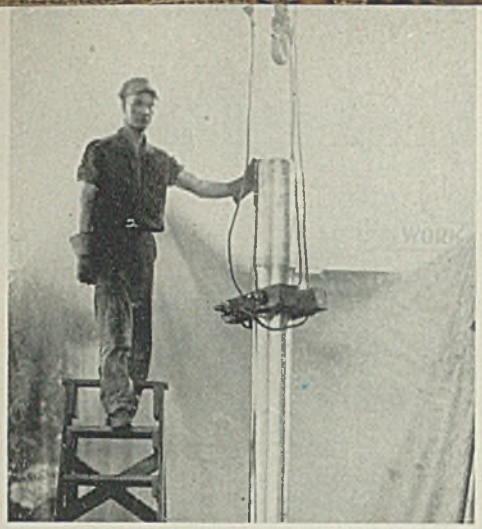

Modern construction of forging hammer employs centuries-old principle of dynamics, p. 112

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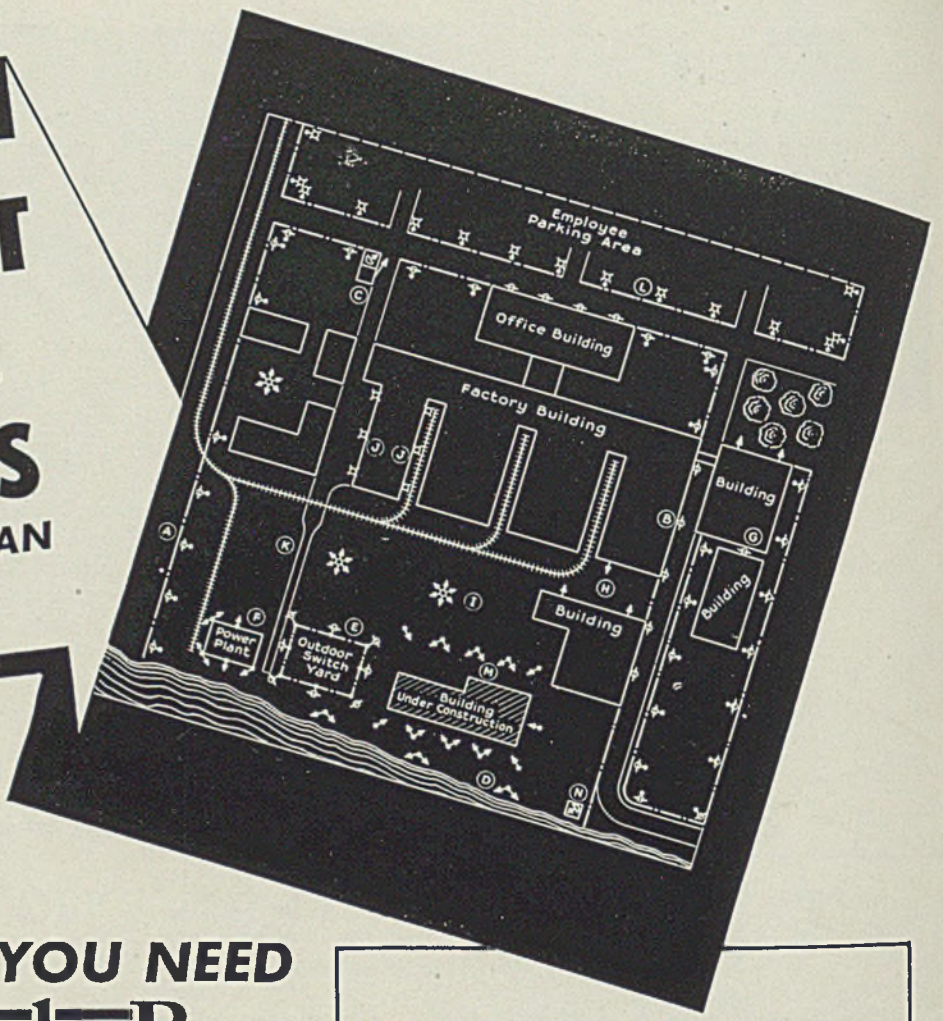
LIGHT THAT *Really* PROTECTS

CALLS FOR A PLAN LIKE THIS . . .



GET THE HELP YOU NEED ...VIA GraybaR

Outdoor lighting for plant protection can't be installed on a hit-or-miss basis. Improperly located, it may *disclose* without *protecting*, and serve to assist the saboteur. In coastal areas, too, it's important to light up danger spots without creating sky glow.

Planned lighting for plant protection is easy with the help of your GRAYBAR Lighting Specialist. He's had experience on the problems of other plants; he knows the various types of equipment that may best meet your needs. By confining the light to where it's needed, he saves on the initial investment, and saves vitally needed power. Equally important, GRAYBAR'S up-to-the-minute knowledge of what's available on your priority rating can often help cut delivery delays.

Whatever your plant lighting problem . . . outdoor or indoor . . . just call your local GRAYBAR office. They'll see that you get the help you need in a hurry.

HERE'S ONE TYPICAL PROBLEM *WHAT'S YOURS?*

PROBLEM: Half a mile of fencing along a well-traveled road. Hard enough to police in daylight, far more difficult at night.

SOLUTION: A "fence of light", highlighting the fence area, and extending out toward the road, obtained with G-E Form 79VR units tilted outward.

INFORMATION: A new booklet "Lighting for Industrial Plant Protection" outlines principles to be followed and shows various types of G-E outdoor units. Write Graybar for GEA-3640A.

GraybaR

IN OVER 80 PRINCIPAL CITIES

GraybaR QUALITY Since 1869 * REG. U.S. PAT. OFF. — *Everything Electrical* . . . . THAT IT TAKES TO WIN!

Executive Offices: GRAYBAR BUILDING, NEW YORK, N. Y.

HIGHLIGHTING

this issue of STEEL

WASHINGTON Attacks on the patent system do not place that system in immediate peril (p. 90), but manufacturers will do well to maintain constant vigilance against future attempts by its enemies to obtain adverse legislation. "Unquestionably the patent system is one of the foremost factors in the development of the United States as an industrial power," says E. L. Shaner, STEEL's editor-in-chief (p. 79). Contract renegotiation act, loosely drawn and hurriedly passed, is hurting some war contractors (p. 92). It whipsaws manufacturers between the two parts of the program to prevent profiteering—renegotiation, and income and profits tax laws. Public Contracts and Wage-and-Hours divisions in the Department of Labor have been consolidated to facilitate administration of both and to save employers vexatious delays in dealing with two inspectors (p. 93).

ENGINEERS The drive for all-out production gives timely significance to the Association of Iron and Steel Engineers' annual meeting in Pittsburgh, Sept. 22-24 (p. 131). Of special interest to the engineers are the following articles in this issue: Roy M. Walker's description of instruments for aiding blast furnace production (p. 134); T. B. Montgomery's discussion of a control method for electric arc furnaces (p. 145); M. J. Wohlgemuth's points on maintenance of electrical equipment in steel plants (p. 153); details of how a blast furnace foundation was poured through a 400-foot pipe line (p. 159); J. D. Keller's study of roll pressures in rolling strip steel (p. 160); Scott D. Baumer's analysis of uses of hardsurfacing and building-up worn parts (p. 170).

PRODUCTION Over 75 per cent of the country's finished steel output of 5,300,000 tons monthly now is going directly into war equipment, and the remainder to essential industries p. 82). Steel ingot output in August (p. 83) was third highest this year, having been exceeded in March and May, also 31-day months. For the first time since October, 1941, plate production in August failed to show an increase over the preceding month (p. 83). Construction of cargo vessels is expected to reach the three-a-day goal in September; the total for August was 86 (p. 104). Eugene Caldwell tells how to obtain figures to measure production achievements, (p. 118); and how they may be used to promote enthusiasm for increasing production by proper presensation in charts, easily understood.

LABOR The ban on penalty rates (p. 88) was generally interpreted last week as a step in general wage stabilization, and evidence of the President's determination to curb inflation. By the end of 1943, 30 per cent of workers engaged in war production will be women (p. 88). Labor-management committees have now been established in 1300 manufacturing plants.

SALVAGE Steel production may fall 5,000,000 tons below capacity this year due to the scrap shortage, and a more vigorous campaign is organized (p. 80), with the Scrap Institute's resources pledged to aid the government's agency, War Materials Inc. By the middle of 1943, enough detinning plants will be in operation to supply 5000 tons of pure tin.

MARKETS Maximums for high-alloy castings will be based on prices for which these products were sold during Oct. 1-5. Wholesalers of wire, cable and accessories now are covered by a Revised Price Schedule No. 82 (p. 106). Steel consumers under PRP are awaiting their allotments for fourth quarter, due this week. Lend-lease requirements for Great Britain and colonies are estimated at 650,000 net tons monthly (p. 201).

TECHNICAL P. R. Kalischer describes (p. 110) a new dew-point indication system that can be used to measure accurately and control the atmosphere of heat-treating furnaces. A new type of electronic tube is the heart of the system. In Section 16 of the forging series, Professor Macconochie delves into the design and construction of forging hammers (p. 112) at Chambersburg Engineering Co. Since operation of the hammer tends to destroy it, a number of unusual problems are considered.

Steel Companies

Contribute $1,500,000 To Get Scrap

The seriousness of the scrap situation is perhaps best indicated by the extent to which the steel companies themselves are going in a desperate attempt to *obtain more scrap*. We are contributing $1,500,000 (other industries $250,000 because other metals, rubber, etc. are to be included) to a total fund of $1,750,000 for a nation-wide educational program sponsored by the War Production Board and over the signature of the American Industries Salvage Committee.

The steel companies have also converted a very large portion of their current advertising to the subject of scrap collection. In addition to the promotional campaign a large number of steel men have been assigned to the task of scouring the country for scrap in cooperation with scrap dealers.

Here at Inland we are making a substantial contribution to the general campaign and are also devoting a major portion of our own advertising to the task of getting in more scrap. But the scrap situation is so critical that we are taking many other steps in an effort to keep our furnaces operating at top capacity.

Inland lake freighters are breaking records and extra freighters have been leased to bring down more ore from our mines to the north. New blast furnaces are being rushed to completion so that we will be able to make more pig iron and use less scrap.

But the situation still remains critical. So we cannot urge you too strongly to recheck your scrap situation—not just production scrap but the frames of old buildings, old machines, tools, dies, parts, etc. It is only with this additional material that we can make enough steel to assure Victory.

Please act today—tomorrow may be too late!

INLAND STEEL COMPANY

38 S. Dearborn St. • Chicago, Ill.

Sales Offices: MILWAUKEE • DETROIT • ST. PAUL • ST. LOUIS • KANSAS CITY

STEEL
September 14, 1942

Defend the Patent System!

On July 31, 1790, the first patent granted by the United States was issued to Samuel Hopkins. It bore the signatures of President George Washington, Secretary of State Thomas Jefferson and Attorney General Edmund Randolph.

The eminence of these signers could not soften the antagonism of the public against patents. The people recalled the abuses of the monopolistic features of patents practiced in England in the previous century. They were prejudiced against the idea of patents.

But in time the public began to see that a properly administered patent system was beneficial. Throughout the nineteenth century patents played an increasingly important role in the development of the nation. Public prejudice and antagonism changed gradually to understanding and appreciation.

This is not surprising because the basic principle of the patent system is sound. The government makes a deal with the inventor. It says, "We will give you the exclusive right to manufacture and sell the product of your invention for 17 years. In return you shall disclose the details of your invention and shall allow the public unrestricted use of it after the 17-year term has expired."

Seven-eighths of the industrial enterprises of the country owe their existence directly or indirectly to the miracle of this simple agreement. Unquestionably the patent system is one of the foremost factors in the development of the United States as an industrial power.

Notwithstanding this enviable record, the patent system has enemies now, as in 1790. Ambitious detractors are bent upon tampering with it to get at alleged violators of the antitrust laws. Monopoly looms big now, as it did in England in 1623.

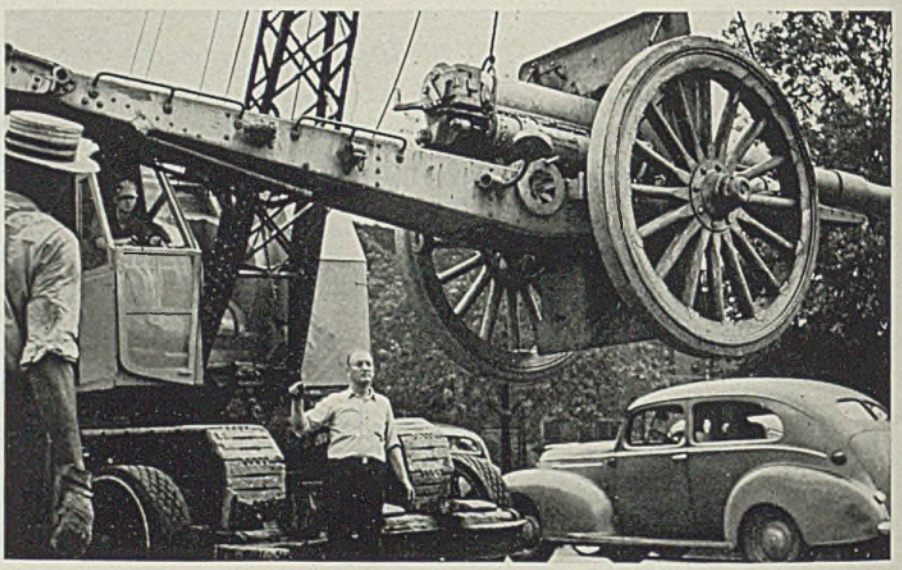
The character and significance of these attacks are outlined succinctly on page 90 of this issue. Manufacturers should stand prepared to resist any attempt to cripple this fine American institution. It is a national asset too priceless to be sacrificed on the altar of aimless and bungling reform.

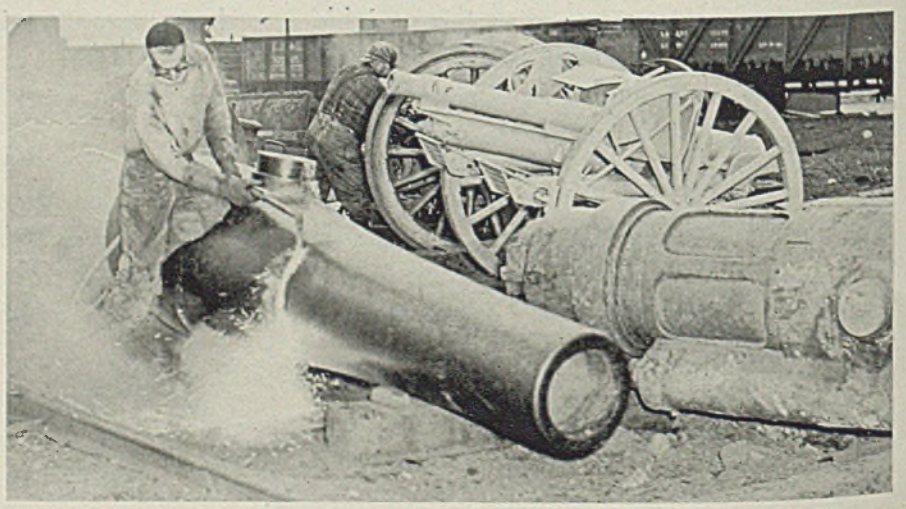
E. L. Shaner

Editor-in-Chief

Scrap Drives Intensified

WMI calls in professionals. . . . Imports from abroad via lend-lease ships proposed. . . "Quit fooling" policy enunciated





WAR MATERIALS INC., the government's agency for drawing out high-cost scrap which cannot flow under present price ceilings, will call in professional assistance to help attain its goal of 5,000,000 tons "before the snow flies."

J. M Hopwood, president of the new corporation, said the scrap industry would be called upon to do the job and that there would be no interference by "amateur" meddlers. Instructions will be to get out the scrap regardless of cost limitations.

Directors of the Institute of Scrap Iron and Steel Inc., 20 of whom are presidents of local chapters, have pledged their complete support to the WMI and will energize all dealers in submitting projects involving tonnages of scrap dormant because of high cost of dismantlement, freight and other factors.

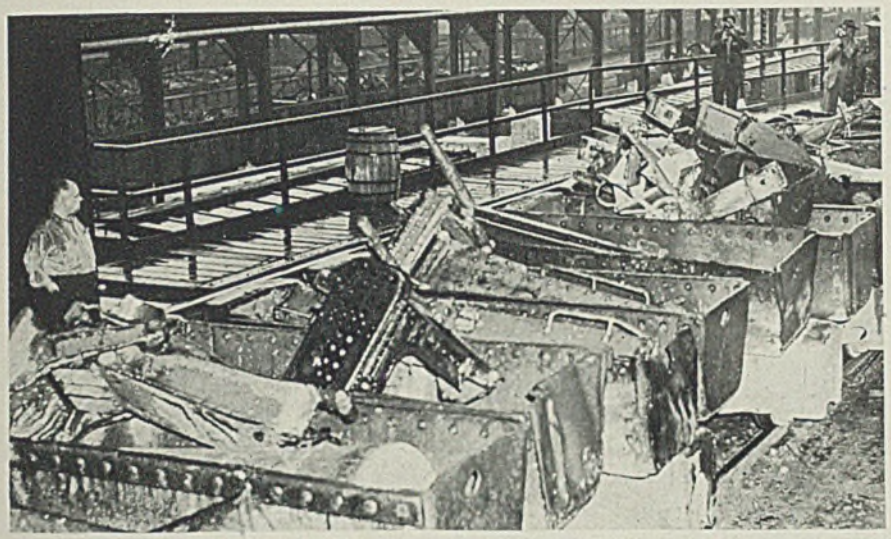
This "quit fooling" policy of WMI was enunciated coincidentally with other phases of an intensified scrap salvage drive. Some of these included:

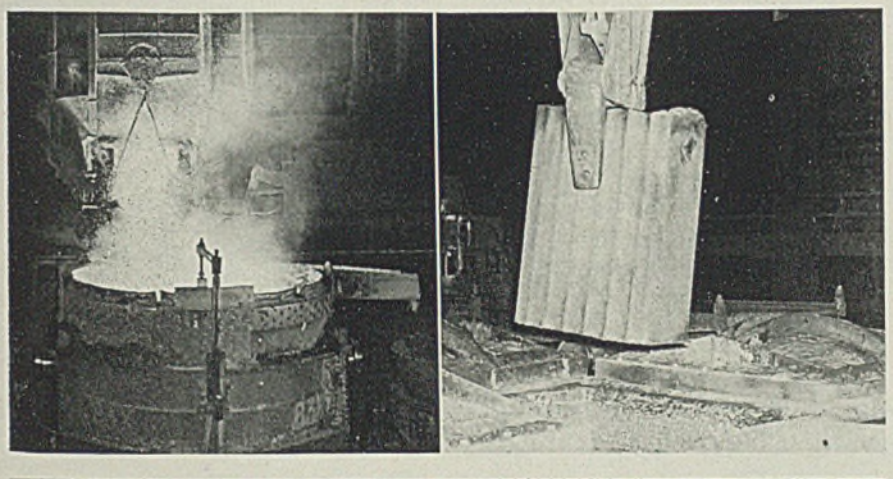
Organization of steel salesmen of large producers for the collection of scrap from their regular customers, without dislocating the regular channels of scrap movement. Salesmen are being assigned to districts to prevent overlapping.

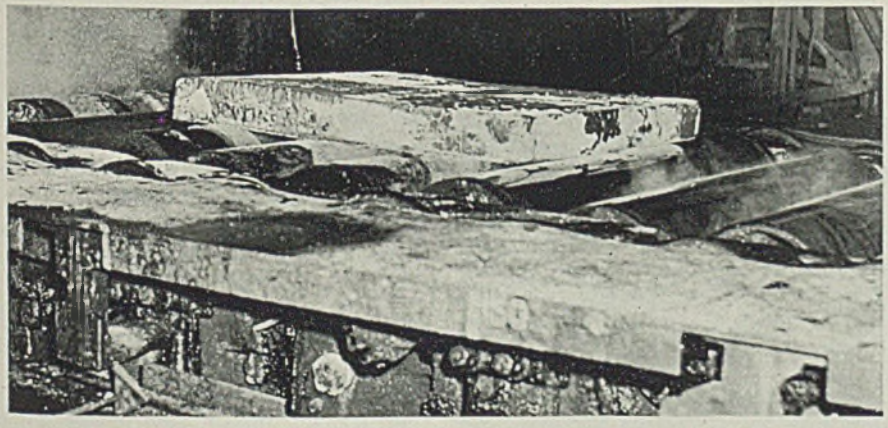
Enlistment by WPB Chief Donald M. Nelson of newspaper editors and publishers to lead campaigns in their areas. Mr. Nelson's plea that the newspapers not only publicize the necessity for scrap but also supply the leadership for organizing the drives in their communities was wholeheartedly accepted by the publishers.

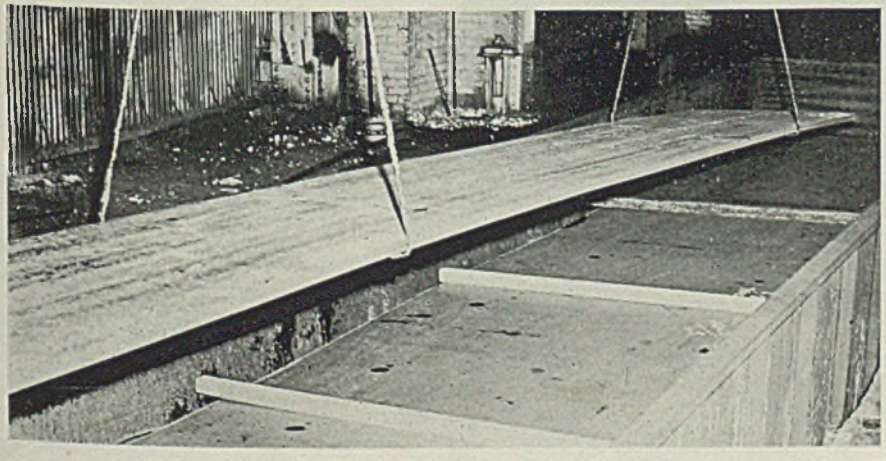
Announcement that detinning plants operating at capacity could supply 297,000 tons of steel scrap and 3000 tons of tin from old tin cans, if the cans were delivered to the detinning plants. By the middle of 1943, enough detinning plants will be in operation to supply 495,000 tons of steel and 5000 tons of tin.

Proposal by steel producers that ships









FROM OLD CANNON TO SHIP PLATES IN 21 HOURS

Nine old cannon, from the Civil, Spanish-American and first World wars which had served as ornaments in various spots in Gary, Ind., last week were acquired by Carnegie-Illinois Steel Corp. and converted into steel ship plates within 21 hours. Steps by which this conversion took place are illustrated in the accompanying photographs, reading from upper left to lower right:

Cannon before moving.

The first move.

"The last mile"—escorted to the steel plant.

Cut up for the open hearth.

In charge buggies on way to open hearth.

Furnace is tapped.

Ingot goes into soaking pit in the slab mill.

Slab is rolled to make the plate.

Plate is placed in gondola car ready to be shipped.

✦

used to haul lend-lease goods to England haul scrap on return trips to compensate for that lost by shipping ingots and semi-finished steel to that country.

Intensification by the War Department of its drive which in July and August netted 65,000 tons of scrap metal. All metal objects for which an absolute need does not exist, such as rails, iron lamp posts, spur tracks, iron guard rails, are being collected. War relics, cannon and cannon balls are being picked up from Army posts. Former CCC camps taken over by the Army also are supplying a considerable tonnage.

Patriotic organizations which have received relics for decorative or memorial purposes are being urged to turn them back to the government, with the promise that other and more recent mementos will be given them when the present war is over.

Seriousness of the situation is being impressed on all concerned by steel producers, WPB and the armed services. R. W. Wolcott, president, Lukens Steel Co., Coatesville, Pa., and chairman of the industry's salvage committee, told a national meeting of newspaper editors at Washington last week that steel ingot production this year would fall 5,000,000 tons short of capacity.

A minimum of 17,000,000 tons of scrap must be rounded up during the last half of this year if steel mills are not to be forced to shut down, Paul C. Cabot,

(*Please turn to Page* 216)

Three-Fourths of Steel Output Used for Direct War Implements

MORE than 75 per cent of this country's finished steel output of 5,300,000 tons monthly is going into direct war use and the remainder into essential industries such as railroads, machinery manufacture, and the like, according to David F. Austin, acting chief of the WPB Iron and Steel Branch.

Eighty per cent of steel is being delivered on ratings of A-1-a or higher.

Mr. Austin estimated 1942 output of finished steel at 62,000,000 and ingot production at 86,000,000. Current production, he said, is far ahead of that of the Axis countries, including the occupied countries of Europe. Axis steel production last year was about 74,000,000 tons. The United Nations in that year controlled 65 per cent of total output.

Where does 5,300,000 tons of steel a month go?

Into tanks: It requires about 38 tons to make a medium tank.

Into ships: Present goals are for 8,000,000 tons of dead-weight shipping this year and 16,000,000 tons in 1943. Each cargo ship of the Liberty type now being made in quantity calls for approximately 4500 tons of rough steel.

Into planes: Big four-engine bombers take 15 tons of steel each. Fighter planes take 3½ tons.

Into guns: Some antiaircraft guns use up 14 tons of steel each; thousands of rifles, machine guns, antitank guns, and howitzers use steel, all the way up to the giant 16-inchers that take 576 tons of steel each.

Little Left for Civilian Needs

In addition, thousands of tons are going into naval ships, land transport, ammunition and bombs, miscellaneous fighting equipment for the armed forces, barracks, airplane hangars, industrial plants to produce munitions, and for lend-lease.

Many essential civilian industries, such as farm machinery, petroleum, utilities, and others, are not getting much steel now, but they must have some, Mr. Austin pointed out.

"The problem of steel, then, is one of proper scheduling and planning in order to come out even on a well-balanced war production program, based upon the amount of material available. We want to make just as many tank guns as we need for tanks, no more and no less. And that goes for everything else.

"Scheduling has been a tough problem so far. After Pearl Harbor we roared out to make all of everything we could. We stopped the production of civilian articles so there was plenty of steel available for every factory for a while. Now the time has come when the program must be brought into balance. It's just now that we must make our five million tons of production fit a demand of around nine million tons a month.

"One important reason the program is out of balance is that the resourcefulness of American industry, when sent to war, could not be foreseen. This country had had no experience in fabricating implements of war. We did not know what our production men could do until they got to doing it.

"Today our factories are turning out some parts faster than anyone dreamed it could be done a few months ago. Rifling a gun barrel is one of the most delicate machining tasks of all. It now is being done in one-thirtieth of the time it took a few months ago. It used to take more than 6 hours to counterbore 280 holes in the crankcase of an aircraft engine. It's being done now in 65 minutes.

"The result is that we have a capacity to 'chew up' steel faster than we can make it. . . . Unfortunately, we cannot make the 'chewing up' capacity the yardstick for war production. Steelmaking capacity has to be that yardstick because it cannot be increased as rapidly as can the plants which consume steel. That is why some plants operating on war contracts have had to slow down at times for lack of material. . .

Projected Increases Are Problem

"The projected increases in steel output over our present high tonnage present a problem. The steel industry is operating currently at more than 97 per cent of capacity and has been over 90 per cent for two years. No more steel can be turned out without new open hearth, bessemer or electric furnaces in which to make it. These are huge, intricate affairs that consume large quantities of time, and steel, in the making. But that is just a part of the problem.

"We must mine more iron ore, and build more ships to haul that ore from the Mesabi range in northern Minnesota down the Great Lakes to the steel mills. We must build more blast furnaces to produce the pig iron from which

WOMEN WARRIORS WITH HELMETS SHARE IN HONORS

WORKERS at the Babcock & Wilcox Co.'s Barberton, O., works received the Maritime Commission "M" burgee Sept. 2 for outstanding production of boilers for Liberty ships. Women now are doing many of the jobs formerly done by men, and are shown here rejoicing over the award

steel is made. We must produce more coke to use as fuel in the refining process. We must find more and more steel scrap, collect it, and get it to steel mills as rapidly as possible. All of these steps are necessary to keep our huge steel output operating at record levels."

Largest Tonnage of Ingots for August

STEEL ingot production in August totaled 7,233,451 net tons, largest August figure ever reported. This exceeded by almost 100,000 tons the 7,148,824 tons made in July and compares with 6,997,496 tons in August, 1941.

The August output, however, was surpassed twice this year, in March, when the all-time monthly record of 7,392,911 tons was established, and in May, when 7,386,890 tons was produced.

During August the steel industry operated at an average of 95.4 per cent of capacity, compared with 94.5 per cent in July and 95.6 per cent of a substantially smaller capacity in August, 1941. An average of 1,632,833 tons of steel was produced per week, against 1,617,381 tons per week in July and 1,579,570 tons per week in August, 1941.

Steel plate shipments failed to set a new monthly record in August for the first time since October, 1941, according to WPB Iron and Steel Branch tabulations.

August shipments were 1,097,866 tons as compared with 1,124,118 in July. The drop was caused by a flood at the Lukens Steel Co., Coatesville, Pa., which curtailed sharply the output.

Plates produced on strip mills continued to gain in August, shipments being 551,959 tons compared with 550,537 in July.

In spite of the accident which set August shipments back its record is still second high for 11 months. October, 1941, shipments were 593,152 tons.

Inland Reports Records In Plate, Merchant Mills

Indiana Harbor plant of Inland Steel Co. has made a new 8-hour record for its 100-inch plate mill, and new 24-hour and 8-hour highs for its 14-inch merchant mill.

From 4 p. m. to midnight Aug. 13, the 100-inch mill produced 1.94 per cent more steel plate than it had previously in a like period. The former high was reached Nov. 5, 1941. The new record production was for use in helium tanks.

The 14-inch mill, rolling 1⅝-inch squares, exceeded its former 24-hour record by 6.18 per cent Aug. 19 and at the same time went above its previous 8-hour mark by 3 per cent. The latter was bettered, however, the next day when the former high was surpassed by 6.2 per cent.

Inland also announced shipment Aug. 17 of a full trainload of bomb steel, considerably above any former comparable shipment by the company.

Armco Sets Sixth Monthly Pig Iron Mark

For the sixth successive month, Hamilton, O., blast furnaces of American Rolling Mill Co. set a new tonnage record in August, 494 gross tons higher than in July. The furnaces in August poured 6079 tons more than in December, 1941, which was the peak before the record-breaking production started. Actual tonnage exceeds rated capacity by several thousand tons.

Norton furnace of American Rolling Mill Co., at Ashland, Ky., broke its production record in August for the third successive month. The stack is not large and is an old furnace, and new records are the result of teamwork among the employes.

Republic's 8-Month Electric Steel Output Exceeds All 1941

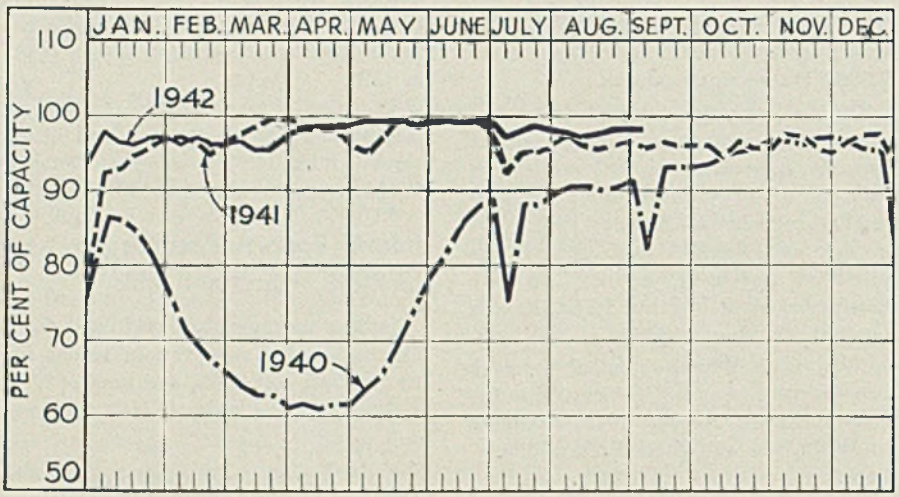
During the first eight months of 1942 Republic Steel Corp. produced more electric furnace alloy steel than in all 1941. Monthly average was substantially larger than the corporation's total annual output a few years ago. Output has doubled annually for several years. New facilities will be completed in a few months, increasing capacity.

STEEL INGOT STATISTICS

	Estimated Production—All Companies								Calculated weekly	Number
	Open Hearth		Bessemer		Electric		Total		production,	of
	Net tons	Per cent of capacity	Net tons	Per cent of capacity	Net tons	Per cent of capacity	Net tons	Per cent of capacity	all companies Net tons	weeks in month
Based on Reports by Companies which in 1941 made 98.5% of the Open Hearth, 100% of the Bessemer and 87.8% of the Electric Ingot and Steel for Castings Production										
1942										
Jan. .	6,328,128	95.4	490,864	86.0	305,930	96.3	7,124,922	94.7	1,608,335	4.43
Feb. .	5,791,813	96.7	453,543	88.0	275,700	96.2	6,521,056	96.0	1,630,264	4.00
Mar. .	6,574,701	99.1	493,294	86.4	324,916	102.3	7,392,911	98.2	1,668,829	4.43
1st quar	18,694,642	97.0	1,437,701	86.7	906,546	98.3	21,038,889	96.3	1,635,994	12.86
April .	6,346,707	98.8	454,583	82.2	321,023	104.4	7,122,313	97.7	1,660,213	4.29
May .	6,600,376	99.5	454,054	79.5	332,460	104.7	7,386,890	98.2	1,667,470	4.43
June .	6,247,302	97.2	452,518	81.8	322,335	104.8	7,022,155	96.4	1,636,866	4.29
2nd qtr	19,194,385	98.5	1,361,155	81.2	975,818	104.6	21,531,358	97.4	1,654,985	13.01
1st half	37,889,027	97.8	2,798,856	83.9	1,882,364	101.5	42,570,247	96.9	1,645,545	25.87
July . .	6,350,047	95.7	453,684	79.6	345,093	96.3	7,148,824	94.5	1,617,381	4.42
Aug. .	6,420,496	96.6	467,313	81.8	345,642	96.3	7,233,451	95.4	1,632,833	4.43
Based on Reports by Companies which in 1941 made 98.5% of the Open Hearth, 100% of the Bessemer and 87.8% of the Electric Ingot and Steel for Castings Production										
1941										
Jan. .	6,274,780	99.0	451,806	76.0	195,766	89.1	6,922,352	96.8	1,562,608	4.43
Feb. .	5,669,425	99.1	378,536	70.5	182,393	91.9	6,230,354	96.5	1,557,589	4.00
Mar. .	6,457,641	101.9	460,225	77.4	206,137	93.8	7,124,003	99.6	1,608,127	4.43
1st quar	18,401,846	100.1	1,290,567	74.8	584,296	91.6	20,276,709	97.7	1,576,727	12.86
April . .	6,137,613	100.0	395,056	68.6	221,510	104.1	6,754,179	97.6	1,574,401	4.29
May . .	6,362,245	100.4	444,079	74.7	238,241	108.4	7,044,565	98.5	1,590,195	4.43
June .	6,098,171	99.4	458,848	79.7	235,732	110.8	6,792,751	98.1	1,583,392	4.29
2nd qtr	18,598,029	100.0	1,297,983	74.3	695,483	107.8	20,591,495	98.1	1,582,744	13.01
1st half	36,999,875	100.0	2,588,550	74.6	1,279,779	99.7	40,868,204	97.9	1,579,753	25.87
July . .	6,085,100	94.4	489,297	85.0	237,827	85.7	6,812,224	93.3	1,541,227	4.42
Aug. . .	6,244,353	96.6	495,761	85.9	257,382	92.6	6,997,496	95.6	1,579,570	4.43
Sept. . .	6,054,418	96.9	500,768	89.8	256,568	95.5	6,811,754	96.3	1,591,531	4.28
3rd qtr	18,383,871	96.0	1,485,826	86.9	751,777	91.2	20,621,474	95.1	1,570,562	13.13
9 mos.	55,383,746	98.6	4,074,376	78.6	2,031,556	96.4	61,489,678	96.9	1,576,658	39.00
Oct. . .	6,423,329	99.4	533,060	92.4	279,679	100.6	7,236,068	98.9	1,633,424	4.43
Nov. . .	6,194,679	99.0	488,822	87.5	277,384	103.0	6,960,885	98.2	1,622,584	4.29
Dec. . .	6,387,865	99.0	481,813	83.7	280,637	101.2	7,150,315	97.9	1,617,718	4.42
4th qtr.	19,005,873	99.1	1,503,695	87.8	837,700	101.6	21,347,268	98.3	1,624,602	13.14
Total. .	74,389,619	98.8	5,578,071	80.9	2,869,256	97.9	82,836,946	97.3	1,588,741	52.14

The percentages of capacity operated in the first six months of 1941 are calculated on weekly capacities of 1,430,102 net tons open hearth, 134,187 net tons bessemer and 49,603 net tons electric ingots and steel for castings, total 1,613,892 net tons; based on annual capacities as of Dec. 31, 1940 as follows: Open hearth 74,565,510 net tons, bessemer 6,996,520 net tons, electric 2,586,320 net tons. Beginning July 1, 1941, the percentages of capacity operated are calculated on weekly capacities of 1,459,132 net tons open hearth, 130,292 net tons bessemer and 62,761 net tons electric ingots and steel for castings, total 1,652,185 net tons; based on annual capacities as of June 30, 1941 as follows: Open hearth, 76,079,130 net tons, bessemer 6,793,400 net tons, electric 3,272,370 net tons.

The percentages of capacity operated in the first six months of 1942 are calculated on weekly capacities of 1,498,029 net tons open hearth, 128,911 net tons Bessemer and 71,682 net tons electric ingots and steel for castings, total 1,698,622 net tons; based on annual capacities as of Jan. 1, 1942 as follows: Open hearth 78,107,260 net tons, Bessemer 6,721,400 net tons, electric 3,737,510 net tons. Beginning July 1, 1942, the percentages of capacity operated are calculated on weekly capacities of 1,500,714 net tons open hearth, 128,911 net tons bessemer and 81,049 net tons electric ingots and steel for castings, total 1,710,674 net tons; based on annual capacities as follows: Open hearth 78,247,230 net tons, bessemer 6,721,400 net tons, electric 4,225,890 net tons.



District Steel Rates

Percentage of Ingot Capacity Engaged in Leading Districts

	Week ended Sept. 12	Change	Same week 1941	Same week 1940
Pittsburgh	95	+ 1	99	87
Chicago	101.5	None	101	97.5
Eastern Pa.	95	None	95	90.5
Youngstown	97	None	98	86
Wheeling	80	— 3	94	98
Cleveland	94.5	— 2	92	89
Buffalo	90.5	None	90.5	90.5
Birmingham	95	None	95	93
New England	95	+ 3	90	75
Cincinnati	91	— 4	89	82
St. Louis	95.5	None	98	80
Detroit	93	+ 7	94	95
Average	98	None	°96.5	°93

°Computed on basis of steelmaking capacity as of those dates.

STEEL . . . . . STEADY

PRODUCTION of open-hearth, bessemer and electric furnace ingots last week continued at 98 per cent of capacity. Three districts advanced, three declined and six were unchanged. A year ago the rate was 96½ per cent; two years ago it was 93 per cent, both computed on the basis of capacity as of those dates.

Chicago — Production held at 101½ per cent, with no open hearths idle for lack of scrap. Two Inland Steel Co. units down part of the preceding week have resumed on better supply.

Detroit — Gained 7 points to 93 per cent, the highest since June. Only two open hearths were idle, under repair.

Cincinnati — Dropped 4 points to 91 per cent, one open hearth being taken off for repairs.

St. Louis — Held steady at 95½ per cent. For the first time in 50 years Granite City Steel Co. operated its open hearths on Labor Day.

Pittsburgh — Advanced 1 point to 95 per cent, the holiday having no effect on production.

Wheeling — Declined 3 points to 80 per cent.

Buffalo — Unchanged at 90½ per cent, with no interruption for Labor Day. Of 43 open hearths, 39 are operating.

Cleveland—Removal of an open hearth by one interest and slight changes by others gave a net drop of 2 points, to 94½ per cent.

Central eastern seaboard—Maintained an unchanged rate of 95 per cent as scrap receipts continued sufficient.

Birmingham, Ala. — With 23 open hearths in production the rate was held at 95 per cent.

New England — With all but one small open hearth in production the rate advanced 3 points to 95 per cent.

Youngstown, O. — Production continued unchanged at 97 per cent, with 77 open hearths and three bessemers active, the Labor Day holiday having no effect on steel output. Schedule for this week is for the same rate. Relighting of two blast furnaces about Oct. 1 is expected to relieve the iron situation.

Republic Steel Awaits WPB Action on Sponge Iron Plant

Officials of Republic Steel Corp., Cleveland, last week awaited approval of the War Production Board to begin construction of a sponge iron plant at its Youngstown property. Plant would be located near its by-products coke ovens to insure sufficient supply of gas for the reduction process. Ore concentrates from Republic's Port Henry, N. Y., mines would be used. An allowance of $275,000 to $300,000 for construction has been suggested.

Charles M. White, vice president in charge of operations, said WPB had referred to a committee the company's application for building as an experiment. No action will be taken without the committee's approval.

U.S. Steel's Shipments

(Inter-company shipments not included)

Net Tons

	1942	1941	1940	1939
Jan.	1,738,893	1,682,454	1,145,592	870,866
Feb.	1,616,587	1,548,451	1,009,256	747,427
Mar.	1,780,938	1,720,366	931,905	845,108
Apr.	1,758,894	1,687,674	907,904	771,752
May	1,834,127	1,745,295	1,084,057	795,689
June	1,774,068	1,668,637	1,209,684	807,562
July	1,765,749	1,666,667	1,296,887	745,364
Aug.	1,788,650	1,753,665	1,455,604	885,636
8 mo	14,057,906	13,473,209	9,040,889	6,469,404
Sept.	.....	1,664,227	1,392,838	1,086,683
Oct.	.....	1,851,279	1,572,408	1,345,855
Nov.	.....	1,624,186	1,425,352	1,406,205
Dec.	.....	1,846,036	1,544,623	1,443,969
Total, by Mos.	.....	20,458,937	14,976,110	11,752,116
Adjustment	.....	.....	†37,639	°44,865
Total	.....	.....	15,013,749	11,707,251

†Increase. °Decrease.

Pipeline To Be Built Of Second-Hand Pipe

Plans for construction of an 8-inch pipeline from Tiffin, O., to a point near Akron were announced last week by Secretary of Commerce Jones. Line will be financed by Defense Supplies Corp. and will be built of used pipe.

It will link systems of the Shell Oil Co. and Standard Oil Co. of Ohio for the movement of oil to Newark, N. J.

Steel Corp. Shipments Set August Record

Shipments of finished steel by the United States Steel Corp. in August totaled 1,788,650 net tons, largest August volume in its history. This was an increase of 22,901 tons over the July production of 1,765,749 tons and of 34,985 tons over August shipments of 1,743,665 tons in 1941.

For eight months ended Aug. 31 shipments totaled 14,057,906 tons, a new record for that period, comparing with 13,473,209 tons shipped in the corresponding period last year.

Launching the third phase of its "Beat the Promise" war production drive, RCA Mfg. Co. Inc., Camden, N. J., on Sept. 13 held a War Show and rally for employes in that city. There were demonstrations by the 104th cavalry of bayonet practice and drills, motorcycle and tank maneuvers, a horse race and dive bomber exhibition.

LeBlond's Second War-Time Distinction

SECOND time in its history, R. K. LeBlond Machine Tool Co., Cincinnati, last week received official recognition from the government for war service in production of machine tools. In World War I the company received the Distinguished Service Award. In a ceremony last Wednesday it received the Army-Navy "E" award.

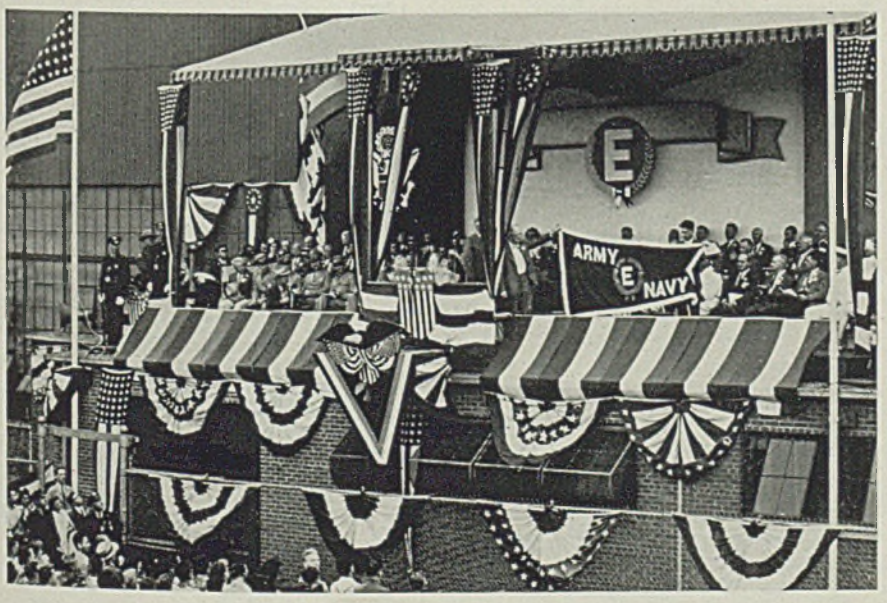
Honor guests, present before the entire personnel of the company, included: John W. Bricker, governor of Ohio; James Garfield Stewart, mayor of Cincinnati; Allen C. Roudebush, mayor of Norwood, O.; Brig. Gen. William Ord Ryan, Commanding General, Army Air Forces, First Concentration Command; and Lieut. Com. William C. Duval, U. S. N. R.

General Ryan presented the flag to Richard E. LeBlond, president of the company. Lieutenant Commander Duval presented the lapel buttons, and these were received in behalf of the employes by Joseph Libbee, chairman of the executive committee, Independent Employes Organization. Henry C. Pierle, secretary and sales manager of the company, was master of ceremonies. Occupying a place of honor on the platform was Richard K. LeBlond, founder of the company and now chairman of the board.

A stirring feature of the ceremony was the unveiling of a huge painting representing co-operation between the men who make the tools of war and the armed forces which use them. This served as a background to the speakers' platform.

Guests of honor at Le Blond Army-Navy "E" ceremony, left to right: Brig. Gen. William Ord Ryan; Lieut. Comm. William C. Duval; John W. Bricker, governor of Ohio; James Garfield Stewart, mayor of Cincinnati; Richard K. Le Blond, founder and board chairman; and Richard E. Le Blond, president of the company

Following the presentation ceremony, reception and dinner were held at the Queen City Club. Several speakers here, including the mayor of Cincinnati, paid tribute to the high esteem in which the LeBlond family and company are held by the citizens. The elder LeBlond acknowledged this tribute briefly with deep feeling. Guest speaker of the evening was Eldridge Haynes, publisher of *Modern Industry*, who reported on his recent trip to England and Scotland where he visited leading plants.



A prized possession: E. P. Bullard, president, Bullard Co., and Vincent Hughes, representing the company's employes, exhibit the Army and Navy "E" at colorful ceremony

Planes Wing Over Bullard Ceremony

WHILE a squadron of warplanes roared overhead, a large delegation of Army and Navy officers, civic and business leaders assembled Aug. 24, on a high platform at the side of the nearest section of the Bullard Co.'s machine tool plant in Bridgeport, Conn. Before the flag-draped platform were hundreds of Bullard workmen and a large number of invited guests. At 4 o'clock sharp, as the program went on the air over a national radio hook-up, Grace Moore, opera star, stepped to the front of the platform and sang the National Anthem.

Such was the prelude to the ceremony of awarding the company the Army-Navy "E" for increasing over and over again its output of vertical turret lathes and Mult-Au-Matics—both of vital importance to the war effort.

Following an address by Jasper McLevy, mayor of Bridgeport, Col. F. H. Payne was introduced by George S.

(*Please turn to page* 214)

MEN of INDUSTRY

William A. McKinley

J. E. White

Irwin A. Marshall

F. Lloyd Woodside

WILLIAM A. McKINLEY, formerly chief sales engineer, Midland Steel Products Co., Cleveland, has been elected vice president in charge of manufacturing and sales, and **R. C. Artner,** treasurer, has been elected vice president in charge of all financing and accounting. Mr. McKinley succeeds the late Gordon Stoner. Except for a brief period when he was in business for himself, Mr. McKinley has been associated with Midland since its organization. His work with Midland has been in engineering and sales capacities. Mr. Artner has also been associated with Midland since its inception. He was elected treasurer in 1939.

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J. E. White, former vice president, R. C. Larkin Co., Chicago, has been appointed project manager for Kropp Forge Co., Chicago, and its new subsidiary, Kropp Forge Aviation Co. Mr. White will be in charge of construction of the new plant.

J. H. Lund, the past several years associated with the sales organization of Kropp Forge, has been promoted to vice president. **Budd H. Gebhardt** has joined the company as production engineer. He formerly was associated with Goss Printing Press Co. in a similar capacity. **I. G. Moore** has been added to Kropp Forge Co.'s staff in the position of personnel promotion director.

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W. G. McFadden has been appointed acting manager of Allegheny Ludlum Steel Corp.'s Chicago office. He replaces **P. E. Floyd,** now serving with the government.

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John K. Colgate has been named vice president and treasurer, Tyson Bearing Corp., Massillon, O.

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R. R. Higgins, formerly secretary-treasurer, Standard Tool Co., Cleveland, has been elected president. **E. E. Wegman** has been elected secretary, and **J. W. Bremer,** treasurer. **W. P. Ross,** present sales manager, will be elected vice president at the next stockholders' meeting.

H. C. McKean has resigned as general manager and will retire because of ill health.

—o—

Irwin A. Marshall has joined the contact engineering staff of Foote Bros. Gear & Machine Corp., Chicago, and will represent the company in the Cleveland and northern Ohio territory. A resident of Cleveland for 30 years, Mr. Marshall has been serving the past 12 years in Ohio and the Central states as a sales engineer and specialist on speed reducers, couplings and gears.

—o—

William A. Bates, works manager of the Long Island division of Brewster Aeronautical Corp., Long Island City, N. Y., has been elected vice president in charge of all manufacturing.

—o—

Arthur W. Thomas, sales manager, construction machinery division, Chain Belt Co., Milwaukee, has been appointed consultant for the Construction Machinery Division, War Production Board. Mr. Thomas has been associated with Chain Belt's engineering and sales staffs 15 years.

—o—

W. W. Castleberry, formerly service supervisor at the Miami, Fla., office of Graybar Electric Co., has been named acting service manager at Jacksonville, replacing **A. W. Palin Jr.,** who has been granted leave of absence to take up active duty as a captain in the United States Army Air Corps.

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David G. Fleet, general manager of Consolidated Aircraft Corp., San Diego, has joined Vultee Aircraft Inc., Downey, Calif., as executive vice president. He will also act as direct assistant to **G. M. Williams,** vice chairman of Vultee.

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F. Lloyd Woodside has been named president, Park Chemical Co., Detroit, succeeding his brother, **William Park Woodside,** who has been president of the company since its organization in 1911 and now becomes chairman of the board. The past six years F. L. Woodside has been active with the metallurgical research division of Climax Molybdenum Co., leaving this connection to assume management of Park Chemical.

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A. G. York has been appointed vice president in charge of sales, Watson-Stillman Co., Roselle, N. J. **R. W. Dinzl** has become vice president in charge of engineering; **F. H. Stillman,** assistant to the president and assistant secretary, and **William Weidt,** assistant secretary. **J. C. Grindley,** formerly sales manager of the hydraulic division, has retired because of ill health.

—o—

Glenn E. Kelso has been appointed superintendent of manufacturing at the Fort Wayne, Ind., plant of Farnsworth Television & Radio Corp. Mr. Kelso has served in an executive capacity in the manufacturing division of the company since its inception and served with the predecessor organization in various supervisory capacities since 1929.

—o—

D. A. Sherick, formerly associated with Weirton Steel Co., Weirton, W. Va., has joined the metallurgical staff of Babcock & Wilcox Tube Co., and will be production metallurgist of the Welded Tube Division, Alliance, O. Mr. Sherick is a graduate of Case School of Applied Science, Cleveland.

M. L. Samuels, formerly of Battelle Memorial Institute, Columbus, O., has joined the metallurgical staff of Babcock

& Wilcox Tube Co., Beaver Falls, Pa., as research metallurgist. He is a graduate of Peabody College and Harvard Graduate School.

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O. F. Seidenbecker, vice president, Wisconsin Steel Works, division of International Harvester Co., Chicago, was honored by his associates Sept. 9, on the occasion of his 30 years' service with the company.

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Albert S. Glossbrenner has been appointed superintendent, Brier Hill plants, Youngstown Sheet & Tube Co., Youngstown, O. He succeeds the late Clifton W. Edwards. He joined the company in 1935 as assistant superintendent of the hot strip mill, and two years later became superintendent.

John S. Stanier, associated with Youngstown Sheet & Tube since 1933, has been appointed superintendent of the hot and cold strip mills at the Campbell plants. He formerly was superintendent of the cold strip and sheet mills.

—o—

C. L. Clark, associated with Westinghouse Electric & Mfg. Co. 13 years, recently as control specialist at the Cincinnati office, has been appointed sales engineer at the Cleveland office of Wheelco Instruments Co., Chicago. **Robert N. Miller,** the past seven years sales and service engineer for Mercoid Corp. in Chicago, is now service engineer with the Wheelco Cleveland office, while **Howard B. Jones** has been employed as sales and service engineer at the Chicago office. He formerly was with McGraw-Hill Publishing Co.

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Charles H. Currier, vice president and general manager, Ross Heater & Mfg. Co. Inc., a division of American Radiator & Standard Sanitary Corp., Buffalo, has been elected a civil member of the American Society of Naval Engineers.

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Functional realignment of the executive staff of Bendix Aviation Corp. has been announced by **E. R. Breech,** president, at Detroit.

Charles Marcus, former group executive over eastern divisions, has been made vice president in charge of engineering throughout the corporation. **D. O. Thomas,** former western group executive, becomes vice president of manufacturing in all Bendix plants.

Malcolm P. Ferguson, former general manager of Bendix Products at South Bend, Ind., succeeds Mr. Thomas as head of the western group. **Marvin A. Heidt** is his staff assistant in charge of industrial relations, and also chairman of the industrial relations committee for the corporation.

Raymond P. Lansing, general manager of Eclipse Aviation and Pioneer Instrument Division at Bendix, N. J., is named head of eastern divisions, with **G. R. Schenck,** former acting manager of the marine division, as staff assistant in charge of industrial relations.

Arthur E. Raabe, formerly sales manager of Eclipse Aviation, becomes assistant general manager of Eclipse-Pioneer, with **Kenneth MacGrath,** formerly factory manager, now also assistant general manager.

Hugh Benet becomes general manager of Bendix Radio Division at Baltimore; **N. B. McLean** general manager of the Philadelphia Division; **G. W. Smith Jr.** general manager of the Marine Division at Brooklyn and Norwood, Mass.

William L. McGrath is reappointed vice president of Bendix Aviation Corp. and general manager of Eclipse Machine Division at Elmira, N. Y. **T. W. Tinkham** is named general manager of Bendix Products at South Bend. He was formerly factory manager.

In co-ordinating widely diversified Bendix engineering activities, Mr. Marcus will be chairman of a new general engineering committee, and also will direct operations of the new devices and patent group, assisted by **L. A. Hyland,** formerly Washington representative of Bendix Radio. **A. A. Kucher** is named director of research, heading a new research laboratory established in Detroit.

OBITUARIES . . .

Carl C. Gibbs, 60, president, National Malleable & Steel Castings Co., Cleveland, died in that city, Sept. 9.

Born in Rush county, Indiana, he received his education in the Indianapolis schools.

He joined National Malleable in the sales department of the Indianapolis plant in 1905. He then worked a year in the shop and returned to sales, and in 1919 became sales agent at Cleveland. A year later he returned to Indianapolis as branch manager. In 1929 he returned to Cleveland as assistant to the president and was elected president five years later.

Mr. Gibbs was a member and had served as director of the American Foundrymen's Association, and was a member of the Steel Founders' Society of America, the Malleable Iron Research Institute and many other organizations. He was assistant chief of the Cleveland district ordnance advisory board.

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C. S. Lindsay, 75, president, Heppenstall Co., Bridgeport, Conn., died Sept. 6, in that city. Born in Pittsburgh, Mr. Lindsay had been associated with the Heppenstall Co. the past 31 years.

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Frank D. Gloser, 62, vice president and general manager, Crawford Steel Foundry Co., Bucyrus, O., died in Marion, O., recently.

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John A. Howe, 55, executive vice president, Truax-Traer Coal Co., Chicago, died in that city, Sept. 2. Associated with the company since 1931, he also was a director of Appalachian Coals Inc., which he helped to organize, and Bituminous Coal Research, Columbus, O.

—o—

John Goetz, 65, president, Goetz-Voss Corp., Milwaukee, maker of stokers and machine tools, died in Wauwatosa, Wis., Sept. 2. He founded the company in 1929, after having been for many years vice president and general manager of the former Kempsmith Mfg. Co., West Allis, Wis.

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Gustav E. Harcke, 64, associated with Air Reduction Sales Co., New York, for 26 years, died Aug. 2, in that city. Mr. Harcke joined Davis-Bournonville Co. in 1916, and became associated with Air Reduction when it acquired Davis-Bournonville. For many years he was active in conducting liquid air demonstrations, and in recent years devoted his services to building up the engineering and data files of Airco's general library.

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Thomas A. Callaghan, 51, president, Federal Pipe & Supply Co., Chicago, died at Mancos, Colo., Aug. 21. Mr. Callaghan's first affiliation with Federal Pipe was in 1923 as secretary; later as vice president and general manager, then as president.

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William H. Baltzell, 74, retired steel company executive and chief construction engineer for several steel plants in the Pittsburgh district, died Sept. 2. He entered the steel business as chief engineer for the old Schoenberger works, retaining the position after the plant was merged with American Steel & Wire Co. He was also chief construction engineer, Midland works of Pittsburgh Crucible Steel Co. Mr. Baltzell was a life member, American Society of Mechanical Engineers and Engineers Society of Western Pennsylvania.

Wage Premiums Hit Anti-Inflation Snag

PROBABILITY that President Roosevelt will issue an order outlawing all wage and salary increases in war industries that exceed the "Little Steel" formula was reported in Washington late last week.

The "Little Steel" formula of the War Labor Board provides that workers may receive up to a 15 per cent increase over their wage as of Jan. 1, 1941, to compensate for an increased cost of living.

Reports that this formula may be applied generally to war industries were circulated after the President by executive order had prohibited double or penalty rates for work on Saturdays, Sundays and holidays, as such.

The latter order permits double rates for a seventh consecutive day of work, but not for any particular day of the week as such. Days of the week lose their identity for wage determining purposes.

The ban on penalty rates was interpreted as a phase in the President's apparently growing determination to achieve an anti-inflation program, as expressed in last week's address to the nation.

United Steelworkers Named In Libel Suit by Falk Corp.

A $50,000 libel action against United Steelworkers of America, CIO, was filed last week in Circuit Court in Milwaukee by Falk Corp. The union's district director, a national field organizer and an agent of the local were named in the suit.

Ccompany alleged it was libeled in a handbill "composed, distributed and published" by the defendants in its plant, which stated Falk Corp. tried "to contradict the law of the land" and invoked a rule against soliciting or canvassing on company premises in an attempt to stop the legal organization of its employes.

Labor-Management Committees Organized in 1300 Plants

Labor-management committees to push War Production Drives have been established in 1300 American war plants, WPB chairman Donald M. Nelson has announced.

In announcing the names of the newest 100 plants, WPB led the list with the J. L. Sparling Pulley Mfg. Co., Bay City, Mich. This is the two-man plant of "the old gent and myself" that recently achieved national fame (STEEL, Aug. 31, p. 43). Mr. Sparling, the owner, 60, and his assistant, Percy Fogessonger, 79, are working 15 hours a day seven days a week on war material.

In the thirteenth 100 plants appears the name of the first major railroad to inaugurate a War Production Drive—the Illinois Central railroad. The railroad has 40,000 employes.

The Todd-Bath Iron Shipbuilding Corp., South Portland, Me., and the Mountain City Copper Co., Rio Tinto, Nev., two important companies in two critical fields of war production, also appear on the new list.

WLB Applies "Formula" to Raise Granite City Steelworkers' Pay

War Labor Board last week authorized a 44-cent per day wage increase for 1500 employes of Granite City Steel Co., Granite City, Ill., approving an agreement submitted by the company and the United Steelworkers of America, CIO.

Only one change in the agreement was made by WLB. It ordered the increase retroactive to Feb. 15, instead of July 1, as previously agreed upon by the union and management.

Hayward Neidringhaus, president, said a proportionate cost-of-living pay increase would also be given to about 300 clerical and office workers.

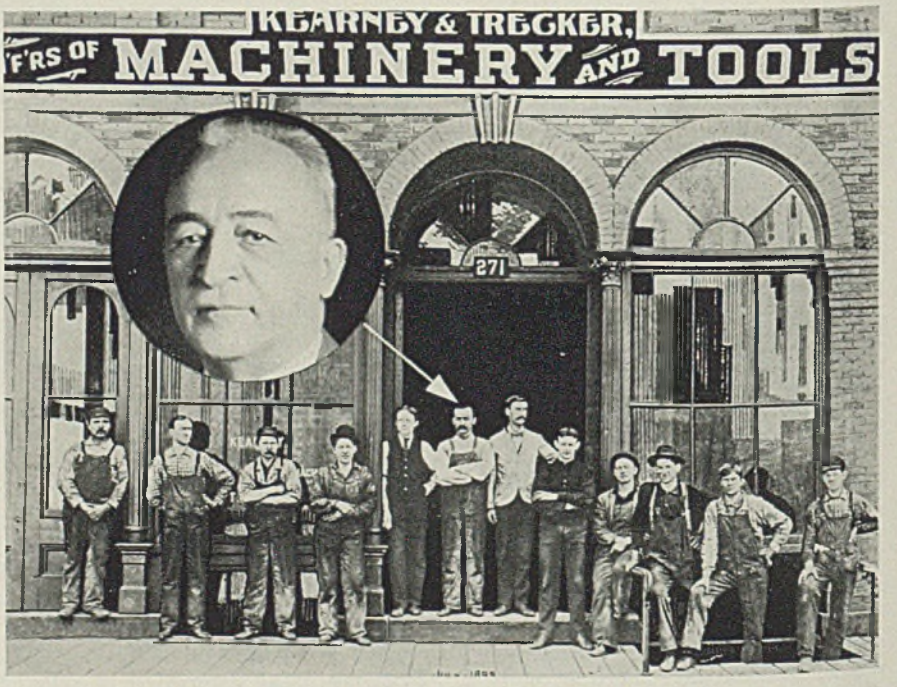
Women To Represent 30% War Labor Force by End of 1943

Women's Policy Committee to aid in mobilizing women workers for the war effort has been created by the War Manpower Commission.

The new committee will consider questions of policy concerning the commission's program for recruiting and training women workers, and will submit its recommendations to the chairman of the commission. It will also work closely with the commission's Management-Labor Policy Committee, which advises the chairman on policy.

War production alone employed about 1,400,000 women last December. This figure will jump to 4,500,000 by December, 1942, and will climb to 6,000,000 by the end of 1943. By then, women will represent at least 30 per cent of the labor force employed in war production, according to Paul V. McNutt, chairman of the manpower commission.

FROM OVERALLS TO HIGHEST HONORS



FORTY-FOUR years ago Theodore Trecker was working in overalls (arrow) in the tiny shop which he and Edward Kearney had just opened in Milwaukee. Last week the Army-Navy "E" award was presented to the 5000 employes of Kearney & Trecker Corp., of which Mr. Trecker (inset) now is president. Under Secretary of War Patterson congratulated Mr. Trecker "for accomplishing more than seemed reasonable or possible a year ago"

PRIORITIES – ALLOCATIONS – PRICES

Weekly summary of orders and regulations issued by WPB and OPA, supplementary to Priorities-Allocations-Prices Guide as published in Section II of STEEL, July 6, 1942

M ORDERS

M-21-f (Revoked): Armor-piercing Shot Steel, effective Sept. 3, 1942. Allocation of armor-piercing and semi-armor-piercing shot steel now covered in order M-21-a which provides for complete allocation of all alloy steel.

M-72-a (Supplementary Order): Lead and Tin Scrap, effective Sept. 2. Prohibits delivery to or acceptance by a producer of steel or iron of tinned scrap. Provides that tin plate clippings may be sold only to a broker or dealer or to a detinning plant. Tinned scrap must be sold only to brokers, dealers, municipal departments or agencies, buyers for beverage bottlers, or to a plant engaged in the precipitation of copper. Bottlers seeking permission to purchase used cans must apply to WPB on a certificate attached as Exhibit 1 to Order M-72-a. Producers of detinned scrap located in counties in California, Kansas, Missouri and Texas listed in the order as schedule A may not deliver scrap except to a plant engaged in the precipitation of copper.

M-126 (Amendments): Iron and Steel Use, effective Sept. 3. One amendment revises 30 items on List "A", Supplementary List "A", and List "C". The "A" lists comprise articles which cannot be manufactured of steel, except as outlined. List "C" is the Military Exemption List. The other amendment adds a number of items to List "C" at the request of the Army, Navy and Maritime Commission.

M-226: Dichlorethyl Ether, effective Sept. 5, 1942. Prohibits delivery or use except as specifically authorized by WPB. Authorization may be requested on forms PD-600 and PD-601.

M-227: Copper Chemicals, effective Oct. 1. Provides for complete allocation control. Deliveries of small orders may be made by certification from purchaser to supplier. Limits on small deliveries are 450 pounds of copper sulphate, oxide, nitrate, and cyanide, in any one month.

L ORDERS

L-5-d (Amendment): Refrigerators, effective Sept. 5, 1942. Permits independent distributors with frozen stocks of gas and electric refrigerators to release those which they had on Feb. 14 through their normal distributive outlets. Retail dealers holding gas refrigerators are permitted to sell those they had on the same date upon consumer's certification that he has no other refrigeration equipment at his disposal.

L-50 (Amendment): Telephone Industry, effective Sept. 7, 1942. Stops further installation of residence telephone extensions; prohibits placing of open copper wire in local exchange line plants; limits replacement of equipment and facilities to the essential requirements of maintenance, repair, or protection of existing service with certain exceptions; reserves certain facilities for war work, public health, welfare, or security; limits additions of telephone plant capacity; and restricts use of copper or steel wire for plant extensions.

L-126 (Amendment): Refrigeration and Air Conditioning Equipment, effective Sept. 2, 1942. Adds a schedule of specifications which limits use of nonferrous metals, the weight of ferrous metals and percentage of materials which may be used as a coating or bonding material in manufacture of coil or tube assemblies.

L-148: Telephone and Telegraph Equipment, effective Sept. 7, 1942. Limits non-essential production of wire telephone and telegraph equipment. Manufacturers, distributors and dealers are prohibited from accepting any order for the purchase or use of wire communications equipment that does not carry a rating of A-7 or higher.

L-158 (Amendment): Automotive Replacement Parts, effective Sept. 1, 1942. Provides that manufacturers may schedule production as if orders received by them had a rating of AA-2X.

P ORDERS

P-129 (Amendment): Communications, effective Sept. 7, 1942. Removes operators of wire telephone communications systems from provisions of P-129 and transfers them to the maintenance, repair and operating supplies provisions of P-130.

P-130 (Revision): Telephone Communications, effective Sept. 7, 1942. Assigns to operators an A-1-a rating for material required for construction of facilities necessary to serve defense projects bearing rating of A-1-c or better.

PRICE ORDERS

No. 82 (Amendment) Wire, Cable and Cable Accessories, retroactive to July 22, 1942. Includes wholesalers in coverage or order, establishing Oct. 15, 1941, as base price date. Simplifies the procedure for establishing new price sheets and new standard estimating procedures.

No. 214: High Alloy Castings, effective Sept. 2, 1942. Establishes maximum prices at levels prevailing between Oct. 1-15, 1941. New pricing provisions follow: (1)—For castings of a design sold between July 15 and Oct. 15, 1941, maxima are the highest prices at which the same quantity of the same design was sold during that period. (2)—For castings of designs not produced by the producer between July 15 and Oct. 15, 1941, but of a design produced and sold commercially by the industry since 1937, maxima are the base schedules used by the Chemical Foundation as a basis for minimum prices under its licensing agreements. (3)—For castings for which no prices are established in the two foregoing categories, maximum prices shall be based on Oct. 1 to Oct. 15, 1941, cost factors and profit margins. Such prices are to be submitted to and approved by the OPA. Certain statements must be filed by producers of high alloy castings by Sept. 25, 1942.

Maritime Commission Aims Toward Greater Conservation

To consolidate efforts to conserve critical materials, the Maritime Commission has established a Conservation Committee. Committee will co-ordinate conservation activities of the commission, shipyards and subcontractors, and will initiate investigations and formulate plans looking toward a greater reduction in the use of rubber, copper, tin and other strategic materials in ship construction.

Establish New Specifications For Government Buildings

Emergency specifications for the design, fabrication and erection of structural steel for buildings, to be applicable to all contracts let by the government after Nov. 9, have been established by WPB. Use of the specifications, which follow the policy stated in the joint directive of wartime construction made by the WPB and the Army and Navy May 20 and the list of prohibited items for construction work issued by the Army and Navy Munitions Board June 29, will result in savings of about 10 per cent of the structurals entering into government buildings.

