive will outlast a rubber V-belt on a corresponding drive by 2 to 1! Write Graton & Knight Company, 322 Franklin St., Worcester 4, Mass., for new, free Belting Manual.

GRATON AND KNIGHT

Research Leather Belting

from Graton & Knight's complete line . . . manufactured under one control from green hide to finished product. Branches and distributors everywhere. Look under "Graton & Knight" in "Belting" section of Classified Telephone Directory or THOMAS' REGISTER.

field, reduced counter-torque and higher speeds. In the alternating current dynamic lowering circuit on intermediate point 3, we introduce the third phase thereby providing a circuit more nearly balanced than in the lower speed points, thus in effect further weakening the field and providing a higher lowering speed.

On the high speed lowering point for direct current we eliminate the common series resistor and connect the two circuits, namely the field circuit and the armature circuit, independently across the line in series with suitable resistors. In the high speed alternating current connection, we also eliminate all resistor and connect all three phases across the three lines.

As noted in the alternating current diagrams, the value of secondary resistor is increased on the high speed lowering point to provide a higher lowering speed. This is analogous to further increasing the armature resistor in the direct current circuit.

The close analogy between alternating current and direct current dynamic lowering is further shown by inspection of the curves:

Curve in Fig. 2 shows relation between speed, torque and current in various circuits for direct current dynamic lowering.

Curve in Fig. 3 shows similar relation for alternating current dynamic lowering.

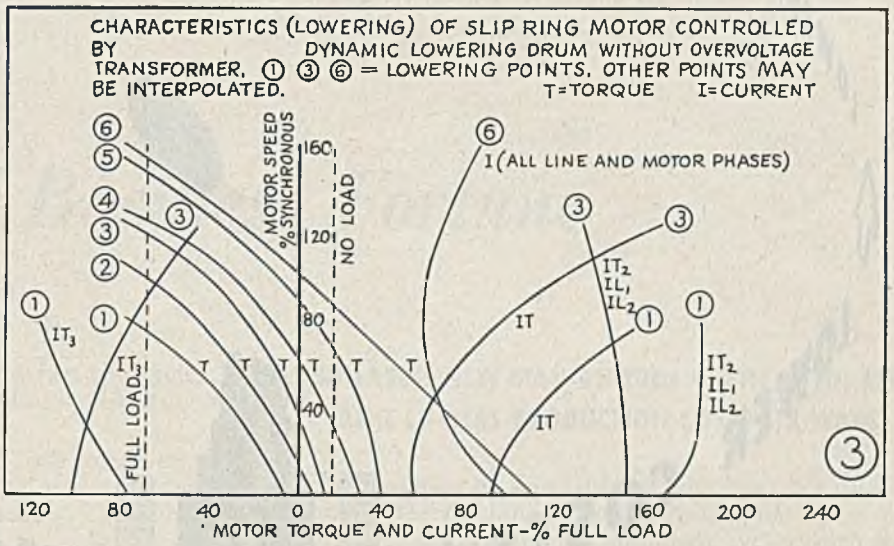
Auto-transformer Used

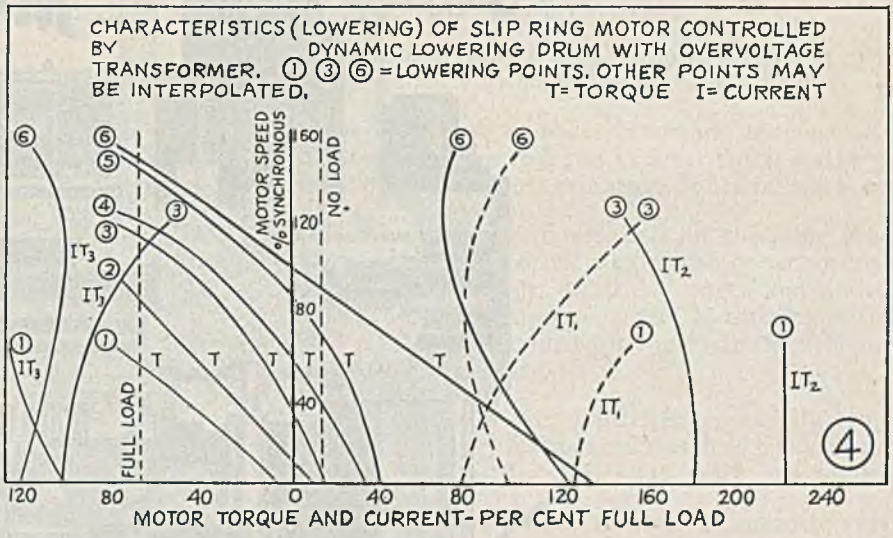
A variation of alternating current dynamic lowering resides in the use of auto-transformer to increase the voltage on the motor, connections otherwise being the same as in Fig. 1. This increases the field strength and reduces the speed. This is analogous to field forcing on direct current thereby saturating the field to provide increased torque. The relations between speed, torque and current when auto-transformer is used are shown by curves in Figs. 4 and 5.

Because of unbalanced conditions both alternating current and direct current motors will heat more during the lowering portion of the crane cycle than in the hoisting portion of the cycle. While hoisting currents are not shown in attached curves, it is well understood that, during the hoisting portion of the cycle, current is proportional to load, and since the load is practically always much below the full load for which motor was chosen, the current and the heating are correspondingly reduced. On the other hand, during the lowering cycle, both for alternating current and direct current, the motor is converted from its originally designed purpose and is really "working against itself." This is sometimes expressed by saying that the motor, by virtue of the unbalanced connection, develops a "positive and negative sequence torque."

Long years of experience have shown that the series direct current motor is sufficiently underloaded during the hoisting portion of the cycle to permit overloading it during the lowering portion of the cycle thus taking advantage of its reserve thermal capacity to effect dynamic braking. Similarly, the alternating current hoist motor has the same reserve thermal capacity and for this reason we can use it as we do the di-

(*Please turn to Page* 168)





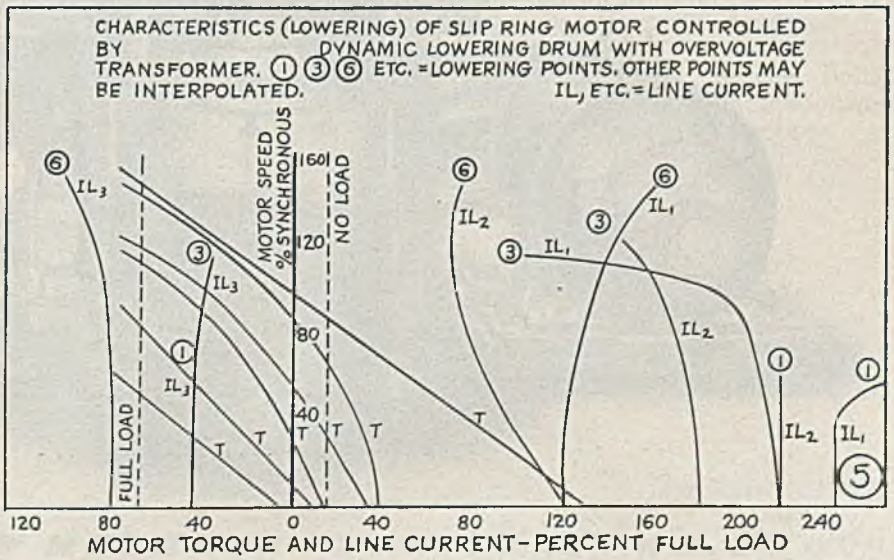
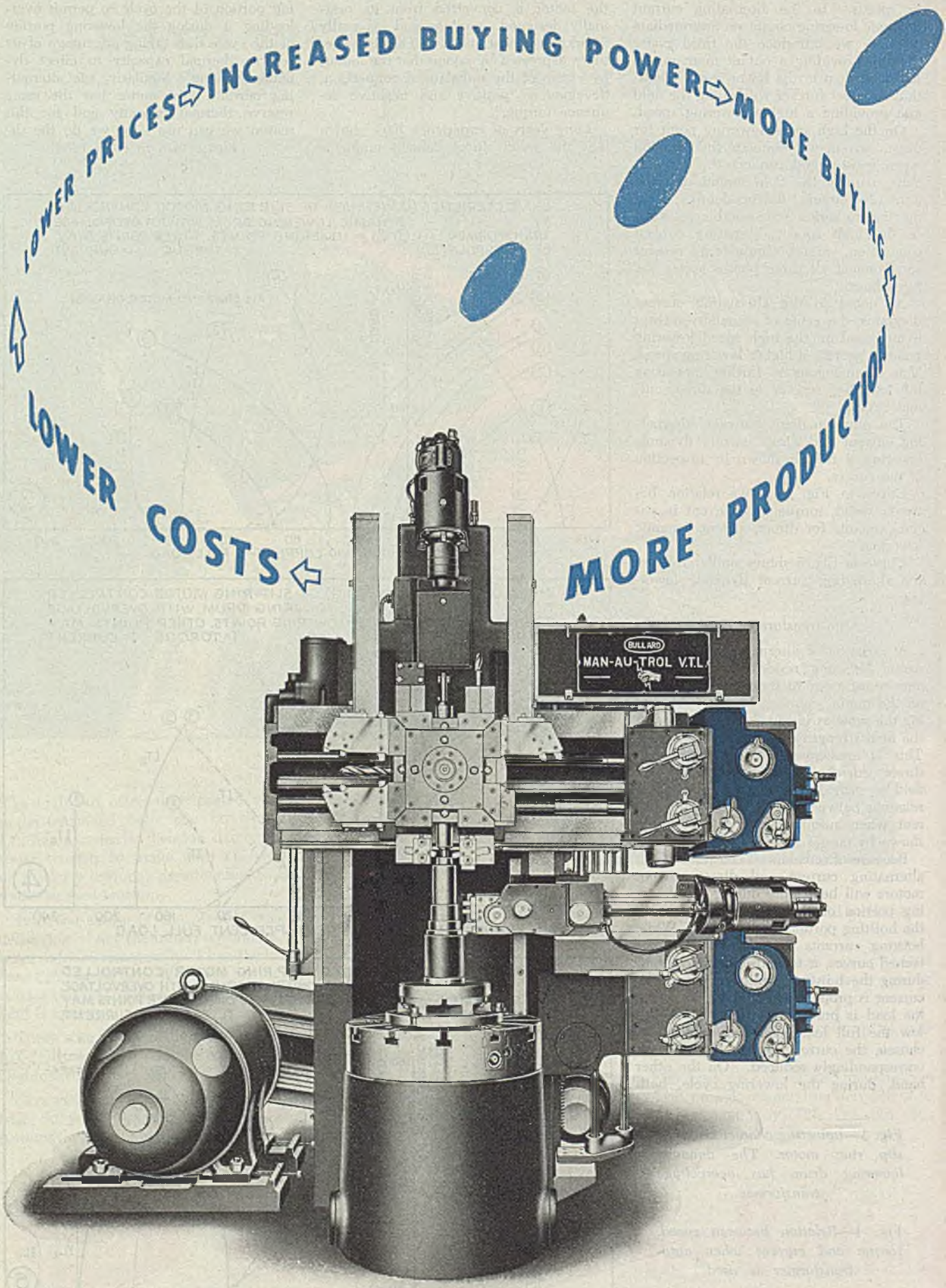


Fig. 3—Lowering characteristics of slip ring motor. The dynamic lowering drum has overvoltage transformer

Fig. 4—Relation between speed, torque and current when auto-transformer is used

Fig. 5—Characteristics of slip ring motor with auto-transformer


LOWER PRICES ⇨ INCREASED BUYING POWER ⇨ MORE BUYING
LOWER COSTS ⇦ MORE PRODUCTION
BULLARD
MAN-AU-TROL V.T.L.

The Wheel of Business Fortune

Business prospers when the cycle of making-and-selling-and-buying turns more and more rapidly.

Making more products makes each one cost less. Lowering prices lets more people buy. More buying means that production must be increased . . . employment increased . . . *profits* increased.

The question, today, is — where, on the wheel, do we apply the pressure to make it turn?

At "More Buying"? Where is the money coming from — government handout?

At "Lower Prices"? Who is going to take the loss — wages and profits?

At "More Production"? *That* is the American way — the way that *has worked*, and will work again . . . to lower costs, widen markets, improve standards of living, provide jobs, give business a greater return on investment.

. . .

Confidence . . . confidence enough in the well-proved principles of mass production to invest in machinery for making better goods cost less . . . is the essential ingredient for postwar prosperity.

As revolutionary today as the Bullard Mult-Au-Matic Method was some 30 years ago at the inception of mass production, is the new Bullard MAN-AU-TROL principle of automaticity. This new principle combines, for the first time in machine tool history, the high-speed production of special-purpose machinery with the all-purpose versatility of manually-operated machines. With it you can provide — at the right point — the impulse that will make *your* wheel of fortune move.

BULLARD'S NEW MAN-AU-TROL VERTICAL TURRET LATHE LOWERS PRODUCTION COSTS SIX WAYS

1. **Helps Manpower Do More:** Makes the operator supervisor of the machine. The best production methods, predetermined, are set into automatic cycles, with the operator supervising production.

2. **Cuts Machining Time:** Does the job in a fraction of the time required with manually-operated machines.

3. **Makes Automaticity Versatile:** Machines, automatically, any and all pieces that the Vertical Turret Lathe can turn out under manual operation, but faster and better.

4. **Saves Time:** Requires fewer tools for the same operations, and the automatic control can be set to predetermine speeds, feeds, direction, length and limit of all cuts in their proper sequence, in little more time than previously required for the cycle of each piece under manual operation.

5. **Eliminates Human Error:** Machines repeatedly to a degree of accuracy no man can match in constant production. Reduces discards, scrap work and salvage.

6. **Gives the Machine a Broader Purpose:** Is instantly available for either automatic or manual operation as production requirements dictate.

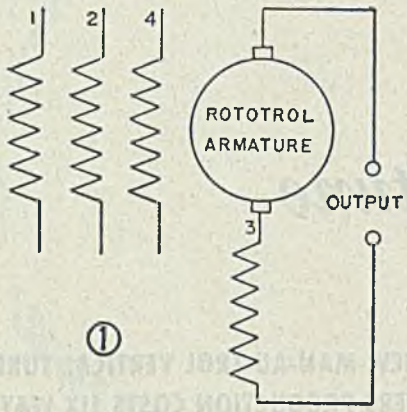
For complete information about the new Bullard MAN-AU-TROL Vertical Turret Lathe, write for Booklet A. The Bullard Company, Bridgeport 2, Connecticut.

BULLARD
MAN-AU-TROL
MASTER OF THE MACHINE

BULLARD CREATES *NEW METHODS* TO MAKE MACHINES DO MORE

Control of generator voltage affords variation through full speed range of motor operating the electrode hoist with a marked reduction in the breakage of electrodes. Electronic regulation and control of electrode motors provide sensitivity and speed of response.

Arc Furnace Regulators



①

By R. A. GEISELMAN and J. E. REILLY

Switchgear and Control Engineers
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

DRASTICALLY reduced electrode breakage, less electrode maintenance due to smoother operation of hoist, and simplicity and reliability of all adjustments are possible with automatic regulation of arc furnaces. This is best achieved through variable voltage control for the electrode motors. Variable voltage can be applied by the rotating amplifier type regulating equipment or by electronic regulating equipment.

The rotating amplifier type regulating system of variable voltage control in its most simple form uses a Rototrol and a direct-current generator for controlling each electrode motor. These machines have the usual air gap, commutator and brush construction found on standard types of direct-current generators.

The armature of the direct-current generator is connected in series with the electrode motor armature. By control of the voltage of the generator, the motor may be varied in speed from zero up to the maximum speed at which it is capable of operating. Also by reversing the polarity of the generator voltage, the direction of rotation of the electrode motor can be reversed.

The rotating regulator used for this application is a small, especially designed direct-current generator driven by a squirrel cage motor at constant speed. The fields and output circuit are shown in Fig. 1. This regulator has four field windings as follows:

1. A current control field "1." The magnitude of the control current is proportional to the electrode current which is the quantity to be regulated.

2. A voltage control field "2." The magnitude of the control voltage serves as a reference against which the current control field will be compared. These two fields are equal in number of turns and oppositely connected.

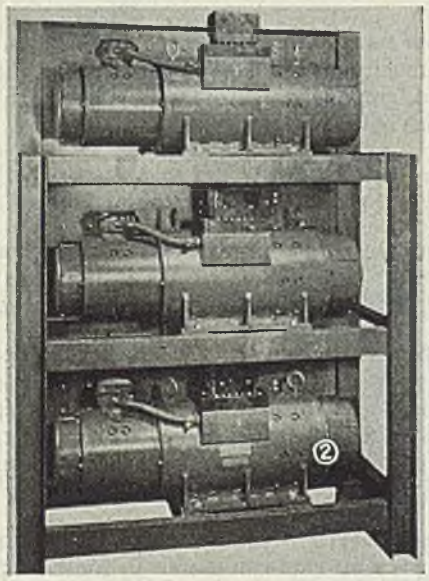
3. The self exciting field "3," which is, in this case, in series with the armature.

4. A differential field "4." This is connected across the armature of the direct-current generator that is excited by the rotating regulator.

The action of the Rototrol is best described by comparing it to an ordinary direct-current generator. Consider fields "1" and "2" as shunt field windings, excited from a separate source. If these are energized equally and with opposite polarity, each field having the same number of ampere turns, the net result will be zero flux across the air gap, and the regulating unit will generate no output voltage. It is evident however that if field "1" predominates over field "2", output voltage having one polarity will be generated. If field "2" predominates over field "1," output voltage having the opposite polarity will be generated.

Now if the output voltage is connected to a load circuit so output current flows, field "3," which is a series self-exciting or self-energizing field, acts like the compounding winding of an ordinary direct-current generator, and provides additional flux for the generation of more voltage as the load current increases.

In order to further amplify the output of the rotating regulator, it is used to excite the field of a direct-current generator, the armature of which supplies energy to the electrode motor. Rototrol field "4" is a differential field receiving its energy from the armature circuit of

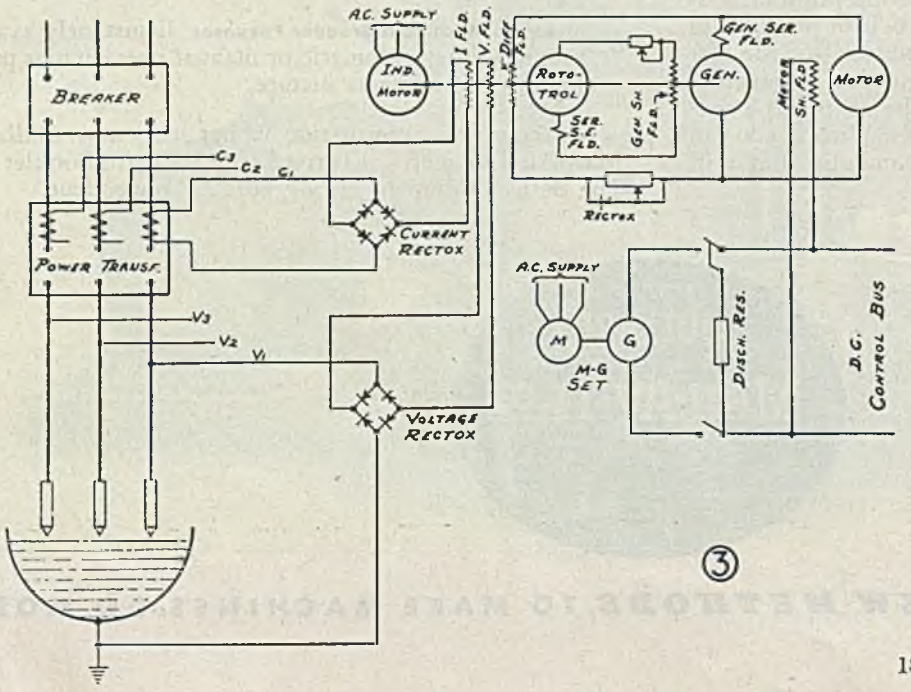


②

Fig. 1—Control, excitation and differential fields and output circuit of regulator

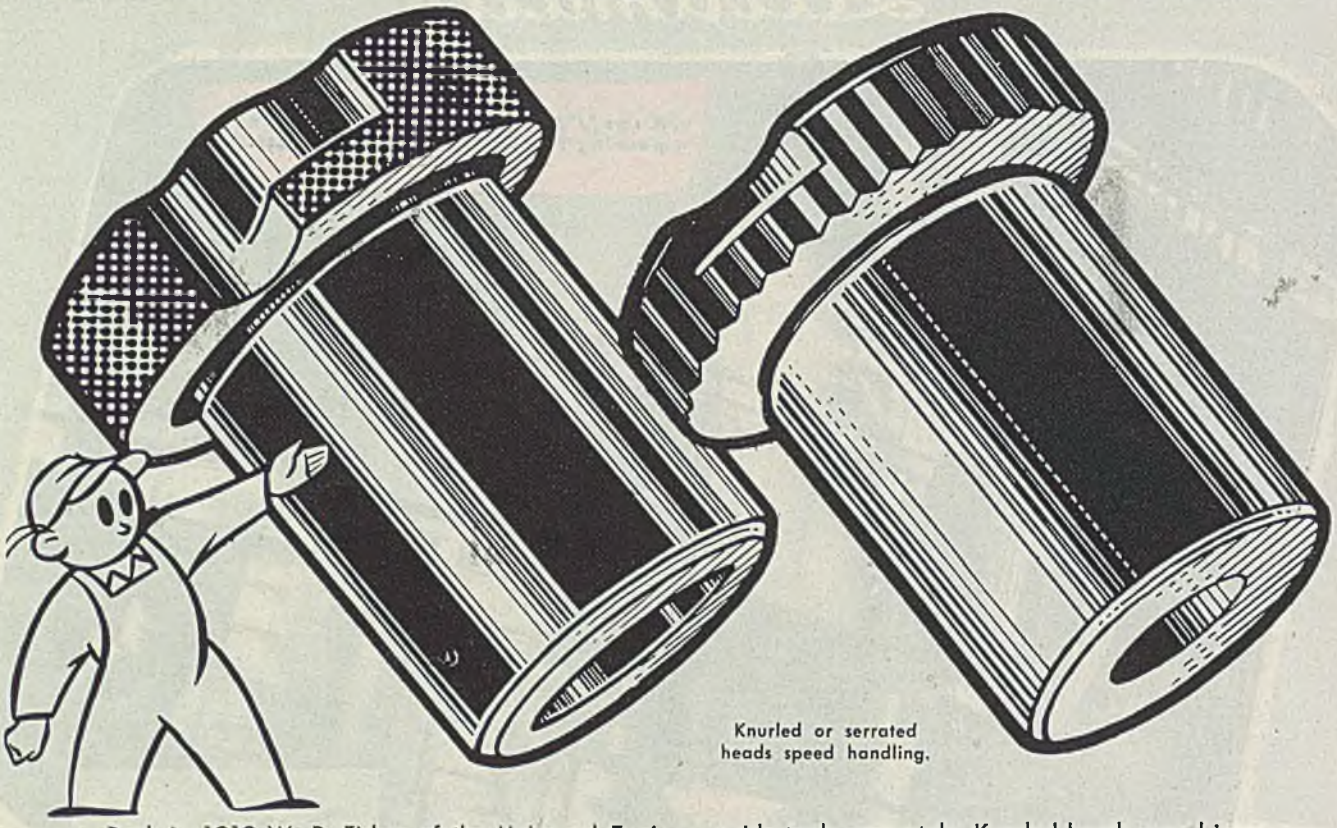
Fig. 2—Simple method of bringing field connections to motor generator set from front of panel

Fig. 3—Diagram of main connections for arc furnace regulator



③

Universal Drill Bushings Save Drills and Tools

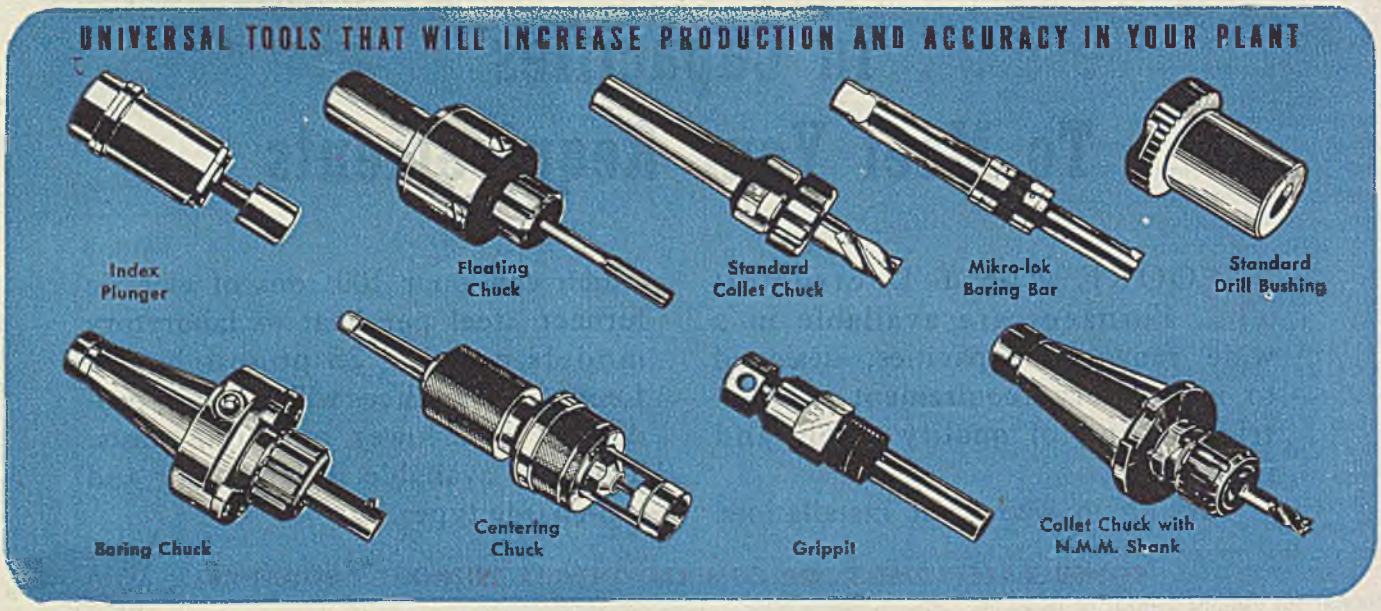


Knurled or serrated heads speed handling.

Back in 1919 W. R. Fisher of the Universal Engineering Co. originated the idea of standard drill bushings. Today, 26 years later, these bushings are saving countless manufacturers thousands of dollars by reducing drill-breakage and insuring more accurate drill, ream, and tap work.

Universal drill bushings are made of hardened, high quality steel with unexcelled resistance to wear through friction and galls caused by chips. Their super-finished bores, straight and round, guide tools accurately. Knurled heads speed insertion in and removal from jigs.

Universal drill bushings are made to the exacting standards of fine workmanship which has made the Universal Engineering Company a leader in the production of quality tools. Write today for complete information on Universal drill bushings, Mikro-lok boring bars, standard collet chucks, or any of the other superior Universal tools illustrated on this page.



UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH, MICHIGAN — Fighter Plane Given by Employees — 100% Employee Bond Deductions

the direct-current generator, as the electromotive force of the electrode motor increases with speed. When the control fields approach a balance the differential quickly reduces the voltage to the motor and prevents overshooting of the electrode position. Thus, the four regulator fields interact cooperatively with each other to supply a regulator and generator output voltage which determines direction and speed of electrode motor.

Fig. 3 is a diagram of main connections. A 3-phase furnace is indicated, but the regulating and Rototrol circuits for one phase only are shown. Alternating current and potential are rectified for the control fields. The electrode motor field is supplied from a direct-current control bus.

Control of the output voltage applied to the electrode motor is obtained simply by the characteristics designed into the rotating regulator and its generator; no interposition of relays or contacts are involved. The speed or response of the voltages applied to the electrode motor is determined by the time constant of these various field circuits. The designer has considerable latitude in his methods of design in giving various proportions to the strength of these different fields. In addition, by means of external resistance the strength of some of these fields can be controlled with excellent results.

Functions of Regulator Combined

Pole structure and windings of what may be called a combination rotating regulator and generator are shown in Fig. 5. This indicates how the functions of the regulator for a pilot exciter can be combined and the generator excited by this regulator in a single unit. The machine has four poles and four brushes. Two of the poles have the excitation circuits of the rotating regulator, while the other two are supplied by the armature output of the regulator. This design has been used with excellent results for small electrode motors.

Advantages of this type of regulator prove that the use of variable voltage control for the motor operating the electrode hoist is a satisfactory method of operation. This is easy to understand when the theory of the regulator is considered. As the desired position of the electrode is approached the excitation characteristics are such that the voltage supplied to the motor will approach zero. This of course, results in a smooth stopping of the motor and is an obvious characteristic of this drive when it is seen in operation. As a result of this smooth stopping of the electrode, breakage chargeable to the operation of the regulator can be neglected as an item of expense. Such records as have been kept on this particular item indicate practically no breakage of electrodes resulting from the variable voltage control of the electrode motor.

A great deal has been heard about speed of response of various types of regulating equipment for arc furnaces. For best overall results in operating a

(*Please turn to Page* 170)

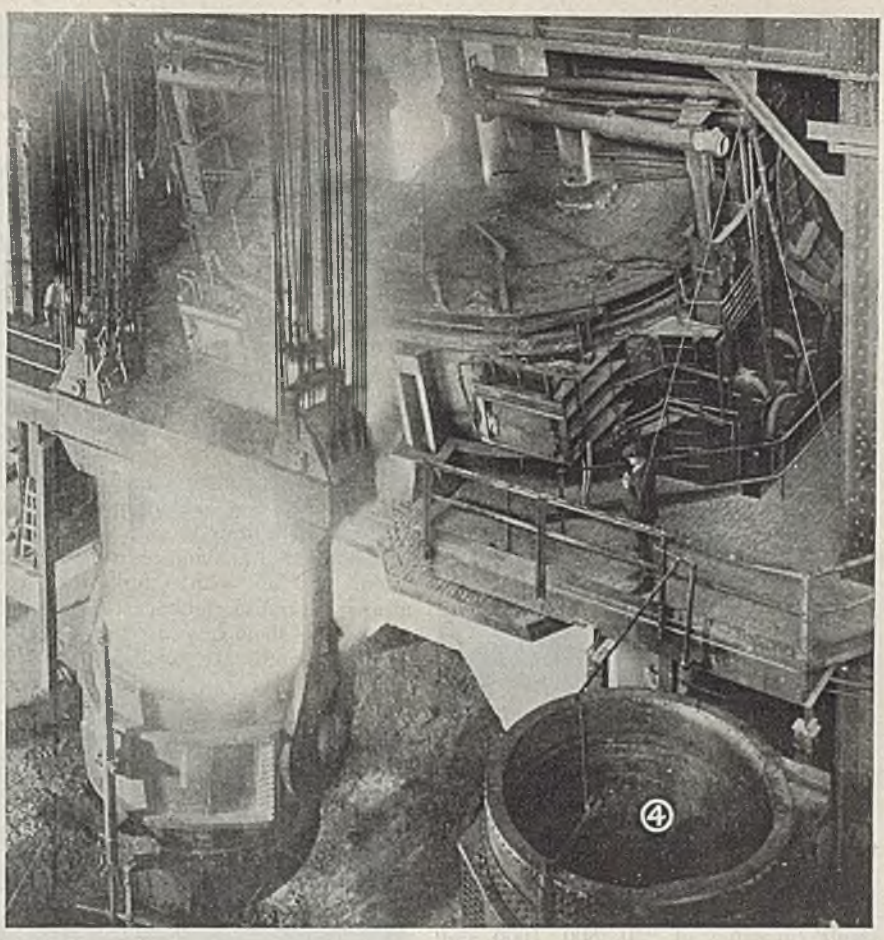


Fig. 4—Tapping a heat of steel from a large electric furnace

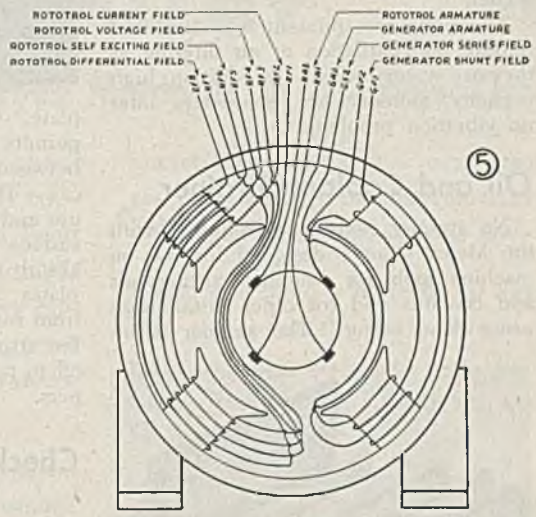


Fig. 5—Pole structure and windings of combination Rototrol and generator

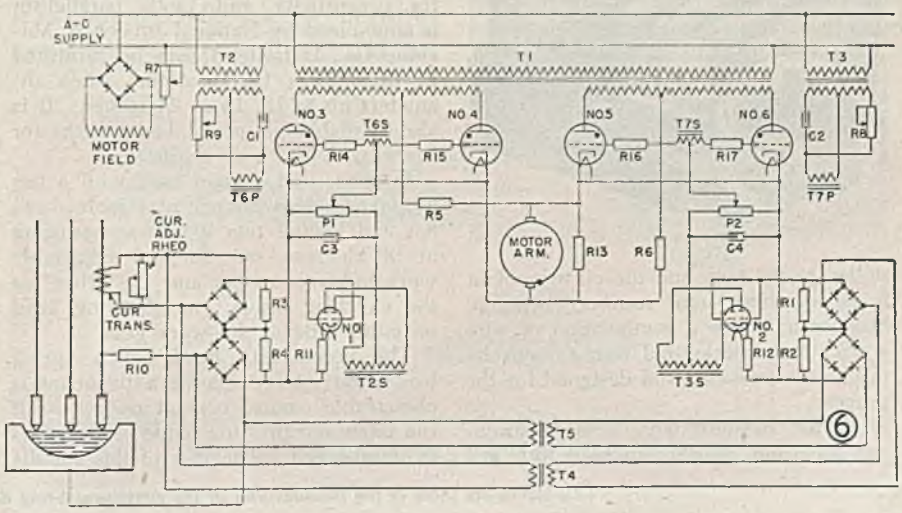
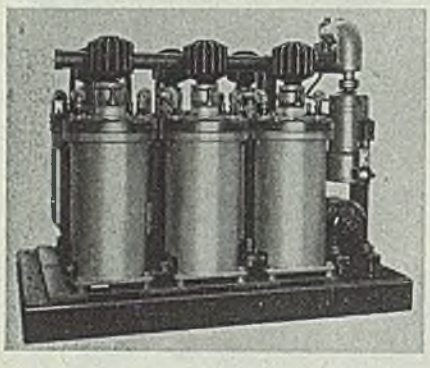


Fig. 6 — Schematic diagram of electronic arc furnace regulating system

INDUSTRIAL EQUIPMENT

Mercury Arc Converter

Development of a new mercury arc converter which fills out the low frequency range of electronic equipment in the field of induction heating applications is announced by Allis-Chalmers Mfg. Co., Milwaukee. Designed for the purpose of electronically changing power at commercial frequencies of 60 or

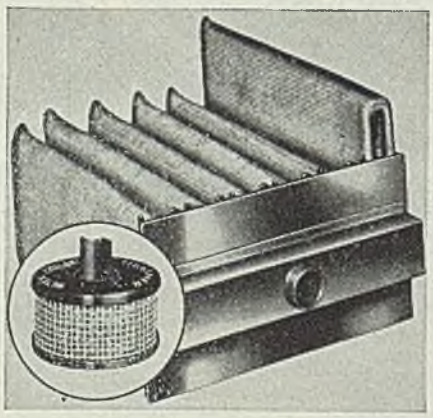


25 cycles into 1000 to 2000 cycle power, the mercury arc type of frequency changer is particularly suitable for supplying power for forging, melting and metal treating applications where large masses of metal or metal parts must be efficiently heated with this power at kilowatt capacities of 250, 500, 1000 and higher.

