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STEEL

The Magazine of Metalworking and Metalproducing

JUNE 26, 1944

Volume 114—Number 26

NEWS

TECHNICAL

FEATURES

MARKETS

Spare the Rod and Spoil the . . . Rope

Proper twist, bend, elongation and tensile strength in wire rope are *inherent* qualities —in which the wire rod mill plays an important part.

Production—and profits—are measured in uniform, trouble-free tonnage, such as you can produce on Morgan Rod Rolling Mills.

MORGAN CONSTRUCTION COMPANY
WORCESTER, MASSACHUSETTS

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PLAN NOW WITH **MORGAN**

ENGINEERS AND BUILDERS OF ROLLING MILLS • WIRE MILLS
GAS PRODUCER MACHINES • REGENERATIVE FURNACE CONTROL

STEEL
June 26, 1944

Helping Them To Shift

To readers who are not familiar with advertising matters, let us explain that the National Industrial Advertisers Association is an important organization composed principally of the advertising executives of industrial companies. The Cleveland chapter of N.I.A.A. has just launched a movement (p. 81) which we think is admirable. We hope it will gain nation-wide acceptance on a grand scale.

The sponsors of this idea realized that sooner or later hundreds of thousands of men in the armed services will be returning to their jobs in industry. They know that the shift from military to civilian routine will not be easy for these men. They will need time to adjust themselves to the change and—very important—they will need to become familiar with advances in industrial methods which have occurred during their absence.

If you think that statements concerning the difficulties of adjusting one's routine from that of war to that of peace are exaggerated, recall or ask your friends who were in World War I how long it took to get back into the swing of the old job. With few exceptions, they will tell you the transition required from six months to a year and that it was a trying ordeal.

The N.I.A.A. idea is to help men in the service to catch up with progress in industry. The initial step is to collect copies of industrial, technical and trade papers from the offices of advertising agencies and to place them in army and navy hospitals where they will be available to convalescing servicemen.

This plan serves two purposes. It helps the veteran to get up to date on happenings in the industry or profession to which he will be returning. Secondly, it accomplishes this very desirable objective without imposing an additional strain upon the already inadequate supply of paper. Copies of business magazines, having served their purpose in the agency offices, go to hospitals for a second round of service.

We feel that this simple, effective idea put forth by advertising managers may well suggest to the top executives of industry that they do something to help their returning employes to adjust themselves more readily to the routine of industrial employment. Management can well afford to assign some of its ablest personnel to the task of studying the problems of returning servicemen and of developing procedures which will help them to reduce the time and minimize the mental torture of readjustment.

B-29s OVER NIPPON: Bombing of the Yawata steelworks on Kyushu island by American land-based bombers holds a double-barreled interest for persons identified with the metalworking industries.

First, the B-29 Superfortresses which performed this spectacular mission are the outgrowth of designs developed by a private airplane builder and of co-operative manufacture by a pool of contractors working along mass production lines. The story of the development of the B-29 and of its manufacture in quantity is one of the industrial thrillers of this war.

Secondly, the target for this first major attack by the Superfortresses was Japan's largest steelworks. The government-owned iron and steel properties at Yawata are believed to constitute about 80 per cent of Nippon's blast furnace capacity and at least 20

(OVER)

per cent of its steel ingot capacity. The original Yawata furnaces and mills, completed shortly after the turn of the century, were the first in Japan to be adapted from western industrial patterns.

If the estimate that Yawata's steelworks account for 20 per cent of Japan's steel output is correct, then the strategic equivalent of the bombing of Yawata would be the bombing in this country of all of the steelmaking facilities of Bethlehem, Jones & Laughlin and Crucible Steel of America.

—pp. 58, 74

° ° °

M. OF M. RECORD BAD: In presenting counter demands against the United Steelworkers of America before a panel of the War Labor Board in the steel wage case, steel producers placed major emphasis upon elimination of maintenance of membership requirements from contracts, cancellation of the check-off feature, provision for NLRB supervised elections at regular intervals and specific penalties for unauthorized work stoppages.

Supporting these demands, Hiland G. Batcheller cited the experience of Allegheny Ludlum Steel Corp., of which he is president, showing that in 1940 there were no work stoppages, in 1941 there were two, in 1942 there were two and in 1943 there were 26. This record indicates that maintenance of membership has not been effective in strengthening the "no-strike" pledge. Also it argues forcibly for specific penalties.