Specifications authorize an increase in the stress allowances from 16,000 to 20,000 pounds per square inch to a mandatory 24,000 pounds a square inch.

Overhead Traveling Cranes Placed Under Allocation

Overhead traveling cranes have been made subject to direct production supervision and allocation by the WPB.

General Preference Order M-225 provides production and delivery schedules may be established by WPB and in such cases, shall be maintained without regard to any preference ratings already assigned or hereafter assigned to particular purchase orders. Only specific directions of the Director General for Operations can alter overhead traveling crane production schedules.

29,300,000 Pounds Immobilized Copper Recovered by WPB

Transfers of copper from idle and excess inventories to producers needing this critical metal for the manufacture of war materials, is aiding many plants to maintain schedules and, in many instances is preventing complete shutdowns when emergency shortages occur.

Inventory and Requisitioning Branch of WPB has allocated 29,700,000 pounds of copper and copper base alloys from immobilized stocks to war production channels through the WPB's copper recovery program, instituted eight weeks ago.

WINDOWS of WASHINGTON

Attacks on patent system, engineered largely by Department of Justice antitrust division and three senators, excellent job of propaganda, but system probably will be able to withstand assault

MANY manufacturing research organizations, as attested by letters they have sent to the editors of STEEL, have become alarmed over recent attacks on the American patent system. It may be said at once that the present threat may not be nearly as serious as seems to be feared. The American patent system is a robust system. It has been under fire for many years but has never given ground when it has been defended with evidence of its benefits.

The latest chapter in the assault upon the patent system began in the hearings of the Temporary National Economic Committee, when volumes of testimony were accumulated without developing any important proposals that had not been heard years before. The antitrust division of the Department of Justice developed this exposition with the thesis that there is misuse of the patent system to evade antitrust laws. This has since been the burden of the Department of Justice in its allegations in cases brought in the courts and which are likely to be contested for some time before there are final decisions. Whatever these decisions, it is to be remembered that they relate primarily to the antitrust laws.

The current attack on the patent system, although appearing to come from the Senate committee on patents, actually is being waged by three senators, O'Mahoney, Lafollette and Bone, of whom only Bone is a member and chairman of the committee on patents.

Would Mean Compulsory Licensing

These three senators in February this year introduced a bill identified as S. 2303. It contains some mysterious draftsmanship. Its language would ordinarily be interpreted to give the President power during the war to issue licenses under patents needed for war production. It has been disclosed that the language is intended to permit anyone to use any patent relating to the production of an article designated as necessary for war purposes. This would mean compulsory licensing on a wide scale. All a patentee could do would be to sue for reasonable compensation.

The Senate patents committee is small, even smaller than the committee on printing. Its membership contrasts with the 20 senators on the committee on agriculture, 20 on the committee on banking and currency, and so on. In addition to the chairman, the members of the patents committee are Senators Cotton Ed Smith, Pepper, Clark of Idaho, Lucas, White and Danaher. Some of these senators did not at first pay much attention to what was going on, so that much water went over the dam before they took notice.

The committee began its hearings in April with Arnold's subordinates testifying under subpoena. No attempt whatever was made to analyze the patent system. The whole inquiry was aimed at airing certain aspects of American-German patent relationships and making capital of them in an attempt to show up the patent system in general in a bad light. The hearings were all ex parte and the defendants were not permitted to cross examine. It constituted a beautiful job of propaganda.

One of the purposes, at least of the antitrust division, careful observers concluded after studying the testimony, was to get American business more under the thumb of the Department of Justice. Consent decrees that have been engineered show that the department wants to move into a supervisory position wherever it can.

Thurman Arnold

Head of the antitrust division, Department of Justice. Recommended legislation for cancellation of patents found to be used in violations of antitrust laws, and led "propaganda" attack on patent system

The purpose was made perfectly clear at the end of July by Thurman Arnold himself. Reappearing for testimony at the hearings, he recommended legislation which would provide for cancellation of patents found to have been used in connection with violations of the antitrust laws—unless in advance the patentee had disclosed to the Antitrust Division the manner in which they proposed to use their patents. Senator Lucas, of Illinois, has since introduced these proposals as a bill, which has thus been formally added to the aggregation of measures before the Patents Committee. This bill is identified as Senate Bill 2730.

During the hearings at the end of July, incidentally, the question was raised as to why the legislation proposed by the Department of Justice did not contain any provision for just compensation to patent holders. On this point a department attorney stated that it was not prepared to go on record as admitting a patent has property rights.

Just as the situation was getting pretty hot and disagreeable, the compaign struck a snag. There was an executive session of the Senate committee on patents—and at this meeting all the members were present. Just what happened has not leaked out but it soon seemed evident that the Bone-O'Mahoney-Lafollette-Arnold quartet had been slapped down.

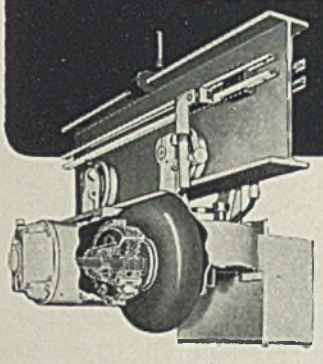
Bill Faces Formidable Barriers

For any measure of success in legislating the propaganda against the patent system for which the Senate patents committee has been furnishing a sounding board some formidable barriers would have to be overcome. It would not only have to obtain support from a majority of the Senate committee and pass the Senate, but would have to undergo the realistic examination which the House committee on patents undoubtedly would give.

One factor that is encouraging to all friends of the patent system is the caliber of the men appointed by President Roosevelt, on Dec. 13, 1941, to constitute the National Patent Planning Commission. This commission was appointed to study the patent system to find if it is furnishing encouragement to invention and whether the efficiency of the system can be increased. The

AMERICAN MONORAIL EQUIPMENT

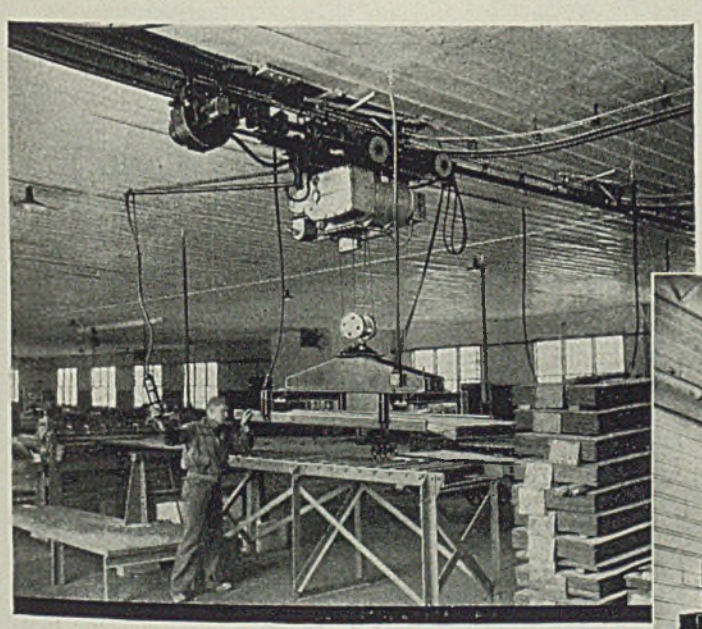
TURNS BACK-BREAKING HANDLING INTO FINGER-TIP HANDLING



Here are photos of two plants that have recently installed American MonoRail Overhead Handling Equipment. In both of these plants, tons of sheet steel are handled as easily as a small boy handles his electric train—with the same finger-tip control. The handling of heavy loads has become practically child's play. These two installations are typical of hundreds of others that have solved their back-breaking jobs with American MonoRail Equipment.

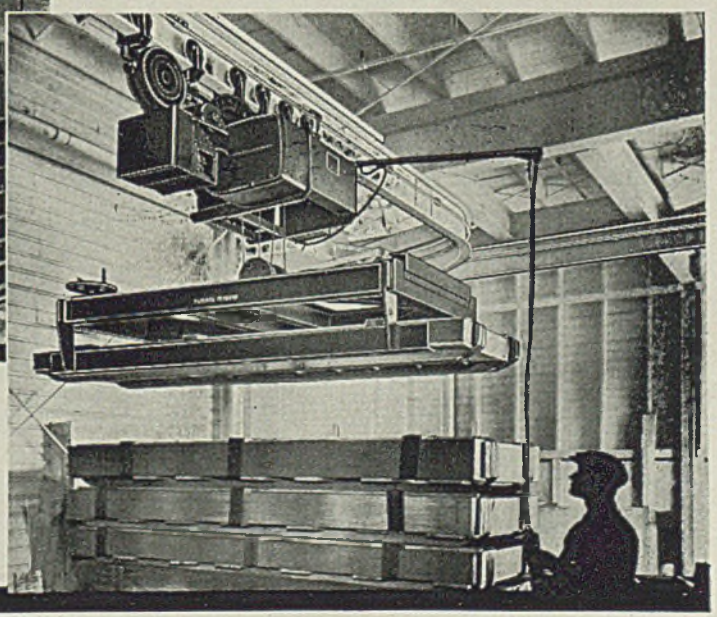
Today, production is handled with unheard of speed and efficiency. American MonoRail Equipment is playing an important part. An American MonoRail Engineer will gladly explain the advantages of this equipment in your plant. This service is without cost or obligation—furthermore, there is no delay or shutdown during installation. Write today.

WRITE FOR Blue Book illustrating hundreds of MonoRail installations.



◀ Push button switch controls Mono-Tractor, hoist and special grab operation.

▼ Five tons of steel travel overhead by finger-tip control.



THE AMERICAN MONORAIL CO.

13102 Athens Avenue Cleveland, Ohio

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objective is to develop ways and means now for speeding to a postwar recovery after period of wartime economy has come to an end.

Chairman of the commission is Charles F. "Boss" Kettering, general manager of the Research Laboratories Division of General Motors Co., and director of the National Inventors Council. Another, chosen for his "labor" background, is Edward F. McGrady, in charge of labor relations for the Radio Corp. of America, and director of R.C.A. Communications, RCA Mfg. Co., National Broadcasting Co. Another is Francis P. Gaines, president of Washington and Lee University. Another, chosen for his "agricultural" background, is Chester G. Davis, president of the Federal Reserve Bank of St. Louis. Conway P. Coe, Commissioner of Patents, is given a close relation to the commission as its executive secretary.

System Still In Danger

At least some of these men are well acquainted with the American patent system and the results it has produced. This summer they have brought in another experienced man and made him executive director of the commission. He is Andrey A. Potter, dean of engineering at Purdue University.

The foregoing summary is not intended to lull anybody to sleep. There will be more attempts to overthrow the patent system and constant vigilance is necessary to ward them off. In order to help prevent any future patent legislation of an adverse character manufacturers can do two things.

The first is to see that their houses are in order and that their possession and use of patents is beyond criticism. They must make sure that no proof can be found that patents are bought and placed on the shelf in order to prevent competition. They must make sure that patents are not used to control prices or to restrain trade. They must be sure that all agreements as to the use of patents in foreign trade will stand the light of day.

The second thing for them to do is to inform their Congressmen about the nature of their patents and the extent to which they have elevated the plane of living and the extent to which they have created employment. Employment is something in which Congressmen always are interested and they seldom refuse to vote the right way on any legislation that will help employment and the general prosperity, provided they are correctly and adequately informed.

Manufacturers will do well to consider maintenance of employment in the postwar period as our greatest future problem. They should convince members of Congress that our patent system should be continued in fullest vigor in order that inventions and their applications may be encouraged and accelerated to create and add to employment when the war production program begins to taper off.

Loosely-Drawn Renegotiation Act Works Hardships on Contractors

DURING the recent Senate finance committee hearings on provisions to be included in the 1942 revenue act, much of the testimony related to Public Law No. 528 which was enacted as part of the Sixth Supplemental National Defense Appropriation Act.

This is the law under which the Secretaries of War, the Navy and the Maritime Commission are instructed to renegotiate any contract involving more than $100,000 "at a period or periods when, in the judgment of the secretary, the profits can be determined with reasonable certainty."

It will be recalled that when this law was under consideration the superficial Senate debate on it revealed that there was confusion in that body as to just what the law really meant. Despite this confusion it was enacted for the purpose of preventing unreasonable profits on war contracts. It was based on the principle that nobody should be allowed to get rich out of this war.

The law was drawn up loosely. It permits each secretary or his representatives to reduce the contract price by any amount which he may believe to represent excessive profits. The secretaries are instructed not to allow "salaries, bonuses or other compensation paid by a contractor to its officers or employes in excess of a 'reasonable' amount, nor shall they make allowance for any excessive reserves set up by the contractor or for any costs incurred by the contractor which are excessive and unreasonable."

The law authorizes each secretary to hold up payments on contracts to the extent of the amount by which the contract price was unreasonable. Where payments already have been made the secretaries are authorized to bring suit for repayment by the offending contractors of an amount found to be unreasonable. The law, as now in effect, is to continue operative up to three years after the end of the termination of the war.

The law contains absolutely no definitions of such terms as "excessive" and "unreasonable." Thus, the three secretaries and their agents are left to use their own particular yardsticks as to the extent to which contracts should be renegotiated.

Risks Government Integrity

From testimony submitted at the hearings it is difficult to see how this law can survive, even with drastic revisions. It is discouraging to maximum war effort through causing contractors to lose confidence in the integrity of government contracts and through placing a contractor's financial status in jeopardy.

One particular witness, John B. Hawley Jr., president, Northern Pump Co., Minneapolis, which has Navy contracts for $200,000,000 of gun mounts and coacting hydraulic equipment, stated the case very effectively as follows:

"We are faced with a tax program composed of two parts: One is the Renegotiation of Contracts Act. The other is the 1942 Revenue Act. A fair tax program should be drafted which will apply only one yardstick, one set of returns, and one body to administer.

"The administration of Public Law No. 528 has resulted in Price Adjustment Boards being created by the Secretaries of War and Navy and by the Maritime Commission. We have observed the functioning of these boards and have had contact with the Navy board.

"The law requires renegotiation and price adjustment of firm contracts entered into prior to the effective date of the law. This is an abrogation by the United States government of its contracts and has caused contractors to lose faith in the integrity of all government contracts. The renegotiation clause in the new contracts makes the contract price subject to reduction without contractor's consent. Then production becomes secondary to caution.

"It is impossible for the Price Adjustment Boards to apply uniform treatment to all contractors. The entire administration of the law is left to the discretion of the Navy, War and Maritime Commission. It is so wide open that contractors are at the mercy of the opinions of a few individuals. No protection is given the contractor against repeated renegotiation. The contractor

has no practical right of appeal from the rulings.

"Federal income tax rulings are of long standing and are familiar to the contractor. Present accounting methods adopted by the boards do not agree with those used by the Treasury Department for income tax purposes and the contractor is whipsawed between conflicting audits. The law cannot be administered without discriminatory action. Discriminatory action must be exercised as to:

"1—Time over which contractor's earnings are to be renegotiated;

"2—Rate of profit to be allowed in each individual case;

"3—Whether profits remaining after renegotiation are subject primarily to normal tax rates or, as in our case, primarily to excess profits tax rates. No consideration whatever is given to income taxes in renegotiation procedure;

"4—Whether or not state income taxes are to be considered in renegotiation.

"The First War Powers Act of 1941 stipulates: 'Nothing herein shall be construed to authorize the use of cost plus a percentage of cost system of contracting.'

"The boards have uniformly based profits on a percentage of costs, which is contrary to the provisions of the First War Powers Act. This method results in contractors with fixed price contracts having their profits determined on the basis of a cost plus a percentage of cost. The contract price becomes merely a ceiling. This encourages high costs and penalizes severely the low-cost producer. Costs are a function of production and the low-cost producer is the high-rate producer. Thus the result of basing profits on costs is very definitely to slow down production. Contractors are unwilling to assume heavy obligations to perform government contracts, knowing that their final profit is left to the discretion of a few individuals.

Slows Production

"In the interest of maximum production, corporate management should not be unduly burdened with problems concerning over-extended financial risks, renegotiation of firm contracts and continuous audits which divert attention from the real job of production. Legislative action having retroactive effects and which leads to abrogation of firm contracts leads the manufacturer to believe that other drastic changes in the rules may be forthcoming. Thus he is willing to make only short-term commitments and take contracts for small quantities. This reduces possible savings resulting from mass production. He is no longer in a position to 'jump the gun' and start work on projects prior to receipt of formal contracts, as future earnings are completely unknown and no longer within his control."

Manufacturers who have been hurt as a result of contract renegotiations, and still others whose security is threatened under this new law, should get the facts before their representatives in Congress. Already feeling in Congress is growing that this law was a mistake but favorable action will depend on the weight of the evidence supporting that viewpoint.

In particular, evidence of this nature should be placed in the hands of the Senate finance committee. The members are: Senators Walter F. George, chairman, David I. Walsh, Alben W. Barkley, Tom Connally, Josiah W. Bailey, Bennett Champ Clark, Harry F. Byrd, Peter Gerry, Joseph F. Guffey, Prentiss M. Brown, Clyde L. Herring, Edwin C. Johnson, George L. Radcliffe, William H. Smathers, Robert M. Lafollette Jr., Arthur Capper, Arthur H. Vandenberg, James J. Davis, Henry Cabot Lodge Jr., John A. Danaher and Robert A. Taft.

Wage-Hour, Public Contract Units Merged To Facilitate Operations

Consolidation of the Wage and Hour and Public Contracts Division of the Department of Labor (STEEL, Sept. 7, p. 54) will facilitate the administration of both, improve enforcement, and save employer the necessity of dealing with two inspectors, L. Metcalfe Walling, administrator, explained last week.

"Administration of the two acts will be conducted from the present field offices of the Wage and Hour Division," Mr. Walling said. "The functions of the Public Contracts Division (Walsh-Healey) will be decentralized to the regions in the same manner that functions of the Wage and Hour Division were decentralized three years ago. Workers who have questions concerning their employment on contracts for the government may now obtain the same information concerning them that employes generally engaged in interstate commerce have obtained in regard to the Wage and Hour law."

The Public Contracts law was passed in 1936 and became effective in 1937. Its aim was to retrieve some of the features of the NRA.

Procurement officers of the government found that under open bids on government contracts legitimate employers were suffering because of unethical competition from those who bid low prices and took it out of the workers' pay envelopes, Mr. Walling said. "It became essential, therefore, to establish certain requirements for a contractor to become eligible to perform a contract for the government.

"These requirements were basically that goods should be produced in safe and sanitary surroundings, that workers engaged in their production should receive at least the prevailing minimum wage of the industry in which they were employed and that they should receive overtime after eight hours in any one day, and 40 hours in any week, whichever was higher.

"The Fair Labor Standards act, commonly known as the Wage and Hour law, was passed in 1938, and provided that all employes engaged in interstate commerce or in occupations necessary to the production of goods for commerce, should receive minimum wages ranging, since 1939, from 30 to 40 cents per hour, and that they should receive overtime at the rate of one and one-half times their regular wage after 40 hours had been worked in any one work-week. The Wage and Hour law made no provision for safety and sanitation, nor for overtime after a single workday of 8 hours.

"Aside from the simplification of inspection procedure, the consolidation, through the training of Wage and Hour inspectors in simple procedures of safety and sanitation, is certain to prove beneficial to the workers of America.

"In 1940, 18,000 workers in industry were killed in industrial accidents. In 1941 the number jumped to 19,600, almost 10 per cent. Within the first six months after Pearl Harbor 11,000 workers, practically an entire division in one of the modern mechanized armies, were killed in industrial accidents.

"Many of these accidents are preventable. Principally, they are of the slip-fall-stumble variety. We have seen mounting evidence that where management and employes co-operate in the formation of safety committees that this type of accident does decrease. We have available now in the Wage and Hour Division offices copies of a pamphlet which shows how many of these accidents can be prevented."

Source of Vanadium Found In Western Phosphate Rock

A NEW method of extracting vanadium, assuring the United States an adequate supply of this strategic metal used to toughen armor plate and war production tools, was announced in a report issued by the American Chemical Society, which held its 104th meeting in Buffalo last week.

With the United States dependent on foreign sources, principally Peru, for nearly 50 per cent of its supply of vanadium, utilization of the new process would ease the critical situation brought about by the increasing hazard of ocean transportation, it was stated.

The method would speed efficient recovery of vanadium which exists in high-grade phosphate rock deposits in Idaho, one of the largest known reservoirs of the ore in the world. It has been estimated there are 5,700,000,000 tons of phosphate rock in that sector, of which 500,000 tons are recoverable vanadium.

The process, both economical and rapid, is the result of four years of research by Dr. J. Perry Morgan, chemical engineer of the Standard Oil Co. of New Jersey, carried out under the direction of Dr. Arthur W. Hixson, professor of chemical engineering at Columbia University.

Requirements Are Double Output

Requirements of the Army and Navy for vanadium are about double the present production of the metal, the report said. The metal which imparts strength and durability to iron and steel, serves in automobile axles, crankshafts, and the like, in armaments and machine tools, in locomotive piston rods and countless heavy duty jobs. Vanadium used in iron and steel varies in amount up to four pounds to the ton.

The Idaho phosphate rock is mined at present by the Anaconda Copper Co. for use in manufacturing fertilizer. Although some vanadium is recovered in the operation, it is estimated that the production of the rock in 1939 which amounted to 95,451 long tons meant more than 385,000 pounds of vanadium went into fertilizer of one form or another.

"This loss becomes quite significant in view of the fact that it is equal to about 23 per cent of the vanadium imported in that year," the report said. "It is probable that the production of phosphate rock from this section has increased sharply during the last two years, making a considerably larger quantity of vanadium available as a by-product."

While the ores are much too low in vanadium to be worked for the metal alone, the report continued, it seems reasonable that the metal may profitably be recovered in the manufacture of fertilizer.

The phosphate rock, treated with sulphuric acid, forms phosphoric acid in solution which is evaporated until its content is 45 per cent phosphorus pentoxide. The concentrate is treated with strong nitric acid in an oxidizing and precipitating tank. The next step is to separate the phosphoric acid from the vanadyl phosphate which was precipitated or separated in the tank.

The phosphoric acid is filtered off to be used in the manufacture of fertilizer, leaving the vanadyl phosphate in solid cake form. The cake is taken to a dissolving tank where water and live steam are played upon it. The resulting solution is then placed in a precipitator and ammonia gas and ammonium nitrate are added. The materials in the precipitator are then filtered, leaving a cake of ammonium vanadate. This cake is heated in a furnace to produce vanadium pentoxide as a solid and the ammonia gas is piped off for reuse in the process. Vanadium pentoxide is the form in which vanadium is usually marketed.

The country's war effort has made it imperative that new sources of vanadium be developed immediately, the report said.

"The indication is that the tremendous demand for vanadium-alloyed steels in war materials will be accompanied by a far greater dependency upon the Peruvian supply. This is particularly undesirable in view of the increasing hazard of ocean transportation.

"Yet even the foreign sources are inadequate. At our scheduled rate of production, the maximum output of every important prewar source in the world would fall far short of that now required. The need for expanding our domestic production is obvious. . . .

"F. L. Hess, of the United States Geological Survey, suggested the possibility of recovering vanadium in conjunction with the manufacture of phosphoric acid and phosphatic fertilizers from Idaho phosphate rock."

Continuing search for strategic and critical minerals in the "black sands" of the Oregon beaches is under way, with the aid of geophysics, by the Geological Survey.

Surveys along the beaches have revealed deposits containing chromite, ilmenite, magnetite, and zircon in sufficient quantities to encourage mining. Investigations by government agencies and private companies thus far indicate reserves, in coastal terraces representing ancient raised beaches, of 1,400,000 long tons of sand averaging between 5 and 9 per cent of chromic oxide and as much as 1 per cent of zircon. Present beaches are estimated to contain perhaps 90,000 long tons of sand averaging 5 per cent or more of chromic oxide. Geologists believe that extensive but unknown reserves are probably present at other locations in which black sands occur.

Chromium is in heavy demand for war purposes, being an essential ingredient in armor plate, stainless steel, and similar types of high-grade steel. Ilmenite is greatly sought by the paint industry, and zircon is needed for special fire brick and as a substitute for badly needed war minerals in baked-on enamels. Methods for separating these economic minerals from the Oregon beach sands have been developed, and the Krome Corp. is now erecting a mill to treat 2000 tons of ore daily.

Outlined with Magnetometer

"Black sand" is so called because it consists in large part of the dark, heavy metallic minerals magnetite, chromite, and ilmenite, and commonly is stained by iron and manganese oxides. The black sand occurs in lenses or strata ranging in thickness from a fraction of an inch to more than 30 feet, and overburden ranges from a few feet to 70 feet.

Geophysical surveys made by the Geological Survey during the past six months have shown promise as an aid in tracing concealed bodies of black sand. Since the metallic minerals, especially magnetite, are more or less magnetic, the richer or thicker bodies of black sand can be outlined with the magnetometer, and beds roughly estimated to contain perhaps 750,000 tons of sand have been indicated with the aid of this instrument. The results of a magnetometer survey on the Shepard property checked closely with data from drilling, and further checking of magnetometer surveys by drilling on the property of the Krome Corp. showed consistent results. The work done so far indicates that the magnetometer is a useful instrument in outlining bodies of black sand that contain sufficient magnetite under shallow or moderate cover, but where the overburden is heavy the results must be checked by drilling.

Build Own Boring Mill To Save Time

INGENIOUS application of tool knowledge to solve a perplexing manufacturing problem is reflected in the special tooling designed by engineers of General Motors' Fisher Body division in producing upper carriages for anti-aircraft guns. Fisher's Ternstedt division was assigned the job and investigation showed necessary machine tools could not be obtained from normal sources in less than 18 months; so decision was reached to build the tools instead of buying them.

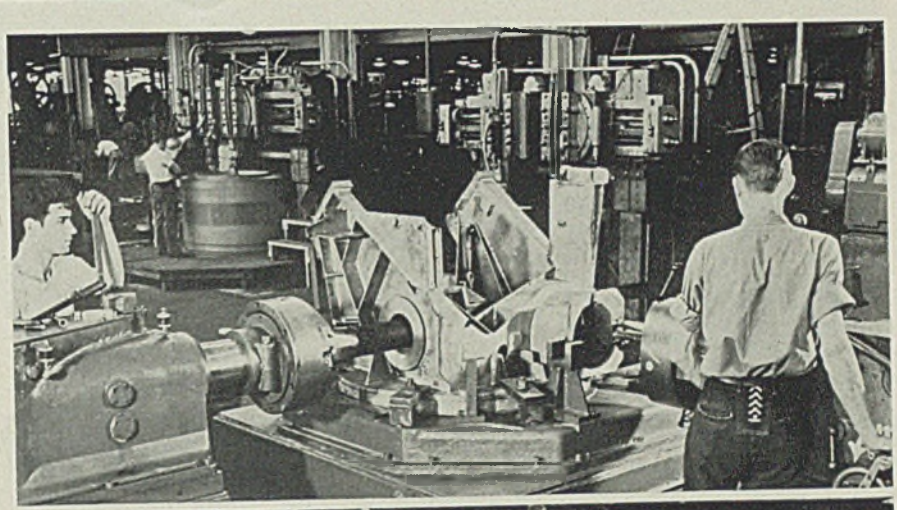
Well over 25 boring machines were built for the job, all representing the adaptation of single-purpose equipment for multiple operations. Standard-type heads were designed, so that parts for them could be farmed out to numerous small machine shops not equipped to build entire machines. Remaining parts of the machines were designed to suit the specific jobs they would be required to do, using the standard type of head on each.

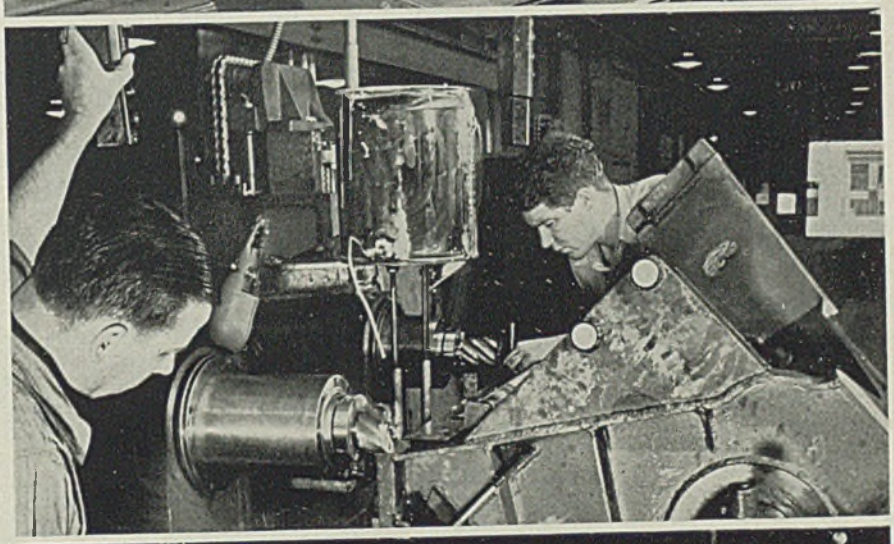
Setups Combined

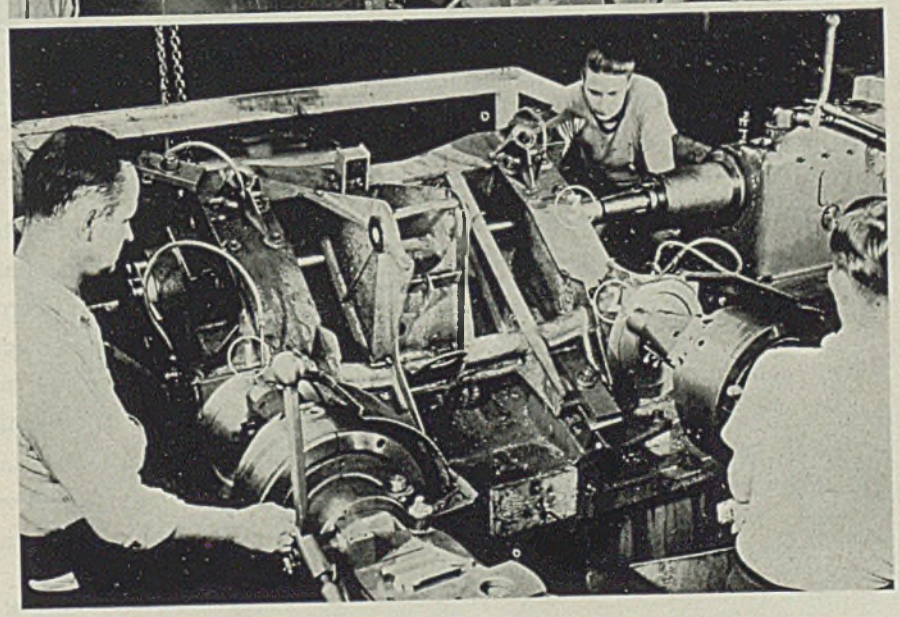
Result is that setups have been combined and operations bunched, permitting one machine to do the work of three of four standard boring mills, and one grouping of seven machines handles the work which otherwise would require 50-odd machines. The savings in floor space and manpower are obvious.

Key to the success of the plan lies in having two and sometimes three boring heads work on one part simultaneously, as shown in accompanying illustrations. The part, once set in the fixture, undergoes several operations—perhaps boring, milling and facing combined—saving production time both in machining and in fixture setting.

Use of standard boring heads for different operations, such as drilling and circular facing, is a novel procedure and requires a facing head which feeds constantly and full automatically. Design of the machines also permits traversing the heads up or down and sidewise.







Boring and facing operations — top photo—are performed simultaneously on gun carriage part on these specially designed machines mounting standard types of heads but tooled and positioned with respect to the fixture to permit combining operations

♦

If you can't buy a machine, build it, was the motto of Ternstedt engineers who worked out this dual head arrangement for two simultaneous milling operations on a gun carriage—middle photo

♦

Here—lower photo—is another version of combined machining operations. Heads 1 and 2 are facing surfaces of the gun carriage; head 3 is boring. This arrangement is said to handle the work of seven standard machine tools

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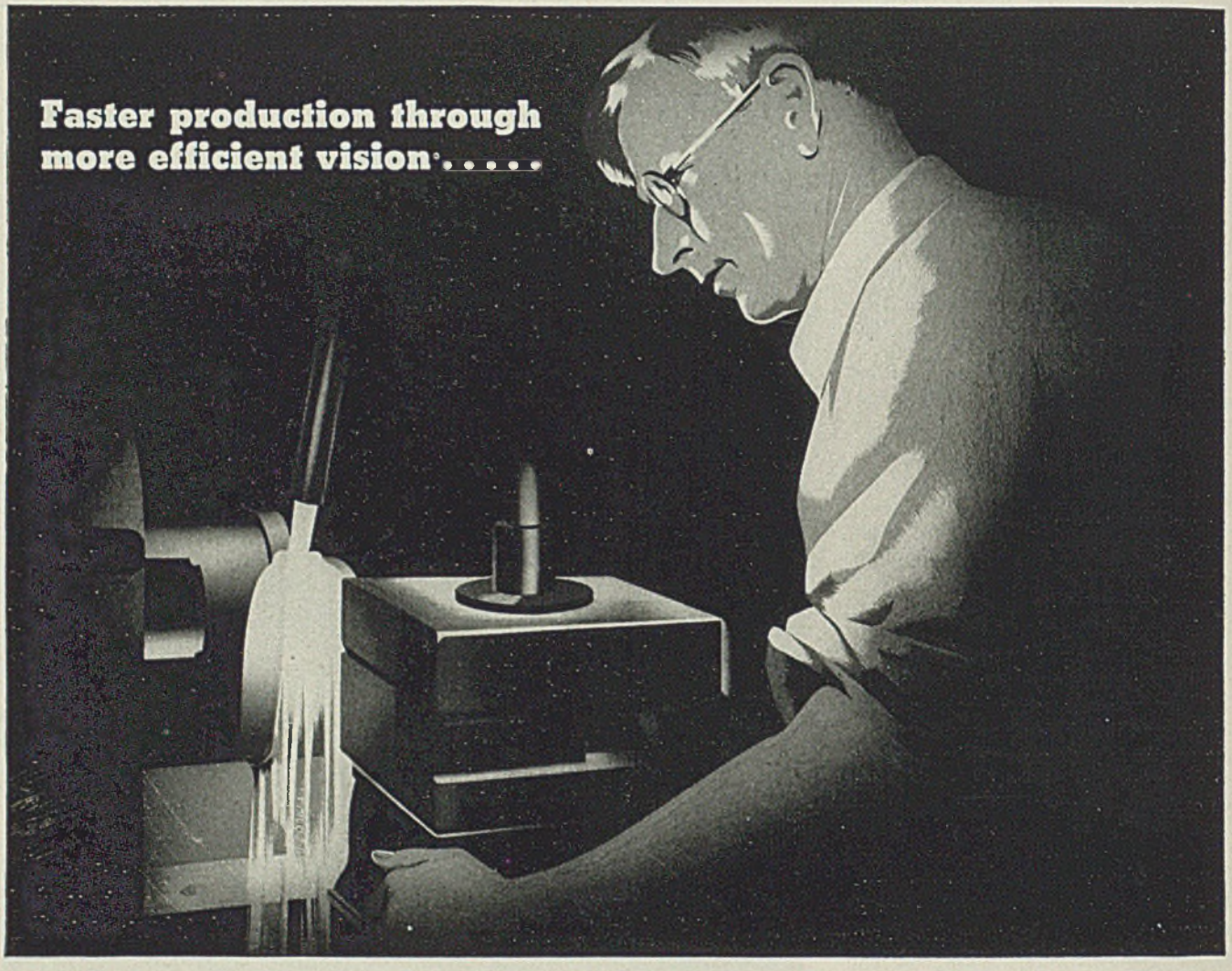
Approximately $50,000,000 of war contracts have been placed recently with New York city plants, according to Commissioner George A. Sloan, city department of commerce. In the past two weeks, he said, government agencies have placed substantial orders for surgical instruments, metal containers for the Chemical Warfare Service, sterilizers, practice bombs, and other items.



Information supplied by "The American Weekly"— Mr. R. D. Potter, Science Editor

More and more wartime conditions are bringing men over 40 into high-speed or close tolerance industrial work. Many of these have eyes not quite up to the job. Under peacetime conditions this defect is not of vital importance, but today with every nerve strained to increase production, it is serious.

Some industries are giving mass eyesight examinations seeking to find those employees needing glasses or optical corrections in the glasses they now have. Still others take the added precaution of endeavoring to fit the job to the type of eyesight available for it — near-sighted people may be excellent on close work such as bomb sight assemblies, whereas far-sighted people would be better suited to work on a large lathe where micrometer readings must be made at distances as great as 30 inches. Following this thought further some companies have employed special occupational eye glasses ground to fit the working conditions of the employee.

Efficient eyesight is the backbone of fast, accurate production. It will pay Industry to further it by every means possible.

By A. H. ALLEN *Detroit Editor, STEEL*

MIRRORS of MOTORDOM

Hurbenium, new lead alloy coating for iron and steel, evolved by surgeon and wife seeking nontoxic lead, interests automotive companies. . . UAW-CIO protest against Labor Day closing "phoney"

DETROIT

HERE is the story of Hurbenium—newest entry in the field of metallic coatings on iron and steel which, for pure drama and fantasy, will really pin your ears back:

Eight years ago, in Orlando, Fla., Dr. Nettie M. Hurd, one-time woman surgeon in Chicago, lay on a sick bed, restless and out of sorts with the world. An infected throat had brought on complications which were destined to make her bed-ridden for some eight years. Her husband, Dr. Benoni A. Bullock, cancer specialist, surgeon and physician in his own right, sought to comfort his wife and to interest her in things which would take her mind off her own helplessness.

One day Dr. Hurd read a shocking story about the death of two youngsters from poisoning induced by playing with lead toys. Pondering this news report, she wondered why it might not be possible to develop a nontoxic lead. She discussed it with her husband and he persuaded her to study the matter thoroughly and offered his services as laboratory technician to carry out his wife's instructions.

Upshot was that after long periods of study on the mechanics of lead poisoning and on the chemistry of lead and its alloys, a method of processing lead was developed which is claimed to remove its toxicity. It must be remembered that the investigators were not metallurgists and their experiments were performed in the crudest types of equipment. Further, they can offer no sound metallurgical explanation for what is accomplished, and as yet independent research has not progressed to the point where explanations are offered.

Highlights of the Process

Essentially, the processing (covered by process patents issued in 1939) involves cutting up pig lead into small chunks, mixing it with fullers' earth plus concentrated sulphuric and nitric acids. This mass is contained in an externally heated pot, held at temperature of about 800 degrees Fahr. until the lead becomes molten. After 90 minutes the pot is skimmed off and the molten metal transferred to a second pot for the final step in the processing. In the first stage, nearly one-third of the metal, by weight, is lost in fumes and in the scum formed on the mixture of metal, fullers' earth and acids.

In the final step, a mixture of sodium chloride, sodium silicate and oxalic acid is added to the molten metal which is agitated continually and kept at high temperature. What this treatment accomplishes Dr. Bullock could not tell this writer, nor could he offer any explanation of the combination of chemicals added in the second stage of refining. Apparently he just threw in the metal soup what his wife told him to throw, and no questions asked.

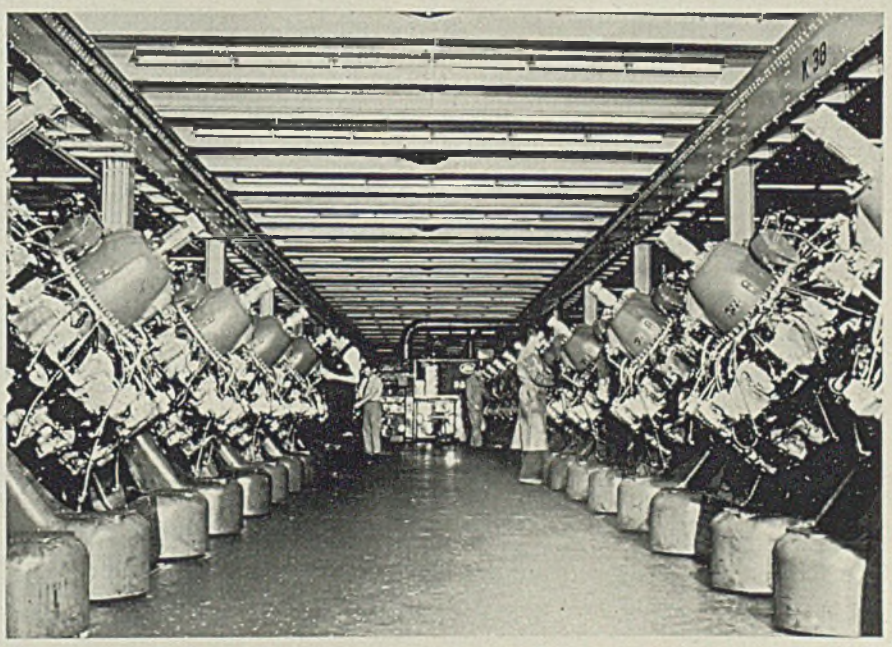
After the purifying treatment, the lead is alloyed with 8 per cent tin and 1 per cent bismuth, following which it is cast into pigs for subsequent use in coating operations. Reasons for the addition of these alloys are fairly obvious. Lead-tin alloys, up to 8 per cent tin, have long been used as coatings or as solder. Hot-dip coatings of lead-tin alloy have been used on sheet iron and sheet copper roofing, providing ease of application and good corrosion resistance. When tin content is raised to the 15-25 per cent range, an alloy is provided which has seen extensive application on steel sheet to produce terne plate, standard material for automotive gasoline tanks. Function of the bismuth apparently is to lower the melting point to around 710 degrees Fahr. and to improve the wetting capacity of the molten metal.

Where does Hurbenium come in? Well, it is the name applied to the lead-tin-bismuth alloy, using the specially processed lead. A coined name, it was evolved by Dr. Hurd, who took the first three letters of her last name, the first three letters of her husband's first name and added the final "ium".

To apply the coating to steel products, they are first pickled in a bath of inhibited sulphuric acid at 160-180 degrees Fahr., then given a quick etching treatment in hot hydrochloric acid and coated with a suitable aqueous soldering flux before dipping in the molten alloy. Because of the acid etch a good bond between coating and base metal is obtained, with penetration of 0.002-0.005-inch claimed. The coating spreads out thinly and evenly, more so than does zinc in the hot-dip galvanizing process, according to the sponsors. One pound of the lead-tin-bismuth alloy serves to coat 35-40 square feet of steel surface, in contrast with about 8 square feet for one pound of spelter. The alloy weighs 669 pounds per cubic foot, compared with 712 pounds per cubic foot for lead.

The coating may be applied to a wide range of products where corrosion resistance, improved drawing qualities or

THEIR OWN POWER WAS USED TO MANUFACTURE THEM



FINISHED Ford-built Pratt & Whitney aircraft engines awaiting shipment. These engines are used to power medium bombers and fighters. Engineering ingenuity has made it possible to supply approximately half the power required to manufacture the motors from the motors themselves, the power being recaptured during test runs

conservation of more critical elements are required. Already thousands of test samples have been coated by Dr. Bullock who has transferred his headquarters to Detroit over the past year.

The coating is claimed to be nontoxic, in contrast with other types of lead coatings. In the absence of specific data, it is impossible to say how the toxicity is removed, except to observe that various researchers have discovered several isotopes of lead in different degrees of abundance. James E. Harris in the *National Metals Handbook* cites investigations on this subject, and also mentions work of other metallurgists indicating the existence of two allotropic modifications of lead, with a transition point at about 120 degrees Fahr. It may be that the initial processing worked out by Drs. Hurd and Bullock removes certain toxic isotopes, for it will be recalled that one-third of the original weight of metal is lost in this processing.

As yet no facilities have been made available for supplying any appreciable quantity of Hurbenium, beyond what Dr. Bullock could "cook up on the kitchen stove." Samples of coated parts have been submitted to a number of companies in this area, and they have created more than a little interest. Now a pilot plant is being constructed at Napoleon, O., where initial production of 40 tons a week is being planned, to be followed by larger output as a market may develop.

One troublesome feature of the processing operation is the fume hazard in the first melting stage. Forced ventilation and the use of respirators by workmen may overcome this danger. The Ohio plant will simply process the lead and alloy it, supplying pig metal to other plants which may wish to use it in coating operations. Cost of the alloy is around 50 cents per pound at the present time, but in comparing this with other metals, consideration must be given to the high fluidity and penetrating power of the Hurbenium. Further, this comparatively high price may drop as production gets under way.

A Point That Was Neglected

One of the hammiest displays of what certainly looked like phoney patriotism was that staged by the UAW-CIO at certain Ford and Chrysler plants in protest against suspension of operations on Labor Day. Except for a number of key plants—steel production, tank arsenal, aircraft parts, etc.—most operations here closed for the holiday in line with a WPB directive.

No sooner had the word gone around than demonstrations in protest started. At one plant a sign reading, "We are working for Hitler today" was made ready for display on Monday. Parades and marches of small groups of "aroused" workmen were organized. But the original plans were not changed. What the union neglected to point out was that the protests were occasioned by layoffs on a day when double-time wages would be in force; in other words, two days' pay for one day's work. In some plants, General Motors for example, double-time provisions have been waived in an interim agreement between the company and the union, but in others the double rates still apply to holiday work.

Ford took the holiday occasion to release one of its infrequent advertisements paying tribute to "ninety-nine per cent" of the workmen in the company's shops. On the score of production interruptions caused by labor disputes, the company said, "War work is rush work. We are all striving to do more than we are doing and do it faster. This eagerness creates tension, which often causes misunderstandings that are unimportant in the long run. Moreover the workers have gone through troublesome times. Betterments gained have brought new and unfamiliar responsibilities. And when some minority somewhere gets out of line, you read about it. . . . Unfortunately, the tremendous job being done by the vast majority . . . the millions of sincere, determined workmen who are fully conscious of their responsibility . . . does not always make the headlines."

823,888 Employed

Reports from 242 companies, operating 686 plants and comprising 94 per cent of the automotive industry, showed total employment in July of 823,888, comparing with 791,753 in June, 751,762 in May and 697,355 in April. These companies include nine one-time automobile manufacturers operating 195 plants, 34 truck builders operating 42 plants, and 199 parts companies operating 449 plants. Of the total number of wage earners in July, 567,446, or 69 per cent were classed as production workers.

Looking ahead, these same 242 companies estimate peak employment of 1,401,856, or 70 per cent beyond the July level. The figures are the latest to be released by the automotive branch of the WPB, and they raise serious questions in the minds of some observers over the possibility of either finding or putting to work another 575,000 persons; in fact, it appears doubtful if employment can go much over 250,000 beyond the record July level. If the task were only one of leading a line of working men and women into plants and seating them at waiting machines, it would be simple, but it is vastly more complicated than that, and the above estimate of peak employment probably has not much chance of realization.

Making Heavier Gun Carrier

Among the numerous types of armored cars nearing or in production is a 7½-ton modification and elaboration of the Bren gun carrier, open-top British vehicle built by Ford plants in Canada. Much heavier than the Bren design, the new vehicle is a four-wheel type powered by two 6-cylinder rear-mounted engines and is covered with armor plate across the top as well as on the sides. Speeds up to 60 miles an hour, plus ready maneuverability, make the car a difficult target for the enemy, and multiple gun installations lend it heavy hitting power.

Commercial Vehicles Under U.S. Control To Save Rubber

Joseph B. Eastman's order placing virtually all trucks, buses and taxis under control of the Office of Defense Transportation, designed to conserve rubber, will mean another tightening of the shoelaces for the ordinary civilian.

The ODT order (No. 21) becomes effective Nov. 15 and will govern the maximum mileage that may be operated and the minimum loads that can be carried. No operator of a commercial vehicle operating on rubber will be able to obtain gasoline, tires or parts without a Certificate of War Necessity, to be obtained from ODT field offices.

The certificates will be drawn with the objective of assuring:

1—Operations be confined to those which are necessary to the war effort or to the essential domestic economy.

2—Operations be so conducted as to attain maximum utilization of the equipment involved.

3—The operators conserve and providently utilize rubber or rubber substitutes and other critical materials used in the manufacture, maintenance, and operation of all vehicles covered by the order.

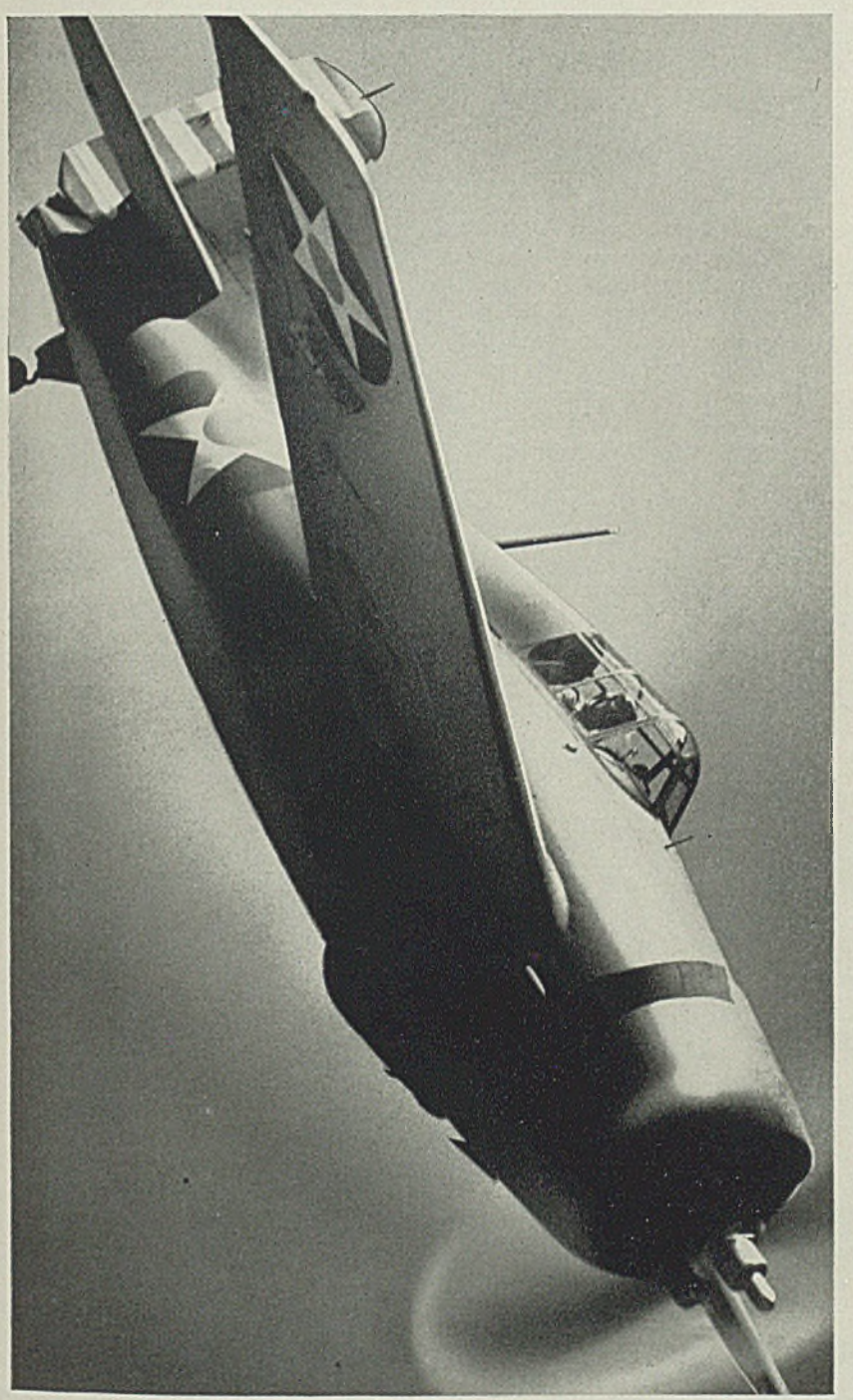
Private automobiles are exempt from the order. Others exempt:

1—Commercial vehicles operated by or under the direction of the military or naval forces of the United States or state militias.

2—Commercial motor vehicles operated by dealers exclusively for the purpose of selling such vehicles.

3—Motor vehicles having a capacity of not more than seven persons which are used in group riding to haul persons to and from work, if such vehicles are not used in any other service for compensation.

DIVING SPEEDS require *Extra Safety*



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When *diving motors* "rev" up to 5600 r.p.m., the entire success of a mission may depend upon having an extra margin of safety in critical bearing surfaces. These surfaces are not completely safe unless extremely accurate, and "structurally perfect"—entirely free of microscopic cracks and disturbed subsurface material which induce fatigue failure.

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Write for Bulletin A. R. 67.

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WING TIPS

P-40 designer takes verbal poke at Seversky. . . Might as well recognize deficiencies in current craft, but keep in mind surprises are coming. . . Launching a new plant

IRRITATING though they may be, the charges hurled by Major Alexander P. deSeversky at the "hard crust of business-as-usual and bureaucratic habit and delusions of superiority" in the field of aviation, few persons in authority have condescended to cross swords with him in defense of those he attacks. Privately, they will say the major is a charlatan and a quack, but publicly they are mute.

Not so Don R. Berlin, aeronautical engineer with General Motors and designer of the Curtiss P-40 pursuit plane in its original version, who in a recent address at Flint, Mich., took issue with the ruthless Russian as follows:

"It may be excusable for a writer to indulge in page after page of analysis and repeat said analyses time and time again to the point of being boring just to fill enough pages to be able to call it a book. It is even excusable if these same analyses are based on hindsight on the part of the author, but it is time to call a halt to the comedy when the Chief of our Army Air Forces is singled out for attack because the Air Forces did not continue to order Seversky's pursuit airplanes.

"If Seversky would confine himself to his crystal-gazing and not indulge in such pronounced, bitter and unfounded criticism of our Air Forces—both army and navy—his book might even be slightly entertaining. However, we are involved in a serious war where all efforts and talents are needed in constructive and violent effort toward winning it. I consider such unjust and widely publicized criticism of General Arnold and the Air Forces . . . . as being a detriment to the war effort by the uncertainty and confusion which it can cause in the minds of those who cannot possibly be in a position to know the facts.

"Let not the honking of the wild goose turn your hand from the plow."

Seversky has been particularly brutal in his attacks on the P-40 pursuit ship, as well as on the Allison engine—a General Motors product—so the reply from a General Motors spokesman who is also the designer of the P-40 was certainly in order, even though Mr. Berlin either could not or preferred not to mention specific details of the airplane or the engine. Reports from the field seem to substantiate Seversky's views regarding deficiencies in the P-39 and P-40 when in combat with high-altitude fighters or with the powerful and highly maneuverable, though flimsy, Japanese Zero fighters.

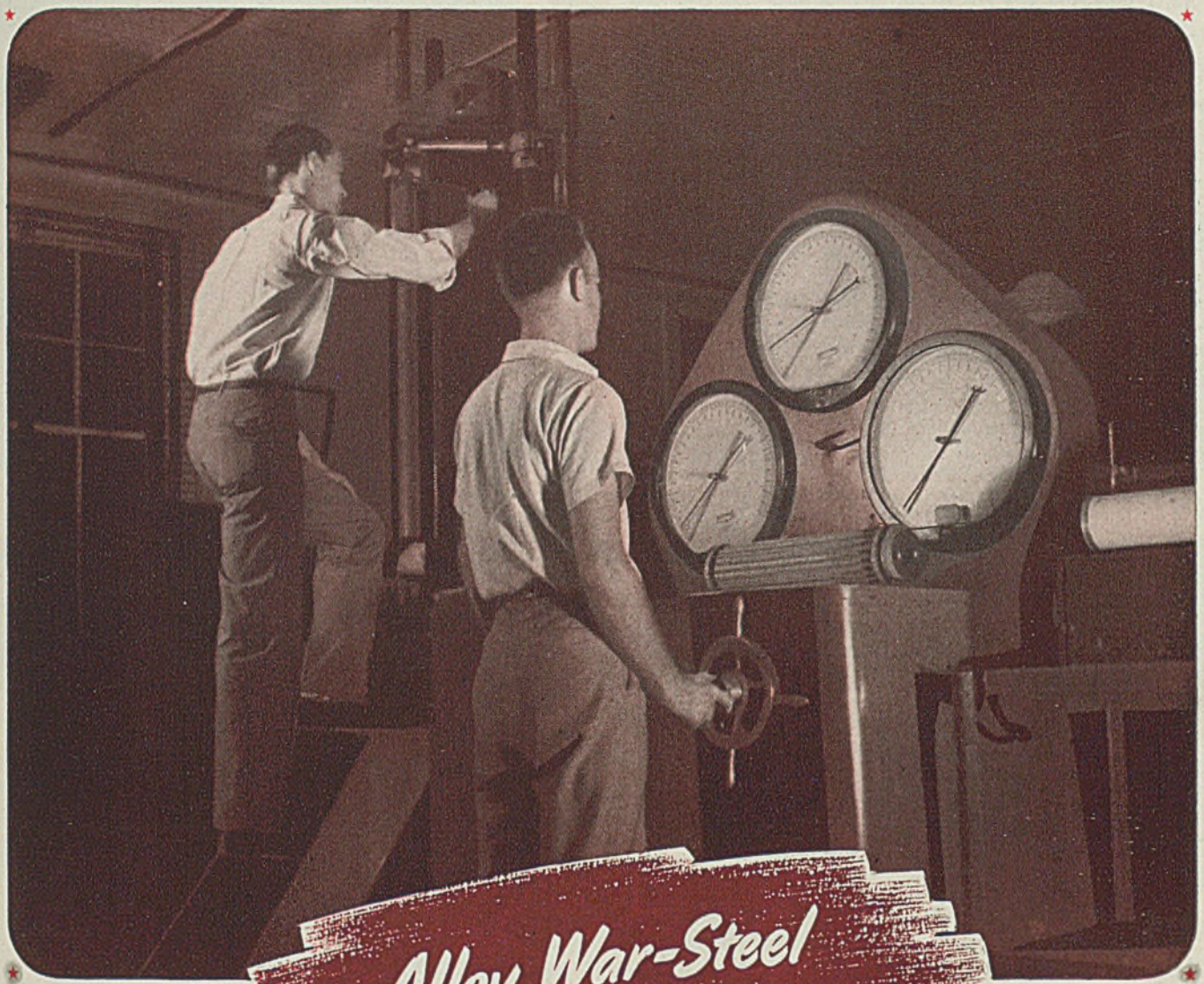
There is no use ignoring such deficiencies or coating them over with sugary adjectives. The Air Forces think they have the answer in the Lockheed P-38 with its two Allison engines and in the P-47 with its 2000-horsepower Pratt & Whitney, both in quantity production. Meanwhile the P-40 with the Packard-built Rolls-Royce engine may graduate to a higher class, and the original P-40 and P-39 Airacobra will still have ample utility as medium-altitude fighters and escorts in areas where there is no superior equipment to challenge them.

Ridicule which Seversky directs toward advertising of combat equipment which is misleading to the public is largely a tempest in a teapot. He should recognize the propensity of American advertising writers to go all-out in claims for their product, a tendency which may create erroneous impressions in the public mind; but after all, the public does not look to advertising to keep informed on performance of our military equipment, for one reason because information in this type of advertising is censored even more rigidly than in news reports. The Army Air Forces know what is happening to planes and engines in combat, but they are not telling it in advertising columns —even to bolster civilian morale.

Aluminum alloy cowling such as these are used to cool, streamline and protect the powerful engines of Douglas transport airplanes. The units seen here in a subassembly department of a Douglas Aircraft Co. plant will enclose engines having a total of more than 50,000 horsepower

Necessity for Secrecy

In war there must be secrets, even from the civilian populace which is helping to fight the war. This is why much of the bickering over cargo planes, and the great, crocodile tears being shed by Raymond Clapper for "Old man Kaiser" who got "pushed around" in Washington actually are ridiculous. If all phases of current activity in airplane manufacturing, particularly in the fields of cargo planes and bombers, could be disclosed to the public and to Mr. Kaiser, the furore would die and he would go back to his shipyards satisfied in at least having made an offer of help. Necessity for secrecy prevents this, however, although one would think that Mr. Kaiser might be advised privately of plans now under way. This writer has learned



Alloy War-Steel reports for its physical

OEM Photo by Palmer, in an Allegheny Ludlum Plant

TESTING is an integral part of production at Allegheny Ludlum mills. Thousands of dollars worth of amazingly accurate machinery are on the job in each mill, testing tensile strength, elastic limit, elongation and reduction of area—all the essential properties of each stainless grade—before it is shipped out for war production.

But after shipping, what? This Allegheny Stainless, made and tested to such rigid exactness, is a war material of the most vital sort. Every alloy in it stands high on the critical list. Is it being used as carefully as it was made? Are fabricators getting the maximum number of products and parts from every ton, with the least possible loss in rejects, spoilage and other forms of waste? Are high alloys being used in places where lower alloys would suffice?

We urge you to check or re-check these questions against your own use of Allegheny Stainless, as a matter of vital concern in national conservation of materials. Especially do so if your plant, as a converted industry, is relatively un-used to the handling of stainless steel.

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some of the details, but military censorship prevents their disclosure.

Censorship has permitted release of the fact that $5,250,000,000 worth of airplanes, engines and propellers have been produced by American aircraft builders during the three years of the current conflict. This is more than eight times the total production in the U. S. during ten years before start of the war on Sept. 1, 1939. Authority for this news is Col. John H. Jouett, president of the Aeronautical Chamber of Commerce.

Production of the large volume of equipment has sent more than 30 different types of combat aircraft into the war on all fronts Expansion of the aircraft industry since the U. S. entered the war, or in a period of nine months, has resulted in 25 per cent increase in floor space, 50 per cent increase in employment, 75 per cent increase in total horsepower of engines produced, 150 per cent increase in pounds of airplanes produced, and a 75 per cent increase in man-hours of work. Col. Jouett does not indicate what the base figures are for engine horsepower production, airplane poundage or man-hours of work, although it is likely the comparison is between the monthly rate before Pearl Harbor and at the present time.

Thunderbolt a Hard Hitter

Commenting on the Republic P-47 Thunderbolt pursuit plane, Lieut-Gen. H. H. Arnold, commander of the Army Air Forces, says, "It carries enough guns to generate at maximum firing speed an impact equal to a 5-ton truck hitting a brick wall at 60 miles an hour. It weighs some 11,000 pounds as compared with the 6000 for ordinary pursuits, most of this weight being in armor, armament, supercharger and equipment for high-altitude flying. Definitely in the 400-mile-an-hour class, it will be at its fastest between 25,000 and 30,000 feet."

Here's What You Do

Recipe for launching a new aircraft manufacturing plant, as sketched by an official of Vultee who has been through this sort of thing, is a concoction familiar to many in the aviation industry in recent months. Here's what you do:

Find yourself a small airplane company somewhere; increase its size by 800 per cent. As your steelwork is going up and concrete is being poured, start setting up new machinery, organize new departments as they are needed and reorganize the old ones to make them fit into the new system. (A novel touch at this point, which any astute public relations man will understand, is to set up some of your equipment out in an open section of the new plant, before the walls and roof have been put in place. Then get a crew of good-looking girls to sit by the machines in the midst of a nice rainstorm. Put slickers on the girls, call in the newspaper photographers and reporters, and point out to them how your loyal operators toil through rain, hail and sleet to keep production moving to beat Hitler.—*Ed.*)

Now somewhere, somehow, find experienced and capable men to head each phase of the job and find other men and women to help them. Set up vocational training programs in nearby schools to train aircraft workers so as to give you a source of manpower. Find places for these people to live, encourage the construction of new homes as long as it is possible to get any priorities on materials. Get a 2,000,000-gallon reservoir built to serve the plant, and don't forget the sewer main and the new roads which are absolutely necessary. You will need a bus line to transport your employes from the residential districts to the plant, and of course the schools in the community will have to be expanded to take care of the many youngsters who will be coming into your community when their father goes to work in your factory. (And don't think the youngsters aren't coming these days!)

While you are doing all these things on the outside, remember what you are really there for—the production of airplanes in ever-increasing quantities as quickly as possible; so keep pushing whatever model you are building and then, of course, get set for that *new bomber*. Get going on that tooling, start those jigs, order all those materials, thrash out your priority problems all the way to Washington if necessary.

Job Gets Bigger Overnight

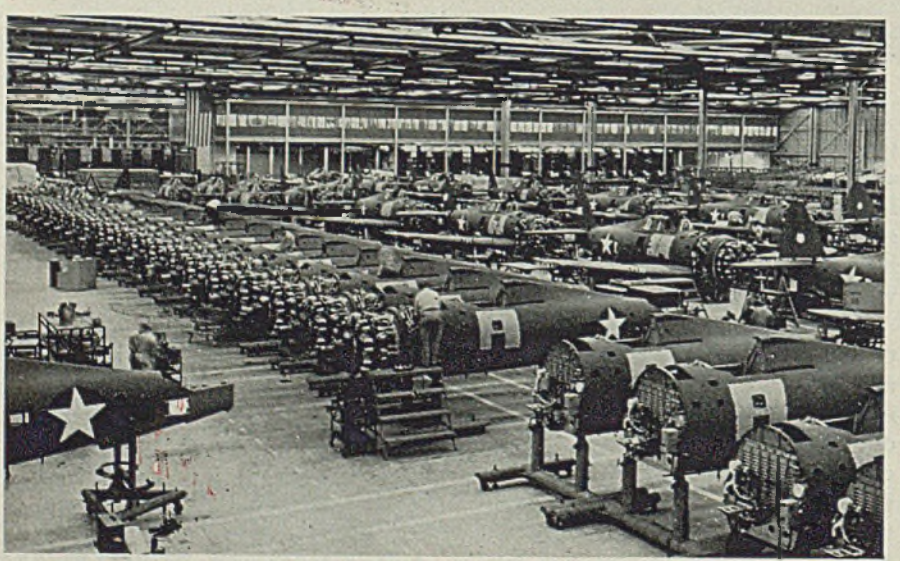
The job is a big one and overnight your assignment becomes even bigger, so pick out some good subcontractors and arrange to have them help with the job. See that they get their tooling, and be sure that it is all co-ordinated with that other plant 2000 miles away which is building the same airplane as you are, for parts from your airplanes and theirs must be interchangeable.

If you are really eager to get production, design and install a mechanized conveyor system to move major assemblies of the airplane through the plant on a mass production basis. (Then call in some of your competitors to let them admire your mass production plans, and listen to them tell you how crazy you are to fall for that "automotive stuff".—*Ed.*)

Now set up your position sheets for production, get your work releases out to the shop, and co-ordinate shipment of materials with schedules in the plant. There will be a few miscellaneous things like engineering changes, relocation of equipment and numerous other problems you will have to tackle and solve as new situations arise. When well-meaning people on the outside ask you if any work is being done in the plant yet, just grin and bear it!

If you are lucky enough to complete your expansion program ahead of schedule and have some airplanes rolling off the line, request the Governor of your state to dedicate the plant and in-

(*Please turn to Page* 169)



All or part of 44 of the new P-47 pursuit and fighter planes are shown in the latest view of the assembly floor at Republic Aviation Corp. Reported to be the most powerful and fastest high-altitude fighter plane ever built, the single-place ship carries a 2000-horsepower radial engine

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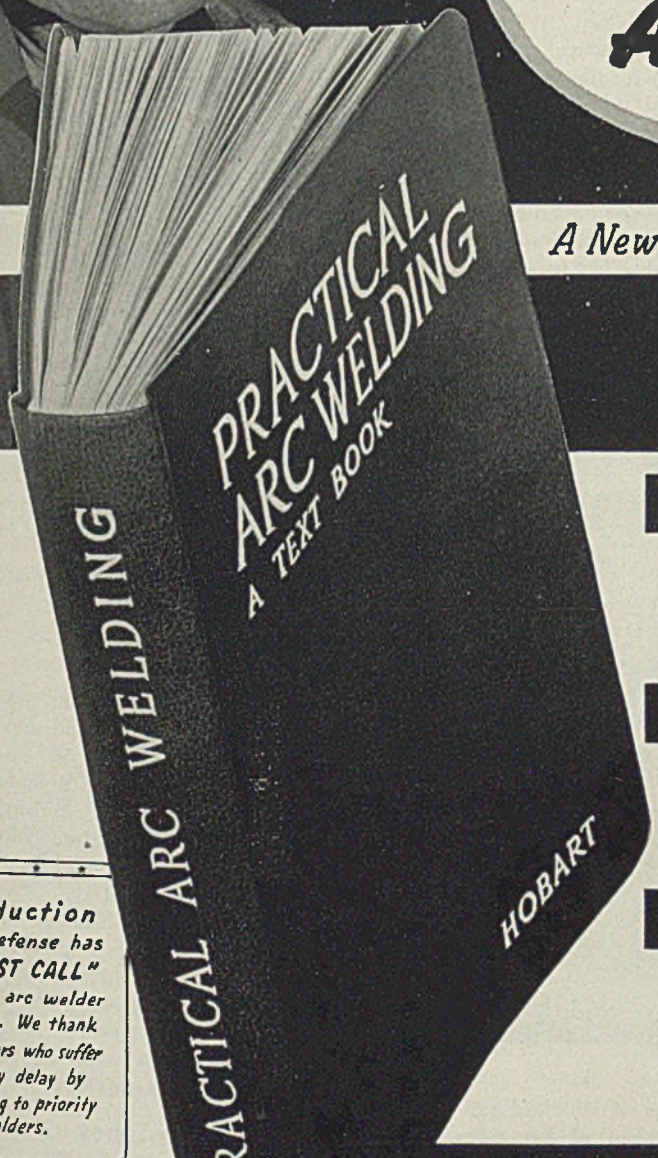

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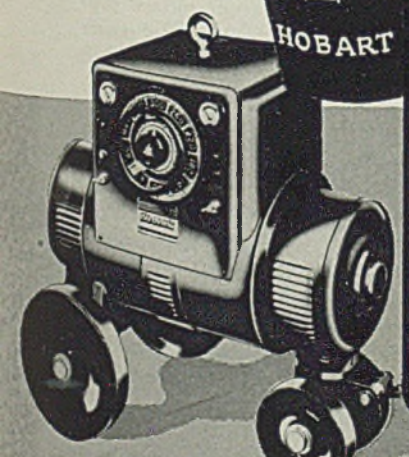

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Three Cargo Vessels a Day, Goal in Sight for This Month

AMERICAN shipyards continued to turn out completed merchant ships at a rate of better than two a day during August.