The units are quiet in operation and require no ventilation or air filtering as they are water cooled. In addition, high capacity mercury arc converters offer no vibration problems.

Oil and Coolant Strainer

No strainer housing is required with the Metex strainer designed for use on machine tools for straining cutting oils and coolants and for other installations using flood oiling. The strainer is in-



stalled in the tank and the oil or coolant is piped direct from strainer to pump. Strainer units are a combination of wire and cotton, interknitted into a mesh by machines developed and designed for the purpose.

All the strainers have a large strainage area and capacity to hold dirt, grit and chips and be provided in the larger units where there is sufficient space for installation. Units are replaceable and slip in and out quickly.

These strainers are available from the Geo. Butler Co., 1073 West Washington boulevard, Chicago, in many sizes and models rated from 2 to 60 gallons per minute and for use with all commercial grades of lubricating oil and coolants.

Bridge Ramps

Engineered and designed to bridge the gap between loading platform and car, Elizabeth Iron Works, Green Lane, Elizabeth, N. J., announces a new bridge ramp. For use with a fork truck as a means of transportation, sizes to span a gap 5 to 46 inches carrying a load of 15,000 pounds are available. Riding surface is four-way nonskid checkered

plate. Curvature at the top of the ramp permits variance in degrees of height between the loading platform and the car. The lift handles stay up when in use and slide down flush with the riding surface when not in use. Shock plates absorb impact and transmit it to stringer plates which prevent truck and load from running off the sides. The ends of the stringers are set back and rounded off to permit the truck to turn sharp corners.

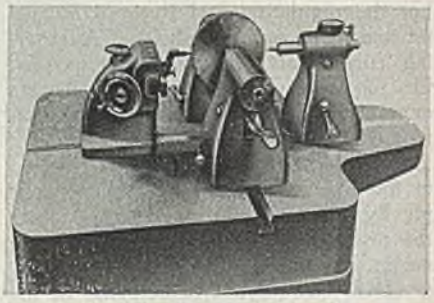
Checking Device

A new device for checking spur gears for eccentricity and tooth parallelism is announced by National Broach & Machine Co., Detroit. It can be furnished in three sizes for maximum pitch diameters up to 12, 18 or 24 inches. It is also available in special bed lengths for gears with integral shafts.

It consists of a rigid base with a top finished to the tolerance of a toolmaker's flat and having two V-keyways crossing at 90 degrees, one for the adjustable work holding centers and the other for the checking heads, one checking head on either side of the work gear.

The eccentricity head has a spring loaded retractable spindle with an interchangeable conical contact point to suit the pitch and pressure angle of the gears to be checked. The rear of this spindle carries an arm which contacts and actuates the spindle of a dial indicator mounted on top of the head.

The other head on the opposite side of the work gear for checking parallelism is built with a sensitive slide running on a ball bearing track. An 8-inch slotted rail on the forward side of the slide carries a contacting finger which actuates



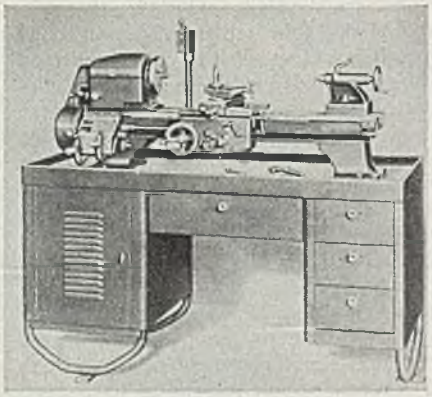
a dial indicator at its base. The slide is reciprocated a maximum distance of 3 inches across the face of the tooth by a handwheel at the side of the checking head.

Moisture Detector

For lumber and wood products and various construction materials, a new moisture detector has been developed by Colloid Equipment Co. Inc., 50 Church street, New York. It is a complete and self-contained unit and is used by forcing the electrode needles into the material being tested and the reading is then taken by turning the dial knob until a small light above the dial flashes at the correct moisture content.

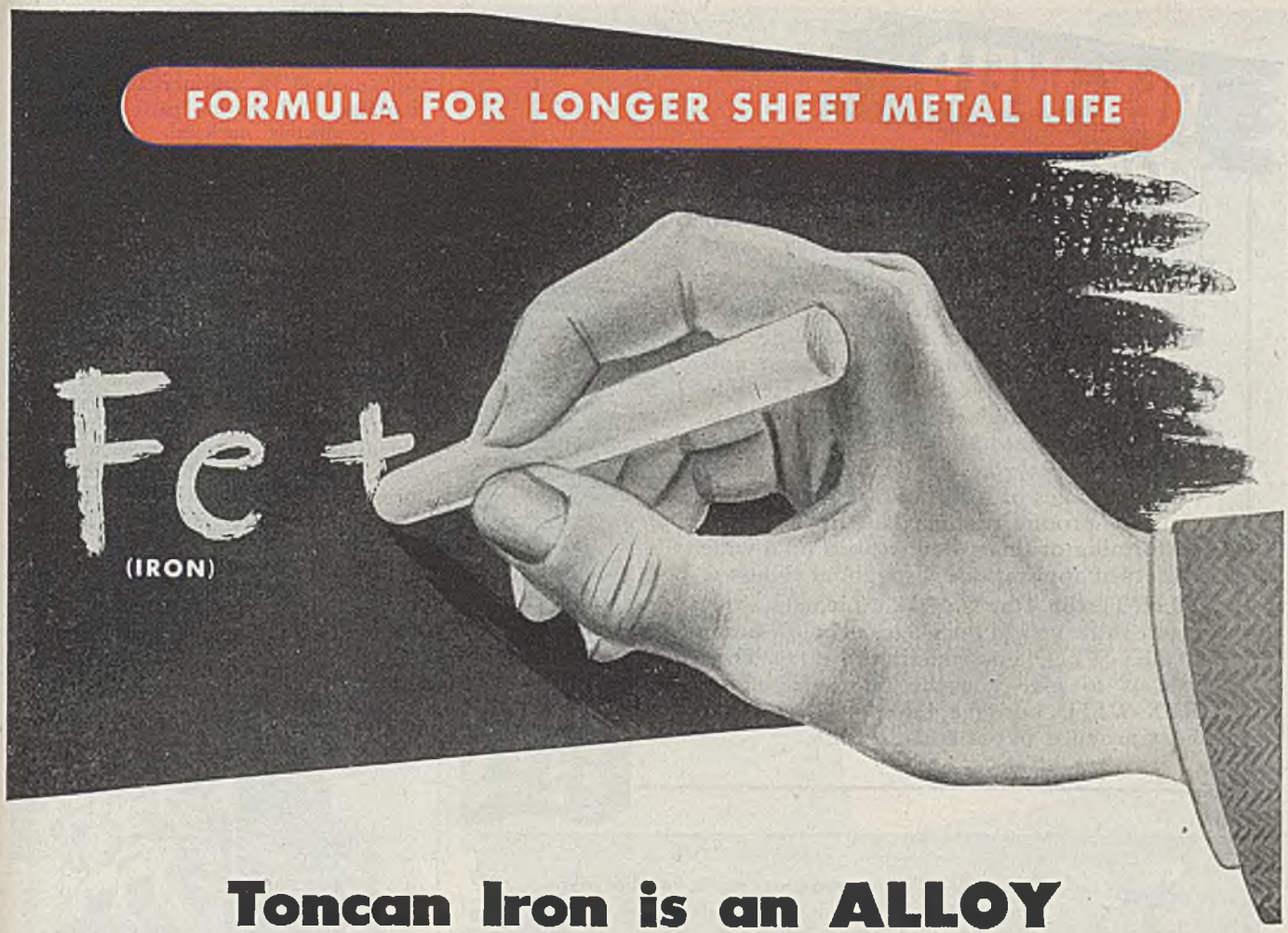
Gear Cabinet Lathe

Combining all features of standard Logan quick change gear lathe in a compact cabinet, the new No. 825 lathe is adaptable to tool room work, for main-



tenance, for training, or for production. The carriage with friction feed automatic apron travels over a bed that is ground to within 0.0005-inch of absolute accuracy. Total run-out of its headstock spindle 12 inches from the bearings is less than 0.001-inch. The lead screw is held to within 0.002-inch in 12

(All claims are those of the manufacturer of the equipment being described.)



Toncan Iron is an ALLOY

that has the Highest Rust-Resistance of all Ferrous Materials in its Price Class

The outstanding performance of mechanized implements of war has further demonstrated the greater advantages obtainable through the alloying of various metals. That's why Toncan Iron—known for its rust-resistance for some 35 years—should be more popular in the future than ever before.

Toncan Iron is an alloy—with the highest rust-resistance of any ferrous material in its price class. It is made from highly-refined open-hearth iron (Fe) with which copper and molybdenum have been alloyed in correct proportion. It has *twice as much rust-resisting copper* as found in copper-bearing steel—along with *molybdenum* to make the copper more effective.

Toncan Iron is one of the easiest materials to fabricate, too—because it is commercially-pure iron, processed for high ductility. And no matter how you work Toncan Iron, you can't weaken its rust-resistance—for it goes *all through the metal.*

When you need a material to fight rust, you'll find the high-resistance you need, together with easy fabricating qualities, in Toncan Copper-Molybdenum Iron.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Bldg., New York 17, N.Y.

Republic

TONCAN COPPER MOLYBDENUM **IRON**

Reg. U. S. Pat. Off.

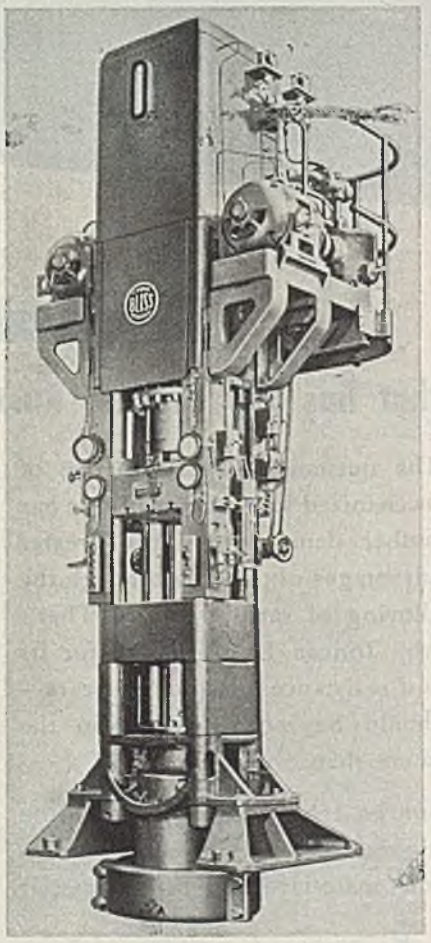
—for those parts of your product and for those sheet metal applications in your plant where low-cost resistance to rust is needed.

inches. The spindle turns on a double row of preloaded precision ball bearings and at 40 other vital points friction is minimized by self-lubricating bronze bearings. All moving parts and gears are completely enclosed. The power plant and underneath drive are enclosed in the left compartment of the four-drawer, stipple finish gray steel cabinet. A multiple V-belt drive transmits power from cone pulley to spindle. Adjustments of both flat and V-belt tensions are accessible to the operator.

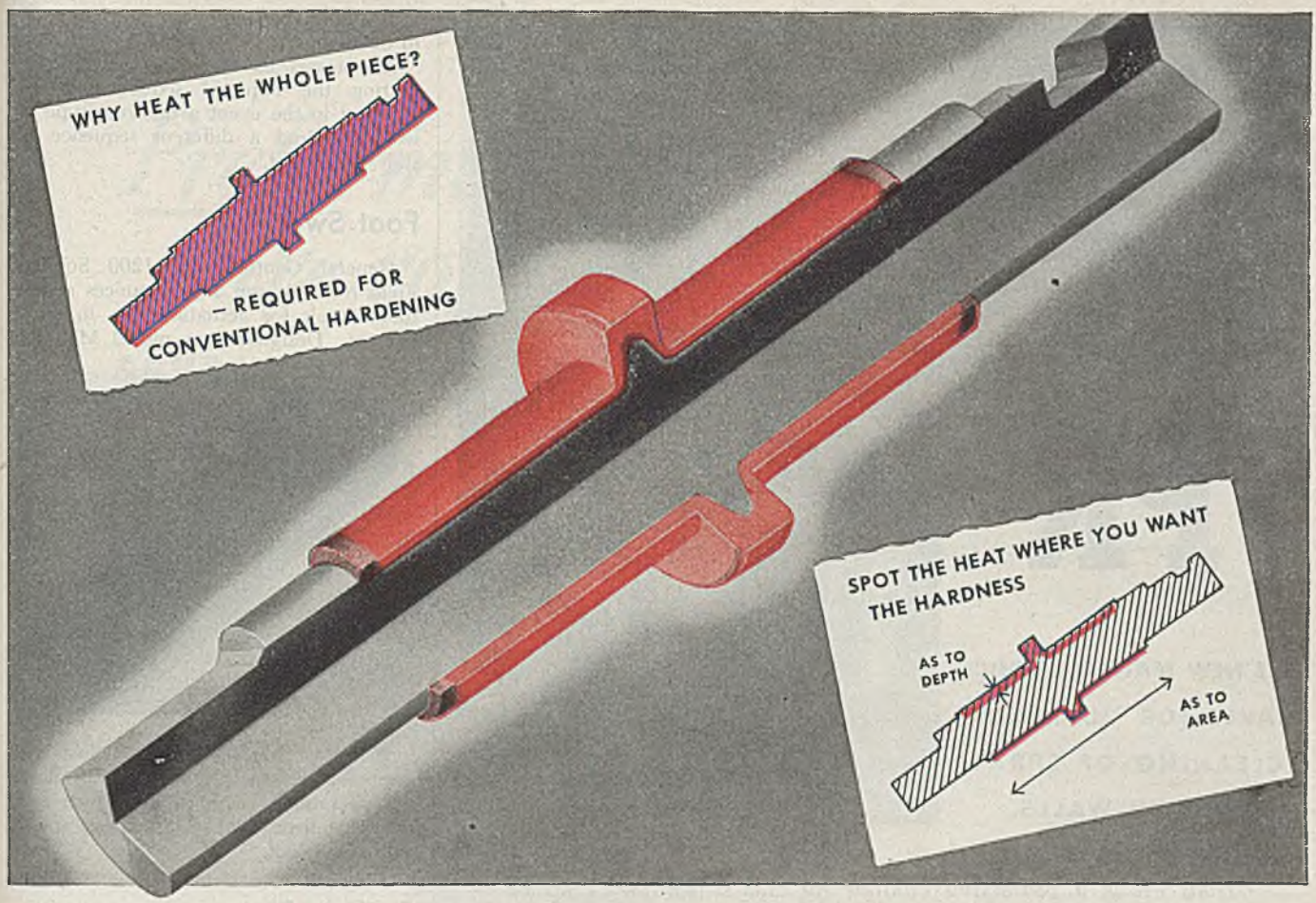
Hydraulic Press

A new press designed for pressing deep sections and also flanged objects in powdered metals wherein one portion of the work must be pressed at a different speed than another is offered by E. W. Bliss Co., Fifty-third street and Second avenue, Brooklyn 32, N. Y.

This press features independent pressure control, stroke control and speed control of each slide. Separate pumping units are furnished for each slide so that the relation of speeds of the two slides can be infinitely varied to suit a wide variety of work.



An automatic cycle is provided with the following sequence: Quick closing to the work; simultaneous pressing by the two slides at predetermined adjustable speeds and pressure; automatic reversal of upper slide; use of lower slide as ejector; timed pause for loading; automatic return of lower slide. They are



HOW TO CUT COSTS . . . IMPROVE QUALITY WITH TOCCO LOCALIZED HARDENING

FAST. By confining heating to the area subjected to wear . . . and by hardening only the wearing surface, TOCCO Induction Hardening cuts treatment time from hours to seconds.

SUPER-HARD AND STRONG. Since this localized treatment does not affect the part's core, there need be no compromise between hardness and toughness. It produces super-hardness without reducing previous strength and ductility.

STRAIGHT. TOCCO speed minimizes warpage . . . eliminates straightening operations.

UNIFORM. Split-second timing of TOCCO'S high-frequency induction heat makes every treatment exactly the same.

GOOD WORKING CONDITIONS. TOCCO machine is cool, clean, compact . . . simple for anyone to operate.

THE PART ILLUSTRATED . . . a track roller shaft, 16½″ long, for a military bulldozer tractor . . . is TOCCO Hardened at flange and bearings. Flange, 4″ diam., is hardened to 50-60 R.C. . . . eight shafts at a time . . . total time, including heating and quenching, 94 sec. or less than 12 sec. per flange. TOCCO machine was designed especially for this application.

Feel free to enlist the TOCCO Engineer in solving *your* heat treating problems. Write for free copy of "Results with TOCCO."

THE OHIO CRANKSHAFT COMPANY · Cleveland 1, Ohio

INDUCTION

HARDENING, BRAZING

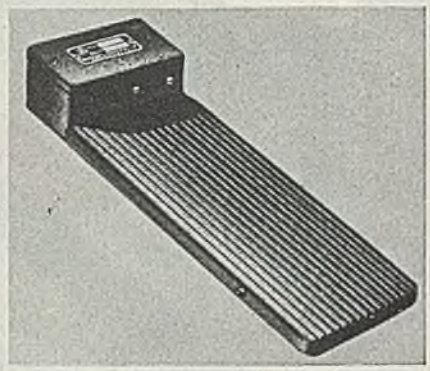
ANNEALING, HEATING

available in capacities ranging from 50 to 5000 tons.

All presses have electric control permitting the required sequence to be changed in the event a different type of work required a different sequence of slide movement.

Foot Switch

General Control Co., 1200 Soldiers Field road, Boston 34, announces a new foot switch for actuating one to eight circuits. Designated as model MF, the



foot rest is ½-inch above the floor and requires 1/16-inch throw. This allows the operator to support his whole foot nearly at floor level. This unit is splash and dust proof.

Surface Plate

Black diamond granite is used in Velsey surface plates distributed by State Mfg. & Construction Co., Franklin, O. It is igneous rock composed of feldspar, quartz and mica. These plates are lapped in series to a tolerance of 0.00005-

inch surface flatness. This flatness is never changed by shock or temperature fluctuation. The material is harder than tool steel; consequently cannot be scratched by instruments. The regular sizes of the surface plates are 12 x 18 inches, 18 x 24 inches and 24 x 36 inches.

Swaged Hook

A new direct-line swaged hook is announced by Poulson & Nardon Inc., Los Angeles. The hook can be swaged to the cable. It has a straight shank and is made from alloy steel in a precision forging operation that retains the full strength characteristics of the steel. It is designed so that the load is on a direct line from the cable.

Other features include smooth inside surface, round throat, ample radius and finished point.

Preformed wire rope

SAVES TIME 3 WAYS

Men in every industry are changing to Preformed wire rope because they have discovered it saves time in three important ways.

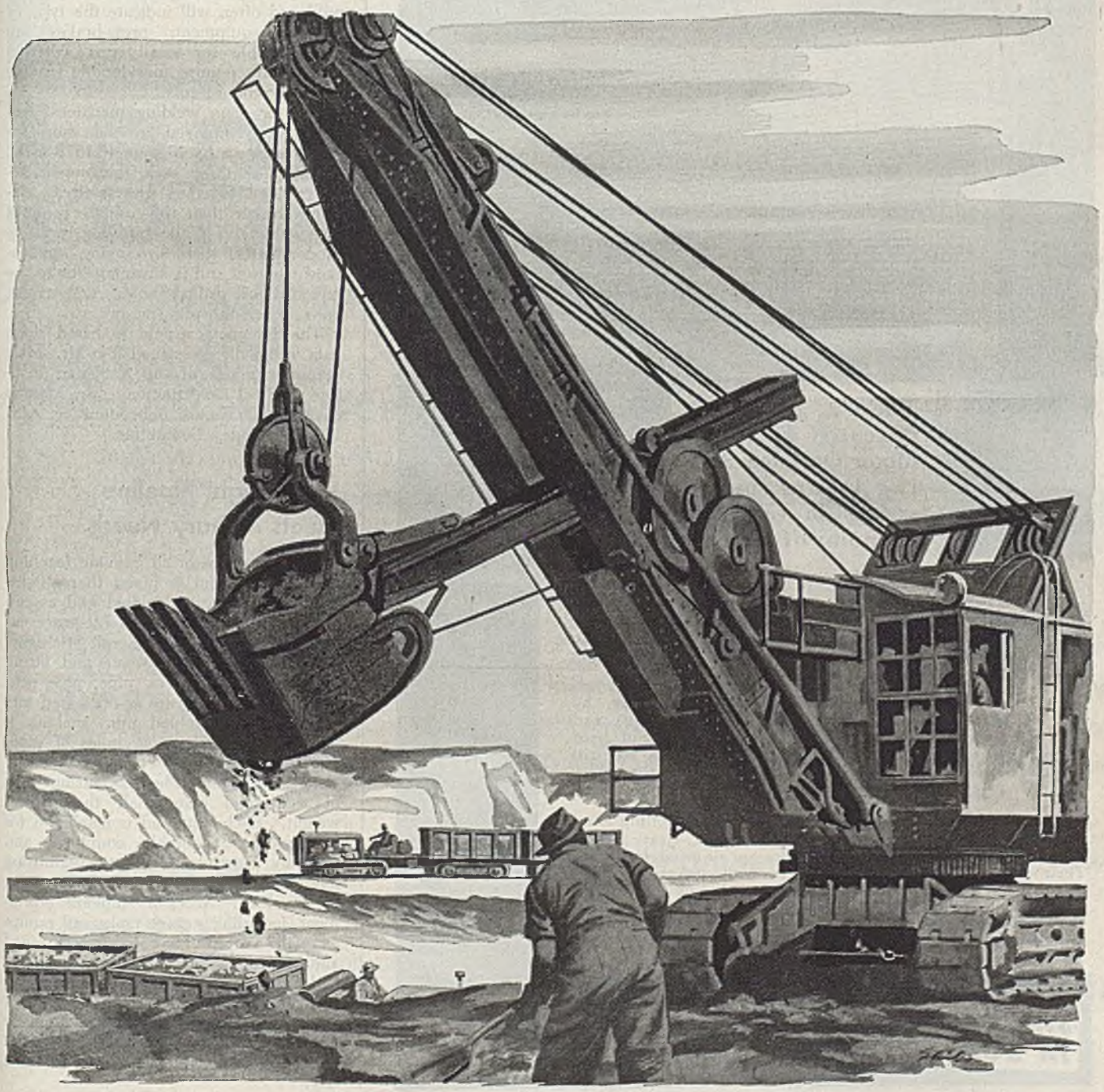
First, it cuts time of installation at least in half because it is so easy to handle, so free from kinking.

Second, Preformed saves time in operations. It is so flexible it can be spooled at higher speeds.

Third, it reduces time-out for shutdowns and replacements because it lasts longer.

These are potent reasons why men searching for new ways to save time prefer Preformed wire rope.

ASK YOUR OWN SUPPLIER FOR PREFORMED WIRE ROPE



Steel Construction

(*Concluded from Page* 110)

of roof deck often are considerably thinner.

Shop fabrication requires relatively simple equipment. Press-brakes ranging in cases up to 26 or 30 feet in length, or cold mills of the Yoder type will handle all the forming work. Presses will produce sharper corners and closer dimensional tolerances with less spring-back than cold-forming rolls, and are preferred for panel construction where close fitup is necessary. Rolls are admirably suited for structural members such as beams and channels, and often are used for roof or floor deck panels where tolerances are no closer than usual for structural work. Cold roll mills sometimes are used for preliminary forming, to be followed by press-brake work. The quantity of a given member to be produced often will indicate the type of forming equipment; press-brakes are more flexible for small runs, whereas rolling mills require considerable footage to justify cost of rolls.

Spot or seam welding machines generally are employed in the shop for thicknesses up to 10-gage (0.1379-inch), as many as three such thicknesses being welded together successfully. Material thicker than this usually requires arc welding. While welding practice predominates, there are many applications where it still is advantageous to use punched or drilled holes, and rivets, bolts, or self-threading screws.

The foregoing article is based upon data originally presented by Mr. Male before members of the American Institute of Steel Construction. Mr. Male is chairman, Technical Subcommittee, AISI Building Codes Committee.

Lightweight Pipeline Meets Military Needs

As 90 per cent of all gasoline reaching the military front is piped there, lightweight lines, easily handled and assembled have been developed by army engineers, Crane Co., 836 South Michigan, Chicago 5, and other valve and fitting manufacturers. Valves, pipe, pipe connectors, and pumps are co-ordinated into one readily assembled unit, making it possible to lay 30 to 40 miles of pipeline per day.

This is accomplished by using pipe of thin steel plate, half the normal weight. Each pipe end is machined for use with demountable couplings and specially constructed gaskets, permitting joining of pipe sections with a few turns of a wrench. Accessory pipeline equipment, including storage tanks and pumps as well as pipe, has been redesigned and lightened so it can be moved quickly and easily in most any lightweight vehicle. Pipelines are laid above ground. Thus, an 800-mile pipe line is made ready for service with unusual speed, delivering 1,500,000 gallons of gasoline a day.

FORGINGS FOR

PARTICULAR USERS

SINCE 1903

THE BIG 3 OF FORGING PRODUCTION

LARGEST COMBINATION IN AMERICA

PRODUCING

QUALITY

FORGINGS

· METALLURGICALLY CONTROLLED ·

ON A COMPLETE RANGE OF MODERN FORGING EQUIPMENT

#1. GIANT.... STEAM HAMMERS

FROM MEDIUM 2000 LB. UNITS TO THE **47,500** MASTER

The Largest in America

#2. MASSIVE.. UPSETTERS

FULL RANGE FROM 4" to 9" FORGING THE MOST INTRICATE CONTOURS ON PRODUCTION BASIS

#3. HUGE..... PRESSES

MECHANICAL AND HYDRAULIC. WEIGHING UP TO **800,000** LBS. PER UNIT

IN TRANSPORTATION UNITS... VITAL PARTS ARE FORGED

---ON *LAND, SEA* OR IN THE *AIR*

Builders of cars, trucks, airplanes, ships, road building and railroad equipment have found that the factual difference in former and modern models, lies in the use of *FORGED PARTS,* scientifically designed and produced to insure maximum strength and durability.

Consult our engineering department Now!

CANTON

THE CANTON DROP FORGING & MANUFACTURING CO.

CANTON, OHIO

NEWARK 108 RAYMOND COMM. BLDG. | CHICAGO 2400 W. MADISON | MILWAUKEE 759 MILWAUKEE ST. | MINNEAPOLIS 215 HODGSON BLDG. | SEATTLE 1600 23rd AVE

Forging Propeller Hubs

(*Concluded from Page* 111)

is largely SAE X-4340 steel. A cut-out cross section of a three-arm, one piece propeller arm forged from this material is shown in Fig. 2.

Development of this one-piece forging with multiple extruded arms not only reduces metal loss in machining but makes possible additional refinements. One is semiautomatic hydraulic pull broaching of the hub interior which has 44 teeth or splines, somewhat similar to an internal gear. All splines are cut at once and allowance on the pitch diameter is 0.003-inch. Extreme tolerance is required on flanks of splines, and must not exceed 0.003-inch.

Two broaches are used on the machine and accuracy obtained, rather than amount of stock removed is an outstanding feature. There is a loading position where a new hub is mounted while broaching takes place. The two broaches operate at the same time, two hubs being in operating position while a third is being loaded. Broaches are approximately 100 inches long, guided on both sides of work to assure accuracy. Designed by the Lapointe Machine Tool Co., Hudson, Mass., the machine has a 75-ton pull capacity. Production averages 15 hubs per hour.

Engine Utilizes Gas or Oil as Fuel

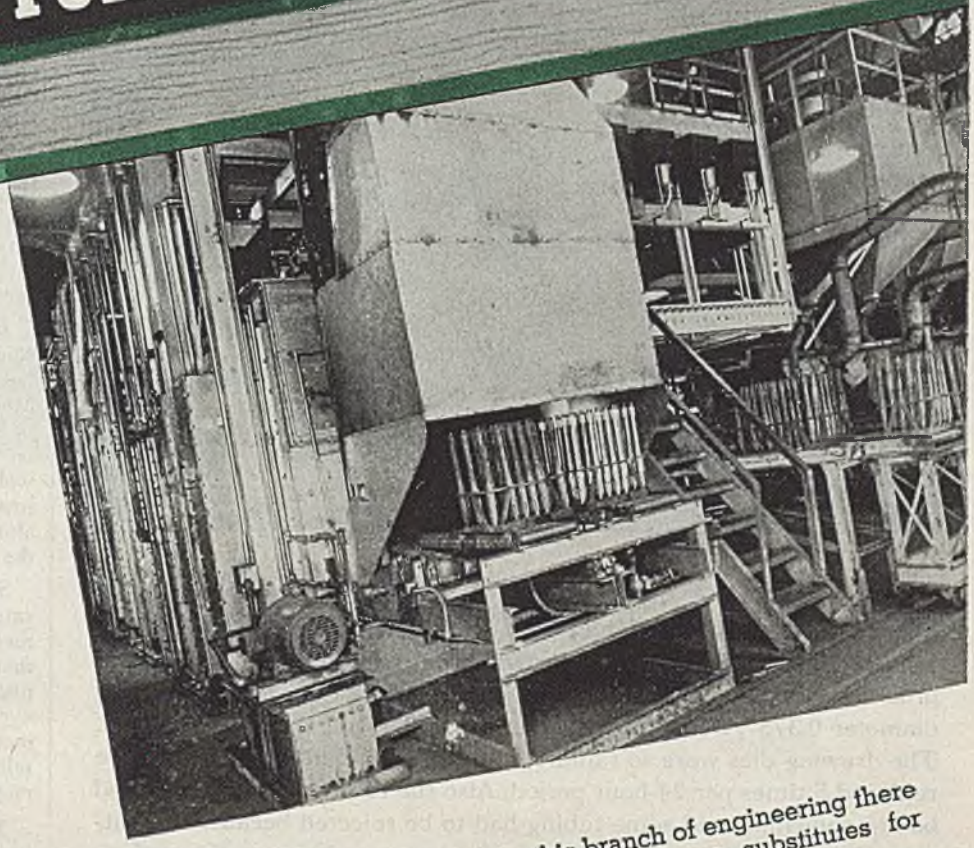
An engine capable of instantaneous conversion from oil to gas fuel without change in load or speed is being manufactured at the Buffalo Works of Worthington Pump and Machinery Corp. Conversion from one fuel to the other or adjustment of a combination of both is accomplished by one revolution of a single control wheel. Regardless of fuel used, engine operates on the diesel cycle, making possible fuel economies previously unobtainable in gas engine operation.

Unit does not require a high pressure fuel gas supply to the engine. A pressure of two inches of water is used. When operating a gas engine, pilot oil ignition is used, eliminating electric ignition. Pilot fuel may be used in amounts as low as 5 per cent of the total full load British thermal unit requirements of the engine.