—p. 62

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STEEL'S WAR RECORDS: A compilation by the American Iron and Steel Institute indicates how differently the impact of war has affected the shipment of the various rolled steel products.

The war caused all major product classifications except three to establish new records, based on annual shipments. The three exceptions were rails and fastenings, whose year of peak tonnage was 1906; welded pipe and tubing, with maximum shipments in 1926; and hot-rolled strip, which enjoyed its best year in 1936.

The peak in the shipments of 11 steel products occurred in the period from 1940 to 1942 inclusive. The remaining six products, whose all-time records were established in 1943, are "ingots, blooms and billets", plates, hot-rolled carbon bars, hot-rolled alloy bars, cold-finished carbon bars and seamless tubing.

It will be interesting to note how long some of these war-period records will stand. It is doubtful whether any of these six 1943 records will be broken in 1944.

—pp. 56, 59

ANOTHER U. S. BANK? Anybody who has heard Maury Maverick expound his views on the plight of small businessmen or has read his remarks on the subject knows that the enterprising Texan is thoroughly sincere in his effort to get at the root of difficulties and to find effective remedies. He made a good impression on the University of Chicago round-table symposium on small business June 18 and also in his recent appearance before the House Special Committee on Postwar Economic Policy and Planning.

While the chairman of the Smaller War Plants Corp. has numerous plans for assisting the smaller businessman, the principal aids proposed are financial. He would create a government-owned and operated bank to cater to the financial needs of small businesses and he would revamp the tax structure to relieve them of inequitable burdens.

We like the latter and will not quarrel too much with the former. However, can't we find a way to help small business without creating new government corporations, banks, agencies, authorities, bureaus, commissions, offices or what not?

—p. 64

° ° °

NEED FEWER STEELS? For many years there has been general agreement among competent observers that most small consumers of steel (consumers who are not in a position to purchase their requirements in heat lots) buy a greater variety of specifications, sizes, finishes, etc. of steel than is necessary or desirable. It is suggested that in view of the experience with simplification during the present war and with a definite challenge for economy in production looming when manufacture for civilian needs is resumed, small consumers should begin now to reclassify and standardize their steel requirements.

It is a fairly safe bet that if many small-lot steel consumers who have been using 20 or more types of steel will examine their needs carefully, they will discover that they can get along satisfactorily with perhaps four general purpose steels and three or four special purpose steels.

A thorough check-up may indicate that a steel standardization program launched now or in the near future will pay handsome dividends a year or two hence.

—p. 86

E. L. Shaner

EDITOR-IN-CHIEF

Design —

For Workability With Inland Steel

Steel offers designers and manufacturers the maximum in workability. It can be formed and fabricated by all practical production methods, keeping shop costs down. It can be formed either hot or cold. It can be easily spun or extruded into many useful shapes. Steel can be deep drawn to such extremes as in the manufacture of steel cartridge cases. It can be machined, sheared, bent, seamed, welded, and brazed. And steel is available in extreme ranges of sizes and shapes, and chemical analyses; this offers a wide scope in the design of parts, and also simplifies shop procedure, reducing wastage to the minimum.