Sixty-eight new cargo carriers and large tankers were put into service and joined the victory fleet during the month. The August deliveries represent 753,600 tons.

Included were 57 Liberty ships, 4 large tankers, 3 C-2 vessels of the commission's standard design, 2 cargo ships for the British, 1 large combination passenger-cargo ship and 1 large Great Lakes ore carrier.

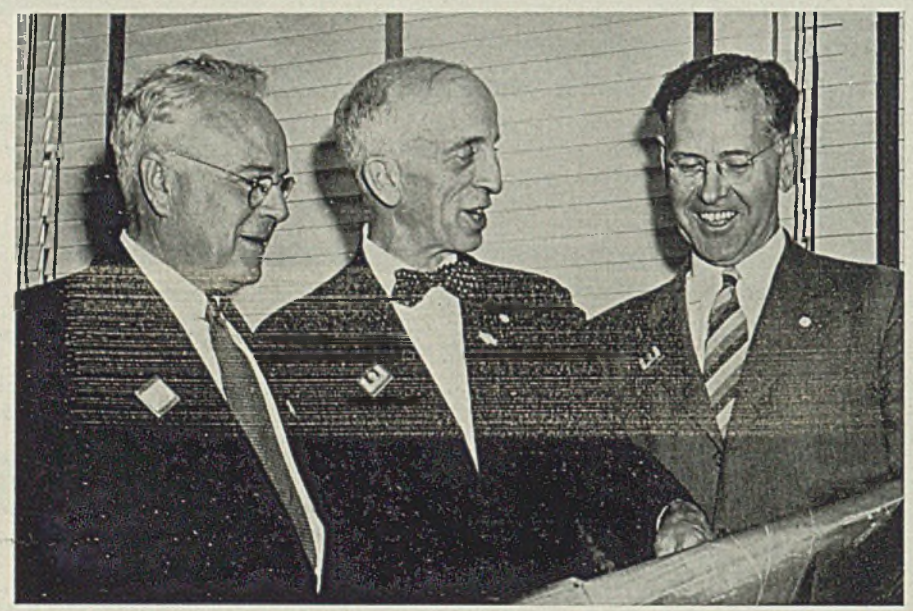
West Coast yards regained the honor of being the most productive by delivering 31 ships; Atlantic Coast yards, which led the nation in July, had 24; and Gulf Coast yards turned out 12 ships. California Shipbuilding Corp., Wilmington, Calif., delivering 11 ships, was the largest single producer for the month and completed its original contracts for 55 Liberty ships almost seven months ahead of schedule. It is now engaged on another contract for 109 ships.

The month also witnessed another substantial reduction in the building time for constructing Liberty ships. The average time for the August deliveries by all shipyards constructing this type of ship was 83.3 days from keel laying to delivery. This is the lowest mark yet attained and it is an improvement over the July average of 108.4 days. Ever since January, when the average time for Liberty ships completed in that month was 241.3 days, shipbuilders have speeded up their construction methods so that they have now reduced the average time by almost two-thirds.

Oregon Shipbuilding Corp. which holds the record for speedy ship construction, delivered nine vessels in August with an average of 50.2 days per ship from keel laying to delivery; California Shipbuilding Corp. averaged 61.3 days for its eleven ships; and Bethlehem-Fairfield Shipyard Inc., averaged 61.7 for its nine ships.

Although there were three less ships delivered in August than in July, a condition resulting both from shortages of bar structural steel that developed in May and June, and the conversion of some Maritime Commission facilities for naval construction, this increased rate of construction gives every indication that the Maritime's Commission goal of three completed ships a day will be reached in September.

DIRECT OPERATIONS AT FEDERAL SHIPBUILDING YARDS



Four more keels for naval auxiliary vessels were laid at the Port Newark, N. J., yard on Labor Day, and the yard staffed for full-speed-ahead operations. Construction of the yard was started early this year by Federal Shipbuilding & Dry Dock Co., United States Steel Corp. subsidiary, under contract with the government.

Fabrication of steel for shipbuilding was started in July, 5½ months after construction of the yard started, and the first keels were laid Aug. 10. Since Federal was asked to build the yard, 33,000 piles have been driven, 30 buildings constructed, 60,000 cubic yards of concrete poured, 6700 tons of steel laid in addition to 2200 tons of reinforcing steel, 1450 tons of rails transformed into 4½ miles of standard railroad, and the equivalent of 6½ miles of roadway 30 feet wide paved.

A million cubic yards have been dredged from Newark bay in front of the ways, and an additional half-million cubic yards remain to be removed. The yards covers 115 acres and its 30 buildings enclose 950,000 square yards of floor space.

Gordon G. Holbrook, center above, has been promoted from general superintendent at Federal Kearny, N. J., yard to works manager for both the Kearny and Port Newark yards. Albert R. McMullen, left, has been named general superintendent of the Port Newark yard; and Paul H. Burbage, right, will be new superintendent at the Kearny yard.

Maine Shipyards Discharge 50 Chronic Absentees

An edict to either "work or fight" was enforced last week by two Maine shipyards with the discharge of 50 employes as chronic absentees. Because of the voluntary absence of workers, launching of a 10,500-ton cargo ship originally planned for an earlier date was postponed until Labor Day.

Yards are demanding explanations of all workers who have made a practice of being absent. Those without legitimate excuses are being discharged and reported to draft boards.

Permit Less Critical Materials In Steam Condenser Tubes

Use of less critical material in tubing and tube sheets for steam surface condensers used in land installations of power generating equipment has been ordered in Schedule II to Limitation Order L-154.

Order prohibits the use of copper, copper base alloy, nickel or tin in tube sheets. Tube sheets will be made of steel.

Tubings for condensers must be made of Admiralty or Muntz metal, which are made from copper-zinc alloy. Previously such tubing was made from Admiralty and Muntz metals and also from more critical cupro-nickel alloy, copper-zinc-aluminum alloy, and some of the tubing was coated with tin.

Government Takes Drastic Action To Make More Steel Available

TORONTO, ONT.

CANADA is encountering serious problems as to supply of steel and other metals for its expanding war industries. It is estimated that despite the record production of steel by domestic mills, which will total upward of 3,200,000 net tons this year, and planned imports of steel from the United States amounting to about 2,000,000 tons there will be a deficit of about 500,000 tons. Some doubt recently has been cast on obtaining 2,000,000 tons from the United States.

In an effort to make up the shortage the government has taken more drastic action against use of steel in civilian and nonessential manufacture. An order has been issued by D. P. Cruickshank, co-ordinator of metals, suspending after Sept. 30 the use of steel and other metals in practically all lines of civilian manufacture. The new order A-367 amends order A-224 and includes a long list of products.

Except with written permission of the co-ordinator under such conditions as he may prescribe, no manufacturer may use any metal other than gold or silver in the manufacture of any product, except such as is required for fittings, joining hardware, reinforcing strips and struts. It is provided in certain products which have been processed to such stage that they cannot be used in the manufacture of any other product, may be used to complete manufacture up to Sept. 30.

A further step to increase steel supply has been taken by C. D. Howe, minister of munitions and supply, who has issued a proclamation calling on all persons in the dominion to make all scrap materials available at once. F. B. Kilbourne, steel controller, has ruled that it is illegal, except by permit, to retain steel and iron scrap weighing 500 pounds or more. The order covers machinery, structural steel or any other article or commodity containing iron and steel which is not now serving an immediate vital purpose. Scrap metal must be disposed of before Sept. 15 or must be reported to the used goods administrator of the Wartime Prices and Trades Board, in Toronto. Any equipment that can not be turned to immediate essential use must be scrapped. Machinery still useful must be put to work at once.

Farm implements and machinery parts have been exempted from the export permit requirement when shipped to any part of the British Empire and the United States. The action is to expedite movement of urgently needed parts for Canadian-made harvesting machinery.

Department of Munitions and Supply announces that sufficient lead for 2,400,000 rifle bullets is being recovered annually from assay slag at gold mines of Kirkland and Larder lakes sections.

Manufacture of Ontario motor vehicle plates for 1943 has been stopped by the steel controller. Already 400,000 plates, one to a vehicle, have been manufactured. It is estimated not more than that number of cars will operate next year, compared with 625,000 this year. An experiment is under way to use large tin cans as material for making these plates.

Steel ingot and casting capacity has been increased by 134,000 tons per year, according to the Dominion Bureau of Statistics. Additional furnace capacity which went into operation in July added 98,000 tons of output of basic open hearth furnaces, bringing rated capacity to 2,765,000 tons per year. Additional steel castings capacity has been built, 36,000 tons, to an annual total of 251,000 tons. Electric furnace capacity remains at 386,000 tons. The new extensions give Canada an annual rated capacity for ingots of 3,151,000 tons and for steel ingots and castings of 3,402,000 tons. This compares with 3,193,000 tons at the end of 1941.

Steel and iron production in July showed a small gain over June, entirely due to the longer month, but the pig iron output, 172,153 tons, was an all-time monthly high. Seven months pig iron production, 1,146,153 tons, set a new record for that period. Similarly, seven months output of steel ingots and castings was the highest ever attained for that portion of the year.

Further comparisons are presented in the following:

	Steel ingots, Castings	Pig iron	Ferro-alloys
July, 1942	256,560	172,153	16,718
June, 1942	254,163	167,961	14,664
July, 1941	220,994	114,245	19,711
7 mos., 1942	1,815,798	1,146,153	124,561
7 mos., 1941	1,607,141	814,862	118,136

Work will be resumed on a large scale in a derelict copper mine near Chilecito, Argentina, under a lease to the Military Factories Department, according to a report to the Department of Commerce. Rehabilitation will require about a year. It is estimated this mine will supply about 10 per cent of the country's requirements.

Compressed Air Application Speeds Cartridge Case Output

The description of a successful application of compressed air to increase speed of producing cartridge cases about 500 per cent last week won first prize of $200 for A. W. Lancaster, Orillia, Ontario, Canada, in a contest conducted by Compressed Air Institute, New York.

Three second prizes of $100 each for papers showing advantages of compressed air in industry went to Irving G. Mayer, chemist, Arizona Refining Co., Phoenix, Ariz.; Lieut. A. J. Nauta, Army Air Base, Daniel Field, Augusta, Ga.; and Harold W. Martin, engineer, Allis-Chalmers Mfg. Co., Boston.

Third prize winners, who received $50 each, included Joseph M. Weil, Easton, Pa., and Paul Hoffman, Phillipsburg, N. J., both of Ingersoll-Rand Co.; Vincent L. Greth, Westinghouse Electric & Mfg. Co., Cleveland; George C. Tucker, Barre, Vt.; Frank D. Biesanz, Winona, Minn.; Joseph P. Burdett, Whittier, Calif., district sales manager, Schramm, Inc.; S. F. Shaw, San Antonio, Tex.; Stephen M. Dunham, West Orange, N. J., sales engineer, Worthington Pump & Machinery Corp.; Rex T. Stafford, Allis-Chalmers Mfg. Co., Pittsburgh; P. O. Egner, Houston, Tex.; and Major G. K. Sauerwein, Watertown Arsenal, Watertown, Mass.

Sale of Wickwire Spencer Proposed by Stockholders

A stockholders' committee of Wickwire Spencer Steel Co., New York, last week mailed proxies to stockholders with the request that sale of the common stock at $19 cash or more a share be approved. Prospective purchaser was not named.

Joseph W. Murray, Holyoke, Mass., committee chairman, pointed out that the company's facilities are not well balanced, that only one blast furnace was operated from 1929 until the emergency and that competition after the war may leave plants idle. He proposed a special meeting to vote for the removal of present ten directors and election of five to a board to negotiate the sale.

In 1941 Republic Steel Corp., Cleveland, was reported to have offered $10,698,131 cash, the equivalent of $16 a share, for company's assets.

Ceilings for High-Alloy Castings Established at Oct. 1-15 Levels

MAXIMUM prices for high-alloy castings have been established at levels prevailing between Oct. 1 and 15, 1941, by the Office of Price Administration.

The measure is titled Maximum Price Regulation No. 214, high alloy castings, and became effective Sept. 7.

Previously high-alloy castings were covered by the General Maximum Price Regulation, and ceilings were the highest prices charged during March, 1942. The General Maximum Price Regulation, however, was not particularly adaptable to the high-alloy castings industry because of the hundreds of different types of cast items whose specifications are ever changing. Engineers continually are redesigning castings—big and small —to make them light and durable.

The new pricing provisions:

1. For castings of a design sold or offered for sale by a producer between July 15 and Oct. 15, 1941, maximum prices are the highest prices at which the same quantity of the same design of castings was sold or offered for sale during that period.

2. For castings of designs not produced by the producer between July 15 and Oct. 15, 1941, but of a design produced and sold commercially by the industry since 1937, maximum prices are the base schedules used by the Chemical Foundation as a basis for minimum prices under its licensing agreements.

3. For castings for which no prices are established in the two foregoing categories, maximum prices shall be based on Oct. 1 to 15, 1941, cost factors and profit margins. Such prices are to be submitted to and approved by the OPA.

In connection with castings of the first foregoing pricing category—those for castings of a design sold or offered for sale by a producer between July 15 and Oct. 15, 1941—the regulation provides that maximum prices for quantities different from those sold in the base period are to be established by use of the producer's own quantity price differentials or, if he had none, by application of the percentage differences between quantity price differentials in the Chemical Foundation base schedules.

Similarly, where the alloy or carbon content of a casting of a base period design is different from the base period specification and, where the producer had no established base period differentials, an adjustment in the maximum price shall be made on the basis of the alloy or carbon content price differentials set forth in the regulation.

The Chemical Foundation, whose minimum prices under licensing agreements are used in determining some maximum prices, was created in connection with the establishment of the alloy castings industry in this country. The alloy castings industry did not develop in the United States until after the first World War. Previous to that time the art had been rather highly developed in Germany, and during the war the Alien Property Custodian confiscated the Strauss patents covering the important formulas for alloy castings.

Foundation a Guiding Factor

In 1919 the Chemical Foundation was founded and was given licensee rights to the patents which it controlled until 1937, when they expired. Although the Chemical Foundation did not control all of the formulas, nevertheless it did have sufficient control to be a guiding factor in the development of the high-alloy casting industry in the United States.

Provisions in regard to invoicing, discounts, transportation charges and allowances, credit terms and extras are adopted in the regulation from industry practice. The regulation does not, however, require the industry to continue guarantees which were customary between Oct. 1 and 15, 1941, nor does it make any adjustment in price to reflect the difference in value in a sale where guarantees are not given. The guarantees are eliminated because of War Production Board limitation orders on the use of nickel and chrome, both necessary materials in the casting of alloys. Steels other than for the Army, Navy and Maritime Commission, will be made with a lower alloy content than in the past so that guarantees would be inequitable since the industry will be dealing in formulas with which it has had little or no experience.

An exception to the Oct. 1 to 15, 1941, price level is made in the regulation with regard to machining where the machining is let out to a machine shop independent of the foundry producing the casting. In such cases the regulation permits the producer to compute his maximum prices on the basis of the actual net invoice of the machining to him plus his customary additional charge, if any, between Oct. 1 and 15, 1941 for handling and other overhead.

The regulation provides:

1. Each producer of high alloy castings shall file with the Iron and Steel Branch, Office of Price Administration, Washington, on or before Sept. 25, 1942: (1) its published price lists and schedules, tentative or subject to change or otherwise, for high-alloy castings and for extras or machining insofar as such lists and schedules were distributed and outstanding with one or more of the producer's customers between July 15 and Oct. 15, 1941, inclusive, and (2) a statement of its established practice between July 15 and Oct. 15, 1941, of making allowances or discounts to any purchasers or classes of purchasers. If a producer had no such lists or schedules, or no established practice of making allowances or discounts, he shall file a statement to that effect.

2. Each producer who had in effect between July 15 and Oct. 15, 1941, inclusive, established a customary quantity of alloy or carbon content price differentials for any or all high-alloy castings produced and sold by him, shall file with OPA by Sept. 25 a statement listing or describing the differentials and types of high-alloy castings to which they applied. If the producer had no such differentials, he shall file a statement to that effect.

3. Each producer who customarily let out machining work on high-alloy castings to independent machine shops between Oct. 1 and 15, 1941, shall file with OPA by Sept. 25 a statement of his customary method in the Oct. 1-15, 1941, period of computing charges for the machining of high-alloy castings in cases where the machining has been let out. If a producer did not let out machining work to independent machine shops between Oct. 1 and 15, 1941, he shall file a statement to that effect.

Wholesalers of Wire, Cable Accessories Covered by P-82

Broadening of the scope of Revised Price Schedule No. 82 to cover wholesalers as well as manufacturers of wire, cable and cable accessories, was announced last week by Office of Price Administration.

"Wire, cable and cable accessories are frequently marketed through wholesalers," the Price Administrator explained. "Maximum Price Regulation No. 136, as amended—covering machines and parts and machinery services—became effective July 22, 1942. In the absence of Amendment No. 2 to Revised Price Schedule No. 82, the terms of the machinery regulation would cover wire, ca-

(*Please turn to page* 169)

Activity Index Climbs To New Peak Level

STEEL's index recorded the fourth consecutive weekly gain during the period ended Sept. 5 to reach a new peak level of 175.1. This compares with 174.5 registered in the preceding week, while in like period a month ago the index stood at 172.8.

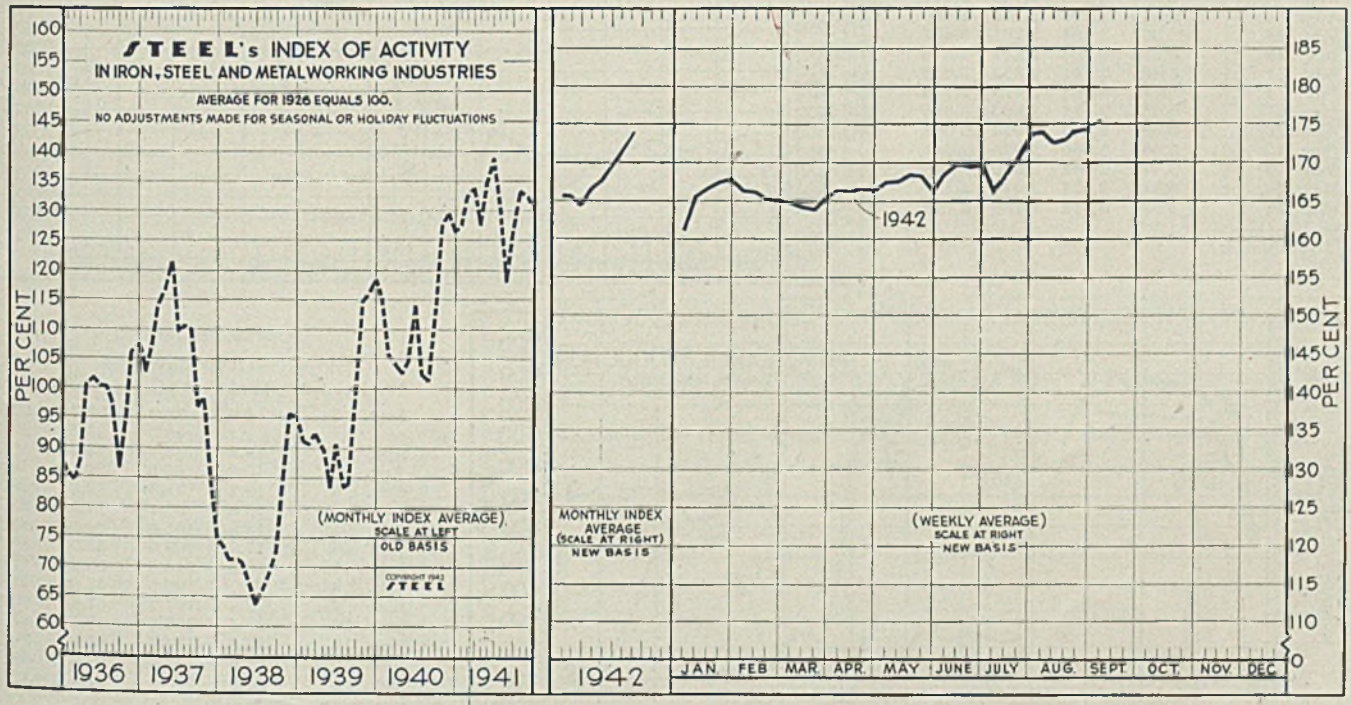
The national steel rate held steady at 98 per cent during the week ended Sept. 5, representing steel ingot production of 1,676,460 net tons. In the like week a year ago steel output totaled 1,577,837 tons. Necessary open hearth furnace repairs combined with steel scrap shortage at some centers continue to be the chief factors preventing steel ingot production from attaining capacity output.

Preliminary estimate of electric power consumption for the week ended Sept. 5 shows a moderate increase to 3,655,000,000 kilowatts. A year ago power output amounted to 3,095,746,000 kilowatts, or 15.3 per cent below the current volume.

Revenue freight carloadings in the latest period rose to the highest level recorded this year. Freight traffic in that week is estimated at 910,000 cars, compared with 899,419 in the week of Aug. 29.

Machine tool output advanced further during July to $113,600,000, a new monthly peak. In the past four years the machine tool industry has produced more tools than it did in the preceding 40 years. Industry's goal of $1,500,000,000 for 1942 now appears within reach, although it is believed August output was slightly below the July total, due to scarcity of materials.

During the week ended Sept. 12, STEEL's index will probably record a slight dip, reflecting labor day interruptions in some industrial lines. However, steel ingot operations were little affected by the holiday.



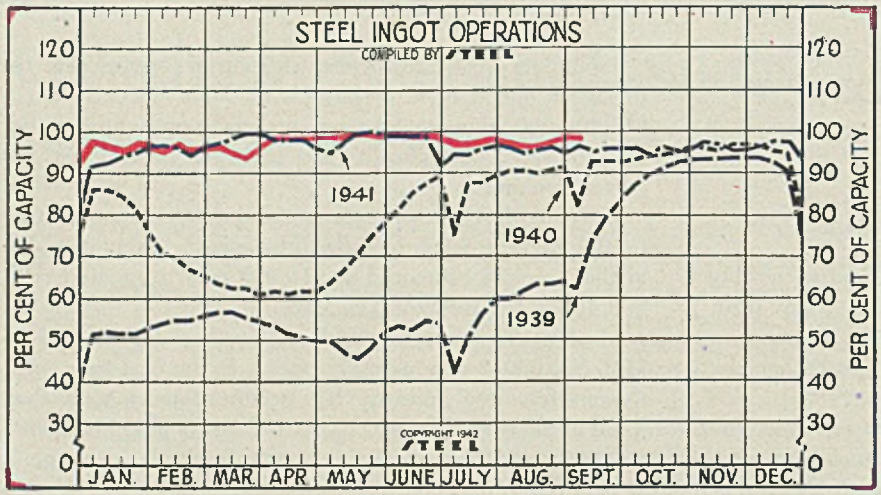
STEEL'S index of activity gained 0.6 point to 175.1 in the week ending Sept. 5:

Week Ended	1942	1941
July 4	166.5	120.9
July 11	168.9	133.4
July 18	172.1	133.2
July 25	173.6	132.9
Aug. 1	173.8	123.3
Aug. 8	172.8	117.5
Aug. 15	173.3	118.2
Aug. 22	174.0	118.5
Aug. 29	174.5	118.2
Sept. 5	175.1†	111.8

†Preliminary.

Mo. Data	1942	1941	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931
Jan.	165.7	127.3	114.7	91.1	73.3	102.9	85.9	74.2	58.8	48.6	54.6	69.1
Feb.	165.6	132.3	105.8	90.8	71.1	106.8	84.3	82.0	73.9	48.2	55.3	75.5
March	164.6	133.9	104.1	92.6	71.2	114.4	87.7	83.1	78.9	44.5	54.2	80.4
April	166.7	127.2	102.7	89.8	70.8	116.6	100.8	85.0	83.6	52.4	52.8	81.0
May	167.7	134.8	104.6	83.4	67.4	121.7	101.8	81.8	83.7	63.5	54.8	78.6
June	169.4	138.7	114.1	90.9	63.4	109.9	100.3	77.4	80.6	70.3	51.4	72.1
July	171.0	128.7	102.4	83.5	66.2	110.4	100.1	75.3	63.7	77.1	47.1	67.3
Aug.	173.5	118.1	101.1	83.9	68.7	110.0	97.1	76.7	63.0	74.1	45.0	67.4
Sept.		126.4	113.5	98.0	72.5	96.8	86.7	69.7	56.9	68.0	46.5	64.3
Oct.		133.1	127.8	114.9	83.6	98.1	94.8	77.0	56.4	63.1	48.4	59.2
Nov.		132.2	129.5	116.2	95.9	84.1	106.4	88.1	54.9	52.8	47.5	54.4
Dec.		130.2	126.3	118.9	95.1	74.7	107.6	88.2	58.9	54.0	46.2	51.3

Note: Weekly and monthly indexes for 1942 have been adjusted to offset the forced curtailment in automobile production and to more accurately reflect expanding steel production.



Steel Ingot Operations

(Per Cent)

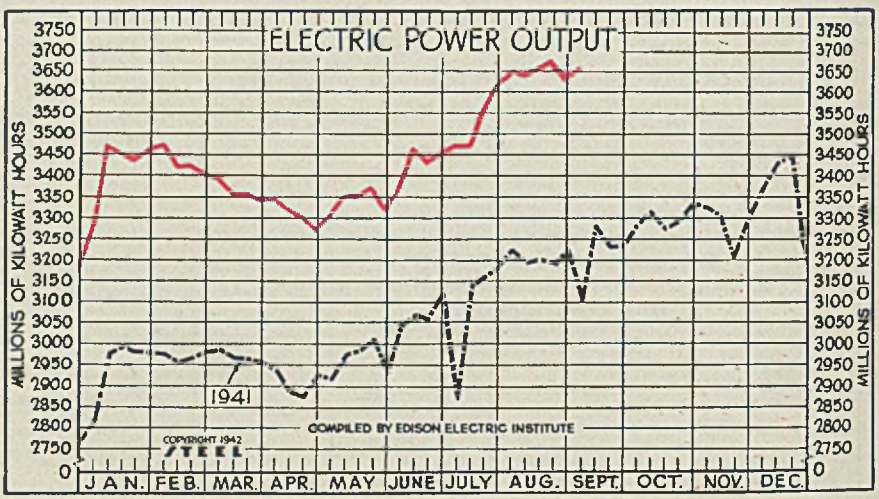
Week ended	1942	1941	1940	1939
Sept. 5	98.0	95.5	82.0	62.0
Aug. 29	98.0	96.5	91.5	64.0
Aug. 22	97.5	96.0	90.5	63.5
Aug. 15	97.0	95.5	90.0	63.5
Aug. 8	97.5	96.5	90.5	62.0
Aug. 1	98.0	97.5	90.5	60.0
July 25	98.5	96.0	89.5	60.0
July 18	98.0	95.0	88.0	56.5
July 11	97.5	95.0	88.0	50.5
July 4	97.5	92.0	75.0	42.0
June 27	98.5	99.5	89.0	54.0
June 20	99.0	99.0	88.0	54.5
June 13	99.0	99.0	86.0	52.5
June 6	99.0	99.0	81.5	53.5
May 30	99.0	99.0	78.5	52.0
May 23	99.0	100.0	75.0	48.0
May 16	99.5	99.5	70.0	45.5

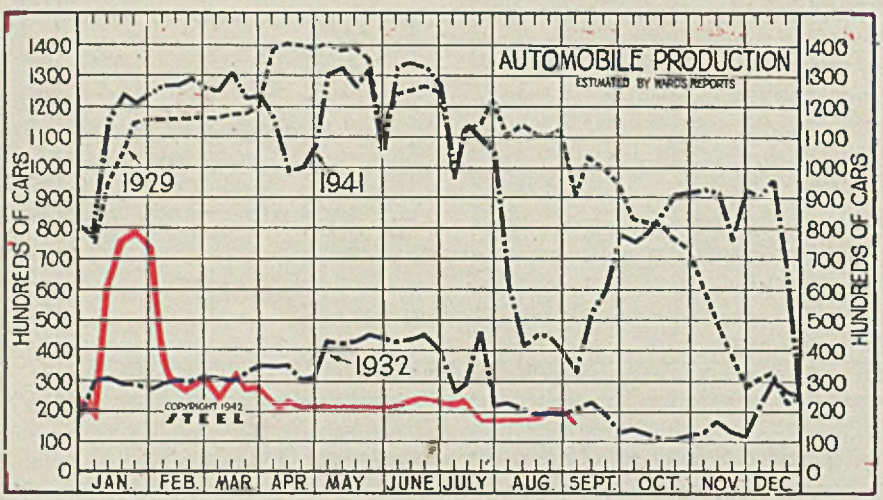
Electric Power Output

(Million KWH)

Week ended	1942	1941	1940	1939
Sept. 5	3,655†	3,096	2,592	2,376
Aug. 29	3,640	3,224	2,736	2,442
Aug. 22	3,674	3,193	2,714	2,434
Aug. 15	3,655	3,201	2,746	2,454
Aug. 8	3,649	3,196	2,743	2,414
Aug. 1	3,649	3,226	2,762	2,400
July 25	3,626	3,184	2,761	2,427
July 18	3,565	3,163	2,681	2,378
July 11	3,429	3,141	2,652	2,403
July 4	3,424	2,867	2,425	2,145
June 27	3,457	3,121	2,660	2,396
June 20	3,434	3,056	2,654	2,362
June 13	3,464	3,066	2,665	2,341
June 6	3,372	3,042	2,599	2,329
May 30	3,323	2,924	2,478	2,186
May 23	3,380	3,012	2,589	2,778

†Preliminary.





Auto Production

(1000 Units)

Week ended	1942	1941	1940	1939
Sept. 5	16.9	32.9	39.7	26.9
Aug. 29	21.1	40.0	27.6	25.2
Aug. 22	20.2	45.5	23.7	17.5
Aug. 15	19.2	45.6	20.5	13.0
Aug. 8	19.2	41.8	12.6	24.9
Aug. 1	18.3	62.1	17.4	28.3
July 25	18.3	105.6	34.8	40.6
July 18	17.9	109.9	53.0	47.7
July 11	23.0	114.3	65.2	61.6
July 4	22.7	96.5	52.0	42.8
June 27	22.9	127.9	87.6	70.7
June 20	23.2	133.6	90.1	81.1
June 13	22.3	134.7	93.6	78.3
June 6	22.0	133.6	95.6	65.3
May 30	21.5	106.4	61.3	32.4

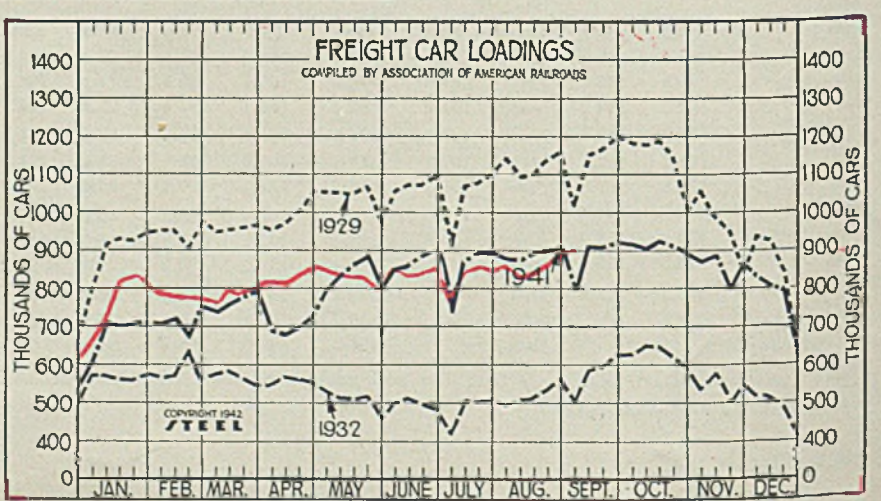
Figures since Feb. 21 last include Canadian trucks and automobiles and United States trucks.

Freight Car Loadings

(1000 Cars)

Week ended	1942	1941	1940	1939
Sept. 5	905†	798	695	667
Aug. 29	899	913	769	722
Aug. 22	869	900	761	689
Aug. 15	869	890	743	674
Aug. 8	850	879	727	665
Aug. 1	864	883	718	661
July 25	856	897	718	660
July 18	857	899	730	656
July 11	855	876	740	674
July 4	759	741	637	559
June 27	853	909	752	660
June 20	840	886	728	643
June 13	883	863	712	638
June 6	855	853	703	635

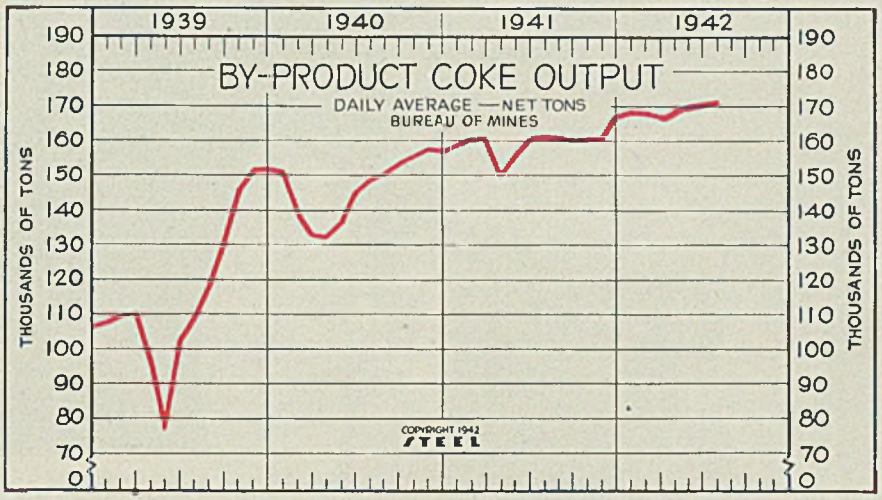
†Preliminary.

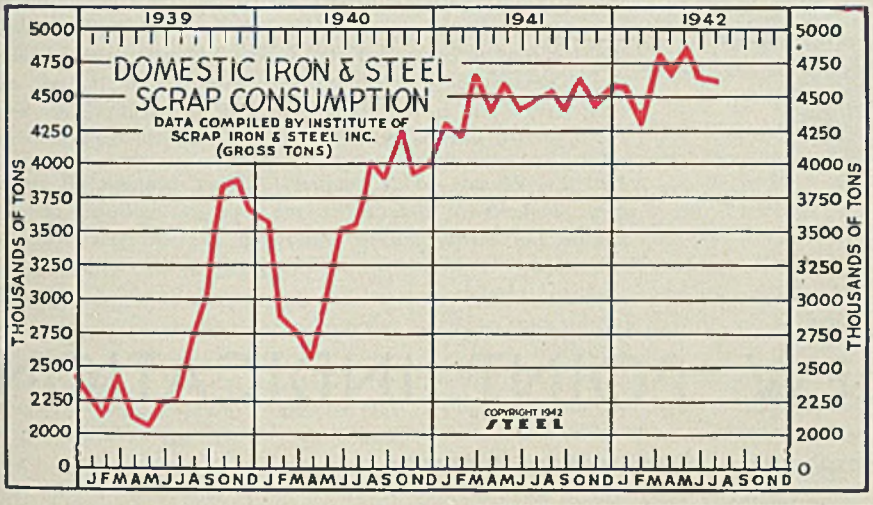


By-Product Coke Output

(Daily Average)

	1942	1941	1940	1939
Jan.	168,508	159,129	151,841	108,611
Feb.	168,414	160,789	138,508	109,923
March	167,733	161,268	133,056	110,921
April	168,960	149,144	132,812	97,155
May	170,187	156,318	136,897	77,304
June	170,593	161,201	145,821	102,991
July	171,361	161,731	149,005	108,542
Aug.	.....	161,709	151,035	118,260
Sept.	.....	160,193	154,247	130,144
Oct.	.....	160,344	156,118	146,019
Nov.	.....	161,116	158,331	152,219
Dec.	.....	167,304	157,743	152,200
Total	.....	160,037	147,157	117,892





Iron and Steel Scrap Consumption

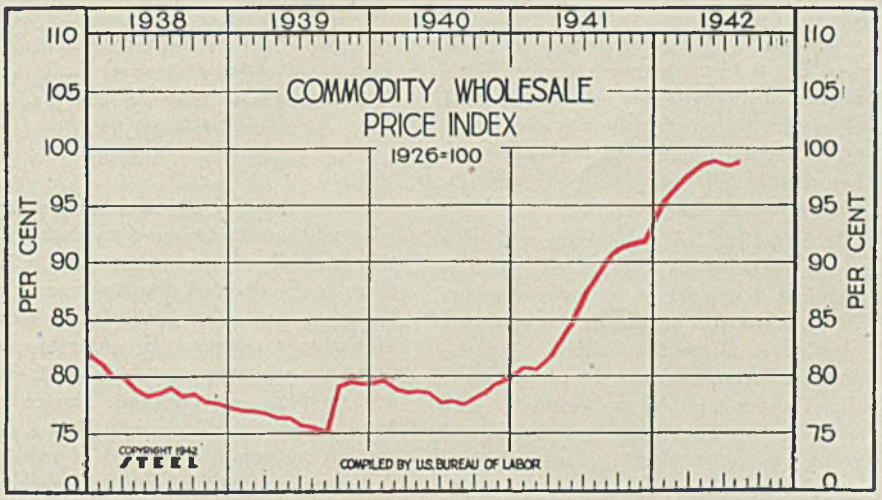
(Gross Tons)

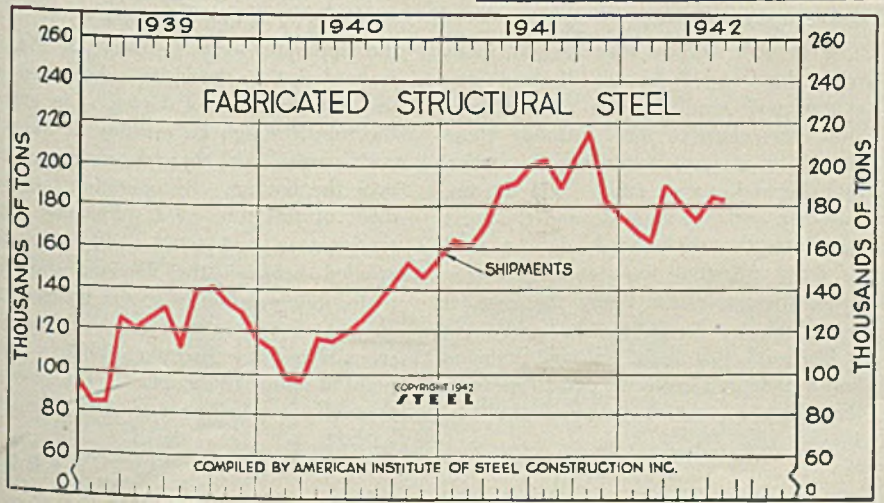
	1942	1941	1940	1939
		(000 omitted)		
Jan.	4,590	4,278	3,581	2,257
Feb.	4,276	4,172	2,812	2,124
Mar.	4,840	4,662	2,728	2,419
Apr.	4,672	4,406	2,548	2,114
May	4,857	4,609	3,061	2,079
June	4,608	4,406	3,482	2,221
July	4,600	4,415	3,526	2,247
Aug.	.....	4,518	3,968	2,675
Sept.	.....	4,392	3,876	3,018
Oct.	.....	4,649	4,233	3,809
Nov.	.....	4,482	3,922	3,858
Dec.	.....	4,634	3,950	3,613
Total	.....	53,623	41,687	32,434
Mo. Av.	.....		3,474	2,703

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

(1926 = 100)

	1942	1941	1940	1939	1938
Jan.	96.0	80.8	79.4	76.9	80.9
Feb.	96.7	80.6	78.7	76.9	79.8
March	97.6	81.5	78.4	76.7	79.7
April	98.7	83.2	78.6	76.2	78.7
May	98.8	84.9	78.4	76.2	78.1
June	98.6	87.1	77.5	75.6	78.3
July	98.7	88.8	77.7	75.4	78.8
Aug.	...	90.3	77.4	75.0	78.1
Sept.	...	91.8	78.0	79.1	78.3
Oct.	...	92.4	78.7	79.4	77.6
Nov.	...	92.5	79.6	79.2	77.5
Dec.	...	93.6	80.0	79.2	77.0
Ave.	...	87.3	78.5	77.1	78.6

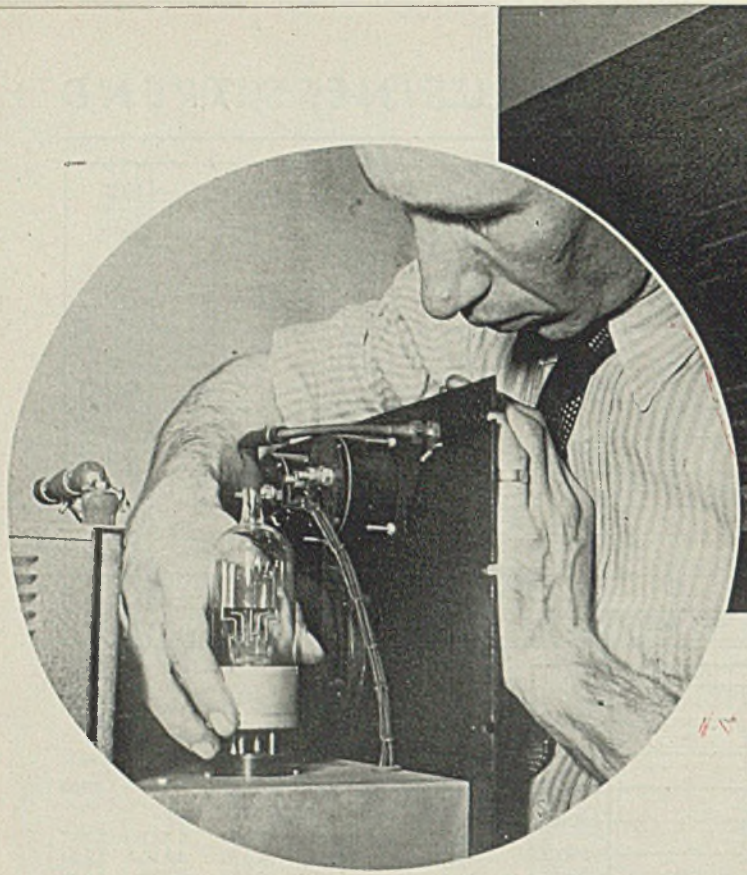




Fabricated Structural Steel

(1000 tons)

	Shipments			Bookings		
	1942	1941	1940	1942	1941	1940
Jan.	167.8	164.6	110.9	183.4	281.2	81.7
Feb.	164.6	161.4	97.2	228.7	173.6	98.9
Mar.	191.3	170.2	95.9	248.3	206.1	128.3
Apr.	180.9	189.8	116.3	314.0	218.0	73.8
May	173.3	191.9	115.6	161.0	179.9	126.8
June	182.7	200.5	119.1	184.5	246.9	109.7
July	181.2	203.0	127.1	116.7	214.8	194.9
Aug.	.....	189.3	134.9	.....	158.7	122.5
Sept.	.....	204.1	142.8	.....	158.8	225.5
Oct.	.....	217.7	153.2	.....	128.7	233.1
Nov.	.....	182.6	147.0	.....	184.0	141.9
Dec.	.....	176.1	155.5	.....	146.4	203.1
Tot.	.....	2251.1	1515.5	.....	2297.0	1748.1



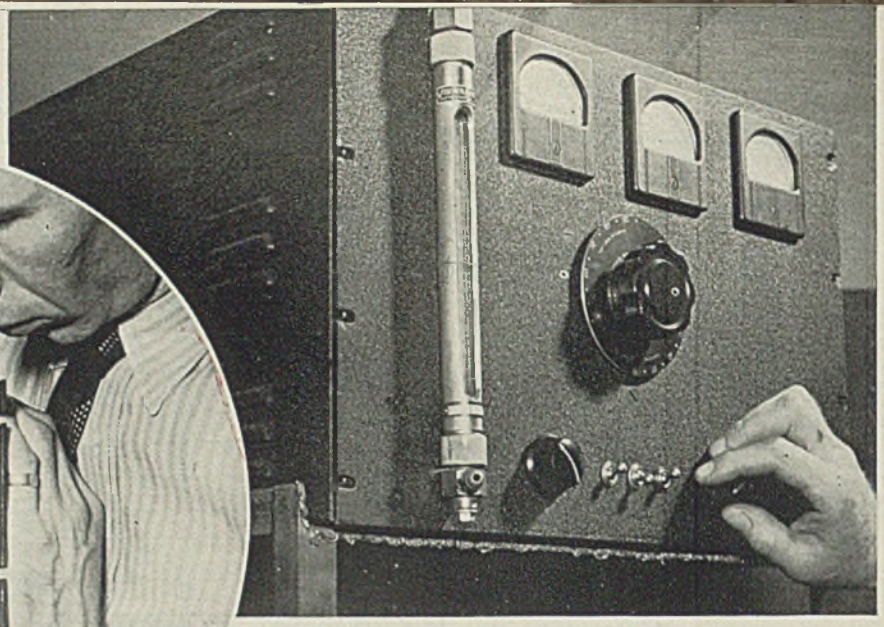


Fig. 1. (Left)—A continuous sample of the purified hydrogen gas (in by hose at top, out by hose at base) for heat treating steel in controlled atmosphere furnaces passes through this 2-element tube. If moisture or oxygen is in the gas, the tube passes less current since many of the electrons are converted into negative ions by the water or oxygen

Fig. 2. (Above)—This compact cabinet contains all necessary elements to detect the presence of moisture or oxygen in the highly purified hydrogen gas for heat treatment of steel

ACCURATE DEW POINT INDICATION

. . . for atmospheres of heat-treating furnaces

By P. R. KALISCHER
Research Engineer
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

HIGHLY purified hydrogen is often used in the heat treatment of steel. Purification of the hydrogen involves removal of oxygen by passing the gas over some type of catalyst such as hot copper or hot nickel, followed by drying, usually with activated alumina.

This method of purification will give a gas substantially free of oxygen and having a dew point in the order of minus 70 degrees Cent. as long as the activated alumina is in good condition. As the alumina becomes saturated with moisture, the dew point of the gas gradually rises until it reaches some pre-determined point, where it becomes necessary to switch to a new drying power and reactivate the used one.

In order to measure the moisture content of the gas where dew points are running below zero Cent., it is customary to pass the hydrogen over a polished metal surface and at the same time cool this metal surface and observe the temperature at which moisture first condenses. Such a method of measuring dew points is sufficiently accurate down to approximately minum 40 degrees Cent. Below that, however, this method of dew point determination becomes largely a matter of guess work, and even skilled observers will disagree in their determinations on gas of the same composition.

In addition to the lack of accuracy of this method of measuring dew points, there is the decided disadvantage of not having a continuous indication or record of moisture content. In order to overcome the very apparent failings of existing methods, an electronic device has been developed which will give a continuous indication or record of moisture and oxygen contents of both hydrogen and dissociated ammonia.

It is well known that certain gases when bombarded by an electron discharge will tend to pick up electrons and form negative ions. Among these gases are oxygen, water vapor, carbon dioxide and some others. Hydrogen, nitrogen, carbon monoxide and the inert gases, on the other hand, do not tend to form negative ions under electron bombardment. This being the case, it is possible to design a tube containing a filament with high electron emission and a plate as a collector and to measure the electron current between the filament and the plate.

With a gas of constant composition such as pure dry hydrogen, for example, we will have a constant electron emission as long as the filament temperature and the plate voltage in the tube are maintained constant. As soon, however, as some impurity such as oxygen or water vapor enters the tube with the hydrogen, a portion of the electrons emitted by the filament will be utilized in the formation of negative ions, thus effectively lowering the electron current. Such a tube as is briefly described above forms the nucleus of the new dew point determination apparatus that has been developed at Westinghouse.

In Fig. 2 is shown a general view of the apparatus now in use. In Fig. 1 is one of the electronic tubes used as the actual measuring device. Gas enters the tube through an opening at the top and passes out through a connection near the bottom. By operating the filament of this tube at a sufficiently high temperature and with a high voltage applied between the filament and the plate, it is possible to secure an electron current of approximately 3 milliamperes when pure dry hydrogen with a dew point of minus 70 degrees Cent. is passing through the tube at a rate of 8 cubic feet

per hour. As the moisture content of the gas increases, the output of the tube drops, rapidly at first and then more slowly, as shown in Fig. 5.

It will be seen from Fig. 5 that in the range of moisture content of interest in bright annealing stainless steel, for example, there is a sufficiently wide spread between minus 35 degrees Cent. dew point and minus 45 degrees Cent. dew point to allow very precise control. A similar calibration curve can be made for dissociated ammonia as shown in Fig. 4.

The factors that influence the tube output are of considerable importance. Assuming a constant voltage between filament and plate, and a constant rate of gas flow through the tube, it can be shown that the output of the tube varies markedly with filament temperature. In Fig. 3, we have the change in tube output as influenced by filament voltage which in turn, of course, is only a measure of filament temperature. In the range of voltages covered, it should be noticed that the linear portion of the curve lies between 23 volts and 28 volts. The significance of this is that we may vary filament voltage in that range and secure a family of parallel curves for the calibration of the tube so that any slight change in filament resistance resulting from manufacturing variables can be compensated for by changing filament voltage. Thus, if we secure one point on the curve that is known to be correct, all other points will automatically follow on the correct calibration curve.

With plate voltage as a variable and filament temperature and gas flow constant, a similar curve is secured as shown again in Fig. 3. Along the linear portion of this curve, plate voltage again may be varied within the limits shown so as to correct tube variables without destroying the calibration. Similarly, gas flow is shown to have the same effect.

Simplicity of construction and operation is one of the outstanding features of this equipment. In Fig. 6 is shown a schematic wiring diagram for the apparatus. It will be noted that the only requirements are a source of high-voltage direct current which need not be filtered and a source of filament power (alternating current). The input to both the plate supply and the filament should be regulated to compensate for line voltage variations, particularly if the apparatus is to be made recording.

The illustrations shown above have been for an indicating type of meter, but it is quite obvious that the equipment could be made recording simply by substituting the proper recording instrument for the output milliammeter. In a like manner, suitable automatic controls could be operated by using sufficiently sensitive relays on the output of the tube.

Handles Only One Impurity

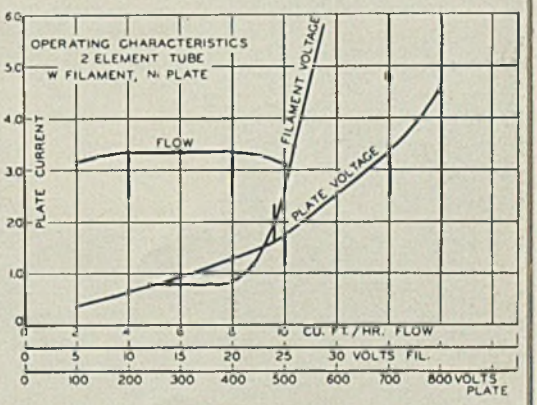
This equipment, at the present time, may be calibrated for only one impurity. For example, in furnaces used for bright annealing steel strip, it is often a practice to carry on the high-temperature annealing until the outlet gas from the furnace has reached a pre-determined dew point. In this type of gas, it is customary to find not only oxygen and water vapor, but also some small amounts of hydrogen sulphide, carbon monoxide, carbon dioxide, and sulphur dioxide, all of which have a tendency to decrease the tube output so that the indication given by the dew point apparatus would be the cumulative effect of all impurities, rather than a single specific one.

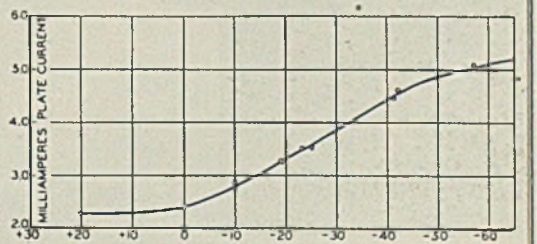
In cases of this type, therefore, it becomes necessary to remove all of the impurities except the one for which the apparatus is calibrated. Generally speaking, carbon dioxide, hydrogen sulphide, and sulphur dioxide can be quite effectively removed by passing the gas over suitable absorbants and then measuring the oxygen and water vapor content, if these are the factors of the most importance.

All of the dew-point tubes made thus far have used tungsten filaments, and are therefore limited in their application. Carbon monoxide and hydrogen sulphide, for example, both form compounds with tungsten which rapidly change the electron emission of the filament. As this filament operates at a high temperature, presence of these gases would cause early failure due to the low melting point of the compounds formed. Nitrogen is another example of a gas which forms compounds with tungsten at an elevated temperature. The life of a tungsten filament in one of these dew-point tubes has not yet been determined when the only impurities in a hydrogen atmosphere are oxygen and water vapor. One tube now in operation has had a life of over 7000 hours without any apparent change in calibration.

There are certain other materials which may be used for filaments, such as Konal and platinum. Konal has many of the same characteristics with regard to compound formation as tungsten. Platinum in general does not have the high temperature strength necessary.

From the above it would seem that suitable filament material is important in extending the scope of the apparatus. This is particularly true if we consider its use only in the light of impurity determinations in the exhaust line of a furnace. If, however, we establish control in annealing furnaces on the input gas, the filament life is sufficiently long to use the equipment economically.





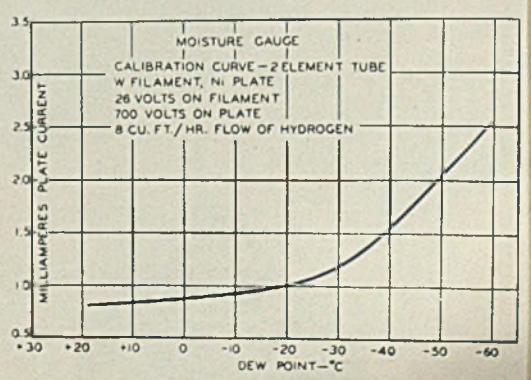
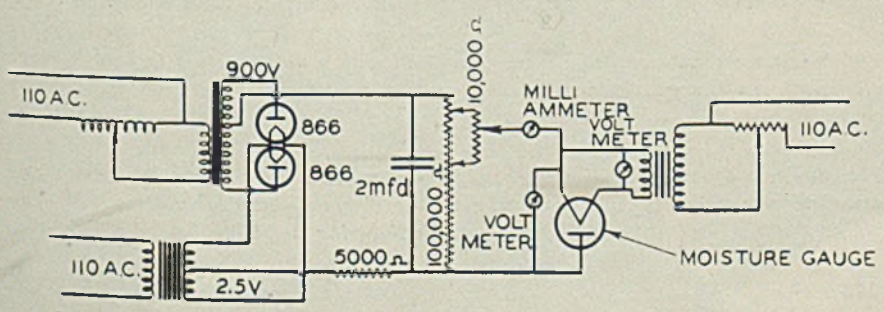


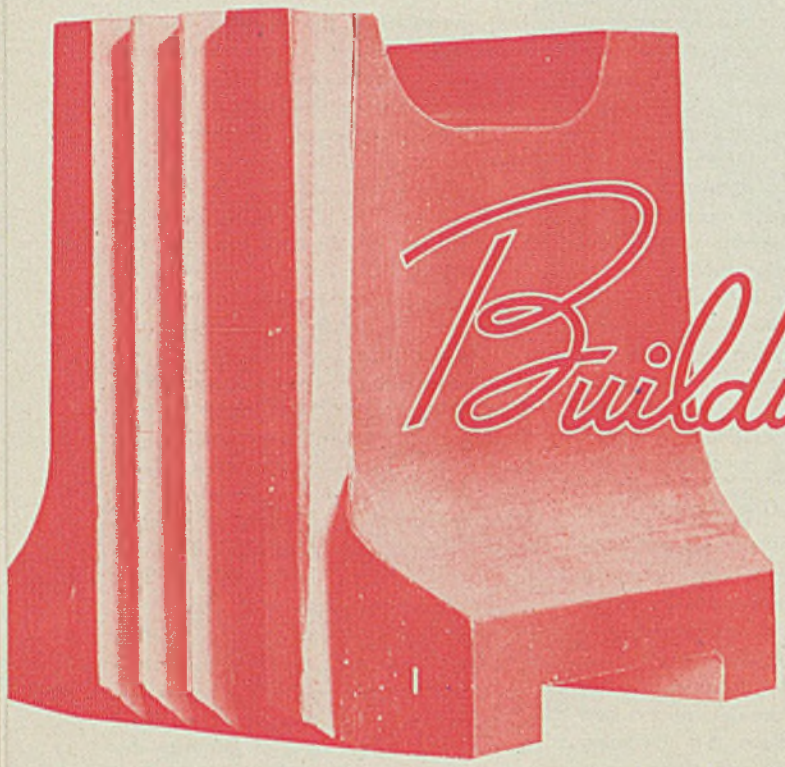
Fig. 3. (Right, top)—Effect of plate and filament voltage on performance

Fig. 4. (Right, center)—Control curve for dissociated ammonia

Fig. 5. (Right, bottom)—Precise control at any point between minus 35 and minus 45 degrees Cent. dew point for hydrogen allows bright annealing of stainless steel

Fig. 6. (Below)—Simplified schematic of the electronic control scheme





Read about ancient and modern hammers; the hammer a self-destroying tool; designer involved in a contest with destructive effects of use; approach to problem of hammer design; moving and fixed anvil hammers; the Chambersburg Model E; present war a contest between forged mechanisms

Building Hammers AT CHAMBERSBURG

By ARTHUR F. MACCONOCHIE
Head, Department of Mechanical Engineering
University of Virginia
University Station, Va.
And
Contributing Editor, STEEL

(Section 16 in a Series on Forgings, Forging Methods and Forging Equipment)

FROM TIME immemorial, the familiar dynamical principle, whereby very large pressure may be applied—especially to metals—by bringing a heavy mass suddenly to rest, has been utilized in many forms and divers ways. Throughout the earlier history of mankind, the strength of the human arm alone was relied upon to provide the energy necessary to strike the blow. But with the passage of time and as other primary sources of energy came under control, the power-driven hammer made its appearance.

In these early designs of mechanically operated hammers, there is ample evidence of the attempt to imitate the action of the smith as he worked at his anvil. With the invention of the falling ram, these limitations dissolved and the modern era of the drop hammer began. Among those personalities which stand out in the record of progress is James

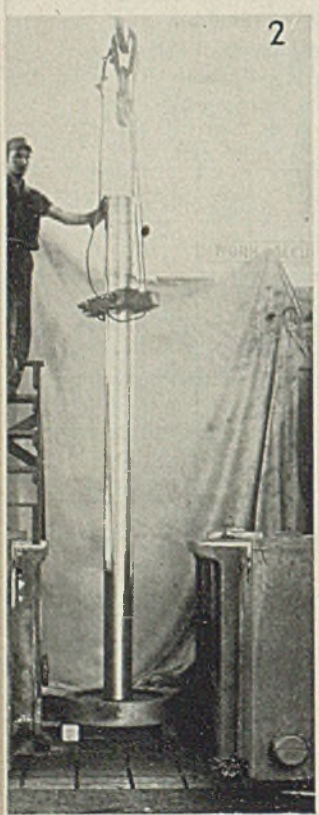


Fig. 1—The "balanced" ram, designed to minimize destructive forces acting on the rod by disposing the center of gravity of the striking mass auxiliary and well down towards the face of the ram

Fig. 2—To mount piston on rod, piston is first heated in a furnace under pyrometer control. Then it is removed to a horizontal support and the rod inserted while piston is still hot—as is shown here

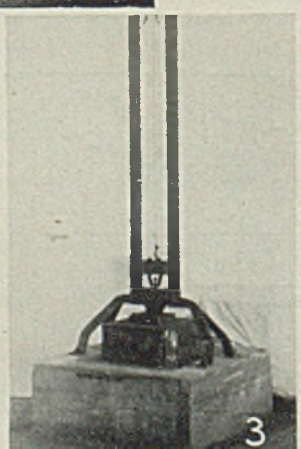


Fig. 3—Test hammer used to study effects of blows far in excess of speeds employed in commercial practice. This is part of laboratory equipment employed by Chambersburg Engineering Co. to keep abreast of the steady advance in hammer design

Fig. 4—This relative light air-driven hammer is particularly suited to working aircraft wing fillets, as shown here, and other parts made from sheet aluminum alloys

Fig. 5—At right, balanced ram being machined with a quill inserted in bore to check alignment. Left, a parallel bar is being used to check relation between guide pocket and base of hammer frame

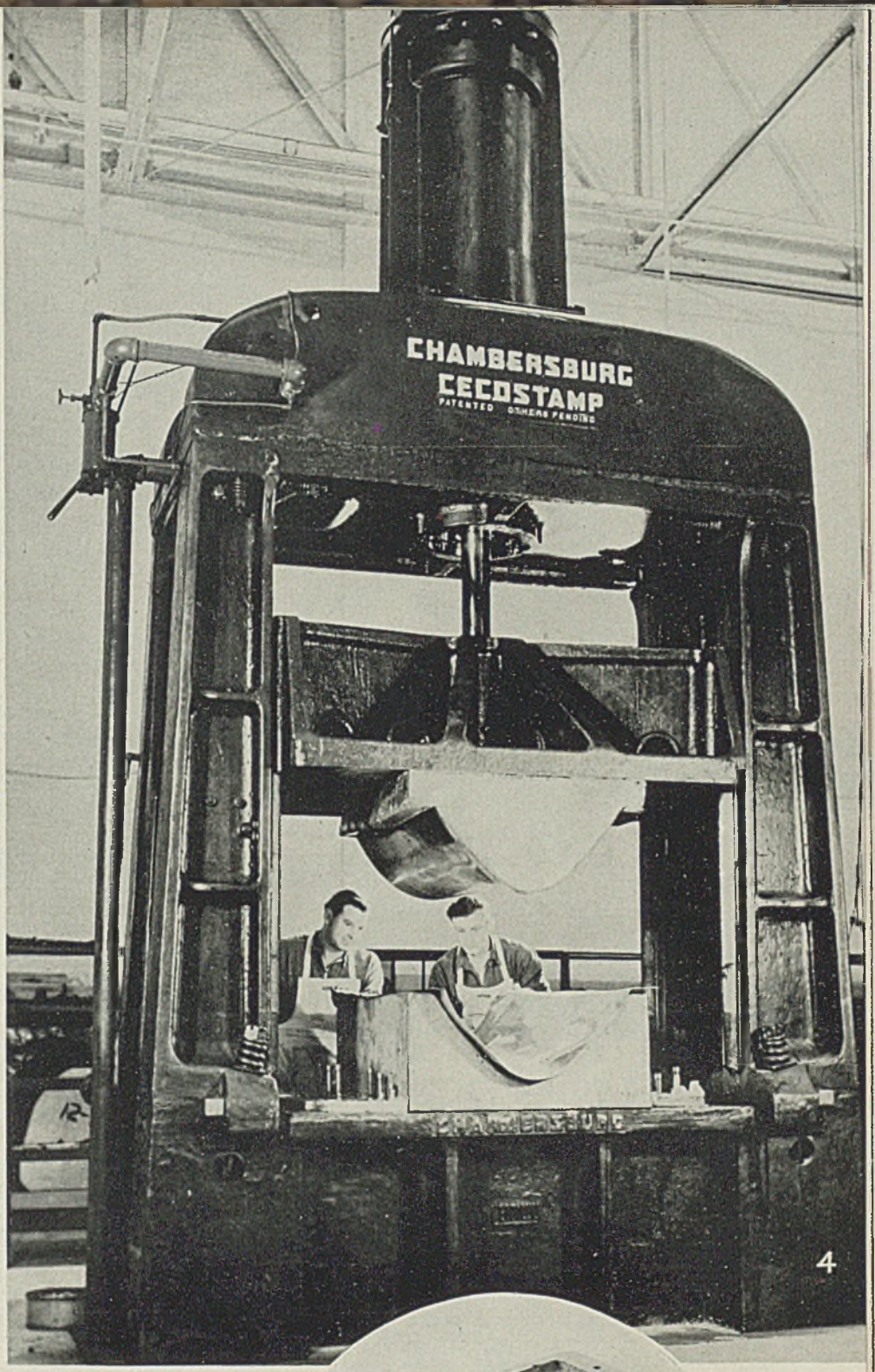
Fig. 6—Two types of laminated or multi-part anvils. Such blocks have been subjected to extended tests and observation in the Chambersburg laboratories. All illustrations furnished by Chambersburg Engineering Co., Chambersburg, Pa.

Naysmith, the Scottish engineer, who conceived and developed the first direct acting steam hammer in 1838, a tool which is readily recognized as the prototype of a numerous progeny. To the Chambersburg Engineering Co. however, in the person of its able president, Eugene C. Clarke, belongs much of the credit for the significant developments of the past two decades, more particularly in the direction of higher impact velocities, greater accuracy and in the adaptation of design of function.

From the standpoint of the end result desired the forging hammer successfully fulfills its mission if the part produced has the desired form and if a minimum of excess metal remains to be removed. Further, the flow of the grain must be under proper control, and the rate of production must be high.

A little consideration will show, however, that these basic requirements are antithetic to an easy solution of the problem of design, inasmuch as the hammer, at best, is a self-destructive tool. Any attempts to increase the speed and precision of its action involve painstaking investigation of the consequences since not only are all parts of the mechanism, especially the moving parts, subjected to the most violent shocks but the effects of heat have to be faced. Many of these studies are made in what is known as the test hammer illustrated in Fig. 3. This piece of laboratory equipment is arranged to permit without re-striking, hammer blows at velocities far in excess of commercial speeds in order that the effect of each blow may be accurately measured and recorded. The weight ratio of impinging bodies, (anvil and ram), the rate of deformation in its relation to ram velocity, and related matters are among the subjects of inquiry.

Anyone who has witnessed the spectacular operations of the forge and has watched a hammer of large capacity beat a mass of glowing steel into the die will have little difficulty in forming some estimate of the forces brought into play without benefit of any acquaintance with



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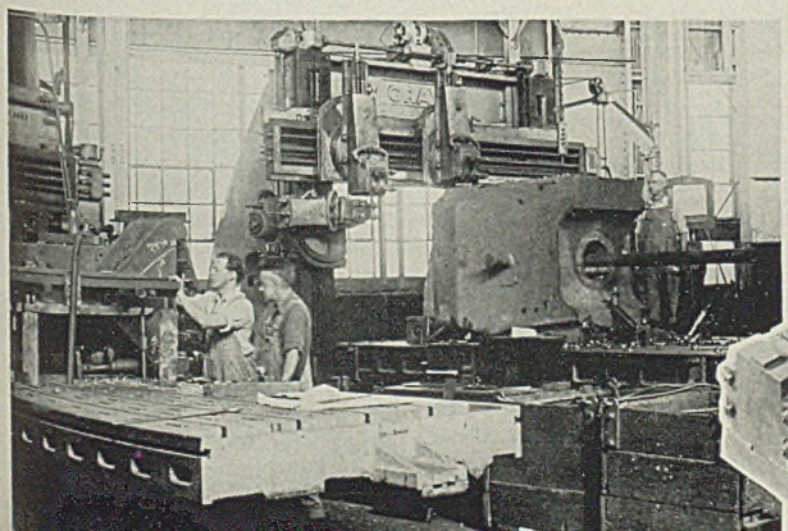

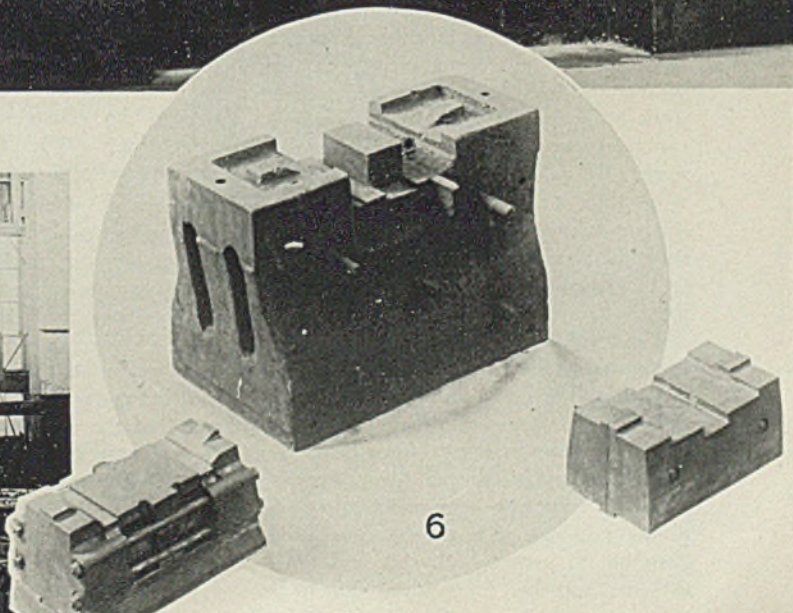
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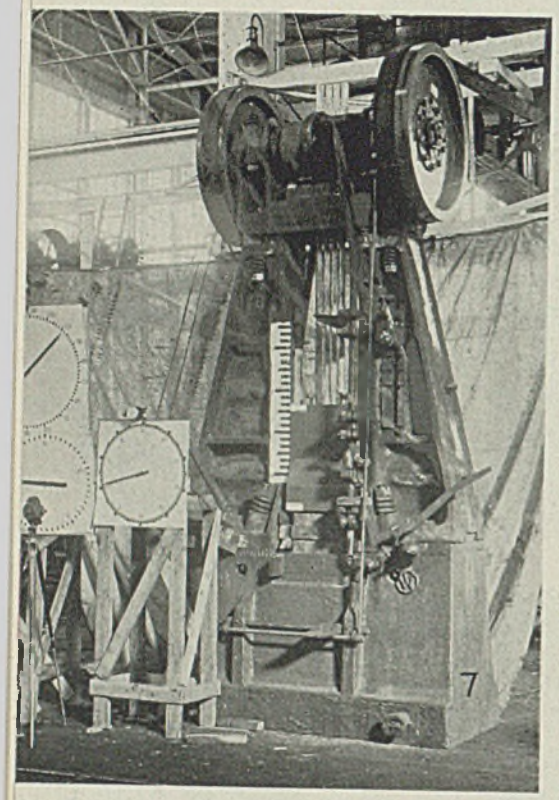


Fig. 7—Setup for putting drop board hammer through its production paces on the test floor. Board drops have the merit of simplicity, need neither steam nor air connections. Their application is limited, however. They can not be used on heavy work

the differential equation of acceleration and Newton's second law. Thus it is not surprising to learn that it is well nigh impossible to avoid the stressing of some parts of the hammer momentarily beyond the elastic limit. Hence the designer is primarily involved in a contest with the destructive effects of ordinary use, with the dice loaded against him.