Fuel consumption as a gas engine is said to be appreciably less than that of a similar engine operating on the conventional spark ignition Otto cycle.

This system covers the entire range of diesel sizes made by the company. Flexibility of this system makes it applicable to many fields, and it is well suited for use in sewage plants, oil fields, industrial and municipal plants, gas utilities and refinery services. Information is available on a number of these applications.

It takes 10 YEARS or more to develop a FURNACE ENGINEER



The Difference between a first-class heat treating furnace and a mediocre unit, judged by actual production results and operating costs, lies in the quality of engineering used in its design and construction.

It has been Holcroft's experience that 10 years or more of constant practice is necessary to develop a furnace engineer capable of maintaining Holcroft's standards. In this branch of engineering there are no short cuts—no substitutes for actual practice.

It is interesting to note that 43% of Holcroft's employees have been with the Company more than 15 years and 50% more than 10 years. When you buy a Holcroft Furnace you get all the advantages of this combined experience and know-how.

HOLCROFT & COMPANY

6545 EPWORTH BLVD. · Detroit 10, Michigan

CHICAGO—C. H. Martin, 1355 Peoples Gas Bldg.
CANADA—Walker Metal Products, Ltd., Walkerville, Ont.

BUILT BY HOLCROFT & COMPANY DETROIT-MICH.

LEADERS
in Building and Designing Electric and Combustion Furnaces, Kilns and Ovens

Deep Drawing Lubrication

(*Continued from Page* 113)

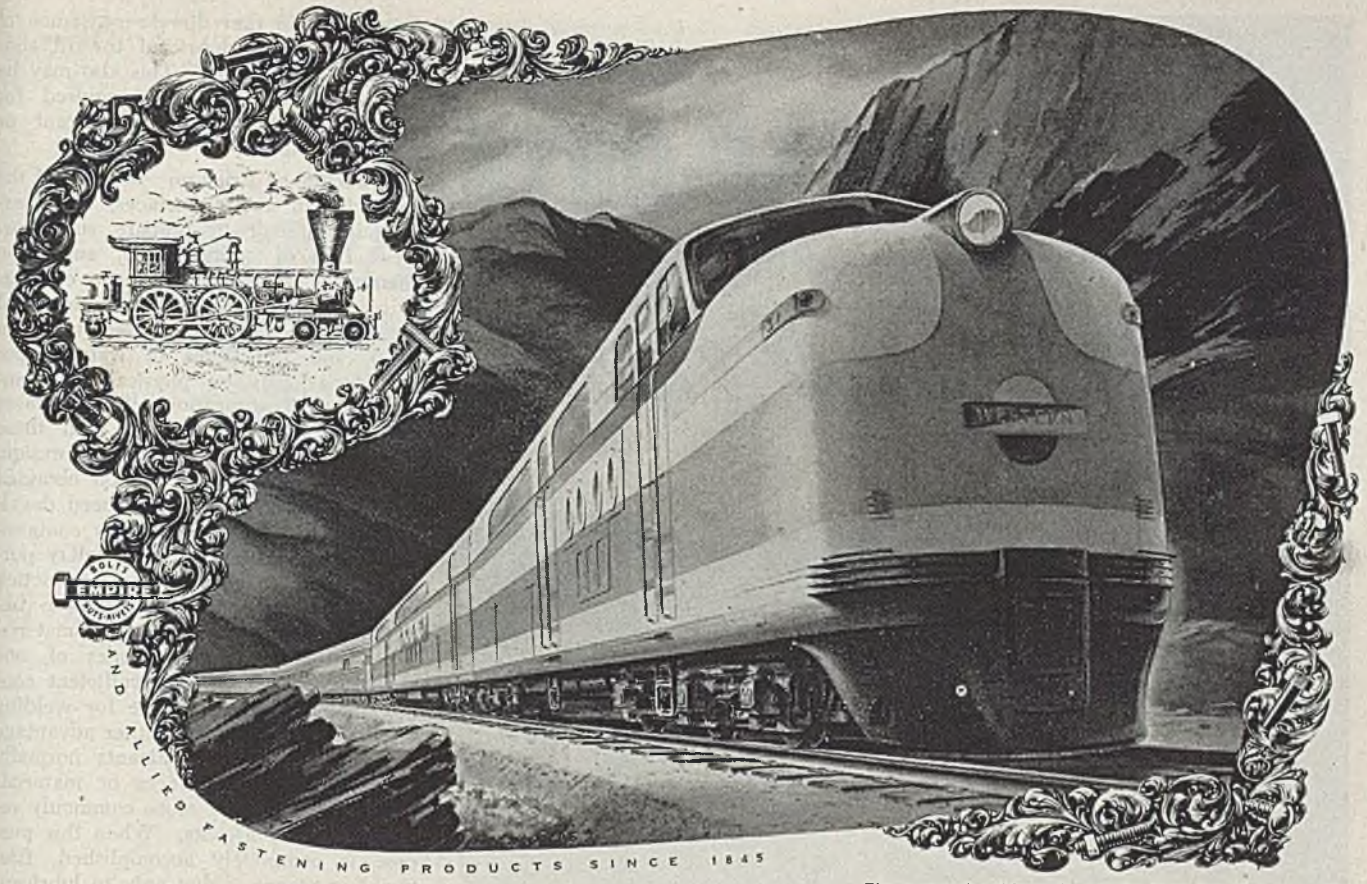
idly that it is not apparent except when highly refined methods of measurement are used. As each weld is broken, there is a flash of heat generated which results in extremely high temperatures, highly localized at the rubbing surface.

In a series of experiments performed by Bowden and Ridler in which the sliding metals were made portions of a thermocouple and the electromotive force generated was measured, it was found that temperatures of 1000 degrees Cent. or more were generated in the dry sliding of metal surfaces at relatively high speed (1200 centimeters per second) although the bulk of the metal was only a few degrees above room temperature. While breaking of welds results in high temperatures, additional welding is facilitated as the temperature is increased. This may lead to a vicious circle resulting in large scale welding under appropriate conditions.

In the case in which softer metal is caused to slide over a harder metal, it has been found by Bowden, Tabor and Moore [7] that the softer metal tends to be torn from its surface and retained on the surface of the harder metal as welded fragments, and at the same time, small portions of the harder metal are also torn off and are carried away with the softer metal.

Some interesting evidence for this smearing of softer metals on harder metals has been obtained by R. Schnurmann[9], who found that while such metal was not visible to the unaided eye, it was possible, by an ingenious method of development utilizing silver salts, to intensify this pattern of smeared metal so that it becomes visible.

Types of Friction: This welding between metal surfaces is responsible for the greater part of frictional resistance. In addition, when lubrication is supplied to reduce welding and the thickness of the film of lubricant is appreciable, some frictional resistance is due to the resistance of the molecules of the lubricant as they slide over one another. In the type of lubrication in which a thick film of liquid lubricant can be maintained between metal surfaces so that welding is almost absent, frictional resistance is almost completely dependent upon viscosity. In another type of lubrication in which solid deposits are maintained between surfaces, frictional resistance is dependent on the force required to cause plastic deformation of the deposit and friction of this type is considerably higher than for liquid lubricants. It is considered likely that insufficient attention has been paid by many authorities in this field to the differentiation between these two forms of frictional resistance, and this may be responsible in part for the confusion that exists in the literature on this subject. For present purposes, frictional resistance will be classified into two types: (1) That due to welding of portions of the metal sur-



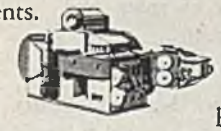
These are the things that make America strong . . . the industries that RB&W has served during its 100 years of developing better fasteners for better products.

NO. 3 *Railroads*

The Railroads.....

CHOO CHOO TO SWWISSH!

You hardly *see* one of today's streamlined fliers before—*swwissh*—it's practically out of sight! What a contrast—in speed, comfort and appearance—to laboring, hard-chugging trains of 100 years ago . . . trains which were also the miracles of their times . . . There is *still* one important element of construction that the pioneer trains and the latest models have in common—the use of RB&W bolts and nuts. Around the middle of the last century, RB&W EMPIRE provided the quality that railroading in those days required . . . and, as the railroads' requirements became more severe through the years, RB&W quality was ready to meet those new requirements.



From the invention of the first automatic cold-header nearly a century ago, RB&W has invested many fortunes in research and development work, equipment and plants. And from these investments has come the creation of a host of new processes and methods for producing fasteners of even greater strength and accuracy—of better appearance and finish—of maximum dependability . . . Entering its second century, RB&W has great plans for further developments that will be important news to the transportation industries and others that have always looked to RB&W for the quality that makes *their* quality products easier to assemble and stronger and better in service.

100 Years.. MAKING STRONG THE THINGS THAT MAKE AMERICA STRONG

RB&W

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Factories at: Port Chester, N. Y., Coraopolis, Pa., Rock Falls, Ill. *Sales offices at:* Philadelphia, Detroit, Chicago, Chattanooga, Los Angeles, Portland, Seattle. *Distributors* from coast to coast. The industry's most complete, easiest-to-use catalog.

faces, and (2) that due to resistance of the molecules of lubricant toward sliding over one another. This also may be referred to as the force required for stress-deformation of the lubricant or lubricant friction.

Reduction of Friction: Because of the reactivity of metal surfaces, it is extremely difficult to prepare such surfaces free of contaminants, and even chemically clean surfaces have coatings of oxides of varying thickness, adsorbed layers of the chemicals used to clean them, and thin films of water vapor held tenaciously by physical or chemical force of adsorption [10]. Surfaces that are somewhat cleaner than these can be obtained by means of abrasion. Therefore, the laws of friction obtained for dry surfaces have really been developed on the basis of surfaces contaminated in this manner. The primary purpose of lubrication is to reduce friction of the first type, i.e., to interpose between metal surfaces a film of material which prevents the molecules of one surface from coming into sufficient contact with the other surface for welding to occur. This is true whether advantage is taken of the contaminants normally present on metal surfaces or materials are applied that are more commonly referred to as lubricants. When this purpose is completely accomplished, frictional resistance is due only to lubricant friction and this type of lubrication is referred to as fluid, viscous, or thick film lubrication. On the other hand, it is frequently not possible to accomplish this purpose completely, and when this is the case, lubrication is attained by thin films of thickness of from 1 to 2000 molecules [11]. This type of lubrication is referred to as "boundary" or thin film lubrication, and friction due to welding is not completely prevented.

Types of Lubrication: Fluid lubrication takes place when the film of lubricant is so thick that the laws that apply to fluids in bulk are followed. A minimum film thickness for fluid lubrication conditions has been found by several investigators to be in the order of 10^{-4} centimeters [12, 13, 14, 15]. With a film thickness of this magnitude, the surfaces are separated to an extent sufficient to reduce the effect of intermolecular attraction to a negligible quantity. Since no welding takes place, frictional resistance is dependent only upon the viscosity of the lubricant and is independent of the nature of the surfaces. It is also dependent upon the relative velocities of the surfaces and the unit pressures. When the viscosity of a lubricant is greater than the minimum required to obtain a film sufficiently thick so that fluid lubrication is obtained, further increase in viscosity results in excess friction due to the extra work required to cause motion within the fluid [16]. In order to attain a sufficiently thick layer of lubricant for fluid lubrication, it is generally necessary to pay considerable attention to design and method of operation, i.e., clearances, oil feed, speed, etc. A large literature has been built up [16, 17] which

concerns itself with this phase of lubrication so far as bearings are concerned, frequently to the exclusion or de-emphasis of other phases of the subject.

When true fluid lubrications are attained, wear is absent. For example, an illustration has been cited in which large turbines operated under fluid lubrication conditions for more than 20 years have shown no appreciable signs of wear [18]. In addition to this, the coefficient of friction is at a very low value since no work is required to break welds between the metal surfaces. A comparison among the coefficients of friction for sliding surfaces under conditions of no (applied) lubrication, boundary lubrication, and fluid lubrication is given in Table I.

When unit pressures are high or when speeds are low, so that most lubricants tend to drain off, and under many other operating conditions, it is not possible to attain fluid lubrication. Under those conditions, lubrication is of the boundary type, and it is necessary to depend upon very thin films of lubricants. Under boundary lubrication conditions, friction conforms to the Amontons-Coulomb law for unlubricated surfaces, and lubricants of a different type (see section C) must be used for satisfactory performance.

Relationship between applied total pressure and unit pressure is, of course, elementary and well-known. Nevertheless, in the design and operation of sliding surfaces, this relationship is frequently lost sight of, and dies with sharp approaches to the land, or ball-bearings used under conditions in which some sliding occurs, too frequently are found. This should be borne in mind in the analysis of lubrication problems, because occasionally bearing surfaces that are apparently under low unit pressures have high unit pressure areas that prevent the formation of fluid lubrication conditions.

(*Continued Next Week*)

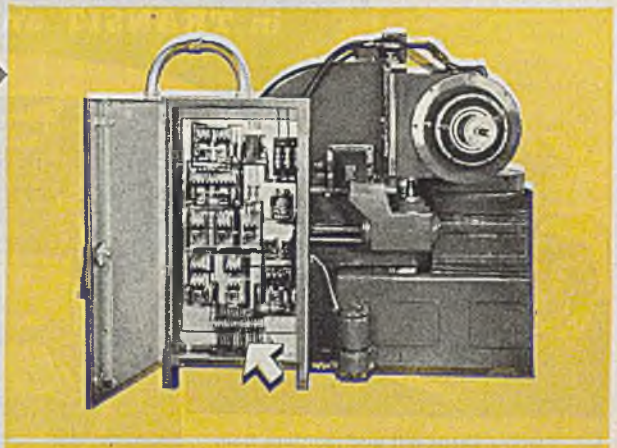
REFERENCES

[1]Swigert, A. M.: "The Story of Superfinish", 1940, Lynn Pub. Co., Detroit.
[2]Bowden, F. P., and Tabor, D.: Proc. Royal Society; A 169,391; 1939.
[3]Beilby, G.: "Aggregation and Flow of Solids", McMillan, London, 1921.
[4]Adam, N. K.: General Discussion on Lubrication, IV-197, ASME, 1938.
[5]Gemant, A.: Journal of Applied Physics, 14-456, 1943.
[6]Rosenberg, S. J., and Jordan, L.: J. Res. Nat. Bur. Stand. 13-267, 1934.
[7]Bowden, Tabor and Moore: Journal of Applied Physics, 14-80, 1943.
[8]Bowden, F. P., and Leben, L.: Proceedings Royal Soc., 169-371, 1939.
[9]Schnurmann, R.: Journal of Applied Physics, 13-235, 1942.
[10]Fogg, A., and Hunwicks, S. A.: J. Inst. Petrol, 26-1, 1940.
[11]Clark, G. L., Lincoln, B. H., and Sterret, R. R.: Proceedings American Petroleum Institute, 16 -Sec. III -68, 1935.
[12]Bulkley, R.: Bur. Stand., J. Res., 6-89, 1931.
[13]Trillat, J. J.: Rev. Gen. Sci., 48-95, 1937.
[14]Kyropqulos, S.: General Discussion on Lubrication, IV-346, ASME., 1938.
[15]Stanton, T. E.: Proceeding Royal Soc., A-102, 241, 1922.
[16]Hersey, M. D.: "Theory of Lubrication", Wiley & Sons, New York, 1938.
[17]Norton, A. E.: "Lubrication", McGraw-Hill Co., New York, 1943.
[18]Pigott, R. J. S.: Mech. Eng., 64-259, 1942.

Here's Why MORE AND MORE MACHINE TOOL USERS ASK FOR...

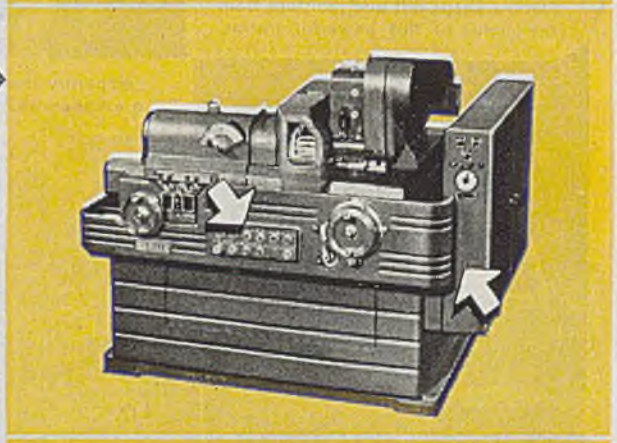
Square D Control

Because the Square D line of machine tool control is so unusually complete, practically any performance requirement can be met with standard devices. These standard devices, designed to perform many different functions, are physically proportioned to make up compact, attractive control panels.



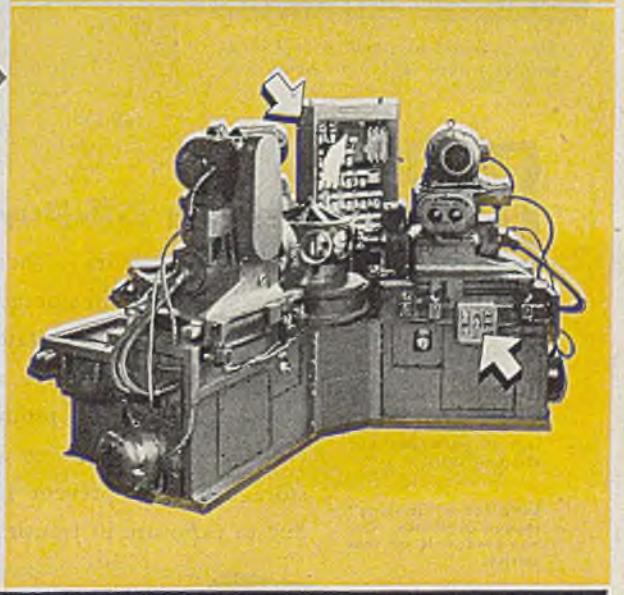
Square D Control

Magnetic starters and contactors, vertical action type, are designed specifically for the exacting requirements of machine tool control which include ample electrical capacity, fast response and long mechanical life. Square D accessories include push buttons, precision limit switches, pneumatic timing relays and terminal blocks.



Square D Control

Square D Field Engineers have had years of experience in designing electrical control for machine tools. They are fully qualified to work out line diagrams for desired operation sequences. Their suggestions are carefully analyzed and confirmed by factory engineering departments with complete research and testing facilities at their command. This Field Engineering Service is available, at no cost, through Square D branch offices in 50 principal U. S. and Canadian cities.



SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

Copper Brazing

(*Continued from Page* 116)

from 0.020 to 0.046-inch in diameter.

Or the copper is supplied to the joint by plating a copper deposit on one of the members to be joined. This method is especially useful on those items with internal joints where it would be difficult or impossible to place properly a wire ring or clip. A copper deposit 0.0008-inch thick has been found most satisfactory here for such joints.

No paste or flux is employed in any of this work.

Brazing the Joint: With copper prepositioned properly, the assemblies are loaded on the mesh belt conveyor at the entering end of the brazing furnace, Fig. 3. A considerable section of conveyor is exposed here so that two or more operators can be employed in loading small units on the conveyor, when one operator can not load them fast enough to take full advantage of maximum furnace speed. A perforated metal shield protects the workers from the conveyor mechanism.

Mesh belt conveyor is 12 inches wide, so can handle a goodly number of parts. Furnace structure accommodates parts extending as high as 6 inches above the conveyor surface. A curtain and exhaust duct at entering vestibule of furnace keep heat and fumes from the room.

Electric Furnace: Heating chamber of the furnace is about 8 feet long, followed directly by a 16-foot long cooling chamber. The furnace with conveyor extensions measures about 28 feet overall. Temperature for brazing ranging from 2000 to 2100 degrees Fahr. is developed by electric heating elements rated at 45 kilowatts. These are distributed between top and bottom of the heating chamber, 24.6 kilowatts being mounted above the conveyor belt and 20.4 below.

Fig. 2 shows exit end of the furnace with an operator unloading brazed assemblies from the conveyor belt. Here also a vestibule and exhaust duct are provided to prevent fumes and heat from entering the atmosphere of the room.

Protective Atmosphere: At the right of Fig. 2 can be seen the equipment that furnishes the controlled atmosphere for the heating and cooling zones of the furnace. This equipment partially combusts fuel gas to produce the protective atmosphere desired; that is, the gas is burned incompletely by limiting the amount of air fed in with it. The unit has a capacity sufficient to furnish 1000 cubic feet per hour of controlled atmosphere.

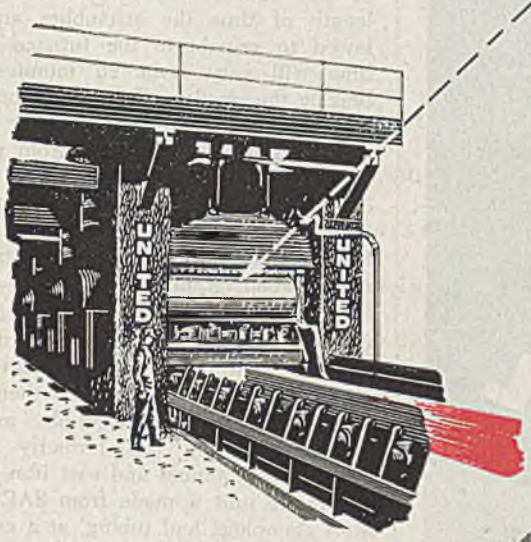
The regular city gas fed into the unit is a coke oven product, rated 540 B.t.u. per cubic foot. Pressure is equivalent to a 6-inch head of water.

The usual air-gas ratio is three volumes of air to one of gas. This is the ratio employed when brazing most small parts where the furnace doors need be

United

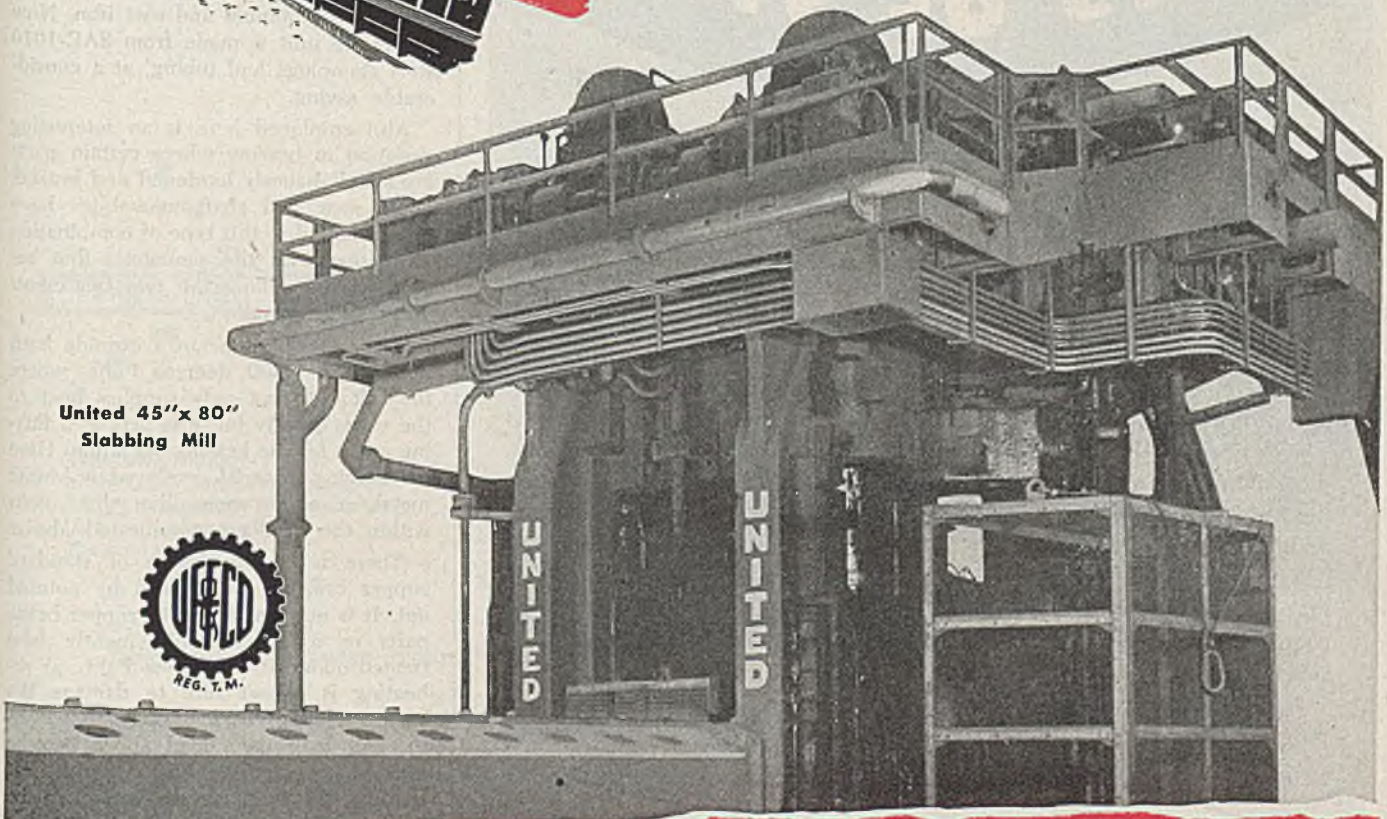
designers and builders of all types of

Rolling Mills



- ★ Blooming
- ★ Slabbing
- ★ Plate
- ★ Universal 2, 3, 4-high
- ★ 4-high Hot Strip
- ★ Bar
- ★ Rail and Structural
- ★ Merchant
- ★ Rod
- ★ Skelp
- ★ Pipe and Tube
- ★ 2 and 4-high Cold Strip
- ★ Sheet
- ★ Tin
- ★ Uni-Temper

In all types: Single Stand, One Way or Reversing, Tandem, Continuous, etc. For Carbon Sheet, Alloy Steels, Copper, Brass, Aluminum and other Non-Ferrous Metals.



United 45"x 80" Slabbing Mill

UE&CO REG. T.M.

UNITED ENGINEERING and FOUNDRY COMPANY

PITTSBURGH, PENNSYLVANIA

Plants at Pittsburgh, Vandergrift, New Castle, Youngstown, Canton

Davy and United Engineering Company, Ltd., Sheffield, England

Dominion Engineering Works, Ltd., Montreal, P. Q., Canada

Aluminum United Company, Akron, Ohio

** The World's Largest Designers and Makers of Rolls and Rolling Mill Equipment*

opened only a small amount, thus minimizing leakage. For larger parts where more leakage is unavoidable, ratio may be reduced to 2½ of air to one of gas.

Analysis of the protective atmosphere so produced will average about 6 per cent carbon dioxide, 7½ per cent carbon monoxide, 9 per cent hydrogen, and the remainder or about 77½ per cent nitrogen. Note that there is no free oxygen. And water vapor is removed, too. Furnace as well as controlled atmosphere equipment was furnished by General Electric Co.

Conveyor Speeds: Of course the speed of the conveyor belt determines the length of time the assemblies are allowed to remain in the furnace. This time will vary from 20 minutes for brazing the small muffler made from 16-gage stock to about 45 minutes for brazing the starter pedal made from material ¼-inch thick. A variable speed drive on the conveyor makes it easy to adjust the conveyor speed to produce these heating times, as well as a much greater range, when required.

Shortcuts: After some experience was obtained with the brazing unit, design changes were made in various parts and assemblies to adapt more of them for copper brazing. For example, an air cleaner assembly was formerly made from cast aluminum and cast iron. Now the entire unit is made from SAE-1010 steel stampings and tubing, at a considerable saving.

Also employed here is an interesting variation in brazing where certain parts are simultaneously hardened and brazed. Some gear and shaft assemblies have been adapted to this type of combination processing with the economies that accrue from handling the two treatments in a single operation.

Such work is done in a cyanide bath at 1400 to 1600 degrees Fahr. where the salt bath not only supplies heat to the work quickly but also acts as a fluxing agent for the brazing operation. Here the brazing material employed is Muntz metal, a copper-zinc alloy that melts within the heat range indicated above.

There is one limitation of standard copper brazing that should be pointed out. It is not practicable to copper braze parts or assemblies subsequently heat treated above 1600 degrees Fahr., as reheating is almost sure to damage the brazed joint. Where possible, however, the salt bath mentioned above can be utilized to combine brazing and heat treating. In fact, certain parts can be hardened directly from the continuous brazing furnace by keeping them at temperature while traversing the cooling zone and discharging the hot work directly into a quench bath. However, this method is not employed at Briggs & Stratton since the large volume of parts that do not require heat treating do not warrant changing over the continuous furnace setup for combined brazing and hardening work.

The new *High-solids lacquers* save money

High-solids nitrocellulose lacquers deposit thicker films at spraying viscosity, give you the same finish with fewer coats.

High-solids lacquers mean thicker coats . . . therefore fewer coats. This saves you money—in the five ways shown, and perhaps others as well. You can estimate just how large your savings will be when you get the full facts from your own lacquer supplier. Ask him about the *new* high-solids lacquers he is developing.

Nitrocellulose lacquers are still the fastest-drying finish . . . in minutes at room temperature. No expensive baking equipment is needed.

You save assembly time with high-solids lacquers. Each finishing operation on assembly line and on feeder lines is speeded up.

One of lacquer's biggest advantages is the ease with which any scratches or imperfections in the finish can be retouched or repaired.

You save on your investment in goods-in-process when you finish in fewer coats. You also save factory space.

High-solids lacquers provide a lifetime finish on metal, fabric, leather, rubber, paper, or glass.

ASK YOUR LACQUER SUPPLIER

for details. Hercules makes no lacquers . . . concentrates on production of highest-quality nitrocellulose and its applications.

HERCULES

HERCULES POWDER COMPANY
INCORPORATED

930 Market Street, Wilmington 99, Delaware

CL-51A

Graphitization

(*Continued from Page* 120)

tally unchanged by the long service.

In the McQuaid-Ehn test, this steel revealed a medium to fine grain size and normal structure. The same steel was subjected to a creep-rupture test at 950 degrees Fahr. under a load of 20,000 p.s.i. which test lasted 1.3 years. The specimen, which contained a weld in the middle of the gage length, was subsequently examined and likewise was found free from graphite formation.

Discussion of Service Results: Summarily, it may be stated that the high-aluminum deoxidized materials—aluminum additions of over 1.5 pounds per ton of melt—which were found to be very fine-grained and totally abnormal in the McQuaid-Ehn test, were found graphitized, while the straight silicon-killed steels or castings or those which had received aluminum additions below 0.5-pound per ton, failed to graphitize.

Over 20 of such cases have been investigated. These straight silicon-killed or low-aluminum deoxidized materials were always totally normal and coarse-to-medium-grained in the McQuaid-Ehn test. Steels or castings which had received medium amounts of aluminum, say between 0.5 and 1.0 pound per ton, were of an uncertain behavior, i.e. their McQuaid-Ehn case characteristics were of the mixed type and could not always be co-ordinated with their graphitization behavior. However, in general, the McQuaid-Ehn test appeared to be a relatively quick and sufficiently reliable indicator of the graphitizing tendency of a steel.

The interpretation and evaluation of the McQuaid-Ehn cases require a certain amount of experience, particularly with respect to the carbon-molybdenum steels which are prone to form the Widmanstatten type of pearlite, i.e. which frequently exhibit in the carburized case some areas of ferrite that are not indicative of abnormality. The extreme type of normal case structure shows the grain boundary hypereutectoid carbide as continuous thin lines of uniform width and contiguous with the lamellar of the pearlite which should be regular and well formed. With decreasing normality the regularity of form of the grain boundary carbide as well as that of the pearlite carbide decrease, become broken up (discontinuous) and coalesced.

On the basis of the described field results, many tests were carried out which had the following aims:

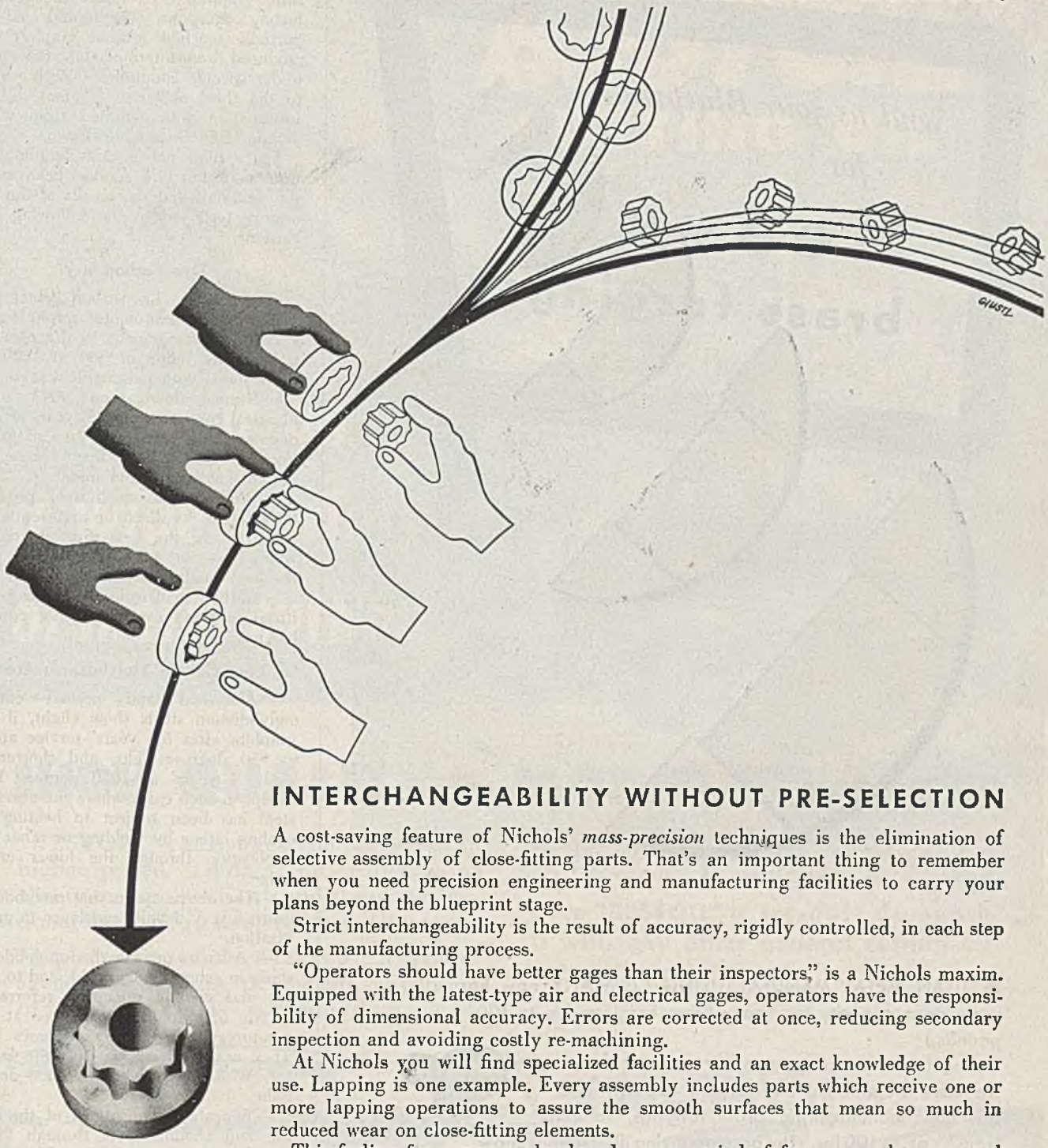
—to graphitize the kind of steel which did not graphitize in service, i.e. the straight silicon-killed or low-aluminum deoxidized steel.