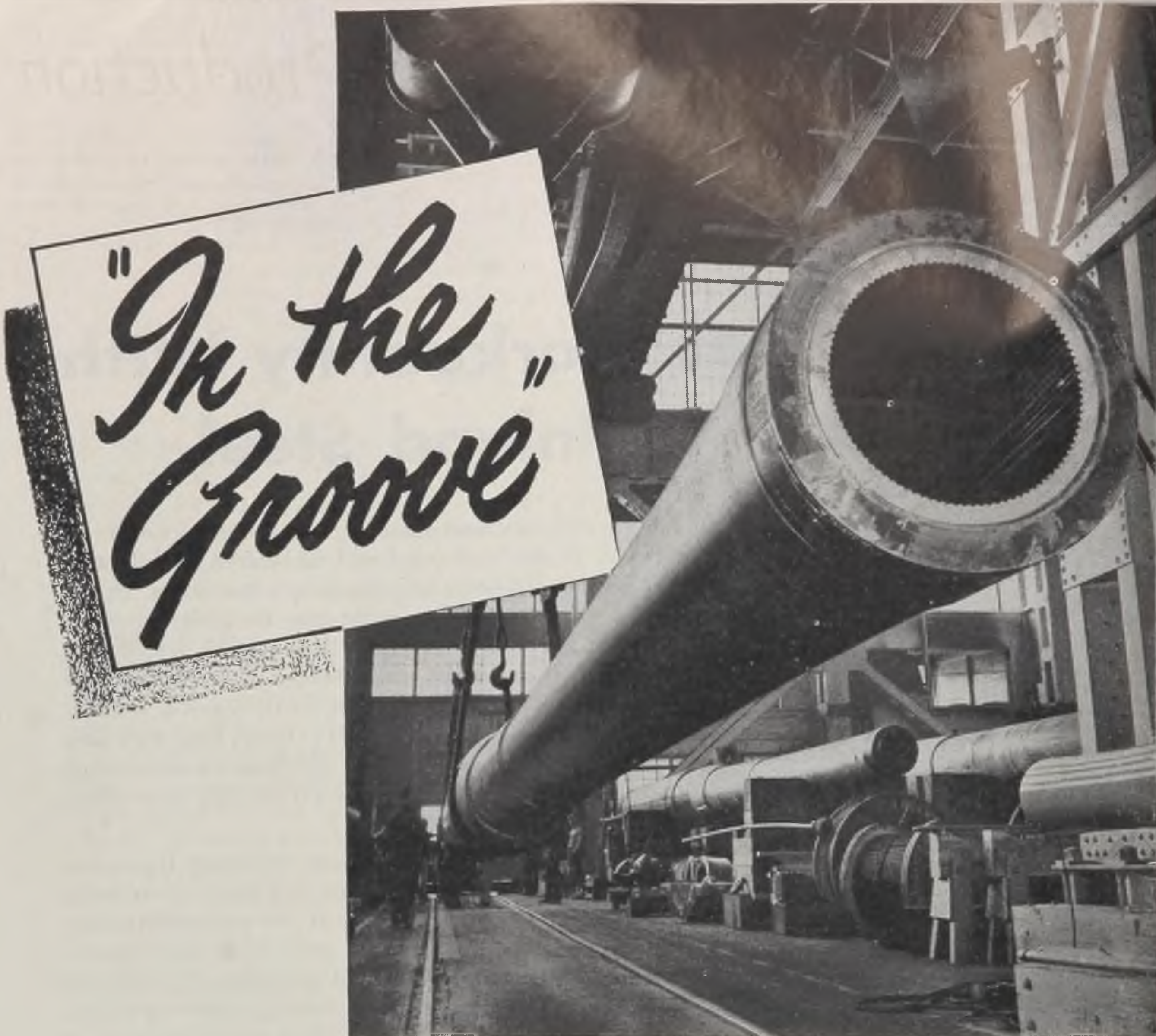
For half a century Inland has been studying the needs of industry, working with designers and production men, to make steel more useful—to give it the workability that simplifies production and assures economical fabrication. From such close contact with field problems, Inland has given industry Ledloy, the lead bearing, faster machining steel—Hi-Steel, the low alloy, high strength steel of exceptional workability—Form-Cote, the galvanized sheet which withstands severe forming—Paint-Tite, the specially treated galvanized sheet to which paint and enamel readily adhere—and many other kinds of steel that offer numerous advantages to the designer, the production man and the consumer.

Inland engineers and metallurgists are at your service to help you design, select steel, and fabricate products for today or for the post-war period.

INLAND STEEL COMPANY

38 S. Dearborn St., Chicago 3, Illinois

Milwaukee Detroit St. Paul St. Louis Kansas City Cincinnati New York



Official U. S. Navy Phot

IT has to be a precise, accurate operation . . . machining barrel riflings of the Navy's 16-inchers.

Whether machining big guns or countless other war materiel, operators everywhere are "in the groove" when they use Texaco Cutting Oils for faster machining, longer tool life.

Texaco Cutting Oils permit higher speeds and feeds, with improved surface finish. They lubricate the tools, and by carrying away the heat prevent chip welding; and lengthen tool life, assuring greater output.

Texaco lubricants have proved so effective in service that they are definitely preferred in many fields, a few of which are listed at the right.