In this connection, the demand for very large hammers having anvil blocks of proportionate dimensions has raised the question of laminated or multi-part anvils. Fig. 6 exhibits two types of such anvil blocks which have been subjected to tests and observations in the Chambersburg laboratory. In almost every case where such designs have been employed, similar assemblies have been tested to destruction in order to make the experimental record complete. At present all development and research work has been set aside so every effort can be concentrated on war production work. But with the return of peace, the work thus far accomplished will permit further important contributions to the study of hammer design and its relation to the deformation of metals under impact.

The evolution of the modern power driven hammer has been marked by such a wealth of practical observation and deduction that sometimes the theoretical reasons for the particular form taken by any given design are not always readily apparent. By way of a major approach to the problem, it might be considered desirable to permit both ram and anvil to move together in opposite directions at speeds which bear some relation to the masses involved as in the Beche drop hammer of German origin in which the two are of equal weight. Such an arrangement would undoubtedly avoid the transmission of vibration to the foundations and to the surrounding territory eliminating the resulting energy losses involved.

Further, the total weight of the hammer including the lower tup, which corresponds to the anvil of the type which we in this country are familiar, would be very much reduced. Indeed, it is claimed that the weight ratio, for equal power, would be about one to three. Foundations would be unnecessary, other than for mere support of the weight of the tool, and the transmission of the energy of the double blow to the forging would unquestionably be effected with a high degree of efficiency.

But when we come to examine this project further, we note as a fundamental objection that either there must be a relative movement of work and operator, or the operator must move up and down with the lower ram—a prospect which is not likely to be particularly welcome. Nor is this all. If we think of the effect of bringing the two halves of the hard steel dies together from opposite directions, we are led to the conclusion that certainly in the later stages of the forgings process, the pressures developed would be very high and in case of direct contact, of incalculable magnitude.

Mr. Clarke reports that he watched connecting rods being made by a hammer of this type at a forge shop in Birmingham, England, and in the course of an hour's production there was not a single rod which did not stick in the dies and require the efforts of two men to set them free. "The die", he concludes, "was ruined as I watched it."

As far as is known the only successful application of this type of hammer in this country is in the manufacture of silverware—a technique which obviously lends itself to an action of this type. When dealing with hot metal, it is essential that extremely intimate contact of forging and die be avoided and that the explosive force of the film of gas trapped in the die be utilized to assist in the release of the forging after each blow. Further, in the case of the double acting hammer, each blow must be absolutely on center, or the hammer is knocked out of line, a limitation which necessitates the use of several hammers if more than one impression is required.

If it be granted, therefore, that a stationary anvil of sufficient mass to resist the impact of the ram be the most practical approach, a primary decision concerns the ratio of the mass of the anvil to that of the ram. In the Chambersburg model "E" this has a value of 20 to 1, in the case of hammers up to and including the 8000 pound size. Above that, a figure of 25 to 1 is employed. Such ratios appear to give an effective guarantee of adequate resistance in the interest of efficient operation.

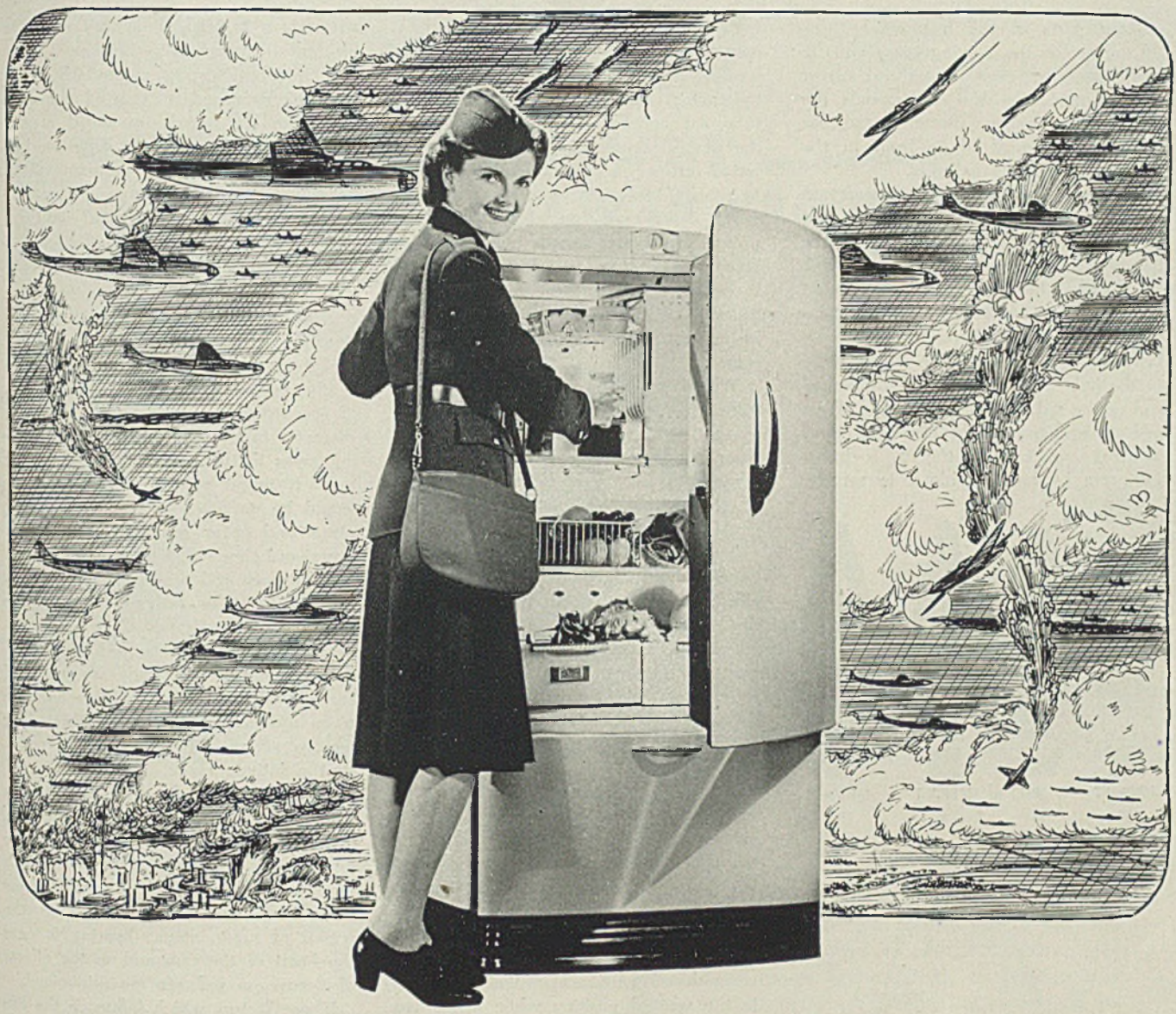
Alignment "Watched" Carefully

From the foundation timbers to the frame seats, the anvil is a modified pyramid, a shape which avoids the incidence of stresses resulting from the inertia of overhanging masses of metal. In the case of smaller hammers, the anvil is a single steel casting, carefully annealed and made without cores in order to avoid casting strains. But for larger sizes, a sub-base of high strength alloy iron is provided and fastened securely to the anvil proper by tongue and groove as well as dowels to prevent side movement.

Fig. 9 is an elevation of this model "E", the design referred to above. In early drop hammers such important members as frames were permitted to move freely at each blow, but this concept has given way to designs of the so-called "rigid" type in which accurate alignment is maintained as the blow is struck. In modern designs, the inevitable movement of one part with respect to another is guided so as not to disturb alignment; frames, for example, being seated on the anvil in such a manner that the almost imperceptible motion, as the blow is struck, occurs in a vertical direction only.

Anvil blocks, in common with other hammer parts, are subjected to vibrational stresses of a high order and so must be free from defects which might serve as the focus of a fatigue failure. It is for this reason that all machined surfaces which might, because of their location, become such foci, are carefully examined and sometimes etched to insure soundness.

Fig. 1 exhibits the "balanced" ram, a relatively recent development. If the forces acting during the delivery of the blow be considered, it is immediately apparent that central impact will tend to avoid the setting up of stresses arising from bending moments applied to the hammer rod—provided, of course, the work is centrally located. In this particular design, the center mass is not only axially disposed, but is located well down towards the face of the ram. The relief afforded to the rod and other



Anne Clark's refrigerator is helping to flatten Essen

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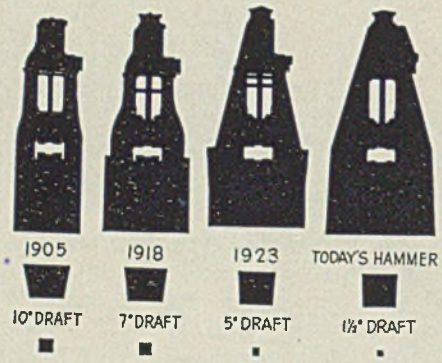
striking parts of the hammer by this disposition of the moving mass will be appreciated by every thoughtful driver of an automobile who understands the menace of an engine placed in the rear of the car instead of in front in the event of a head-on collision.

At the right in Fig. 5, a balanced ram is being planed with a quill inserted in the bore to check alignment. At the left, a parallel bar is being used to check the relation between the guide pocket and the base of a hammer frame. Hammer rods are not keyed or otherwise fastened to the ram. The sleeve fitted in the hole in the ram and the enlarged end of the rod have nearly similar tapers and are held together by frictional forces of great magnitude, as the rod is driven into ram by hammer blows in service.



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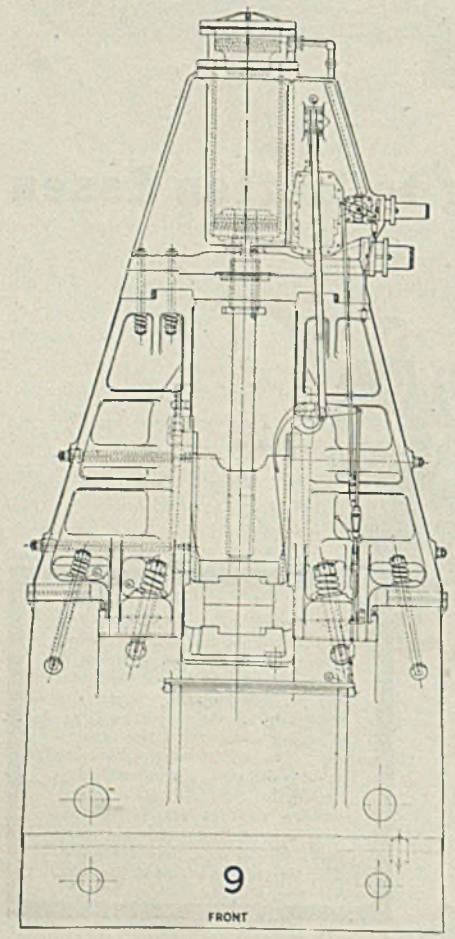

Fig. 2 shows the method employed to mount the piston on the rod. The piston head is first heated in a furnace under pyrometer control and is then removed to a flat horizontal support. While at the desired temperature, the rod is inserted vertically and the assembly allowed to cool.

No other mounting method has yet proved as effective for the purpose. The actual temperature to which the piston is heated prior to this operation is a function of its diameter, long experience having established the proper relationship.

When erecting a hammer, it is carefully tested for parallelism of guides and uprights. These are held to 0.002-inch when the hammer is cold. Check pads at each end of each frame, machined at the setting for planing the guide pockets, serve as measuring points.

The intimate relation which exists between a well designed hammer and the effective fulfillment of its function is nowhere better exemplified than by the instructions issued by the Chambersburg Engineering Co. for its maintenance. Most—but not all—of the vagaries of behavior are associated with dynamic and temperature stresses. However, one runs across such thoughtful design features as the provision of breather holes for the passage of relatively scale free air to the space which opens between the frame and anvil seats as the blow is struck. Unnecessary wear is thereby avoided. An interesting recommendation, which the experience of the average engineer would hardly foresee, concerns the suspension of replacement rods in the vertical position while in storage in order to avoid permanent set as a result of the deflection of their main axes.

Concerning the protection of the hammer against the effects of temperature stresses, we note the objection to the common practice of piling hot forgings against the rear of the anvil. This causes expansion. The operator then tightens the anvil cap key in order to maintain a fit, and all is well until the forgings are removed and the anvil cools and frequently splits. Similarly, care must be exercised in starting the run. Since the die warms up ahead of the ram, it is easily possible to drive the key too tightly and fracture the ram at the notch. As the run continues, the temperature of the ram rises, in its turn, causing expansion against the guides which must be adjusted accordingly.

Fig. 8—Steady reduction in amount of excess stock (shown by squares in lower section) is made possible by hammer improvements. From a 10-degree draft, common 40 years ago, drafts of 1½ degrees may now be employed with corresponding great reduction in volume of flash shown

Fig. 9—The Chambersburg model E. Prime aims of modern hammer design are: Increased forging work per blow and more strokes per minute; reduction in amount of steam or air used; lower maintenance costs and less "down time"; greater accuracy and minimum excess stock in the work

So far as injury from dynamic stresses is concerned, the piston rod is unquestionably the most vulnerable element in the steam drop hammer. It must be flexible enough to bend under the action of eccentric blows and yet of sufficient diameter to provide the necessary bearing areas in the piston and also in the ram. It might appear as though there would be an advantage in constructing piston and piston rod in one piece, but experience shows that the change of section between rod and piston constitutes a focal point of fatigue failure. For the same reason it has been found undesirable to enlarge the rod end which enters the ram. All rods are made of carefully alloyed steel forgings and are given a high polish after machining to remove all surface marks which might start a fatigue crack.

After entering the rod in the piston as described above, the upper end is riveted over, ensuring a permanent bond. The lower end, however, is tapered in such wise that seizure with the ram takes place first near the point. Thus the region of most intense bearing is near the heart of the ram and so the effects of flexure on rod life are minimized.

Those factors which influence the life of the rod include off-center work, eccentricity of the ram itself and looseness of the ram in its guides. But just how long any particular rod will last cannot be predicted. Obviously forgings of thin section permit relatively rapid cooling and close approach of the upper and lower halves of the die thus are harder on the rod than heavier sections in which the flash is held to a minimum. Then again, a long run is easier on the hammer than frequent changes of work which cause reversals of the bending moment on the rod, resulting from eccentric loading.

The inertia stresses which ultimately destroy the rod raise problems of piston ring maintenance. Cast iron will not answer this purpose and alloy steel must be used. But the rings pound their sets, enlarging them and permitting the rings to cock. Rings, like the rod, thus suffer from fatigue and must be renewed if failure from this cause is to be avoided.

At least half the battle of successful hammer design lies in the completeness and sensitivity of control. When pound-

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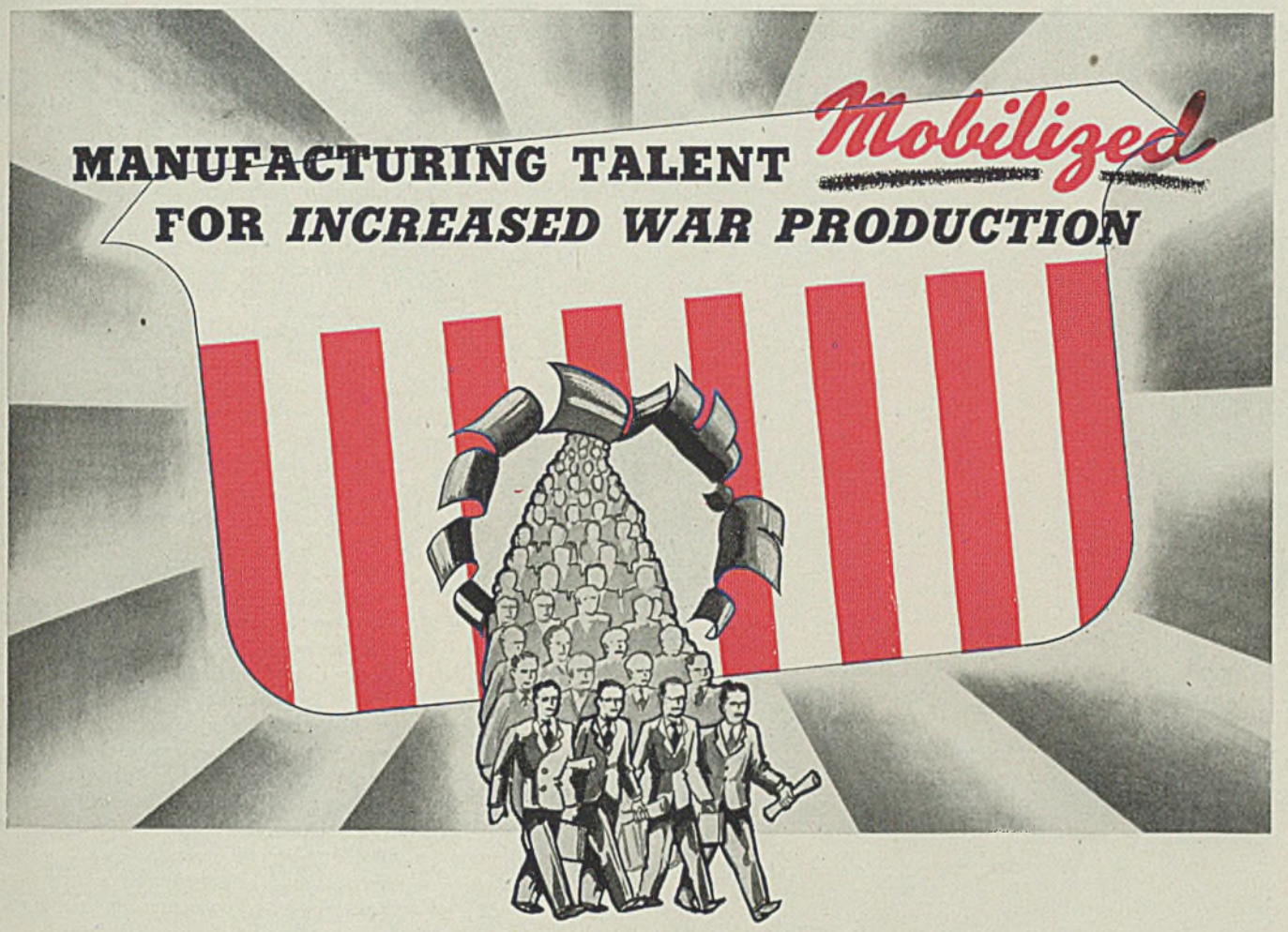


The greatest mobilization of engineering, technical and production talent in the metal industry will take place in Cleveland the week of October 12 at the National Metal Congress and War Production Edition of the National Metal Exposition.

250 leading manufacturers, anxious and willing to play their part in this five-day drive to increase production of war products, will have educational and conference displays manned by their production and engineering experts.

Outstanding authorities in government and industry will speak briefly, informally and off-the-record at twenty-five A.S.M. war production sessions, and will participate in Information Panels for open discussions. These practical sessions will be in addition to more than 100 papers to be presented at the regular meetings of the four big cooperating societies.

With the event devoted exclusively to education that will help increase war production, it may be likened to a great university with 200,000 square feet of class rooms, lecture halls, conference and display spaces, with a faculty of thousands of the "know how" and "know why" experts of the metal industry ready to counsel and advise how we can do more with what we have, ready to explain new wrinkles in standard processes, or to explain new methods and equipment.

Plan now to take advantage of this great university short course on metals, their production, fabrication and use. Learn and share in the new production developments that will help win this war of metals.

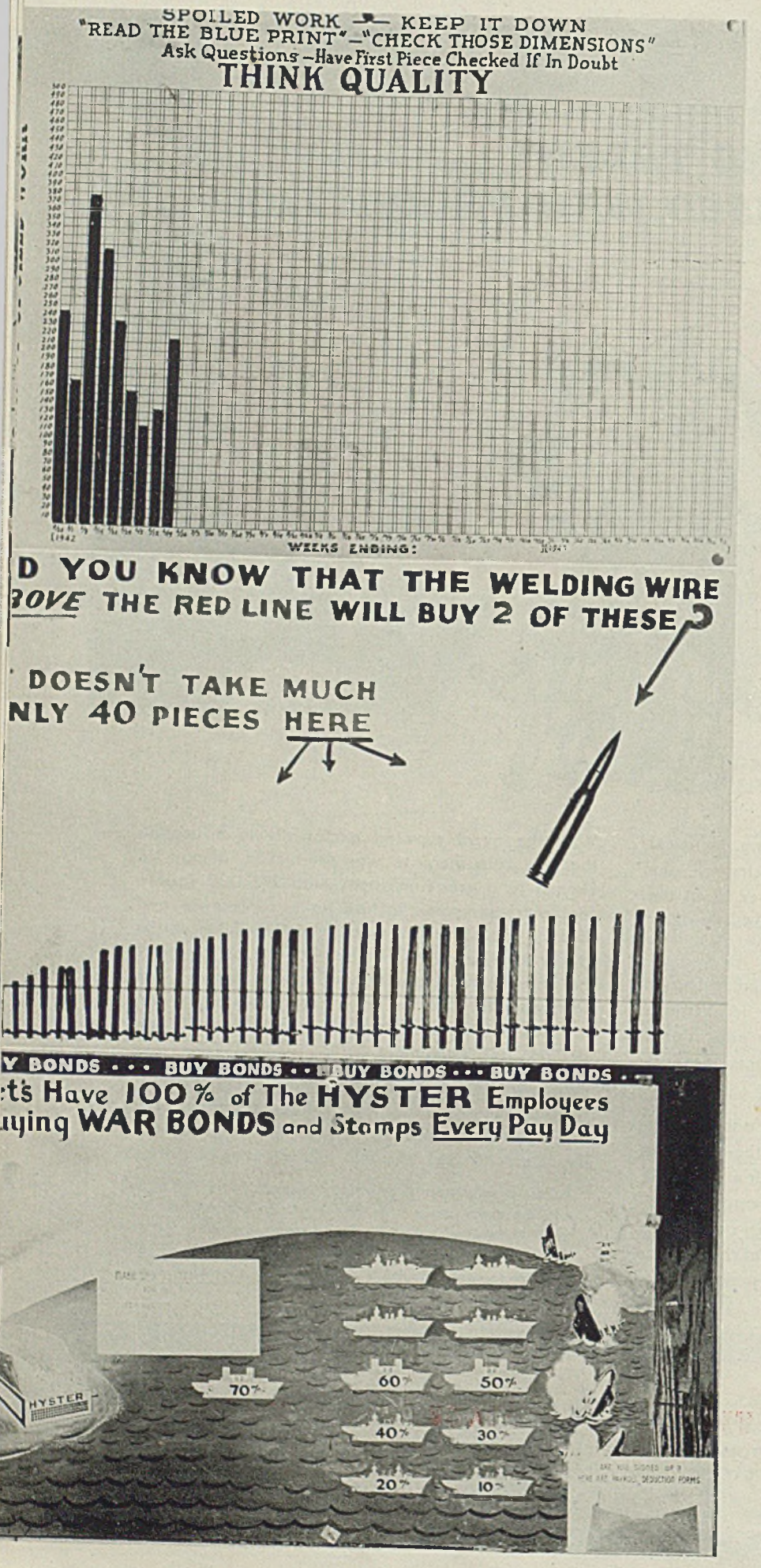
N.B. 250 manufacturers have already reserved 95 per cent of the available display space in the War Production Edition of the National Metal Exposition. Several fine locations remain — get the details now and participate in this educational drive to increase production — write A.S.M., 7301 Euclid Ave., Cleveland, Ohio.

EVENT
THE NATIONAL METAL CONGRESS AND WAR PRODUCTION EDITION NATIONAL METAL EXPOSITION

TIME
OCTOBER 12 TO 16, MONDAY THRU FRIDAY

PLACE
CLEVELAND'S PUBLIC AUDITORIUM

THEME
INCREASED PRODUCTION OF WAR PRODUCTS



CHARTS

. . . that promote enthusiasm for maximum production

By EUGENE CALDWELL
Consulting Management Engineer

THE SUCCESS of Donald Nelson's drive to increase war production 25 per cent depends on enlisting the co-operation and enthusiasm of the workers themselves. Such co-operation can best be obtained by showing the men their day-by-day output. By setting up certain production goals to be reached, complete reports of progress can be shown and made known to the men daily.

Where There Is a Natural Unit of Production: In quite a few plants the measuring of production is a simple matter. For example, in many industries weight of the product in pounds turned out is an accurate measure of accomplishment. In other factories where one item is being made in large volume, production is easily measured by the number of units produced. Thus production is at a higher level today than yesterday if more units are turned out today.

Not So Easy Everywhere: On the other hand, the products manufactured in many plants are so complex that there is really no good yardstick to measure production. Hence it is difficult to obtain a figure showing the level of production from day to day. This is particularly true of the machinery business in general.

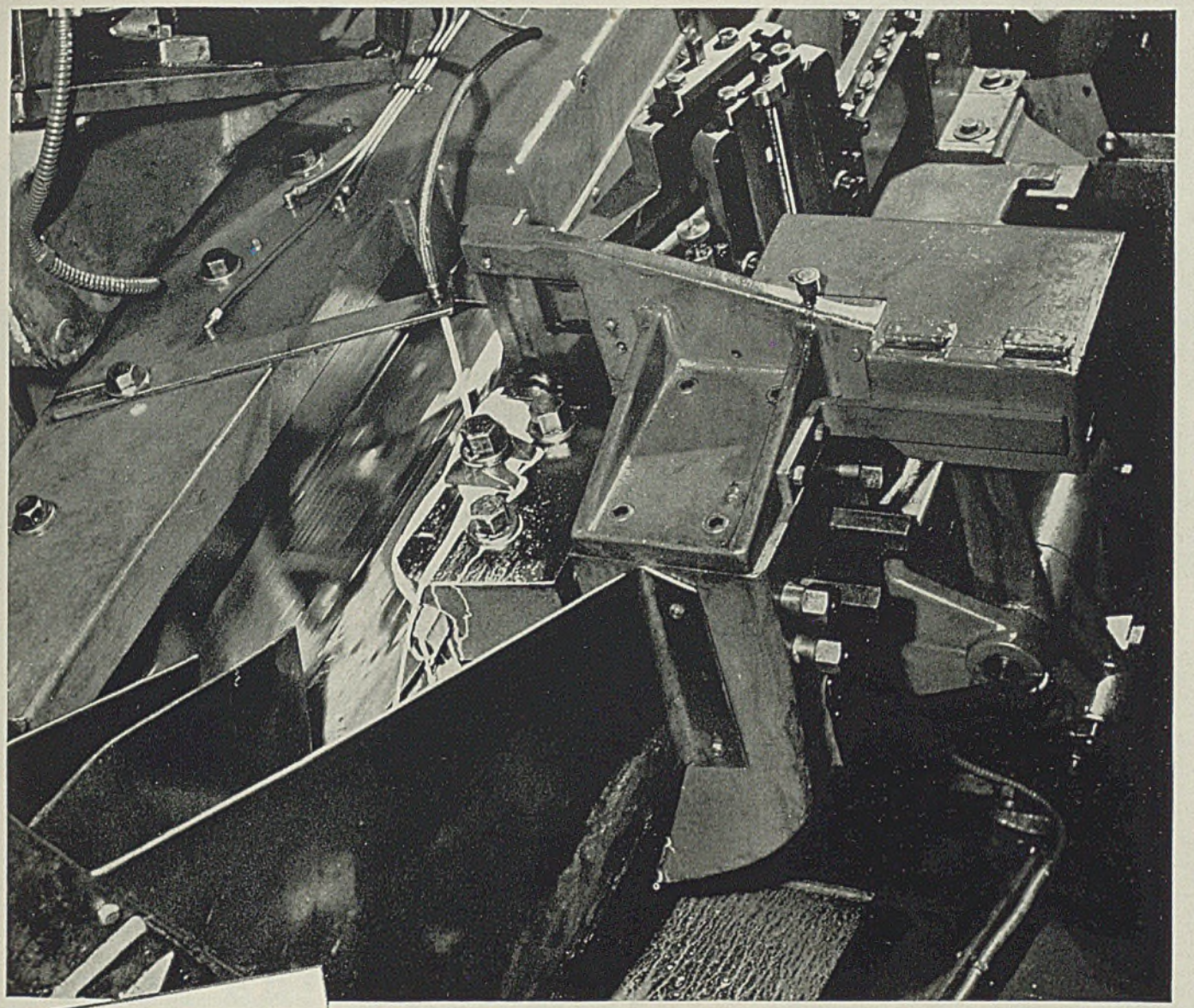
An example of the complexity of this problem is found in a company manufacturing about 50 different kinds of machines of various models. The total number of parts involved is about 40,000. The company has two plants located 2000 miles apart. For many machines, about half of the parts are

(*Please turn to Page* 183)

Top, keeping up a chart that shows spoiled work in money, not units spoiled, is suitable for almost any type of production work, even where many different types of products are made or where only parts are produced

Center, charts can be made to bring home many associated messages. Here is one that helped to cut waste of electrodes represented by excessive stub lengths

Bottom, charts are well suited to showing progress of many different types of campaigns. This one helped sell war bonds and stamps



Cold forged full threads of R B & W bolts are clean and sharp, with accurate lead and pitch, giving uniform load distribution and preventing stripping. Nuts, faced or semi-finished, have the bearing face at right angles to the hole, assuring stud alignment . . . with lead end countered-bored, after tapping, for quick starts.

How much hangar can a finger-flick build?

HOW IMPORTANT is a ***single*** bullet in a machine gun cartridge clip? How vital is ***one*** out of 2000 incendiary bombs dropping from a single Yankee plane over Tokio? How much faster can a hangar be built by ***quick***-assembling bolts and nuts?

A nut with a cranky thread . . . a bolt with a badly-formed head . . . are like bullets that miss, bombs that are duds. War industries want nuts that run on smoothly with a flick of the fingers, bolts that take tightening without injury.

High on the list of suppliers to the builders of fighting equipment — the airports, the tanks, the battleships, tractors and big guns — is R B & W, whose service to America is one bolt, one nut multiplied by millions . . . tons . . . carloads.

The men who know what quick assembly means to war production specify "Empire" for bolts and nuts that are clean-threaded, accurate, and sturdy.

Our three great plants are strategically located for Industrial America's convenience — our workers are giving full energy to serving wartime America's fastening needs.

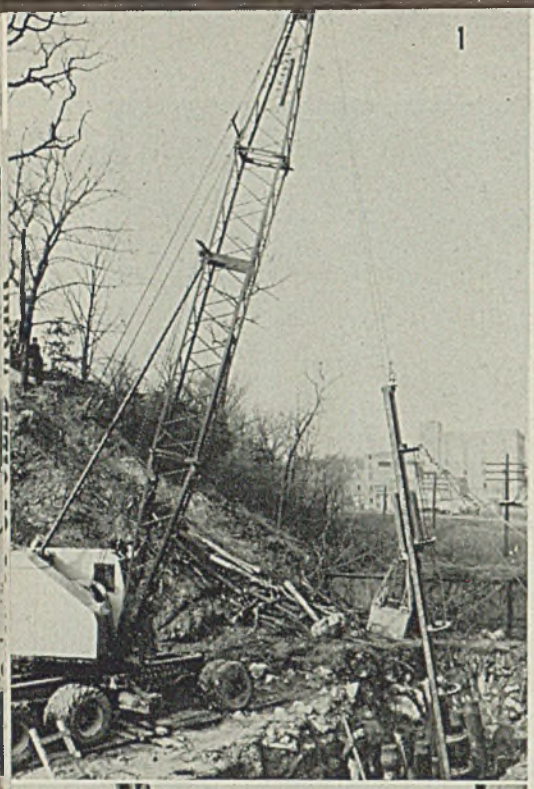
Russell, Burdsall & Ward Bolt and Nut Company. Factories at Port Chester, N.Y., Rock Falls, Ill., Coraopolis, Pa.; sales offices at Philadelphia, Chicago, Detroit, Chattanooga, Los Angeles, Portland, Seattle.

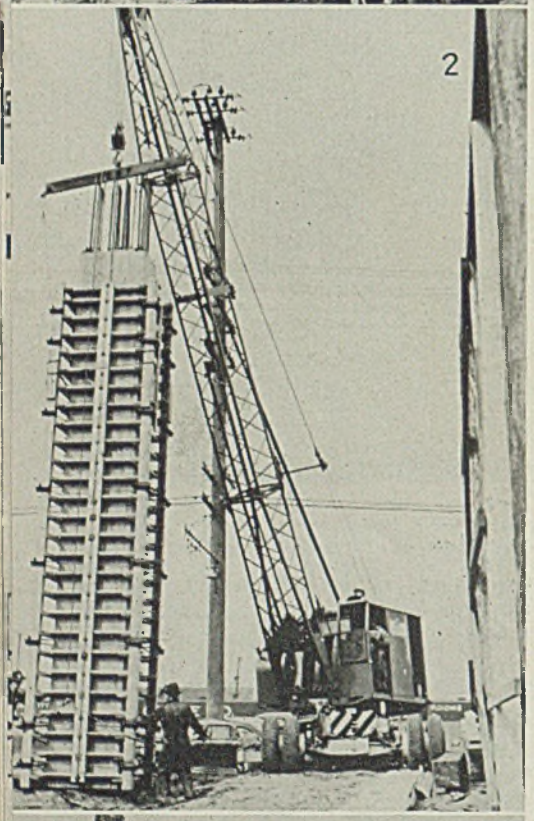
RB&W **RUSSELL, BURDSALL & WARD**

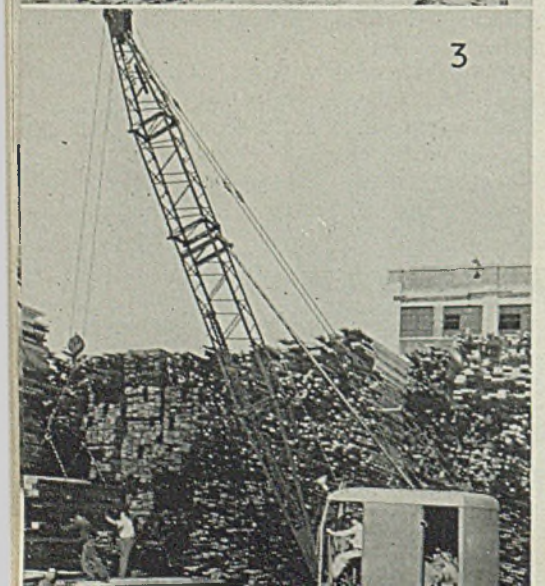
Making strong the things that make America strong

EMPIRE BOLTS NUTS · RIVETS

AND ALLIED FASTENING PRODUCTS...SINCE 1845







A Versatile
MATERIALS HANDLING AID

THE FRST World war brought the truck crane—a full revolving ½-yard crane upper body mounted on a solid-tired Liberty truck chassis, according to the General Excavator Co., Marion, O. This offered mobility—after a fashion—the company points out. But it took many years of refining and development to produce the modern crane mounted on pneumatic tires, self-propelled, hydraulically steered and operated by one man.

Such a unit can lift and carry loads with the boom in any position, can creep at a snail's pace or put on a burst of speed to race to some other location when and where it happens to be needed. With only one man seated up in the crane cab to control all operations, the crane pauses, turns, speeds up, swings around, lifts its load, holds it in position or places it exactly where wanted—all under perfect mechanical control.

Many cranes of this type are finding their way to the fighting front, to the shipyards for speeding ship production, to embarkation points to supplement dock handling facilities. But their broadcast application is on the home front, in the hands of industry.

The one-man operated, self-propelled crane on pneumatic tires is said to be excellent for breaking down bottlenecks in handling raw materials, parts in process and finished products around industrial plants where greatly increased war production has introduced serious yard storage problems. Being able to travel about at will, yard storage is not limited by handling facilities if one of these units can be made available to supplement overhead traveling yard cranes and other handling equipment.

An important advantage of this type of crane is the great lifting power that is available over the side of the unit. As will be noted in accompanying illustrations, the chassis on which the crane cab is mounted is furnished with outriggers at both ends and at the center. Provided with screw jacks at their outer tips, these outriggers afford a means of supporting the crane platform so unusually large loads can be handled over the side without danger of tipping.

Too, many of these units are supplied with a comparatively long wheel base. Fig. 1, for example, shows a three-axle chassis supporting a General Supercrane working over the side. Note here that the center outrigger jack has been screwed down against heavy planking to stabilize the unit.

Machines Save Manhours

The amount of work that can be handled by these machines is hard to believe. Owners report savings amounting to as much as 1.76 man-hours per 1000 board feet when stockpiling lumber with one of these cranes compared with other methods previously employed. Fig. 3 shows an operation. It is difficult to visualize how this particular work could be handled efficiently without some unit of this type.

In order to be able to travel over poor terrain, these machines are available with tandem rear axles and with dual drives for maximum traction. In addition, four-way oscillation of these rear axles allows movement over obstacles and uneven ground. Extra low gearing is provided so they can pull out of places which would stop a conventional truck.

Boom sections can be added easily so that it is not unusual to see these cranes supporting booms as long as 100 feet. Fig. 4, for example, shows the same type of boom, as long as in Fig. 1 but with sections added to give a much greater working height. The unit is being employed to speed erection of a new coal tipple near Cleveland. The welded tubular construction utilized in the boom units produces a strong, rigid structure and yet one which is light. This feature is of particular advantage as it pro-

Fig. 1—This crane works over the side without danger of tipping because the outrigger extending out from the chassis gives needed stability

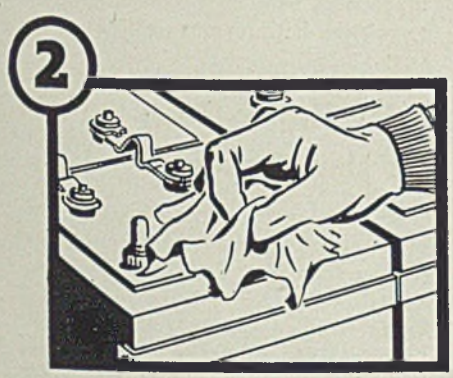
Fig. 2—Working in close quarters, this crane helps McRae Bros. to speed construction of Spokane street viaduct in Seattle. Here it is setting a column form weighing 10,000 pounds, 29 feet high. Entire job from truck to final position takes only 15 minutes

Fig. 3—Owner of this crane reports savings amounting to as much as 1.76 man-hours per 1000 board feet when stockpiling lumber compared with other methods

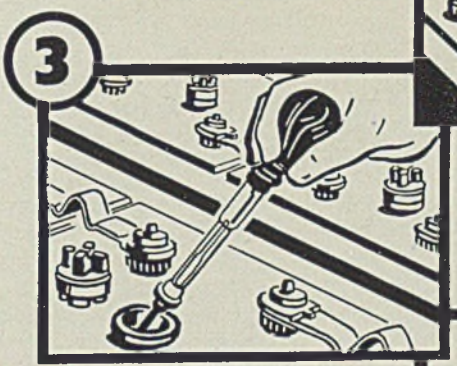
SAVE TO WIN

EVERY storage battery is a war weapon, containing metals vital to our fighting men. You hold these metals in a sacred trust. It's your duty to squeeze from them every ounce of use . . . by following simple rules for battery conservation.

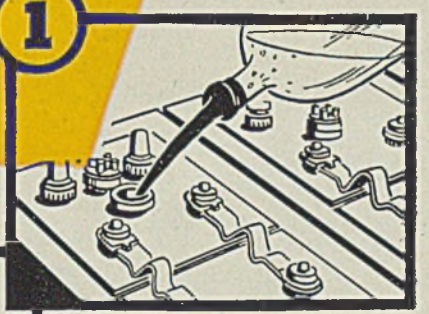
HERE'S HOW TO MAKE YOUR BATTERIES LAST!*



Keep the top of the battery and battery container clean and dry at all times. This will assure maximum protection of the inner-workings.



Keep the battery fully charged—but avoid excessive overcharge. There's always a right-way to do any job, and a storage battery will last longer when charged at its proper voltage.



Keep adding approved water at regular intervals. Most kinds of local water are safe in an Exide Battery. Ask us if yours is safe.

Keep records of water additions, voltage and gravity readings. Don't trust your memory. Write down a complete record of your battery's life history. Compare readings. *Know* what's happening!

Exide IRONCLAD BATTERIES

*** If you wish more detailed information, or have a special battery problem, don't hesitate to write to Exide. We want you to get the long-life built into every Exide Battery. Ask for booklet Form 1982.**

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
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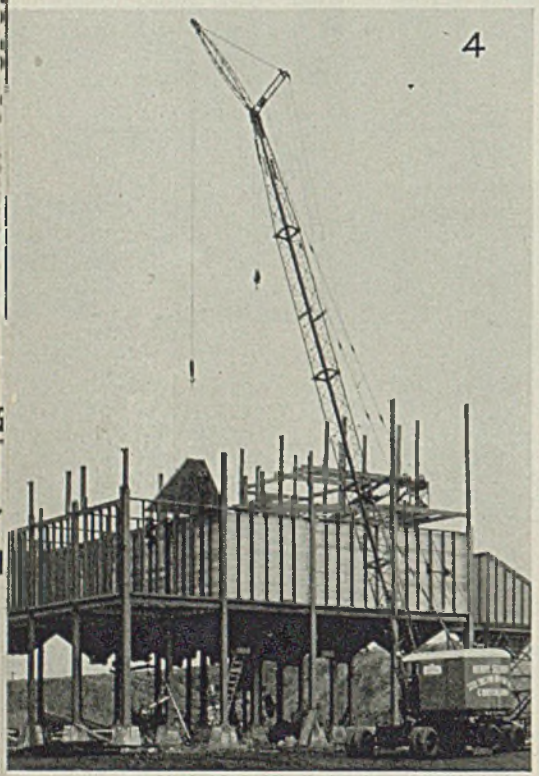
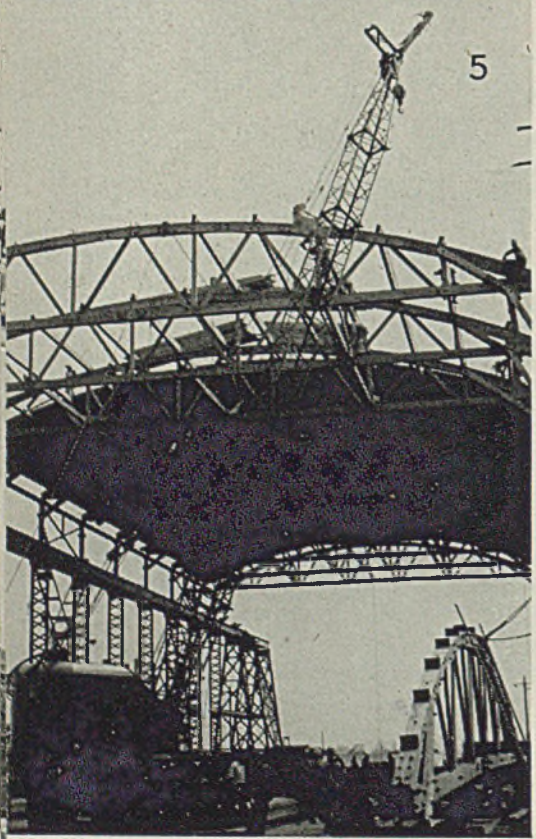
Fig. 4—Boom sections can be added to produce booms up to 100 feet in length. The crane shown here has such added sections and auxiliaries to speed erection of a new coal tipple near Cleveland

Fig. 5—Shipyards find these cranes particularly useful. Their ready availability and flexibility makes them not only useful in construction work but in a wide variety of other handling jobs





vides better control of swing movements and allows faster swings—due to the lower inertia involved with the lighter structure.

Other variations in boom assemblies can be seen in Fig. 5 where one of these cranes is being used to speed shipyard construction. Here the cry is speed, more speed. And one answer that appears to be quite effective is to use one of these cranes—equipment that is ready to pick up and go at a moment's notice, readily available at any point in the entire yard.

At the same time, these units can work well in cramped quarters. The unit shown in Fig. 2 is doing just that. It is helping McRae Brothers, Seattle contractors, to speed construction of the new million-dollar viaduct on Spokane street in Seattle. Working in tight quarters, between falsework, with constant traffic on both sides, yet maneuvering on soft sand, this machine was found able to go almost anywhere and do the job well at low cost. In Fig. 2, it is setting a column form weighing 10,000 pounds and measuring 40 inches wide by 29 feet high. The entire operation from taking the form off the truck to placing it accurately in position in the prepared hole is accomplished in less than 15 minutes.

New Phosphor Coating Provides More Light

A new phosphor developed by research engineers of the Westinghouse Lamp Division, Bloomfield, N. J., for use in coating fluorescent lamps, is reported to produce more light. It uses no cadmium or lead, and its function is to transform invisible ultra-violet rays into light radiations.

War Standard for Machine Tools Offered

Another American war standard—"Machine Tool Electrical Standards"—purpose of which is to speed further the manufacture of machine tools by standardizing the electrical wiring of such tools is announced by American Standards Association, 29 West Thirty-ninth street, New York.

Already it has been made mandatory by War Production Board Order L-147, which limits the future electrification of machine tools to the types of equipment recommended in the standard.

According to the WPB, "the standard is found to provide satisfactory electrification for most purposes, and only under special conditions will machine tool builders be authorized to produce tools which do not comply with these specifications."

Work on co-ordinated specifications and safety provisions for electrification of machine tools has been going on since the first World war, but the result has been a confusion of requirements, some of which actually created unnecessary hazards to operator and machines.

There was a growing tendency for some users of electrically driven machine tools to write their own specifications, which varied widely. These presented a difficult problem to the machine tool builder. Sometimes he was forced to read through 20 or 30 pages of specifications before wiring the machine tool, and finally buy the equipment specified instead of using what he had on hand. When the customer's specifications imposed details inherently unsuited to the machine in question lengthy correspondence ensued, and finished machines clogged the assembly floor awaiting the final decision.

Added to these problems was confusion over the way in which local inspectors interpreted the provisions of the National Electrical Code.

In 1939 the committee on electrical problems of the National Machine Tool Builders' Association undertook a search for the least common denominator of all the codes and specifications in use, and prepared the first draft of the standard. Last year ASA was asked to study and further revise these standards for acceptance as an American war standard.

A special section covering machine tool equipment will be included in the next revision of the National Electrical Code and will co-ordinate the provisions of that code with the new standards.

Copies of "Machine Tool Electrical Standards" may be obtained from the association headquarters at 40 cents per copy.

Joins Tips to Tools By New Process

An improved method of joining carbide and all other types of cutting tips and cutting blades to tool shanks reported to provide a tight fit is announced by Krembs & Co., 669 West Ohio street, Chicago. According to the company, the method is adapted to both small and large-scale production and can be used with furnace, torch, or spot-welding methods.

Process comprises a specially developed Fluxined-Spelter which is used to brush on the contacting surfaces of both the cutting tip and the tool shank. The work is then assembled to form a tight fit and brazed.

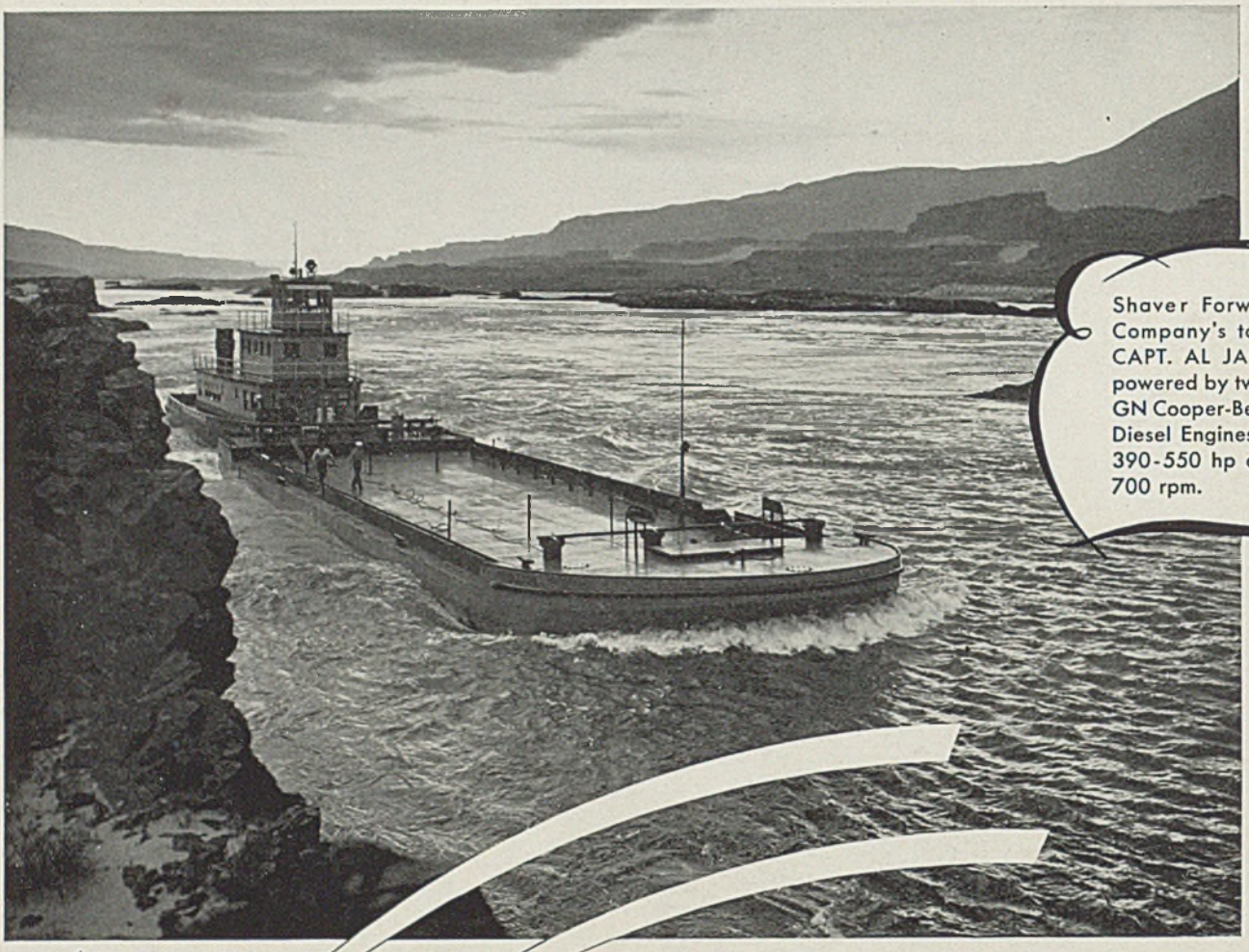
When completed, the finished braze looks like a gold-plated joint with absolutely no waste of joining material, and the cleaning job is almost nil, the company states.

OUR
Victory Pledge:
EVERY
CONTINENTAL PRODUCT
WILL CONTRIBUTE
TO THE
FORCES OF
VICTORY

CONTINENTAL

ROLL AND STEEL FOUNDRY COMPANY

CHICAGO • PITTSBURGH



Shaver Forwarding Company's towboat CAPT. AL JAMES is powered by two Type GN Cooper-Bessemer Diesel Engines, rated 390-550 hp at 520-700 rpm.

AFTER 5800 TOUGH HOURS!

Rings Free Condition Excellent

Towing on the swift Upper Columbia River isn't easy on marine engines. Rapids, white water, and tight places are numerous. Boats that ply that waterway must have engines built for hard going and heavy overloads.

The CAPT. AL JAMES is powered with a pair of Cooper-Bessemer Diesels. Now, after 5800 hours of hard work, heads and pistons have been pulled for inspection. All rings were found free, maximum cylinder liner wear was less than one-thousandth of an inch for each thousand hours of operation, and engines' condition declared excellent.

That sort of record speaks for the ruggedness of C-B Diesels, and their economy of maintenance. They will serve you just as well!

THE COOPER-BESSEMER CORPORATION

Mount Vernon, Ohio — Grove City, Pennsylvania

25 West 43rd St., New York City — 529 M & M Bldg., Houston, Texas — 640 East 61st St., Los Angeles, Calif.
Investment Bldg., Washington, D. C. — 1501 Arcade Bdg., St. Louis, Missouri — 49 Duncan St., Gloucester, Mass.
Calmes Engineering Co., New Orleans, La. — 1223 Western Avenue, Seattle, Washington

CONVERTER CAST STEEL

WILL MEET REQUIREMENTS

By C. E. SIMS and F. B. DAHLE
Battelle Memorial Institute
Columbus, O.

NOW that side-blow converter cast steel can be made to the same chemical composition as acid open hearth or acid electric cast steel, the present question is, does it nevertheless differ essentially in mechanical properties? It seemed that an appraisal of these properties was in order.

An investigation was sponsored by Whiting Corp., Harvey, Ill., for determining the facts, and contemplated as a follow-through study of means to correct any deficiencies that might be found. All of the steels used were from regularly produced commercial heats.

It is recognized that steel castings are products of three factors: (1) the inherent engineering properties of the steel that is used, (2) the mechanical integrity of the casting, and (3) the heat treatment.

The mechanical integrity of a casting is largely a matter of foundry technique, and no attempt was made here to determine whether, as is often claimed, converter steel has superior castability. The heat treatment was a constant, and the investigation was concerned only with the comparative engineering properties of these steels, under standardized conditions.

Specimens of cast steel for testing were solicited from various commercial found-

The accompanying article was taken from the September, 1942 issue of *THE FOUNDRY*.

Fig. 1—Low temperature notched-bar impact strength of cast steels

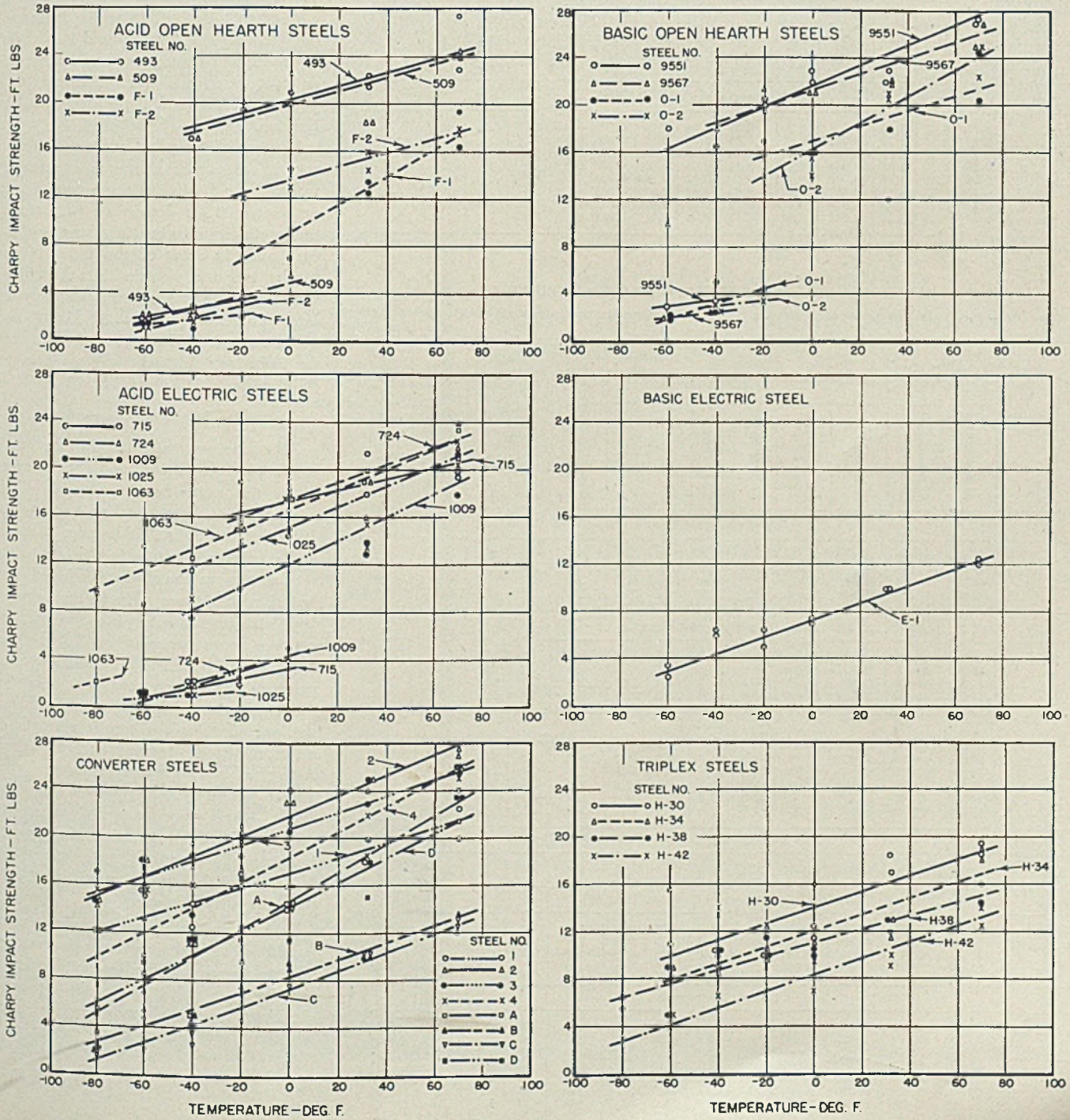


TABLE I.—CHEMICAL ANALYSES OF GRADE "B" CAST STEELS.

Steel	Carbon, per cent	Manganese, per cent	Silicon, per cent	Phosphorus, per cent	Sulfur, per cent	Residual Metals: Copper, per cent	Residual Metals: Chromium, per cent	Residual Metals: Nickel, per cent	Residual Metals: Molybdenum, per cent	Residual Metals: Nitrogen, per cent	Special Deoxidizers Added to Ladle, lb. per ton: Al	Fe Ti	Ca Si	Ca Si Mn
Acid Open Hearth Steels														
493	0.21	0.69	0.42	0.030	0.035	0.11	0.05	0.01	0.006	0.006	...	2	3	...
509	0.24	0.66	0.47	0.036	0.035	0.12	0.04	0.01	0.006	0.005	...	2	3	...
F-1	0.33	0.67	0.36	0.036	0.036	0.05	0.02	0.04	0.060	0.005	...	...	...	...
F-2	0.30	0.85	0.37	0.035	0.033	0.04	0.02	0.04	0.051	0.006	...	...	...	...
Basic Open Hearth Steels														
9551	0.27	0.58	0.46	0.013	0.025	0.15	0.14	0.06	0.016	0.005	...	...	...	...
9567	0.27	0.68	0.45	0.019	0.034	0.10	0.12	0.05	0.012	0.005	...	...	...	...
O-1	0.32	0.72	0.34	0.017	0.027	0.12	0.05	0.15	0.04	0.004	...	...	...	...
O-2	0.30	0.77	0.34	0.016	0.029	0.12	0.06	0.17	0.03	0.004	...	...	...	...
Acid Electric Steels														
715	0.27	0.80	0.45	0.027	0.034	0.06	0.05	0.03	0.013	0.008	...	3	...	3
724	0.26	0.72	0.39	0.026	0.036	0.08	0.03	0.06	0.009	0.008	...	3	...	3
1009	0.26	0.68	0.40	0.034	0.038	0.11	0.06	0.18	0.038	0.010	...	4	...	1.5
1025	0.24	0.66	0.39	0.035	0.040	0.11	0.06	0.16	0.034	0.009	...	4	...	1.5
1163	0.26	0.68	0.49	0.036	0.037	...	...	...	...	0.009	2	...	...	...
Basic Electric Steels														
E-1	0.34	0.88	0.28	0.033	0.035	0.12	0.19	0.43	0.06	0.007	0.7	...	...	...
Converter-Acid Electric Steels (Triplex)														
H-30	0.30	0.73	0.40	0.029	0.035	0.36	0.04	0.08	0.056	0.011	2[a]	...	2	...
H-34	0.34	0.78	0.40	0.033	0.036	0.39	0.04	0.06	0.062	0.011	2[a]	...	2	...
H-38	0.33	0.58	0.31	0.023	0.041	0.38	0.03	0.08	0.005	0.012	2[a]	...	2	...
H-42	0.35	0.73	0.35	0.059	0.047	0.43	0.03	0.10	0.004	0.010	2[a]	...	2	...
Converter Steels														
1	0.26	0.77	0.55	0.034	0.041	0.19	0.04	0.09	0.008	0.008	2	...	...	...
2	0.26	0.66	0.38	0.032	0.027	0.09	0.04	0.06	0.006	0.009	2	...	...	...
3	0.27	0.65	0.37	0.038	0.026	0.09	0.05	0.06	0.007	0.009	2	...	...	...
4	0.26	0.50	0.32	0.033	0.028	0.14	0.03	0.05	0.007	0.009	2	2	...	...
A	0.29	0.50	0.33	0.040	0.031	0.09	0.02	0.085	0.008	0.006	1	...	...	...
B	0.33	0.85	0.43	0.043	0.035	0.09	0.02	0.072	0.018	0.008	1	...	...	...
C	0.33	0.64	0.39	0.049	0.038	0.10	0.03	0.079	0.018	0.007	1	1.7	...	...
D	0.29	0.73	0.36	0.044	0.035	0.09	0.03	0.077	0.014	0.007	2.25	...	...	...

[a] Aluminum added to electric furnace in these heats.

TABLE II.—MECHANICAL PROPERTIES OF GRADE "B" CAST STEELS.

NOTE.—Tensile values and Charpy impact values are averages of duplicate tests. Izod values are averages of three tests.

Steel	Yield Strength, psi.: As Normalized	Yield Strength, psi.: As Normalized and Drawn	Tensile Strength, psi.: As Normalized	Tensile Strength, psi.: As Normalized and Drawn	Elongation, per cent: As Normalized	Elongation, per cent: As Normalized and Drawn	Reduction of Area, per cent: As Normalized	Reduction of Area, per cent: As Normalized and Drawn	Brinell Hardness As Normalized and Drawn	Impact Strength As Normalized and Drawn, ft-lb.: Izod	Impact Strength As Normalized and Drawn, ft-lb.: Charpy	A.S.T.M. Grain Size Normalized and Drawn	Type of Sulfide Inclusions
Acid Open Hearth Steels													
493	49 000	46 500	74 500	74 500	33.5	32.0	57.0	55.5	147	34	25	7 to 8	I
509	46 000	43 000	75 000	75 000	33.0	34.0	57.0	56.5	142	32	24	7 to 8	I
F-1	46 500	46 000	84 000	83 000	28.0	29.0	47.0	46.5	162	22	18	6 to 7	I
F-2	49 000	47 500	86 500	87 000	29.5	29.0	49.5	49.5	169	22	18	6 to 7	I
Basic Open Hearth Steels													
9551	45 000	45 500	74 000	75 500	29.0	33.0	38.0	56.5	144	40	27	6 to 7	I
9567	46 000	46 000	78 000	79 500	31.5	32.5	56.5	57.0	150	36	26	7	I
O-1	48 500	46 500	82 500	81 500	31.0	31.5	52.5	52.5	162	34	22.5	7	I
O-2	47 500	48 000	80 000	80 500	32.0	33.0	53.5	55.5	157	29	24	6 to 7	I
Acid Electric Steels													
715	56 000	48 000	83 000	81 000	28.5	28.5	49.0	49.5	165	28	20	8	I
724	52 500	47 500	80 000	80 000	30.5	30.0	54.0	54.0	157	29	23	8	I
1009	50 500	49 000	82 500	82 000	29.0	30.0	53.0	52.0	162	25	20	7	I
1025	47 000	47 000	78 500	78 500	32.0	30.5	53.0	54.5	155	27	21.5	7	I
1163	47 000	46 000	75 000	75 000	27.0	29.0	40.0	45.0	142	...	22	7 to 8	III
Basic Electric Steels													
E-1	59 000	60 500	92 000	93 500	20.0	23.0	26.5	33.0	188	19	12	7 to 8	II
Converter-Acid Electric Steels (Triplex)													
H-30	58 500	53 500	84 500	87 000	28.0	26.0	44.5	35.5	170	34	19	8	III
H-34	58 000	55 500	87 500	87 500	25.5	24.5	35.0	37.0	174	33	18.5	8	III
H-38	47 500	47 500	81 000	81 000	20.0	24.0	29.0	33.5	157	27	15	6 to 8	III
H-42	61 000	55 500	90 000	91 500	23.0	23.5	32.0	30.0	176	21	13	8+	III
Converter Steels													
1	53 000	53 500	80 500	81 000	29.5	31.0	45.0	49.5	155	38	21	8	III
2	47 500	46 000	74 500	75 000	28.0	33.0	42.5	55.5	146	44	28	8	III
3	48 500	48 000	76 500	77 500	27.0	31.0	44.5	53.0	152	42	26	7 to 8	III
4	47 000	47 000	72 500	73 500	29.0	31.0	47.0	50.0	143	43	25.5	8	III
A	46 000	44 500	77 000	76 500	28.0	31.5	40.5	52.0	148	28	23	7	III
B	59 500	58 500	87 500	88 000	19.0	24.0	22.5	34.5	172	26	13	8	II
C	55 500	55 000	85 500	85 000	22.5	23.5	32.0	31.0	168	30	13	8	II
D	52 000	50 000	81 000	80 000	27.0	30.0	47.0	48.5	157	39	23.5	7 to 8	III

ries. These specimens were in the form of coupons cut from keel blocks. All specimens were from the same design of keel block, except two heats (9551 and 9567, Table 1), which differed only by being slightly greater in cross-section. The processes represented by the specimens are as follows: Acid open hearth, basic open hearth, acid electric, basic electric, triplex (cupola-converter-electric), and side-blow converter.

An effort was made to obtain at least two heats of each type from each contributing shop and to have two shops represented by each process. Triplex heats were obtained from only one shop and only one basic electric steel was secured.

The request was made that all of these steels represent the current standard practice in use at any particular shop. The only exception to this was in converter heats 4 and C in which it was requested that titanium be used in addition to the regular deoxidizers and in converter heat D in which an addition of 2 pounds of aluminum per ton was requested.