—to graphitize under controlled conditions the intermedite type of steel, i.e. one which had been deoxidized with medium amounts of aluminum, say between 0.5 and 1.0 pounds per ton.

—to evaluate some of the factors which influence graphitization in these low-carbon steels.

The first objective was not attained. The straight silicon-killed and the low-

ANOTHER EXAMPLE OF NICHOLS MASS-PRECISION METHODS



INTERCHANGEABILITY WITHOUT PRE-SELECTION

A cost-saving feature of Nichols' *mass-precision* techniques is the elimination of selective assembly of close-fitting parts. That's an important thing to remember when you need precision engineering and manufacturing facilities to carry your plans beyond the blueprint stage.

Strict interchangeability is the result of accuracy, rigidly controlled, in each step of the manufacturing process.

"Operators should have better gages than their inspectors," is a Nichols maxim. Equipped with the latest-type air and electrical gages, operators have the responsibility of dimensional accuracy. Errors are corrected at once, reducing secondary inspection and avoiding costly re-machining.

At Nichols you will find specialized facilities and an exact knowledge of their use. Lapping is one example. Every assembly includes parts which receive one or more lapping operations to assure the smooth surfaces that mean so much in reduced wear on close-fitting elements.

This feeling for accuracy, developed over a period of forty years, has attracted the unusual precision problems to Nichols for successful development and economical mass-production.

Nichols-built products have been called "the most accurate assembly of commercial parts ever produced." The case-histories of these products are discussed in "Mass-Precision," our new brochure. It will prove helpful when you are faced with a similar "hard-to-make" part or assembly. May we send you a copy?

W. H. NICHOLS & SONS, 48 WOERD AVENUE, WALTHAM 54, MASS.

"Accurate" Nichols

PRECISION ENGINEERING AND MANUFACTURING FACILITIES FOR MASS PRODUCTION

aluminum deoxidized steel refused to form graphite even under the severest testing conditions. The second goal was partially reached in that graphite was produced in an intermediate type of steel under specific conditions. With respect to the third objective, a great deal of information was obtained from which certain deductions were drawn.

Space does not permit detailing the tests here but the service behavior of the materials and the results of the laboratory tests led to the following conclusions:

Low Carbon Steel

—Abnormal low-carbon steel with normal heat treatments graphitizes in a random arrangement in the observed temperature range of 850 to 1020 degrees Fahr. with reasonable stress.

—Normal low-carbon steel under identical conditions for 8¾ years at 1020 degrees Fahr. was found free of graphite in both the weld-affected zone and in the weld-unaffected metal.

—Welding abnormal steel produces little if any localized or preferential effect, that is, the heat-affected zone of welds shows no more graphitization than the heat-unaffected metal.

—Carbon steel weld metal has graphitized in some cases, in other cases it has not.

Low Carbon Molybdenum Steel

—Abnormal and normal carbon-molybdenum steels show slight, if any, graphite after 5½ years' service at 935 to 950 degrees Fahr. and shorter periods, 4 years' at 1050 degrees Fahr. except in such cases where the abnormal steel has been subject to heating and cooling either by welding or other heat application through the lower critical range.

—The above means that molybdenum exerts a very definite resistance to graphitization.

— Abnormal carbon-molybdenum steels in general, when subjected to heating and cooling operation referred to in No. 5, graphitize in service at temperatures as low as 915 degrees Fahr. They can be graphitized in the laboratory within 1000 hours at 1000 degrees Fahr.

—Repeated applications of the heating and cooling cycle through the A transformation promote graphite formation in a given time at the subcritical temperature of 1000 degrees Fahr.

—Increased rates of heating and cooling appear to favor the formation of chain graphite.

—Slightly abnormal carbon-molybdenum steel which has been subject to the heating and cooling cycle has shown slight graphitization in service at 950 to 975 degrees Fahr. In the laboratory, the repeated application of the heating cycle under quick-cooling has developed graphite after 3500 hours at 1000 degrees Fahr. at an applied stress of 5000 p.s.i.

—Normal carbon-molybdenum steel which has been subject to the heating cycle is not found graphitized in service

at temperatures up to 975 to 990 degrees Fahr. and in the same pipe line in which abnormal carbon-molybdenum steel has graphitized severely.

—Normal carbon-molybdenum steel subjected to repeated heating cycles in the laboratory has not developed graphite after 6000 hours at 1000 degrees Fahr.

—Carbon-molybdenum weld metal, although abnormal in a McQuaid-Ehn test has been found free of graphite.

—The McQuaid-Ehn test has proven to be a valuable criterion of the graphitizing tendency of carbon and carbon-molybdenum steel.

On the basis of the studies made, it is recommended that coarse-grained normal carbon-molybdenum steel with an addition of 0.4 to 0.6 per cent chromium be used for high-temperature steam plant applications because of the greater stability of the carbide phase in these normal steels as compared to similar steels showing abnormality on the McQuaid-Ehn test.

Filter Paper Used in Dust Analyses

A new filter-paper method for obtaining samples of air for dust analysis in health surveys has been proposed by the Bureau of Mines to aid industry's efforts to prevent harmful respiratory disease caused by continued breathing of dust by workers.

The device recovers dust from the air by drawing the atmosphere with a hand-operated pump through a special filter-paper instead of through liquid, as in the impinger method long used in obtaining dust samples for scientific study, according to a Bureau bulletin which describes both techniques and compares their effectiveness.

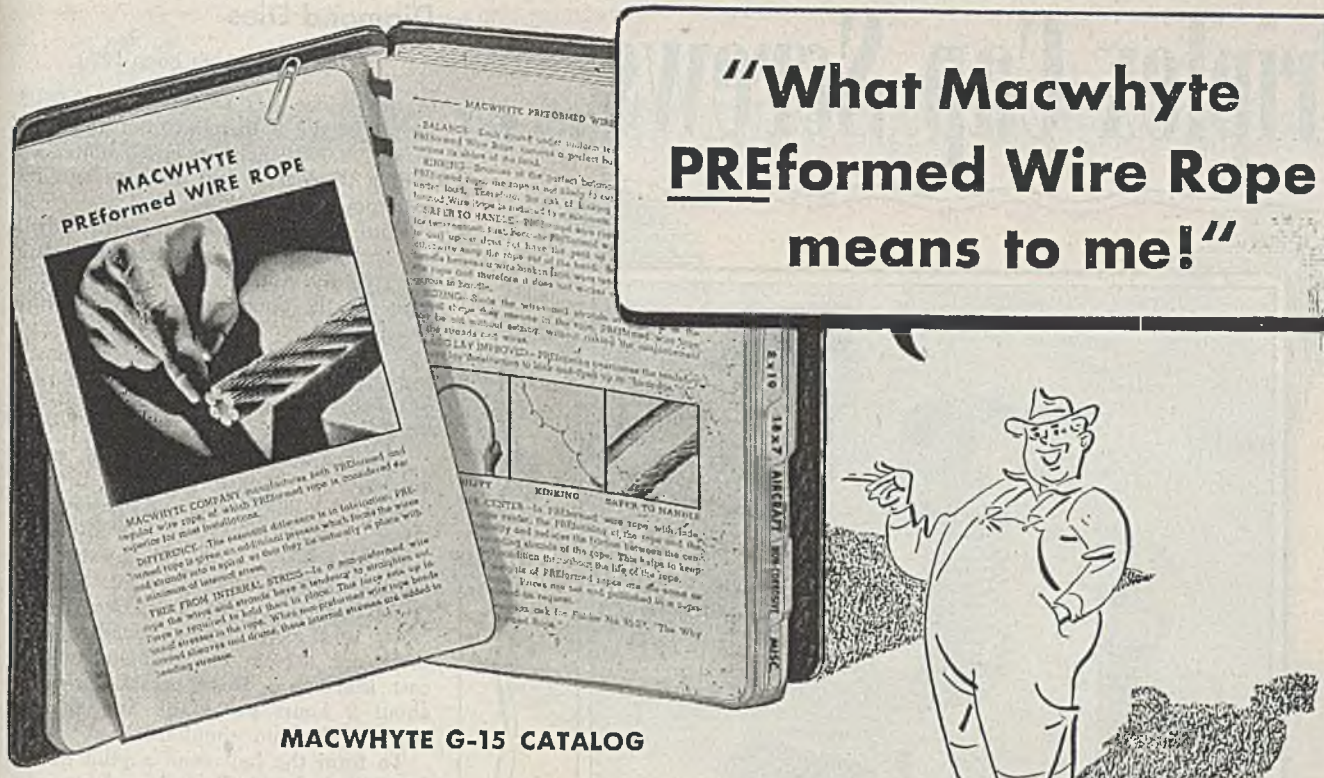
With the filter-paper method dust is collected from the air by filtration through pieces of special paper and gathers on the paper. Before it can be counted it must be removed; this is accomplished by placing the filter papers in a dust-free liquid, such as ethyl alcohol, and shaking them vigorously. Dust leaves the paper readily. Lintless, high-wet-strength, hardened filter paper is used for fine precipitates.

Determinations were made by the Bureau on impinger and filter-paper samples of silica dust and coal dust, and results indicate that the filter paper method has promise of securing results comparable to those of the impinger.

Being dry, the filter paper sample can be kept indefinitely before the dust particles are counted, but the impinger samples in water cannot be stored easily because of the danger of bacterial growth or solution of the dust.

A copy of the publication, Report of Investigations 3788, "Filter-Paper Method for Obtaining Dust Concentration Results Comparable to Impinger Results," may be obtained free by writing Bureau of Mines, Department of the Interior, Washington 25, D. C.

"What Macwhyte PREformed Wire Rope means to me!"



MACWHYTE G-15 CATALOG

"Quick, easy handling . . . smooth, uniform spooling . . . long, economical service — those are some of the *plus* benefits I get from Macwhyte PREformed," says the typical wire rope user.

Why Macwhyte PREformed is preferred

All wires and strands in a Macwhyte PREformed rope are formed into a spiral, so that they lie naturally in place. Because it is free from internal stress, a Macwhyte PREformed rope has great fatigue resistance. Internal friction caused by wires and strands moving against each other is sharply reduced, resulting in a minimum of internal wear.

In Macwhyte PREformed, every strand in the rope is under uniform tension. There is no "early" wearing out of some strands while others "loaf." The perfect balance of strands makes Macwhyte PREformed exceptionally kink resistant.

Other User Benefits

Macwhyte PREformed on your equipment means fewer shut-downs, less trouble. It is safer to use because it can be cut without seizing—broken strands won't wicker. The extreme flexibility of Macwhyte PREformed makes it hug the drum, reduces wear both on the wires and in the groove of the sheave. Because of its long life, Macwhyte PREformed gives lowest possible cost per load carried.

All this, and Macwhyte Internal Lubrication, too!

Every wire in every strand of Macwhyte PREformed rope is coated with Macwhyte internal lubricant to protect against moisture, rust and ordinary acids. Heavy and tenacious, it clings to the wires unaffected by temperature changes.

The demands of our armed services are so great now, there may be times when we cannot give you our usual prompt service and delivery. The situation changes from day to day, so please keep trying. We'll serve you if we possibly can.

MACWHYTE PREformed WIRE ROPE
Plus Internal Lubrication · Selected Steels · Tested-Proved

The correct rope for your equipment

MACWHYTE COMPANY

Wire Rope Manufacturers

ARMY E NAVY

NO. 781

2912 FOURTEENTH AVENUE KENOSHA, WISCONSIN

Mill Depots: New York • Pittsburgh • Chicago • Fort Worth • Portland • Seattle • San Francisco. Distributors throughout the U.S.A.

MACWHYTE PREformed and Internally Lubricated Wire Rope · MONARCH WHYTE STRAND Wire Rope · MACWHYTE Special Traction Elevator Rope · MACWHYTE Braided Wire Rope Slings · MACWHYTE Aircraft Cables and Tie-Rods · MACWHYTE Stainless Steel Wire Rope · MACWHYTE Monel Metal Wire Rope

Diamond Dies

(*Concluded from Page* 127)

of the orifice has increased by 0.0002-inch. The die is then inverted and relief about 0.0004-inch deep countersunk with a 90-degree drill and grade 3 micron powder.

With the control of the electrical drilling and mechanical reaming and polishing recently attained, the following contour specifications can be held within close limits:

	Angle Deg.	Length
Bell Cone	60	1.0 to 1.3 mm.
Secondary Cone	16	0.007 to 0.009-inch
Bearing	4	0.001-inch

The majority of dies should polish out with an orifice diameter between 0.0006 and 0.001-inch and a maximum range of from 0.0004 to 0.0015-inch.

Conclusions: With the electric die drilling method developed at the National Bureau of Standards, two parallel facets and a window perpendicular to these are cut on the diamond with a cast iron lap. This operation requires about 2 hours per blank and at least two can be run simultaneously.

To form the bell cone a pilot hole is foredrilled electrically followed by countersinking on a drilling machine. This operation repeated until the desired depth is attained requires about 3 hours per die. One operator can care for two electric drills or ten countersinking spindles.

The secondary cone is drilled electrically in one hour's time. One operator can run two units.

The polishing operation is performed on a light rotary drilling machine and each die requires approximately 30 hours to obtain the best finish. One operator, however, should be able to care for at least 30 spindles because application of a new abrasive is required only 2 or 3 times during the period. The machine can be allowed to run unattended during the night.

Total time for flat opened type is 4.0 manhours, for sphere opened type it is 4.5 manhours.

With the method required in this report it is believed that a good quality fine diamond die from 0.0004 to 0.0015-inch in size can be produced with considerable saving of time and cost over the established mechanical methods.

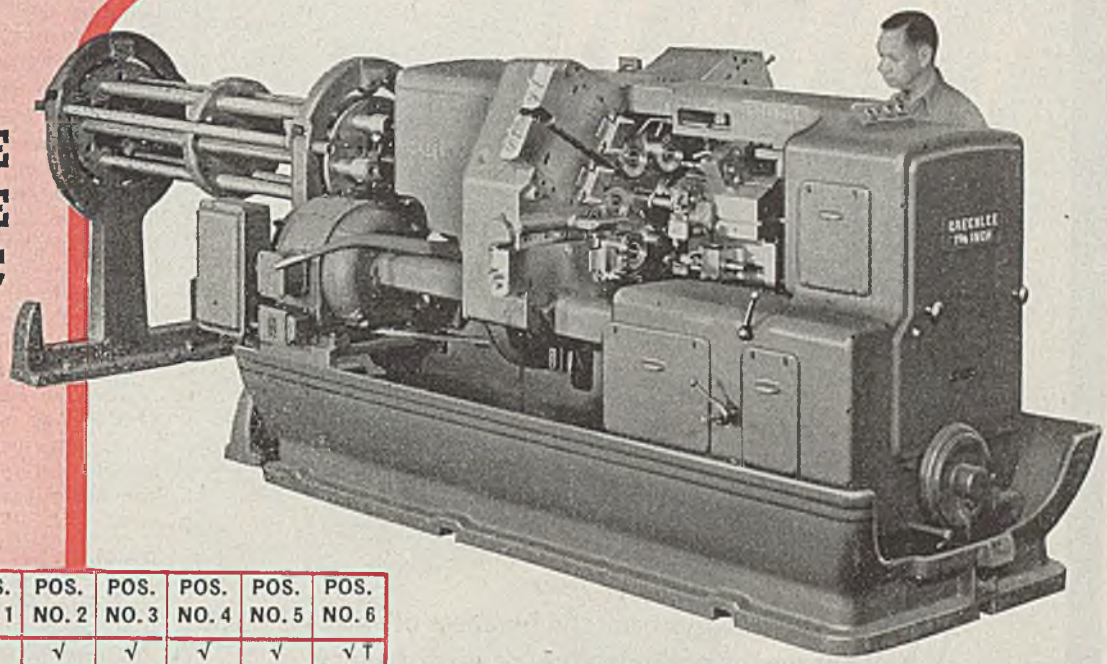
Folder Describes New Car Puller

A new car puller is described in a folder made available by American Engineering Co., Philadelphia 25. In this hauling device the barrel, gear box and motor are a single unit. Starting line pull is 5000 pounds, using a single line, or more with various block combinations.

Lo-Hed car puller may be used for hauling railroad cars, pulling skids, powering boat and airplane runways, dragging logs, bending pipe and numerous other operations.

Capacity TO MEET CHANGING REQUIREMENTS

GREENLEE 6-SPINDLE AUTOMATIC



CROSS-SLIDE OPERATIONS	POS. NO. 1	POS. NO. 2	POS. NO. 3	POS. NO. 4	POS. NO. 5	POS. NO. 6
Forming	√	√	√	√	√	√ †
Form Turning	√	√	√	√	√	√ †
Shaving	√	√	√	√	√	√ †
Skiving	√	√	√	√	√	√ †
Stenciling	√	√	√	√	√	√ †
Knurling	√	√	√	√	√	√ †
Wide Form Knurling	√	√	√	√	√	√ †
Facing	√	√	√	√	√	√ †
Burnishing	√	√	√	√	√	√ †
Thread Rolling	√	√	√	√	√	√ †
Under Cutting			√	√		
*Cut-Off	√	√	√	√	√	√
END-WORKING OPERATIONS						
Threading			√	√	√	√
Tapping			√	√	√	√
Reaming			√	√	√	√
Drilling	Any	Position		Except	Cut-Off	
High-Speed Drilling	"	"	"	"	"	"
Boring	"	"	"	"	"	"
Eccentric Boring	"	"	"	"	"	"
Facing	"	"	"	"	"	"
Burnishing	"	"	"	"	"	"
Recessing	"	"	"	"	"	"
Chamfering	"	"	"	"	"	"
Milling	"	"	"	"	"	"
Roller Turning	"	"	"	"	"	"

† Only when not used as cut-off position.

* Cut-off is not usually combined with another operation on same cross-slide. Position may be varied to produce two or more parts simultaneously.

HANDLES THREADING, TAPPING, REAMING OPERATIONS in 3rd, 4th, 5th, or 6th POSITIONS

● The Greenlee Automatic is built to handle efficiently a wide range of operations. Its tooling arrangement is such that operations can be handled at various spindle positions to suit requirements. As indicated in chart at left, forming operations can be set up at any position except cut-off. Long operations can be split up to speed production. Threading, tapping, and reaming operations can be handled in 3rd, 4th, 5th, or 6th positions. Cut-off operation and tooling can be arranged to produce two or more parts simultaneously. In addition, the Greenlee has quick change-over features and provisions for reducing tooling expense, which facilitates handling many short run jobs. Write today for more facts.

GREENLEE BROS. & CO.
1923 MASON AVENUE, ROCKFORD, ILLINOIS

GREENLEE

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

Crane Controls

(*Concluded from Page* 133)

rect current motor. The alternating-current condition is in one respect more favorable than the direct-current condition in that the secondary of the alternating-current motor is balanced during dynamic lowering, whereas when friction type load brake is used, the secondary is unbalanced during both hoisting and lowering.

Choice of alternating-current dynamic lowering with overvoltage transformer or without overvoltage transformer will depend on whether or not very low lowering speeds are desired. In many cases it will be found that control without overvoltage transformer provides sufficiently low lowering speeds. Using attached curves, check of motor heating can readily be made, and in case there is any doubt regarding the thermal capacity of the motor an oversize motor may of course be used on alternating current just as on direct current applications. Experience has so far not brought to light any applications where an oversize motor has been required.

Book Aids in Solving Pump Problems

A new book entitled "How to Solve Pumping Problems" by George D. Roper Corp., Rockford, Ill., is designed to assist engineers and servicemen concerned with the operation, purchase or sale of pumps in the marine, manufacturing, petroleum and process industries. It outlines the basic fundamentals used in estimating requirements of the average pumping job, explains the formula used in figuring suction lift and discharge head, and gives information on how to estimate horsepower requirements and the size and speed of pulleys. Technical charts and tables show friction loss in pipes, viscosity, viscosity conversion, wiring data and fuze sizes. It also includes information on installing pumps and on trouble-shooting.

Plastic Shipping Coat Protects Airplane

Airplanes shipped overseas are now packaged with a spray of plastic solution based on Vinylite resins, manufactured by Bakelite Corp. Plastic solution, applied with an air brush, solidifies in less than 30 minutes into a protective coating which hermetically seals the entire plane. Equipment coated with this plastic is said to be immune from attacks of temperature, moisture, dirt, or grease in its passage to overseas theaters of war. Coating is easily stripped on arrival, and the plane is ready for action exactly as it was when it left the embarkation point. This simply-applied, easily-removed, water-resistant coating also may be used to package many things, washing machines, tractors, food, sensitive chemicals, etc.

Arc Furnace Regulators

(*Continued from Page* 139)

slow moving device such as an electrode in response to rapidly changing electrical conditions as prevail in the furnace circuit, there must, of necessity, be a compromise, the best compromise appears to be one which combines good sensitivity, and at the same time good control of the maximum voltage in either direction to which the device is always tending to build up. Such characteristics can only be obtained by proper design considerations and cannot usually be gotten by external adjustments or relay operation. It will always be necessary to coordinate the speed of response of the excitation circuit to the acceleration characteristics of the electrode motor, if the best performance is to be obtained. The best regulator will be one which is sufficiently sensitive, so there will never be any likelihood of trouble due to carbon pickup when refining, and at the same time it will have self limiting characteristics in the voltage build-up so it will not give trouble due to excessive voltages when melting down.

The method of manual operation with this regulator is simple. By using the shop direct-current source, a suitable value of current can be applied to either the current control field or the voltage control field in order to run the electrodes in the desired direction. In addition there is the usual master control which operates all three electrode motors simultaneously.

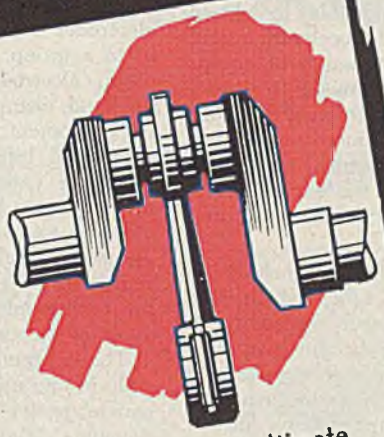
The importance of the regulator and its control from the standpoint of the power factor of the furnace cannot be overestimated. There is a tendency for the operators to set for more and more current when it is desired to increase the input to the furnace. That this is a mistaken idea has been brought out clearly in many recent articles and papers, but the point can still be emphasized that to operate the furnace at the best power factor, the maximum value of current for which the regulator is set should be decreased as the voltage tap is lowered. The operators do not always operate in this manner. It is, however, a simple matter to combine with any regulator a suitable circuit for limiting the value of the low-tension current on any tap gap so that excessive current and poor power factor can be avoided.

Some rather extravagant claims have been made for rotating regulators indicating considerable savings in kilowatt hour consumption and time of heat when compared with the older type of regulator. As a matter of interest, one of the steel companies ran tests on a furnace in which 50 heats of various kinds of alloy steels were made with a balanced beam regulator and a Rototrol for comparison. The results of these tests, which have only recently been completed, indicate that savings in kilowatt hour consumption with the use of the rotating regulator are rather small, not more than 5 per cent, and in some cases only

WHY MORE FORGINGS IN YOUR POST-WAR PRODUCTS ?

The advantages of the broader use of forgings have proved themselves in armament making to such an extent that the nation's forge facilities were taxed to their utmost during the peak war production period. These same advantages are being utilized by designers of postwar machines and equipment.

HIGH TENSILE STRENGTH



Forgings provide metals at their ultimate strength and toughness, with maximum resistance to tensional, torsional and compression stresses; obtained through controlled grain flow, resulting from the forging process. Forged parts also embody the high fatigue resistance which results in longer service life.

SAVINGS IN WEIGHT

The forging process produces maximum strength, permitting use of thinner metal sections, resulting in parts of less weight. Valuable space may also be saved. These are important considerations in many postwar machines.

LOWER MACHINING COSTS

With the close tolerances obtainable by modern day methods, forgings generally require less time to machine and finish; resulting in reduced machining and tool costs.

GREATER SAFETY

The fracture of a part is too often accompanied by a serious accident. The use of forgings for stressed parts affords the highest safety factor.

At Kropp Forge, facilities for essential civilian forgings are becoming available as our war assignments are completed.

When you need flat die, drop or upset forgings, call the nearest Kropp engineering representative, or write direct for information or quotation.

KROPP FORGE COMPANY
5301 W. Roosevelt Road, Chicago 50, Ill.
Engineering Representatives In Principal Cities

SERVING INDUSTRY SINCE 18 31 OVER 100 YEARS
KROPP FORGE CO.

KROPP

ARMY E NAVY

3 per cent. Thus there appears to be a narrow margin in favor of the rotating type regulator over the balanced beam type.

Recently electronic motor control has been developed and has proven successful on many applications where wide range of speed control and quick response are desired. It is possible to obtain many combinations of acceleration and speed range with a minimum of equipment and almost instantaneous response. The use of electronic regulation and control for the electrode motor eliminates moving parts in the electrical equipment up to the motor. At the same time it provides the necessary sensitivity and speed of response.

The electronic regulator includes a number of electronic tubes which take the place of relays and contactors to control the input to the furnace electrode motors. The power supplied to the regulator is taken from the available alternating-current line and no direct-current voltage is required from any separate source. The grid to cathode circuit of the vacuum tubes constitutes the input of the device, while the output is obtained from the thyratron tube circuit.

Certain Details Omitted

An elementary schematic diagram of an electronic regulating system is shown in Fig. 6. To simplify the diagram, certain details including grid balancing circuits, have been omitted. The grid control voltage of the regulating tubes, proportional to the electrode current, is taken from two Rectox rectifiers, which are connected to a current transformer in the electrode circuit. The grid control voltage, proportional to the arc potential, is taken in a similar manner from the voltage between each electrode and the shell of the furnace. In practice, when the furnace transformer breaker is closed, voltage is applied to the potential circuit which causes the output of tube No. 1 to decrease. This in turn decreases the drop across potentiometer P1, supplying negative direct-current grid voltage to tubes No. 3 and 4. When the negative grid voltage is decreased, tubes No. 3 and 4 break down and start conducting, supplying full wave rectified voltage to the electrode motor in the direction to lower electrodes.

When the first electrode strikes the metal, the voltage drops to zero causing the voltage to be removed from the potential circuit, thereby allowing tube No. 1 to increase its output, consequently increasing the negative grid voltage on tubes 4 and 5, thereby blocking the conduction of current through these tubes. When a second electrode strikes the metal, current flows causing a voltage to appear in the current circuit which will place a negative grid voltage on tube No. 2 thereby decreasing its output. Tubes Nos. 2, 5 and 6 and potentiometer P2 will operate in the same manner as tubes Nos. 1, 3 and 4 and potentiometer P1 did for the lowering operation. A voltage will then be impressed on the armature circuit in the direction to raise the electrodes thus establishing an arc. As the arc is lengthened, its voltage increases and the current decreases until a balance is established between the potential and current grid control voltages. The third electrode is controlled in a similar manner.

Provision is made for controlling the electrodes manually, either individually or in a group. This facilitates handling of the electrodes during charging, pouring, and changing electrodes. Regulating equipment is housed in a single metal cabinet, a hinged panel door affording access to various tubes and their connections. A bolted rear plate is provided in two sections so that any one or all of the regulator panels can be readily removed. The control panel is arranged for setting into the wall of the furnace vault in the usual manner.

The equipment is made so far as possible in one unit so that the various parts can be protected from dirt and physical damage. This also permits factory assembly and complete test, up to the operation of the electrode motors. A minimum of external connections and erection time is thus required.

The regulator described herein was designed for a furnace which requires relatively small electrode motors by reason of using counter-balance electrodes and hydraulic lowering and raising means. It is evident that the output energy of such a regulator depends on the rating and size of the electrode motor. The size of the furnace having balanced electrodes which this type of regulator can handle depends therefore on the energy requirements of the electrode motors. For other types of furnaces certain changes in design such as braking means for the motors, are required, and are available. In the application described this was not necessary, which resulted in simplification of the regulating equipment.

Electronic Vulcanization Achieves Uniform Heat

Equipment for electronic vulcanization of rubber and other plastic materials by oscillations of high frequency electric waves which shake the molecules of the material and the vulcanizing agent millions of times a second, creating uniform heat throughout, is used by B. F. Goodrich Co., Akron, O. For many years vulcanization of rubber and other materials has been effected by applying heat to outside surfaces. As rubber and other materials which can be vulcanized insulate against, rather than conduct heat, it has been in most cases a slow process. In electronic vulcanization uniform heat is created throughout the material in less time than was required by the older method. Sponge rubber mattresses and pads are said to have been cured by the new process in ⅛ the time taken by the conventional method. Uniform heating removes difficulties in molding thick plastic products and makes possible use of simplified equipment.

FORCE, *properly applied,* CAN SHATTER THE EARTH

A physicist advanced the theory that if a man struck the earth with a sledge hammer, and timed his next blow to augment the vibrations set up, he could shatter the earth eventually. Harnessing, guiding and controlling power for specific purposes is more than a theory—WRIGHT-HIBBARD INDUSTRIAL ELECTRIC TRUCKS illustrate this. Here is one of our low-lift trucks. It can turn the corner of a 45" aisle, and handle 4000 lbs. It represents power and force subservient to hand control. Write for our catalog describing our Low and High Lift Trucks.

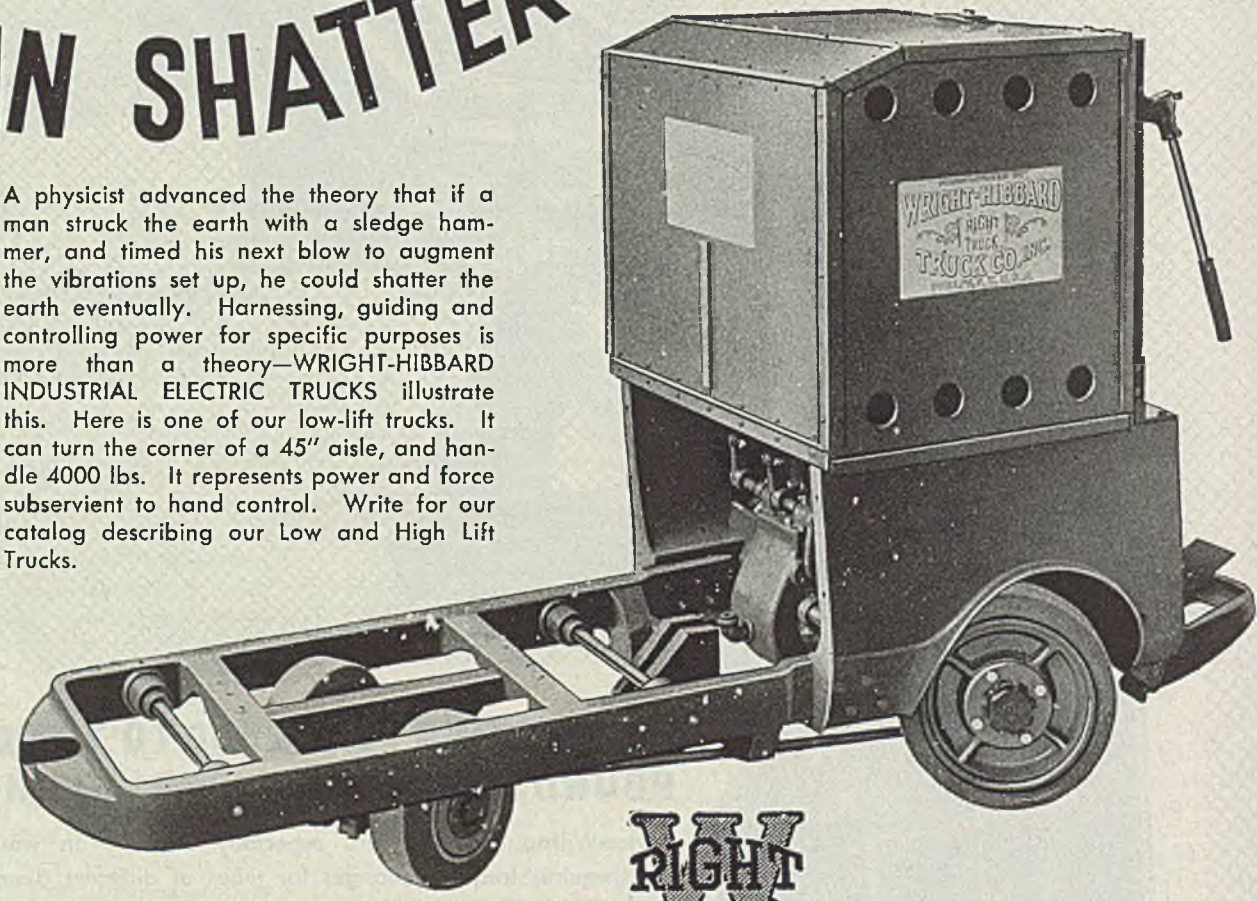


Photo shows truck without platform, with wheels turned to extreme position, showing short turning radius.