The services of a Texaco Engineer specializing in cutting coolants are available to you through more than 2300 Texaco distributing points in the 48 States. The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★ *More locomotives and railroad car in the U. S. are lubricated with Texac than with any other brand.*

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★ *More buses, more bus lines and mor bus-miles are lubricated with Texac than with any other brand.*

★ *More stationary Diesel horsepower i the U. S. is lubricated with Texaco tha with any other brand.*

★ *More Diesel horsepower on stream lined trains in the U. S. is lubricate with Texaco than with all other brand combined.*

TEXACO

TEXACO CUTTING, SOLUBLE AND HYDRAULIC OILS FOR FASTER MACHINING

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT – CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTL

Plan Return to Civilian Production

War Production Board to free materials for building of working models of postwar products. Limitations on aluminum and magnesium relaxed for use in civilian end products. Purchase and ordering of machinery and tools to be permitted

ALTHOUGH the next three months are expected to be the most critical yet faced in munitions output, War Production Board officials last week started charting definite preparations for reconversion to civilian goods output.

Prefacing every step in the new peace-preparedness program with emphatic statements on the necessity of getting military production up to schedule and keeping it there, WPB Chairman Donald M. Nelson outlined three steps to be taken at once to ease the country back toward a civilian economy. These were:

1. An order authorizing any manufacturer to acquire enough materials and components to make and test a single working model of any product planned for postwar production. It was pointed out that the manufacturers could take orders against this working model for future delivery.

2. Reconversion of WPB orders limiting the use of aluminum and magnesium so that manufacturers will be able to obtain these metals and fabricate them into essential end products whenever and wherever manpower is available. With the exceptions of castings, foil and forgings, stocks of aluminum and facilities for producing it are more than sufficient for war needs. Existing restrictions on the manufacture of end products from aluminum and magnesium will be lifted by vesting in the WPB regional offices authority to permit manufacture of items from these metals as the manpower situation warrants.

3. Beginning July 1, manufacturers will be allowed to purchase machinery, tools and dies for civilian production, whenever possible out of existing surpluses listed with WPB and Defense Plant Corp., but if necessary, through the placing of orders validated by WPB for production at times and under conditions that will prevent interference with war production.

Must Not Interfere with War

Mr. Nelson, however, told Congress he would not hesitate a minute to cancel any of these steps to restore civilian production if they interfered in any way with the war program.

Speaking of the war production program over the next quarter, Mr. Nelson said military production schedules are heavier than ever before. "Some increases have already been ordered as a result of recent actions overseas; the tank program, for instance, was ordered stepped up last week, and other increases will undoubtedly follow. Our need for on-schedule production is absolutely imperative, and we are faced by a manpower problem which is causing us to lag far behind schedule in some of the most critical programs. We have got to drive harder than ever before to meet our military needs.

"This obviously means there can be precious little in the way of expanded civilian production for the immediate future. But in the interest of war production itself, and for the protection of the entire economy, it nevertheless is essential to prepare now for the return to civilian production.

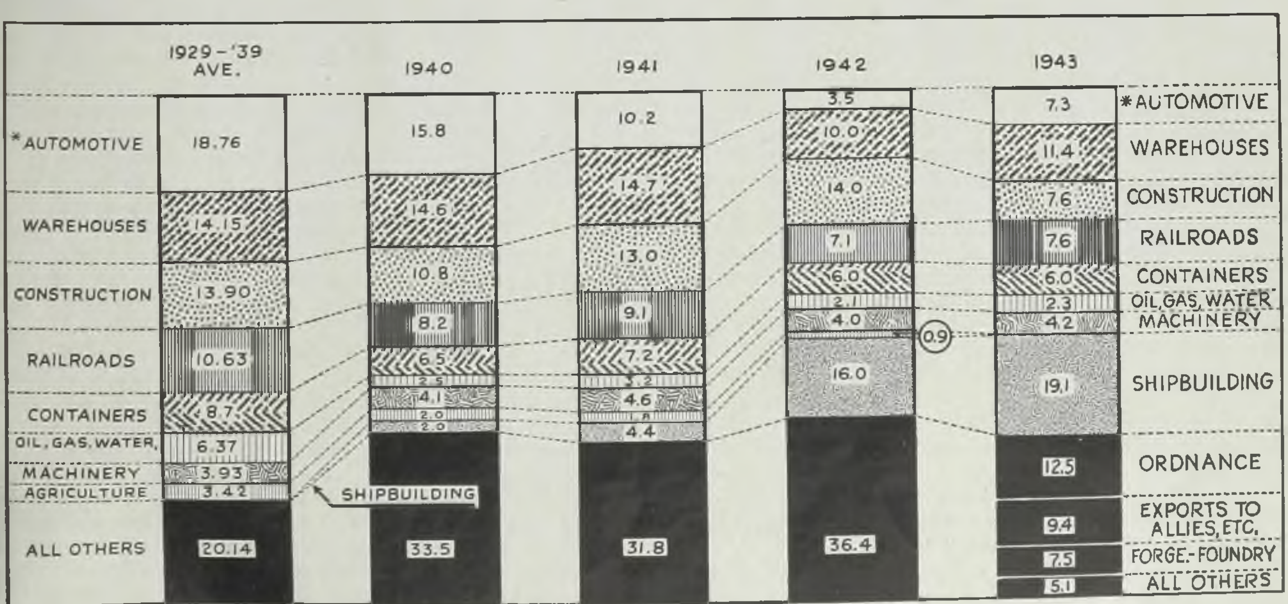
"Just as industrial preparations for war had to be started long before the large-scale fighting began, so also the industrial preparations for peace must be begun in plenty of time before the fighting ends."