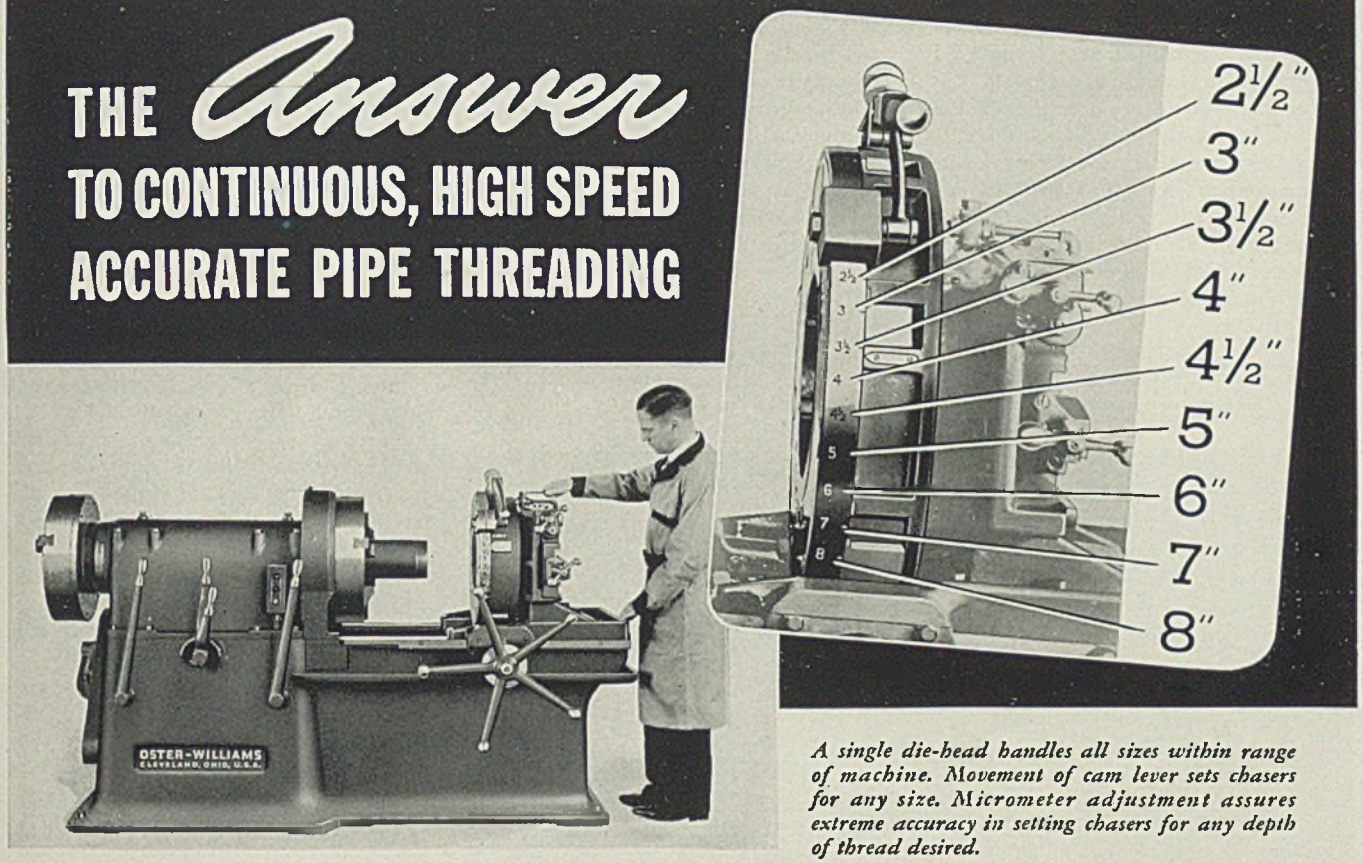
In view of the prevalent use of aluminum in cast steels, the normal expectation would have furnished some open-hearth or electric steels deoxidized with aluminum. Such unfortunately was not the case and, in view of the trend of the results, two acid electric heats deoxidized with 2 pounds of aluminum per ton were later especially requested. Only one of these, heat 1163, was acquired in time for inclusion. This came from the same shop as heats 715 and 724.

Steels Were Analyzed

All coupons were received in the green or as-cast condition and heats were given the same heat treatment. This consisted of heating the coupons to 1650 degrees Fahr., holding for 2 hours, and cooling separately in still air. One set of tension bars was machined and tested within three days of the normalizing treatment. All the rest of the coupons were annealed at 750 degrees Fahr. for 15 hours. This annealing temperature was chosen because it is known to eradicate hydrogen embrittlement without affecting the tensile strength of a normalized medium-carbon steel. Aging at normal temperatures for a longer period will accomplish the same result. Any improvement in ductility produced by this low-temperature anneal is regarded, therefore, as a qualitative evidence of hydrogen embrittlement in the normalized bars.

In most instances, plant analyses were furnished with the steel specimens, but all steels were analyzed at Battelle Institute and, in addition to the common elements, copper, chromium, nickel, molybdenum, and nitrogen were determined.

THE *Answer* TO CONTINUOUS, HIGH SPEED ACCURATE PIPE THREADING



A single die-head handles all sizes within range of machine. Movement of cam lever sets chasers for any size. Micrometer adjustment assures extreme accuracy in setting chasers for any depth of thread desired.

NOTE THESE SPEEDS!

Seconds required to cut full American National Standard pipe thread at recommended speed are indicated below. Pipe made of tougher material than standard should be run at slower speeds. Higher speeds may be used for finer pitches, smaller tapers and brass; and for cutting off.

No. 4 "Rapiduction" Pipe Size	Seconds	No. 6-A "Rapiduction" Pipe Size	Seconds
1"	10.5	1½"	11.3
1¼"	10.7	2"	16.5
1½"	15.4	2½"	24.3
2"	16.1	3"	25.3
2½"	22.0	3½"	33.4
3"	32.2	4"	34.9
3½"	33.3	5"	52.6
4"	49.0	6"	80.0
No. 8 "Rapiduction" Pipe Size	**Seconds**	**No. 12 "Rapiduction" Pipe Size**	**Seconds**
2½"	20.1	3½"	31.8
3"	29.8	4"	46.6
3½"	30.8	5"	49.6
4"	41.7	6"	64.3
5"	44.4	7"	74.5
6"	66.0	8"	86.7
7"	80.0	10"	132.0
8"	103.0	12"	190.0

OSTER

Speeds up PIPE THREADING

OSTER "RAPIDUCTION" Power Pipe Threading Machines

Do you need pipe threading speed? Get a *"RAPIDUCTION"!* But you must be assured of accuracy? *Get a "RAPIDUCTION"!*

What about sizes? "RAPIDUCTION" is made in four sizes. (See table at left.) What about special work requiring extreme accuracy? A lead screw attachment is available for pitches 8, 10, 11 or 11½ and 14; is extra equipment on machines, 4, 6-A and 8; standard equipment on machine No. 12. Also available (as extra equipment) is a taper attachment for A. P. I. Standard and other threads of longer than Briggs Standard Length.

But what are the FEATURES of these "RAPIDUCTION" machines? Too many to enumerate here. Why not fill in the form below, tear out, mail to us, Now?

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Rush, by return mail, complete information about "RAPIDUCTION" Power Pipe Threading Machines.

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Address .....

City ..... *State* .....

In those few cases where the plant analyses and Battelle Institute determinations did not agree, an umpire analysis was made by a third laboratory.

The compositions are shown in Table I. It will be noted that although the carbon varies from 0.21 to 0.35 per cent, the manganese from 0.50 to 0.88 per cent, and the silicon from 0.25 to 0.55 per cent, they all come in the grade B raised in regard to the chromium and nickel content of the basic electric furnace steel E-1 and the copper content of the triplex steels because these residuals undoubtedly affect the properties, as will be pointed out later.

As might be expected, the basic open-hearth steels are lower in phosphorus than any of the others, while the converter steels as a class are slightly higher in phosphorus than the acid open-hearth and electric steels. The triplex steels were given a ladle dephosphorization treatment which was effective except in heat H-42 where converter slag got into the ladle and made the dephosphorizing slag too acid.

The basic open hearth also has a slight advantage in sulphur content, but the desulphurizing treatment of the cupola metal has put the converter steels on a par with the acid electric and acid open hearth in respect to this impurity.

Nitrogen contents were determined by the Cunningham distillation method which is standard for wet methods, but the accuracy of the reported results is not considered greater than ±0.002 per cent. Certain trends, nevertheless, are apparent. The triplex steels have the highest content with an average of about 0.011 per cent; the straight converter steels and acid electric steels are in the same range of 0.006 to 0.010 per cent, while the open-hearth steels have a still lower range of 0.004 to 0.006 per cent.

Microscopic examinations were made to determine the nature of the inclusions and the grain size, inasmuch as both are known to affect the mechanical properties. Except that the high sulphur steels had more sulphides than those low in sulphur, there was no notable difference in cleanliness.

The type of inclusions was found to coincide closely with the deoxidation practice and particularly with the use of aluminum, as described by Sims and Dahle[1]. When no aluminum was used, regardless of whether calcium or titanium were used, the inclusions consisted of globular sulphides and silicates. These are designated type I and steels with this type are inclined to have good ductility.

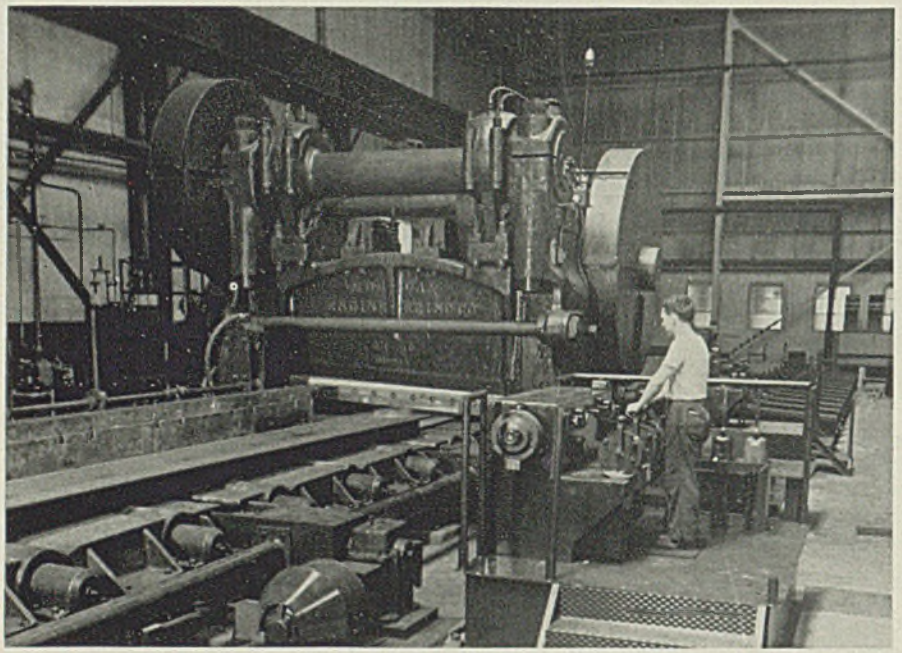
When additions of aluminum too small to leave an appreciable excess are used, the silicates disappear and the sulphides assume the form of an eutectic. Such chain of film type sulphides, strung along the primary grain boundaries, act as zones of weakness and produce poor ductility. This was described by Sims and Lillieqvist[2]. These inclusions in the steels are designated as type II.

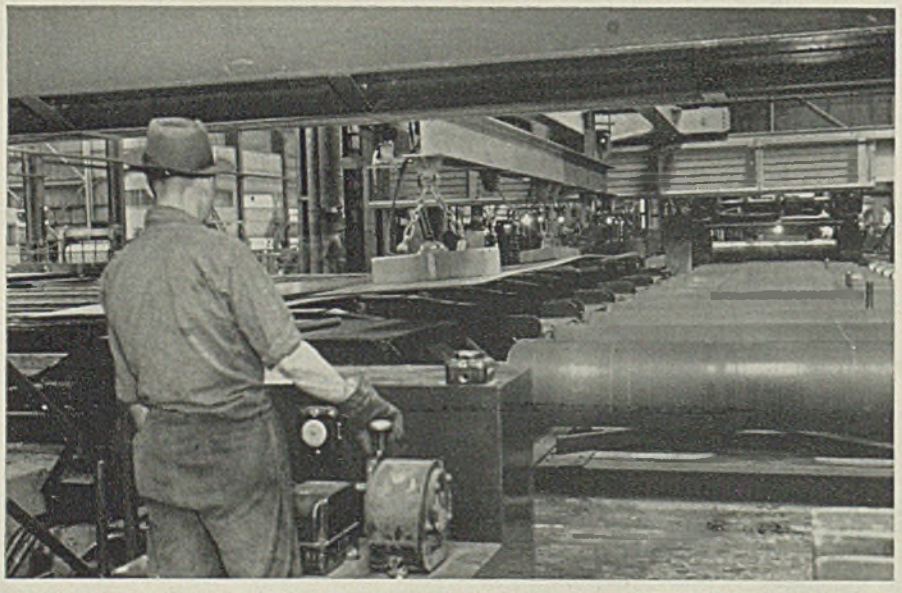
If aluminum is used in sufficient amount to leave an appreciable excess, the sulphides are larger, farther apart, and are irregular in shape or are crystalline. Many duplex inclusions appear. These are type III inclusions. Steels with these inclusions have good ductility but not quite so good as with the type I inclusions.

The grain size listed in the tables is the grain size of the steels as normalized from 1650 degrees Fahr., the condition in which they were tested. Although the grain size does not vary over a wide range, it does show the aluminum deoxidized steels to have the smallest grain size, with the titanium deoxidized steels showing an advantage over those with

(*Please turn to Page* 187)

CONVERTED SHEAR "KEEPS 'EM SAILING"





CONVERTED to electric power, this old steam-driven shear, upper view, contributed much to the record production of plates for ships (greater by 41,000 tons than a prior high in March, STEEL, *p. 36, June 15 issue) at the Irvin Works of Carnegie-Illinois Steel Corp., U. S. Steel subsidiary. The shear was coupled with an old roller-leveler, both being worked into a modern finishing line. Plates handled on the recently completed giant Irvin 80-inch hot strip mill are as heavy as 1-inch in thickness and 72 inches wide. Lower view shows a magnetic depiler transferring plates to roller-leveler on the new line*

It will open . . . *of course!*

Because it has been folded properly. Because it has been made with care. Because it has been inspected with even greater care.

And because it has been stored in a special air conditioned room—with exact temperature and humidity control—to protect the silk fabric against mildew or other climatic damage.

Ordinary air conditioning . . . the kind of air conditioning you've known in the past . . . wouldn't do for a job like this. *More precise* . . . and *more flexible* equipment . . . the air conditioning of the future . . . had to be developed.

General Electric has been specializing in meeting the difficult air conditioning problems created by America's war effort. Air conditioning to preserve materials . . . to improve the operation of machinery . . . to make it easier for men to work better!

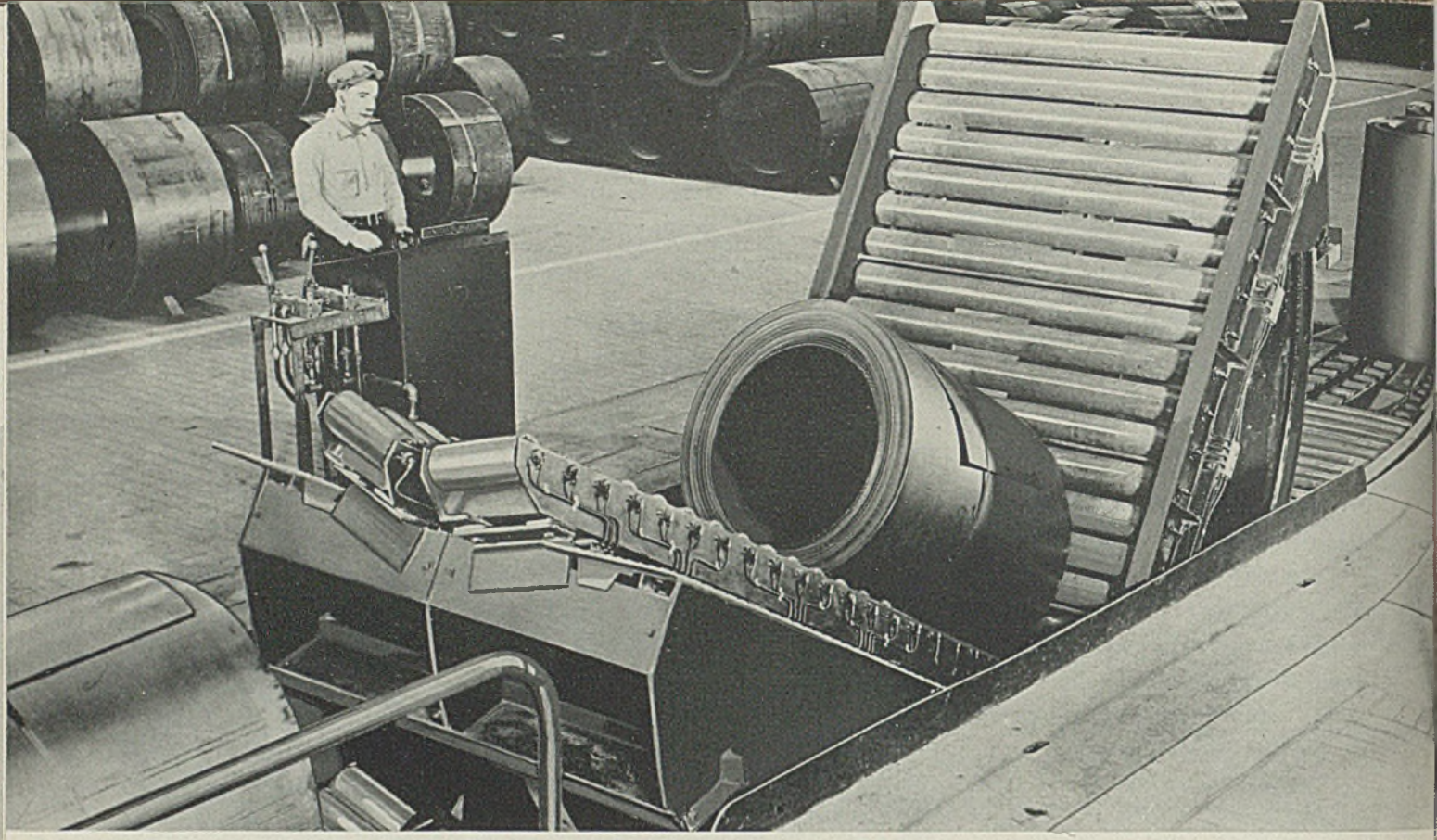
When final Victory is won, many valuable lessons learned in fighting the Battle of Production will be turned to the uses of peace.

More people will be able to enjoy air conditioning in homes, offices and other places . . . because it will be less expensive, more compact. And it will be vastly improved air conditioning . . . with accurate control of *humidity* as well as temperature. *Required climates* will be reproduced at will.

When the time comes to supply the air conditioning needs of the post-war world, General Electric will be ready. General Electric Co., Air Conditioning and Commercial Refrigeration Department, Bloomfield, N.J.

Air Conditioning by

GENERAL ELECTRIC



SPEEDING AMERICA'S PRODUCTION

The success of the Allied war effort depends greatly upon the speed of our production — the output of coils and sheets, castings and forgings, bars and shapes — and thousands of other vital materials. American Industry has already come through in a way that spells disaster for the Axis nations, and it's only the beginning.

Mathews Engineers are spending long hours in solving the many conveying problems which go along with this great production program. You can get Mathews engineering service and Mathews Conveyers with much less delay than you might think. By furnishing the highest preference rating you can possibly obtain, along with complete information regarding your problem, much time can be saved in obtaining the conveying equipment you require. Our job is to serve you in the most efficient manner possible.

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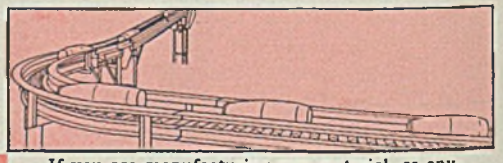
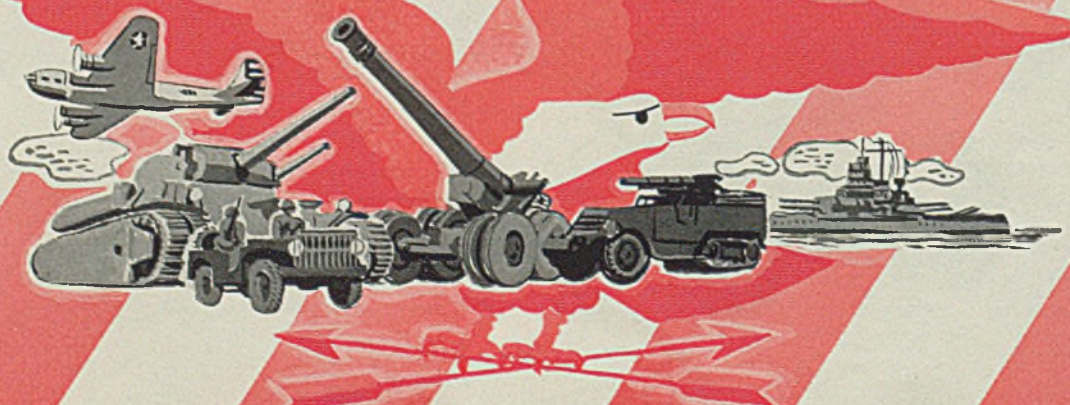


If you are manufacturing war material, or anything vital to the success of the war effort, you can get Mathews Conveyers to handle that material Rely as usual on your Mathews Engineer.

MATHEWS CONVEYERS FOR MECHANIZED PRODUCTION



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AISE Invites you

TO OUR FRIENDS IN THE STEEL INDUSTRY

Recognition by industry and by government agencies of the necessity of an exchange of ideas and information in the all-out drive for production lends new significance to the annual meeting and engineering conference of the Association of Iron and Steel Engineers, to be held in Pittsburgh, Pa., September 22-23-24.

Association members of long standing know full well the value of these meetings, and in order that maximum benefit be derived by the iron and steel industry, I extend an invitation to the engineering and operating personnel to take advantage of the opportunity to further their production efforts.

Very truly yours,

Thos. E. Hughes

Thomas E. Hughes, President
Association Iron & Steel Engineers

Considerable operating data will be made available at this year's meeting of the Iron and Steel Engineers at the William Penn hotel, Pittsburgh—the thirty-eighth annual gathering since the inception of the association. Not for many years has an annual convention of this organization opened without an accompanying exhibition of steel mill equipment. But this year because of war-time conditions no exposition will be held.

Program

Tuesday, Sept. 22

9:00 A. M.

Registration

Chairman: C. H. Williams, Asst. to Vice President of Engineering, U. S. Steel Corp. of Delaware, Pittsburgh.

Vice Chairman: H. F. Martin, Maintenance Supt., Jones & Laughlin Steel Corp., Aliquippa, Pa.

9:15 A. M.

Business Session

Chairman: T. E. Hughes, Supt. of Maintenance, Carnegie-Illinois Steel Corp., Duquesne, Pa.

Vice Chairman: J. L. Miller, Asst. Comb. Engr., Republic Steel Corp., Cleveland.

9:30 A. M.

Electrical Engineering Division

Chairman: L. V. Black, Supt. Electrical Dept., Bethlehem Steel Co., Bethlehem, Pa.

Vice Chairman: J. H. Miller, Electrical Engr., Wisconsin Steel Works, Chicago.

"Air-Break Circuit Breakers for Industrial Use," by R. Lockett, Application Engr., I-T-E Circuit Breaker Co., Philadelphia.

"Carbon Brushes—Selection, Application and Maintenance," by R. Rowell, Asst. Electrical Supt., Wheeling Steel Corp., Steubenville, O.

"Electrical Equipment for Continuous Electrolytic Tinplating of Strip Steel," by J. H. Hopper, Industrial Engineering Dept., General Electric Co., Schenectady, N. Y.

1:30 P. M.

Electrical Engineering Division

Chairman: H. R. Ford, Electrical Engr., Wheeling Steel Corp., Steubenville, O.

Vice Chairman: E. L. Anderson, Electrical Supt., Bethlehem Steel Co., Johnstown, Pa.

"Conservation of Critical Materials in Transformer Design and Application," by J. K. Hodnette, Engineering Mgr., Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

"Gage Control in Cold Rolling of Strip Steel," by J. D. Campbell, Industrial Engineering Dept., General Electric Co., Schenectady, N. Y.

"The Blast Furnace Skip Hoist," by G. Fox, Vice President, Freyn Engineering Co., Chicago.

1:30 P. M.

Welding Division

Chairman: M. M. MacDonald, Electrical Supt., Andrews Steel Co., Newport, Ky.

Vice Chairman: W. Dudley, Asst. Supt. of Maintenance, National Tube Co., McKeesport, Pa.

"A-C Welding in the Steel Industry," by E. Steinert and W. W. Reddie, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

"Welding Metallurgy," by W. G. Theisinger, Director of Welding Research, Lukens Steel Co., Coatesville, Pa.

"Preparation and Handling for Welding," by A. E. Gibson, President, Wellman Engineering Co., Cleveland.

8:00 P. M.

"Victory Through Production"

Motion pictures, selected subjects.

Wednesday, Sept. 23

9:00 A. M.

Operating Practice Division

Chairman: A. Montgomery Jr., Supt. of Rolling, Carnegie-Illinois Steel Corp., Duquesne, Pa.

Vice Chairman: A. D. Brodie, Supt. 93-Inch Cold Strip Mill and Galvanizing Dept., Jones & Laughlin Steel Corp., Pittsburgh.

"Roll Oils and Coolants for the Cold Mill," by M. Reswick, Lubrication Engr., Standard Oil Co. of New Jersey, Pittsburgh.

"Electrolytic Tinning," by W. Cooper, Electrical Engr., Crown Cork & Seal Co., Baltimore.

"Modern Roll Design Practice," by C. Elms, Chief Engr., Pittsburgh Rolls Div., Blaw-Knox Co., Pittsburgh.

1:30 P. M.

Operating Practice Division

Chairman: W. H. Collison, Supt. By-

However, the very well-balanced groups of papers scheduled for presentation at the nine technical sessions should warrant a large attendance because of their relation to war-time production. The 27 papers to be presented will cover the six divisions of electrical engineering, welding, operating practice, mechanical, combustion and lubrication. Only one session will be held each morning of the convention; afternoon sessions will be simultaneous.

Product Coke Plant, Great Lakes Steel Corp., Ecorse, Detroit.

Vice Chairman: J. D. Jones, Chief Engr., Youngstown Sheet & Tube Co., Youngstown, O.

"Innovations in Coke Oven Design," by M. D. Curran, President, Coal Carbonizing Co., St. Louis.

"Properties of Blast Furnace Cokes: Their Measurements, Significance and Control," by H. H. Lowry and M. A. Mayers, Coal Research Laboratory, Carnegie Institute of Technology, Pittsburgh.

"Coal Washing and Its Effect on Coke Oven and Blast Furnace Practice," by W. S. McAleer, McNally Pittsburgh Mfg. Corp., Pittsburgh.

"Survey of the Iron Ore, Pig Iron and Scrap Situation," by M. D. Harbaugh, Vice President, Lake Superior Iron Ore Association, Cleveland.

1:30 P. M.

Mechanical Division

Chairman: E. W. Trexler, Supt. Mech. Dept., Bethlehem Steel Co., Cambria Plant, Johnstown, Pa.

Vice Chairman: C. J. Duby, Chief Engr., Warren District, Republic Steel Corp., Warren, O.

"Application of Modern Cold Sawing Technique," by N. A. Malone, Plant Industrial Engr., Steel & Tube Division, Timken Roller Bearing Co., Canton, O.

"Development of Personnel in the Steel Industry," by R. Greenly, Carnegie-Illinois Steel Corp., Pittsburgh.

"The Application of NE Steel," by J. Mitchell, Metallurgical Engr., Carnegie-Illinois Steel Corp., Pittsburgh.

7:30 P. M.

Informal Stag Dinner

Thursday, Sept. 24

9:00 A. M.

Combustion Division

Chairman: E. E. Callinan, Combustion and Refractory Engr., Steel & Tube Division, Timken Roller Bearing Co., Canton, O.

Vice Chairman: C. J. Wyrough, Supt. Steam Efficiency and Combustion, Jones & Laughlin Steel Corp., Pittsburgh.

"Fundamentals of Open-Hearth Design," by F. Loftus, Loftus Engineering Co., Pittsburgh.

"Relation of Flame Character to Open-Hearth Operation," by A. J. Fisher, Fuel Engr., Bethlehem Steel Co., Sparrows Point, Md.

"Developments in Steel Plant Refractories," by C. A. Brashares, Technical Dept., Harbison Walker Refractories Co., Pittsburgh.

1:30 P. M.

Combustion Division

Chairman: E. C. McDonald, Combustion Engr., Republic Steel Corp., Cleveland.

Vice Chairman: F. C. Frye, Steam and Fuel Engr., Great Lakes Steel Corp., Ecorse, Detroit.

"Determination of Blast Furnace Credits," by F. Leahy, Supt. Fuel Dept., Youngstown Sheet & Tube Co., Youngstown, O.

"Modern Turbine Types and Design," by F. K. Fischer, Central Sta. Steam Engr., Westinghouse Electric & Mfg. Co., Philadelphia.

Round Table Discussion: Steel Plant Fuel Supplies.

1:30 P. M.

Lubrication Division

Chairman: C. R. Hand, Lubrication Engr., Bethlehem Steel Co., Sparrows Point, Md.

Vice Chairman: P. J. Doyle, Lubrication Engr., Republic Steel Corp., Cleveland.

"The Use of Addition Agents in Petroleum Products," by F. F. Musgrave, Asst. to Director of Research, Lubri-Zol Corp., Cleveland.

"Bearing Surfaces," by E. L. Hemingway, Chief Metallurgist, International Machine Tool Corp., Elkhart, Ind.

"Turbine Lubrication," by S. O'Dette, Senior Field Engr., Standard Oil Co. of New Jersey, New York.

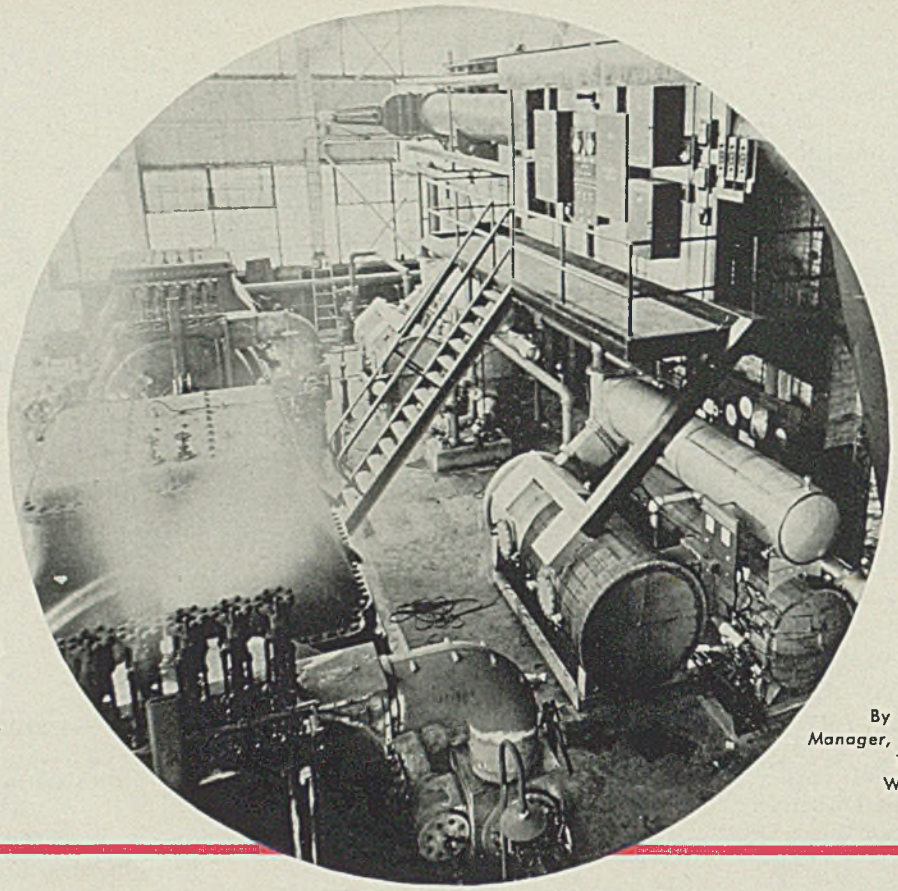


Fig. 1—Turbovacuum compressors and control panel in the blowing engine house (Courtesy, Trane Co.)

By ROY M. WALKER
Manager, Field Engineering Dept.
The Bristol Co.
Waterbury, Conn.

INSTRUMENTS

for aiding

BLAST FURNACE PRODUCTION

EVERY recording and controlling instrument now generally used in blast furnace operations has been developed within the memory of many of us. These modest working tools have contributed vitally to the progress of the industry. Besides any exclusive function of each blast furnace instrument, they all work together to simplify, guide or definitely control many factors in the economical production of the maximum quantity of high-quality pig iron.

The blast pressure recording gage, with its range, so often used, of 0 to 32 pounds per square inch, is closely watched to discover or prevent trouble. Low pressure does not force air far enough into the bosh and high pressure tends to force much air into the center of the furnace. Either condition results in uneven heat zones and decreased production. Irregular pressures also result in greater loss of ore dust out of the top of the furnace. Obstructions to the movement of stock may often be loosened by a drop in the blast pressure.

A high-pressure record on the blast pressure recorder may indicate a hanging furnace, causing excessive resistance to the normal flow of air through the furnace.

But the operator has other instruments to which he may refer to prove what this high pressure may mean. The stockline recorder shows any delay in the progress of the stock through the furnace. The top gas temperature recorder will record the changes in temperature and the top gas pressure recorder will add its written testimony, by a drop in pressure which will be greater than expected from the gas consuming load.

A low-pressure record on the blast pressure recorder may reveal that a channel has formed through the stock and this condition will be verified by the high temperature of the top gas.

Each of these instruments helps in maintaining uniform operating conditions, thereby tending to prevent hot and cold spots in the furnace with the irregularities which will follow.

Constant temperatures and pressures in the blast and in the top gas, and steadily moving stock are the conditions for which the operators strive, and the trend from hour to hour is clearly shown on their recorder charts.

It is claimed that a variation of less than 20 degrees Fahr. in the hot blast temperature, during a critical period when the furnace stock is hanging, may be the turning-zone between real trouble and the resumption of normal operation.

The more variables in temperature, pressure, flow, humidity, materials, etc., which can be controlled at the blast furnace, the greater is the margin permissible for uncontrollable factors and the greater is the assurance of maximum quantities and quality of iron. Therefore, the use of many indicating, recording and controlling instruments is necessary to most nearly obtain uniform conditions.

Over 30 years ago Gayley installed a refrigerating system for removing moisture from the air blast for one of the Isabella furnaces outside of Pittsburgh. The undertaking was discontinued and a blast furnace superintendent, then in contact with the experiment, told me

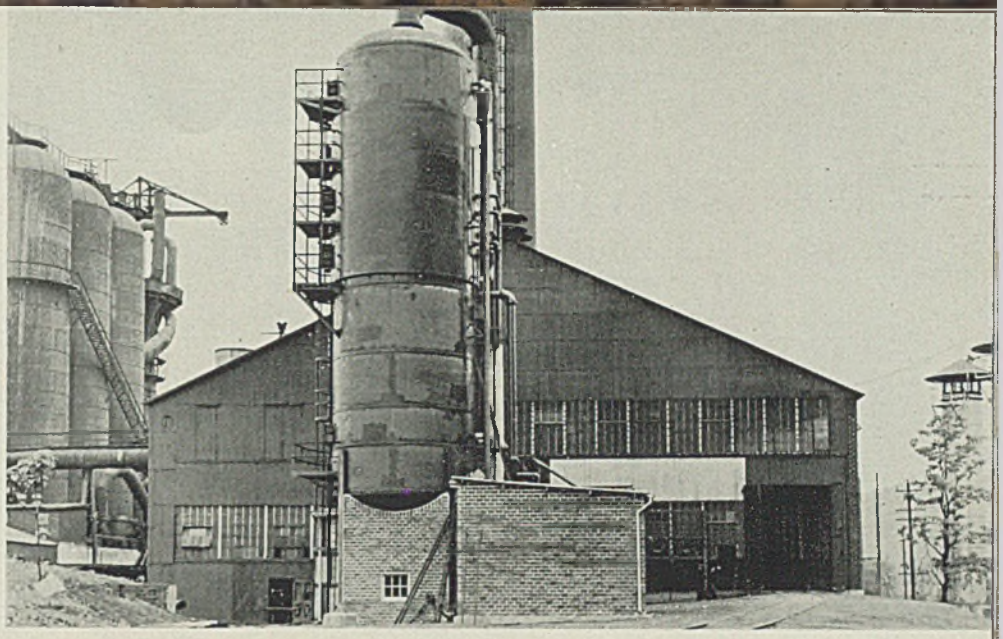


Fig. 2—Dry blast installation serving a southern Ohio blast furnace (Courtesy, Trane Co.)

its merit seemed inconclusive due to so many variables in the furnace processes.

Much more economical and efficient air conditioning mechanism has been evolved since that time. Contributing to the elimination of many of the variables has been the development and intelligent use of modern blast furnace instruments. Today six or more manufacturers are offering air conditioning systems which relieve the blast furnace superintendent of bother about deviations in the humidity of the air going into the melting iron. The variation in humidity has been a difficult one for which to correct, because changing the coke ratio to compensate for changes in humidity, except for seasonal changes, is often too slow a correction. While the humidity of the air may change in a short period of time, the stock added in the top of the furnace takes about 12 hours to reach the hearth. During this period it is possible for the humidity to change so that anywhere between 1000 and 3000 pounds of water per hour may go into the blast furnace through the hot blast line, to be converted to steam and then to hydrogen and oxygen. As 5760 B.t.u. are used in the process of dissociation of each pound of moisture, the cooling effect of so much moisture in the hottest and most critical temperature zone of the furnace is obvious.

When dry blast is not employed, changes in hot blast temperatures are regularly made to compensate for daily changes in humidity. But any form of correction for a humidity change tends to disturb the uniformity of other conditions.

It is of interest to note that A. K. Reese, Cardiff, South Wales, presented a paper at York, England in 1922, advocating dry blast which he had used for some time. Among the advantages he mentioned was that dry blast made it possible to use high-blast temperature without the usual sticking.

A year or more ago, a Russian blast furnace was mentioned in a news report, where steam was added to the air blast to bring up the humidity to a uniform level at which to work from day to day. In the United States, the trend on air conditioning systems for blast is to reduce the humidity to 4 grains of moisture or less per cubic foot of air.

Several descriptions of air conditioning systems for blast furnaces have been recently published. As these have referred little to the instruments used, it may be pertinent to briefly describe the instruments used on an up-to-date installation made by The Trane Co. and now in successful service on a southern Ohio stack.

Fig. 2 shows the exact location of the dry blast system in relation to the arrangement in almost any steel plant.

On the extreme right are the intakes for blowing engines. The air is drawn from these engines into the lower part of the conditioning tower which is shown in the center foreground. After passing through the stages of conditioning, the air leaves at the top of the tower, goes through the cold blast main and much of it goes into one of the three stoves shown at the left. To the right of these stoves is part of the blast furnace itself.

The moisture content of the air going through the tower, just mentioned, is controlled by means of sprays and cooling coils. The arrangement is shown in Fig. 4.

The pressure in the tower varies from 15 to 25 pounds per square inch along with the blast furnace pressure. As the pressure varies, the instrument equipment shifts the temperature control point to agree and to hold the temperature at a set point for a given pressure.

A pressure-temperature ratio controller is used for this. The ratio may be adjusted, but that now in use gives 1 degree Fahr. change per pound per square inch of air change (a 33 to 43-degree Fahr. temperature change for 15 to 25 pounds per square inch gage pressure change).

To maintain the desired temperature of a cooling coil, the ratio controller operates the 3-way mixing valve between the chilled water supply tank and the cooling coils. A temperature control bulb is installed below the coils and above the spray, to hold the temperature at approximately 60 degrees Fahr. This is accomplished by regulating the flow to the spray. A Johnson service R354 air relay is installed between the spray controller and the spray valve, to hold the valve position to some predetermined minimum opening, so as not to shut off

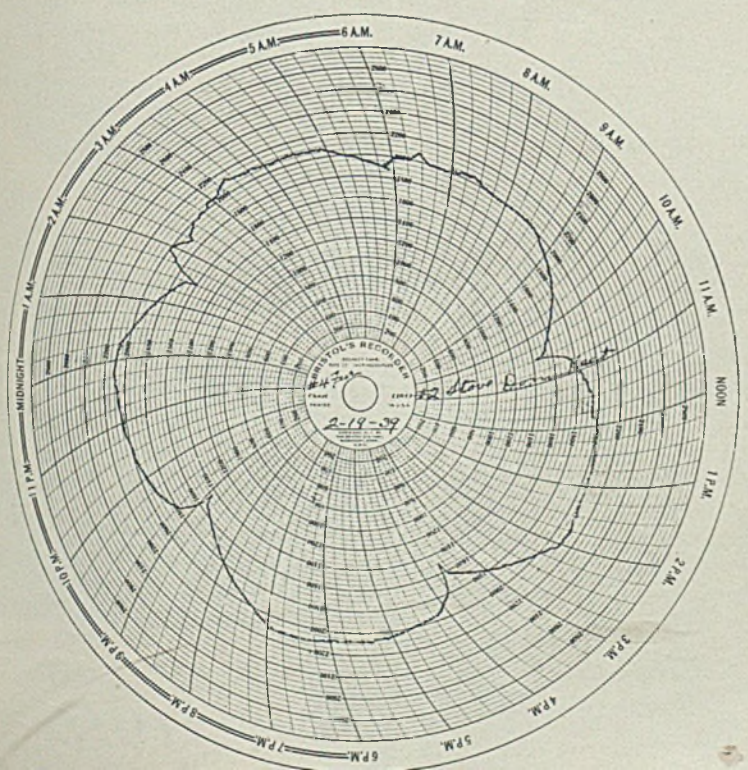


Fig. 3—Chart record taken of stove dome temperatures using a platinum, platinum-rhodium thermocouple

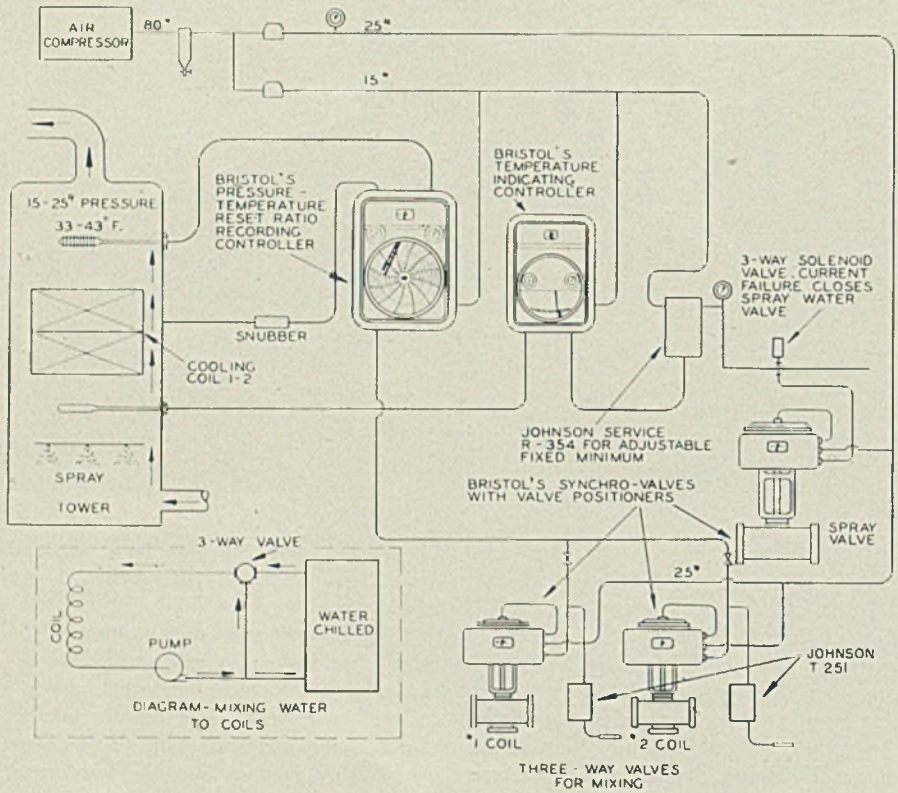


Fig. 4—Arrangement of instruments and valves for dry blast system control spray tower

the spray entirely, regardless of temperature requirements.

The two air-operated, free-vane, pressure controllers in the turbovac room are for regulating the temperature of water in the chilled water tanks for the use of mixing valves in the line to the coils.

All valves have positioners to take full advantage of the sensitivity of the control instruments, so that a valve will take a definite position, regardless of friction or load, for each change dictated by its controller.

The ratio controller is a reset recorder-controller suitable for the process lag and the variations which might be required in the throttling ranges. The other controllers are the ampliset indicating type with adjustable throttling ranges.

A float safety instrument, not shown in the sketch, is located in the tower to prevent flooding, should the spray be excessive.

Fig. 1 shows the turbovac room, with the control panel at the top of the stairway. Two pressure controllers on center panel operate valves supplying condenser water to the two turbovacuum compressors.

For many blast furnaces, an orifice in the air line, when a turboblower is in service, will be used with a flow meter to record the air flow to the furnace. The range may be 0 to 100,000 cubic feet of air per minute, depending on the size of the blower and the furnace requirement. The cold blast pressure of 0 to 35 pounds may be recorded on the same chart. For distances of about 100 feet between the orifice and the recorder, a mechanical-type flow meter should be satisfactory, with the air connections direct to the mercury manometer of the recorder. If the recorder is to be located at a greater distance, it is best to use an electrically-operated flow meter system which is built like a telemetering device, so that the recorder may be located any distance away from the transmitter, at the orifice with its flow meter manometer. Either type is available with an integrator to totalize the air flow.

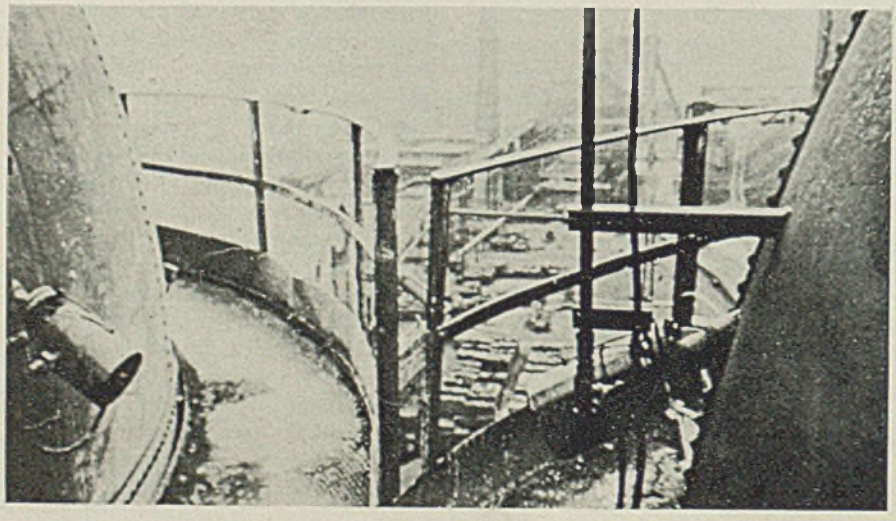
A very practical flow recorder has been in general use for many years which is well adapted to this particular application. Turboblowers have been provided with large wooden venturi intakes. A pipe connection from the venturi throat leads to a recording vacuum gage. A second pipe connection from the venturi mouth goes to the inside of the air tight case of the same recorder. The resulting record gives a differential which may be calibrated in cubic feet of air per minute. The second pipe line to the venturi mouth is desirable, for connecting line temperature compensation, even though atmospheric pressure may be the same at the air intake and at the instrument case. Without the second connection, nearly 2 per cent error may result.

Tachometers Are Employed

Where reciprocating engines are used for the blowers, it has been usual the last 30 years to install recording tachometers on the blowing engines and empirically gage the air flow, for a given engine adjustment, by the revolutions per minute. The blast furnace superintendent will speak of air flow in terms of engine revolutions per minute instead of cubic feet of air per minute. For a working range of 40 to 60 revolutions per minute the record should be read within ½ revolution per minute. For this reason a strip chart tachometer has been popular. A millivoltmeter type recorder connected by several hundred feet of wire, if desired, to an instrument magneto, has been extensively used. A chain and sprocket drives the magneto from the large blowing engine rotating shaft.

The governor on these reciprocating engines must work perfectly. At one plant where excessive flue dust was annoying, the engine operators were stationed right in front of the recording tachometers to maintain a straight line

Fig. 5—Dome temperature radiation fixture mounted on a stove dome in Germany



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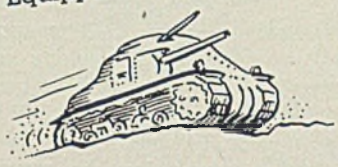

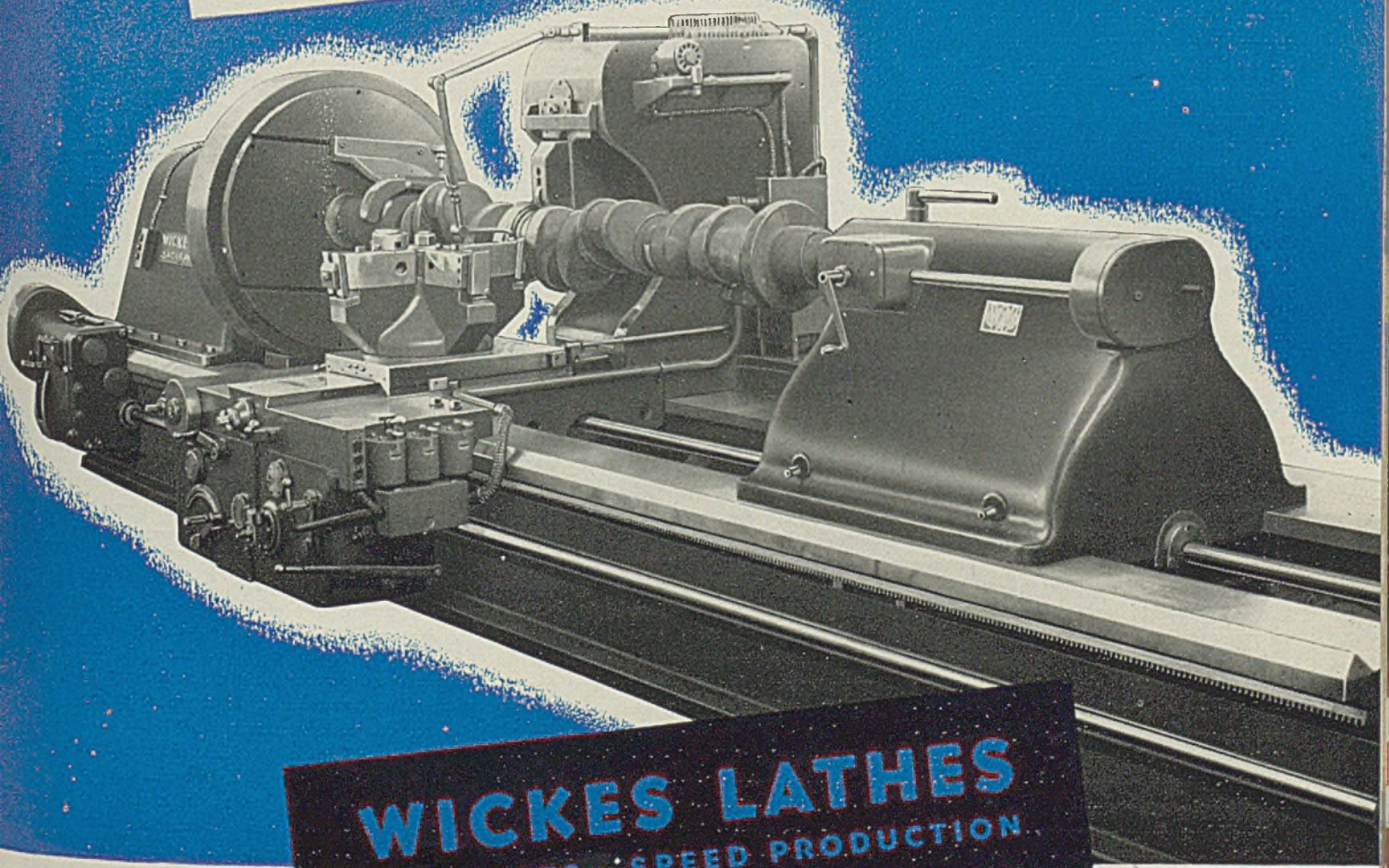

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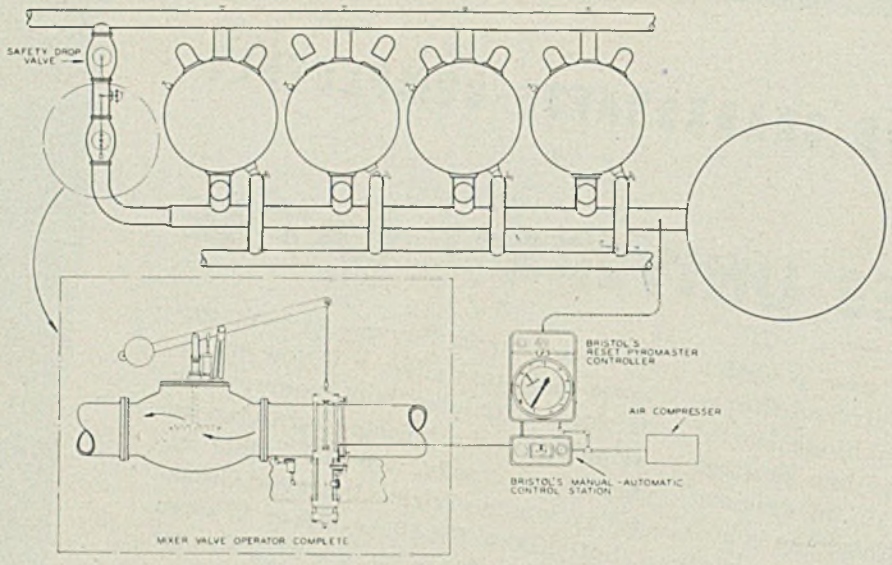

Fig. 6—Air-operated hot blast control system

on each chart by the manipulation of the engine throttles. By a careful watch of the tachometer chart and regulation of the engine speed, enough flue dust was reported saved, which would otherwise blow out through the downcomers at the top of the furnace, to pay the wages of several men.

The cold blast line from the engine room to the furnace will carry air at a lower humidity than the same air at atmospheric pressure even though an air conditioning system is not in service. Some water is trapped out when the air is compressed from atmospheric to 30 pounds gage pressure. Recording psychrometers often are connected so that humidity readings are taken of air arranged to leak from the cold blast line. One simple plan has been to pipe air through a ¼-inch line around the instrument room, or through a long enough line to reduce the temperature from 300 or 400 degrees Fahr. down below 200 degrees Fahr. and then adjust a needle valve so that the air will blow over the wet and dry bulb of the recorder in a fixture designed for this purpose. Criticisms are justified of the accuracy of the plan but it is suitable for comparisons of humidity in the line from hour to hour.

One modification of the foregoing plan is to control the temperature of the air sample by a small cooling coil, to maintain a constant dry bulb temperature reference point.

Some instrument manufacturers are experimenting with dewpoint recorders working on the principal that a mirror can be used to retard a reflected beam of light to a photocell, when the temperature of this mirror drops to the dew point of the air sample.

For blast furnace parlance, humidity should be measured in grains of moisture per cubic foot of air. Either the wet and dry bulb recorder or the dewpoint recorder can be designed to record directly in grains of moisture per cubic foot.

At some blast furnaces, a wet and dry bulb thermometer bulb fixture is located at the air intake to the blowing engines. At other plants the humidity reading in the instrument house is considered sufficient. This may be a self-contained wet and dry bulb thermometer with its fan to give at least 15 feet per second air velocity over the wet bulb. Another type of recorder in general use, records atmospheric temperature and per cent relative humidity. The humidity actuating element is helical in shape similar to those in many pressure and thermometer recorders. But the helix twists to move the pen arm, due to the expansion and contraction of thousands of capillary cells in a prepared, wooden, paper-thin strip. This thermo-humidigraph is practical for humidity measurements at lower temperatures than the wet and dry bulb recording thermometer.

The blast pressure recorder always is furnished with a round chart, revolved once in 24 hours by a spring clock or an electric clock. The chart is usually approximately 12 inch diameter with a scale suitable for a working range of 15 to 25 pounds per square inch. The recorder is in a dust tight case and, for appearance, it is desirable to have a flush mounted case on a panel with other instruments. This panel is at some central location convenient for inspections by the blast furnace operators.

Most of the other instruments on the same panel will be the round chart type. The round chart is convenient to inspect and to file and most instrument manufacturers are now offering round charts for nearly all applications.

Most of the other instruments on the same panel will be the round chart type. The round chart is convenient to inspect and to file and most instrument manufacturers are now offering round charts for nearly all applications.

The strip charts in rolls about 100 feet long may be preferred for a few records where open divisions are required or where some multiple, related records are too crowded on the narrower scale of the conventional round chart.

Some plants are provided with panels of charts with a suitable peg for each instrument on which to hang round chart records. A round plate glass cover with an identification label for the chart application and with a center hole, to fit on the peg, holds charts flat and leaves the front chart in the stack exposed to veiw so that the last day's record may always be seen. Anyone wishing to inspect the chart records can then visualize what has transpired throughout the plant.

To many, the most interesting record around the blast furnace is that of the hot blast temperature. Several effects result from changes in the blast temperature. A previous reference was made to humidity corrections made by a change in blast temperature. A high-temperature setting helps to secure an economical coke rate. Other conditions remaining the same, the higher blast temperature increases the silicon and carbon content in the pig iron but decreases the sulphur content.

Cold Blast Is Heated

Air from the cold blast line, which has been compressed by the blowing engines, flows through the heated checker bricks of one of the blast furnace stoves. The air then goes through the hot blast main to the bustle pipe, which surrounds the upper part of the bosh. This air blast then enters the furnace through a number of tuyeres which distribute it evenly into the melting zone.

While one stove is surrendering its heat to the air for the furance, the other stoves are being heated up by a portion of the gas fuel secured as top gases from the blast furnace. Usually there are four stoves for one furnace but there are sometimes five. Recently several new furnaces have been erected having only three stoves. This is because modern checker brick provides more square feet of heating surface.

Naturally the air blast going through a freshly heated stove is much hotter than the air supply will be at the end of an hour, when much of the heat in the stove has been absorbed.

To maintain a constant temperature in the hot blast line to the furnace, a mixing valve is manipulated to by-pass some of the unheated air from the cold blast line, so it will not go through the stove but mix with hot air in the hot blast line and reduce the hot blast to

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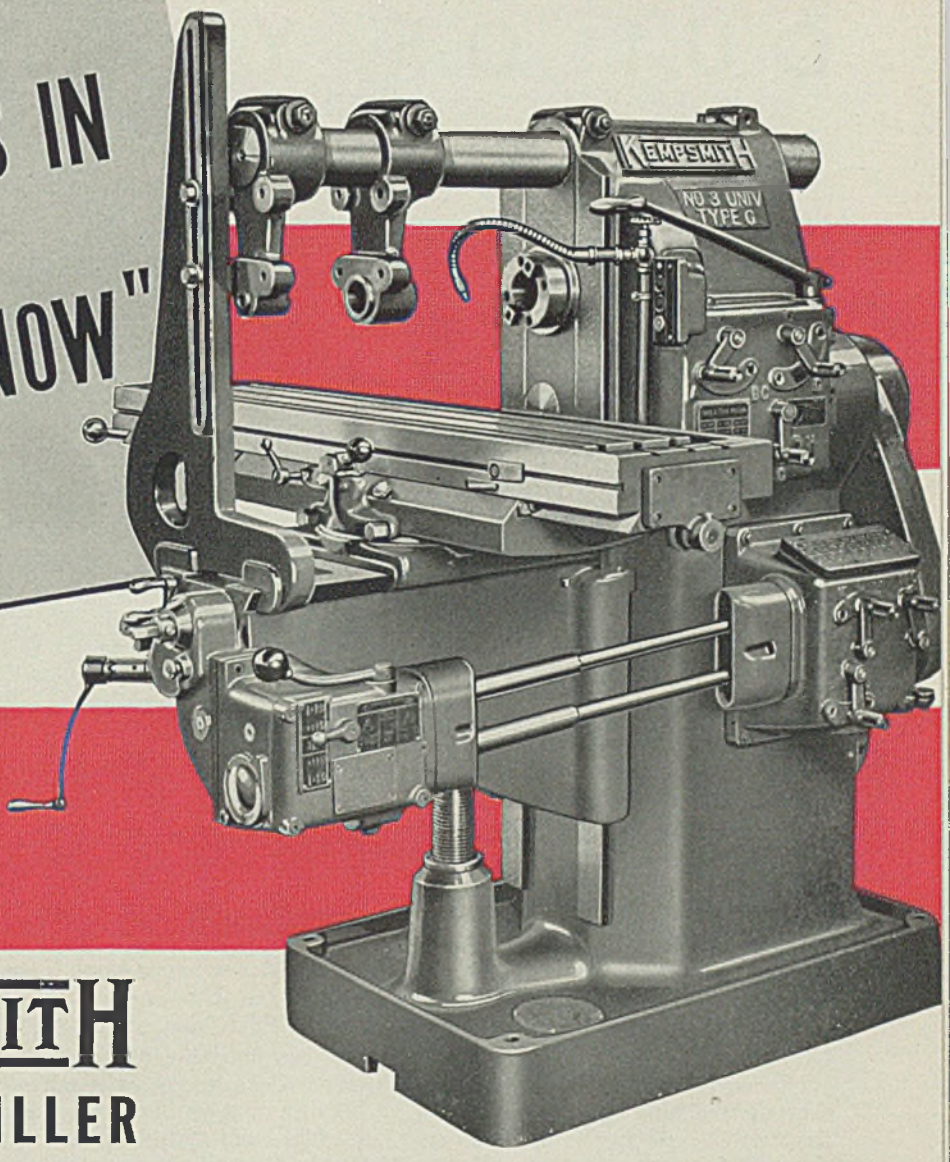

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HOW TO GET THE MOST OUT OF YOUR LATHES

No. 1 in a series of suggestions made by the South Bend Lathe Works in the interest of more efficient war production.

Keep Your Lathes Clean

Yes, it's as simple as that. Just by keeping your lathes (and other machine tools) clean, you can increase production, reduce scrap, and lengthen the life of your equipment.

This will not only benefit you, but it will be a definite contribution to our total war effort. For every available machine tool must be kept going. The combined output of all machine tool builders cannot supply enough equipment to keep pace with the rapidly expanding war production program, so there can be no unnecessary replacements.

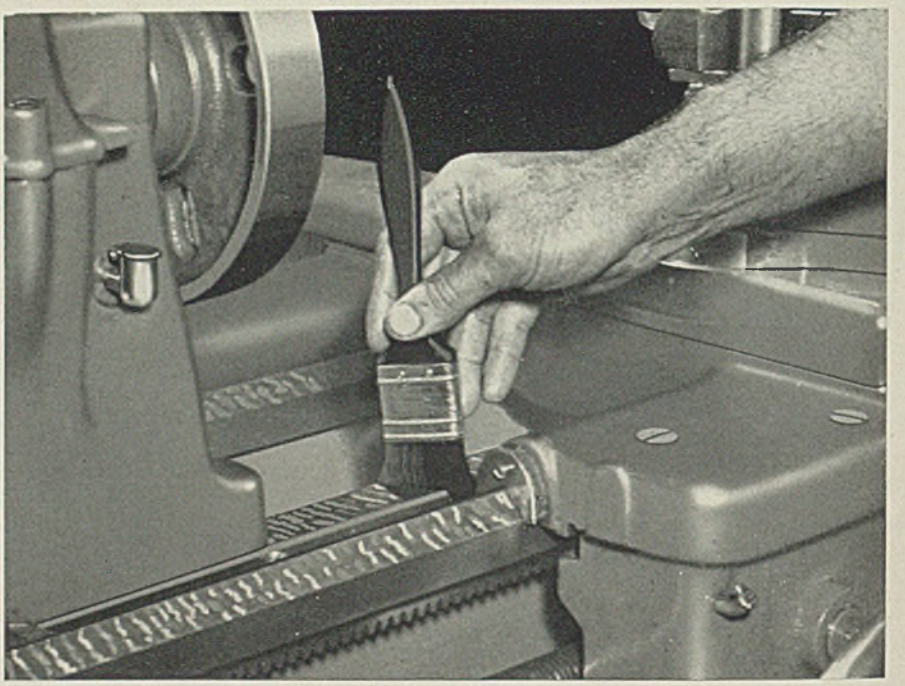
Dirt Is Abrasive

Unless brushed away frequently, the scale, grit and fine chips produced by the cutting tool mix with the oil on the bed ways, dovetails and other bearing surfaces, forming a dirty sludge. Because this dirt is abrasive, it increases friction and causes wear wherever it is allowed to collect.

Obviously, this retards production, shortens machine life, and makes it hard for the operator to maintain exacting tolerances. And when chips work under the tailstock or saddle, or into the spindle taper, the accuracy of the lathe may be seriously impaired.

Encourage the Operator

A good way to keep your lathes clean is to encourage each operator to take care of his own machine. Let him know that you appreciate his interest and effort. Explain how easy it is to spot a good machinist by the way he takes care of his lathe. Urge him to take pride in keeping his lathe clean, free from dirt and chips. He will have greater respect for his job and will unconsciously become a more careful workman.



A small paint brush is convenient for brushing away dirt and chips

A small paint brush is convenient for brushing away loose dirt and chips. Compressed air is not so good because it may blow dirt and chips into oil holes and bearings. Pliers are handy for pulling long steel shavings away from the machine. A clean cloth can be used, after brushing, to remove the last traces of dust and grit. A little oil on the cloth will prevent rust from forming on the finished surfaces of the machine.

The felt wipers on the ends of the saddle wings should be removed and cleaned in kerosene occasionally. An experienced machine tool service man should periodically inspect the lathe and remove any grit or chips that may have worked under the saddle or tailstock. The bed ways can be badly scored by a small steel chip imbedded in the saddle or tailstock base.

Don't Let Chips Collect

Adequate chip disposal should be provided to prevent chips from piling up underneath or around the lathe. Dirt and chips should not be allowed to work into the threads of the lead screw or the gearing of the apron or quick change gear box.

At a time like this, when most machine tools are operating 24 hours a day at speeds and feeds far beyond those for which they were designed, a small amount of carelessness may cause excessive wear — even a breakdown. Certainly an ounce of prevention is now worth far more than a pound of cure.

Write for Bulletin H1

Bulletin H1 giving more detailed information on the cleaning and care of the lathe will be supplied on request. Reprints of this and other advertisements in this series can also be furnished. State number of copies wanted.

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the constant temperature required. When a fully heated stove is put in blast, the mixing valve will be wide open and supply the most cold air. It will be gradually closed as less heat is transferred to the hot blast from the stove.

This adjustment can be accomplished in the most practical way by means of a hot blast temperature control instrument. This controller will be called on to quickly open the mixing valve after a stove change and then gradually throttle down this mixing valve to hold the blast temperature constant as the stove cools down.

Most of the hot blast controllers now installed are provided with electrical relay combinations for adjusting the setting of the mixing valve by means of an electric motor. Recently, several air-operated hot blast controllers have been purchased and these have some inherent advantages over present designs of electrically-operated controllers, including the electric motor power devices for impelling the mixing valves. While an electric controller moves the mixing valve in steps, the air-operated controller imparts full floating control and permits greater simplicity in the design of throttling adjustments and reset corrections for the time lag between the time the mixing valve moves and the effect of the change in temperature is felt by the hot blast control thermocouple, located in the hot blast main, a few feet from the bustle pipe.

Air Control Has Lagged

The steel industry has been more tardy than the oil, rubber and food industries in taking advantage of the special usefulness of air control. Maintenance men are probably more familiar with electrical equipment. Past experiences, when moist or dirty air had been used, may also have caused hesitation about installing a system which might plug or freeze up.

More applications for controllers in steel mills are being provided now with air controllers as confidence is established by the use of the few precautions required in using air control. Clean air can be provided for instruments with small economical air compressors, further protected by suitable filters. The plant manager of a steel mill in Duluth, Minn., who has used air control there for years, suggested that an inspection be made of the air controllers in successful operation in the mines further north where it really got cold. The only unusual protection noticed for air lines during the sub-zero weather at Duluth was somewhat oversized air lines in exposed sections so that any possible frost forming inside the line would not stop the flow of air.

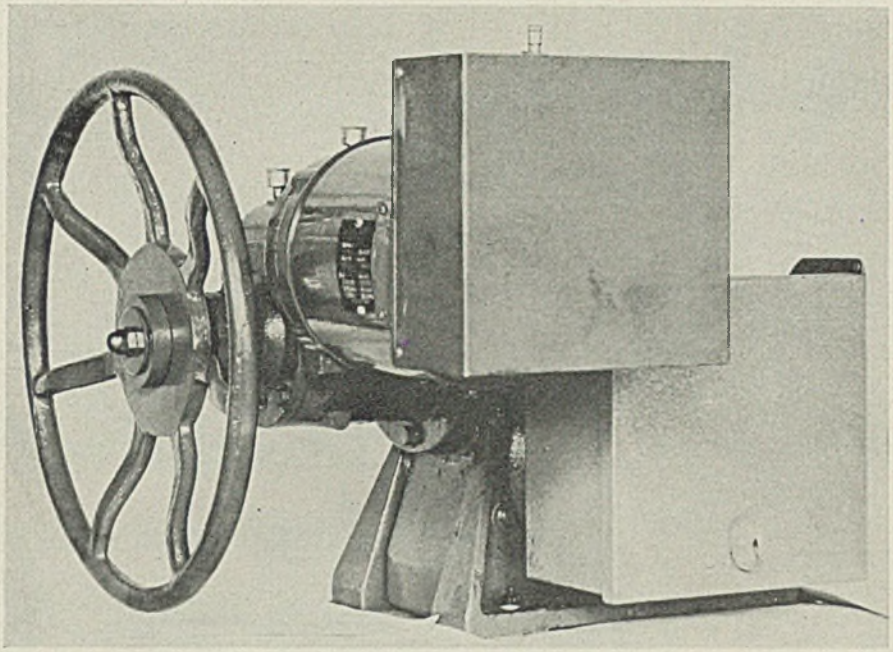


Fig. 7—Electrical power unit for use with electrically-operated hot blast control pyrometer

One air-operated temperature controller, which was installed about two years ago in the Pittsburgh district for hot blast control, uses clean air from a small compressor for the air supply at the instrument and for the pilot valve of the air motor operator of the mixing valve. But the power for the cylinder of the air motor which moves the valve stem is derived from air piped from the cold blast main.

The arrangement is shown in Fig. 6. The control instrument is an indicator and is located on a panel on the operating floor beside the blast furnace, accessible for constant inspection and for adjustment by the furnace men. The recorder, not shown in the sketch, is located in the instrument shanty, about 200 feet away.