RIGHT TRUCK

WRIGHT-HIBBARD

INDUSTRIAL ELECTRIC TRUCK CO.

INCORPORATED

PHELPS, NEW YORK

War Steel Needs Still Exceed Mills' Best Efforts

Moves to match demand to capacity show little result . . . Munitions taking heaviest tonnage . . . Navy places more ships

WITH steel demand materially in excess of production every effort is being made by Washington to distribute the load more evenly and provide capacity for materials most needed.

Recent appeal by the War Production Board for consumers to screen their mill contracts and cancel everything they can spare has produced some results but most of the help in this direction is expected to come the latter half of this month. Total gain is seen as substantial. This is the first appeal of this nature since the effort of about two years ago to consumers to share the steel.

Greatest tightness at present is in sheets and strip and every effort is being made to eliminate plate tonnage from strip mill schedules as rapidly as manpower for processing lighter products becomes available. Strip mills now are producing about 150,000 tons of plates per month, down more than 400,000 tons from the peak of last spring and summer, when these mills supplied almost half plate output. In expectation of gaps in sheet schedules WPB is holding a tight rein and dictating what tonnage shall be substituted.

Ammunition work dominates war requirements, affecting a number of products, through diversion of steel or rolling facilities or both. Bars are most affected directly, with deliveries on hot-top steel falling into next year in some cases. Plain hot-drawn carbon bars in large sizes can be booked generally for fourth quarter, with cold-drawn in these sizes practically sold for the year. The rocket program bears heavily on cold-drawn bars of 2¼ inches diameter and this demand affects schedules of tube, rail and shape mills, as well as sheets for containers.

Directives are being used sparingly after the recent experience where they were piled up deeply, ending in a condition almost impossible of solution. Mills now are referring claimant agencies to the War Production Board for authorization.

Naval shipbuilding continues to come out as support to the slackening demand for plates, recent awards including two 45,000-ton and two 27,500-ton aircraft carriers and eight escort carriers.

Steelmaking last week maintained its rate of 95 per cent of capacity, recovery from flood interruption at Ohio river points being balanced by losses in other districts. Wheeling rate rebounded to 93.5 per cent, regaining 25½ points, Buffalo gained 2½ points to 93 and eastern Pennsylvania rose 1 point to 92. Chicago declined 1 point to 99½ per cent, Pittsburgh 1½ points to 89 and Cleveland 2 points to 91½. Unchanged rates were as follows: Cincinnati 72, St. Louis 80, Birmingham 95, Youngstown 92, New England 92 and Detroit 86.

Raw material supplies for steelmaking are in slightly better position, though scrap tonnage is below consumption and more pig iron is being used. Shortage of labor is a deterrent to normal supply of scrap and some blast furnaces suffer from the same condition.

After the decline in average weekly production of steel ingots in January the industry rebounded approximately to the rate of December on a weekly basis but total ingot production was below that of January because of the shorter month. Output was 6,657,703 net tons, compared with 7,204,303 tons in January and with 7,188,317 tons in February last year. The loss from the short month in 1944 is attributed to manpower shortage and bad weather.

February finished steel shipments by United States Steel Corp. followed the same pattern, totaling 1,562,488 net tons, a drop of 6627 tons from January and 193,284 tons less than in February last year.

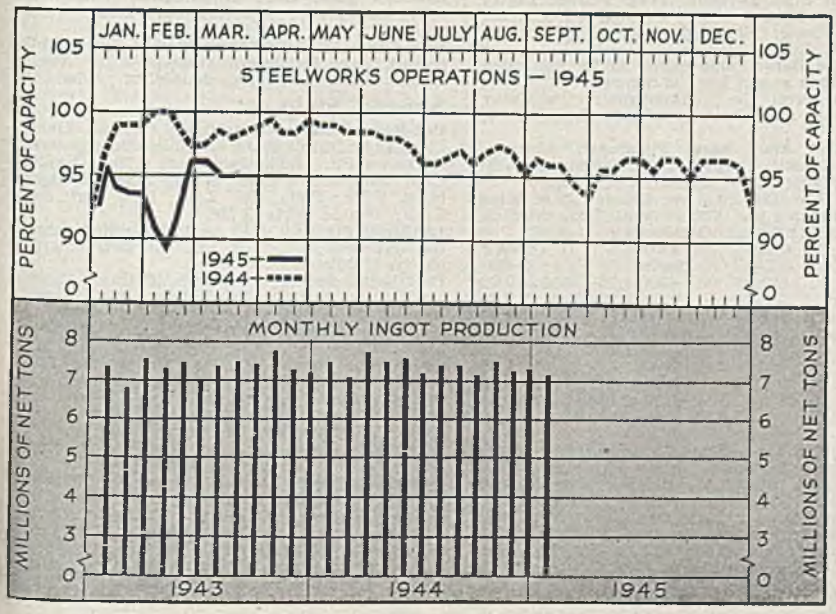
Average composite prices of steel and iron products continue at ceilings, with finished steel composite $57.55, semifinished steel $36, steelmaking pig iron $24.05 and steelmaking scrap $19.17.

DISTRICT STEEL RATES

Percentage of Ingot Capacity Engaged in Leading Districts

	Week Ended Mar. 17	Change	Same Week 1944	Same Week 1943
Pittsburgh	89	—1.5	93.5	101
Chicago	99.5	—1	100.5	98.5
Eastern Pa.	92	+1	94	95
Youngstown	92	None	95	98
Wheeling	93.5	+25.5	95.5	88.5
Cleveland	91.5	—2	94	95
Buffalo	93	+2.5	90.5	90.5
Birmingham	95	none	95	100
New England	92	None	92	92
Cincinnati	72	None	88	88
St. Louis	80	None	74	91
Detroit	86	None	86	92
Estimated national rate	95	None	*98	99.5

*Based on steelmaking capacities as of these dates.



COMPOSITE MARKET AVERAGES

	Mar. 17	Mar. 10	Mar. 3	One Month Ago Feb., 1945	Three Months Ago Dec., 1944	One Year Ago Mar., 1944	Five Years Ago Mar. 1940
Finished Steel	$57.55	$57.55	$57.55	$57.55	$56.73	$56.73	$56.73
Semifinished Steel	36.00	36.00	36.00	36.00	36.00	36.00	36.00
Steelmaking Pig Iron	24.05	24.05	23.05	23.55	23.05	23.05	22.05
Steelmaking Scrap	19.17	19.17	19.17	19.17	19.17	19.17	16.55

Finished Steel Composite:—Average of industry-wide prices on sheets, strips, bars, plates, shapes, wire nails, tin plate, standard and line pipe. Semifinished Steel Composite:—Average of industry-wide prices on billets, slabs, sheet bars, skelp and wire rods. Steelmaking Pig Iron Composite:—Average of basic pig iron prices at Bethlehem, Birmingham, Buffalo, Chicago, Cleveland, Neville Island, Granite City and Youngstown. Steelworks Scrap Composite:—Average of No. 1 heavy melting steel prices at Pittsburgh, Chicago and eastern Pennsylvania. Finished steel, net tons; others, gross tons.

COMPARISON OF PRICES

Representative Market Figures for Current Week; Average for Last Month, Three Months and One Year Ago

Finished Material

	March 17, 1945	Feb., 1945	Dec., 1944	Mar., 1944
Steel bars, Pittsburgh	2.15c	2.15c	2.15c	2.15c
Steel bars, Chicago	2.15	2.15	2.15	2.15
Steel bars, Philadelphia	2.47	2.47	2.47	2.47
Shapes, Pittsburgh	2.10	2.10	2.10	2.10
Shapes, Philadelphia	2.215	2.215	2.215	2.215
Shapes, Chicago	2.10	2.10	2.10	2.10
Plates, Pittsburgh	2.20	2.20	2.10	2.10
Plates, Philadelphia	2.25	2.25	2.15	2.15
Plates, Chicago	2.20	2.20	2.10	2.10
Sheets, hot-rolled, Pittsburgh	2.20	2.20	2.10	2.10
Sheets, cold-rolled, Pittsburgh	3.05	3.05	3.05	3.05
Sheets, No. 24 galv., Pittsburgh	3.65	3.65	3.50	3.50
Sheets, hot-rolled, Gary	2.20	2.20	2.10	2.10
Sheets, cold-rolled, Gary	3.05	3.05	3.05	3.05
Sheets, No. 24 galv., Gary	3.65	3.65	3.50	3.50
Bright bess., basic wire, Pittsburgh	2.60	2.60	2.60	2.60
Tin plate, per base box, Pittsburgh	$5.00	$5.00	$5.00	$5.00
Wire nails, Pittsburgh	2.80	2.80	2.55	2.55

Semifinished Material

Sheet bars, Pittsburgh, Chicago	$34.00	$34.00	$34.00	$34.00
Slabs, Pittsburgh, Chicago	34.00	34.00	34.00	34.00
Rerolling billets, Pittsburgh	34.00	34.00	34.00	34.00
Wire rods, No. 5 to 9/32-inch, Pitts	2.00	2.00	2.00	2.00

Pig Iron

	March 17, 1945	Feb., 1945	Dec., 1944	Mar., 1944
Bessemer, del. Pittsburgh	$26.19	$25.69	$25.19	$25.19
Basic, Valley	24.50	24.00	23.50	23.50
Basic, eastern del. Philadelphia	26.34	25.84	25.34	25.34
No. 2 fdry., del. Pitts., N.&S. Sides	25.69	25.19	24.69	24.69
No. 2 foundry, Chicago	25.00	24.50	24.00	24.00
Southern No. 2, Birmingham	21.38	20.88	20.38	20.38
Southern No. 2 del. Cincinnati	25.30	24.80	24.30	24.30
No. 2 fdry., del. Phila.	26.34	26.34	25.84	25.84
Malleable, Valley	25.00	24.50	24.00	24.00
Malleable, Chicago	25.00	24.50	24.00	24.00
Lake Sup., charcoal, del. Chicago	37.34	37.34	37.34	37.34
Gray forge, del. Pittsburgh	25.19	24.69	24.19	24.19
Ferromanganese, del. Pittsburgh	140.33	140.33	140.33	140.33

Scrap

Heavy melting steel, No. 1 Pittsburgh	$20.00	$20.00	$19.75	$20.00
Heavy melt. steel, No. 2, E. Pa.	18.75	18.75	18.75	18.75
Heavy melting steel, Chicago	18.75	18.75	16.70	18.75
Rails for rolling, Chicago	22.25	22.25	22.25	22.25
No. 1 cast, Chicago	20.00	20.00	20.00	20.00

Coke

Connellsville, furnace, ovens	$7.00	$7.00	$7.00	$7.00
Connellsville, foundry ovens	7.75	7.75	7.75	7.75
Chicago, by-product fdry., del.	13.35	13.35	13.35	13.35

STEEL, IRON RAW MATERIAL, FUEL AND METALS PRICES

Following are maximum prices established by OPA Schedule No. 6 issued April 16, 1941, revised June 20, 1941 and Feb. 4, 1942. The schedule covers all iron or steel ingots, all semifinished iron or steel products, all finished hot-rolled, cold-rolled iron or steel products and any iron or steel product which is further finished by galvanizing, plating, coating, drawing, extruding, etc., although only principal established basing points for selected products are named specifically. Seconds and off-grade products are also covered. Exceptions applying to individual companies are noted in the table. Finished steel quoted in cents per pound.

Semifinished Steel

Gross ton basis except wire rods, skelp.

Carbon Steel Ingots: F.o.b. mill base, rerolling qual., stand. analysis, $31.00.

(Empire Sheet & Tin Plate Co., Mansfield, O., may quote carbon steel ingots at $33 gross ton, f.o.b. mill. Kaiser Co. Inc. $43, f.o.b. Pacific ports.)

Alloy Steel Ingots: Pittsburgh, Chicago, Buffalo, Bethlehem, Canton, Massillon; uncrop., $45.

Rerolling Billets, Blooms, Slabs: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, Sparrows Point, Birmingham, Youngstown, $34; Detroit, del. $36; Duluth (bil) $36; Pac. Ports, (bil) $46. (Andrews Steel Co., carbon slabs $41; Continental Steel Corp., billets $34, Kokomo, to Acme Steel Co.; Northwestern Steel & Wire Co., $41, Sterling, Ill.; Laclede Steel Co. $34, Alton or Madison, Ill.; Wheeling Steel Corp. $36 base, billets for lend-lease, $34, Portsmouth, O., on slabs on WPB directives. Granite City Steel Co. $47.50 gross ton slabs from D.P.C. mill. Geneva Steel Co., Kaiser Co. Inc., $58.64, Pac. Ports).

Forging Quality Blooms, Slabs, Billets: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, Birmingham, Youngstown, $40. Detroit, del. $42; Duluth, billets, $42; forg. bil. f.o.b. Pac. Ports, $52.

(Andrews Steel Co. may quote carbon forging billets $50 gross ton at established basing points; Follansbee Steel Corp., $49.50 f.o.b. Toronto, O. Geneva Steel Co., Kaiser Co. Inc., $64.64, Pacific ports.)

Open Hearth Shell Steel: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, Youngstown, Birmingham, base 1000 tons one size and section; 3-12 in., $52; 12-18 in., excl., $54.00; 18 in. and over $56. Add $2.00 del. Detroit; $3.00 del. Eastern Mich. (Kaiser Co. Inc., $76.64, f.o.b. Los Angeles.)

Alloy Billets, Slabs, Blooms: Pittsburgh, Chicago, Buffalo, Bethlehem, Canton, Massillon, $54; del. Detroit $56, Eastern Mich. $57.

Sheet Bars: Pittsburgh, Chicago, Cleveland, Buffalo, Canton, Sparrows Point, Youngstown, $34. (Wheeling Steel Corp. $37 on lend-lease sheet bars, $38 Portsmouth, O., on WPB directives; Empire Sheet & Tin Plate Co., Mansfield, O., carbon sheet bars, $39, f.o.b. mill.)

Skelp: Pittsburgh, Chicago, Sparrows Point, Youngstown, Coatesville, lb., 1.90c.

Wire Rods: Pittsburgh, Chicago, Cleveland, Birmingham, No. 5—9/32 in. inclusive, per 100 lbs., $2. Do., over 9/32—47/64-in., incl., $2.15; Galveston, base, 2.25c and 2.40c, respectively. Worcester add $0.10; Pacific Ports $0.50. (Pittsburgh Steel Co., $0.20 higher.)

Bars

Hot-Rolled Carbon Bars and Bar-Size Shapes under 3": Pittsburgh, Chicago, Gary, Cleveland, Buffalo, Birmingham, base 20 tons one size, 2.15c; Duluth, base 2.25c; Mahoning Valley 2.22½c; Detroit, del. 2.25c; Eastern Mich. 2.30c; New York del. 2.49c; Phila. del. 2.47c; Gulf Ports, dock 2.52c; Pac. ports, dock 2.80c. (Calumet Steel Division, Borg Warner Corp., and Joslyn Mfg. & Supply Co. may quote 2.35c, Chicago base; Sheffield Steel Corp., 2.75c, f.o.b. St. Louis.)

Rail Steel Bars: Same prices as for hot-rolled carbon bars except base is 5 tons.

(Sweet's Steel Co., Williamsport, Pa., may quote rail steel merchant bars 2.33c f.o.b. mill.)

Hot-Rolled Alloy Bars: Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem, base 20 tons one size, 2.70c; Detroit, del., 2.80c.

(Texas Steel Co. may use Chicago base price as maximum f.o.b. Fort Worth, Tex., price on sales outside Texas, Oklahoma.)

AISI Series	(*Basic O-H)	AISI Series	(*Basic O-H)
1300	$0.10	4100 (.15-.25 Mo)	0.70
		(.20-.30 Mo)	0.75
2300	1.70	4300	1.70
2500	2.55	4600	1.20
3000	0.50	4800	2.15
3100	0.85	5100	0.35
3200	1.35	5130 or 5152	0.45
3400	3.20	6120 or 6152	0.95
4000	0.45-0.55	6145 or 6150	1.20

*Add 0.25 for acid open-hearth; 0.50 electric.

Cold-Finished Carbon Bars: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, base 20,000-39,999 lbs., 2.65c; Detroit 2.70c; Toledo 2.80c. (Keystone Drawn Steel Co. may sell outside its usual market area on Proc. Div., Treasury Dept. contracts at 2.65c, Spring City, Pa., plus freight on hot-rolled bars from Pittsburgh to Spring City. New England Drawn Steel Co. may sell outside New England on WPB directives at 2.65c, Mansfield, Mass., plus freight on hot-rolled bars from Buffalo to Mansfield.)

Cold-Finished Alloy Bars: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, base 3.35c; Detroit, del. 3.45c; Eastern Mich. 3.50c.

Reinforcing Bars (New Billet): Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Sparrows Point, Buffalo, Youngstown, base 2.15c; Detroit del. 2.25c; Eastern Mich. and Toledo 2.30c; Gulf ports, dock 2.50c; Pacific ports, dock 2.55c.

Reinforcing Bars (Rail Steel): Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Youngstown, Buffalo base 2.15c; Detroit, del. 2.25c; Eastern Mich. and Toledo 2.30c; Gulf ports, dock 2.50c.

(Sweet's Steel Co., Williamsport, Pa., may quote rail steel reinforcing bars 2.33c, f.o.b. mill.)

Iron Bars: Single refined, Pitts. 4.40c; double refined 5.40c; Pittsburgh, staybolt, 5.75c; Terre Haute, single ref., 5.00c, double ref., 6.25c.

Sheets, Strip

Hot-Rolled Sheets: Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Buffalo, Youngstown, Sparrows Pt., Middletown, base 2.20c; Granite City, base 2.30c; Detroit del. 2.30c; Eastern Mich. 2.35c; Phila. del. 2.37c; New York del. 2.44c; Pacific ports 2.75c.

(Andrews Steel Co. may quote hot-rolled sheets for shipment to Detroit and the Detroit area on the Middletown, O. base.)

Cold-Rolled Sheets: Pittsburgh, Chicago, Cleveland, Gary, Buffalo, Youngstown, Middletown, base, 3.05c; Granite City, base 3.15c; Detroit del. 3.15c; Eastern Mich. 3.20c; New York del. 3.39c; Phila. del. 3.37c; Pacific ports 3.70c.

Galvanized Sheets, No. 24: Pittsburgh, Chicago, Gary, Birmingham, Buffalo, Youngstown, Sparrows Point, Middletown, base 3.65c; Granite City, base 3.75c; New York del. 3.89c; Phila. del. 3.82c; Pacific ports 4.20c.

(Andrews Steel Co. may quote galvanized sheets 3.75c at established basing points.)

Corrugated Galv. Sheets: Pittsburgh, Chicago, Gary, Birmingham, 29 gage, per square 3.31c.

Culvert Sheets: Pittsburgh, Chicago, Gary, Birmingham, 16 gage, not corrugated, copper alloy 3.60c; Granite City 3.70c; Pacific Ports 4.25c; copper iron 3.90c, pure iron 3.95c; zinc-coated, hot-dipped, heat-treated, No. 24, Pittsburgh, 4.25c.

Enameling Sheets: 10-gage; Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Middletown, base, 2.75c; Granite City, base 2.85c; Detroit, del. 2.85c; eastern, Mich. 2.90c; Pacific ports 3.40c; **20-gage;** Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Middletown, base 3.35c; Detroit del. 3.45c; eastern Mich. 3.50c; Pacific ports 4.00c.

Electrical Sheets No. 24:

	Pittsburgh Base	Pacific Ports	Granite City
Field grade	3.20c	3.95c	3.30c
Armature	3.55c	4.30c	3.65c
Electrical	4.05c	4.80c	4.15c
Motor	4.95c	5.70c	5.05c
Dynamo	5.65c	6 40c	5.75c
Transformer			
72	6.15c	6.90c	.....
65	7.15c	7.90c	.....
58	7.65c	8.40c	.....
52	8.45c	9.20c	.....

Hot-Rolled Strip: Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Youngstown, Middletown, base 1 ton and over, 12 inches wide and less 2.10c; Detroit del. 2.20c; Eastern Mich. 2.25c; Pacific ports 2.75c. (Joslyn Mfg. Co. may quote 2.30c, Chicago base.)

Cold Rolled Strip: Pittsburgh, Cleveland, Youngstown, 0.25 carbon and less 2.80c; Chicago, base 2.90c; Detroit, del. 2.90c; Eastern Mich. 2.95c; Worcester base 3.00c.

Commodity C. R. Strip: Pittsburgh, Cleveland, Youngstown, base 3 tons and over, 2.95c; Chicago 3.05c; Detroit del. 3.05c; Eastern Mich. 3.10c; Worcester base 3.35c.

Cold-Finished Spring Steel: Pittsburgh, Cleveland bases, add 20c for Worcester; .26-.50 Carb., 2.80c; .51-.75 Carb., 4.30c; .76-1.00 Carb., 6.15c; over 1.00 Carb., 8.35c.

Tin, Terne Plate

Tin Plate: Pittsburgh, Chicago, Gary, 100-lb. base box, $5.00; Granite City $5.10.

Electrolytic Tin Plate: Pittsburgh, Gary, 100-lb. base box, 0.50 lb. tin, $4.50; 0.75 lb. tin $4.65.

Tin Mill Black Plate: Pittsburgh, Chicago, Gary, base 29 gage and lighter, 3.05c; Granite City, 3.15c; Pacific ports, boxed 4.05c.

Long Ternes: Pittsburgh, Chicago, Gary, No. 24 unassorted 3.80c; Pacific ports 4.55c.

Manufacturing Ternes: (Special Coated) Pittsburgh, Chicago, Gary, 100-base box $4.30; Granite City $4.40.

Roofing Ternes: Pittsburgh base per package 112 sheets; 20 x 28 in., coating I.C. 8-lb. $12.00; 15-lb. $14.00; 20-lb. $15.00; 25-lb. $16; 30-lb. $17.25; 40-lb. $19.50.

Plates

Carbon Steel Plates: Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Youngstown, Sparrows Point, Coatesville, Claymont, 2.20c; New York, del. 2.39c; Phila., del. 2.25c; St. Louis, 2.44c; Boston, del. 2.52-77c; Pacific ports, 2.75c; Gulf ports, 2.55c.

(Granite City Steel Co. may quote carbon plates 2.35c f.o.b. mill; 2.65c f.o.b. D.P.C. mill; Kaiser Co. Inc., 3.20c, f.o.b. Los Angeles. Central Iron & Steel Co. 2.50c f.o.b. basing points; Geneva Steel Co., Provo, Utah, 3.20c, f.o.b. Pac. ports.)

Floor Plates: Pittsburgh, Chicago, 3.35c; Pacific ports, 4.00c.

Open-Hearth Alloy Plates: Pittsburgh, Chicago, Coatesville, 3.50c; Gulf ports 3.95c; Pacific ports 4.15c.

Wrought Iron Plates: Pittsburgh, 3.80c.

Shapes

Structural Shapes: Pittsburgh, Chicago, Gary, Birmingham, Buffalo, Bethlehem, 2.10c; New York, del. 2.27c; Phila., del. 2.215c; Pacific ports, 2.75c.

(Phoenix Iron Co., Phoenixville, Pa., may quote carbon steel shapes at 2.35c at established basing points and 2.50c, Phoenixville, for export; Sheffield Steel Corp., 2.55c f.o.b. St. Louis. Geneva Steel Co., 3.25c, Pac. ports); Kaiser Co. Inc., 3.20c f.o.b. Los Angeles.)

Steel Sheet Piling: Pittsburgh, Chicago, Buffalo, 2.40c.

Wire Products, Nails

Wire: Pittsburgh, Chicago, Cleveland, Birmingham (except spring wire) to manufacturers in carloads (add $2 for Worcester, $1 for Duluth).

Bright basic, bessemer wire 2.60c
Spring wire 3.20c
(Pittsburgh Steel Co., 0.20c higher.)

Wire Products to the Trade:

Standard and Cement-coated wire nails, and staples, 100-lb. keg, Pittsburgh, Chicago, Birmingham, Cleveland, Duluth $2.80; galvanized, $2.55; Pac. ports ..... $3.30 and $3.05

Annealed fence wire, 100-lb., Pittsburgh, Chicago, Cleveland 3.05c

Galvanized fence wire, 100 lb., Pittsburgh, Chicago, Cleveland 3.40c

Woven fence, 15½ gage and heavier, per base column ..... .67c

Barbed wire, 80-rod spool, Pittsburgh, Chicago, Cleveland, Birmingham, column 70; twisted barbless wire, column 70.

Tubular Goods

Welded Pipe: Base price in carloads, threaded and coupled to consumers about $200 per net ton. Base discounts on steel pipe Pittsburgh and Lorain, O.; Gary, Ind. 2 points less on lap weld, 1 point less on butt weld. Pittsburgh base only on wrought iron pipe.

Butt Weld

Steel In.	Blk.	Galv.	Iron In.	Blk.	Galv.
⅛	56	33	½	24	3½
¼ & ⅜	59	40½	¾	30	10
½	63½	51	1-1¼	34	16
¾	66½	55	1½	38	18½
1-3	68½	57½	2	37½	18

Lap Weld

Steel In.	Blk.	Galv.	Iron In.	Blk.	Galv.
2	61	49¼	1¼	23	3½
2½-3	64	52½	1½	28½	10
3½-6	66	54½	2	30½	12
7-8	65	52½	2½, 3½	31½	14½
9-19	64½	52	4	33½	18
11-12	63½	51	4½-8	32½	17
			9-12	28½	12

Boiler Tubes: Net base prices per 100 feet f.o.b. Pittsburgh in carload lots, minimum wall, cut lengths 4 to 24 feet, inclusive.

O.D. Sizes	B.W.G.	—Seamless— Hot Rolled	Cold Drawn	—Lap Weld— Steel	Charcoal Iron
1"	13	$ 7.82	$ 9.01	.....	.....
1¼"	13	9.26	10.67	.....	.....
1½"	13	10.23	11.72	$ 9.72	$23.71
1¾"	13	11.64	13.42	11.06	22.93
2"	13	13.04	15.03	12.38	19.35
2¼"	13	14.54	16.76	13.79	21.63
2¼"	12	16.01	18.45	15.16	.....
2½"	12	17.54	20.21	16.58	26.57
2¾"	12	18.59	21.42	17.54	29.00
3"	12	19.50	22.48	18.35	31.38
3½"	11	24.63	28.37	23.15	39.81
4"	10	30.54	35.20	28.66	49.90
4½"	10	37.35	43.04	35.22	.....
5"	9	46.87	54.01	44.25	73.93
6"	7	71.96	82.93	68.14	.....

Rails, Supplies

Standard rails, over 60-lb., f.o.b. mill, gross ton, $43.00. Light rails (billet), Pittsburgh, Chicago, Birmingham, gross ton, $43.00.

*Relaying rails, 35 lbs. and over, f.o.b. railroad and basing points, $31-$33.

Supplies: Track bolts, 4.75c; heat treated, 5.00c. Tie plates, $43 net ton, base, Standard spikes, 3.00c.

*Fixed by OPA Schedule No. 46, Dec. 15, 1941.

Tool Steels

Tool Steels: Pittsburgh, Bethlehem, Syracuse, base, cents per lb.; Reg. carbon 14.00c; extra carbon 18.00c; special carbon 22.00c; oil-hardening 24.00c; high car.-chr. 43.00c.

Tung	Chr.	Van.	Moly.	Pitts. base per lb.
18.00	4	1	...	67.00c
1.5	4	1	8.5	54.00c
.....	4	2	8	54.00c
5.50	4	1.50	4	57.50c
5.50	4.50	4	4.50	70.00c

Stainless Steels

Base, Cents per lb.—f.o.b. Pittsburgh

Type	Bars	Plates	Sheets	H. R. Strip	C. R. Strip
CHROMIUM NICKEL STEEL					
302	24.00c	27.00c	34.00c	21.50c	28.00c
303	26.00	29.00	36.00	27.00	33.00
304	25.00	29.00	36.00	23.50	30.00
308	29.00	34.00	41.00	28.50	35.00
309	36.00	40.00	47.00	37.00	47.00
310	49.00	52.00	53.00	48.75	56.00
312	36.00	40.00	49.00	.....	.....
*316	40.00	44.00	48.00	40.00	48.00
†321	29.00	34.00	41.00	29.25	38.00
‡347	33.00	38.00	45.00	33.00	42.00
431	19.00	22.00	29.00	17.50	22.50
STRAIGHT CHROMIUM STEEL					
403	21.50	24.50	29.50	21.25	27.00
**410	18.50	21.50	26.50	17.00	22.00
416	19.00	22.00	27.00	18.25	23.50
††420	24.00	28.50	33.50	23.75	36.50
430	19.00	22.00	29.00	17.50	22.50
‡‡430F	19.50	22.50	29.50	18.75	24.50
440A	24.00	28.50	33.50	23.75	36.50
442	22.50	25.50	32.50	24.00	32.00
443	22.50	25.50	32.50	24.00	32.00
446	27.50	30.50	36.50	35.00	52.00
501	8.00	12.00	15.75	12.00	17.00
502	9.00	13.00	16.75	13.00	18.00
STAINLESS CLAD STEEL (20%)					
304	.....	§§18.00	19.00	.....	.....

*With 2-3% moly. †With titanium. ‡With columbium. **Plus machining agent. ††High carbon. ‡‡Free machining. §§Includes annealing and pickling.

Basing Point Prices are (1) those announced by U. S. Steel Corp. subsidiaries for first quarter of 1941 or in effect April 16, 1941 at designated basing points or (2) those prices announced or customarily quoted by other producers at the same designated points. Base prices under (2) cannot exceed those under (1) except to the extent prevailing in third quarter of 1940.

Extras mean additions or deductions from base prices in effect April 16, 1941.

Delivered prices applying to Detroit, Eastern Michigan, Gulf and Pacific Coast points are deemed basing points except in the case of the latter two areas when water transportation is not available, in which case nearest basing point price, plus all-rail freight may be charged.

Domestic Ceiling prices are the aggregate of (1) governing basing point price, (2) extras and (3) transportation charges to the point of delivery as customarily computed. **Governing basing point** is basing point nearest the consumer providing the lowest delivered price.

Seconds, maximum prices: flat-rolled rejects 75% of prime prices, wasters 75%, waste-wasters 65% except plates, which take waster prices; tin plate $2.80 per 100 lbs.; terne plate $2.25; semifinished 85% of primes; other grades limited to new material ceilings.

Export ceiling prices may be either the aggregate of (1) governing basing point or emergency basing point (2) export extras (3) export transportation charges provided they are the f.a.s. seaboard quotations of the U. S. Steel Export Co. on April 16, 1941.

Bolts, Nuts

F.o.b. Pittsburgh, Cleveland, Birmingham, Chicago. Discounts for carloads additional 5%, full containers, add 10%

Carriage and Machine

½ x 6 and smaller ..... 65½ off
Do., ⅝ and ⅝ x 6-in. and shorter... 63½ off
Do., ¾ to 1 x 6-in. and shorter ..... 61 off
1⅛ and larger, all lengths ..... 59 off
All diameters, over 6-in. long ..... 59 off
Tire bolts ..... 50 off
Step bolts ..... 56 off
Plow bolts ..... 65 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.

Nuts

Semifinished hex	U.S.S.	S.A.E.
⅞-inch and less	62	64
⅛-1-inch	59	60
1⅛-1½-inch	57	58
1⅝ and larger	56	

Hexagon Cap Screws

Upset 1-in., smaller ..... 64 off
Milled 1-in., smaller ..... 60 off

Square Head Set Screws

Upset, 1-in., smaller ..... 71 off
Headless, ¼-in., larger ..... 60 off
No. 10, smaller ..... 70 off

Piling

Pittsburgh, Chicago, Buffalo 2.40c

Rivets, Washers

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham

Structural 3.75c
⅞-inch and under ..... 65-5 off
Wrought Washers, Pittsburgh, Chicago, Philadelphia, to jobbers and large nut, bolt manufacturers l.c.l. ... $2.75-3.00 off

Metallurgical Coke

Price Per Net Ton

Beehive Ovens

Connellsville, furnace *7.00
Connellsville, foundry 7.50- 8.00
Connellsville, prem. fdry. 7.75- 8.10
New River, foundry 8.50- 8.75
Wise county, foundry 7.25- 7.75

By-Product Foundry

Wise county, furnace 6.75- 7.25
Kearney, N. J., ovens 12.65
Chicago, outside delivered 12.60
Chicago, delivered 13.35
Terre Haute, delivered 13.10
Milwaukee, ovens 13.35
New England, delivered 14.25
St. Louis, delivered ..... †13.35
Birmingham, delivered 10.50
Indianapolis, delivered 13.10
Cincinnati, delivered 12.85
Cleveland, delivered 12.80
Buffalo, delivered 13.00
Detroit, delivered 13.35
Philadelphia, delivered 12.88

*Operators of hand-drawn ovens using trucked coal may charge $7.75, effective Nov. 29, 1943. †13.85 from other than Ala., Mo., Tenn.