In reference to expanded tank production, military authorities said builders would be called upon to replace three times the expected losses on the beaches of France, because expenditure of the armored vehicles was running at a rate far exceeding expectations. This expansion likely will be at the cost of the locomotive building program.

Heavy truck output, now running 25 per cent behind schedule, must be stepped up to schedule and kept there, due to losses in the invasion.

Likewise, cargo ship construction, which recently has been reported as tapering, is to be increased, according to Rear Adm. Emory S. Land, chairman of the Maritime Commission. Admiral Land said the present program calls for 20,000,000 deadweight tons this year and that the volume of work in merchant

DISTRIBUTION OF STEEL PRODUCTS BY CONSUMING GROUPS



*Distribution of steel products shipped to consuming industries on a percentage basis for 1940 through 1943, compared with the yearly average for the decade 1929 through 1939. *Includes aircraft from 1941 on.*

SHIPMENTS OF ROLLED STEEL PRODUCTS IN WAR AND PEACE

(Net Tons)

	1943	Maximum Annual Shipments 1940-1942 incl.	Maximum Annual Recorded Shipments Prior to 1940
Ingots, Blooms, Billets, etc.	* 8,552,000	7,609,000 (1942)	4,966,000 (1936)
Structural Shapes and Piling	3,909,000	* 5,190,000 (1941)	4,657,000 (1929)
Plates	* 12,967,000	11,543,000 (1942)	5,734,000 (1918)
Rails and Fastenings	2,747,000	2,763,000 (1942)	* 4,455,000 (1906)
Bars Hot-Rolled—Carbon	* 7,268,000	6,688,000 (1942)	6,721,000 (1929)
—Alloy	* 2,927,000	2,199,000 (1942)	1,323,000 (1929)
Cold Finished—Carbon	* 1,773,000	1,244,000 (1941)	Included with
—Alloy	* 448,000	313,000 (1942)	hot-rolled bars
Concrete Reinforcing	502,000	* 1,892,000 (1941)	1,266,000 (1939)
Tool Steel Bars	177,000	* 210,000 (1942)	Not available
Pipe and Tubing Welded	3,092,000	3,200,000 (1941)	* 3,811,000 (1926)
Seamless	* 2,778,000	2,475,000 (1941)	1,968,000 (1937)
Wire — Drawn	2,000,000	* 2,308,000 (1941)	1,375,000 (1939)
Wire Products	1,307,000	* 1,358,000 (1941)	1,183,000 (1939)
Finished Black Plate	355,000	* 474,000 (1941)	391,000 (1939)
Tin and Terne Plate	2,105,000	* 3,566,000 (1941)	2,870,000 (1937)
Sheets Hot-Rolled	6,371,000	* 8,209,000 (1941)	5,480,000 (1939)
Cold-Rolled	1,550,000	* 3,025,000 (1941)	2,274,000 (1937)
Galvanized	824,000	* 1,622,000 (1941)	1,615,000 (1939)
Strip Hot-Rolled	1,550,000	2,013,000 (1941)	* 2,480,000 (1936)
Cold-Rolled	1,155,000	* 1,322,000 (1941)	941,000 (1926)
Other Products	2,921,000	....	....
TOTAL	67,278,000	....	....