The range of both of these instruments is 700 to 1700 degrees Fahr. Included also is a control station, by means of which the automatic control may be changed to manual control. Using the adjusting knob on the control station, a pressure reducing valve is regulated to make the changes in the air pressure in the control line to the air motor. This air pressure positions the pilot valve at the cylinder and resets the mixer valve.

Where electric controllers are preferred, a similar instrument may be selected except that the control mechanism will move a contact arm in the instrument across a proportioning slide wire resistance. The main features of the electric hot blast control unit being installed at the plant of the Woodward Iron Co., Birmingham, Ala., may be of interest.

The proportioning slide wire in the hot blast temperature controller is connected by three wires through a detecting, polarized relay to a follower slide wire, in the motor valve operator. In the circuit is a current interruptor. Control adjustments provide ample changes in the throttling range and for proportionate reset and for timed reset.

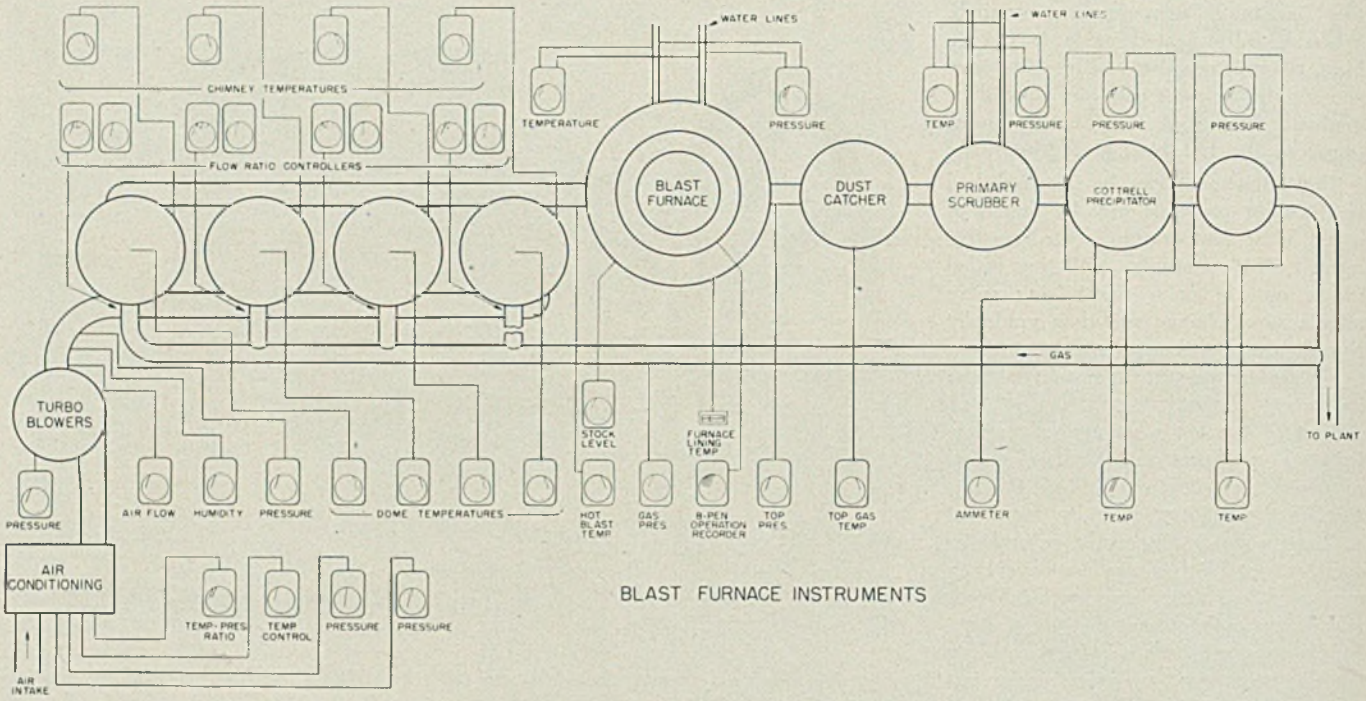
If the temperature tends to overshoot the control point, the throttling range is increased; but if the temperature tends to drift away from the control point, the throttling range is decreased. If the temperature does not return to the control point fast enough, the reset adjustments are increased. After the control unit has been tuned for the particular hot blast installation for which it is intended, there will be no further adjustment needed and the furnacemen will only reset their control point as changes are desired in the hot blast temperature.

The electric motor operator with limit switches, relays and hand wheel is illustrated in Fig. 7.

The electric hot blast control also includes a station for manual operation of the valve motor.

The McCarthy mixing valve, gate valves or butterfly valves are all suitable for use with either air or electrically-powered mechanisms.

One of the difficulties of applying blast temperature controllers to furnaces which have been in service for many years, has been that these old furnaces often are provided with undersized mixing valves and the line from the cold blast to the hot blast main, in which the mixing valve is located, may be too small from the standpoint of automatic control. This means that not enough



BLAST FURNACE INSTRUMENTS

Fig. 8—Instrument flow sheet with location of instruments for principal applications around a blast furnace

cooling air can flow through the mixing valve, just after a stove change, to bring down the hot blast temperature to the control point. When it is not practical to replace this line and valve with large enough sizes for good hot blast temperature control, then it is necessary for the operator to manually throttle back the air going into a freshly heated stove for a period of time so that a larger proportion of cold air will be forced through the mixing valve. The control is therefore no longer fully automatic. An installation is now pending where it is proposed to automatically throttle the air supply to the stove when the mixing valve reaches its maximum opening position.

It is apparent that a furnace working on a hot blast temperature of 1400 degrees Fahr. will not require as large a mixing line as it would require if running with a hot blast temperature of 900 degrees Fahr. Also good stoves, which transfer large quantities of heat to the blast, will make an ample sized mixing valve more necessary.

The top gas pressure recorder will be similar to the hot blast pressure recorder, but will have a range of about 0 to 75 inches head of water.

For ranges of pressure above 25 pounds per square inch, the actuating element in most recorders consists of a hollow, cork screw shaped, coil. This helix is connected through a pipe line to the source of pressure. As the pressure increases inside the helical hollow coil, it tends to unwind the coil which moves a pen arm, attached to the end of the coil, so that the pen point follows the calibrated scale imprinted on the chart.

For lower ranges of pressure like that of the top gas, the usual pressure element for the recorder consists of a small metal bellows mounted inside of a cylinder or shell, which prevents distortion of the element even when rather heavy overloads are encountered.

The cooling water which circulates through hollow plates in the brickwork of the bosh and hearth must be checked constantly. If any part of the water circulating system is obstructed, the intense heat of that section of the furnace may begin to melt the brickwork as well as the clogged bosh plate. A 2-pen pressure recorder, recording incoming and outgoing water pressure, provides some evidence of trouble by an increase in the difference in pressure at two points.

A 2-pen recording thermometer with a record of the incoming and outgoing temperature of the cooling water will show a decrease in the difference in temperature of the two records, because an obstruction or short circuit of the flow means less heat will be absorbed by the stream of water.

Even a comparatively small leak of water into the hot hearth will soon cause irregularities in the furnace operation.

The range of the 2-pen thermometer in the water line is often 40 to 225 degrees Fahr.

The range of the 2-pen gage may be as high as 0 to 150 pounds because a force (motor-operated) pump may sometimes be used in flushing out the bosh manifold.

More than 25 years ago at Donora, Pa., a pyrometer indicator was put in service to take temperatures of the furnace lining at a number of points around the stack. Records were kept of these temperatures over a long period of years. Similar records have been taken at other furnaces. At Central Furnaces, Cleveland, multiple recorders were used for this application. The usual procedure is to insert fire ends through the shell, 12 inches into the lining at two levels. Three thermocouples at one level may be 120 degrees apart and midway between these, and 10 feet or more above them, are three more thermocouples. Temperatures are noted occasionally to check on the location of possible hot spots.

When a foundation of one furnace was laid, arrangements were made to embed several thermocouple wires at different locations in the cement near the floor of the furnace, so that these could be connected to a portable pyrometer. This experimental procedure was followed to provide some indication of how far molten iron from the hearth might work down into the base; and provide a warning in case of a breakout.

The stockline recorder often will have a round chart and be housed in a case to match others on the same panel. The recorder itself is furnished with a gear-reducing mechanism and records the up-and-down movement of the stock rod and thus shows the height of the material in the furnace. In recent years, this recorder is mechanically or electrically connected to the automatic machines which are used for raising and

(*Please turn to Page* 192)

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MOGUL . . . Jessop Steel Company
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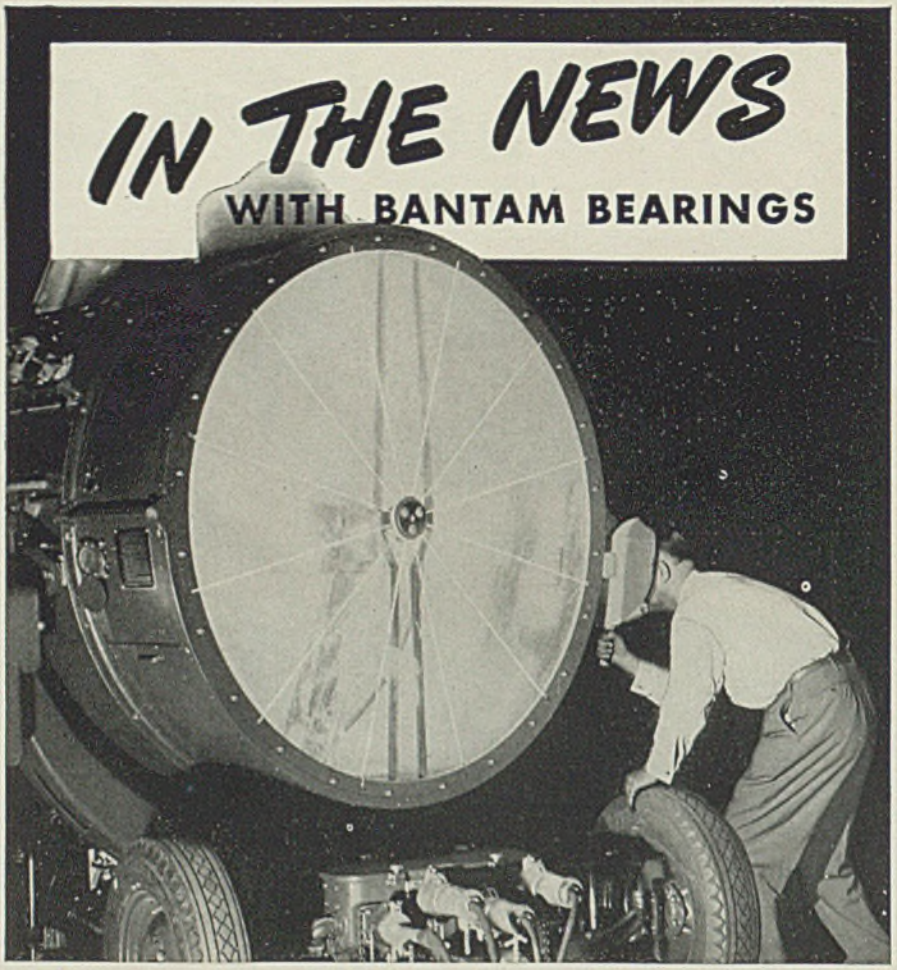
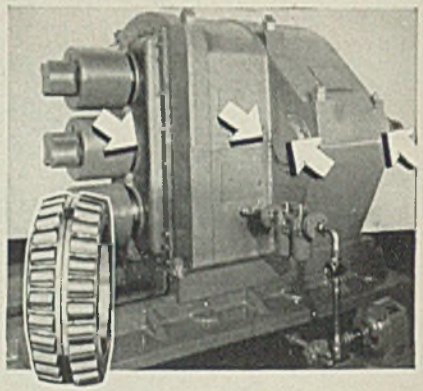


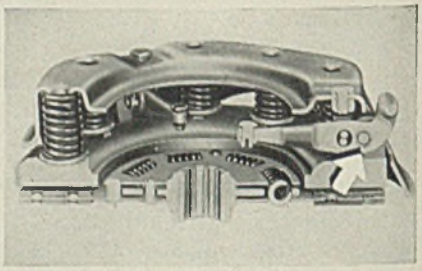
EYES OF THE ANTI-AIRCRAFT BATTALIONS, giant searchlights like this will pierce the skies with 800-million-candlepower beams to track down hostile planes. Among the advanced engineering features incorporated in the design of this searchlight is the use of Bantam Quill Bearings to assure high capacity, efficient operation, and long life at vital points in the trailer mechanism. Here is another instance of the many ways in which Bantam Bearings are contributing to the successful functioning of America's war equipment.

ABILITY TO MEET SPECIAL REQUIREMENTS in bearing design is an important aspect of Bantam's service to industry. In addition to a comprehensive line of standard anti-friction bearings—straight roller, tapered roller, needle, and ball—Bantam offers a highly developed skill in the design and production of unusual types, such as this ball radial bearing. If you have a difficult bearing problem, TURN TO BANTAM.



SMOOTH, UNFAILING POWER for a three-high copper rod mill is transmitted by this special drive combined with a three-high pinion stand, built by Farrel-Birmingham Company, Inc. Bantam two-row tapered roller bearings are used both on the high-speed shaft of the gear reduction unit and on the center pinion of the three-high stand.

41,000 IN USE WITHOUT A SINGLE FAILURE is the remarkable service record established by Bantam Quill Bearings in the pumping units and pumping jacks built by the National Supply Co. Though subjected to the severe operating conditions of oil field service, the Quill Bearings have been performing with this consistent dependability for periods as long as five years. For further details on these compact, high-capacity, anti-friction bearings, write for Bulletin H-104.



REDUCTION IN PEDAL PRESSURE is made possible through the use of Bantam Needle Rollers to form a compact, high-capacity anti-friction unit in the lever assembly of clutches produced by Long Manufacturing Division of Borg-Warner Corporation. Efficient lubrication throughout the life of the unit is an added advantage of these bearings.

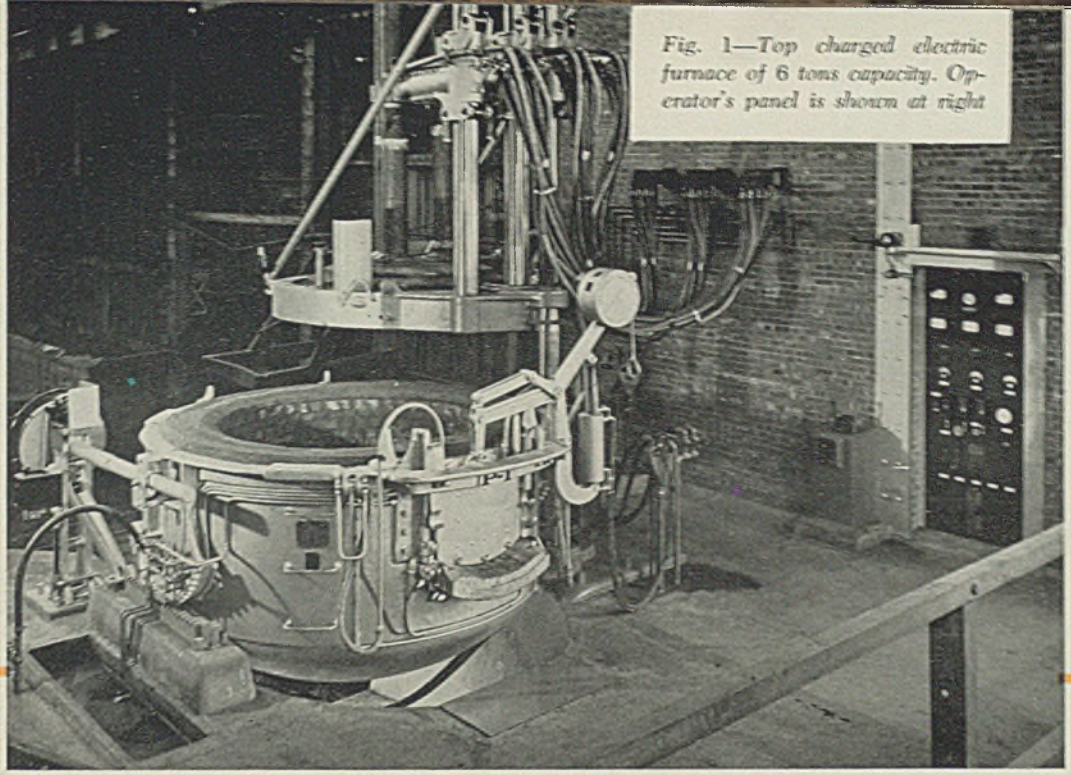


Fig. 1—Top charged electric furnace of 6 tons capacity. Operator's panel is shown at right

Control Method for

ELECTRIC ARC FURNACES

By T. B. MONTGOMERY
Control Engineer
Allis-Chalmers Mfg. Co.
Milwaukee

IN CONTROLLING an electric arc furnace, as is the case in most other control applications, the function to be reckoned with most is the element of time. Fig. 1 shows a 6-ton furnace arranged for top charging. The operator's control panel is shown at the right, set into the wall of the furnace bay. The transformer room is directly behind the panel.

Common experience indicates that where a quantity is required be held constant continually, or for any given period of time, the faster the quantity tends to change from normal the more difficult is the problem of controlling it.

To obtain some visualization of the problem in controlling an arc then it may not be amiss to consider a few fundamental characteristics of the arc. Particularly the rapidity of current changes. The electric arc is a pure resistance load, that is, impediment to the flow of current through it *does not change with time*. The reason for this is plain. No magnetic flux is produced by the arc current (more than that which surrounds any other conductor in air); therefore, current can change instantly.

This is, of course, the opposite of the other type of impediment to the flow of electric current, *inductance*, in which the impediment exists only during the time current is changing. This latter type of impediment then only resists a change in current flow, but not the actual flow.

Analagous to Water Pump

This is illustrated in Fig. 3 where R is a resistance represented as a rheostat with a voltage E_R impressed across it. With a given value of resistance a given current will flow the instant voltage is applied because no magnetic field flux is set up, the change in which delays current change. The action is similar to the mechanical analogy at the right of the illustration. Here, with pump P delivering a given pressure, a given amount of water will flow instantly with a given valve opening corresponding to the value of resistance R. If the pressure is doubled the volume of water is doubled. Thus, the resistance to flow in both cases is constant. It is the constant ratio between flow and pressure or $I = E \div R$ in the electrical circuit.

If a constant direct-current voltage, however, is applied between $B-B^1$ and ground G G^1 across inductance L and resistance R in series (Fig. 2), the current flow is not established instantly because a flow of current through L establishes a magnetic field flux which requires time to change. This action is similar to the inverted pump, or waterwheel, A, shown at the right of the illustration which is without friction and drives only a flywheel. With pressure from pump P applied suddenly the flow of water is impeded by the pump A and flywheel until it is up to speed and thereafter flow is determined only by the opening of valve V. In the electric circuit (with direct-current voltage applied) as soon as the magnetic field in L is established, L offers no further impediment to current flow and the rate of flow is determined solely by the value of R. However, in alternating-current circuits the current values change rapidly and continually and therefore L offers continuous impediment to current flow. Its value, in the same units of impediment to flow as the resistance R, which is ohms, is:

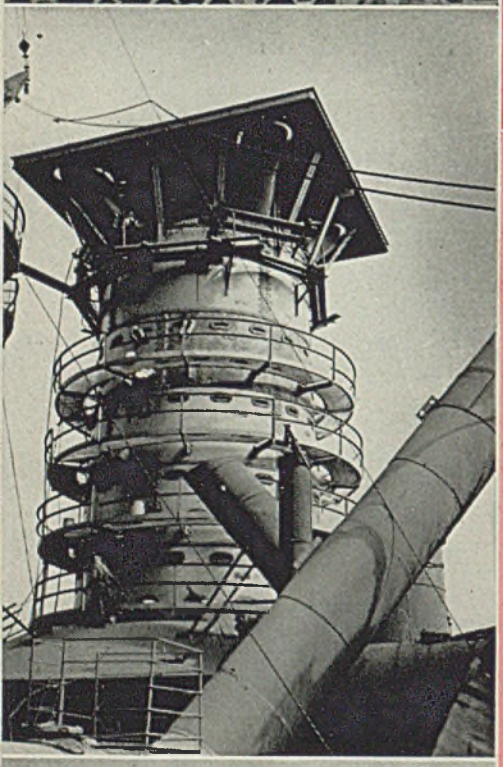
$$X_L = 2\pi FL$$

where F = frequency in cycles per second and L the inductance of the circuit in henries. The value X_L is the reactance.

7 days after blowing out, the old blast furnace was being dismantled in gigantic sections.

16 days after blowing out, the base plates for the new furnace were put in place.

70 DAYS

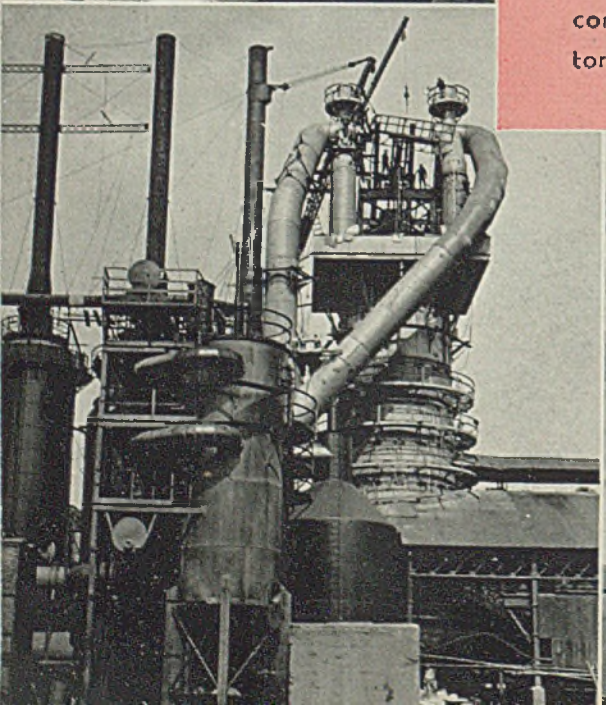


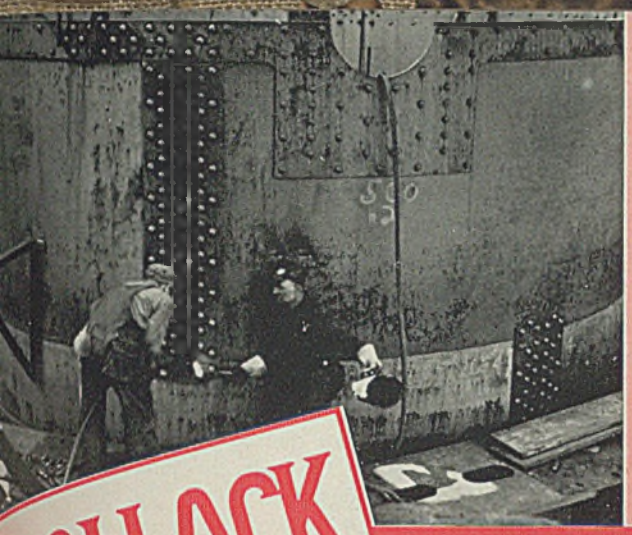
On the **31st day** the top platform was being erected.

By the **43rd day** the furnace top structure, downcomers, etc. were in place.

By the **54th day** virtually all erection work on the furnace proper was completed. *(Lower left.)*

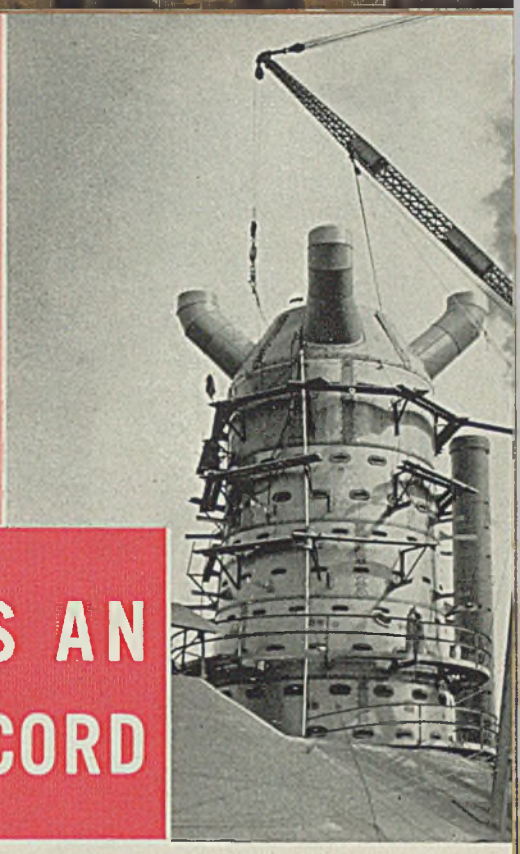
On the **70th day,** the newly enlarged blast furnace was lit and continues to give a highly satisfactory tonnage output.





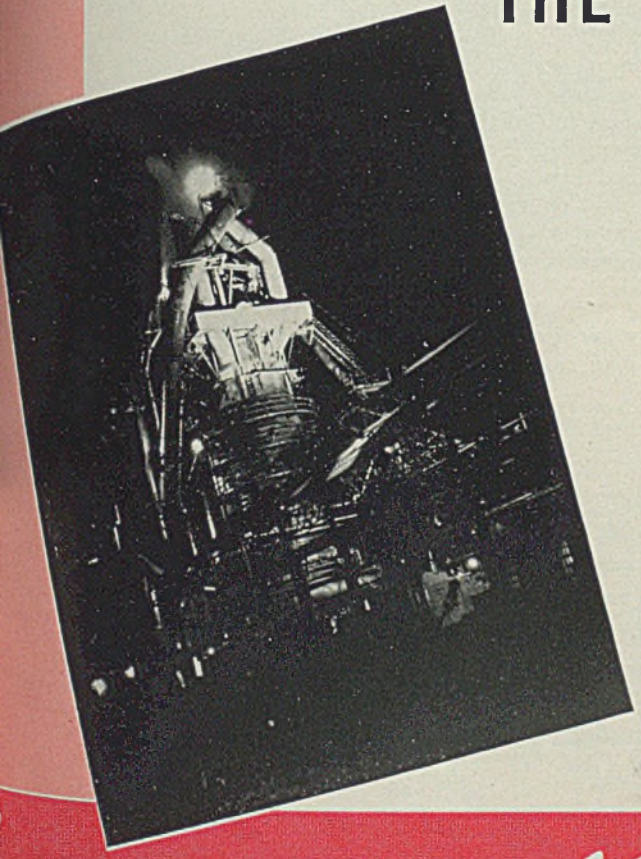
The hearth jacket for the new furnace was erected on the **17th day.**

28 days after blowing out, the top of the new furnace was in place.



POLLOCK AGAIN PERFORMS AN OUTSTANDING CONSTRUCTION RECORD

ANOTHER EXAMPLE OF AMERICAN RESOURCEFULNESS THAT IS WINNING THE BATTLE OF PRODUCTION



Everyone in the steel industry knows that pig iron production in the United States today is less than the war effort demands, and with that realization The Jackson Iron and Steel Company left no stone unturned to see to it that their Blast Furnace was out of blast for a complete rebuild the fewest number of days that was humanly possible.

The William B. Pollock Company is proud to have been chosen to perform the complete job of dismantling and new construction, and is free to acknowledge that the construction record performed could not have been performed without the full cooperation of every man at The Jackson Furnace.

THE WILLIAM B. *Pollock* COMPANY

YOUNGSTOWN, OHIO

BLAST FURNACE AND STEEL PLATE CONSTRUCTION *Since* 1863

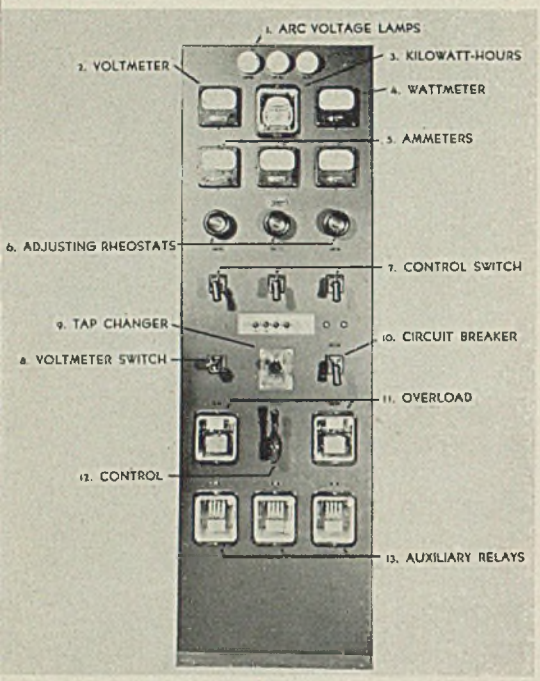


Fig. 2—Arc Furnace operator's panel

The actual value of this reactance impediment is directly proportional to the amount of current flow since the amount of flux built up varies directly with the current, unless the ratio is reduced at high-current values due to saturation in the iron magnetic circuit of the reactor. The relative value of this reactance effect in an actual furnace circuit is similar to curve *A*, Fig. 4. At 100 per cent current its value is *XY*, while at 233.5 per cent current its value is SV. In each case the value is IX_L and is the voltage required across *L* (Fig. 3) for any given current. Since this value of reaction increases as current increases, it is said to have a positive characteristic.

Current Changes Occur Instantly

The electric arc, however, is similar to resistance *R* (Fig. 3) in that current changes can take place instantly since its impediment to current flow *does not change with time*, but it differs completely in that the ratio of current flow to impressed voltage,

$$I = \frac{E}{R}$$

is not constant but changes as the amount of current flowing changes.

This is illustrated by curve *B*, Fig. 4, which is the volt-ampere characteristic of an arc with length of separation between electrodes constant. If the furnace size and transformer size supplying it are such that 100 per cent current is 7370 amperes, produced by 135 volts across the arc, this corresponds to point *Z* on the curve, and the arc resistance at this load is 135 ÷ 7370 or 0.0183 ohm. At 233.5 per cent load, however, the resistance is 114 ÷ (2.33 × 7370) or 0.00658 ohm or about one third as much; where 114 volts corresponds to the vertical distance shown by dotted line *SU*. Since the resistance decreases with increase in current it is said that an arc has a *negative resistance* characteristic. In Fig. 3, E_R corresponding to *SU*, then, would be approximately three times as great at 233.5 per cent current as the vertical distance X_Z at 100 per cent if the arc characteristic were positive and the same as a normal resistance such as *R* in Fig. 3. Further, the increase from 100 to 233.5 per cent consumes no time in changing.

Thus, if with the furnace operating at 100 per cent current point *Z* on curve *B*, 135 volts corresponding to dotted line *ZT* is held constant, when for any reason the current increases slightly, conditions are shifted immediately to the right on curve *B*. But with increase in current, since the resistance of the arc decreases, the result is a *rising characteristic*. At 233.5 per cent current voltage *SU* is required to hold this current but voltage *ST* is applied to the arc. Since no time lag is required by the current in changing it would increase immediately to infinite value. On the other hand if when operating at 100 per cent current at point *Z*, curve *B*, the resistance increased conditions would shift to the left and from the curve the voltage required to maintain the arc is greater than the impressed 135 volts so immediate extinction would result.

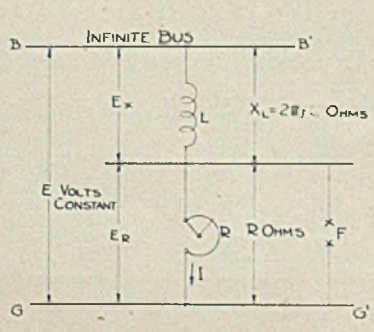
Not Generally Understood

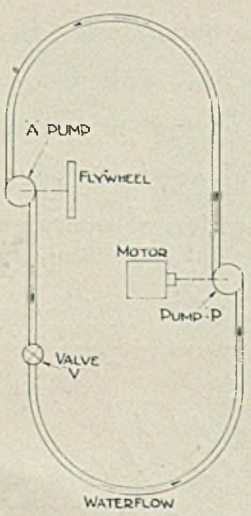
The reason for the negative resistance characteristic of the arc is not altogether familiar to most of us. In a solid conductor the molecular structure is homogeneous and the physical relation of individual atoms more or less fixed at temperatures below the point where melting begins. In the arc, which is vaporous, the individual atoms are not held fixed to the same extent and in addition low-resistance metal vapors are added in an amount varying with the amount of current.

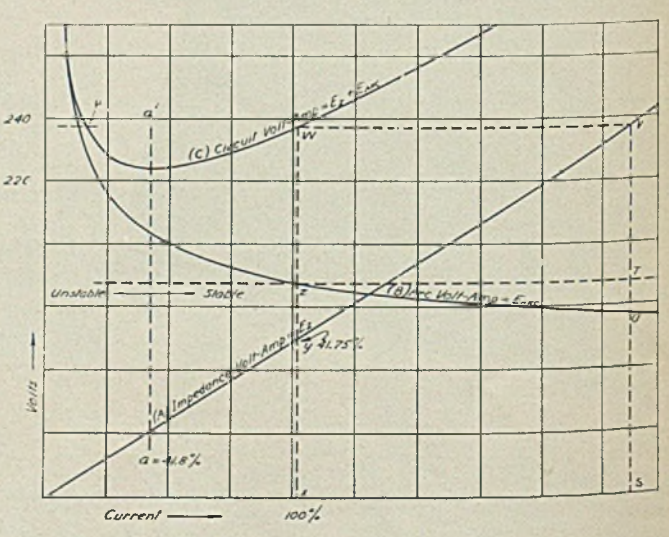
Thus far consideration has been given only to the arc itself which, due to negative resistance characteristics with no time lag for current change, is within itself uncontrollable. As shown in Fig. 3 a reactance *L* is connected in series with the arc. The impediment to current flow of this reactance and the reactance and resistance of the rest of the circuit being all directly proportional to current the total voltage required to overcome reactance and resistance external to the arc, which together form impedence, at any current value is given by curve *A*, Fig. 4. This impedence voltage curve *A* when added to the resistance voltage

Fig. 3. (Left)—Electrical and water systems compared to show resistance to flow in both cases is constant

Fig. 4. (Right)—Volt-ampere characteristic of an arc is depcited by caurve B







PENNSALT CLEANER

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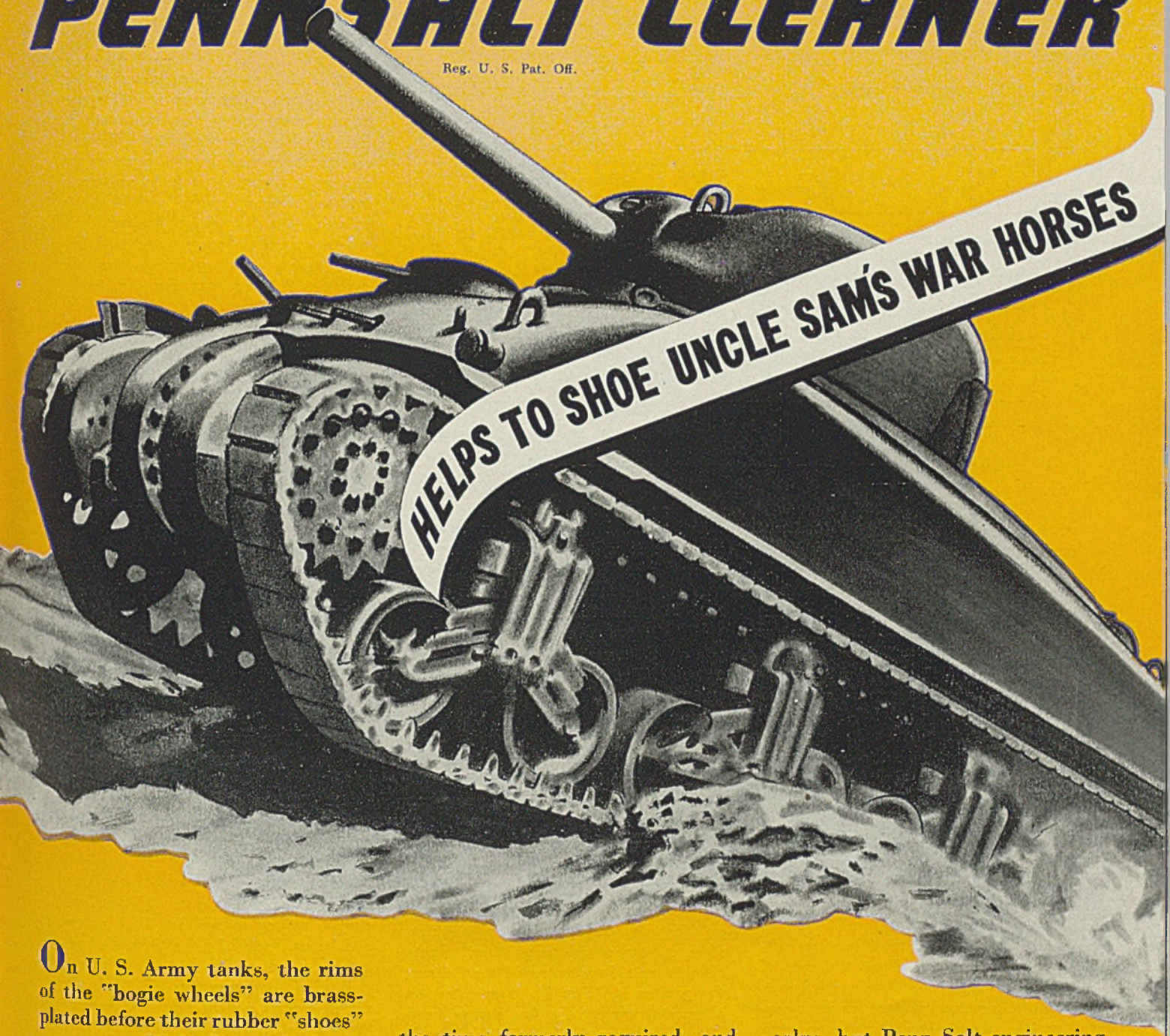

On U. S. Army tanks, the rims of the "bogie wheels" are brass-plated before their rubber "shoes" are put on. If the brass-plating is unsatisfactory, a poor rubber-coating job results.

A manufacturer had the problem of stripping unsatisfactory brass-plating from the tank rims. He was using a boiling chromic acid bath, but the job took an hour and entailed considerable evaporation of the acid. Since chromic acid is on priority, he wanted to speed up the operation in order to conserve this critical material.

A Penn Salt representative saw that a Pennsalt Cleaner could help. Result? The Pennsalt Cleaner stripped the brass in one-fourth the time formerly required, and cut down the time in chromic acid to *one-fifteenth*, thus effecting a substantial reduction in the chromic acid lost by evaporation. It did everything the customer needed, from a brass-removing standpoint, and subsequent re-plating of the rims was entirely satisfactory.

This was a tough problem to solve, but Penn Salt engineering, backed by the complete line of Pennsalt Cleaners, was equal to the task. In the family of Pennsalt Cleaners, there is at least one which will facilitate some metal cleaning operation in your plant. Let the Penn Salt technical staff help you with your problem. Phone or write to Pennsalt Cleaner Division, Dept. S.

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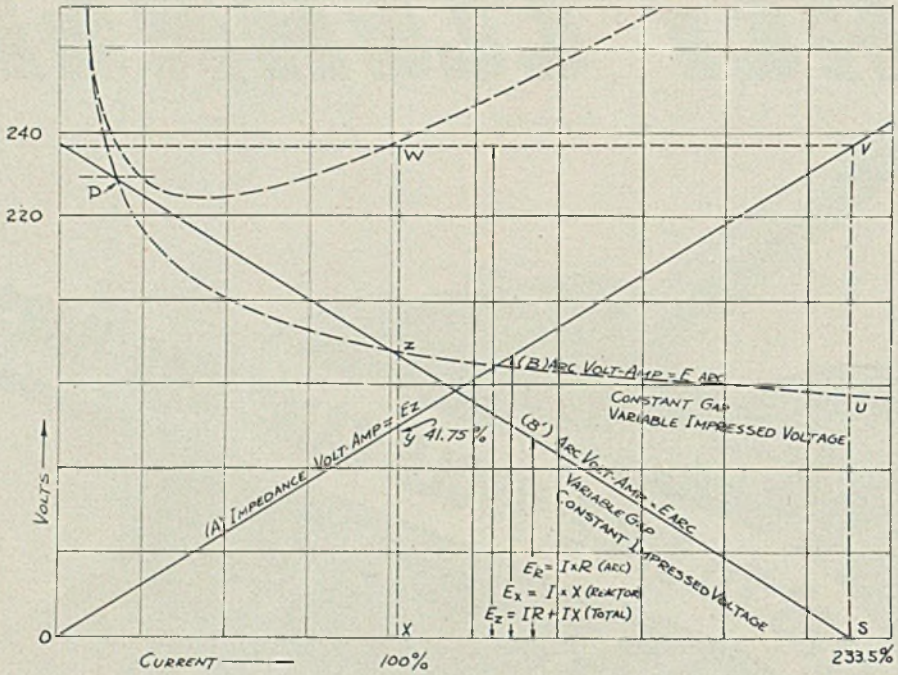

Fig. 5—Curve showing circuit characteristics

of the arc itself, curve *B*, gives a circuit impedence voltage as shown by curve *C*. But if a constant 235 volts, as indicated by dotted line *WV*, is impressed on bus *B*—*B*', at 100 per cent current 135 volts (*XZ*) is consumed in the arc and 100 volts *ZW* = *XY* is consumed in the reactor. If current increases proportionately more voltage is consumed in the reactor until at 233.5 per cent current the entire 235 volts impressed (*SV*) is consumed in the reactor and this is the maximum current obtainable in the circuit. Further, the *impedence* characteristics, curve *C*, is positive at all points beyond dotted line a-a', that is, an increase in current requires an increase in voltage. But under the conditions of constant impressed voltage at 233.5 per cent current and 41.75 per cent reactance, there must be zero voltage across the arc. Since the sum of impedance voltage and arc voltage is equal to impressed voltage which is constant the circuit characteristics become as given in Fig. 5.

Assume operation at 100 per cent current point *Z* curve *B*, as before in Fig. 4. Suppose the electrode makes direct contact with metal as, for example, produced by a "Cave-in". The arc resistance becomes zero as at point *S* (Fig. 5) with zero electrode separation, and 233.5 per cent current flows limited only by reactance. If the electrode is raised to increase separation the arc voltage is given, not by curve *B* for constant arc length, but by curve *B*'. Normal arc separation is reached again at point *Z*, or 100 per cent current.

If when operating at 100 per cent current, point *Z* (Fig. 5), the arc resistance increases continuously without electrode movement arc voltage and current will follow curve *B* until at and above point *P* corresponding to 16½ per cent it will be extinguished. To meet this condition of increasing resistance, since impressed voltage is fixed, the arc resistance is lowered naturally by lowering the electrodes. The arc voltage then varies along straight line curve *B*' (Fig. 5) when under automatic control. It will be noted that at 233.5 per cent current no voltage is present across *R* (Fig. 3), the total being across reactance *L*. At 16½ per cent current, point *P*, curve *B*' (Fig. 5), most of the voltage is across the arc, little across the inductance. The relative values of E_X and E_R are fluctuating continually while their sum stays constant, for any given value of voltage and reactance.

All of the foregoing values are based on 235 volts, 41.75 per cent reactance°. Both reactance and voltage are adjustable to suit furnace conditions. Since the reactor *L*, (Fig. 3), is operated on alternating current the flux change from *O* to a maximum or vice-versa occurs each quarter cycle, therefore its delaying action to current change between the foregoing values is necessarily of short duration, and of no practical value in maintaining electrode current constant. The current fluctuations as described may occur in a cycle or so. Current thus is free to fluctuate between 16½ and 233.5 per cent full load value as rapidly as the resistance between electrode and furnace shell changes and is determined by this resistance. Fast electrode movement thus is required to control arc resistance and current.

In Fig. 5 the 3-phase furnace at *F* indicates the level of a fresh charge of scrap metal at the beginning of the melt. Since under these conditions the current must traverse a long path of loose nonhomogeneous material between electrodes as well as the vaporous arc stream, it is evident that as melting is initiated the resistance will fluctuate wildly. Oscillographic studies have shown current surges on one type furnace to occur approximately every six cycles on a 60-cycle system. Obviously, such violent irregularities could not be successfully followed by any mechanical correcting system.

°This figure is given as the value of reactance in which 41.75 per cent of the applied voltage is consumed in reactance voltage drop at full load current.

Control Is Required

Therefore, in a control system what is required is a *time rate* of response which follows average conditions. By such control, while rapid current fluctuations take place, the maximum current being limited by the reactor, the response is such that these fluctuations are kept above arc extinction and fluctuating in a band above and below full load or other preset value. Again, the conditions during the refining period after meltdown are indicated by the broken lines at the bottom of the furnace *F* (Fig. 6). During this period the metal is "boiling" so to speak with bubbles forming under the electrodes which cause sudden current peaks, then disappear. Here, too, *time rate* of response must meet average conditions to prevent the electrodes moving too far. During the refining period generally smaller current values are used and less reactance giving a shorter arc. It, therefore, is an important requirement of a successful control that it operate stably at low-current values as well as high values and be unaffected by the amount of reactance used.

Finally, the corrective effort of any closed control system needs be proportional directly to the *deviation* from normal value. The normal value is the value to be held constant for which the device is set.

In Fig. 6, at the furnace, *WM-A* indicates a shunt wound separately excited 250-volt direct-current motor, varying in size from ½ to 7½ horsepower, connected to a winch which by means of a cable system raises or lowers the electrode of phase *A*. The armature of this motor is connected solidly, without contacts, to the armature of a winch generator, *WG-A*, of comparable size to do winch motor, and is one unit of a 7-machine motor-generator set. Thus the speed of the winch motor is, for practical purposes, proportional to the voltage produced on the generator and when generator voltage is collapsed the winch mo-

(*Please turn to Page* 174)

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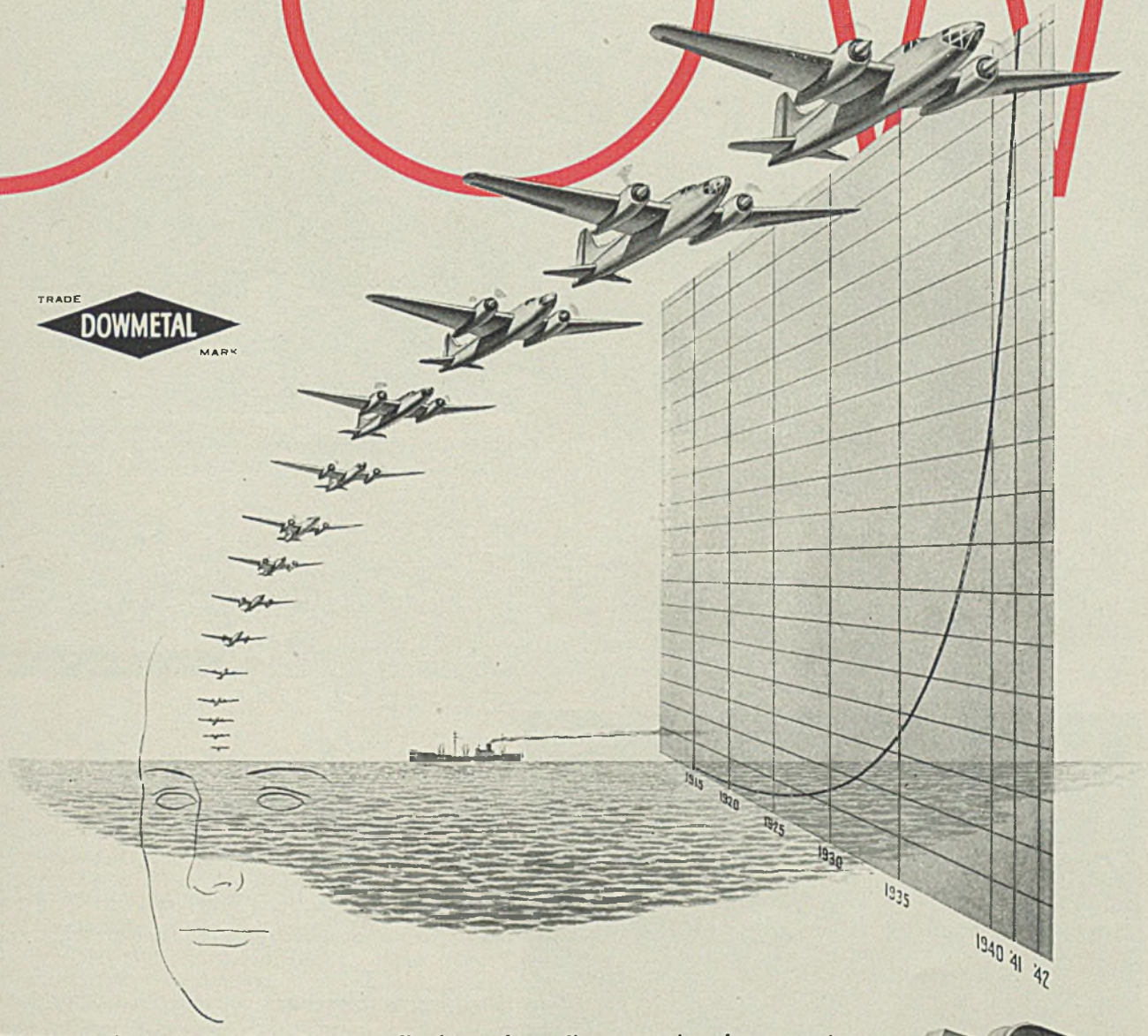

CONSTRUCTION of airplanes for victory calls for a boundless supply of magnesium. The production curve of this remarkable weight-saving metal rises ever higher as Dow extracts millions of pounds from the waters of the sea. The eye of the designer is on the future when these vast quantities of magnesium will release more horsepower for peaceful purposes and lighten our daily tasks in innumerable ways.

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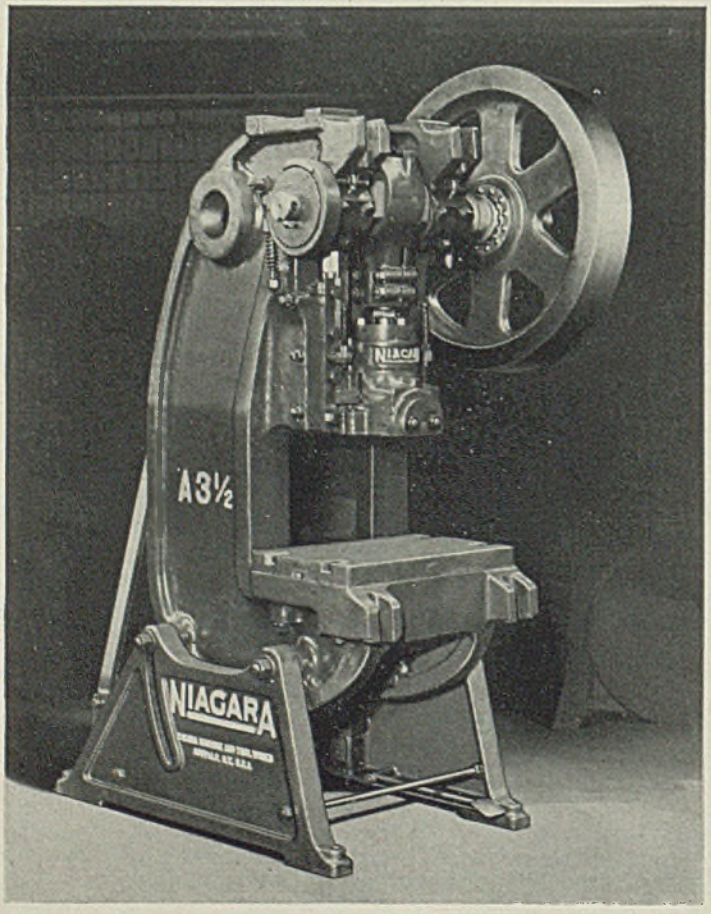

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High output, convenient operation, reliability that reduces shut downs to a minimum are performance factors resulting from Niagara design.

Niagara Presses and Shears are built in a complete range of well graduated sizes. Write for Bulletins. Niagara Machine & Tool Works, Buffalo, N. Y. District Offices; Cleveland, Detroit, New York.

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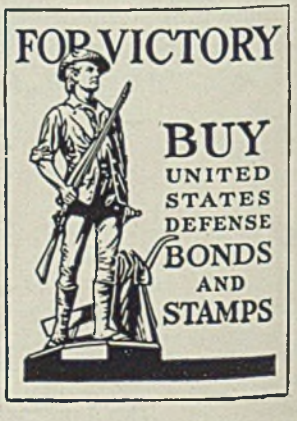
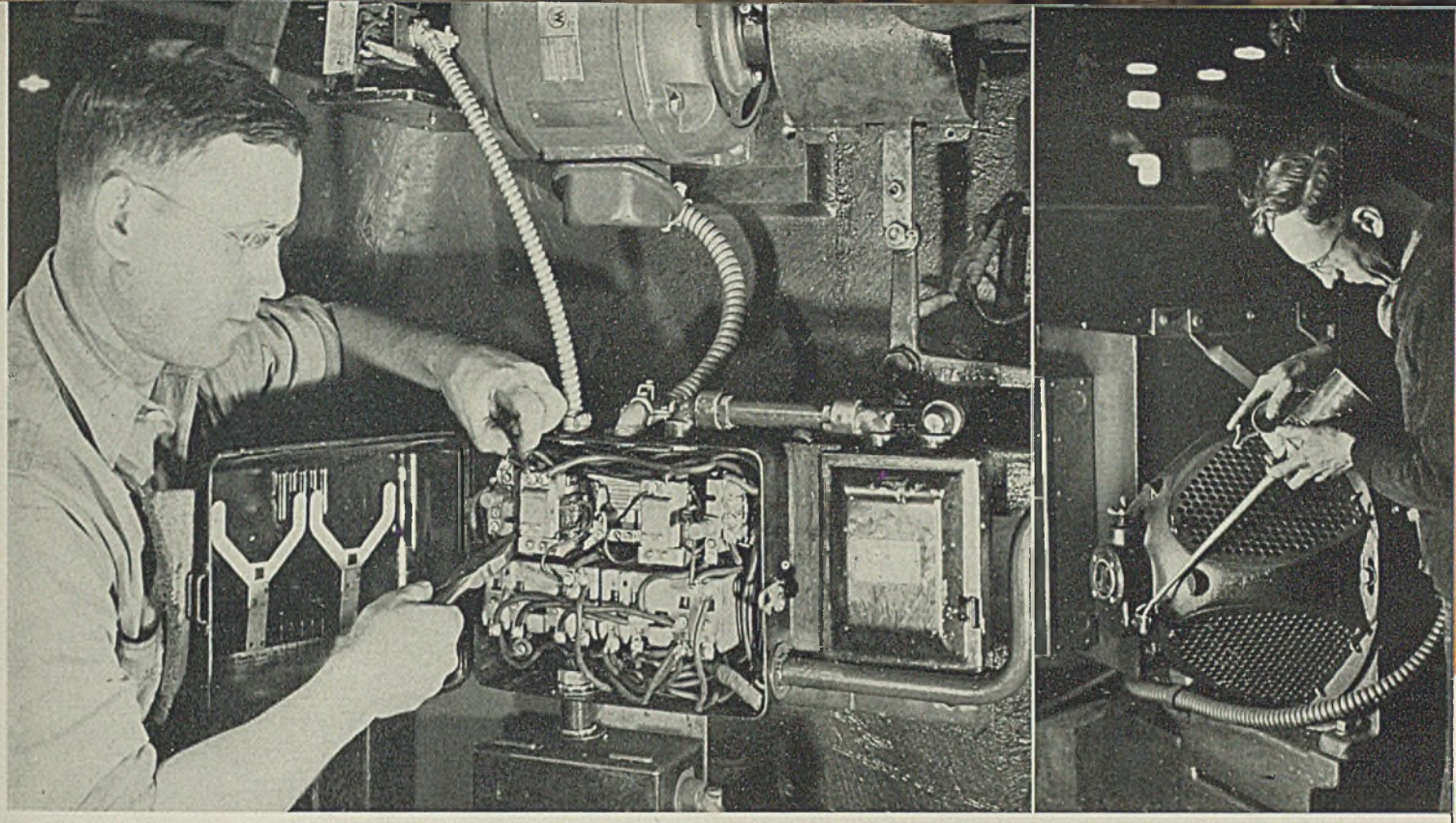




Left, regular inspection of motor linestarters reduce time outages. Right, smooth operation and longer motor life result when motors are properly oiled. Care should be taken to avoid using too much oil, lest it contaminate motor windings

MAINTENANCE OF ELECTRICAL EQUIPMENT

In Steel Plants

By M. J. WOHLGEMUTH
Central Electrical Superintendent
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

MUCH has been written and said about this subject and less has been done than on probably any other single item making up the complex operations of a plant. It is only, however, by continually hammering at the importance of keeping equipment fit that some measure of extra effort can be obtained. It is with this in mind that this summary has been prepared to be added to the voluminous data that has gone before.

A steel plant is one of the vital links in the chain of our war production facilities. It is important, therefore, that precautions should be taken to avoid interruptions of large mills due to failure of electrical equipment. With stepped-up operating schedules caused by demand for increased tonnages from the mills and with the pressure of other work associated with these increases, there might be a tendency on the part of maintenance men at times to neglect proper inspection of equipment in order to forestall major failures.

The apparatus for a large mill consists of the main drive equipment, such as main mill motors and motor-generator sets, with their switchgear and control, plus auxiliary equipment consisting of table motors, screwdown equipment, etc., with their control.

Main Drive: A breakdown of a large driving motor or generator supplying such a motor, results not only in loss of tonnage, but involves costly repairs, not to mention the time factor necessary to make these repairs, and also diverts essential material and time from other necessary activities. It is important, therefore, that large equipment be given more than the ordinary maintenance in these times. Some of the major items that should receive particular attention are as follows:

1. Keep a temperature record of electrical equipment used to operate the mill as this is a good indication as to whether the equipment is being overloaded consistently.

2. Test the overspeed devices on all your drives to make sure that they are operating properly and that they are set to trip at safe speeds.

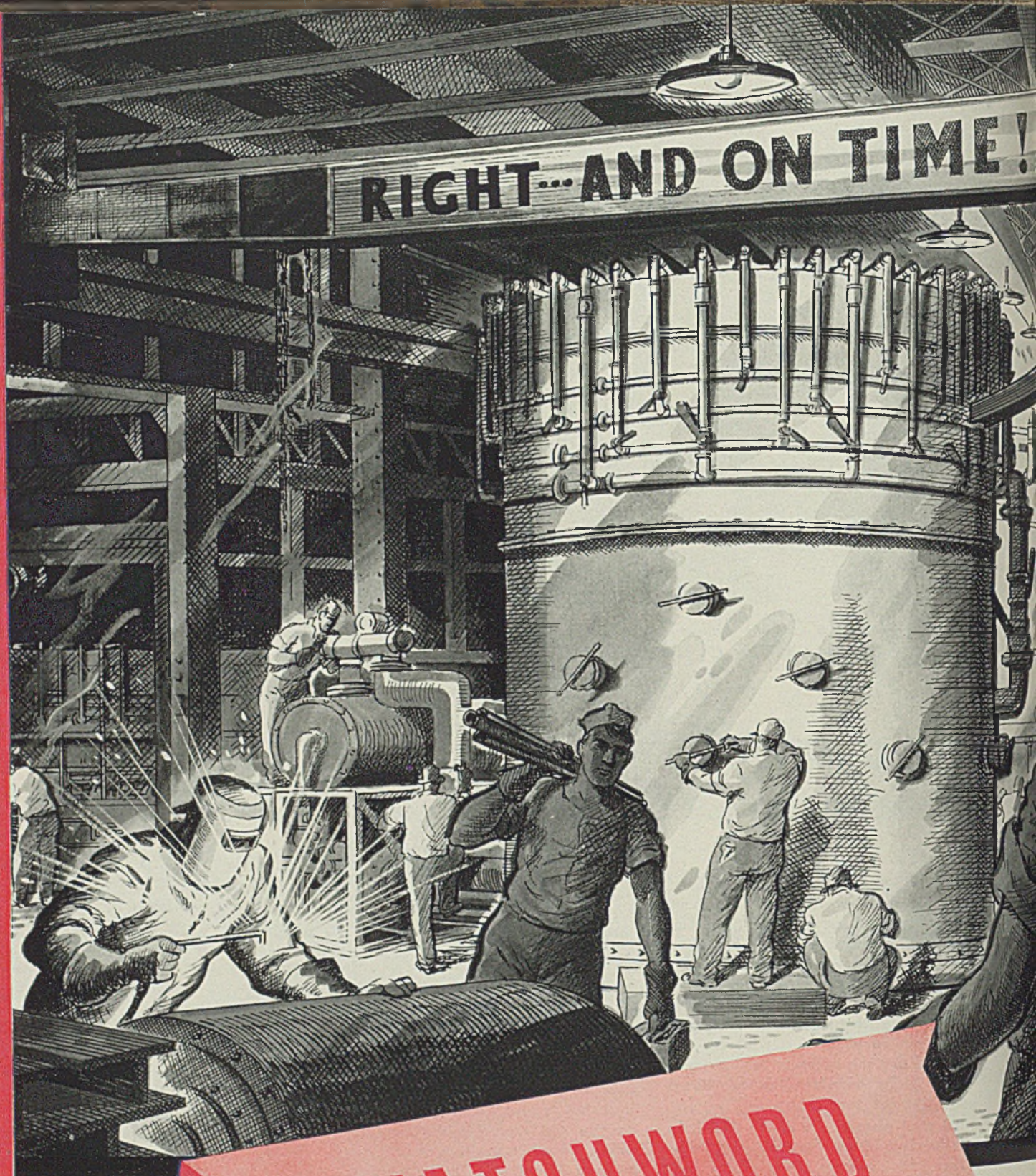
3. It is important to make sure that your machine heater circuits are in satisfactory shape so that if the equipment is shut down for any length of time, there will be no failure due to sweating.

4. If surge protective equipment is provided for large alternating-current machines, it should be inspected to make sure that it is in operating condition.

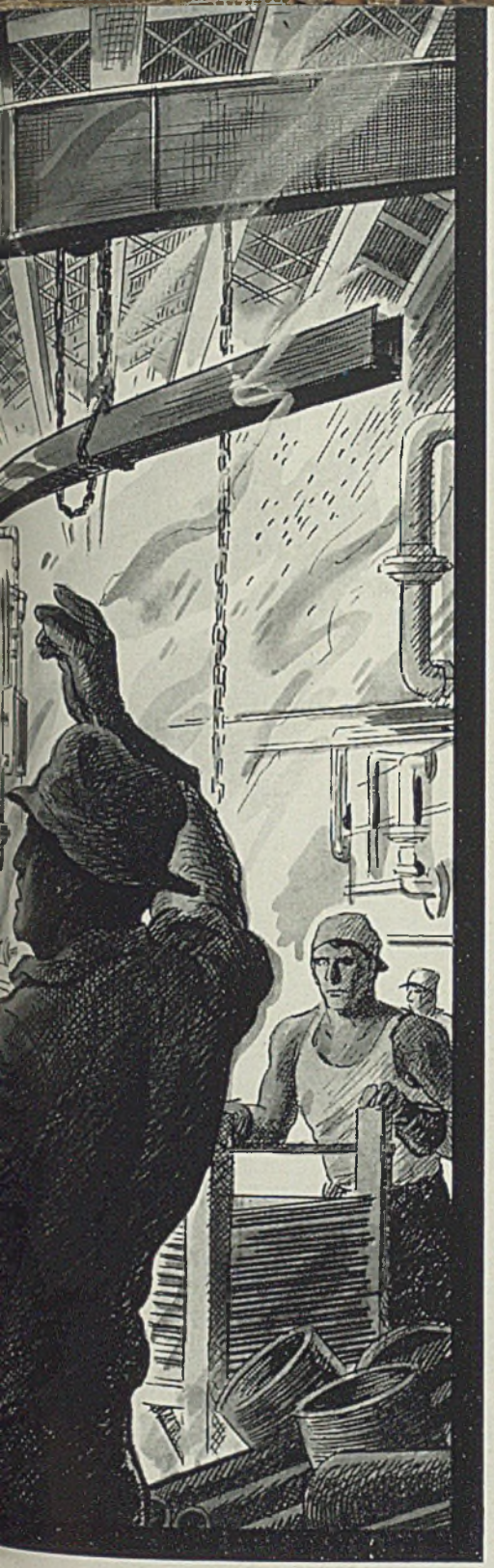
5. Due to increased operation of the mills, the air is bound to have a greater amount of dust which tends to overload your air cleaning equipment. This, naturally, will require more frequent attention to assure the proper amount of clean ventilating air to the motors and generators. It is suggested that air-flow readings be taken at periodic intervals to make sure that each machine is getting its share of clean air.

A recent inspection of several machines showed accumulation of dirt which is harmful to proper operation. A machine which is clogged with dirt will give trouble quickly, if not cleaned out, even though the air supply is checked.

6. On electrical equipment which has forced oil lubrication for the bearings, particular attention should be taken to insure the oil system is kept clean. A number of cases have been found where



WATCHWORD FOR VICTORY



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"Right...and on time!" For years this thought has ruled operations at Surface Combustion. For years each workman has seen the phrase posted as you see it here, in every manufacturing department.

"Right...and on time" is *not* just another slogan. It is a living principle, with years of performance to back it up. It moved us over a year ago to anticipate greater need for heat treating equipment with four important measures.

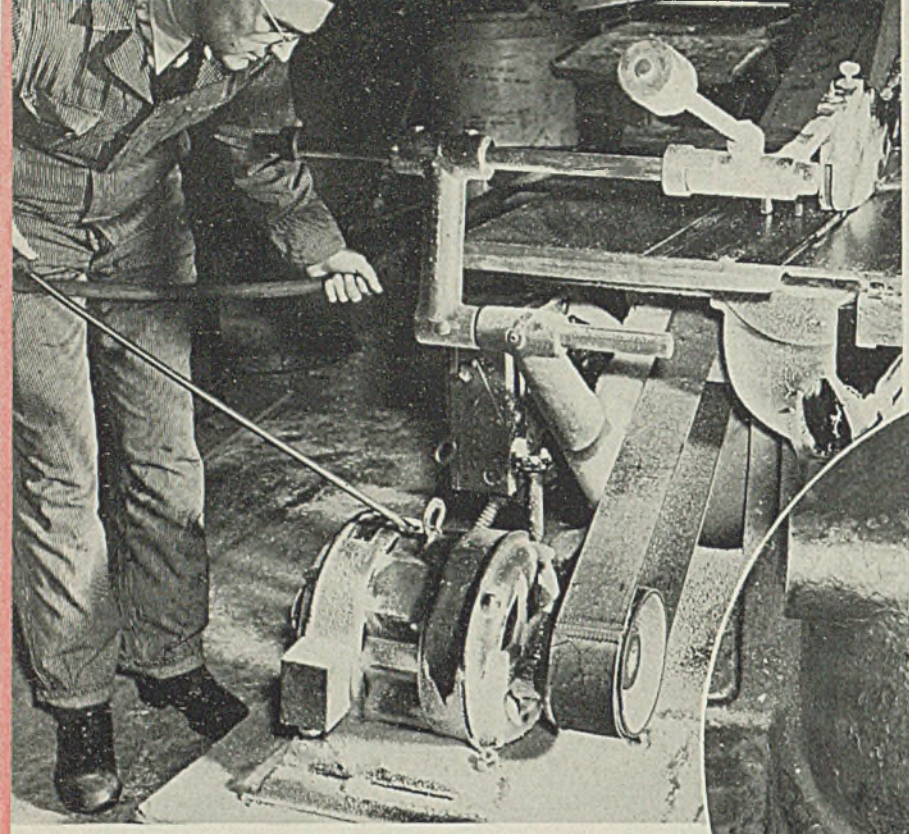
1. Production operations were simplified wherever possible.
2. Departments and equipment were rearranged to bring related operations closer together.
3. An improved production control system was instituted to keep things rolling on predetermined schedules.
4. Subcontractors used to fullest extent.

So Pearl Harbor found Surface Combustion ready to serve increased emergency demands. Our furnace output is hitting new all-time highs. More and more Surface Combustion heat treating furnaces are going on jobs, "Right...and on time", to help America produce "enough and on time".