Coke By-Products

Spot, gal., freight allowed east of Omaha

Pure and 90% benzol 15.00c
Toluol, two degree 28.00c
Solvent naphtha 27.00c
Industrial xylol 27.00c

Per lb. f.o.b. works

Phenol (car lots, returnable drums).... 12.50c
Do., less than car lots 13.75c
Do., tank cars 11.50c

Eastern Plants, per lb.

Naphthalene flakes, balls, bbls., to jobbers 8.00c

Per ton, bulk, f.o.b. port

Sulphate of ammonia $29.20

WAREHOUSE STEEL PRICES

Base delivered price, cents per pound, for delivery within switching limits, subject to established extras.

	Hot rolled bars	Structural shapes	Plates	Floor plates	Hot rolled sheets (10 gage base)	Hot rolled bands (12 gage and heavier)	Hot rolled hoops (14 gage and lighter)	Galvanized flat sheets (24 gage base)	Cold-rolled sheets (17 gage base)	Cold finished bars	Cold-rolled strip	NE hot bars 8600 series	NE hot bars 9400 series
Boston	4.044[1]	3.912[1]	4.012[1]	5.727[1]	3.874[1]	4.106[1]	5.106[1]	5.374[14]	4.744[14]	4.144[11]	4.715	6.012[23]	6.012[23]
New York	3.853[1]	3.758[1]	3.868[1]	5.574[1]	3.690[1]	3.974[1]	3.974[1]	5.160[12]	4.613[14]	4.103[21]	4.774	.....	.....
Jersey City	3.853[1]	3.747[1]	3.868[1]	5.574[1]	3.690[1]	3.974[1]	3.974[1]	5.160[12]	4.613[14]	4.103[21]	4.774	.....	.....
Philadelphia	3.822[1]	3.666[1]	3.705[1]	5.272[1]	3.618[1]	3.922[1]	4.272[1]	5.168[15]	4.872[26]	4.072[21]	4.772	5.816[23]	5.860[26]
Baltimore	3.802[1]	3.759[1]	3.694[1]	5.252[1]	3.494[1]	3.902[1]	4.252[1]	5.044[1]	4.852[26]	4.052[21]	.....	.....	.....
Washington	3.941[1]	3.930[1]	3.896[1]	5.341[1]	3.696[1]	4.041[1]	4.391[1]	5.346[17]	4.841[26]	4.041[21]	.....	.....	.....
Norfolk, Va.	4.065[1]	4.002[1]	4.071[1]	5.465[1]	3.871[1]	4.165[1]	4.515[1]	5.521[17]	4.965[24]	4.165[21]	.....	.....	.....
Bethlehem, Pa.*	.....	3.45[1]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Claymont, Del.*	.....	.....	3.55[1]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Coatesville, Pa.*	.....	.....	3.55[1]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Buffalo (city)	3.35[1]	3.40[1]	3.73[1]	5.26[1]	3.45[1]	3.819[1]	3.819[1]	4.90[15]	4.40[10]	3.75[21]	4.669	5.60[23]	5.75[26]
Buffalo (country)	3.25[1]	3.30[1]	3.40[1]	4.90[1]	3.35[1]	3.81[1]	3.50[1]	4.80[15]	4.30[10]	3.65[21]	4.35	5.60[23]	5.75[26]
Pittsburgh (city)	3.35[1]	3.40[1]	3.50[1]	5.00[1]	3.45[1]	3.60[1]	3.60[1]	4.90[12]	4.40[24]	3.75[21]	.....	.....	.....
Pittsburgh (country)	3.25[1]	3.30[1]	3.40[1]	4.90[1]	3.35[1]	3.50[1]	3.50[1]	4.80[12]	4.30[24]	3.65[21]	.....	.....	.....
Cleveland (city)	3.35[1]	3.588[1]	3.50[1]	5.188[1]	3.45[1]	3.60[1]	3.60[1]	5.027[12]	4.40[24]	3.75[21]	4.45[21]	5.60[23]	5.65[26]
Cleveland (country)	3.25[1]	.....	3.40[1]	.....	3.35[1]	3.50[1]	3.50[1]	.....	4.30[24]	3.65[21]	4.35[21]	.....	.....
Detroit	3.450[1]	3.661[1]	3.709[1]	5.281[1]	3.550[1]	3.700[1]	3.700[1]	5.15[13]	4.500[24]	3.800[21]	4.659	5.93[23]	5.93[26]
Omaha (city, delivered)	4.115[1]	4.165[1]	4.265[1]	5.765[1]	3.965[1]	4.215[1]	4.215[1]	5.758[19]	5.443[24]	4.443[13]	.....	.....	.....
Omaha (country, base)	4.015[1]	4.065[1]	4.165[1]	5.665[1]	3.865[1]	4.115[1]	4.115[1]	5.658[19]	.....	.....	.....	.....	.....
Cincinnati	3.611[1]	6.391[1]	3.761[1]	5.291[1]	3.525[1]	3.675[1]	3.675[1]	4.975[13]	4.475[24]	4.011[21]	4.711	6.10	6.20
Youngstown, O.*	.....	.....	.....	.....	.....	.....	.....	4.55[13]	.....	.....	.....	.....	.....
Middletown, O.*	.....	.....	.....	.....	3.35[1]	3.50[1]	3.50[1]	4.80[16]	.....	.....	.....	.....	.....
Chicago (city)	3.50[1]	3.55[1]	3.65[1]	5.15[1]	3.35[1]	3.60[1]	3.60[1]	5.381[15]	4.20[24]	3.75[21]	4.65	5.75[23]	5.85[26]
Milwaukee	3.637[1]	3.687[1]	3.787[1]	5.287[1]	3.487[1]	3.737[1]	3.737[1]	5.422[15]	4.337[24]	3.887[21]	4.787	5.987[23]	6.087[26]
Indianapolis	3.58[1]	3.63[1]	3.73[1]	5.23[1]	3.618[1]	3.768[1]	3.768[1]	5.068[15]	4.568[24]	3.98[21]	4.78	6.08[23]	6.18[26]
St. Paul	3.76[2]	3.81[2]	3.91[2]	5.41[2]	3.61[2]	3.86[2]	3.86[2]	5.407[15]	4.46[24]	4.361[21]	5.102	6.09[23]	6.19[26]
St. Louis	3.647[1]	3.697[1]	3.797[1]	5.297[1]	3.497[1]	3.747[1]	3.747[1]	5.322[15]	4.347[24]	4.031[21]	4.931	6.131[23]	6.231[26]
Memphis, Tenn.	4.015[5]	4.065[5]	4.165[5]	5.78[5]	4.065[5]	4.215[5]	4.215[5]	5.415[15]	4.78[24]	4.33[21]	.....	.....	.....
Birmingham	3.50[1]	3.55[1]	3.65[1]	5.903[1]	3.55[1]	3.70[1]	3.70[1]	4.90[15]	4.852[24]	4.54	5.215	.....	.....
New Orleans (city)	4.10[4]	3.90[4]	4.00[4]	5.85[4]	4.158[4]	4.20[4]	4.20[4]	5.40[26]	5.079[19]	4.60[21]	5.429	.....	.....
Houston, Tex.	3.75[3]	4.25[3]	4.35[3]	5.50[9]	3.863[3]	4.313[3]	4.313[3]	5.463[15]	4.10[10]	3.65[22]	.....	.....	.....
Los Angeles	4.40[4]	4.65[4]	5.05[4]	7.20[4]	5.10[4]	4.95[4]	6.75[4]	6.15[12]	7.20[6]	5.583[30]	5.613	5.85[23]	5.95[26]
San Francisco	4.15[7]	4.35[7]	4.75[7]	6.35[7]	4.65[7]	4.50[7]	5.75[7]	6.50[15]	7.30[15]	5.338[21]	7.333	8.304[23]	8.404[26]
Portland, Oreg.	4.45[27]	4.45[27]	4.85[27]	6.50[27]	4.75[27]	4.75[27]	6.30[27]	5.90[15]	6.60[15]	5.533[15]	.....	.....	.....
Tacoma	4.35[6]	4.45[6]	4.85[6]	6.50[6]	4.75[6]	4.25[6]	5.45[6]	6.10[15]	7.05[15]	5.783[21]	.....	.....	8.00[23]
Seattle	4.35[6]	4.45[6]	4.85[6]	6.50[6]	4.75[6]	4.25[6]	5.45[6]	6.10[15]	7.60[15]	5.783[21]	.....	.....	8.00[23]

*Basing point cities with quotations representing mill prices, plus warehouse spread.

NOTE—All prices fixed by Office of Price Administration in Amendments Nos. 10 to 18 to Revised Price Schedule No. 49. Deliveries outside above cities computed in accordance with regulations.

BASE QUANTITIES

[1]400 to 1999 pounds; [2]—400 to 14,999 pounds; [3]—any quantity; [4]—300 to 1999 pounds; [5]—400 to 8999 pounds; [6]—300 to 9999 pounds; [7]—400 to 39,999 pounds; [8]—under 2000 pounds; [9]—under 4000 pounds; [10]—500 to 1499 pounds [11]—one bundle to 39,999 pounds; [12]—150 to 2249 pounds; [13]—150 to 1499 pounds; [14]—three to 24 bundles; [15]—450 to 1499 pounds; [16]—one bundle to 1499 pounds; [17]—one to nine bundles; [18]—one to six bundles. [19]—100 to 749 pounds; [20]300 to 1999 pounds; [21]—1500 to 39,999 pounds; [22]—1500 to 1999 pounds; [23]—1000 to 39,999 pounds; [24]—400 to 1499 pounds; [26]—1000 to 1999 pounds; [26]—under 25 bundles. Cold-rolled strip, 2000 to 39,999 pounds, base; [27]—300 to 4999 pounds.

Ores

Lake Superior Iron Ore

Gross ton, 51½% (Natural)
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, units, del. E. Pa.

Foundry and basic 56-63% contract	13.00

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.
Brazil iron ore, 68-69% f.o.b. Rio de Janeiro	7.50-8.00

Tungsten Ore

Chinese wolframite, per short ton unit, duty paid	$24.00

Chrome Ore

(Equivalent OPA schedules):

Gross ton f.o.b. cars, New York, Philadelphia, Baltimore, Charleston, S. C., Portland, Ore., or Tacoma, Wash.

(S/S paying for discharging; dry basis; subject to penalties if guarantees are not met.)

Indian and African

48% 2.8:1	$41.00
48% 3:1	43.50
48% no ratio	31.00

South African (Transvaal)

44% no ratio	$27.40
45% no ratio	28.30
48% no ratio	31.00
50% no ratio	32.80

Brazilian—nominal

44% 2.5:1 lump	33.65
48% 3:1 lump	43.50

Rhodesian

45% no ratio	28.30
48% no ratio	31.00
48% 3:1 lump	43.50

Domestic (seller's nearest rail)

48% 3:1	52.80

less $7 freight allowance

Manganese Ore

Sales prices of Metals Reserve Co., cents per gross ton unit, dry, 48%, at New York, Philadelphia, Baltimore, Norfolk, Mobile and New Orleans, 85.0c; Fontana, Calif., Provo, Utah, and Pueblo, Colo., 91.0c; prices include duty on imported ore and are subject to premiums, penalties and other provisions of amended M.P.R. No. 248, effective as of May 15. Price at basing points which are also points of discharge of imported manganese ore is f.o.b. cars, shipside, at dock most favorable to the buyer.

Molybdenum

Sulphide conc., lb., Mo. cont., mines	$0.75

NATIONAL EMERGENCY STEELS (Hot Rolled)

(Extras for alloy content)

Designation	Chemical Composition Limits, Per Cent: Carbon	Mn.	Si.	Cr.	Ni.	Mo.	Basic open-hearth: Bars per 100 lb.	Billets per GT	Electric furnace: Bars per 100 lb.	Billets per GT
NE 8612	.10 .15	.70-.90	.20-.35	.40-.60	.40-.70	.15-.25	$0.65	$13.00	$1.15	$23.00
NE 8720	.18-.23	.70-.90	.20-.35	.40-.60	.40-.70	.20-.30	.70	14.00	1.20	24.00
NE 9415	.13-.18	.80-1.10	.20-.35	.30-.50	.30-.60	.08-.15	.75	15.00	1.25	25.00
NE 9425	.23-.28	.80-1.20	.20-.35	.30-.50	.30-.60	.08-.15	.75	15.00	1.25	25.00
NE 9442	.40-.45	1.00-1.30	.20-.35	.30-.50	.30-.60	.08-.15	.80	16.00	1.30	26.00
NE 9722	.20-.25	.50-.80	.20-.35	.10-.25	.40-.70	.15-.25	.65	13.00	1.15	23.00
NE 9830	.28-.33	.70-.90	.20-.35	.70 .90	.85-1.15	.20-.30	1.30	26.00	1.80	36.00
NE 9912	.10-.15	.50-.70	.20-.35	.40-.60	1.00-1.30	.20-.30	1.20	24.00	1.55	31.00
NE 9920	.18-.23	.50-.70	.20-.35	.40-.60	1.00-1.30	.20-.30	1.20	24.00	1.55	31.00

Extras are in addition to a base price of 2.70c, per pound on finished products and $54 per gross ton on semifinished steel major basing points and are in cents per pound and dollars per gross ton. No prices quoted on vanadium alloy.

Pig Iron

Prices (in gross tons) are maximums fixed by OPA Price Schedule No. 10, effective June 10, 1941, amended Feb. 14, 1945. Exceptions indicated in footnotes. Base prices bold face, delivered light face. Federal tax on freight charges, effective Dec. 1, 1942, not included in following prices.

	Foundry	Basic	Bessemer	Malleable
Bethlehem, Pa. base	$26.00	$25.50	$27.00	$26.50
Newark, N. J., del.	27.53	27.03	28.53	28.03
Brooklyn, N. Y., del.	28.50	.....	.....	29.00
Birdsboro, Pa., base	26.00	25.50	27.00	26.50
Birmingham, base	†21.38	†20.00	26.00	.....
Baltimore, del.	26.61	.....	.....	.....
Boston, del.	26.12	.....	.....	.....
Chicago, del.	25.22	.....	.....	.....
Cincinnati, del.	25.06	23.68	.....	.....
Cleveland, del.	25.12	24.24	.....	.....
Newark, N. J., del	27.15	.....	.....	.....
Philadelphia, del.	26.46	25.96	.....	.....
St. Louis, del.	25.12	24.24	.....	.....
Buffalo, base	25.00	24.00	26.00	25.50
Boston, del.	26.50	26.00	27.50	27.00
Rochester, del.	26.53	.....	27.53	27.03
Syracuse, del.	27.08	.....	28.08	27.58
Chicago, base	25.00	24.50	25.50	25.00
Milwaukee, del.	26.10	25.60	26.60	26.10
Muskegon, Mich., del.	28.19	.....	.....	28.19
Cleveland, base	25.00	24.50	25.50	25.00
Akron, Canton, O., del.	26.39	25.89	26.89	26.39
Detroit, base	25.00	24.50	25.50	25.00
Saginaw, Mich., del.	27.31	26.81	27.81	27.31
Duluth, base	25.50	25.00	26.00	25.50
St. Paul, del.	27.63	27.13	28.13	27.63
Erie, Pa., base	25.00	24.50	26.00	25.50
Everett, Mass., base	26.00	25.50	27.00	26.50
Boston, del.	26.50	26.00	27.50	27.00
Granite City, Ill., base	25.00	24.50	25.50	25.00
St. Louis, del.	25.50	25.00	.....	25.50
Hamilton, O., base	25.00	24.50	.....	25.00
Cincinnati, del	25.44	25.61	.....	26.11
Neville Island, Pa., base	25.00	24.50	25.50	25.00
§Pittsburgh, del. No. & So. sides	25.69	25.19	26.19	25.69
Provo, Utah, base	23.00	22.50	.....	.....
Sharpsville, Pa., base	25.00	24.50	25.50	25.00
Sparrows Point, base	26.00	25.50	.....	.....
Baltimore, del.	26.99	.....	.....	.....
Steelton, Pa., base	.....	25.50	.....	26.50
Swedeland, Pa., base	26.00	25.50	27.00	26.50
Philadelphia, del.	26.84	26.34	.....	27.34
Toledo, O., base	25.00	24.50	25.50	25.00
Youngstown, O., base	25.00	24.50	25.50	25.00
Mansfield, O., del.	26.94	26.44	27.44	26.94

Base grade, silicon 1.75-2.25%; add 50 cents for each additional 0.25% silicon, or portion thereof; deduct 50 cents for silicon below 1.75% on foundry iron. †For phosphorus 0.70% or over deduct 38 cents. §For McKees Rocks, Pa., add .55 to Neville Island base; Lawrenceville, Homestead, McKeesport, Ambridge, Monaca, Aliquippa, .84; Monessen, Monongahela City .97 (water); Oakmont, Verona 1.11; Brackenridge 1.24.

Note: Add 50 cents per ton for each 0.50% manganese or portion thereof over 1.00%.

Nickel differentials: Under 0.50%, no extra; 0.50% to 0.74% incl., $2 per ton; for each additional 0.25% nickel, $1 per ton.

High Silicon, Silvery

5.00-6.50 per cent (base)			$30.50
6.51-7.00	$31.50	9.01- 9.50	36.50
7.01-7.50	32.50	9.51-10.00	37.50
7.51-8.00	33.50	10.00-10.50	38.50
8.01-8.50	34.50	10.51-11.00	39.50
8.51-9.00	35.50	11.01-11.50	40.50

F.o.b. Jackson county, O., per gross ton, Buffalo base prices are $1.25 higher. Prices subject to additional charge of 50 cents a ton for each 0.50% manganese in excess of 1.00%.

Bessemer Ferrosilicon

Prices same as for high silicon silvery iron, plus $1 per gross ton. (For higher silicon irons a differential over and above the price of base grades is charged as well as for the hard chilling iron, Nos. 5 and 6.)

Charcoal Pig Iron

Northern

Lake Superior Furn. $34.00
Chicago, del. 37.34

Southern

Semi-cold blast, high phos., f.o.b. furnace, Lyles, Tenn. $28.50
Semi-cold blast, low phos., f.o.b. furnace, Lyles, Tenn. 33.00

Gray Forge

Neville Island, Pa. $24.50
Valley base 24.50

Low Phosphorus

Basing points: Birdsboro, Pa., $30.50; Steelton, Pa., and Buffalo, N. Y., 30.50 base; 31.74, del., Philadelphia. Intermediate phos., Central Furnace, Cleveland, $27.50

Switching Charges: Basing point prices are subject to an additional charge for delivery within the switching limits of the respective districts.

Silicon Differentials: Basing point prices are subject to an additional charge not to exceed 50 cents a ton for each 0.25 silicon in excess of base grade (1.75 to 2.25%).

Phosphorus Differential: Basing point prices are subject to a reduction of 38 cents a ton for phosphorus for each 0.50% manganese content in excess of 1.0%.

Ceiling Prices are the aggregate of (1) governing basing point (2) differentials (3) transportation charges from governing basing point to point of delivery as customarily computed. Governing basing point is the one phorus content of 0.70% and over.

Manganese Differentials: Basing point prices subject to an additional charge not to exceed 50 cents a ton resulting in the lowest delivered price for the consumer.

Exceptions to Ceiling Prices: Struthers Iron & Steel Co. may charge 50 cents a ton in excess of basing point prices for No. 2 Foundry, Basic Bessemer and Malleable. Mystic Iron Works, Everett, Mass., may exceed basing point prices by $1 per ton.

Refractories

Per 1000 f.o.b. Works, Net Prices

Fire Clay Brick

Super Quality

Pa., Mo., Ky., ... $66.55

First Quality

Pa., Ill., Md., Mo., Ky. 52.85
Alabama, Georgia 52.85
New Jersey 57.70
Ohio 46.35

Second Quality

Pa., Ill., Md., Mo., Ky. 47.90
Alabama, Georgia 39.15
New Jersey 50.50
Ohio 37.10

Malleable Bung Brick

All bases 61.65

Silica Brick

Pennsylvania 52.85
Joliet, E. Chicago 60.65
Birmingham, Ala. 52.85

Ladle Brick

(Pa., O., W. Va., Mo.)

Dry press 31.95
Wire cut 29.90

Magnesite

Domestic dead-burned grains, net ton f.o.b. Chewelah, Wash., net ton, bulk 22.00
net ton, bags 28.00

Basic Brick

Net ton, f.o.b. Baltimore, Plymouth Meeting, Chester, Pa.

Chrome brick $54.00
Chem. bonded chrome 54.00
Magnesite brick 76.00
Chem. bonded magnesite 65.00

Fluorspar

Metallurgical grade, f.o.b. Ill., Ky., net ton, carloads CaF^2 content, 70% or more, $33; 65 but less than 70%, $32; 60 but less than 65% $31; less than 60%, $30. (After Aug. 29 base price any grade $30.)

Ferroalloy Prices

Ferromanganese (standard) 78-82% c.l. gross ton, duty paid, eastern, central and western zones, $135; add $6 for packed c.l., $10 for ton, $13.50 less-ton; f.o.b. cars, New Orleans, $1.70 for each 1%, or fraction contained manganese over 82% or under 78%; delivered Pittsburgh, $140.33.

Ferromanganese (Low and Medium Carbon); per lb. contained manganese; eastern zone, low carbon, bulk, c.l., 23c; 2000 lb. to c.l., 23.40c; medium, 14.50c and 15.20c; central, low carbon, bulk, c.l., 23.30c; 2000 lb. to c.l., 24.40c; medium, 14.80c and 16.20c; western, low carbon, bulk, c.l., 24.50c, 2000 lb. to c.l., 25.40c; medium, 15.75c and 17.20c; f.o.b. shipping point, freight allowed.

Spiegeleisen: 19-21% carlots per gross ton, Palmerton, Pa. $36; 16-19%, $35.

Electrolytic Manganese: 99.9% plus, less ton lots, per lb. 37.6 cents.

Chromium Metal: 97% min. chromium, max. .50% carbon, eastern zone, per lb. contained chromium bulk, c.l., 79.50c, 2000 lb. to c.l. 80c; central, 81c and 82.50c; western, 82.25c and 84.75c; f.o.b. shipping point, freight allowed.

Ferrocolumbium: 50-60%, per lb. contained columbium in gross ton lots, contract basis, R.R. freight allowed, eastern zone, $2.25; less-ton lots $2.30. Spot prices 10 cents per lb. higher.

Ferrochrome: High carbon, eastern zone, bulk, c.l., 13c, 2000 lb. to c.l., 13.90c; central, add .40c and .65c; western, add 1c and 1.85c—high nitrogen, high carbon ferrochrome: Add 5c to all high carbon ferrochrome prices; all zones; low carbon eastern, bulk, c.l., max. 0.06% carbon, 23c, 0.10% 22.50c, 0.15% 22c, 0.20% 21.50c, 0.50% 21c, 1.00% 20.50c, 2.00% 19.50c; 2000 lb. to c.l., 0.06% 24c, 0.10% 23.50c, 0.15% 23c, 0.20% 22.50c, 0.50% 22c, 1.00% 21.50c, 2.00% 20.50c; central, add .4c for bulk, c.l. and .65c for 2000 lb. to c.l.; western, add 1c for bulk, c.l. and 1.85c for 2000 lb. to c.l.; carload packed differential .45c; f.o.b. shipping point, freight allowed. Prices per lb. contained Cr high nitrogen, low carbon ferrochrome: Add 2c to low carbon ferrochrome prices; all zones. For higher nitrogen carbon add 2c for each .25% of nitrogen over 0.75%.

Special Foundry ferrochrome: (Chrom. 62-66%, car. approx. 5-7%) Contract, carload, bulk 13.50c, packed 13.95c, ton lots 14.40c, less, 14.90c, eastern, freight allowed, per pound contained chromium; 13.90c, 14.35c, 15.05c and 15.55c central; 14.50c, 14.95c, 16.25c and 16.75c, western; spot up .25c.

S.M. Ferrochrome, high carbon: (Chrom. 60-65%, sil. 4-6%, mang. 4-6% and carbon 4-6%.) Contract, carlot, bulk, 14.00c, packed, 14.45c, ton lots 14.90c, less 15.40c, eastern, freight allowed; 14.40c, 14.85c, 15.55c and 16.05c, central; 15.00c, 15.45c, 16.75c and 17.25c, western; spot up .25c; per pound contained chromium.

S.M. Ferrochrome, low carbon: (Chrom. 62-66%, sil. 4-6%, mang. 4-6% and carbon 1.25% max.) Contract, carlot, bulk, 20.00c, packed 20.45c, ton lots 21.00c, less ton lots 22.00c, eastern, freight allowed, per pound contained chromium; 20.40c, 20.85c, 21.65c and 22.65c, central; 21.00c, 21.45c, 22.85c and 23.85c, western; spot up .25c.

SMZ Alloy: (Silicon 60-65%, Mang. 5-7%, zir. 5-7% and iron approx. 20%) per lb. of alloy contract carlots 11.50c, ton lots 12.00c, less 12.50c, eastern zone, freight allowed; 12.00c, 12.85c and 13.35c central zone; 14.05c, 14.60c and 15.10c, western; spot up .25c.

Silcaz Alloy: (Sil. 35-40%, cal. 9-11%, alum. 6-8%, zir. 3-5%, tit. 9-11% and boron 0.55-0.75%), per lb. of alloy contract, carlots 25.00c, ton lots 26.00c, less ton lots 27.00c, eastern, freight allowed; 25.50c, 26.75c and 27.75c, central; 27.50c, 28.90c and 29.90c, western; spot up .25c.

Silvaz Alloy: (Sil. 35-40%, van. 9-11%, alum. 5-7%, zir. 5-7%, tit. 9-11% and boron 0.55-0.75%), per lb. of alloy. Contract, carlots 58.00c, ton lots 59.00c, less 60.00c, eastern, freight allowed; 58.50c, 59.75c and 60.75c, central; 60.50c, 61.90c and 62.90c, western; spot up ¼c.

CMSZ Alloy 4: (Chr. 45-49%, mang. 4-6%, sil. 18-21%, zir. 1.25-1.75%, and car. 3.00-4.50%). Contract, carlots, bulk, 11.00c and packed 11.50c; ton lots 12.00c; less 12.50c, eastern, freight allowed; 11.50c and 12.00c, 12.75c, 13.25c, central; 13.50c and 14.00c, 14.75c, 15.25c, western; spot up .25c.

CMSZ Alloy 5: (Chr. 50-56%, mang. 4-6%, sil. 13.50-16.00%, zir. .75-1.25%, car. 3.50-5.00%) per lb. of alloy. Contract, carlots, bulk, 10.75c, packed 11.25c, ton lots 11.75c, less 12.25c, eastern, freight allowed; 11.25c, 11.75c and 12.50c, central; 13.25c and 13.75c, 14.50c and 15.00c, western, spot up .25c.

Ferro-Boron: (Bor. 17.50% min., sil. 1.50% max., alum. 0.50% max. and car. 0.50% Max.) per lb. of alloy contract ton lots, $1.20, less ton lots $1.30, eastern, freight allowed; $1.2075 and $1.3075 central; $1.229 and $1.329, western; spot add 5c.

Manganese-Boron: (Mang. 75% approx., boron 15-20%, iron 5% max., sil. 1.50% max. and carbon 3% max.), per lb. of alloy. Contract, ton lots, $1.89, less, $2.01, eastern, freight allowed; $1.903 and $2.023 central, $1.935 and $2.055 western, spot up 5c.

Nickel-Boron: (Bor. 15-18%, alum. 1% max., sil. 1.50% max., car. 0.50% max., iron 3% max., nickel, balance), per lb. of alloy. Contract, 5 tons or more, $1.90, 1 ton to 5 tons, $2.00; less than ton $2.10, eastern, freight allowed; $1.9125, $2.0125 and $2.1125, central; $1.9445, $2.0445 and $2.1445, western; spot same as contract.

Chromium-Copper: (Chrom. 8-11%, cu. 88-90%, iron 1% max., sil. 0.50% max.) contract, any quantity, 45c, eastern, Niagara Falls, N. Y., basis, freight allowed to destination, except to points taking rate in excess of St. Louis rate, to which equivalent of St. Louis rate will be allowed; spot, up 2c.

Vanadium Oxide: (Fused: Vanadium oxide 85-88%, sodium oxide, approx. 10% and calcium oxide approx. 2%, or Red Cake: Vanadium oxide 85% approx., sodium oxide, approx. 9% and water approx.

2.5%) Contract, any quantity, $1.10 eastern, freight allowed, per pound vanadium oxide contained; contract, carlots, $1.105, less carlots, $1.108, central; $1.118 and $1.133, western; spot add 5c to contracts in all cases.

Calcium metal; cast: Contract, ton lots or more $1.80, less, $2.30, eastern zone, freight allowed, per pound of metal; $1.809 and $2.309, Central, $1.849 and $2.349, western; spot up 5c.

Calcium-Manganese-Silicon: (Cal. 16-20%, mang. 14-18% and sil. 53-59%), per lb. of alloy. Contract, carlots, 15.50c, ton lots 16.50c and less 17.00c, eastern, freight allowed; 16.00c, 17.35c and 17.85c, central; 18.05c, 19.10c and 19.60c western; spot up .25c.

Calcium-Silicon: (Cal. 30-35%, sil. 60-65% and iron 3.00% max.), per lb. of alloy. Contract, carlot, lump 13.00c, ton lots 14.50c, less 15.50c, eastern, freight allowed; 13.50c, 15.25c and 16.25c central; 15.55c, 17.40c and 18.40c, western; spot up .25c.

Briquets, Ferromanganese: (Weight approx. 3 lbs. and containing exactly 2 lbs. mang.), per lb. of briquets. Contract, carlots, bulk .0605c, packed .063c, tons .0655c, less .068c, eastern, freight allowed; .063c, .0655c, .0755c and .078c, central; .066c, .0685c, .0855c and .088c, western; spot up .25c.

Briquets: Ferrochrome, containing exactly 2 lb. cr., eastern zone, bulk, c.l., 8.25c per lb. of briquets, 2000 lb. to c.l., 8.75c; central, add .3c for c.l. and .5c for 2000 lb. to c.l.; western, add .70c for c.l., and .2c for 2000 lb. to c.l.; **silicomanganese,** eastern, containing exactly 2 lb. manganese and approx. 1/2 lb. silicon, bulk, c.l., 5.80c, 2000 lbs. to c.l., 6.30c; central, add .25c for c.l. and 1c for 2000 lb. to c.l.; western, add .5c for c.l., and 2c for 2000 lb. to c.l.; **ferrosilicon,** eastern, approx. 5 lb., containing exactly 2 lb. silicon, or weighing approx. 2 1/2 lb. and containing exactly 1 lb. of silicon, bulk, c.l., 3.35c, 2000 lb. to c.l., 3.80c; central, add 1.50c for c.l., and .40c for 2000 lb. to c.l.; western, add 3.0c for c.l. and .45c for 2000 to c.l.; f.o.b. shipping point, freight allowed.

Ferromolybdenum: 55-75% per lb. contained molybdenum, f.o.b. Langeloth and Washington, Pa., furnace, any quantity 95.00c.

Ferrophosphorus: 17-19%, based on 18% phosphorus content, with unitage of $3 for each 1% of phosphorus above or below the base; gross tons per carload f.o.b. sellers' works, with freight equalized with Rockdale, Tenn.; contract price $58.50, spot $62.25.

Ferrosilicon: Eastern zone, 90-95%, bulk, c.l., 11.05c, 2000 lb. to c.l., 12.30c; 80-90%, bulk c.l., 8.90c, 2000 lb. to c.l., 9.95c; 75%, bulk, c.l., 8.05c, 2000 lb. to c.l., 9.05c; 50%, bulk c.l., 6.65c and 2000 lb. to c.l., 7.85c; central 90-95%, bulk, c.l., 11.20c, 2000 lb. to c.l., 12.80c; 80-90%, bulk, c.l., 9.05c, 2000 to c.l., 10.45c; 75%, bulk, c.l., 8.20c, 2000 lb. to c.l., 9.65c; 50% bulk, c.l., 7.10c, 2000 lb. to c.l., 9.70c; western, 90-95%, bulk, c.l., 11.65c, 2000 lb. to c.l., 15.60c; 80-90%, bulk, c.l., 9.55c, 2000 lb. to c.l., 13.50c; 75%, bulk, c.l., 8.75c, 2000 to c.l., 13.10c; 50%, bulk, c.l., 7.25c, 2000 to c.l., 8.75c; f.o.b. shipping point, freight allowed. Prices per lb. contained silicon.

Silicon Metal: Min. 97% silicon and max. 1% iron, eastern zone, bulk, c.l., 12.90c, 2000 lb. to c.l., 13.45c; central, 13.20c and 13.90c; western, 13.85c and 16.80c; min. 96% silicon and max. 2% iron, eastern, bulk, c.l., 12.50c, 2000 lb. to c.l., 13.10c; central, 12.80c and 13.55c; western, 13.45c and 16.50c f.o.b. shipping point, freight allowed. Prices per lb. contained silicon.