* Denotes record shipments. Data from American Iron and Steel Institute.

shipyards would be increased very soon.

Appearing before the Truman Committee of the Senate, Mr. Nelson cautioned that relaxation of the aluminum and magnesium limitation orders does not mean large-scale production of many civilian goods.

Relaxation of these orders arose from the fact stockpiles of these metals now exceed 1,000,000,000 pounds. Many bottlenecks, however, will prevent their use for civilian goods. Electric washing machines and household refrigerators cannot be made without fractional-horsepower motors which are still short for war uses.

Manufacturers interested in getting into the production of nonwar products should go to the regional offices of WPB, said Mr. Nelson, to ascertain what they can do in the light of all the factors involved.

Still another important reason why extreme care must be exercised in permitting resumption of production of peacetime products, said Mr. Nelson, is the disposition on the part of workers to stay in their communities if they think other work is going to come into the community to replace cutback or terminated war work. Right now, at least 150,000 essential war production jobs are calling for that many migratory workers. It would be a mistake materially to liberalize civilian production as long as this deficiency exists.

Undoubtedly, there will be a need for important switches in war production over the next few months, and it is the intention of the WPB to maintain a "fluid" situation which will permit of quick switches in production.

In the meantime, Mr. Nelson believed manufacturers favorably located with reference to manpower, and having unoccupied capacity, should be able to begin using aluminum in making such items as cooking utensils, garment hangers, umbrellas, safety pins, etc., of aluminum. These do not require complicating components.

No steel liberalization order may be expected for some time, said Mr. Nelson. "The supply of ingots is holding its own, is about in balance," he said, "but steel is not yet so plentiful that we can issue an order making it available for civilian goods in general."

Urges Accumulation of Orders

Manufacturers should begin accumulating backlogs of orders for civilian products, said Mr. Nelson. He urged that they should accumulate these orders both from domestic and foreign sources, and added that WPB "can do something to help manufacturers accumulate backlogs of orders" but he did not go into particulars as to ways and means.

No effort whatever will be made by the WPB to protect competitive positions in reconverting to peacetime production, said Mr. Nelson. "If you wanted to control all those things," he said, "you would have a system much more complicated than anybody imagines. It is entirely a question of materials and manpower in each individual case. We went into the war without any thought about competitive advantages and disadvantages—and that's the way we are coming out."

For help in the reconversion process, WPB has compiled a long list of the various types of consumer goods needed in the economy. This list, copies of which are to be found at all the WPB regional offices, sets up the quantities of each item needed in order to meet varying volumes of demand. For instance, minimum needs of electrical refrigerators which would be required under a strict rationing system which would provide for needs of hospitals, blood plasma stations and other essential wartime uses would be 13,500 annually; at the second level of demand the need would be 250,000 units; at the third level, calling for a refrigerator for each individual user, the need would come to 1,226,000 units.

The WPB list, said Mr. Nelson, calls for many items such as vacuum cleaners, sewing machines, electric heaters of different types, fans, farm radio batteries, typewriters, laundry and dry cleaning machinery, washing machines, vacuum tubes, dairy machinery, display cases, bathtubs, plumbing equipment, electric water heaters, stokers, coal hods, galvanized oil tanks and many others.

In general, said Mr. Nelson, manufacturers in a position to turn to civilian production should make one or more items on the WPB civilian shortage list.

In general, said Mr. Nelson, WPB is in close contact with the Army and Navy in studying cutbacks and contract terminations so as to be ready wherever possible to replace cutbacks and terminated war contracts with other war work or with civilian production. In addition, the various L and M orders are being studied continuously to see which of them from time to time may be nullified or eased. The first real act of liberalization in the use of materials for the war effort was that of June 17, involving aluminum and magnesium. As rapidly as possible, without hurting the war effort, said Mr. Nelson, will come further liberalization.

See Big Tank Replacement Demand

Army plans sharp increase in output to replace battle losses. Chicago builders think present production lines will be asked to enlarge schedules. Reopening of idle facilities doubted

CHICAGO

DESPITE Army announcement production of military tanks must be increased sharply to offset greater than anticipated invasion losses, no steps apparently have been taken thus far to step up output in this district. Speculation is that contractors engaged in tank manufacture may have their schedules increased, but it appears unlikely that former producers will receive instructions to re-open closed-down facilities.