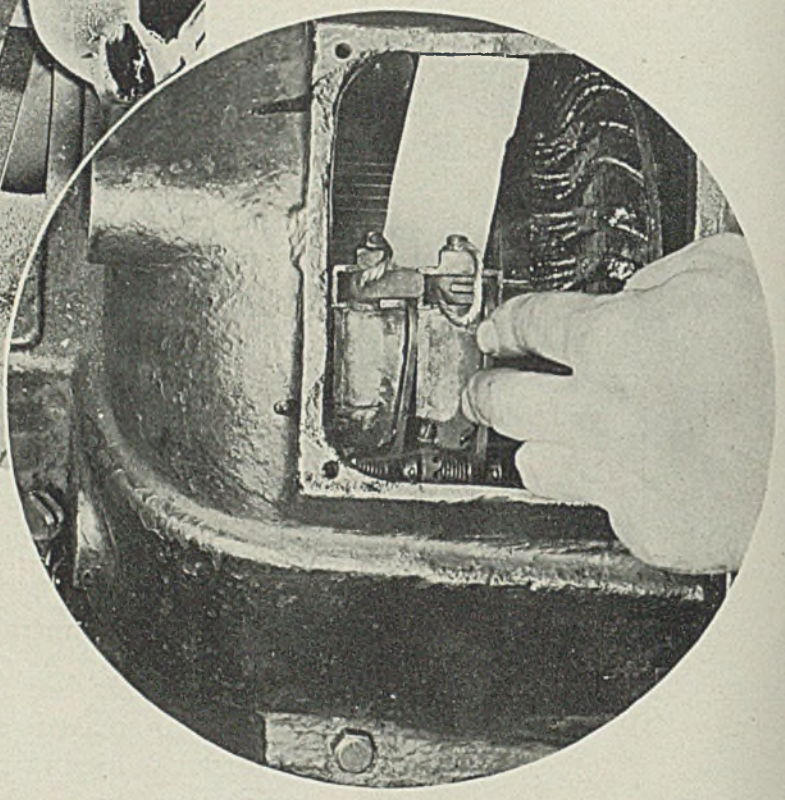
THE SC RECORD

Accurate production control methods, the coordination of effort with 100 to 150 different sources of supply and subcontracting made possible the stepping-up of SC industrial furnace output 400%. SC has met the unprecedented demand for furnaces to aid in production of aeroplanes, tanks, trucks, armor plate, carriages, mounts, guns, bombs, cartridge cases, projectiles, and clips—to name only a few of the vital products of war. Delivery has been abreast, even ahead in many cases, of industry's requirements without sacrifice of SC quality. Customers of SC know from experience that "Right...and on time!" means exactly that!

SURFACE COMBUSTION SC TOLEDO, OHIO



(Left)—It is essential to keep a motor clean using a suction hose or by blowing with an air line. Although a removable metal cover gives some protection to this motor installed on a carpenter's saw, sawdust will get to the windings



(Right)—A thorough motor maintenance program does not neglect brushes. Proper method of cleaning and surfacing is to press brush down on a strip of sandpaper placed between brush and commutator. Sand paper is then pulled in the direction of commutator rotation. Several passes should be sufficient, depending on the brush condition

damaging material has been discovered in the oiling system.

7. After long continued use of electrical equipment, the insulation tends to dry out somewhat and in several cases the coils tend to become somewhat loose in the slots. If this condition is not corrected, especially on reversing equipment, eventual failure to ground occurs. It is suggested that this be checked on large motors, and, if necessary, the machines can be rewedged in a reasonable time and save a major shutdown and repair.

8. With increased load on the mills, there will be a tendency to increase the settings of the overload protective equipment beyond that normally used. This should be done with caution in order not to overload the equipment too much, causing burn out and consequent major shutdown. Any change in load setting on equipment should be carried along with the temperature reading (as recommended above) in order to insure that the equipment is not overloaded.

9. Another important item that should have careful checking is commutators on motors and generators, and especially on generators. Proper commutator condition and proper brushes can forestall serious trouble.

10. Condition of bolted and soldered joints becomes exceedingly important when loads are increased. Cross connections on direct-current machines should be checked for tightness. Bolts holding fans on armatures and rotors should be checked. Coupling bolts should be checked.

11. The control for the mills should be kept in good operating condition. This means that contactors should have contact tips dressed or renewed at proper intervals, that dirt should be removed from the operating parts so that sticking will not cause a delay, shunts should be examined and replaced if signs of wear appear, etc. Space or time will not permit a detailed discussion of maintenance of control equipment and all manufacturers of such equipment can supply maintenance procedure for their products. It is recommended that this be studied and followed.

12. The same holds true of your switchgear equipment which includes oil-circuit breakers on incoming lines, feeders and large high-voltage machines. The breaker equipment should be kept clean so that flashovers will not occur on bushings; mechanisms should be kept adjusted and feeder and relay equipment kept in proper condition so that load conditions can be supervised. Here, again, the manufacturer can be of great assistance in providing maintenance literature and help.

Auxiliary Equipment: Auxiliary equipment on mills probably receives less attention than main drive equipment. This undoubtedly is due to the fact that auxiliary drive motors are apt to be totally enclosed, mill type, located in somewhat inaccessible locations. These motors have the reputation of being able to take a terrific amount of punishment and thus are apt to be overloaded. The control for the auxiliary is apt to be located also in out of the way places and may be neglected.

It is imperative that this auxiliary equipment be given as good maintenance as the main drive equipment since failure of an auxiliary drive, due to a motor or control trouble, results in decreased tonnage. It is true that an outage on this type of equipment does not result in as long or costly delay, as the motor or control item is much smaller and can usually be replaced by spares, but continued determined checkups can cut these delays to a minimum. The main items to check

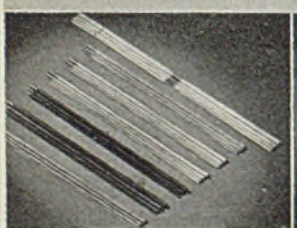
(Please turn to Page 181)

WELDING..

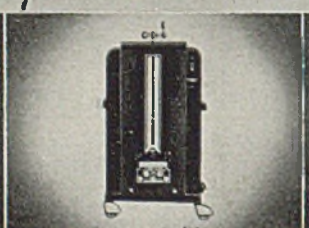
Tanks . . . Guns . . . Planes — and even the Ships used to transport them — are getting to our fighting fronts faster and in greater number because of welding.

Hollup Corporation, a division of National Cylinder Gas Company, is doing all it can in the 24 hours of each day to speed its output of rods and electrodes, A.C. and D.C. welding machines, "Shield-o-matic" welding apparatus, and the new Stud Welding System.

HOLLUP *products and services are helping speed war production*



Sureweld" protected arc electrodes, in many types and sizes, ive the best results for any job.



Electric welders for A.C. or D.C. operation are available in a complete range of sizes to meet any requirement.

"Shield-o-matic"—fully automatic shielded–arc welding process which meets all code requirements.

Stud welding system for pr duction end-welding of sm sections to metal surfaces

HOLLUP products may help speed your output . . . *Write for literature, specifying equipment in which you are interested.*

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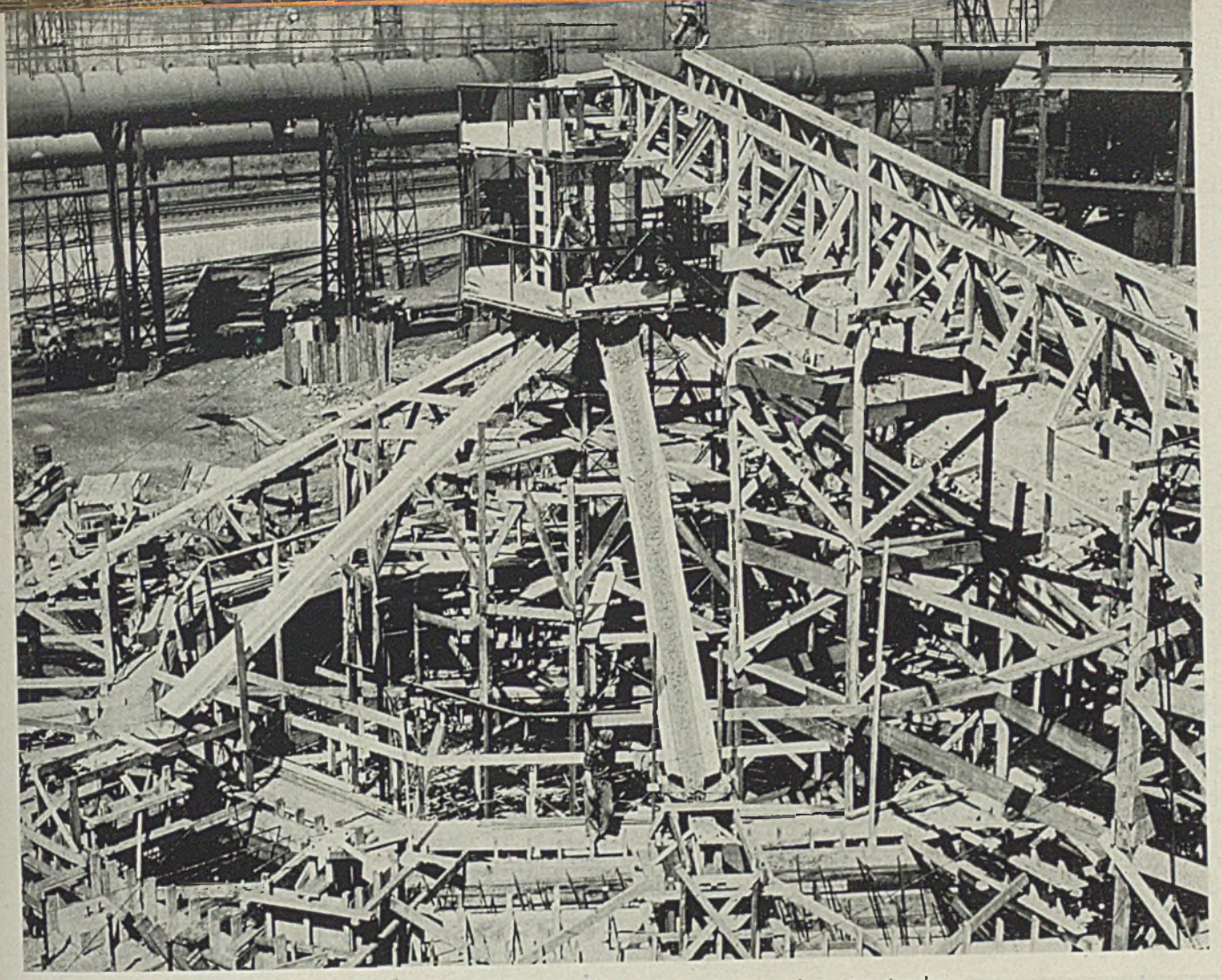


Discharge end of pipe line distributing concrete to forms for outer ring base

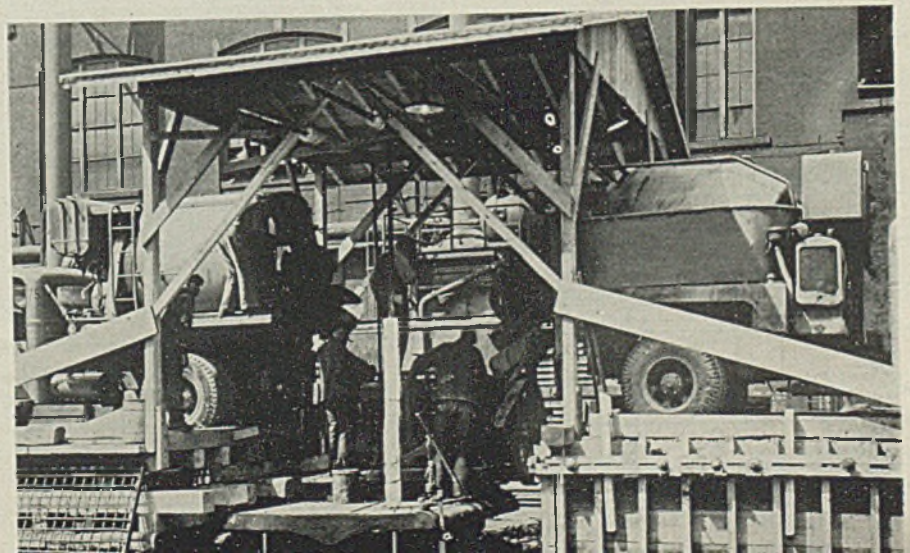
Pours Foundation Through 400—Foot Pipe Line

CONCRETE aggregate recently was pumped to the job through a 400-foot pipe line in order to facilitate installation of foundations for a new blast furnace at one of the plants of the Bethlehem Steel Co. Mixer trucks transported the concrete approximately 2 miles from the mix plant. But the final leg of the route to the site of the new furnace would have been complicated by truck, crossing the plant's trunk rail line, two sets of tracks for cinder and hot metal cars serving existing blast furnaces and also a main trucking thoroughfare.

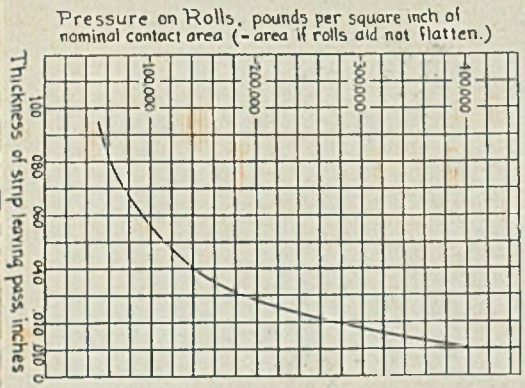
In order to speed up concrete deliveries and avoid periodically tying up other plant traffic as would have resulted if the concrete had been hauled all the way by truck, two temporary ramps with hopper and pumping unit between them were set up at a point inside the plant that could be reached without interfering with other traffic. From this location a 7-inch pipe line was run 400 feet in a direct route to the job, passing under the three plant railways and roadway, and running through one of the plant buildings. A standard 1-2-3 mix with 2 B stone was employed, held in suspension in the hopper by an agitator and forced through the 400-foot pipe line by a pump.

In the first pour for stove and stack foundations 1512 cubic yards of aggregate were poured in 40 hours. Subsequently, 1606 cubic yards for the outside ring of the main furnace base and another stove foundation were poured in 41 hours; 2172 cubic yards for the center portion of the main furnace base were poured in 50 hours and 50 minutes and 758 cubic yards for the skip house and skip hoist foundation, elevator foundation and skip pit footing were poured in 23½ hours.

Fourteen transit mix trucks were employed on the job. The combination of the pipe line and pumping system reduced truck haulage time by more than one half, enabling the work to be done without interruption.



A truck discharges and another arrives in position at pumping unit



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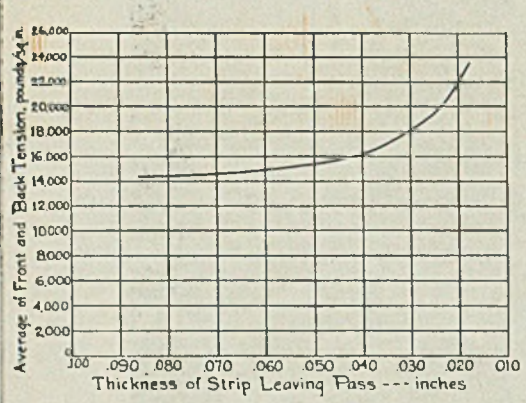

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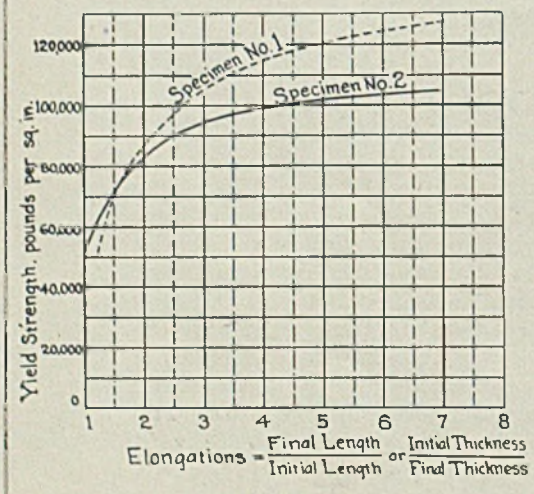

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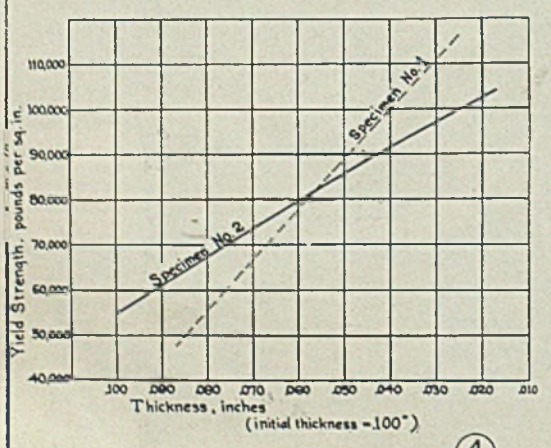

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ROLL PRESSURES

In Rolling Steel Strip

By J. D. KELLER
Associated Engineers,
Farmers Bank Building,
Pittsburgh

IMPORTANCE of being able to predict with accuracy the forces or pressures exerted on the rolls of strip mills need hardly be stated. In mills not yet built but in process of design, such knowledge is important because the durability as well as the strength of the bearings and of other mill parts, and hence the required size of these parts, depends on the magnitude of these forces. In mills now in existence, the question of rolling schedules depends on the drafts which may be taken, and this again depends largely on the allowable forces on the rolls; and although modern mills are equipped with pressure meters, the readings obtained with these may be of little help in planning a rolling schedule for the kinds of steel which have not hitherto been rolled in a given plant, and of which other than small samples are not available.

Two methods have been used for determining or trying to determine or predict these forces. The first consists in assembling all of the measured force data available, and trying to decide therefrom, largely by intuition, what the forces are likely to be in the new mill or under the new, untried conditions. The second method consists in calculations, often highly theoretical and not sufficiently checked by reference to measured data, based on the fundamentals of plastic deformation of materials. Unfortunately there has been a lack of co-ordination between those using the two methods. The line of development, as in other advances, must pass from theory to measurement and from measurement back to theory; and such cross-checking is an all important factor in progress. Engineers cannot rest satisfied with knowledge on a purely empirical basis, as seems to be the case at the present time in respect to roll pressures. Engineers of a certain company, while perfectly competent to design a mill of proportions which have become nearly standard, admittedly felt completely "lost" when called upon to design a mill with rolls much smaller than the standard. The purpose of this article is to show that theory on the one hand and practical data on the other hand can be correlated closely, and that the theory in its present state of development, when thus cross-checked with available measured data, is a reliable guide for predicting the rolling forces to be encountered under novel conditions.

The line of development of the theory is interesting, having had two initially independent but converging branches. One, having to do with the inter-relation between plastic deformation of the metal and friction of the strip on the rolls, passed from Siebel to v.Karman to Trinks. The other, relating to the elastic flattening of the rolls, passed from Hertz and Foppl to Hitchcock to Trinks. The complete method[1] was published in 1937, but to this day few engineers seem to be capable of utilizing it. Some have taken the friction effect into account, but have not allowed for the effect of flattening of the rolls or seem even to understand it. Others have done just the reverse. Probably for this reason, some engineers, notably some of the roller bearing manufacturers, have concluded that "the Trinks method gives too low results, sometimes only 50 per cent of the actual bearing forces," and this erroneous opinion of those who have not taken the trouble to use the method properly, has become somewhat general. In the present article, the proper use of the method will be illustrated by working out actual examples from practice, and comparing them with the actually measured results.

Actually measured forces on the 16-inch diameter work rolls of a cold reduction mill rolling low-carbon steel strip, are given by the curve of Fig. 1, the data for which were furnished by one of

All references are presented at end of this treatise.

Fig. 1—Measures pressures on the rolls of a cold strip mill rolling low-carbon steel. Roll diameter, 16 inches. Fig. 2—Typical values of tension used in cold reduction of strip. (Average of front and back tension). Fig. 3—Variation of yield strength of low-carbon strip with total elongation; showing the effect of work hardening. Fig. 4—Yield strength of cold reduced low-carbon strip in relation to final thickness. (Initial thickness of hot rolled strip, 0.100-inch)

Plan NOW to increase your Blast Furnace Efficiency

While Relining is in Progress

WHEN the time comes to reline your blast furnace, production must stop . . . but it may be possible to more than compensate for this loss of production.

During the shut-down period McKee engineers may be able to increase the capacity and efficiency of your plant by enlarging and modernizing your existing units while the furnace is being relined.

This necessarily requires advance planning so that all engineering is completed and material is available before the furnace is blown out. Thus, relining and alterations proceed simultaneously.

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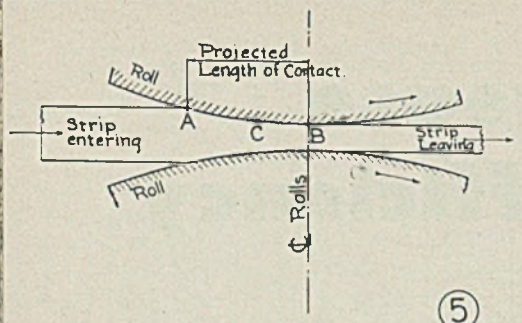

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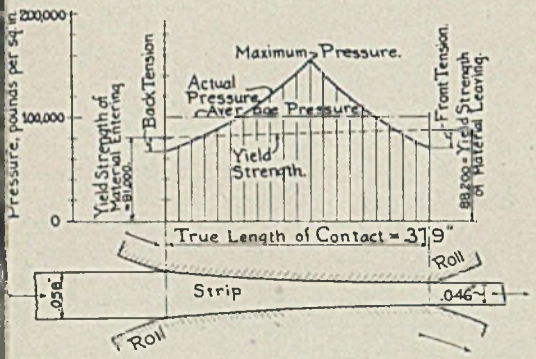

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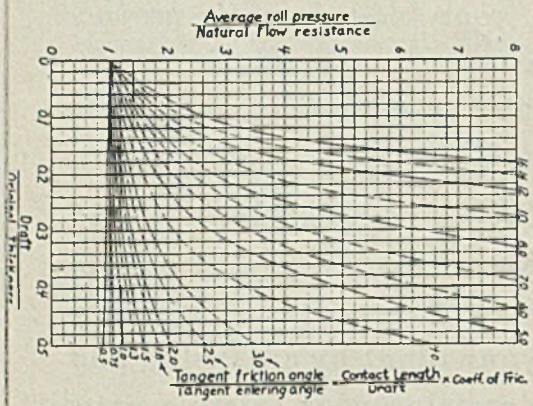

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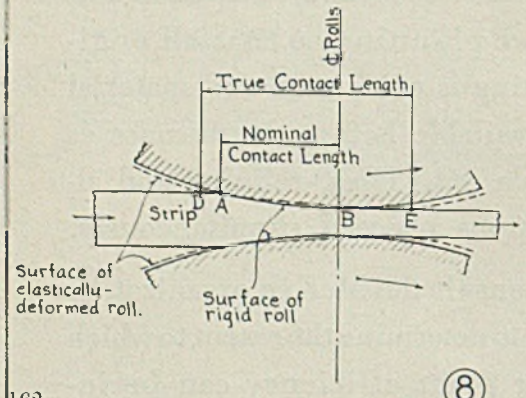

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the mill-building firms on the basis of "number of elongations" but which for convenience have been converted to the basis of thickness of strip, starting with a hot-rolled strip 0.100-inch thick.

Front and back tensions under which the strip was being rolled when the pressure measurements were taken, were not given, but were stated to be "typical." Values of such typical tensions obtained elsewhere are shown in Fig. 2.

To be complete, the percentage reductions per pass corresponding to Fig. 1 should have been given for each pass. These seem to have varied from 20 to 45 per cent.

In order to check, by calculation, the values of roll pressures given in Fig. 1, the following additional items are needed:

1. The yield strength of the strip material being rolled, after various elongations;

2. The coefficient of friction of the strip on the rolls.

In Fig. 3, the yield strengths of two different samples of low-carbon steel strip are given on the basis of number of elongations, and in Fig. 4 they have been re-plotted on the basis of final thickness, starting with hot-rolled strip 0.100 inch thick. The 0.08 per cent carbon steel corresponding to the solid-line curves is believed to be about the same as the material rolled in the mill on which the measurements of Fig. 1 were obtained, and the values of this solid-line curve will be used in the calculations.

The coefficient of friction depends on the effectiveness of lubrication and on the smoothness of the roll surface. Calculations from measurements made some years ago on one of the earliest cold strip mills indicated the low value of 0.04, but later measurements make this appear doubtful. Laboratory tests of polished steel drill rod on cold rolled strip, lubricated, under unit pressures equal to those encountered in rolling, gave values between 0.10 to 0.20 for the coefficient of friction. In the present calculation, the value of 0.105 is used.

Those not familiar with the matter may wonder what the coefficient of friction has to do with pressure on the rolls. The sketch in Fig. 5 may help to explain. The strip comes into contact with the rolls at *A*, is continuously reduced in thickness as it passes through the area of contact, and leaves at *B*. Since the steel does not diminish in volume, and spreads laterally hardly at all, it is evident that the strip must be moving faster and faster as it goes from *A* to *B*. At some point *C* in the contact area, the roll surface has the same speed as the strip (otherwise "skidding" would occur). This means that to the left of *C* (referring to Fig. 5), the strip is moving more slowly than the roll surface and is slipping backward on the latter while to the right of point *C*, the strip is moving faster and is slipping forward on the roll surface. But the frictional resistance to slippage creates tangential forces on the strip surface, acting from *A* toward *C* and from *B* toward *C*, and producing a horizontal compressive pressure in the material of the strip. While not exactly the same fluid pressure, which is transmitted equally in all directions, the conditions in plastic flow are such that this horizontal compressive pressure does increase the vertical compressive pressure which must be exerted by the rolls on the strip, or the resisting force which the strip exerts on the rolls.

For the example to be calculated in detail, pass No. 3 will be taken in a rolling schedule in which the initial hot-rolled strip 0.100-inch thick was cold-reduced to 0.020-inch thickness. In this third pass, the thickness of the strip entering the rolls was 0.058-inch; leaving, 0.046-inch; draft, 0.012 inch; reduction, approximately 20.7 per cent. From Fig. 4, the yield strength was 81,000 lbs./sq. in. for the entering strip, and increased, because of cold working, to 88,200 lbs./sq. in. in the strip leaving this pass. Average tension (Fig. 2) according to usual practice would be 15,600 lbs/sq. in.

Fig. 6 shows the distribution of pressure over the contact area of the strip on the rolls. The form of the two branches of the unit-pressure curve can be worked

Fig. 5—Diagrammatic sketch of region of contact of strip with the rolls. Fig. 6—Distribution of pressure over length of contact of strip with rolls, for the calculated example. Fig. 7—Curves giving ration of average roll pressure to natural flow resistance of the material. (From Trinks' Roll Pass Design Supplement). Fig. 8—Diagram showing increase of contact length by elastic flattening of the rolls

Calculation of Rolling Pressures

Pass No.	Strip Thickness initial	Strip Thickness final	Draft	Contact Length nominal	Contact Length actual	Increase of contact length by flattening of rolls	Average yield strength of material	Avg. tension	Net base pressure	Actual avg. press. calculated for true contact area	Total force on roll/inch width strip	Press. referred to nominal contact area calculated	Press. referred to nominal contact area measured*	Increase of pressure due to friction	Coefficient of friction†
	Inches					%	Lbs. per sq. in.				Lbs.	Lbs. per sq. in.		%	
1	0.100	0.074	0.026	0.456	0.500	9.6	63,000	14,700	48,300	63,300	31,650	69,400	69,000	31.	0.105
2	0.074	0.058	0.016	0.357	0.416	16.5	76,500	15,000	61,500	83,700	34,800	97,400	97,000	36.	0.107
3	0.058	0.046	0.012	0.309	0.379	22.6	84,600	15,600	69,000	101,000	38,300	123,700	123,500	46.	0.105
4	0.046	0.035	0.011	0.296	0.364	23.0	91,200	17,000	74,200	119,500	43 600	147,000	160,000	62.	0.109
5	0.035	0.026	0.009	0.268	0.372	38.6	96,800	19,200	77,600	150,000	55,800	208,000	218,000	93.	0.107
6	0.026	0.020	0.006	0.219	0.380	73.5	100,300	22,000	78,300	206,000	78,400	357,000	273,000	163.	0.097

*Fig. 1. †Corresponding to values of Fig. 1.

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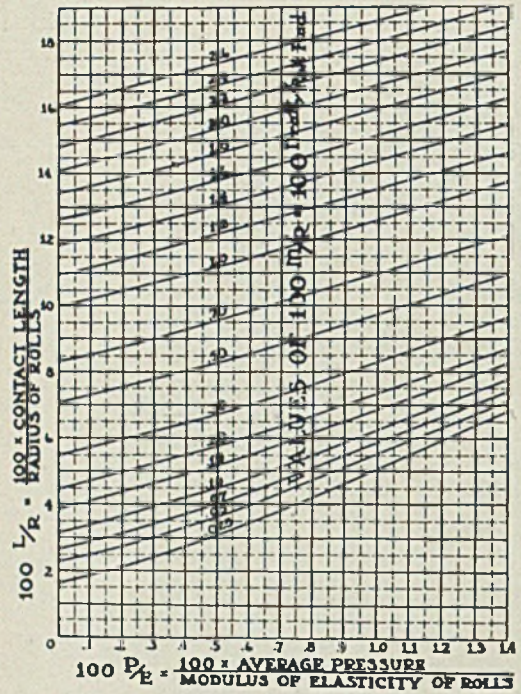

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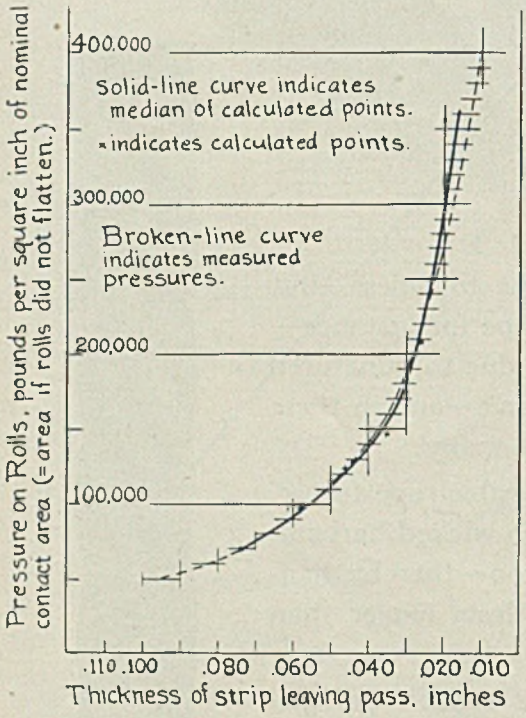

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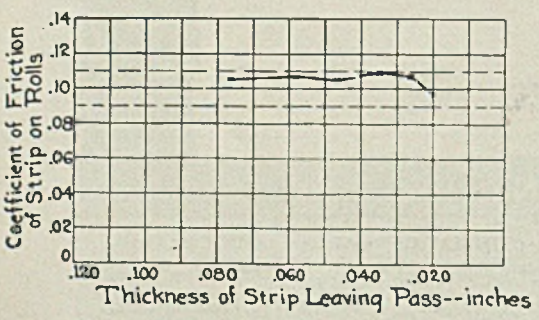

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out by considering the differential equation[2] as a finite-difference equation and performing a step-by-step integration; but recently the equation, first given by v.Karman, has been integrated by Nadai[3], and the latter's equations 53 and 54 may be used. For the present purpose, however, only the *average* pressure is required, and the author has found it much less time-consuming and accurate enough, to take the arithmetical mean of the initial and final yield points and tensions and to use the curves of Trinks' Roll Pass Design Supplement, Fig. S4.

Average yield point, using the values for Specimen No. 2 in Fig. 4, is ½ (81,000 + 88,200) = 84,600 pounds per square inch. Average tension, from Fig. 2, is 15,600 pounds per square inch. Then, from the laws of plastic deformation, the "base pressure" or the average pressure which would exist if there were no friction of the strip on the roll surface, is 84,600 —15,600 =69,000 pounds per square inch.

The nominal contact length of the strip on the roll is as follows:

$$L = \text{draft} \times \text{radius}$$
$$= 0.012 \times 8.00 = 0.309\text{-inch}$$

This would be the actual contact length if the roll were perfectly rigid. Actually, however, the roll flattens elastically, as shown in Fig. 8, so that instead of *A-B* the true contact length becomes *D-E*. To determine this length, it is necessary to assume a trial value of the contact length; find from Fig. 7 the average pressure corresponding thereto; then find from Fig. S61 of Trinks' Roll Pass Design Supplement, here reproduced as Fig. 9, the contact length corresponding to this pressure; compare this with the trial value; and if the two do not coincide, modify the trial value in the indicated direction and repeat the procedure.

For the first trial, the increase of contact length caused by the elastic flattening of the rolls will be taken to be 15 per cent, or the new contact length = 1.15 × 0.309 =0.356-inch.

For use in Fig. 7:

$$\text{Abscissa} = \frac{\text{draft}}{\text{initial thickness}}$$
$$= \frac{0.012}{0.058} = 0.207$$
$$\text{Parameter} = \frac{\text{contact length}}{\text{draft}} \times \text{coeff. of friction}$$
$$= \frac{0.356}{0.012} \times 0.105 = 3.11$$

By interpolation in Fig. 7, the ordinate (or distance in the vertical direction) is found to be 1.42, which means that the effect of friction has increased the "base pressure" 42 per cent, or

$$\text{Avg. press.} = 1.42 \times 69{,}000 = 98{,}000 \text{ lbs./sq. in.}$$

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$$\text{Avg. press.} = 1.42 \times 69{,}000 = 98{,}000 \text{ lbs./sq. in.}$$

For use in Fig. 9:

$$\text{Abscissa} = \frac{100 \times \text{average pressure}}{\text{modulus of electricity}}$$
$$= \frac{100 \times 98{,}000}{30{,}000{,}000} = 0.327$$
$$\text{Parameter} = \frac{100 \times \text{draft}}{\text{radius of roll}}$$
$$= \frac{100 \times 0.012}{8.00} = 0.150$$

Interpolating in Fig. 9, the ordinate is found to be 4.70, and the corresponding contact length:

$$\frac{4.70 \times 8.00}{100} = 0.376\text{-inch}$$

The first trial, namely 0.356-inch, evidently was somewhat too low. Since the effect of an increase is accumulative, the

Fig. 9—Curves for finding the increase of contact length caused by roll flattening. (From Trinks' Roll Pass Design Supplement). Fig. 10—Comparison of calculated roll pressures with calculated pressures of Fig. 1—Coefficient of friction, 0.105. Fig. 11—Coefficient of friction required to replace roll pressures shown in Fig. 1

HOW YOUR ADVERTISING CAN HELP WIN THE WAR

Free Manual tells HOW

90 PAGES OF PRACTICAL HELP Demonstrates, by example, how your advertising, too, can help fight this war; help customers; help build a sound foundation for future business.

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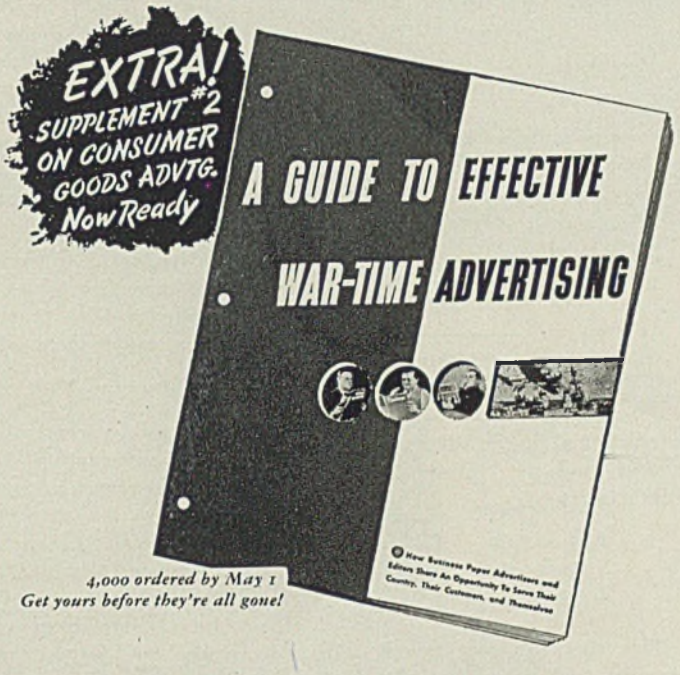


4,000 ordered by May 1
Get yours before they're all gone!

Useful Advertising Needs No Defenders!

We have to use
EVERYTHING WE'VE GOT
to win this war!

Good business papers are multi-purpose carriers that can convey important messages quickly, accurately, economically, to special groups of men with kindred war-time problems.

America, the world's greatest user of these vehicles of communication, has a powerful tool to use against the Axis.

By making the best possible use of business papers, now, we can strike a blow that will be felt across both oceans. "A Guide to Effective War-Time Advertising" will help you do this. One copy is yours for the asking . . . if you'll ask before they're all gone.

After you read this "Guide," you will have a new concept of what advertising can do to help America's war effort and to help your company solve its customer-relations problems, present and future. *And you will know what GOOD "institutional" advertising is!*

The "Guide" features advertisements that show some recognition of the conditions which today have *increased* rather than lessened the need for making business paper advertising *useful, informative* and *specific!* This "Guide," while comprehensive in itself, is only our introduction to a collection of case studies that will constitute a veritable WAR ALBUM. Send for it now and you'll receive additional up-to-the-minute case studies, free, as fast as they're produced.

TWO SUPPLEMENTS NOW INCLUDED!

In the first one a company head tells why his organization uses FOUR separate business paper advertising campaigns *as tools of management* to help solve difficult customer-relations problems under "sold out" conditions.

The second Supplement is Part One of a continuing study of dealers' war-time problems. It reports what distributive people are up against today and illustrates how some consumer goods manufacturers are using dealer paper advertising to speed useful suggestions and practical information that helps solve their mutual problems.

THE ASSOCIATED BUSINESS PAPERS

A national association of business publications devoted to increasing their usefulness to their subscribers and helping advertisers get a bigger return on their investment.

FREE

ASSOCIATED BUSINESS PAPERS,
Dep't. 2764, 369 Lexington Avenue, New York City
Please send, without obligation, my free copy of ABP's latest aid to advertisers, "A Guide to Effective War-time Advertising," including the supplements.

NAME _____

POSITION _____

COMPANY _____

STREET _____ CITY & STATE _____

true value will not lie between the two figures but will exceed the former.

For the second trial, let the contact length be taken to be 0.378-inch.

For use in Fig. 7:

$$\text{Abscissa} = 0.207 \text{ as before}$$

$$\text{Parameter} = \frac{0.378}{0.012} \times 0.105 = 3.31$$

By interpolating in Fig. 7, the ordinate is found to be 1.46, corresponding to an average pressure of $1.46 \times 69{,}000 = 100{,}800$ pounds per square inch.

For use in Fig. 9:

$$\text{Abscissa} = \frac{100 \times 100{,}800}{30{,}000{,}000} = 0.336$$

$$\text{Parameter} = 0.150$$

Interpolating in the chart, the ordinate is 4.74, and the corresponding contact length is:

$$\frac{4.74 \times 8.00}{100} = 0.379\text{-inch}$$

This checks almost exactly with the assumed trial value, hence the latter is correct, as is also the average pressure of 100,800 pounds per square inch of *actual* contact area.

The force exerted on (or by) the roll per inch width of strip, is:

$$100{,}800 \times 0.379 \times 1 \text{ inch} = 38{,}300 \text{ pounds}$$

Referred to the *nominal* contact length of 0.309-inch, the calculated pressure is:

$$\frac{38{,}300}{0.309 \times 1''} = 123{,}700 \text{ lbs./sq. in.}$$

From Fig. 1, for 0.046-inch final thickness of strip leaving the pass, the pressure referred to the nominal contact length is 122,000 pounds per square inch. Hence in this case the calculated figure is within 1½ per cent of the measured force on the rolls.

Similar calculations have been made for the other five passes of the rolling schedule. The results appear in the accompanying table, and also have been plotted in Fig. 10, with the curve of Fig. 1 entered in dotted line for comparison.

Pressure Varies in Final Passes

It will be seen that in the earlier passes the agreement of the calculated with the measured pressure is almost exact, while in the later passes there is some discrepancy. However, when it is remembered that the data for the tension, the yield strength, and the coefficient of friction are from various sources and may not "belong with" the values of Fig. 1, this discrepancy is not surprising. It is in the latest passes, of course, where the strip is thinner, that both the friction and the roll flattening have the greatest effect. As a check, a calculation has been made, by the same methods as used above, to determine what coefficient of friction must exist in each pass, to give the forces in Fig. 1, if everything else remained unchanged. The results are plotted in Fig. 11.

It is interesting to note that in the sixth or last pass, a decrease of less than 10 per cent in the coefficient of friction, namely from 0.105 to 0.097, would be sufficient to reduce the calculated value (see table) of 357,000 pounds per square inch to exact agreement with the measured value (Fig. 1) of 273,000 lbs./sq. in. of nominal contact area.

These results warrant two conclusions: 1. Trinks method of calculating forces developed in rolling gives results which are well within the limits of accuracy required for engineering purposes, provided the data used are even reasonably accurate. 2. In cases where the strip is thin (relative of course to the roll diameter) good judgment is required in the use of the method, because of the large variation in the result which corresponds to a much smaller proportionate change in the friction coefficient, or the yield strength of the material, or the tension.

Various questions have also been raised as to whether the assumptions made in the derivation of the Trinks method are warranted, and whether other factors may not have been overlooked. Thus, the v.Karman differential equation is based on the assumption that the stresses, both vertical and horizontal, are distributed uniformly through the thickness of the strip. This assumption has been shown not to be strictly true[3]; but while the variation of the stress which actually exists will affect the deformation of the

(*Please turn to Page* 198)

100,000,000-Volt Machine Under Construction

A machine which will speed electrons to energies of 100,000,000 volts, and which will produce X-rays of the same power, is being constructed as an addition to the General Electric Research Laboratory, Schenectady, N. Y. Called on "induction electron accelerator", it will give electrons energies far higher than have ever been given by a human agency before, it is reported.

One of the investigations with the equipment, according to the company, will be a determination of the maximum thicknesses to which X-rays can usefully be applied for examination of armor plate and other very thick cross sections. At present 8 inches of steel is the practical limit for convenient use of the present million-volt industrial X-ray unit.

Dr. Ernest E. Charlton, head of the X-ray section of the laboratory, and W. F. Westendorp are responsible for the design and construction of the new accelerator. Its main part will be a huge electromagnet, weighing 125 tons. Because it works with alternating current this could not be made solid. Instead, it is being constructed of more than 100,000 pieces of silicon steel, each 0.014-inch thick. These are fastened together with a special cement to make large steel slabs from which the magnet will be assembled.

At the heart of the magnet, between the 78-inch-diameter pole faces where the magnetic field will be most intense, will be a 6-foot hollow glass "doughnut", inside which the electrons will be speeded in a vacuum. The cross section of the doughnut will be elliptical, 5 inches high and 8 inches across. The wall will be about ¼-inch thick. It will be assembled of 12 molded sectors, which are being made by the Corning Glass Works.

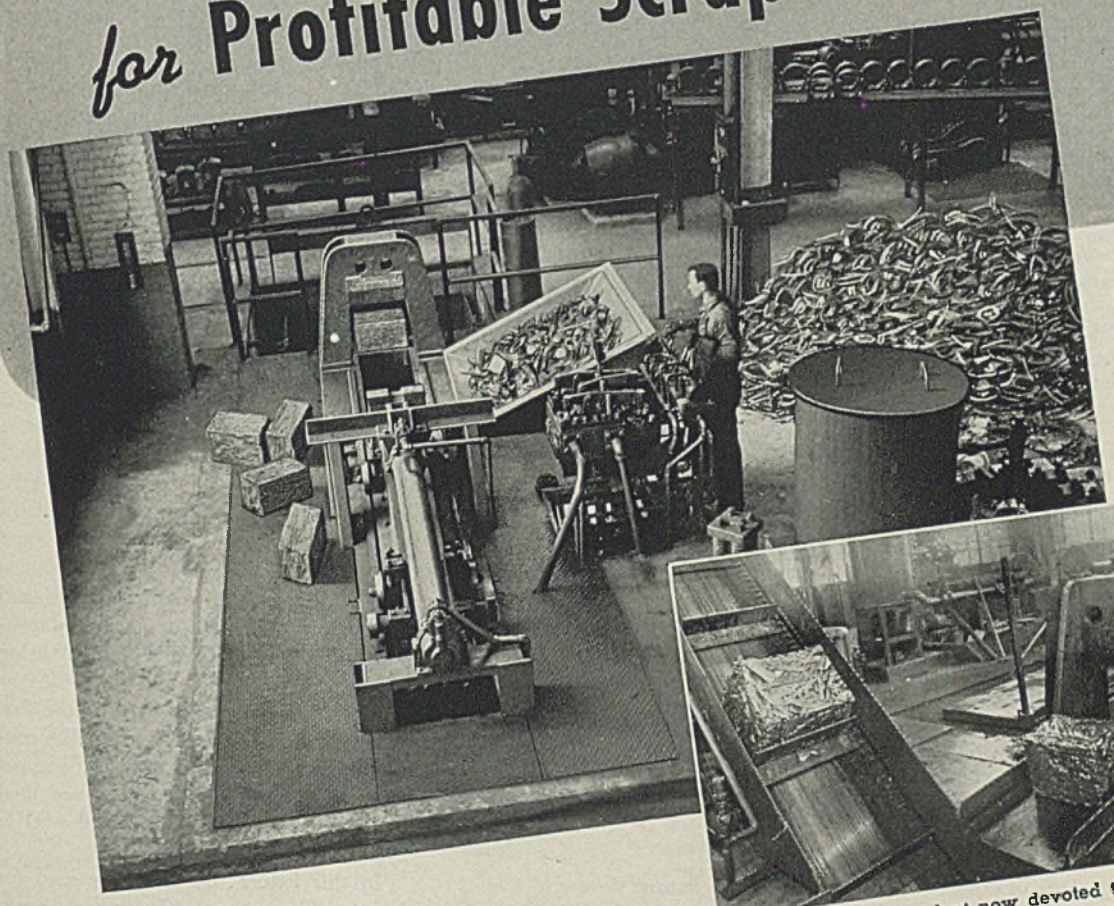
The induction electron accelerator in its principle, according to the company, bears a superficial resemblance to the cyclotron, but it is quite different. The cyclotron speeds positive particles by whirling them around in the field of a powerful direct-current magnet. The particles are accelerated only when they cross the gap between the D-shaped semicircular boxes, inside which they coast in a curved path on the rest of their journey. In the accelerator the electrons are speeded continually, and reach almost the speed of light.

Powerful Deodorant Works Faster

Unusual detergent and disinfecting properties in addition to vigorous deodorizing action are features of a new deodorant, Oakite Deodorant No. 1, recently developed by Oakite Products Inc., 57 Thames street, New York. This three-fold function, according to the company, eliminates many of the steps necessary with single-purpose deodorants and enables the work in the maintenance of plant lavatories, washrooms, locker rooms, rest rooms, etc., to be handled faster.

Solutions are readily prepared by mixing a small amount with cold water directly from the tap, and solution is applied with mop, brush, cloth or sponge.

G-H BALERS *plus* G-H EXPERIENCE *for* Profitable Scrap-Metal Salvage



This installation shows a Model MCY Baler, one of several G-H Hydraulic Balers operating in various Westinghouse plants.

In a leading body plant now devoted to War Production, a conveyor system carries baled metal scrap from the G-H Baler direct to freight cars.

The handling and baling of metal scrap varies in every metal working plant, depends upon the type and volume of scrap produced and the ease with which it may be routed to the baler. The capacity of the baler must be equal to peak requirements. Its power and efficiency must result in bales of maximum density at lowest possible cost.

The efficiency, capacity and durability of G-H Hydraulic Balers, coupled with the vast experience of G-H engineers in setting up efficient scrap-baling installations in all types of plants, is your assurance of a profitable scrap salvage program.

GET IN THE SCRAP FOR VICTORY — BALE IT THE G-H WAY!

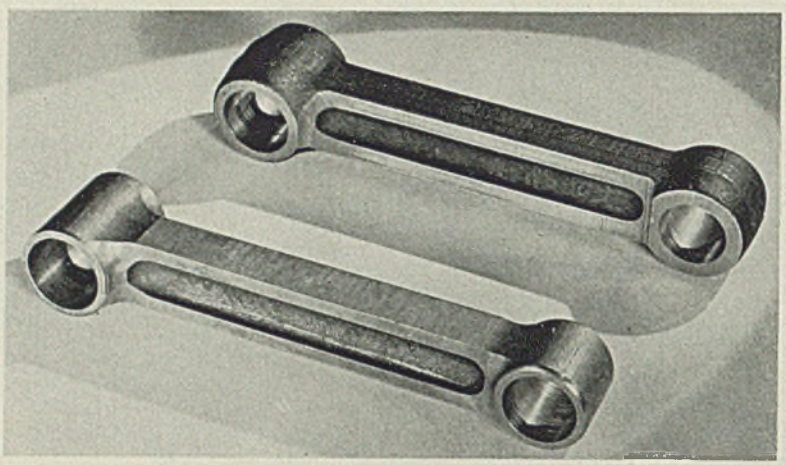
Representatives in Principal Cities

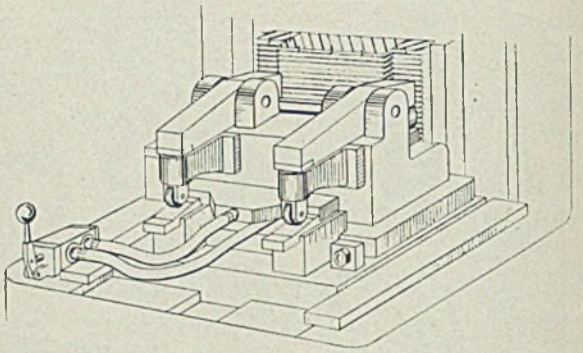
G-H

GALLAND-HENNING MFG. CO.

2747 SOUTH 31st STREET • MILWAUKEE, WISCONSIN

A 3853-1P





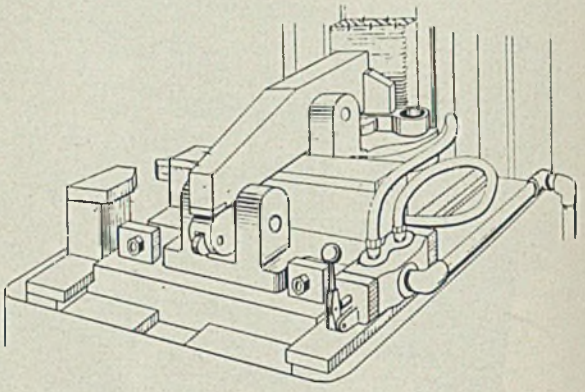


Fig. 1. (Above)—Articulated rod after first pass and drilling. Below, rod after second pass and profiling ends

Fig. 2. (Above, right)—Fixture used in making first broaching pass on both sides of articulated connecting rods

Fig. 3. (Right)—Fixture for second pass using holes for locating piece

BROACHING

Speeds Production of Articulated Connecting Rods

SURFACE broaching all four sides of articulated connecting rods for radial engines in four passes on two machines is one of the recent developments of Colonial Broach Co., Detroit, in reducing materially time required for machining components of engines needed for the war.

With this process only 11 seconds are required for each of the four passes, or a total cutting time of less than three-quarters of a minute, it is revealed. The inserting and removing time to and from the fixtures also is low, due to their quick-wedging design and the type of broaching machine used.

Broached "As Forged"

Parts are broached directly from the "as forged" condition on a 10-ton 66-inch stroke single ram machine. Two fixtures, one for broaching the sides parallel with the hole openings and the other for the sides which run into the profiled cylindrical outer surfaces of the rod ends, are used.

Sequence of operations is as follows:

Before holes are drilled in the ends of the rods, the fixture shown in Fig. 2 is used. In the first pass the broach faces the entire surface including the flats for the holes. Then, using a different set of locators, the piece is turned over and the similar face on the opposite side is broached.

Removes 3/16-Inch of Metal

Approximately 3/16-inch of metal is removed in each pass, the amount varying due to differences in the size of the rough forgings. Because of the heavy pressure exerted on the piece, tending to make it turn or slip in the fixture, double wedge-cam type clamps are used. The clamps are V-shaped with serrated surfaces where contact is made with the large end of the rod. The Vs serve to locate the piece in the fixture. The clamp for the small end is flat and also serrated for tight clamping effect.

To obtain uniform clamping force even though the size of the forging may vary, ample clamping space is provided and the roller-type cam followers are mounted on ball bearings. The wedges also slide on ball bearings.

A third factor in holding the piece tightly is that the hydraulic pressure used to operate the clamps is applied continuously while the piece is being broached.

After broaching the faces in the first fixture, the pieces are drilled. The condition of the piece is shown in the upper view in Fig. 1. The pieces are then mounted in the fixture as shown in Fig. 3.

In this fixture the holes are used for locating the piece. The broach again removes approximately 3/16-inch of metal along the faces, but is tapered away from the piece at the end of the flat surface to allow for a succeeding profiling operation around the rod ends. The piece is then turned over and, using different locators, is broached on the opposite face. The ends are then profiled and appear as shown in the lower view of Fig. 1.

High Clamping Force

The fixtures are mounted on receding tables of the hydraulic cam lock type for quick loading. Clamping also is hydraulically controlled, the cylinders operating the clamps, especially those used in the first operation, being designed to provide the high clamping force mentioned above. In combination with the wedge cams, it is possible to exert enough force to push the serrated clamps of this fixture securely into the surfaces of the piece. And with the continuous application of this force during the broaching operation, no difficulty from slipping in the fixture is experienced.

New Interest Develops In Brazilian Manganese

Latin American manganese is assuming increasing importance to the United States as a result of the effect of the war in the Black Sea and Indian Ocean upon chief prewar sources, Russia and India, according to Department of Commerce officials. During the last war, Latin American producers assisted in overcoming a manganese shortage here, and it is expected that a keen interest will develop again in the development of manganese mining in the Western Hemisphere.

Most important Latin American producer of manganese is Brazil which also has best prospects for further development. Manganese is found in a number of Brazilian provinces, but has been developed only in Minas Geraes, Bahia and Matto Grosso. The latter two groups of mines have been idle for ten years and the Minas Geraes have been worked far below capacity.

Exports of manganese ore from Brazil in 1940 amounted to 217,300 metric tons, compared with 254,000 tons in 1937 and the record high of 542,000 tons in 1917. Repetition of the 1917 production record is conditioned upon bringing developed mines back into production, doing further development work, and improving the rolling stock of the Brazilian Central Railway, which transports the bulk of the ore to Rio de Janeiro.

Wire Wholesalers Covered by P-82

(*Concluded from Page* 106)

ble and cable accessory wholesalers.

"Compelling reasons dictate that wire and cable wholesalers be subject to Revised Price Schedule No. 82, rather than Maximum Price Regulation No. 136, as amended," he added. The base date for manufacturers under Schedule No. 82 is Oct. 15, 1941, while the base date in Regulation No. 136 for most manufacturers and wholesalers is Oct. 1, 1941.

"Thus, if this amendment were not issued, manufacturers of wire and cable would be permitted to base their prices on Oct. 15, but their wholesalers would be forced to base their prices on Oct. 1.

"As many manufacturers had increased their prices in the interval between Oct. 1 and Oct. 15, and as Schedule No. 82 permits an adjustment of Oct. 15 prices for increases in the price of lead and for solid copper weatherproof wire, the retention of an Oct. 1, 1941 base date for wholesalers would work an obvious injustice."

Following exemptions have been established by the amendment:

1. Sales and deliveries of wire, cable and cable accessories under "developmental" contracts in connection with the war program.

2. Sales and deliveries under "secret" war contracts.

8. Purchases made by the United States government under emergency conditions also are exempted, although a report of the emergency sale or delivery must be filed with OPA if the transaction involves $500 or more. The report must state the circumstances necessitating the purchase at a price exceeding established maximums.

The foregoing exemptions are to apply not only to the United States, but also to governments receiving lend-lease assistance.

Hand-Operated Tools for War Plants Placed Under P-136

Hand-operated tools especially designed for manufacture, repair or maintenance of aircraft, military vehicles and other predominately military equipment have been placed under the provisions of Maximum Price Regulation No. 136, as amended, (machines and parts and machinery services).

These tools previously were covered by Maximum Price Regulation No. 188 (manufacturers' maximum prices for specified building materials and consumers' goods other than apparel), or the General Maximum Price Regulation.

Hand-operated aircraft and other military tools are constantly subject to change in design. Transfer of these tools to Regulation 136 will permit determination of maximum prices under a formula which takes such changes into account, but which will retain prices at approximately March, 1942, levels. Many of the tools are produced in the same shops as jigs and fixtures already governed by Regulation No. 136.

Specially designed hand-operated aircraft and other military tools are placed under Regulation 136 through amendment No. 15 to the regulation, which becomes effective on Sept. 9, 1942.

Wing Tips

(*Concluded from Page* 102)

vite the public and a group of nationally-known people—including a few generals and admirals if possible—to attend and take part in the ceremonies.

Afterward roll up your sleeves again, keep pushing and some major assemblies for that dive bomber will begin to take shape in the jigs. If you all pull together, several of the production bombers will appear on the final assembly line, and before you know it, you will be over the hump. Parts and assemblies from your many subcontractors will begin to flow in and each day will see production increasing.

All this, of course, must be accomplished in about a year's time, and then you will be set to receive the Army-Navy E. When these ceremonies have been concluded, all you need do is to sit down and worry about receiving enough aluminum, or to wake up one morning and find the powers that be have decided your ship doesn't have enough ceiling or rate of climb or firepower or armament and that the whole thing had better be redesigned.

OPA Co-ordinates All Fuel Rationing in New Division

All fuel rationing activities have been reorganized as a new division of OPA.

Director of the new division is Joel Dean, who was chief of the former Fuel Rationing Branch. Mr. Dean has been in charge of the gasoline rationing program since its inception.

The assistant director of the new division is Wallace S. Sayre, who was chief of the Operations Section of the Fuel Rationing Branch.

The new division will have three operating branches: Gasoline, Fuel Oil, and Industry Relations.

Chief of the Gasoline Rationing Branch is John R. Richards, formerly associate chief of the Fuel Rationing Branch.

John G. Neukom is the new chief of the Fuel Oil Rationing Branch. He came to Washington last spring to serve with Mr. Dean as chief of the Operations Section of the Fuel Rationing Branch.

Paul R. Baugh, chief of Industry Relations Branch, joined OPA last March to head up trade relations activities in the fuel rationing branch.

Refrigeration Coil Assembly Specifications Established

To save copper, zinc, tin and other critical materials, the Director General for Operations has issued an order setting forth manufacturing specifications for coil or tube assemblies for refrigeration condensers or coolers.

Schedule of specifications, which becomes a part of Limitation Order L-126, limits the use of nonferrous metals, the weight of ferrous metals and the percentage of materials which may be used as a coating or bonding material in the manufacture of coil or tube assemblies.

It is estimated that the rigid specifications will result in the saving of approximately 40 pounds of copper per ton of refrigeration capacity. Based on production figures of 1941, this would mean an annual saving of at least 3100 tons of copper, in addition to further savings in steel, zinc and tin.

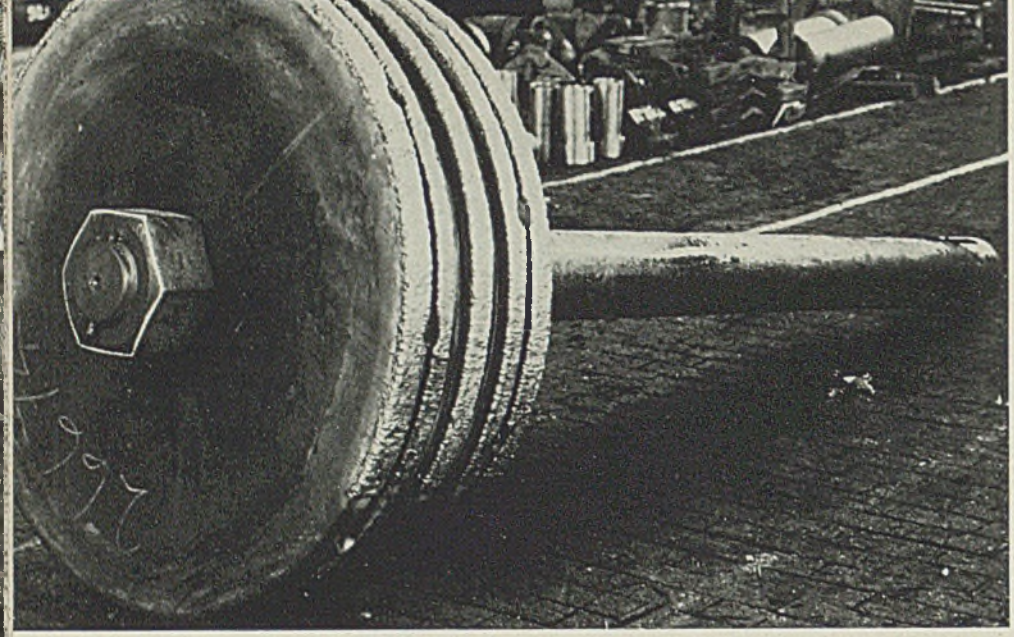


Fig. 1. (Upper left)—This worn piston from a blooming mill engine has been built up approximately two-thirds of its circumference. About 90 pounds of bronze was applied, using the oxyacetylene welding process

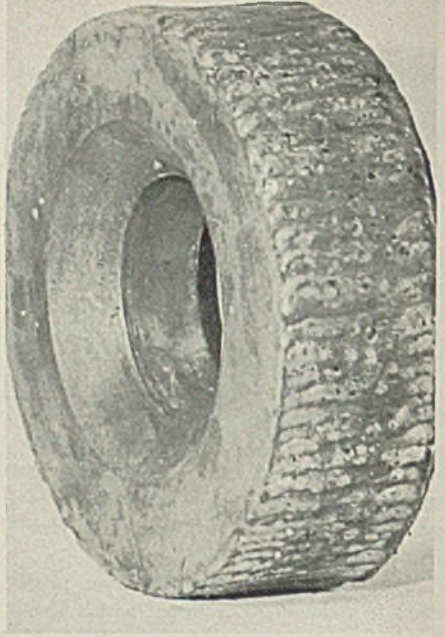


Fig. 2. (Upper right)—Here is a brick-grinding roll that was hardsurfaced by applying a layer of Silfram for corrosion resistance and toughness. To get longest service, the hardsurfacing material must be chosen to fit the working conditions

BUILDING-UP and HARDFACING

In Mill Maintenance

By SCOTT D. BAUMER
Steel Mill Representative
Air Reduction Sales Co.
New York

IN ANY discussion of steel mill maintenance problems, undoubtedly the most important topic is the constantly recurring need to rebuild or restore parts which have become badly worn. The wearing down of moving parts must be handled properly or it may upset both the economy and production of the mill. Since the full benefits in terms of extended service of rebuilt parts are not always obtained, either because of improper selection of overlay material, or because the correct welding process is not used, a discussion of the factors affecting these choices is particularly important at the present time.

Reclamation of worn parts is an especially pressing problem today because replacement parts are difficult to obtain. But one worn part may cause excessive wear of associated parts. The entire problem of restoration is now seen in a new light, and as a result, maintenance departments are beginning to plan their work accordingly. To take a simple example:

The reclamation of a badly worn coupling box once a question of whether the cost of rebuilding would be justified by the additional service obtained. When the economical aspect of such restoration was established, the actual rebuilding operation was frequently put off until the coupling box was well worn. The same problem today is considered from the standpoint of not only the worn coupling box, but also the spindle, gears and pinions which would receive unnecessary batter and wear, and which must also be conserved for maximum length of service. Hence, the restoration of worn wabblers and coupling boxes is planned as a routine operation, to be performed when the parts are only moderately worn. An incidental benefit of such planned effort is a reduction in

Fig. 3. (Lower left)—A heavy-duty screen used for sizing slag is protected against severe abrasion by application of hardsurfacing material as shown here

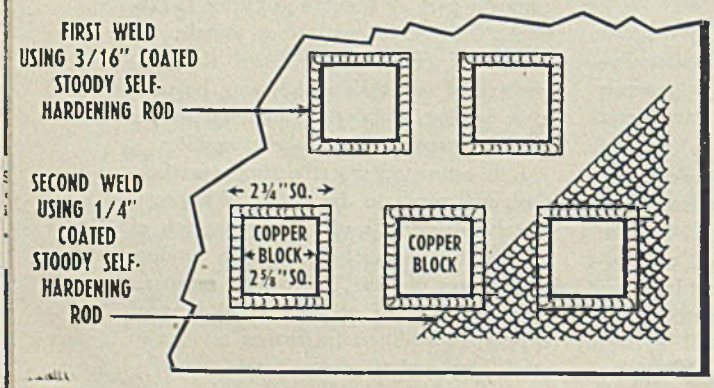
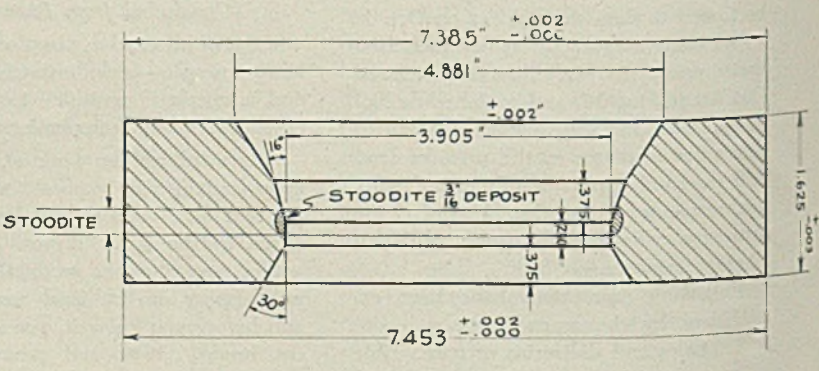


Fig. 4. (Lower right)—Hardsurfacing at the point of greatest wear can increase service life many times. Some hardsurfaced dies like this draw ring have lasted 2400 drawings



It's healthier on the Attacking Side

Whether you're fighting a Jap 5 miles up or tackling a problem in the shop . . . it helps a lot to have the jump on your competitor.

ALTER EGO: True as gospel. Competition forces progress. We've changed over to welding of ships, planes, tanks and guns. Why? Because the Axis had a head start in designs and output. They *forced* us to make 'em better and build 'em faster.

Imagine that! It took a threat to our very lives to drive home the necessity of converting old methods to new!

ALTER EGO: But have we learned our lesson? Will we be content to plod along after this scrap is over? As for me, I'm going to convert now to the offensive for tomorrow's Battle for Business.

That's the spirit! Let's take off our rose-colored glasses and put on our reading glasses. Let's learn all about welding so we can get the jump on competition.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

ALTER EGO: Literally, "one's other self"— the still, small voice that questions, inspires and corrects our conscious action.

Photo Courtesy: Lockheed Aircraft Corp.

long-term cost of the build-up welding, since less preparation and weld metal are required.

The advantages of building-up and hardfacing are so well known that it is unnecessary to say more than to point out that two of these advantages are doubly significant today. First, the extra service life obtained from reclaimed or hardfaced parts permits reduction of inventories of replacement parts, and reduces demands upon foundries which may be unable to supply replacements at the time or in the quantities needed.

Second, with uninterrupted production now a vital necessity, the fact that hardfaced parts outlast ordinary parts 2 to 20 times means that the time lost during shutdowns for replacement is considerably reduced, since fewer shutdowns are necessary. Moreover, a higher average of mechanical efficiency is maintained with slow-wearing hardfaced parts than with ordinary parts which become less effective when worn.

Selection of Material: In choosing the proper material to deposit in building-up or hardfacing, it is essential to thoroughly study the conditions under which the part works. Important as this is, it is sometimes overlooked, and it is not uncommon to find a hardfacing material used because of its high hardness, when resistance to impact would be a more essential requirement. A good rule to follow in selecting rod for general building-up purposes is to use a material similar in analysis to that of the base metal: If the base metal is soft and subject to abrasion and impact, the building-up material should be a type which will give greater support or stiffness and also provide a good base for the overlay.

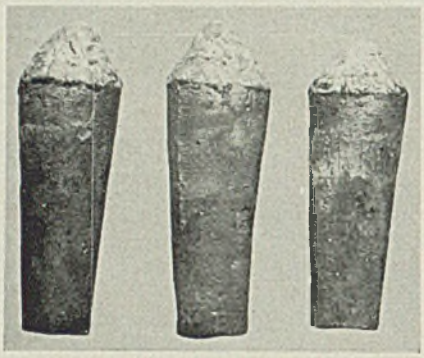


Fig. 5—Crane tong bits, hardsurfaced and ready for grinding. The use of hardsurfacing in this application increases the life of the bits 15 to 20 times—an extremely paying proposition

Medium carbon or low alloy steels are generally suitable for this purpose. Where the part is not subject to abrasion, as for example a lubricated sliding member such as a piston head, the build-up material may be a corrosion-resistant manganese bronze. The oxyacetylene torch should be used for this operation, since this method of deposition allows extremely accurate control of the rate of metal deposit, thickness and smoothness.

Reclamation of worn piston heads by building-up with manganese bronze is a successful operation of long standing among the railroads, and more recently has been adopted as standard practice in steel mills. The surface of the piston is prepared for brazing by cleaning off all oil and grease. It is sometimes advisable with cast iron pistons to grind or sand-blast the surface to remove oil which has penetrated into the metal. Mounted on rollers for easy positioning, the piston is preheated to 400 to 600 degrees Fahr. and the worn area, usually two-thirds of the circumference, is built-up with weld metal. Properly done, this restoration gives an added span of life to the piston, longer than its original, and increases by about three times the life of the cylinder before reboring is required.

Choice of Process: Selection of the welding process to be employed in hardfacing deserves careful consideration. It is entirely possible and occasionally happens, that the correct type of hardfacing material is used but the finished work is unsatisfactory due to improper selection of gas, arc, or carbon arc for depositing the overlay. The oxyacetylene torch is preferred for applying manganese bronze to malleable or cast iron, or when building-up with cast-iron filler material; for building up nonferrous metals. The close control obtainable with the torch is an important advantage both for securing a smooth deposit and for controlling the degree of penetration.