Manganese Metal: (96 to 98% manganese, max. 2% iron), per lb. of metal, eastern zone, bulk, c.l., 36c, 2000 lb. to c.l., 38c, central, 36.25c, and 39c; western, 36.55c and 41.05c; 95 to 97% manganese, max. 2.50% iron, eastern, bulk, c.l., 34c; 2000 c.l., 35c; central, 34.25c and 36c; western, 34.55c and 38.05c; f.o.b. shipping point, freight allowed.

Ferrotungsten: Carlots, per lb. contained tungsten, $1.90.

Tungsten Metal Powder: 98-99% per lb. any quantity $2.55-2.65.

Ferrotitanium: 40-45%, R.R. freight allowed, per lb. contained titanium; ton lots $1.23; less-ton lots $1.25; eastern. Spot up 5 cents per lb.

Ferrotitanium: 20-25%, 0.10 maximum carbon; per lb. contained titanium; ton lots $1.35; less-ton lots $1.40; eastern. Spot 5 cents per lb. higher.

High-Carbon Ferrotitanium: 15-20% contract basis, per gross ton, f.o.b. Niagara Falls, N. Y., freight allowed to destination east of Mississippi River and North of Baltimore and St. Louis, 6-8% carbon $142.50; 3-5% carbon $157.50.

Carbortam: Boron 0.90 to 1.15%, net ton to carload, 8c lb. F.O.B. Suspension Bridge, N. Y., frt. allowed same as high-carbon ferrotitanium.

Bortam: Boron 1.5-1.9%, ton lots 45c lb., less ton lots 50c lb.

Ferrovanadium: 35-55%, contract basis, per lb. contained vanadium, f.o.b. producers plant with usual freight allowances; open-hearth grade $2.70; special grade $2.80; highly-special grade $2.90.

Zirconium Alloys: 12-15%, per lb. of alloy, eastern, contract, carlots, bulk, 4.60c, packed 4.80c, ton lots 4.80c, less tons 5c, carloads bulk, per gross ton $102.50; packed $107.50; ton lots $108; less-ton lots $112.50. Spot 1/4c per ton higher.

Zirconium Alloy: 35-40%, Eastern, contract basis, carloads in bulk or package, per lb. of alloy 14.00c; gross ton lots 15.00c; less-ton lots 16.00c. Spot 1/4 cent higher.

Alsifer: (Approx. 20% aluminum, 40% silicon, 40% iron) contract basis f.o.b. Niagara Falls, N. Y., per lb. 5.75c; ton lots 6.50c. Spot 1/2 cent higher.

Simanal: (Approx. 20% each Si., Mn., Al.) Contract, frt. all. not over St. Louis rate, per lb. alloy; carlots 8c; ton lots 8.75c; less ton lots 9.25c.

Borosil: 3 to 4% boron, 40 to 45% Si., $6.25 lb. cont. Bo., f.o.b. Philo, O., freight not exceeding St. Louis rate allowed.

OPEN MARKET PRICES, IRON AND STEEL SCRAP

Following prices are quotations developed by editors of STEEL in the various centers. For complete OPA ceiling price schedule refer to page 156 of Sept. 4, 1944, issue of STEEL. Quotations are on gross tons.

PHILADELPHIA:

(Delivered consumer's plant)

No. 1 Heavy Melt. Steel	$18.75
No. 2 Heavy Melt. Steel	18.75
No. 1 Bundles	18.75
No. 2 Bundles	18.75
No. 3 Bundles	16.75
Machine Shop Turnings	13.75
Mixed Borings, Turnings	13.75
Shoveling Turnings	15.75
No. 2 Busheling	15.50
Billet, Forge Crops	21.25
Bar Crops, Plate Scrap	21.25
Cast Steel	21.25
Punchings	21.25
Elec. Furnace Bundles	19.75
Heavy Turnings	18.25

Cast Grades

(F.o.b. Shipping Point)

Heavy Breakable Cast	16.50
Charging Box Cast	19.00
Cupola Cast	20.00
Unstripped Motor Blocks	17.50
Malleable	22.00
Chemical Borings	16.51

NEW YORK:

(Dealers' buying prices.)

No. 1 Heavy Melt. Steel	$15.33
No. 2 Heavy Melt. Steel	15.33
No. 2 Hyd. Bundles	15.33
No. 3 Hyd. Bundles	13.33
Chemical Borings	14.33
Machine Turning	10.33
Mixed Borings, Turnings	10.33
No. 1 Cupola	20.00
Charging Box	19.00
Heavy Breakable	16.50
Unstrip Motor Blocks	17.50
Stove Plate	19.00

CLEVELAND:

(Delivered consumer's plant)

No. 1 Heavy Melt. Steel	$19.50
No. 2 Heavy Melt. Steel	19.50
No. 1 Comp. Bundles	19.50
No. 2 Comp. Bundles	19.50
No. 1 Busheling	19.50
Mach. Shop Turnings	11.50-12.00
Short Shovel Turnings	13.50-14.00
Mixed Borings Turnings	11.50-12.00
No. 1 Cupola Cast	20.00
Heavy Breakable Cast	16.50
Cast Iron Borings	12.50-13.00
Billet, Bloom Crops	24.50
Sheet Bar Crops	22.00
Plate Scrap, Punchings	22.00
Elec. Furnace Bundles	20.50

BOSTON:

(F.o.b. shipping points)

No. 1 Heavy Melt. Steel	$14.06*
No. 2 Heavy Melt. Steel	14.06*
No. 1 Bundles	14.06*
No. 2 Bundles	14.06*
No. 1 Busheling	14.06*
Machine Shop Turnings	9.06
Mixed Borings, Turnings	9.06
Short Shovel, Turnings	11.06*
Chemical Borings	13.06*
Low Phos. Clippings	16.56*
No. 1 Cast	20.00
Clean Auto Cast	20.00
Stove Plate	19.00
Heavy Breakable Cast	16.50

*Inland base ceiling; Boston switching district price 99 cents higher.

PITTSBURGH:

(Delivered consumer's plant)

Railroad Heavy Melting	$21.00
No. 1 Heavy Melt. Steel	20.00
No. 2 Heavy Melt. Steel	20.00
No. 1 Comp. Bundles	20.00
No. 2 Comp. Bundles	20.00
Mach. Shop Turnings	14.00
Short Shovel, Turnings	16.00
Mixed Borings, Turnings	14.00
No. 1 Cupola Cast	20.00
Heavy Breakable Cast	16.50
Cast Iron Borings	16.00
Billet, Bloom Crops	25.00
Sheet Bar Crops	22.50
Plate Scrap, Punchings	22.50
Railroad Specialties	24.50
Scrap Rail	21.50
Axles	26.00
Rail 3 ft. and under	23.50
Railroad Malleable	21.00

VALLEY:

(Delivered consumer's plant)

No. 1 R.R. Hvy. Melt.	$21.00
No. 1 Heavy Melt. Steel	20.00
No. 1 Comp. Bundles	20.00
Short Shovel Turnings	14.00-14.50
Cast Iron Borings	13.00-13.50
Machine Shop Turnings	12.00-12.50
Low Phos. Plate	21.00-22.00

MANSFIELD, O.:

(Delivered consumer's plant)

Machine Shop Turnings	11.00-12.00

BIRMINGHAM:

(Delivered consumer's plant)

Billet, Forge Crops	$22.00
Structural, Plate Scrap	19.00
Scrap Rails, Random	18.50
Rerolling Rails	20.50
Angle, Splice Bars	20.50
Solid Steel Axles	24.00
Cupola Cast	20.00
Stove Plate	19.00
Long Turnings	8.50- 9.00
Cast Iron Borings	8.50- 9.00
Iron Car Wheels	16.50-17.00

CHICAGO:

(Delivered consumer's plant)

No. 1 R.R. Hvy. Melt.	$19.75
No. 1 Heavy Melt. Steel	18.75
No. 2 Heavy Melt. Steel	18.75
No. 1 Ind. Bundles	18.75
No. 2 Dir. Bundles	16.25-16.75
Baled Mach. Shop Turn.	16.25-16.75
No. 3 Galv. Bundles	14.25-14.75
Machine Turnings	9.00- 9.50
Mix. Borings, Sht. Turn.	9.00- 9.50
Short Shovel Turnings	9.00- 9.50
Cast Iron Borings	9.00- 9.50
Scrap Rails	20.25
Cut Rails, 3 feet	22.25
Cut Rails, 18-inch	23.50
Angles, Splice Bars	22.25
Plate Scrap, Punchings	21.25
Railroad Specialties	22.75
No. 1 Cast	20.00
R.R. Malleable	22.00

(Cast grades f.o.b. shipping point, railroad grades f.o.b. tracks)

BUFFALO:

(Delivered consumer's plant)

No. 1 Heavy Melt. Steel	$19.25
No. 2 Heavy Melt. Steel	19.25
No. 1 Bundles	19.25
No. 2 Bundles	19.25
No. 1 Busheling	19.25
Machine Turnings	12.75-13.25
Short Shovel Turnings	14.75-15.25
Mixed Borings, Turn.	12.75-13.25
Cast Iron Borings	13.75-14.25
Low Phos.	21.75

DETROIT:

(Dealers' buying prices)

Heavy Melting Steel	$17.32
No. 1 Busheling	17.32
Hydraulic Bundles	17.32
Flashings	17.32
Machine Turnings	9.00- 9.50
Cast Iron Borings	10.00-10.50
Short Turnings	11.00-11.50
Low Phos Plate	19.82
No. 1 Cast	20.00
Heavy Breakable Cast	13.50-14.00

ST. LOUIS:

(Delivered consumer's plant)

Heavy Melting	$17.50
No. 1 Locomotive Tires	20.00
Misc. Rails	19.00
Railroad Springs	22.00
Bundled Sheets	17.50
Axle Turnings	17.00
Machine Turnings	7.50- 8.50
Rerolling Rails	21.00
Steel Car Axles	21.50-22.00
Steel Rails, 3 ft.	21.50
Steel Angle Bars	21.00
Cast Iron Wheels	20.00
No. 1 Machinery Cast	20.00
Railroad Malleable	22.00
Breakable Cast	16.50
Stove Plate	19.00
Grate Bars	15.25
Brake Shoes	15.25

(Cast grades f.o.b. shipping point)

Stove Plate	18.00

CINCINNATI:

(Delivered consumer's plant)

No. 1 Heavy Melt. Steel	$18.50
No. 2 Heavy Melt. Steel	18.50
No. 1 Comp. Bundles	18.50
No. 2 Comp. Bundles	18.50
Machine Turnings	7.50- 8.00
Shoveling Turnings	9.50-10.00
Cast Iron Borings	9.50-10.00
Mixed Borings, Turnings	8.50- 9.00
No. 1 Cupola Cast	20.00
Breakable Cast	16.50
Low Phosphorus	21.00-21.50
Scrap Rails	20.50-21.00
Stove Plate	16.00-16.50

LOS ANGELES:

(Delivered consumer's plant)

No. 1 Heavy Melt. Steel	$14.00
No. 2 Heavy Melt. Steel	13.00
No. 1, 2 Deal. Bundles	12.00
Machine Turnings	4.50
Mixed Borings, Turnings	4.00
No. 1 Cast	20.00

SAN FRANCISCO:

(Delivered consumer's plant)

No. 1 Heavy Melt. Steel	$15.50
No. 2 Heavy Melt. Steel	14.50
No. 1 Busheling	15.50
No. 1, No. 2 Bundles	13.50
No. 3 Bundles	9.00
Machine Turnings	6.90
Billet, Forge Crops	15.50
Bar Crops, Plate	15.50
Cast Steel	15.50
Cut Structural, Plate, 1", under	18.00
Alloy-free Turnings	7.50
Tin Can Bundles	14.50
No. 2 Steel Wheels	16.00
Iron, Steel Axles	23.00
No. 2 Cast Steel	15.00
Uncut Frogs, Switches	16.00
Scrap Rails	16.00
Locomotive Tires	16.00

NONFERROUS METAL PRICES

Copper: Electrolytic or Lake from producers in carlots 12.00c, Del. Conn., less carlots 12.12½c, refinery; dealers may add ¾c for 5000 lbs. to carload; 1000-4999 lbs. 1c; 500-999 1½c; 0-499 2c. Casting, 11.75c, refinery for 20,000 lbs., or more, 12.00c less than 20,000 lbs.

Brass Ingot: Carlot prices, including 25 cents per hundred freight allowance; add ¼c for less than 20 tons; 85-5-5-5 (No. 115) 13.00c; 88-10-2 (No. 215) 16.50c; 80-10-10 (No. 305) 15.75c; Navy G (No. 225) 16.75c; Navy M (No. 245) 14.75c; No. 1 yellow (No. 405) 10.00c; manganese bronze (No. 420) 12.75c.

Zinc: Prime western 8.25c, select 8.35c, brass special 8.50c, intermediate 8.75c, E. St. Louis, for carlots. For 20,000 lbs. to carlots add 0.15c; 10,000-20,000 0.25c; 2000-10,000 0.40c; under 2000 0.50c.

Lead: Common 6.35c, chemical, 6.40c, corroding, 6.45c, E. St. Louis for carloads; add 5 points for Chicago, Minneapolis-St. Paul, Milwaukee-Kenosha districts; add 15 points for Cleveland-Akron-Detroit area, New Jersey, New York state, Texas, Pacific Coast, Richmond, Indianapolis-Kokomo; add 20 points for Birmingham, Connecticut, Boston-Worcester-Springfield, New Hampshire, Rhode Island.

Primary Aluminum: 99% plus, ingots 15.00c del., pigs 14.00c del.; metallurgical 94% min. 13.50c del. Base 10,000 lbs. and over; add ½c 2000-9999 lbs.; 1c less than 2000 lbs.

Secondary Aluminum: All grades 12.50c per lb. except as follows: Low-grade piston alloy (No. 122 type) 10.50c; No. 12 foundry alloy (No. 2 grade) 10.50c; chemical warfare service ingot (92½% plus) 10.00c; steel deoxidizers in notch bars, granulated or shot, Grade 1 (95-97½%) 11.00c, Grade 2 (92-95%) 9.50c to 9.75c, Grade 3 (90-92%) 8.50c to 8.75c, Grade 4 (85-90%) 7.50c to 8.00c; any other ingot containing over 1% iron, except PM 754 and hardness, 12.00c. Above prices for 30,000 lb. or more; add ¼c 10,000-30,000 lb.; ½c 1000-10,000 lbs.; 1c less than 1000 lbs. Prices include freight at carload rate up to 75 cents per hundred.

Magnesium: Commercially pure (99.8%) standard ingots (4-notch, 17 lbs.), 20.50c lb., add 1c for special shapes and sizes. Alloy ingots, incendiary bomb alloy, 23.40c; 50-50 magnesium-aluminum, 23.75c; ASTM B93-41T, Nos. 2, 3, 4, 12, 13, 14, 17, 23.00c; Nos. 4X, 11, 13X, 17X, 25.00c; ASTM B107-41T, or B-90-41T, No. 8X, 23.00c; No. 18, 23.50c; No. 18X, 25.00c. Selected magnesium crystals, crowns, and muffs, including all packing screening, barrelling, handling, and other preparation charges, 23.50c. Prices for 100 lbs. or more; for 25-100 lbs., add 10c; for less than 25 lbs., 20c. Incendiary bomb alloy, f.o.b. plant, any quantity; carload freight allowed all other alloys for 500 lbs. or more.

Tin: Prices ex-dock, New York in 5-ton lots. Add 1 cent for 2240-11,199 lbs., 1½c 1000-2239, 2½c 500-999, 3c under 500. Grade A, 99.8% or higher (includes Straits), 52.00c; Grade B, 99.8% or higher, not meeting specifications for Grade A, with 0.05 per cent maximum arsenic, 51.87½c; Grade C, 99.65-99.79% incl. 51.62½c; Grade D, 99.50-99.64% incl., 51.50c; Grade E, 99-99.49% incl. 51.12½c; Grade F, below 99% (for tin content), 51.00c.

Antimony: American, bulk carlots f.o.b. Laredo, Tex., 99.0% to 99.8% and 99.8% and over but not meeting specifications below, 14.50c; 99.8% and over (arsenic, 0.05%, max. and other impurities, 0.1%, max.) 15.00c. On producers' sales add ¼c for less than carload to 10,000 lb.; ½c for 9999-224-lb.; and 2c for 223 lb. and less; on sales by dealers, distributors and jobbers add ½c, 1c, and 3c, respectively.

Nickel: Electrolytic cathodes, 99.5%, f.o.b. refinery 35.00c lb.; pig and shot produced from electrolytic cathodes 36.00c; "F" nickel shot or ingot for additions to cast iron, 34.00c; Monel shot 28.00c.

Mercury: OPA ceiling prices per 76-lb. flask f.o.b. point of shipment or entry. Domestic produced in Calif., Oreg., Wash., Idaho, Nev., Ariz., $191; produced in Texas, Ark. $193. Foreign, produced in Mexico, duty paid, $193. Open market, spot, New York, nominal for 50 to 100 flasks; $165 to $168 in smaller quantities

Arsenic: Prime, white, 99%, carlots, 4.00c lb.

Beryllium-Copper: 3.75-4.25% Be., $17 lb. contained Be.

Cadmium: Bars, ingots, pencils, pigs, plates, rods, slabs, sticks and all other "regular" straight or flat forms 90.00c lb., del.; anodes, balls, discs and all other special or patented shapes 95.00c lb. del.

Cobalt: 97-99%, $1.50 lb. for 550 lb. (bbl.); $1.52 lb. for 100 lb. (case); $1.57 lb. under 100 lb.

Indium: 99.9%, $7.50 per troy ounce.

Gold: U. S. Treasury, $35 per ounce.

Silver: Open market, N. Y. 44.75c per ounce.

Platinum: $35 per ounce.

Iridium: $165 per troy ounce.

Palladium: $24 per troy ounce.

Rolled, Drawn, Extruded Products

(Copper and brass product prices based on 12.00c, Conn., for copper. Freight prepaid on 100 lbs. or more.)

Sheet: Copper 20.87c; yellow brass 19.48c; commercial bronze, 90% 21.07c, 95% 21.28c; red brass, 80% 20.15c, 85% 20.36c; phosphor bronze, Grades A and B 5% 36.25c; Everdur, Herculoy, Duronze or equiv. 26.00c; naval brass 24.50c; manganese bronze 28.00c; Muntz metal 22.75c; nickel silver 5% 26.50c.

Rods: Copper, hot-rolled 17.37c, cold-rolled 18.37c; yellow brass 15.01c; commercial bronze 90% 21.32c, 95% 21.53c; red brass 80% 20.40c, 85% 20.61c; phosphor bronze Grade A, B 5% 36.50c; Everdur, Herculoy, Duronze or equiv. 25.50c; Naval brass 19.12c; manganese bronze 22.50c; Muntz metal 18.87c; nickel silver 5% 26.50c.

Seamless Tubing: Copper 21.37c; yellow brass 22.23c; commercial bronze 90% 23.47c; red brass 80% 22.80c, 85% 23.01c.

Extruded Shapes: Copper 20.87c; architectural bronze 19.12c; manganese bronze 24.00c, Muntz metal 20.12c; Naval brass 20.37c.

Angles and Channels: Yellow brass 27.98c; commercial bronze 90% 29.57c, 95% 29.78c; red brass 80% 28.65c, 85% 28.86c.

Copper Wire: Soft, f.o.b. Eastern mills, carlots 15.37½c, less-carlots 15.87½c; weatherproof, f.o.b. Eastern mills, carlots 17.00c, less-carlots 17.50c; magnet, delivered, carlots 17.50c, 15,000 lbs. or more 17.75c, less carlots 18.25c.

Aluminum Sheets and Circles: 2s and 3s, flat, mill finish, base 30,000 lbs. or more; del.; sheet widths as indicated; circle diameters 9" and larger:

Gage	Width	Sheets	Circles
.249"-7	12"-48"	22.70c	25.20c
8-10	12"-48"	23.20c	25.70c
11-12	26"-48"	24.20c	27.00c
13-14	26"-48"	25.20c	28.50c
15-16	26"-48"	26.40c	30.40c
17-18	26"-48"	27.90c	32.90c
19-20	24"-42"	29.80c	35.30c
21-22	24"-42"	31.70c	37.20c
23-24	3"-24"	25.60c	29.20c

Lead Products: Prices to jobbers; full sheets 9.50c; cut sheets 9.75c; pipe 8.15c, New York; 8.25c, Philadelphia, Baltimore, Rochester and Buffalo; 8.75c, Chicago, Cleveland, Worcester, Boston.

Zinc Products: Sheet f.o.b. mill, 13.15c; 36,000 lbs. and over deduct 7%. Ribbon and strip 12.25c, 3000-lb. lots deduct 1%, 6000 lbs. 2% 9000 lbs. 3%, 18,000 lbs. 4%, carloads and over 7%. Boiler plate (not over 12") 3 tons and over 11.00c; 1-3 tons 12.00c; 500-2000 lbs. 12.50c; 100-500 lbs. 13.00c; under 100 lbs. 14.00c. Hull plate (over 12") add 1c to boiler plate prices.

Plating Materials

Chromic Acid: 99.75%, flake, del., carloads 16.25c; 5 tons and over 16.75c; 1-5 tons 17.25c; 400 lbs. to 1 ton 17.75c; under 400 lbs. 18.25c.

Copper Anodes: Base 2000-5000 lbs., del.; oval 17.62c; untrimmed 18.12c; electro-deposited 17.37c.

Copper Carbonate: 52-54% metallic cu, 250 lb. barrels 20.50c.

Copper Cyanide: 70-71% cu, 100-lb. kegs or bbls. 34.00c f.o.b. Niagara Falls.

Sodium Cyanide: 96%, 200-lb. drums 15.00c; 10,000-lb. lots 13.00c f.o.b. Niagara Falls.

Nickel Anodes: 500-2999 lb. lots; cast and rolled carbonized 47.00c; rolled, depolarized 48.00c.

Nickel Chloride: 100-lb. kegs or 275-lb. bbls. 18.00c lb., del.

Tin Anodes: 1000 lbs. and over 58.50c, del.; 500-999 59.00c; 200-499 59.50c; 100-199 61.00c. **Tin Crystals:** 400 lb. bbls. 39.00c f.o.b. Grasselli, N. J.; 100-lb. kegs 39.50c.

Sodium Stannate: 100 or 300-lb. drums 36.50c, del.; ton lots 33.50c.

Zinc Cyanide: 100-lb. kegs or bbls.33.00c f.o.b. Niagara Falls.

Brass Mill Allowances: Prices for less than 15,000 lbs. f.o.b. shipping point. Add ⅝c for 15,000-40,000 lbs.; 1c for 40,000 lbs. or more.

Scrap Metals

	Clean Heavy	Rod Ends	Clean Turnings
Copper	10.250	10.250	9.500
Tinned Copper	9.625	9.625	9.375
Yellow Brass	8.625	8.375	7.875
Commercial bronze			
90%	9.375	9.125	8.625
95%	9.500	9.250	8.750
Red Brass, 85%	9.125	8.875	8.375
Red Brass, 80%	9.125	8.875	8.375
Muntz metal	8.000	7.750	7.250
Nickel Sil., 5%	9.250	9.000	4.625
Phos. br., A, B, 5%	11.000	10.750	9.750
Herculoy, Everdur or equivalent	10.250	10.000	9.250
Naval brass	8.250	8.000	7.500
Mang. bronze	8.250	3.000	7.500

Other than Brass Mill Scrap: Prices apply on material not meeting brass mill specifications and are f.o.b. shipping point; add ¾c for shipment of 60,000 lbs. of one group and ½c for 20,000 lbs. of second group shipped in same car. Typical prices follow:

(Group 1) No. 1 heavy copper and wire, No. 1 tinned copper, copper borings 9.75c; No. 2 copper wire and mixed heavy copper, copper tuyeres 8.75c.

(Group 2) soft red brass and borings, aluminum bronze 9.00c; copper-nickel and borings 9.25c; car boxes, cocks and faucets 7.75c; bell metal 15.50c; babbit-lined brass bushings 13.00c.

(Group 3) zincy bronze borings, Admiralty condenser tubes, brass pipe 7.50c; Muntz metal condenser tubes 7.00c; yellow brass 6.25c; manganese bronze (lead 0.00%-0.40%) 7.25c, (lead 0.41%-1.0%) 6.25c; manganese bronze borings (lead 0.00-0.40%) 6.50c, (lead 0.41-1.00%) 5.50c.

Aluminum Scrap: Prices f.o.b. point of shipment, respectively for lots of less than 1000 lbs.; 1000-20,000 lbs. and 20,000 lbs. or more, plant scrap only. Segregated solids: S-type alloys (2S, 3S, 17S, 18S, 24S, 32S, 52S) 9.00c, 10.00c, 10.50c; All other high grade alloys 8.50c, 9.50c, 10.00c; low grade alloys 8.00c, 9.00c, 9.50c. Segregated borings and turnings: Wrought alloys (17S, 18S, 32S, 52S) 7.50c, 8.50c, 9.00c; all other high grade alloys 7.00c, 8.00c, 8.50c; low grade alloys 6.50c, 7.50c, 8.00c. Mixed plant scrap, all solids, 7.50c, 8.50c, 9.00c; borings and turnings 5.50c, 6.50c, 7.00c.

Lead Scrap: Prices f.o.b. point of shipment. For soft and hard lead, including cable lead, deduct 0.55c from basing point prices for refined metal.

Zinc Scrap: New clippings, old zinc 7.25c f.o.b. point of shipment; add ½-cent for 10,000 lbs. or more: New die-cast scrap, radiator grilles 4.95c, add ½c 20,000 or more. Unsweated zinc dross, die cast slab 5.80c any quantity.

Nickel, Monel Scrap: Prices f.o.b. point of shipment; add ½c for 2000 lbs. or more of nickel or cupro-nickel shipped at one time and 20,000 lbs. or more of Monel. Converters (dealers) allowed 2c premium.

Nickel: 98% or more nickel and not over ½% copper 26.00c; 90-98% nickel, 26.00c per lb. nickel contained.

Cupro-nickel: 90% or more combined nickel and copper 26.00c per lb. contained nickel, plus 8.00c per lb. contained copper; less than 90% combined nickel and copper 26.00c for contained nickel only.

Monel: No. 1 castings, turnings 15.00c; new clipping 20.00c; soldered sheet 18.00c.

Sheets, Strip . . .

Sheet & Strip Prices, Page 176

Sheet demand shows no sign of slackening and cancellations in response to the WPB appeal have not yet developed to important degree. Little hot-rolled material is available before September, most makers being sold into fourth quarter. In cold-rolled some mills can offer nothing before December and some are sold for the year. Stainless sheets can be bought for June and July. Urgent sheet needs can be met only by directives, which are being used more sparingly than recently.

New York — While demand is still heavy, a little less pressure is being noted in sheets. Cancellations of tonnage not needed, in line with the War Production Board's recent request, have so far been relatively few in this district. However, trade leaders believe that within another two weeks or so there will be considerable response to this appeal, which was the first of this kind in almost two years, or since the WPB inaugurated its share-your-steel drive.

Meanwhile, delivery schedules are more extended. A few producers still have a little hot-rolled, in lighter gages, available for shipment in September, but most sellers are now well sold into fourth quarter. This also is true of cold-rolled sheets, various sellers having nothing to offer before December and in a few instances are actually sold out for the year. Galvanized sheet deliveries are now generally being quoted for fourth quarter, with only some scattered tonnage available in September, and with at least two sellers having nothing to offer before February. Stainless steel sheets are being quoted for shipment in late June and July.

Silicon sheet deliveries cover a wide range, with high-silicon grades available in September in hot-rolled and in November in cold-rolled. Much of the high-silicon cold-rolled sheets are going into radar work. Deliveries on low-silicon sheets are even more extended, with hot-rolled being offered in late October and November and cold-rolled in at least one or two instances in January and February.

Substantial tonnage has been placed recently for insecticide bombs. Until recently hot-rolled sheets were purchased for these bombs because of better deliveries but practically all orders now for this purpose are for cold-rolled sheets because of their better drawing qualities. Substantial tonnage of heavy gage hot-rolled sheets is now being figured for bolted oil tanks, some running up to as high as 1000 barrels capacity. These tanks are for the armed forces, with the program extending over a period of five months.

Chicago — The sheet situation grows more critical. Vacancies created by cancellations must be held for filling by WPB. Urgent requirements can be met only by directives, which already are so numerous as to upset mill schedules badly. Cancellations are in small volume, making the outlook doubtful for about 250,000 tons which the government has not succeeded in placing. One district sheetmaker has booked nearly 19,000 tons of 10-gage hot-rolled sheets for landing mats from a local fabricator, with delivery scheduled in fourth quarter this year and first quarter, 1946. An additional 15,000 tons from the same source, needed for earlier delivery, could not be accepted by this mill.

Cincinnati — Ohio river flood to a higher stage than originally anticipated also caused loss of more steel output and more sheet tonnage than by initial estimates. Andrews Steel Co., Newport, has not yet resumed and some other curtailments were the result of precautions, absenteeism, and transportation difficulties. Despite check on directives, mill schedules are loaded to December on hot-rolled, November on cold-rolled. Small tonnages of galvanized and long ternes are available for August delivery.

St. Louis — Heavy sheet demand continues but producers believe declining shipbuilding activity will release some capacity from plates by the end of June. Manpower shortage, estimated at 20 to 30 per cent, is worse rather than better, and is shown particularly in maintenance, causing unusual delays. Directives on sheets and strip are increasing and upsetting schedules further. WPB is canvassing mills in an effort to obtain open tonnage for needed items without directives. Indications are for a better situation soon.

Pittsburgh — There is apparently no hope for early reshuffling of the sheet situation which might lead to a more equitable distribution. Mills have made little if any gains against the backlog, and shipments are about 30 days behind schedule at most points. The freeze order may help but it is too early to have

had any effect. Cancellations at the moment are practically nonexistent. Substantial tonnage is taking advantage of the extended period now permitted, and placements for March, 1946, are on the increase.

Cleveland — Demand for strip and sheets continues heavy although the number of directives has declined. As an alternative mills are referring claimant agencies to the WPB Steel Division, for it is recognized as the only source of complete information on the overall picture. Some sellers still promise late third quarter delivery on hot and cold-rolled sheets, but in most instances schedules are extended into November, and on galvanized into first quarter, 1946.

Steel Bars . . .

Bar Prices, Page 176

Pressing needs of arms and ammunition programs are extending delivery dates on steel bars, notably on larger sizes, with deliveries on smaller rounds also going further into the future. Cold-drawn material is most extended, partially due to difficulty in obtaining hot-rolled carbon material. Alloy bars are less delayed than carbon bars. Deliveries on carbon bars range from August to the end of the year.

New York — Cold-drawn bar processors are quoting late in the year on larger rounds. This is ascribed not only to heavy requirements for certain programs, such as rockets, but also to difficulty in getting hot carbon bars because of demand for heavy artillery shells. It appears that cold drawers are having difficulty promising anything larger than 1¼ inch rounds before late in fourth quarter, at least as far as carbon bars are concerned.

At the same time promises on smaller sizes are well extended, due in particular to demands from the bearing industry and from manufacturers of gun parts and shell and bomb components. The small arms ammunition program is being accelerated and is taking considerably more small bessemer stock. Most promises on medium and small sizes run late in third quarter, and in some cases even beyond. Alloy drawn bar schedules are not quite so extended, even some of the larger specifications being available as early as August. However, backlogs are still accumulating, especially as a result of demands from the aircraft industry.

Hot carbon bar deliveries run generally from August to late in the year, depending much upon size and the position of individual mills.

Boston — Although more extended, alloy bars are available ahead of carbon on most sizes, but the gap has narrowed. Buying has eased from the recent peak, which involved directives; fabricators have covered against war contracts, which are less in number. Filling steel requirements to meet new contracts is difficult with mill deliveries well into third quarter, warehouses are in a less favorable position to meet demands with inventories unbalanced and distributors are pressing for deliveries. Although a substantial part of the shell program takes seamless tubing, shell steel deliveries will be notably heavier next quarter. Forge shop consumption is near the limit of manpower. Considerable bar tonnage is on mill books without directives for third quarter delivery, but how much of this can be eliminated is questionable for most is tied directly into urgent war programs.

Chicago — Bar situation, both carbon and alloy, becomes more complicated, due partly to heavy overall demand, and partly to growing pressure of the shell and rocket program. Reports are heard of plans for installing additional shell and rocket making facilities. It is estimated that about 10 per cent of steel capacity for second quarter is earmarked for these essential military items.

St. Louis — Pressure for merchant bars is unrelieved and capacity is covered by directives, with no improvement in sight. Increased needs for the bomb program are expected. Frequent changes by the Army and Navy in types of munitions tends to upset schedules.

Philadelphia — Mill deliveries on alloy bars continue to expand. Most producers now can promise little before August on electric furnace alloys and little before September and October on open-hearth alloys. On some larger sizes some producers are booked well over the remainder of the year on open-hearth grades.

Pittsburgh — Continued flow of new business builds backlogs higher on all mills. Little tonnage is available for the balance of this year in most items, with large rounds and cold-finished probably in the worst shape. Cold-finished bar situation has been aggravated by new long term procurement of fuse parts for artillery and bombs, with the result that screw machine operators holding these long term contracts have found it difficult or impossible to place their require-

ments on cold-finished bars.

Cleveland — Most steel requirements for rockets, heavy shells, large trucks and tanks is centered in special alloys and carbon hot-topped steels. Large rounds are obtainable only in late fourth quarter, while in a few instances producers are booked solidly into next year.

Steel Plates . . .

Plate Prices, Page 177

March plate production, estimated at more than 800,000 tons, is expected to be the largest of the year, diminution after the middle of the year being foreseen. Maritime Commission needs are dwindling and navy requirements, while large, are spread over several months. Strip mills are being progressively relieved of their plate load to resume sheet and strip production as labor becomes available for that purpose.

New York — Plate production this month, well over 800,000 tons, should be the heaviest for the year, in the opinion of trade leaders. Output during the ensuing three months should not be far below, probably averaging around 800,000 tons, but there is little likelihood of any one of the three months equaling current output. Prospects for the last half are for still lower average. This is expected particularly in view of the drop in maritime work which is likely to develop by that time. The Maritime Commission's requirements in second quarter should not run much more than 650,000 tons, whereas its needs in the third quarter may not amount to more than a third that amount.

Miscellaneous demands also are expected to taper, although navy requirements may be sustained for a while. The latest naval program involving 83 combat ships will require a substantial tonnage. However, the program extends over so many months, running until the end of 1947, according to present schedules, that tonnage will be spread out rather thinly.

Meanwhile an increasing tonnage is being diverted from strip mills to regular plate producers, as fast as adequate manpower is available to conduct the additional processing that is required on sheets and strip. It is estimated in some quarters now that not more than about 150,000 tons of plates are being produced monthly on strip mills at this time. This would represent a drop of more than 400,000 tons from the peak of plate production on strip mills, reached possibly late last spring or early summer, a peak that represented almost half the plate tonnage then produced.

Whereas early in the year, when the Maritime Commission's latest program of 226 ships was inaugurated, it was expected that the peak of plate requirements would be reached in March with a sharp decline in the schedules for the remaining five months which the program had to run, it now appears that rolling of these plates for at least the remainder of this half will be on a more graduated scale, with less of this particular tonnage being rolled in March than originally expected and more in the succeeding months. At one time recently there was talk of an additional program of 200 ships being formulated However, all signs at present point to this second program being dropped.

Boston — Slackening demand for plates for shipbuilding is not replaced in other directions; only yards with navy contracts promise sustained tonnage beyond second quarter. Others have mill orders for completion of current contracts and buying has slowed materially, including repair tonnage. Industrial demand, including heavy fans, blowers and electrical equipment, is fairly well sustained. Structural fabricating shops, with one or two exceptions having navy subcontracts, are taking few plates; deliveries range from June into third quarter, but pressure has eased materially.

Pittsburgh — Despite the fact that most shipyards have reduced tonnage commitments considerably, a fairly large volume of plate tonnage is coming in. January plate production is reported only slightly better than 50 per cent of capacity and February on about the same level. This represents augmented capacity and all stripsheet mills are now off the plate program and trying to make headway against the heavy backlogs of light-gage flat-rolled products. This reduces substantially the potential plate capacity, but nevertheless total plate demand could be increased somewhat without requiring the use of any sheet mills.

St. Louis — Virtually all plate capacity continues devoted to shipbuilding, plus much of the converted sheet mill capacity. Expectation is that by the end of June the situation will be better and deliveries will not be extended so far. At present mills are sold practically for the entire year. Lack of labor is appar-

ent in plate mills, one plant now employing 1500 reporting need for 500 more workers. With mills pressed to capacity maintenance is difficult with present crews, causing delays from breakdowns.

Chicago — At its present level, plate production is causing no serious trouble. Schedules are comfortable, as compared with a year ago, and new shipbuilding programs are of relatively small size and sufficiently spread over this year and next as not to be aggravating. However, plate load has not yet receded to the point where any considerable amount of continuous mill capacity can be utilized for rolling sheets. Plate situation here has been helped to some extent by transfer of some orders to less heavily booked mills in other districts.

Philadelphia — While down substantially from the alltime peak of March, 1944, when 1,200,000 tons were produced plate production this month of possibly 850,000 tons is expected to be the highest this year, with third and fourth quarters dropping somewhat. The Navy has announced award of two 45,000-ton aircraft carriers to Newport News Shipbuilding & Dry Dock Co., Newport News Va., two 27,500-ton carriers to Norfolk yard and eight escort aircraft carriers to the Henry Kaiser yard at Vancouver, Wash. Several hundred tons of plates have been placed for 50 steam locomotives for the Pennsylvania railroad. Plates can be had for June delivery, though one large producer is sold solidly into July.

Wire . . .

Wire Prices, Page 177

Chicago — Shortage of cement coated nails, used in crating and boxing, has become so acute that in some instances shipments of vital war goods are being held up. Demand for barbed wire and fencing exceeds available supply.

Boston — There is slight, if any, downtrend in orders to wire mills. Bookings still exceed production and shipments, with backlogs growing. Directives are fewer and tonnage is being fitted into schedules under a new alignment series designated as Series 5, Series 10 and Series 20. The lower series is most urgent, affecting spot tonnage, and tops everything. Music wire demand for spring material is heavy, as well as for products which have replaced Swedish steel under war pressure, such as razor blade steel, valve spring wire and piston springs. Alloy demand for aircraft is strong, including jet propulsion types, which is stimulating alloy demand in other shapes.

New York — Although most available capacity for tire, rope and signal corps wire has been filled additional space is sought for all three on continuing directives, although directives applying against new tonnage are less in evidence. New orders are unabated and exceed capacity in numerous sizes. More volume is filling third quarter schedules and several producers name September and October for rod deliveries. Schedule revisions growing out of elimination of nonvalid tonnage are minor and most CMP tonnage crowded out remains so or is included in carryovers.

Tin Plate . . .

Tin Plate Prices, Page 177

Washington — Second quarter allocation of steel for the can industry will be considerably less than requested, War Production Board officials told members of the Can Manufacturers' Industry Advisory Committee, last week.

WPB has allocated 591,500 tons of prime steel plate and 15,000 tons of rejects for second quarter. The industry requested more than 700,000 tons of prime plate for the quarter.

Committee members pointed out that the allocation would not provide sufficient steel for manufacture of new cans permitted under amendment of Order M-51, dated Jan. 1, and that the steel possibly would be insufficient for manufacture of some other cans for military and essential food.

Military requirements for cans this year are substantially larger than in 1944 and tax industry's facilities and the steel supply, committee members said. They pointed out that the armed forces specify sanitary cans for a number of additional food items, including coffee, spices, lard and cereals. Because of the burden on facilities of large manufacturers equipped to produce sanitary cans, some committee members suggested changing specifications to permit packing these items in cans which smaller manufacturers are equipped to make.

Chicago — Box cars received by tin plate makers has improved to the extent that imminent danger of reduction of tinning operations through exhaustion of storage space is removed temporarily. Included in the cars were a number headed for the grain belt but set off to

take tin plate moving in the same direction. It is doubted, however, if these facilities will be available in the future, for Association of American Railroads announced that effective March 10 such diversion could no longer be made without Army-Navy approval. Feeling is that such approval will not be forthcoming unless an immediate shutdown of plant operations is at hand.

Pittsburgh — Reduction from 900,000 tons in first quarter allotment to slightly less than 600,000 tons in second quarter will probably cut into some food packs and will certainly prevent packaging plans of some buyers who had intended to change from present substitute packages. There will probably be a cut in electrolytic operations as the volume of light coating business drops off. Current operating rates on electrolytic lines are somewhat better than 50 per cent of capacity, against 70 per cent on hot-dipped plate. During the second quarter this spread is almost certain to be increased.

Bolts, Nuts . . .

Bolt, Nut, Rivet Prices, Page 177

New York — Heavy demand continues for bolts and nuts, for loading pallets, prefabricated houses, bolted tanks and sheet metal assemblies of various descriptions. At present there is an inquiry for 18,000,000 bolts of one size for bolted tank assemblies for the armed forces.

Bolt and nut makers are booked 12 to 14 weeks on small sizes, reflecting an increase in backlogs over the past few weeks. About the only items in which there is any particular lag are heavy construction bolts, and here the situation is expected to improve sharply if easing in war demand permits civilian building construction to go ahead.

Bolt and nut makers are severely handicapped by shortage of labor, with most operating on single turns and overtime schedules. Bar supply also has tightened considerably. Shipments originally due in February are now being promised in April in some cases and on new specifications late third quarter appears to be about the best that can be done.

Rails, Cars . . .

Track Material Prices, Page 177

New York — Car buying is featured by placing 1000 fifty-ton hopper cars by the Carolina, Clinchfield & Ohio, and 1500 box cars by the National Railways of Mexico, both orders going to American Car & Foundry Co. Argentina State Railways are inquiring for 600 thirty-five-ton box cars.

While new orders are being entered, car builders are being forced to readjust their schedules, due to the recent curtailment in steel allocations for second quarter. Little or no tonnage is being cancelled as a result of this curtailment, but rather is simply being postponed.

Structural Shapes . . .

Structural Shape Prices, Page 177

New York — Structural inquiry is more lively, including a few projects for early erection and some substantial postwar work. Of the earlier work are approximately 1000 tons for a pasteurizing plant for the Dairymen's League on the upper west side of Manhattan and a moderate tonnage for two navy warehouses in Bayonne, N. J., if steel is used instead of wood now considered. For postwar erection 4800 tons are being figured for a building for Best & Co., department store, at Fifty-first street and Fifth avenue. Metropolitan Life Insurance Co. has a postwar program involving three housing projects requiring 42,000 tons, 13,000 tons and 4000 tons, totaling 59,000 tons. This is said to have been tentatively placed with three fabricators. A 4000-ton addition to the Times building on West Forty-third street for postwar construction is also reported tentatively placed.

Philadelphia — Leading producers quote July on shapes with ship and shell work contributing principally to these more extended schedules. Building construction is limited, due to government restrictions.

Reinforcing Bars . . .

Reinforcing Bar Prices, Page 177

Pittsburgh — The order dated March 5 which makes it impossible for new billet mills to use excess steel in reinforcing bars has caused considerable confusion and if continued will cause some hardship as well as reducing overall tonnage. Rail mills report they are not in a position to take on the orders which would otherwise go to new billet mills and the answer apparently is that such orders will not be accepted. Rail mill tonnage in February was cut substantially from January, and the overall tonnage declined from some 78,000 tons in January to 43,000 tons in February.

Pig Iron . . .

Pig Iron Prices, Page 179

Better supply of pig iron is being received since transportation difficulties have lessened but inventories in most cases still are below the 30-day stock allowed by WPB. Shortage of scrap tends to cause heavier pig iron melt and pressure is exerted on producers to increase shipments. Second quarter buying is somewhat heavier than during first quarter.

New York — Continued improvement in weather contributes to a somewhat better movement in iron. However, there is still considerable pressure for nearby tonnage and demand for second quarter shipments well exceeds that for the current quarter. This is ascribed to scarcity of scrap, especially cast. District foundries in general have little on hand and see no signs of early improvement. Pig iron producers also are confronted by increasing demand for basic as well as foundry grades.

Boston — While the most acute period in pig iron supply seems to have passed consumers are making headway slowly in building up to the 30-day inventory limit, notably in malleable and basic. Buying for early second quarter delivery is crowding furnace schedules; producers stocks of iron are non-existent in most wanted analyses. With depletion of district furnace stocks of basic, approximately 15,000 tons a month will be required from outside units for an uncertain period. Water shipments to some melters, notably Bridgeport, Conn., are expected to start next month, but a shortage of barges, which retarded movement last season, again looms. That more tonnage was not lost because lack of iron during the recent critical weeks is fortunate; numerous foundries and at least two steel works were on the verge of reducing operations and there have been minor schedule revisions.

Buffalo — With marked improvement in the railroad situation, pig iron producers are in better position for next quarter. Movement to the New England and seaboard areas is back to what might be considered normal for a wartime period. Sellers report no difficulty loading their books with orders sufficient to maintain capacity operations, as far as manpower permits.

Cincinnati — Second quarter pig iron buying has picked up, most melters contracting for three months and for tonnage about the same as for current quarter. A flood-induced rail embargo brought a critical supply situation to some foundries, borrowing enabled some to avoid a shutdown. The melt was off sharply for two weeks.

St. Louis — Pig iron demand is strong and supply limited. Larger mills have been able to obtain all the iron they needed by WPB allocations, but some smaller concerns are in less firm position, with stocks below the 30-day allowance. Strike of molders has closed seven foundries, all engaged in war production. WPB denial of a wage increase of five cents per hour was the cause.

Chicago — Although pig iron is the tightest for months, foundries are more concerned over coke than iron. Flood conditions in southern Ohio have put more strain on otherwise heavily burdened cokemakers in this district. Insufficient or improper type car equipment also complicates shipments. Foundries are getting along fairly well with the new 30-day iron inventory imposed recently, partly because some were already below this level. Manpower has improved recently in some spots, but reports are now filtering in of needed workers being taken for military service.

Philadelphia — Although movement is slightly better consumers still press hard for pig iron, reflecting particularly shortage of scrap. Many foundries have little or no cast scrap and look to pig iron to supply most raw material. Steel mills get more adequate supply but still require more pig iron than normally.

Pittsburgh — Flood conditions here and downriver caused a slight interruption in blast furnace operations and the tonnage loss will further aggravate the situation. Neither furnaces nor consumers have been holding stocks up to the allowable limit, and in most cases the gap is less than a week. If furnaces could continue operations on the present basis, it is probable that they would be able to prevent serious shortage. At present 44 stacks out of 50 are in blast here and most of the idle units are down for lack of manpower.

Cleveland — Foundry operations continue to improve. Foundry stocks of pig iron are well under the 30-day limitation. However, inventories have tended to become better balanced lately, with only one out of 14 stacks in this district now idle. Extent of second quarter contracting to date indicates little change from first quarter.

Scrap . . .

Scrap Prices, Page 180

Scrap, notably cast grades and heavy melting steel, is fairly scarce and melters continue to use material from reserves. Allocations are being used to supply some important users. Turnings are in excess supply and prices on these and similar grades are the only ones below ceilings. Melters in general are using more pig iron than normal in absence of full scrap supply. Lack of labor hampers collection and preparation.

Chicago — Scrap volume is not heavy even for open-hearth, electric furnace and foundry grades. Principal items command ceiling price, and consumers buy only to keep inventories stable. Weakness in baled machine shop turnings at $16.25 to $16.75 has pulled No. 2 dealer bundles down to the same level, but quantity of the latter is comparatively light. Turnings and boringss are weaker at $9 to $9.50, but can be shipped east at $10 on tracks and some are consigned there despite the hazard of rejection difficulties. Easing in price on No. 2 heavy melting steel develops to be nothing more than talk. All grades of cast scrap continue scarce.

Philadelphia — To ease shortage of melting steel scrap permission has been granted by Washington to some mills to purchase low phos scrap, which is in somewhat freer supply, which until recently was reserved for electric furnace operators. Improve weather has eased the situation slightly though little headway has been made in building up inventories, even though they have used far more turnings than in the past. Cast scrap is critical. Demolition work is negligible, with the scrap industry unable to obtain a critical manpower rating.

Pittsburgh — With improvement in weather and better distribution of cars has come an increase in yard scrap here. Mill demand for all grades is heavy but the tonnage now moving is better than a month ago. Cast scrap is still scarce, and turnings plentiful, although there has been no further weakening in price. Sales have been made on both long and short turnings and boring at $1 to $1.50 below ceiling. There has been an upturn in industrial scrap from many sources as the increased military program begins to get under way. Plate scrap, however, has been reduced because several shipyards which have provided a large percentage of plate scrap here have reduced operations substantially.

Cleveland — Steel mills continue to deplete inventories and are unable to get replacements. Some dealers are reluctant to accumulate much tonnage as a precaution against a sharp price adjustment which would likely follow on the heels of V-E Day. Good open-hearth grades remain at ceiling price levels, but weakness in turnings persist with supply well in excess of demands.

Boston — Steelmaking scrap, notably heavy melting, arriving at consumer yards hardly balances current melt; acute shortage of cast continues. Yard scrap volume is restricted and shipyards are offering less although low phos is still available in fair-size lots. Light industrial material is freer, but alloy contamination crops out from time to time in bundles, affecting quality steel melts. Both carbon and alloy turnings are under ceilings at seaboard points. Forge shop scrap includes a relatively high portion of alloys. Despite efforts to guard against it, open-hearth operators are still confronted by alloy contamination.

Buffalo — Steelmaking scrap grades are scarce, dealers being short of workers and unable to obtain a guarantee clause on price in contracts. Collection is said to be hampered by low prices offered producers. Turnings from war plants are in heavy volume and prices are lower. Machine shop turnings are moving at $12.75 to $13.25, compared with $14.25 ceiling, and short shoveling turnings at $14.75 to $15.25, with ceiling of $16.25.

Cincinnati — Activity in iron and steel scrap is off sharply because of dislocations by high water. Many yards were hit, but will resume quickly. Rail deliveries in some areas were halted, and in a few cases material was diverted to other districts. Dealers and brokers are beset by demand for good cast scrap and rails appear tighter. Supplies of turnings continue excessive, with the price weak.

St. Louis — All scrap grades are scarce, with prices at ceiling, except machine shop turnings. Most melters are cutting into reserves, which now are estimated at about five weeks supply. Bad weather has limited shipments, giving hope of an early improvement with spring. Normal supply is not expected until the labor situation improves. Heavy melting steel is in strongest demand, only WPB allocations preventing serious shortage for large steelmakers. Two major war plants have put about 3000 tons of turnings on the market recently.

Los Angeles — Steelmakers are using larger proportion of scrap, with premium shipyard grades plentiful for local use as well as for shipment east. WPB spokesmen say this section is well supplied because of ship construction, one large yard providing about 6500 tons per month. Prices are steady, below ceilings. Less shipbuilding activity causes speculation as to the result of smaller supply from this source.

Warehouse . . .

Warehouse Prices, Page 178

St. Louis — Demand on warehouse stocks is heavy and assortments are low. Needs for navy rocket and mortar shells have increased and prompt material is sought from stock. Expected 25 per cent increase in warehouse allotments has failed, WPB directives serving to supersede steel for that purpose, and have resulted in many carload orders from stock.

Cincinnati — Warehouse business has been disrupted by high water. Urgent tonnage was diverted to interests which continued deliveries. Some buyers also curtailed operations because of the emergency. Discounting the interruptions, it is certain that demand continues unabated, against dwindling stocks. The general supply situation is tighter than in many months.

Los Angeles — Alloy bars and sheets and galvanized sheets are scarce in local warehouses. Labor shortage is critical with draft threatening loss of many present employes. Mills claim unusually large sheet orders, with customers continually disappointed in shipments. New sheet jobbing houses are a current development, usually starting with surplus stocks they are able to buy.

Philadelphia — Jobber demand is expanding for the third consecutive month, mill shipments showing some improvement. A leading distributor reports receipts this month about 85 per cent of outgoing shipments, compared with 65 per cent average for two prior months.

Iron Ore . . .

Iron Ore Prices, Page 178

January production of iron ore in the United States totaled 2,468,961 gross tons, compared with 2,391,714 tons in December and 2,753,535 tons in January, 1944, according to the Bureau of Mines. January shipments were 1,181,786 tons, compared with 1,256,087 tons in December. Underground mines in the Lake Superior district continued operations during January and stocks in that area increased 36 per cent over December, totaling 4,524,685 tons at the end of the month. Stocks at all mines totaled 6,016,346 tons at the end of January, 26 per cent over December.

Nonferrous Metals . . .

Nonferrous Prices, Page 181

New York — Demand for copper exceeds the earlier war peak and indications are March and April deliveries will approach and probably exceed the 172,585 tons last month. With domestic production declining, domestic fabricators get most of requirements from foreign sources. Crude copper production, 67,425 tons in February, was the smallest since war started and 100,062 tons supplied was refined from foreign ores. Thus foreign arrivals and some

withdrawals from Metal Reserve Co. stocks helped meet record demand. Delivery of 175,000 tons in March is freely predicted, depending on manpower and transportation. April domestic output has been earmarked already and again reserves and foreign copper will give much aid. Expansions in brass mill fabricating capacity are being rushed, including new plant additions at Euclid, O., and Hammond, Ind., the latter a brass rod mill with capacity of 10,000 tons per month, to be operated by Phelps-Dodge Copper Products Corp. for Defense Plant Corp. Expansions also are under way for increased output of wire, tubing and strip. Meanwhile there is general tightening of controls on use of copper and other major nonferrous metals as increased needs for war production come out.

Steel in Europe . . .

London — (*By Radio*) — Heavy demand for railroad and colliery steel is encountered in Great Britain, with brisk buying of steel sheets insuring capacity production for several months. Early resumption in export trade in steel products is expected. Iron foundries are increasing activity.

Canada . . .

Toronto, Ont. — Under steadily increasing demand for steel, on war account, Ottawa officials are exercising rigid control over mill deliveries and have been cutting down on shipments to nonwar consumers. While car and locomotive builders have not been greatly affeced it is stated that there will be sharp reduction in allocation to the agricultural implement industry within the next two or three months. However, progress of the war in Europe may have some bearing on production of consumer goods and it is stated that in the event of an end of hostilities that Canada's war output will be cut by about 35 per cent.

While there has been some tapering off in demand for structural shapes on building account, largely due to new restrictions placed on this type of material by the steel controller, demand on shipbuilding account is developing on a broader scale and fabricators now are assured of capacity operations for some months.

Little change is reported in merchant pig iron, with sales holding at approximately 10,000 tons. Of this total, basic iron accounted for about 1500 tons; malleable iron 5000 tons and foundry iron 3500 tons. While a few melters show interest in forward delivery most are satisfied to order as deliveries dictate, with the result that most orders call for lots of 100 to 200 tons. Pig iron production is being maintained at approximately 67 per cent of capacity and supply appears to be in excess of actual demand.

Scrap receipts show slow but steady improvement, with some dealers reporting deliveries from outside points, although most of the material continues to come from war plants in the immediate Toronto area. Large scrap piles have been established in many rural communities and with improvement in weather, efforts are being made to prepare this for shipment. Deliveries to steel mills also have improved and it is estimated that mill receipts now are running about 40 per cent of actual requirement.

STRUCTURAL SHAPES . . .

STRUCTURAL STEEL PLACED

250 tons. aircraft products building for Heintz Mfg. Co., Philadelphia, to Bethlehem Fabricators, Bethlehem, Pa., through H. E. Baton Co., Philadelphia, general contractor.

STRUCTURAL STEEL PENDING

2000 tons, aviation storehouses, San Diego, Calif., for U. S. Navy.

1480 tons, inert storage buildings, Hastings, Neb., for U. S. Naval Ammunition Depot; bids March 14; Maxon Construction Co., Dayton, O., low.

1480 tons, inert storage buildings, McAllister, Okla., for U. S. Naval Ammunition Depot, bids March 20.

397 tons, highway bridge, federal aid road between Fontanelle and Nickerson, Neb., for state department of roads and irrigation; bids March 15.

250 tons, stacks, Southwark station, Philadelphia Electric Co.

130 tons, two plate girder spans, Reading Co., one near Conestoga, Pa., and the other near Guyencourt, Del.

REINFORCING BARS . . .

REINFORCING BARS PLACED

387 tons, factory building for Norwalk Tire & Rubber Co., Norwalk, Conn., to Fireproof Products Co., New York.

191 tons, powerplant, Clinton, Iowa, for Interstate Power Co., to Concrete Steel Co., Chicago; Sargent & Lundy, Chicago, engineers; bids March 12.

170 tons, car repair shops, Brainerd, Minn., for Northern Pacific railroad, to Truscon Steel Co., Youngstown, O.; bids Feb. 20.

160 tons, grain elevator, Bellevue, O., to Bethlehem Steel Co., Bethlehem, Pa.; James Stewart Corp., Chicago, contractor.

100 tons, Damericux Co., Fond du Lac, Wis., to Bethlehem Steel Co., Bethlehem, Pa.

100 ton, bridge over Elk river, Grove, Okla., to Sheffield Steel Corp., Kansas City, Mo.

REINFORCING BARS PENDING

4000 tons, Naval ordnance plant, McAlester, Okla.; bids Mar. 20.

3900 tons, also 325 tons wire mesh, inert storage buildings, Hastings, Neb., for U. S. Naval Ammunition Depot; bids March 14; Maxon Construction Co., Dayton, O., low.

3500 tons, also 325 tons wire mesh, inert storage buildings, McAllister, Okla., for U. S. Ammunition Depot; bids March 20.

3500 tons, Naval ordnance plant, Hastings, Nebr.; bids Mar. 14.

250 tons, Lee Rubber Co., Kansas City, Mo.

125 tons, test building, Lincoln plant, Ford Motor Co., Detroit.

100 tons, addition to Kingsbury ordnance plant, LaPorte, Ind.

100 tons, Algoma Plywood & Veneer Co., Algoma, Wis.

PIPE . . .

CAST IRON PIPE PENDING

350 tons, 15,000 feet 8-inch pipe, for Portland, Oreg., city stock supply; bids to G. W. Yates, city purchasing agent, March 21.

Unstated, 23,000 feet of 4, 6 and 8-inch water pipe for Marietta water district, Bellingham, Wash., cast iron or alternates; bids soon; Parker & Hill, Seattle, engineers.

RAILS, CARS . . .

RAILROAD CARS PLACED

Carolina, Clinchfield & Ohio, 1000 fifty-ton hopper cars, to American Car & Foundry Co., New York.

Chicago & Eastern Illinois, 10 passenger train cars, to Pullman-Standard Car Mfg. Co., Chicago, to be made up into two streamlined trains, with delivery dependent upon War Production Board authorization of their construction; the equipment will include one diner and one lunch car.

National Railways of Mexico, 1500 box cars, to American Car & Foundry Co., New York.

RAILROAD CARS PENDING

Argentine State Railways, 600 thirty-five-ton box cars, bids asked.

Paulista of Brazil, 500 to 1000 forty-two-metric ton box cars; bids asked.

Seaboard Air Line, Pennsylvania and Richmond, Fredericksburg & Potomac, 48 light alloy high tensile steel passenger coaches with stainless steel sheathing, for joint purchase through Seaboard Air Line's offices in Norfolk, Va.; bids opened March 16; Seaboard and Pennsylvania will take 40 of the cars and the Richmond, Fredericksburg & Potomac the remaining eight.

LOCOMOTIVES PLACED

Chicago & Eastern Illinois, two 2000-horsepower diesel-electric locomotives, to Electro Motive Division, General Motors Corp., La Grange, Ill.

Great Northern, 25 diesel-electric locomotives, to Electro Motive Division, General Motors Corp., La Grange, Ill.

Pennsylvania, fifty 4-4-4-4 type steam locomotives, 25 to the Baldwin Locomotive Works, Eddystone, Pa., and 25 to its own shops at Altoona, Pa.

Auto Builders Charge Unions With Cutting Production

(*Concluded from Page 79*)

only getting the equivalent of 75 per cent of an honest day's work.

The general manager of a plating company says under normal conditions he could produce the same output with 35 per cent fewer workers.

A former automobile body company reports total productivity about 60 per cent of standard.

The pattern is so universal that it could not be accidental or mere coincidence. Rather it stems from a well-organized plan aided and abetted by international union officers and perhaps even beyond there. The CIO postwar plan, for example, is simply usurpation of the responsibility and functions of management. Stripped to its essentials, it is another proposal for government creation of a union - management - government board which would be responsible for "Taking the country through reconversion and managing peacetime production."

Summing up, Mr. Romney observes the diminishing productivity of automotive plants is the fruit of seeds sown by the CIO in the soil of an out-dated national labor policy. Under it, unions and union representatives have been exempt from laws with which every other American or American organization must comply. The policy can be briefed as "the government will aid unions in their organization and prevent any interference with unions, or union representatives, regardless of the concentration of power resulting from their form or organization and regardless of whether their power is used for or against the national interest."

CONSTRUCTION AND ENTERPRISE

OHIO

AKRON, O.—Service Iron & Steel Co. has been incorporated with $500 capital and 250 shares of $100 par value to design and fabricate iron and steel products, by Don K. Hallauer, 3466 Manchester road, and associates.

AKRON, O.—Falls Hollow Staybolt Co., 7 Portage street, Cuyahoga Falls, O., will build a one-story plant 87 x 189 feet, to cost about $28,000.

CLEVELAND—Kennedy Maurer Co., 10112 Tanner road, has been formed by Gordon T. Kennedy and Vernon H. Maurer to do steel fabricating and manufacture automotive products. Tool and die manufacture and industrial engineering is planned for the future. Additional machinery and equipment is being bought.

CLEVELAND—Jones & Laughlin Steel Corp., G. R. Monks, resident engineers, 3341 Jennings road will build a pickling plant 60 x 80 feet at its plant when WPB approval is obtained.

CLEVELAND—American Gas Association, 1032 East Sixty-second street, will build a two-story addition 80 x 101 feet, to cost about $100,000.

VERMILION, O.—Wakefield Brass Co., Carl Schroeder, manager, will add about 9000 square feet of floor space in an addition to be built this spring.

MASSACHUSETTS

BRAINTREE, MASS.—Armstrong Cork Co., Hancock street, will let contract soon for a two-story plant addition costing over $40,000.

FALL RIVER, MASS.—Excel Foundry & Machine Co., 2 Lawton street, has let contract to Fred J. Rudd Construction Co., Weetamoe street, for foundry additions to cost about $50,000.

VERMONT

BURLINGTON, VT.—City, City Hall, has plans under way for postwar construction of sewage treatment plant, sewage disposal plant and additional sewers, at cost of about $970,000. G. C. Stanley, City Hall, is city engineer.

BURLINGTON, VT.—City, City Hall, plans postwar construction of additional filter beds, coagulation basin, elevated steel tank and other facilities, costing about $210,000. Whitman & Howard Co., 89 Broad street, Boston, is consulting engineer. J. E. Moore is superintendent of water department.

NEW YORK

BUFFALO—Industrial Metallizing & Machine Co., 1940 West Kenmore avenue, has been formed as a partnership by Eric McLean and Francis O. Near.

JAMESTOWN, N. Y.—City, C. J. Stromberg, department of public works, City Hall, plans postwar construction of sewage disposal and treatment plant, costing $1 million. Metcalf & Eddy, 1300 Statler building, Boston, are consulting engineers.

WHITESBORO, N. Y.—Utica Drop Forge & Tool Corp., 2415 Whitesboro street, plans plant alterations and additions costing about $200,000.

NEW JERSEY

CLAYTON, N. J.—Clayton Boro, Boro Hall, plans postwar construction of sewage disposal plant, pumping station and sewers, costing over $250,000. William A. Goff, Broad Street Station building, Philadelphia, is consulting engineer.

PENNSYLVANIA

JOHNSTOWN, PA.—Air Reduction Sales Co., 60 East Forty-second street, New York, has let contract to Wilson Construction Co., Schenkemeyer building, Johnstown, for a one-story 55 x 90-foot manufacturing building, including cooling tower, control house and gas storage lines, to cost about $287,000. (Noted Jan. 29.)

ST. MARYS, PA.—Stackpole Carbon Co., J. O. Wittman in charge of construction, 201 Tannery street, has plans by C. S. Kirby, 606 Commerce building, Erie, Pa., for two one-story plant buildings 50 x 80 feet, costing $75,000.

TOWANDA, PA.—Sylvania Electric Products Inc., W. Zimmer, manager, Emporium, Pa., has plans by C. Wagner, 133 West Fourth street, Williamsport, Pa., for postwar construction of a plant, laboratory and warehouse, to cost about $80,000.

ILLINOIS

CHICAGO—J. H. Keeney & Co., 6610 South Ashland avenue, manufacturer of radar and special training equipment for the air forces, will build a one-story addition 117 x 120 feet to plant recently bought at 2600 West Fiftieth street from Majestic Radio & Television Corp. The latter will occupy the former Howard Aircraft Co. plant on the airfield at St. Charles, Ill.

JOLIET, ILL.—State department of public safety, Armory building, Springfield, Ill., plans postwar construction of an elevated water storage tank of 300,000 gallons capacity, pumps, etc., to cost about $51,000.

ROCK ISLAND, ILL.—City, City Hall, W. J. Gallagher, city engineer, plans postwar construction of a standpipe and other waterworks improvements to cost $1 million.

ROCK ISLAND, ILL.—Department of public works, City Hall, plans postwar construction of sewage treatment plant addition and additional sewers costing $3 million. W. J. Gallagher is city engineer.

SAVANNA, ILL.—Waterworks department, City Hall, plans postwar construction of a water treatment plant and watermains costing about $100,000. Beling Engineering Co., 501 Fifteenth street, Moline, Ill., is consulting engineer.

INDIANA

CONNERSVILLE, IND. — American Central Mfg. Corp., Saunders P. Jones, president, has bought the plant of Steel Kitchens Corp., containing 70,000 square feet of floor space and much equipment, on a 12-acre site adjoining the American Central plant.

HUNTINGTON, IND. — Maco Corp., Henry street, has been incorporated with 1000 shares no par value to manufacture ferrous and nonferrous castings, by H. D. Lamont, D. A. Purviance and K. F. Triggs.

INDIANAPOLIS—Metallurgical Service Co. has bought plant at 1014 East Michigan street, formerly occupied by Hoosier Foundry Co., 65,000 square feet, and will erect an addition for heat treating and cleaning departments.

INDIANAPOLIS—Central Boiler & Sheet Iron Works Inc., 8 East Market street, has been incorporated with 100 shares no par value to manufacture boilers and similar products, by Raymond Demaree, Terence J. West and Roy Boatman.

WEST VIRGINIA

SOUTH CHARLESTON, W. VA.—M. C. Catlette, City Hall, city engineer, has plans completed for postwar construction of sewage disposal plant, incinerator, pumping station and additional sewers, to cost about $1,144,000.