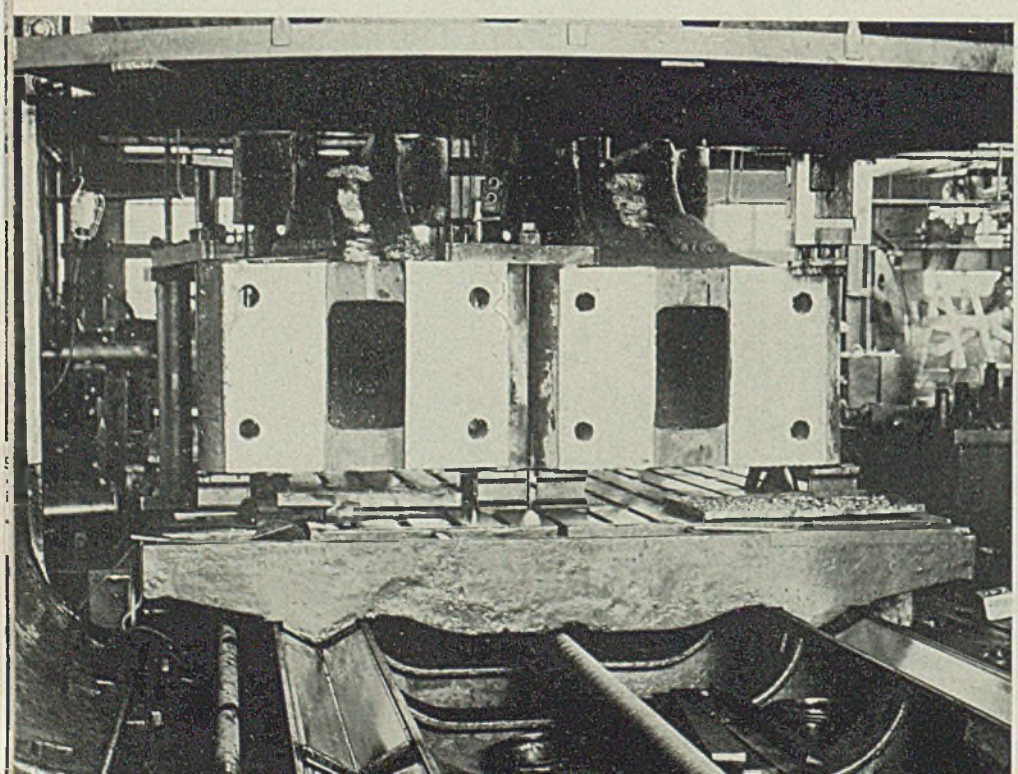
Certain hardfacing materials must be sweated on without inter-alloying with the base metal, while others are deficient in iron and must be puddled to produce the desired composition and characteristics in the overlay. This method also permits elimination of blowholes and the floating off of scale and foreign particles. Corners and sharp edges can be hardfaced readily, thus reducing grinding and finishing costs.

The metallic arc process is advantageous in speed of metal deposit and in localized control of heat, which is necessary to prevent warpage and undue stresses on parts having both light and heavy sections. The wide selection of rod analysis, flexibility, and ease of working in confined places are also in the favor of the metallic arc process.

The carbon arc, although much more limited in application, is nevertheless the preferred process for certain building-up operations. It is frequently used as an alternative to gas or arc welding, as there is considerable overlapping of applicability of the three processes. In a specific case the welding foreman may decide in favor of the carbon arc as being quicker or less costly. Some of its uses are building-up worn brass or bronze mill guides and cast iron wabblers, filling up holes in copper chill molds from induction furnaces and copper welding of heavy sections.

(Concluded Next Week)

Fig. 6—The ends of this hammer housing became worn under the constant battering received in operation. The frame is shown after the ends had been built up by hardsurfacing and with the frame on its side, ready for machining



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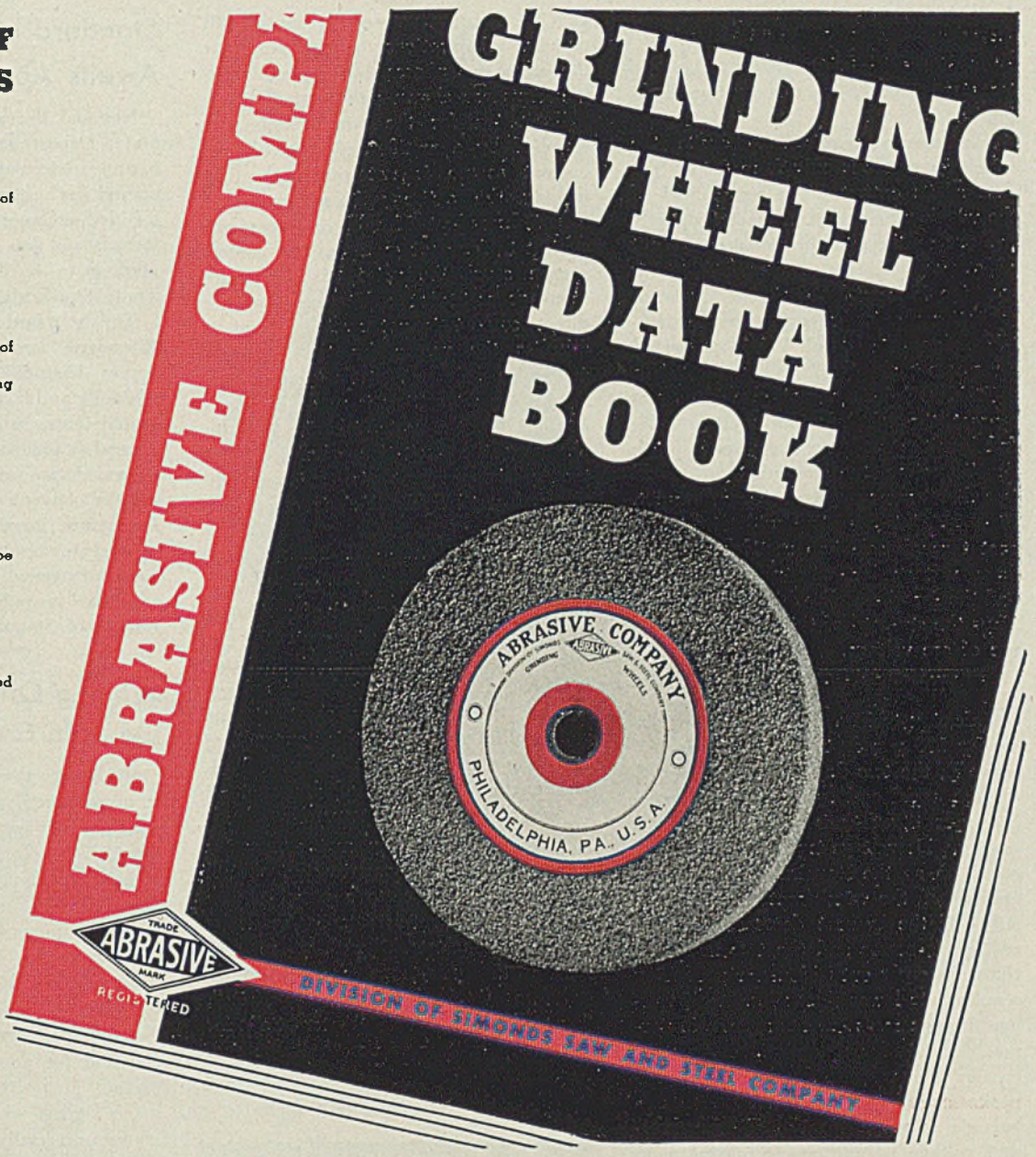

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Furnace Control Method

(*Concluded from Page* 150)

tor stops quickly by regenerative braking.

The energy required to excite the winch generator is only from 3 to 5 per cent of its output. The shunt field of the winch generator is connected directly without contacts to the armature output of a small Regulex exciter, *RA*. This machine is specially designed for small excitation requirements and has two control fields *CF-A* and *VF-A* connected to oppose each other.

Field *CF-A* is energized with direct current through selenium rectifier, *AR*, fed from the current transformer in phase *A*. Therefore, the strength of this field is a direct measure of phase arc current. Field *VF-A* is energized with direct current through selenium rectifier, *VR*, fed from voltage between phase electrode and the furnace shell, which is grounded. Thus the strength of this field is a measure of arc voltage.

Winch Motor at Standstill

Referring to Fig. 5, with the Regulex set for 100 per cent current, at point Z curve B, the two fields *CF-A* and *VF-A* will be equal and opposed. The measured quantity thus is actually arc watts energy. No voltage is present under this condition on the Regulex or winch generator, and the winch motor is at standstill. If the current decreases the arc voltage increases and the two fields are thrown sharply out of balance producing a voltage to lower electrodes. This voltage disappears as current returns to normal. In similar manner if current increases the voltage decreases and opposite action takes place. If the unbalance is maximum the winch generator voltage is built up to maximum to give the maximum speed the motor will deliver. Connections are the same for the other two phases, but so save complications are shown only partially.

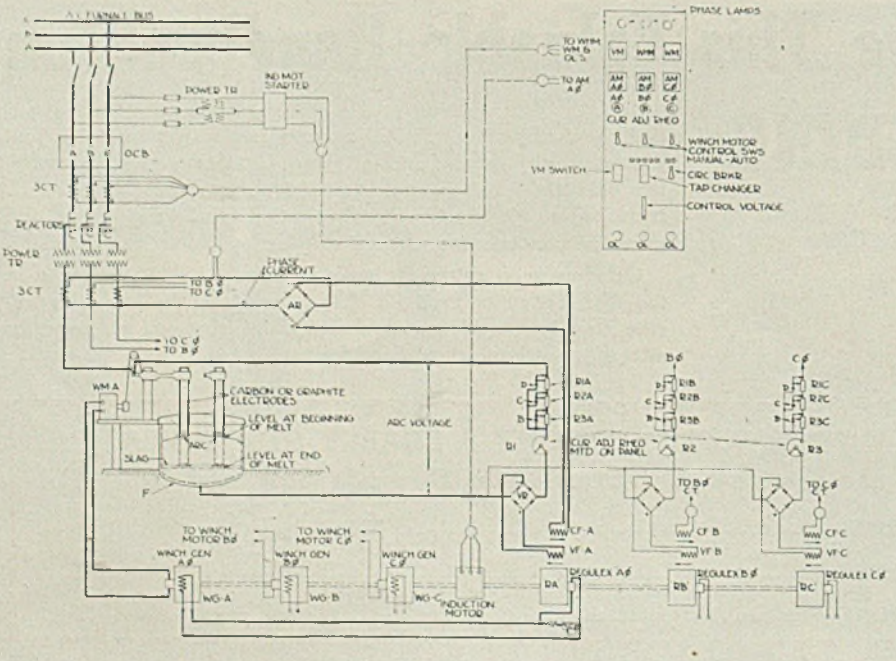
Excitation for the winch motors is supplied by a rectifier, if other direct-current source is not preferred, thus making the entire unit self-contained and independent of mill or crane bus subject to frequent grounds. The control system saves the price of a separate motor-generator set and its control where direct current is not available and it supplies the power for the electrode motors as well as controls them.

The current setting is made by rheostat *R1* in the potential circuit. By changing the excitation of field *VF-A* the phase current is automatically changed until field *CF-A* is equal and opposite.

Four voltage positions normally are provided on the transformer tap changer. On the highest voltage all of resistance *R1A*, *R2A*, and *R3A* in the potential circuit are connected. When the circuit is changed to the next lower voltage contact *B* automatically short circuits resistor *R3A* so that on this new voltage the current setting is not changed. Similar function is performed by contacts *C* and *D* for other voltages.

Besides the Regulex motor-generator set and rectifier accessories the control consists of an operator's panel shown in Fig. 2. Current settings are made by adjusting rheostats 6 and phase ammeters 5. Electrode motor control switches 7 have positions "Raise", "Lower", "Off", and "Automatic" for individual control of the electrode motors.

Fig. 6—Circuit for controlling electric arc furnace operation



Standard on Tap Drills Awaits Approval

National Bureau of Standards, United States Department of Commerce, Washington, is circulating in the industry concerned for written acceptance a recommended commercial standard for screw threads and tap drill sizes, TS-3310, according to R. T. Friebus, Division of Trade Standards.

The standard combines and revises "Standard Screw Threads and Special Screw Threads", commercial standards CS24-30 and CS25-30, in line with essential tables in handbook H28, "Screw-Thread Standards for Federal Services", to provide an accepted, up-to-date standard for convenient use in shops and for acceptance inspection. It is being circulated to producers, distributors, and users of screw threads for acceptance as a basis for publication by the National Bureau of Standards.

Whiting Offers Manual On Safe Crane Operation

Realizing the drain on manpower from industrial accidents is especially serious in wartime, Whiting Corp., Harvey, Ill., is offering for free distribution a printed manual and display posters designed to help establish safe standard practices in crane operation. It contains rules for the guidance of crane operators and hookers-on and for men working in the crane operating area.

Colored posters for use in the crane cab and for general display in the operating area give the standard set of crane signals which have been adopted almost universally. Copies of the manual and posters may be secured by addressing the company.

Develops Substitute Babbitt Metal

Good babbitts are now available in spite of the tin shortage, according to National Bearing Metals Corp., St. Louis, which recently placed on the market a new tin-saving "Rex" babbitt metal.

By developing a completely new base, the company is able to bring the composition of the new babbitt metal within the government's tin limitation order, with a minimum sacrifice of tensile and compressive strengths.

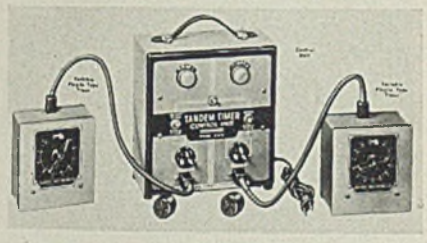
Rigid tests indicate the metal will stand up as a substitute for high-tin-base babbitt, for most present uses, if the lining is properly applied and the bearings are carefully fitted and lubricated.

Timing Device

Industrial Timer Corp., 113 Edison place, Newark, N. J., is offering a new Tandem Timer timing device embodying versatile features of particular value in production departments, laboratories, and for life testing of electrical apparatus. It is said to permit practically any timing sequence that may be desired.

Device is essentially a control unit with two individual and variable plug-in type timing elements. With the timing elements adjusted to their correct respective time intervals, each cycle of operation will follow the other continuously in regular sequence. When the timer dials are once set at the time interval desired, further adjustments are unnecessary until a new sequence is required, according to the company.

Automatic reset features of the timer makes a continuous, as well as a single

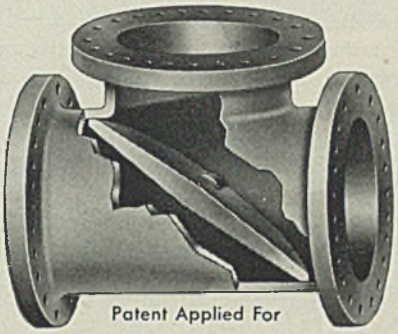


cycle of operation possible. Also plugging in of different timing elements is accomplished in a matter of seconds. Control cabinet of the device measures 8½ x 8½ x 5 inches and contains the "On" and "Off" toggle switch, repeat and single-cycle toggle switch, single-cycle start push-button switch, pilot lamps, receptacles, and sockets into which are plugged the two timing elements which control the single-pole double-throw load relays. Contact circuits of the load relays are unpowered so that they may be powered with the particular voltage and current necessary for test or production requirement. Load relay contacts are rated at 110 volts, 10-amperes alternating current. Elements are synchronous motor driven, automatic resetting timers, of sturdy design and construction, contained in a formed steel box which measures 5 x 5 x 3 inches. A graduated dial and pointer knob allows quick and accurate selection of timing period.

Butterfly Valve

R-S Products Corp., Wayne Junction, Philadelphia, is offering a 3-way butterfly valve for mixing and quick interchange. It is adapted to fully automatic control by means of an air-diaphragm motor or hydraulic cylinder.

Of cast steel or cast iron, the valve handles pressures up to 600 pounds per square inch. Special feature of the

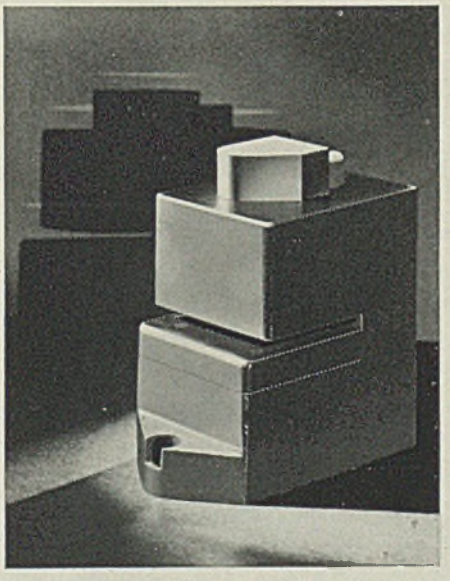


unit is the self-cleaning double-beveled streamlined vane. It seats wedge-tight against the body producing a tight shut-off as well as positive control of volume and pressure. When placed in inaccessible locations, a reach rod with de-clutching unit is provided for automatic operation or manual control in case of power failure.

Notching Unit

Strippit Corp., 1200 Niagara street, Buffalo, is marketing a new Wales notching unit for notching aircraft bulkhead clearances and similar notching operations. It features the same characteristics as the company's hole punching units now in use.

Nothing is attached to the unit's press



ram. A self-contained holder maintains constant punch and die alignment. Top portion of punch fits into notches in the templet for instant resetting and removing from rails, templets or T-slotted plates. The notching units, set up in series, can be used for every size and shape bulkhead. Standard and irregular notching patterns are notched in one stroke of the press ram.

Steel Floodlight

Lighting Division, General Electric Co., Schenectady, N. Y., is marketing a new all-steel L-66 floodlight featuring a socket housing and reflector that is die-formed in one piece. It is designed to take a 200-watt bulb and provides a wide beam of light which can be pointed in any direction by means of the 2-jointed shaft upon which the unit rests.

The floodlight is designed to provide

inexpensive outdoor illumination. It is particularly adapted to dock, platform and airport lighting and for speeding up night work.

Electric Timer

Philco Corp., Tioga and C streets, Philadelphia, has introduced an automatic electrical timing device arranged to close an electrical circuit after the expiration of a pre-determined time. It also can be adapted for opening a circuit by simply reversing the position of the mercury switch element.

When used on alternating current circuits, the unit has a capacity of 1200 watts, sufficient to control a 1-horsepower motor of the repulsion induction type. Setting merely requires the turning of a knob to the time the switch is to operate. A series connector with 5 feet of heavy-duty cord is supplied to simplify connections to plug-in types of electrical equipment.

One-Man Crane

Osgood Co., Marion, O., announces model 805WM Mobilcrane the latest addition of one-man, one-engine oper-

ated cranes mounted on pneumatic rubber tired wheels to its line cranes. Air power controls all of its operating functions.

Independent travel, independent boom hoist, extra wide chassis, 18 rubber-tired wheels, hydraulic steering, and air brakes include advanced features. Extra width of the chassis, and the use of 18 wheels, (12 at the rear, 6 at front) make it possible to lift loads up to 30 tons over the side of the machine as well as the ends, or carry the load to the desired location.

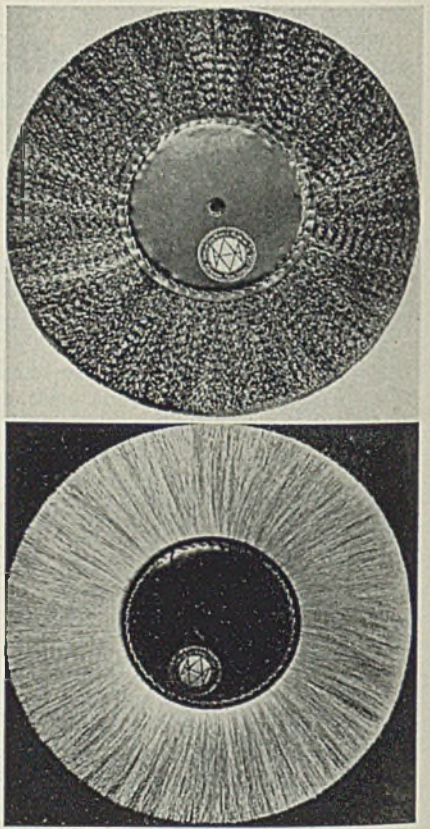
The use of outriggers is eliminated. The tandem rear-wheel drive unit, which consists of a chain case and cover carrying 6 wheels, 3 forward and 3 back, with four on the outside of the chassis, and 2 inside, is arranged to oscillate up and down.

The front axle supports three wheels on each side, with the axle suspended in a saddle block. Brakes are operated by air, and can be set with the cab in any position over the wheels. The swing and travel clutches on the horizontal reversing shaft in the upper body are operated by Twin Disc clutch, and controlled by air. Independent boom hoist of the crane is mounted in the upper part of the gantry. The cab is of modernized design, giving full vision.

Wire Brushes

Hanson-Van Winkle-Munning Co., Matawan, N. J., has developed new types of Stapl-bond wire brushes and Tampico brushes for cleaning, polishing and finishing metals. To remove metal, these are equipped with fiber flanges.

According to the company, the fiber flanges on the Tampico sections allow brushes to be used for either wet or dry work. The steel wire sections, one of which is shown in upper part of illustration, are recommended for cleaning, polishing and heavy brushings on steel, brass and other metals, rubber, gear teeth and castings, and for removing rust, scale, corrosion, dirt and paint. They are of especially tempered, high carbon, crimped steel wires, held in



place by heavy twisted steel wire welded fiber flanges which are fastened together with hard tinned steel wire staples.

Each section is compactly filled and the wires stand out stiffly to give a uniformly sharp scratching surface. Also, each section is approximately 3/8-inch thick, and is mounted directly on a shaft without the use of a hub.

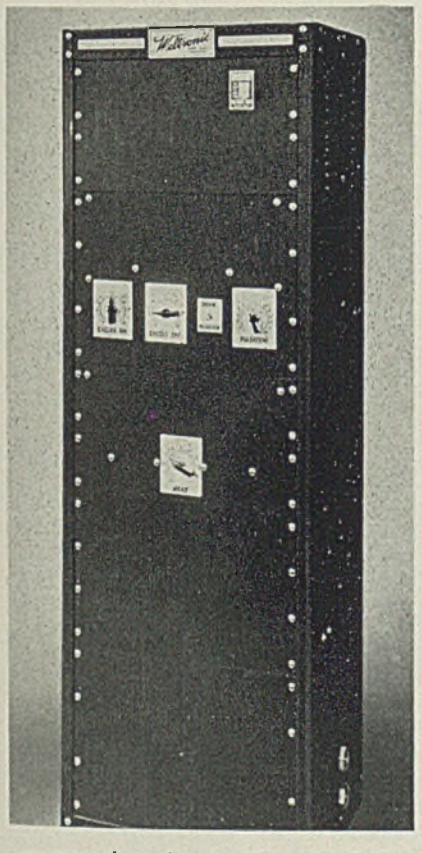
The Tampico sections, see lower part of illustration, are used by metal finishers for polishing and buffing operations. They are of heavily filled, medium grade white Tampico fiber, which is evenly distributed in the brush by hand

on special machines, and held in place by a triple ring of wire which locks the fiber. Their fiber flanges also are fastened together with hard-tinned steel wire staples.

Each section of these brushes has a dense face for efficient performance and is a complete wheel, designed to be mounted directly on a shaft without use of adapters or hubs. Also any desired arbor hole can be incorporated. Each section is about ½-inch thick.

Seam Welder Control

Weltronic Corp., 3080 East Outer drive, Detroit, announces a new full-electronic model 40 timer and control for use with seam welders and spot welders. When used with spot welding machines, it provides both single-shot and pulsation-type welding controls. Of the synchronous type, and incorporating phase-shift type heat control, the unit starts and stops current flow at the zero point of the current wave, while current duration is adjustable to the



exact number of cycles desired. Cabinet housing the control is of the standard 4-panel type. The top panel is blank in the standard control, being provided for mounting of sequencing controls, etc. The second panel is provided with three dials. Dial at left adjusts current duration. The next similarly controls the "cycles off" or "cool" time. Both dials are adjustable for any value from 1 to 30 cycles of current. Dial at right controls number of automatic repetitions

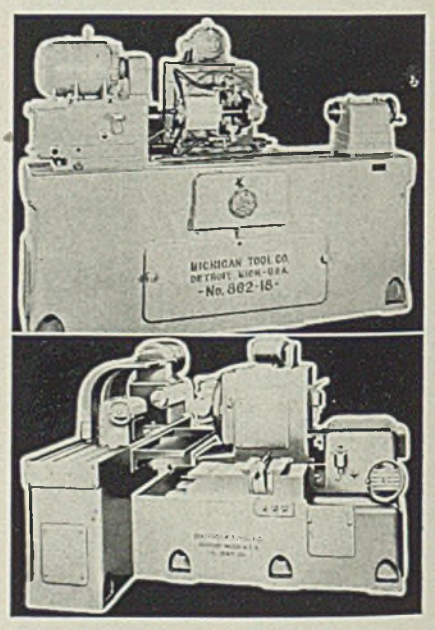
of "heat" and "cool" cycles, up to a maximum of 15 pulsations. Between these dials is a toggle switch which determines whether or not the pulsation control is used.

On the third panel is the selector dial for the phase-shift heat control. This permits adjustment of current value from 100 per cent to 20 per cent of full current when used with a 440/550-volt supply. With a 220-volt supply, the range of adjustment available is from 100 per cent to 40 per cent of full current value. Also provided in the timer is a built-in tube contactor. Its capacity is the only necessary variable in the entire control to adapt it to varying capacities.

Gear Finishers

Michigan Tool Co., 7171 East McNichols road, Detroit, has introduced new 862 series crossed-axis gear finishing machines for heavy gears up to 24 inches in diameter. They are suitable for finishing gears used in speed reducers, machinery of various types, large engines, turbines, etc.

Gears as small as 2¼ inches in diameter



may be finished with these machines. Also face widths up to 20 inches may be accommodated. The gears also may be finished when mounted on long or large diameter shafts.

Flexibility of these machines permits selection of the most desirable method of finishing for any specific gear type, such as face width, diameter and shaft length of the gears. In all methods, the work drives the meshing cutter. In the first method, particularly suited to finishing wide face gears, the cutter, in addition to having an infeed toward the gear, also is reciprocated parallel to the axis of the gear.

In the second method, used for quick

finishing of gears having a narrower face width than the cutter and also for close shoulder work, the slide is set vertically, the cutter, however, being in the same crossed-axis relationship to the gear as in the first method. Infeed is not used, but the cutter head is located in such a manner that the axis of the cutter and the axis of the gear, when viewed vertically, are at proper center distance from each other for correct sizing of gears.

Third method represents a combination of the first and second methods. Movements of the cutter head are controlled by limit switches. The operating cycle can be terminated at any time by pushing a "Stop" button. A "Jog" button permits "inching" the work drive motor in the forward direction for the set-up process. Each machine is equipped with a separate motor-driven rotary type coolant pump with lines supplying coolant both above and below the cutter.

Vernier-Set Timer

Automatic Temperature Control Co. Inc., 34 East Logan street, Philadelphia, has embodied design improvements on its series 2800 Vernier-Set timers which are said to be instrumental in providing increased performance.

The company reports the standard built-in features of Telechron motor,

knob setting without locking device, use of vernier scale for micro settings, 3/8-inch fine silver contacts, and hand adjustments to slides and bridges for changing operating functions in the field are now augmented with: One piece molded bakelite terminal block accommodating all external wiring to marked screw post terminals, as well as bridge positions for selection of desired arrangement; leaf-spring contact for positive make-break action; timer and load circuits are now wired independently on all types, but timer and load circuits

can be wired together by simply placing an external jumper across L2 and C terminals; Flaminol and special flexible wiring employed throughout. These improved units are being offered in two types—normal-clutch-action for resetting upon power failure and reverse-clutch-action for nonresetting on power failure.

Variety of sheet metal housings for surface or flush mounting, as well as cast iron explosion-proof cases for one or two timers are available for selection. Standard units may operate from 110 or 220 volts, 25, 50 or 60 cycles. Load contacts are rated to carry 25 amperes at 110 volts, alternating current noninductive.

Automatic Synchronizers

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., announces a new automatic synchronizer, type XK, for synchronizing small generators automatically. It is simple in design and ruggedly constructed.

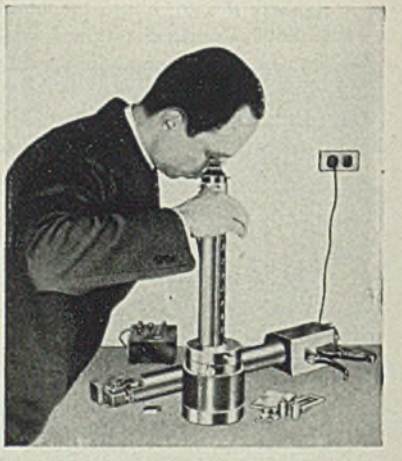
The synchronizer is limited in use to alternating current machines having a kilovolt-ampere rating of 250 or below and a voltage rating of 600 or less, with a suitable governor and fast-closing machine contractor or breaker.

One synchronizer and control switch is used for opening a machine contractor coil circuit when it is held closed magnetically. If the contractor is held closed by a latch and tripped electrically, the switch is used in the trip coil circuit.

Wear Gage

American Instrument Co., Silver Spring, Md., has placed on the market a McKee wear gage for measuring precisely amount of material removed from metallic surfaces after such surfaces have been subjected to wear, abrasion, grinding, honing, lapping, etc. It features a minimum detectable wear (sensitivity) of 0.000015-inch.

Maximum amount of wear it measures is 0.0014-inch. The gage can be used to measure flat surfaces; outer surfaces of cylinders down to 1/32-inch diameter; spheres down to ¼-inch diameter. Measurements can be made at any distance on the inside of a cylinder up to 10 inches from the end and on any accessible spot on the outer



surface of flats, cylinders, or spheres.

The principle of operations is as follows: A diamond-shaped pyramidal indentation is made in the surface on which the amount of wear is to be measured. The depth of the indentation is a function of the peak angle of the indenter point. This angle has been accurately measured, and thus by measuring the initial length of the base of the indentation, application of a factor will give the initial depth. As wear takes place, the entire diamond-shaped indentation becomes smaller (shorter). After wear has taken place, a second measurement of the length of the base of the indentation will show the amount of material that has been removed from the test surface. The wear gage consists of four main parts—indenter, measuring microscope, cylinder indentation locator and polishing template. Each instrument is supplied with a multiplying factor for converting microscope depth measurements.

Electrical Maintenance

(*Concluded from Page* 156)

on auxiliary equipment, so far as motors are concerned, are as follows:

1. Bearings should be checked periodically to make sure that proper lubrication has been applied and that the bearings are not leaking. A bearing failure usually results in the rotor dropping down on the stator and may necessitate a complete rewind of the stator and replacement of the rotor in the case of a squirrel cage motor, or a rewind in the case of a wound-rotor or d.c. motor.

2. Load checks on important auxiliaries are sometimes advisable. Due to increased operating schedules, load cycles change and increased heating may result.

3. Open motors should be blown out periodically to keep windings clean. At longer intervals, it may be necessary to clean the windings with a good solvent to get greasy dirt out of them. After cleaning such as this, windings should be sprayed with a good air drying varnish.

4. Mill-type motors are ordinarily enclosed, but are not dirt tight. These motors should be cleaned out periodically.

5. Commutators and brushes on direct-current motors should receive particular attention. The proper brush should be used with the motors and commutators should be kept clean and smooth.

Steel Mill Service Different

On the control used with auxiliary drives, it is important that contactors and relays should be kept clean so that moving parts will operate freely. Contacts should be dressed or replaced as required.

In the past years, a large number of electric arc furnaces have been installed by major steel plants. Many more will be installed in the near future. Operation of electrical equipment for furnaces represents service usually quite different than that encountered on other steel plant equipment. Circuit breakers operate frequently and require extraordinary maintenance in order to keep the equipment in continuous production. Here again, the electrical manufacturers can be of great assistance to the steel plants in rendering advice on proper maintenance procedure on this type of equipment.

The foregoing represents some of the high spots on maintenance of the equipment. Electrical manufacturers can be of great assistance in planning maintenance schedules and giving instructions on such maintenance. If proper maintenance is scheduled and adhered to, the outages will be few and far between. It brings to mind the old adage, "An ounce of prevention is worth a pound of cure."

Building Hammers

(*Continued from Page* 116)

ing a large slug, a heavy dead-weight blow may be struck. But in drop forging, the hammer must strike and leave the work quickly if sticking of the hot metal in the dies is to be avoided. This is not hard to understand, if we realize that gases trapped between work and die assist in their separation. Much effort and expensive investigation has been undertaken by the Chambersburg Co. in years gone by to perfect the design of the valves and valve mechanism which control the entry and exit of the steam for it is particularly important to get steam under the piston quickly in order to speed the getaway.

Our attention thus far, has been directed towards the steam drop hammer used to produce drop forgings or more properly "impact die forgings". Classified along with this type are the board drop hammers, see Fig. 7, which rely on gravity alone for the strength of the blow. As a matter of fact, more than a dozen types of hammers are now being produced to meet the urgent demands of the war program. These range from the small tool-dressing hammers, through the larger single frame and double frame ingot-forging hammers with their variations (e. g. those developed for the production of oxygen bottles, forming of bombs, etc.) to the large cogging hammers which are used to refine cast ingots and the equally large but less powerful hammers used in the forging of steel rings.

War—Contest of Forging Tools

This war might almost be regarded as a contest between forged mechanisms, so largely do forgings enter into the construction of aircraft, tanks, ships and guns. Looming most importantly in this picture are the board and steam drop hammers necessary for the production of the millions of drop forgings needed by our ever growing war machine. These are among the most powerful and efficient of the various types of forging hammers since they utilize the forces of impact most effectively.

Within the past 20 years, the development of steam and air-operated drop hammers has resulted in the mass production of more accurate impact die forgings, thus contributing to a reduction in price and still more important in time of war, of machining time. As an agent of conservation, the modern hammer has materially reduced the amount of excess stock, as exhibited in Fig. 8. This reduced wastage is made possible by a reduction in the amount of draft required in the dies. The amount of machining saved can easily be imagined as can the easing of the load on the rolling mills

in the light of the millions of forgings in production for planes, tanks, ships and other vital war materiel.

Another contribution of the Chambersburg Engineering Co. concerns the development of a hammer for the hot forming of thin work at high speed. Fig. 4 exhibits this hammer at work on airplane wing fillets. High strength metals, such as stainless steel and many aluminum alloys, are often best hammered, since their successful hot-forming depends on speed. Further, hammering operations tend to maintain temperatures by the transformation of mechanical work into heat in the metal. The embossing and shallow forming of thin sections is sometimes performed by a heavy squeeze, involving the use of special hardened dies. Hammering, for this purpose, presents certain advantages, inasmuch as the inertia effects of the action aid in "jumping up" the metal into the die and enabling the use of lower pressures and less costly dies.

Indeed, short run stampings can often be inexpensively formed with the machine, using dies cast of lead and zinc in simple plaster molds. Such dies require no machining and, when no longer wanted, can be re-melted with almost 100 per cent material salvage.

Charts Promote Activity

(*Continued from Page* 118)

made at one plant and shipped to the other to be assembled into a completed unit together with the parts made in that plant.

It is almost impossible to determine the day-to-day level of production under such a setup. An attempt to determine production by pounds output would be meaningless. Many heavy castings require little machine work, whereas some small parts necessitate a large amount of machine work. Moreover, a statement as to the number of complete units assembled in a day would be meaningless because some days no units at all are completed while on other days quite a number will be finished on the same day. A statement of the number of man-hours worked in a day would simply be an indication of the payroll for the day. All these fail to answer the purpose because a production progress chart must show what was accomplished and not the amount of labor available.

Chart Must Measure Production: It is highly important that a production chart really be a measure of the actual production. Based upon some unreasonable unit, it can be worse than nothing. To keep the men interested in maintaining maximum production, the chart must go up when the men put extra effort into the work. The easiest

way to get them to lose interest entirely is to have such variables in the calculation that the chart shows a decrease in production on the very day when everyone put an extra amount of effort into the job trying to make a new record.

The Permanent Solution: To get a measure of production where many types and models of machines are being made, it is necessary to make methods studies of each job in the plant in an effort to determine a reasonable day's work for each part. When these jobs are all standardized, the amount of work turned out in standard units of labor can be determined. Then the standard units represent accomplishment since this indicates the amount of time the parts manufactured ought to have taken. Thus the standard can be divided by the actual man-hours on the payroll and a percentage obtained representing the level of production efficiency at which the plant is operating for the period. It is convenient to establish some sort of unit; for example, $10 of standard labor might be used. Then one model could be regarded as to 15 units for some other model.

But a methods engineering program involving detailed time studies of each job requires about two years to set up, even in a fairly small size plant. Consequently this permanent program will be of no help in making production charts for posting in Mr. Nelson's production drive. However, many plants already have such data available. In those plants, it should be possible to set this system up quickly to show production rates, for an excessive amount of calculation is not involved.

Chart of Spoiled Work: However, there are other charts (although not measuring effective production directly) which can be used to stir up enthusiasm and spur the men on to raise their output. The first that might be mentioned is a chart of spoiled work. Almost every plant keeps sufficient records to enable such a report to be compiled without difficulty. The more work that is spoiled, of course, the less usable production there is compared with the amount there should be.

Such a chart of spoiled work might be shown in hours of work lost or spoiled. However, it is most effective to base the figures for the chart on dollar value. For example, an expensive casting might be spoiled after 15 minutes work in your plant. On the basis of man-hours this would show up only as 15 minutes lost. But the work of the foundry done outside of your plant is lost, too, and the dollar value of the casting plus the value of the labor put on it up to the time of spoiling is the true measure of the overall loss.

And this is of most interest to the War Production Board.

Machine Operating Efficiency: An effective chart showing production levels in the machine shop can be made by comparing the time all the machines in the plant actually run with the total time they are available for running. This might be called the "Machine Operating Efficiency".

Some of the things that cause a particular machine to operate less than 24 hours per day are: Personal time out for the operator, setups, sharpening tools, oiling machine, maintenance and crane service, waiting for materials, waiting for instructions, and other delays.

Many plants where incentive rates are not in operation require the operator to punch in and out on each new job at the job recorder, this being for the purpose of accruing costs. No record is made of interruptions to the work between jobs.

Idle Machine-Time Cards: It is recommended that new cards be designed so as not to interfere with the present cost cards, the new cards to be called "Idle Machine Time." These new cards can be used to record every time the machine stops for any reason and regardless of the reason. It is suggested that the operator's name should not appear on the card—just the machine number—and the same card should be used for all three shifts in the day, regardless of the fact that three different operators are involved.

This will eliminate to some extent the objection the operator may have to punching out for his own personal time. The cards may be colored red, white and blue and labeled with some such slogan as "Keep the Machines Running" to promote enthusiasm for the production drive. Code letters can be listed on the card for each type of delay so all the operator has to put on the card besides the time stamp is a single letter.

Since each operator will be punching his card many more times than formerly, it is advisable to check into the location of job recorders. It is foolish to devise means of increasing production if the plan requires more time-keeping than the necessary records for more production will thereby be lost than gained. Usually it is necessary to install additional job recorders so one will be adjacent to every group of machines.

It is suggested that the actual time the machines were running be compared with 24 hours. This charges the operation or utilization factor with all the delays including lunch periods regardless of whether the operator has any control over the particular idleness

period or not. It is easily possible that some of the men themselves will think up ways to co-ordinate and eliminate some of the fixed delays.

Analysis of Delays: Needless to say these idle-time cards should be studied and analyzed by the management for co-ordinations. Perhaps the oiling can be done during a setup period and perhaps some maintenance or inspection. Idleness due to personal time can be cut down by having relief operators substitute at staggered intervals.

At any rate it is an easy matter to add up the total delays as shown on all the cards for the 24 hours in order to prepare the chart showing the utilization factor. For example if there are 50 machine tools in the plant this makes 1200 machine hours available in 24 hours. If the tickets show delays totaling 200 hours, the utilization efficiency would be 83 1/3 per cent.

Charts of Assembly Schedules: It is no doubt possible to show charts of actual numbers of units finished in the assembly departments. This can be compared with the predetermined quota of assemblies scheduled.

Production Delays Because of Meetings: For Mr. Nelson's production drive it has been suggested that a committee of management and labor be appointed. Care should be taken in selecting the shop men because no production on a man's machine should be lost while he is in the meeting. Perhaps a worker from another department can be found to run his machine during meeting periods. Or the committee can meet during hours when shop representatives are not on active duty if all representatives are from the same shift. Committee members are usually paid for their time regardless of when the meetings are held.

In addition, less frequent meetings would also contribute to minimizing lost production.

Maintaining Morale: It is important not to overlook the factors influencing the general morale of workmen in your plant. Most of those who do not fully appreciate their value in winning the war probably do not realize how thoroughly the plant is engaged in war work. Moreover some men have the impression that every able-bodied man should join the Army and that the men in industry are to some extent slackers.

This attitude should be eliminated. The best way to do this is to be sure every worker knows just where your plant products are being used in the war.

Many plants are losing men because they have read accounts of the progress of the war and of our many setbacks and feel they should do something about it so they join the Army.

It would appear highly desirable for the War Department to issue some sort of a card or certificate to every vital defense worker to bring home to him his importance in the war work. Any worker receiving such recognition would surely have his morale and enthusiasm increased tremendously.

A few plants have made some such effort by supplying war workers with caps, armbands, etc., inscribed "Soldier of Production" or bearing some similar label to emphasize the worker's direct connection with the success of our war effort. Much, much more could be done, for the importance of the war worker should be made more widely known and appreciated.

Substitutes Wood for Steel for Duration

Lyon Metal Products Inc., Aurora, Ill., announces that its portable shop-robes, lockers and cabinets will be manufactured of wood instead of steel for the duration. This move is in accordance with priority regulations to further the war effort.

Will Meet Requirements

(*Continued from Page* 128)

no special deoxidizer.

The data in Table II, covering tension, hardness, and notched bar-impact tests, give a general comparison of the properties most commonly determined for these steels. The yield and tensile strengths shown are slightly higher than those ordinarily obtained commercially for similar compositions because the individually handled laboratory bars cooled somewhat faster.

The yield and tensile strengths, however, follow the compositions very closely. High carbon or manganese content, or a combination of high carbon and high manganese, produce high strength. The chromium and nickel content of heat E-1 has increased the strength of this steel, whereas the copper in the triplex steels has a negligible effect.

The draw or low-temperature anneal caused a slight average drop in the yield strength but had no effect on the tensile strength.

Other things being equal, the ductility tends to vary with the composition. Carbon and sulphur are the most potent elements and the ductility decreases as either or both of these elements increase. Superimposed on these effects, however, is the strong effect of inclusion type and it will be observed that all of the steels with type I inclusions have very good ductility.

Good Ductility Present

The three steels with type II inclusions, E-1, B, and C, all have good ductility, although this can be accounted for in part by the high carbon contents. With the exception of the triplex steels, all of the steels with type III inclusions have good ductility but average a little lower than those with type I. The ductility of the triplex steels is somewhat lower than can be accounted for by composition, but some of the inclusions in these heats are close to type II.

Hydrogen embrittlement, as indicated by the improvement of ductility produced by the draw, is present in the basic open-hearth heat 9551, acid electric heat 1163, basic electric heat E-1, and the converter steels 1, 2, 3, 4, A, and B. This indicates a greater prevalence in the the converter steels, although some trouble with hydrogen is not uncommon in the other steels. There is some indication that present practices tend to minimize this trouble.

Brinell hardness numbers were taken on sections cut from the center of the coupons and, as usual, follow the tensile strengths very closely.

Notched-bar impact tests were made both on V-notch Izod specimens and keyhole-notch Charpy specimens. The Izod values, although higher, follow the same trends as the Charpy figures and both, in general, bear a close correlation to the ductility. Comparing steels with the same ductility, however, it is apparent that the aluminum, deoxidized steels have the highest average impact ratings, whereas those treated with titanium show no advantage over those without a special deoxidizer.

It so happens that most of the aluminum deoxidized steels are converter steels, but because this effect of aluminum is well known, no significance is given to the method of production.

All of the properties in Table II, therefore, seem quite orthodox for grade B steel and can be accounted for by composition and deoxidation practice.

One of the properties in which converter steel has been alleged to be especially vulnerable is notch sensitivity at low temperatures. However, data are on the record[3] for properly aluminum-killed bessemer pipe (0.15 per cent carbon) that gave Charpy values of 50 foot-pounds at room temperature, 34 at —25 degrees Fahr., and 21 at —50 degrees Fahr.

Large tonnages of such pipe have

been in successful commercial use over a period of years. While this behavior of wrought steel leads to the expectation of similar behavior of cast steel, direct evidence was lacking.

Considerable attention was given, therefore, to low-temperature notched-bar impact tests in the present study. It is well known that such tests differentiate sharply between steels properly and improperly deoxidized, whereas the static tensile properties at low temperatures do not.

Every one of the impact tests at low temperatures were made with standard keyhole-notch Charpy bars, single and double width.

The specimens were cooled by immersion in a bath of acetone and dry ice and were broken within 3 seconds after removal from the bath. During this interval, they would warm up from 2 to 4 degrees Fahr. and, to compensate, the bath was held to a temperature 3 degrees Fahr. below the desired breaking temperature. Each bar was held 15 minutes at temperature while the bath was agitated, before testing.

In all cases, the tests were made in duplicate but further check tests were made when it seemed to be desirable. Check tests were made primarily where the original duplicate tests gave erratic results. Data are shown graphically in Fig. 1.

It may be observed from the illustration that the impact values gradually decrease with drop in temperature until suddenly they become very erratic or drop to a much lower figure. It is this drop-off, where the steels change from a relatively tough to a brittle material, that is most important to determine.

It is obvious, of course, where duplicate tests give such values as 17 and 2 foot-pounds, that chance might just as well have given either two high values or two low values. Too much importance, therefore, must not be placed on individual figures.

Among the acid open-hearth heats, the heat 493 begins to show erratic values at —20 degrees Fahr., 509 and F-1 at 0 degrees Fahr., and F-2 at —20 degrees Fahr. At —40 degrees Fahr. three show extremely low values.

The basic open-hearth heats held up better and 9551 and 9567 show no drop-off until —40 degrees Fahr., while Q-1 and Q-2 drop off sharply at —20 degrees Fahr. The better properties of these steels may be attributed tentatively to the relatively low phosphorus content. These steels had no special deoxidation.

Treated with Titanium

Erratic results were obtained at 0 degrees Fahr. for acid electric steels, heats 715 and 1009, at —20 degrees Fahr. for 724, while 1025 failed at —40 degrees Fahr. The fifth heat of this series (1163), however, exhibits no erratic behavior but only a gradual reduction in impact value down to —80 degrees Fahr., where a sharp drop was obtained. It should be noted here that the first four steels were treated with titanium and calcium, whereas the last was deoxidized with 2 pounds of aluminum per ton.

The basic electric heat, starting rather low, shows no inconsistency and falls gradually to a low value at —60 degrees Fahr. The nickel content of 0.43 per cent is thought to be of benefit in this steel because the aluminum content is too low for the best effect.

The triplex steels held up very well down to —60 degrees Fahr. Only heat H-42, which has a low value at room temperature, shows erratic behavior at —40 degrees Fahr, but none of them shows a temperature value until —60 degrees Fahr. is reached. The copper content of these steels undoubtedly aids the low-temperature properties but they also were deoxidized with 2 pounds of aluminum per ton.

The converter steels, heats 1 to 4, inclusive, have easily the best low-tem-

perature properties. Only heat 4 begins to show erratic results at —80 degrees Fahr. All of these steels had an addition of 2 pounds of aluminum per ton. Heats A, B, and C to which 1 pound of aluminum per ton was added begin to fall in the range of —20 degrees Fahr. to —40 degrees Fahr., whereas heat D to which about 1.5 pounds of aluminum was added is consistent down to at least —60 degrees Fahr. Generally speaking less than about 5-foot-pounds had brittle fractures, while those above this figure showed some toughness.

Data on the low temperature impact values are shown graphically in Fig. 1. There is some scatter in the data, but it is believed that straight lines represent the true trend. For those steels showing a sudden change from tough to brittle fracture two separate curves are drawn, because in most instances, there are no intermediate data. Where the upper and lower curves overlap, however, there is apt to be some erratic results.

Deoxidation Practice Important

Superficially, these low-temperature notched-bar impact values seem to show a distinct advantage for converter (including triplex) steel, but the evidence of acid electric heat 1163 and the converter steels B and C clearly indicate that the melting medium is of secondary importance at best and that the deoxidation practice is paramount. The value of deoxidation and aluminum additions in enhancing the low-temperature toughness of steels has been shown by Herty[4], and by Kinzel, Crafts and Egan[5].

An exception to the above statement should be made in the case of the basic open-hearth furnace, if it can be shown that low phosphorus content, which is more or less inherent to the process, is responsible for the good properties shown by these steels.

As a further check on the low-temperature notch brittleness of these steels, a limited number of double width Charpy bars were broken at temperatures in the region of the drop-off shown by the single width bars. As shown by Hoyt[1] and by McAdam and Clyne[2], a double width Charpy bar of a tough steel will require approximately double or at least a substantially greater amount of energy to break as for a single width specimen of the same steel. A brittle or notch-sensitive steel, on the other hand, will break with considerably less energy absorption for a double-width specimen.

It might be expected that the results obtained would show a different trend or be more erratic, yet they present substantially the same picture. In general the first signs of brittleness are observed at a slightly higher temperature with the double-width specimens, but in a few cases, this is reversed.

The ability of a material to retain its impact strength after strain age-hardening is often considered of importance in evaluating it for some applications. Converter steels have been considered to be especially susceptible to strain age-hardening effects because of a supposedly high nitrogen or oxygen content. In view of this, a number of comparative tests were made on the cast steels.

Specimens of the normalized and drawn coupons were machined to oversize dimensions for the standard impact bar. These then were compressed in the center of the specimen for about ¼-inch on either side of the notch location until they were cold worked 10 per cent. The specimens, after the cold working treatment, next were finish machined to size and the keyhole notch put in the center of the worked portion. Four specimens were machined from each steel, two of which were tested as cold worked. The duplicate pair of specimens were aged at 475 degrees Fahr. for 30 minutes and then tested at room temperature. Rockwell "B" hardness data were also obtained and it was noted that the major increase in hardness of the steels occurs after cold working. The aged specimens show only minor differ-

ences in comparison with the cold-worked specimens as a result of the aging treatment.

Impact strength values, on the other hand, show marked reduction, the major portion of which occurs in some of the steels after cold working and in others after aging. This is illustrated best by the percentage of reduction figures. In comparing these data with the deoxidation practice used, some relationship is evident.

These steels having no strong deoxidation treatment, as a rule, are much more susceptible to aging after cold working than are the steels fully deoxidized. It was observed in the data that the former steels show substantially larger decreases in impact strength after aging than do the latter steels. The steels receiving the strong deoxidation have the major reduction in impact strength occurring after cold working. The two basic open-hearth steels, 9551 and 9567, are apparent exceptions to this rule and show good resistance to strain aging.

The effect of deoxidation practice on the aging tendencies of these steels has a corollary in its effect on aging in deep-drawing steels. In the rimming steel grade of deep-drawing steels, no aluminum is used and the steel is strongly susceptible to aging after the temper rolling following the annealing operation. When this grade of steel has been killed with aluminum, however, it loses its aging characteristics to a large extent and is known as a nonaging killed steel.

The fatigue or endurance strengths of the grade B steels has assumed an importance greater than normal during the present emergency. Very few data are available on cast steels which could be used in comparing the various steels produced by the different melting units. Therefore, a few tests were made on representative steels from each group received.

In order to obtain a fairly complete analysis of the fatigue properties of the steels, two types of specimens were run in the tests. These were standard smooth specimens and Kommers square-notched specimens. Two of the steels, the acid electric steel 724 and converter steel 3, were also tested at —40 degrees Fahr., using the notched specimens only. Similar low-temperature tests were run previously at Battelle and the operation of the equipment is described in detail in a paper by Russell[8].

Only One Heat Run

Data for the standard specimens show a distinctly higher endurance ratio for the two acid steels than for the basic and converter steels. Inasmuch as only one heat from each group was run, however, no generalization can be made.

The notch endurance tests at room temperature, on the other hand, have a striking uniformity which shows no preference for any group. Likewise, the two steels tested as notched bars at —40 degrees Fahr. give very similar results. Since steel 724 had only 2 foot-pounds, Charpy impact resistance at —40 degrees Fahr., it is evident, as might have been expected, that fatigue properties do not reflect the types of brittleness brought out by single-blow notched-bar impact tests but, instead, fall in line with the static tensile properties.

All of the endurance limits are within normal expectations and do not appear to be influenced by deoxidation practices in the same manner as some other properties tested.

Commercial cast steels made by six processes of melting were compared as to composition and mechanical properties. The compositions of all were normal.

The basic open-hearth steels had lower phosphorus contents. If the identification were to be removed from the others, it would be difficult to decide by what process they had been made.

The converter steels, as a group, were

deoxidized with aluminum, whereas only two of the other steels were aluminum killed.

The microstructures were governed by the deoxidation practice, both as to inclusion type and grain size. Aluminum was the only deoxidizer that caused a definite change in type of inclusion. Titanium produced some grain refinement but not so much as aluminum.

The room temperature mechanical properties were entirely orthodox for grade B cast steel, and varied with the composition and type of inclusions, without regard to the method of manufacture.

The converter steels, as a group, had the best low-temperature notched-bar impact properties, but this is held to be a result of deoxidation with aluminum rather than melting practice.

The aluminum-killed steels also showed less strain age-hardening, which gave a fallacious advantage for the converter steels.

A limited number of standard fatigue tests showed a superiority in endurance ratio for the acid open-hearth and acid electric steels, but notched fatigue tests showed a notable similarity for all steels.

Nothing Favors Either Process

No evidence was found to favor one process over another, except that the basic open hearth gave better phosphorus control. Mechanical or engineering properties of all the steels were governed by composition and by deoxidation, rather than by melting process. For example, acid electric cast steel not having had an adequate aluminum addition shows low-temperature impact shortcomings, just as converter steel would without an adequate aluminum addition. When low-temperature shock resistance is needed, it would be in order to impose a low-temperature notched-bar impact acceptance test. If this be done and steel be passed or rejected on performance rather than on the melting process used, some steel now being accepted but not of good low-temperature toughness would be excluded and much good converter steel would be made available.

With proper deoxidation, all the processes can make steel of the quality demanded for war purposes.

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THE EDITORS.

Furnace Instruments

(*Continued from Page* 142)

lowering the stock rod, just before and after the big bell is lowered to discharge material into the furnace.

Beginning at the outside of the chart, the stockline recorder measures about 0 to 20 feet down from the big bell opening of stockline.

The recorder may be located on the instrument panel in the instrument house; but a large indicator should be mounted at the foot of the hoist for the reference of the larry car operator. This may be a dial type indicator, a vertical scale 6 or 8 feet long or a bank of lights, usually arranged in a vertical row. The recorder is often mounted at the foot of the hoist and an extra indicator may be located in the cast house near the furnace.

Affords Uniform Distribution

Revolving furnace tops were designed to distribute the charge of materials evenly in the furnace, so that big lumps will not collect in one section of the shaft and cause channeling. Some years ago the Wisconsin Steel Co. installed telemetering recorders, to have a record in the instrument house of the exact time of rotation of the top and the angular degrees of rotation. The plan most often followed, for recording the position of the rotary top, is to provide contactors around the furnace top so that a circuit is closed to one of the pens of an electric operation recorder, whenever the contact closing arm on the rotary top may pass one of these contactors. Six contactors usually are installed at intervals of 60 degrees around the top. The operation recorder will have six pens to record the positions of the rotary top and may have additional pens to record the time the skip car is dumped or the time the big bell and also the little bell are lowered.

A cluster of signal lights may also be in these circuits and a separate light will flash for each contact closed.

When fine, dusty ore is watered before it is charged into the furnace, this reduces the top gas temperature and prevents so much ore dust going out to the dust catcher. In some plants, liquid level recording gages have been mounted on the water measuring tanks at the foot of the skip hoist. The record shows when the water is drawn, as well as the quantity, and furnishes the operator proof that each charge has received the required amount of water.

Water added for reducing ore dust steams out of the furnace with the top gas and is not broken down into gas in a critical zone of the furnace with a great loss of heat, like the moisture in the air blast.

The top gas from the furnace passes through several cleaning devices before being used for fuel in the blast furnace stoves and is also at least moderately cleaned before being used as fuel under boilers or for other steel mill requirements. If dirty gas is burned in the stoves, the checkerwork soon clogs with so much dust that the bricks are insulated from the heat and do not absorb as much heat as clean checkers will absorb.

Various combinations of cleaners are in use, the first being the dust catcher. This is a large chamber into which top gas flows. The diameter of the chamber is large so that the velocity of flow of the gas is retarded and much dust is deposited in the bottom over a trap door through which the dust is frequently removed.

The top gas temperature is taken with a thermocouple, usually inserted through the shell of the dust catcher near the downcomer connection from the furnace. This instrument will be a recording pyrometer and a round chart is frequently used. The usual working range is 300 or 400 degrees Fahr. but the temperature might easily be 800 degrees.

Smoke Recorder Holds Promise

Experimental installations have been made using a smoke recorder to measure the grains of dust per cubic foot in top gas, entering the dust catcher. Operation is with a light beam directed through the gas on to a photoelectric cell. The intensity of light is recorded and the record compared with a calibration curve to determine the grains of dust. While the results of tests seem encouraging, no permanent installations have been reported.

Records are commonly taken of the pressure before and after each cleaner. These records are needed to show when passages through the cleaners and valves become clogged. Too large a differential in pressure between incoming and outgoing gas indicate restrictions to the gas flow through the cleaner. The range of 0 to 50 inches head of water is ample for single and 2-pen gages.

On washers or scrubbers for cleaning gas, through which water is circulated should be on the water supply line, to be sure that water is held at high enough pressure to reach all parts of the washer and make intimate contact with the gas being cleaned. Theisen disentegrators in the gas line will take the same instruments as other types of gas washers. When a Cottrell precipitator is employed to electrically deposit ionized dust on electrodes, recording voltmeters, ammeters or wattmeters may be useful to show the condition of the equipment. Too much dust or moisture collecting on the cathodes will cause disagreeable short circuits. Recording ammeters on the alternating-current side before the current is rectified are helpful guides. These are wound for 5 amperes and used with current transformers.

The portion of the cleaned gas which is used to heat up the checker brick in the blast furnace stoves is mixed at the stove burners with a forced draft of air, often supplied by individual fans for each stove.

Satisfactory gas and air ratio controllers have been furnished for years for use at the stove burners. One type now offered is a flow ratio controller consisting of a flow meter in the gas line which sets the control point for a flow controller in the air line; so that, for the existing gas flow, the correct ratio of air flow is maintained.

On the new highly efficient stoves, a controller may be supplied to reduce the gas flow at times when the temperature in the dome reaches a point so high that the brick in the top of the stove may start to slag.

These new stoves are of the 2-pass type with the combustion chamber ex-

tending from the burner up to the dome, which will be the hottest part of the stove. Burned gases descend from the dome through the checkers designed to absorb as much heat as possible. The spent gases then pass out at the base of the stove through the chimney valve into a tunnel and thence to the chimney. This tall stack usually provides a common flue for all of the stoves.

In recent years, when stoves have been heated to such high temperatures, considerable attention is being given to the dome temperatures. Fig. 5 shows a radiation fixture located on one side of a blast furnace stove in Germany. This is focused on the brick lining in the top of the dome. Radiated heat to one or more miniature thermocouples in the fixture, shown in the picture, generate the usual thermocouple potential which is recorded in degrees of temperature on a pyrometer wired to the radiation unit and located on the instrument panel.

Similar radiation fixtures are offered by most pyrometer manufacturers.

Subject to Expansion

One danger of installing the radiation unit, as shown in the illustration, is that the refractory tube extending through the shell and brick lining, and through which the radiation unit is focused, will be subjected to the expansion of the brick lining. The cumulative movement of heating brick in most stoves from the base up to this point will be several inches greater than the expansion of the outside steel shell.

Blast furnace engineers in this country seem to be more interested in the temperature of the top layer of bricks in the checkers rather than the dome lining. Radiation units are therefore focused down on the checkers 8 feet below the dome. Expanding lining then slides along the side of the refractory tube with no shearing affect.

Glow tubes have been used for this application. These tubes have closed ends and the radiation pyrometer records the temperature of the tip of the tube on which the thermocouple in the fixture is focused. For experimental work this may not be as satisfactory as the open end tube, which permits radiation to the sensitive couple, direct from the checkers.

As the interior of the stove is under 25 pounds pressure while connected to the furnace, the open end radiation fixture presents more complications than the fixture used with the glow tube.

In either case the lens of the radiation fixture may be protected with a shutter, which automatically closes to shade the lens when the temperature, due to some leak from the stove, becomes high enough to melt a safety fuse.

The fixture also is provided with a cooling device consisting of a hollow shell through which air or water may be circulated. Alarm contacts are closed when the safety shutter acts.

Where comparative temperature measurements are satisfactory, which clearly show changes in the dome temperature, the most practical plan is to insert a platinum, platinum-rhodium thermocouple, in a refractory protection well, into the stove dome, extending this vertically downward and perhaps through the conveniently located manhole cover.

Fig. 3 shows a record made at a Cleveland blast furnace plant using the platinum couple for several years. It will be noted by the small but sharp saw teeth in the record that the couple is sensitive to temperature changes.

Base metal couples also have been used but seem suitable for test work only, as they burn out in a few weeks at the high temperature of nearly 2300 degrees Fahr.

Chimney Temperature Recorded

It has been the practice for many years to record chimney valve temperatures. When the stove is first put on heat the checkers are coolest and cool down the flue gas temperature. This is shown by the pyrometer connected to a base metal couple which is protected by an ordinary wrought iron well in the chimney valve outlet. Clean, efficient checkers continue to absorb this heat for several hours, while dirty brickwork permits the flue gas temperature to rise much sooner. A comparison of the dome temperature and chimney valve temperatures reveals much information about the condition of stove checkers.

As chimney valve temperatures usually are between 300 and 800 degrees Fahr. it is possible to use recording thermometers and both single record and multiple record thermometers have been tried. However, if a stove is not changed on time and the heat left on, the temperatures will go higher and a thermoelectric pyrometer will be safer.

A range of 0 to 1100 degrees Fahr. is usual for the application. Both single record round chart pyrometers and strip chart multiple record pyrometers, with flue temperature records of all stoves for each furnace on one chart, are used.

It is possible that some day equipment will be designed to automatically shut off the heat on a stove and close the chimney valve when the flue gas reaches a temperature found to be the point where additional heating of the stove is not economical. The stove would then hold its heat and await its turn to go on blast. The gas thus saved would be available for other uses.

The foregoing comments apply to instruments generally used at the blast

furnace, beginning at the air intake and following through the instrument flow diagram to the disposal of the top gas from the furnace. Power plant instruments are not included as their application is not peculiar to the blast furnace. Neither is the list of flow meters included for determining the cost distribution of gas, water and steam, as these are usually provided in other departments of a steel plant.

The number and variety of test instruments, indicating gages, glass manometers and similar equipment needed, depends both on the size of the plant and the amount of service work which will be done by the blast furnace department. Most blast furnaces are divisions of steel mills and can apply to their general instrument sections for service. Service contracts with instrument manufacturers are often made to provide for checking instruments periodically and instructing the plant instrument men in the care and field repair of instruments. In any event, the blast furnace department should at least have a test portable pyrometer, standard test indicating gages and laboratory glass stem thermometers for checking the accuracy of instruments in service.

If a barometer reading cannot be obtained conveniently from a nearby department, one should be available. If turbo blowers are used, the barometer may be a recorder and located in the blower room.

Pyrometers with special thermocouples for securing the temperature of the slag from the furnace are now cautiously used. The same application is a suitable one for the optical pyrometer.

The sintering plant has become so much a part of the blast furnace in our northern plants that reference will be made to a few of the important instruments. These are much the same for the vacuum, bath process, as for the continuous process, which is the one now in general use.

Flue dust from the several gas cleaners and perhaps quantities of fines from the ore supply, are mixed with some carbon, consisting of fine sized coke or coal. The mixture moves in a continuous layer, first going under a flame which is sucked down into the carbon and ore by a vacuum beneath the material. The carbon is ignited at the top of the material which is several inches thick. The carbon gradually burns on down through the mass, over the induced draft. Sinter is formed by the time the endless sintering grate reaches the loading car. The porous, crumbly formation is now in rather ideal condition for the blast furnace.

Electrical recorders consist of a volt-

meter to show that the voltage reaching the plant is satisfactory; and also a wattmeter or ammeter, which will record the excess load, if friction develops in any part of the machinery in the dusty atmosphere.

A recording tachometer is wired to a magneto to record the speed of the grates. The magneto is propelled through a universal joint by the shaft which turns the wheel over the endless chain grate makes its turn, to dump sinter. The tachometer may be calibrated in feet per minute of grate movement, or for some range like 0 to 75 revolutions per minute.

The recording vacuum gage, connected through a ¼-inch pipe to the under side of the grates, will have a range of 0 to 30 inches head of water vacuum and the working range may be about 15 inches head of water vacuum.

A low range recording pressure gage on the fuel gas line, to the sintering ignition burners, will record the gas pressure available.

In conclusion, mention is made of an instrument used as a safety device in ore storage yards. Large ore bridges, moving on tracts for the distribution of ore on the ore piles, are often located where wind velocities may sometimes be great enough to accelerate the motion of a moving bridge until it is out of control. A $100,000 bridge might be blown off the end of the track and ruined.

A fixture is provided, consisting of anemometer vanes, which are four cups or half cylinders revolved by the wind around a shaft which propels a magneto. The fixture at the top of the bridge is wired to a control instrument mounted at the base of the bridge. Electrical contacts on a weather vane device are in the control circuit to prevent the operation of the control mechanism except when the wind is from a direction about parallel with the track. When the wind reaches the dangerous velocity against the broad side of the bridge, the controller energizes electrical apparatus to throw in the brakes so the bridge will not be used until the wind moderates.

Mounted Wheel Manual

A new booklet on the use of mounted wheels and accessories for portable tools is being offered by Chicago Wheel & Mfg. Co., 1101 West Monroe street, Chicago. It includes a selection guide on the use of mounted wheels which covers every conceivable material and important war operations.

In addition, a wide variety of portable tool accessories are shown including miniature steel cutters, polishing wheels, sanding drums, disks, and other items.

Roll Pressures

(*Continued from Page* 166)

various elements throughout the thickness, nevertheless, in view of the thinness of the strip compared to the contact length, this variation would appear unlikely to affect the pressure distribution over the area of contact with the rolls. Again, the assumption that the coefficient of friction is constant over the contact length has been questioned, and Dr. Nadai has done excellent work[1] in developing the equations for the case of liquid friction instead of solid friction; that is, with the coefficient varying in proportion to the velocity of sliding. To the present author, the facts that the pressure distribution curves actually measured by Siebel and Lueg approximate much more closely to the peak curve corresponding to solid friction (such as the curve in Fig. 6) than they do to the round-topped curve of Nadai corresponding to liquid friction conditions; that if liquid friction (continuous film lubrication) existed, "skidding" would almost certainly occur if any considerable percentage of the power were transmitted by driving the rolls; and above all, that the friction coefficient corresponding to the measured roll pressure is so high, namely 0.105, all together indicate almost conclusively that liquid-friction conditions cannot exist between the strip and the rolls. While the coefficient was thought to be as low as 0.04, liquid-friction or at least semi-continuous-film lubrication conditions were a possibility, but a coefficient as high as 0.105 can correspond to nothing but the condition known as "boundary lubrication".[4] However, it is far from the author's intention to rule out the possibility that other factors, not now known, may exist and may influence the roll pressure under some circumstances; and for that reason, additional (and *complete*) roll pressure data from other mills are much to be desired, in order to determine the range over which factors which are known to influence the pressure, such as the coefficient of friction, vary under the different conditions met with in cold strip mill practice.

Other questions, raised in a previous paper[2], have to do with the effect of the form of the curve of pressure distribution over the contact length on the percentage increase of that length due to roll flattening, and with the elastic-deformation areas which must exist at each end of the plastic-deformation zone in the strip. In view of the excellent agreement of calculated and measured pressures found above, it appears probable that these effects are of minor importance under most conditions of rolling.

In the present article, only cold reduction has been considered, but the same method of calculation can be used in the case of hot strip mills. There are then two additional variables, namely temperature and speed of rolling; on the other hand, tension is not used, nor is the strip lubricated, hence the friction coefficient depends only on the smoothness of the roll surfaces and on the characteristics of the oxide scale on the particular composition of steel being rolled. Values of the friction coefficient, including the effect of temperature, are given in Trinks' Roll Pass Design Supplement, page 14. Data on the yield strength of various kinds of steel, at various temperatures and speeds of rolling, are given on pages 3 and 4 of the same volume. With all of this information at hand, it is no difficult task to calculate the roll pressures and forces to be expected under any conditions of strip rolling.

[1] *Blast Furnace and Steel Plant*, June 1937 and Supplement To Roll Pass Design, by W. Trinks, (Penton Publishing Co., 1937) pages 9 to 13 and 80 to 84.

[2] J. D. Keller, *Blast Furnace and Steel Plant*, October 1937, page 1112.

[3] A. Nadai, *Journal of Applied Mechanics*, vol. 6 (1939) p. A-54-62.

[4] It seems probable that for a short distance, only, from the entering end of the contact area, liquid friction does exist.