Col. John Slezak, chief of the Chicago Ordnance District, asserts that whatever increase in tank production is required will be needed quickly and that it would take as long as nine months to retool, reorganize and re-man plants which have been dismantled. It is his opinion that two procedures will be utilized in supplying Army needs.

1. Production lines now operating will have output stepped up, and 2, training tanks being removed from service as the training program tapers off will be rebuilt and re-equipped.

Awarded Tank Rebuilding Contract

In connection with the latter procedure, announcement was made here within the past few days that International Harvester Co. recently was awarded a contract for rebuilding M-4 General Sherman tanks at its Bettendorf, Iowa, works. Extensive rearrangement of facilities in preparation for the new work now is under way. Tank alterations will incorporate latest revisions in engineering design and changes intended to improve performance based on battle experience. Some new features will contribute to comfort of the crew, it is understood.

Repairs will be made where necessary, but tanks to be sent to the plant are not battle damaged. They constitute vehicles not yet shipped overseas. First shipment is reported on the way to Bettendorf, and work on the contract is expected to extend into 1945.

Harvester officials state the contract will more than offset reduced production of high-speed prime movers on which the plant has been engaged since early 1943, after concellation of the original M-7 tank program for which the company had taken over the former car shops of the Bettendorf Co.

Chicago district manufacturers of tanks include the Pressed Steel Car Co., Chicago, which is building M-5 light tanks, and reconditioning M-4 medium tanks; and Massey-Harris Co., Racine, Wis., which is both building and reconditioning M-4s.

Pullman-Standard Car Mfg. Co., Chicago, had its tank program canceled several months ago, and paid off about 2500 employes. Facilities have been converted to manufacture artillery and other items and to re-establish them would not seem feasible. Furthermore, the trained force has been broken up and new employment would be a difficult matter in view of critical manpower shortage.

Cast armor plant of American Steel Foundries, East Chicago, Ind., has almost completed the discharging of several thousand workers after it was ordered to terminate its production of tank armor. The manpower problem would be a serious bar to reopening this $26,500,000 plant completed in late 1942.

Likewise, the rolled steel armor plant of Carnegie-Illinois Steel Corp., Gary, Ind., is operating with about one-fifth of the workers engaged at height of production, and never did reach full capacity. Full re-manning of the facilities would be an almost impossible undertaking.

Present, Past and Pending

■ GARY WORKS' STRIKE DISRUPTS SHIP PLATE PRODUCTION

CHICAGO—Serious disruption of ship plate production occurred last week at Gary sheet and tin mill, Carnegie-Illinois Steel Corp., strike hampering production in the 80-inch hot strip mill department.

■ LABOR SHORTAGE BARS OPERATIONS BOOST

CHICAGO—Because of inability to recruit sufficient manpower to man equipment, Republic Steel Corp. this week was unable to start additional operations at its new DPC plant here as scheduled.

■ CONTRACTS PEND FOR TANK GUN MOUNTS

NEW YORK—Eastern manufacturers are figuring on gun mounts and recoil mechanisms for 1000 large combat tanks which a midwestern builder is scheduled to build as part of the new tank program.

■ QUICK RECONVERSION OF AUTOMOBILE INDUSTRY EXPECTED

NEW YORK—Resumption of automobile production on a basis of 2 million cars a year, as planned by War Production Board and automotive industry, may come "very quickly," Alfred P. Sloan Jr., chairman of the board, General Motors Corp., states.

■ NORTHROP-HENDY CO. FORMED TO DO AIRCRAFT RESEARCH

SAN FRANCISCO—Joshua Hendy Iron Works, Sunnyvale, Calif., and Northrop Aircraft Inc., Hawthorne, Calif., have organized a new research organization, Northrop-Hendy Co., to develop and manufacture a new type of secret aircraft equipment.

■ CLASS I RAILROADS REPORT LARGE ORDER BACKLOGS

WASHINGTON—Class I railroads on June 1 had on order 43,444 new freight, 14,749 hopper, 4820 gondola, 700 flat, 18,507 plain box, 2968 automobile box, 1200 refrigerator, and 500 stock freight cars. They also had 643 locomotives on order.

■ BLAW-KNOX TO OPERATE NAVY'S $8 MILLION YORK PLANT

YORK, PA.—Navy Bureau of Ordnance's $8 million plant here, devoted to production of the Bofors antiaircraft guns, hereafter will be operated as a division of Blaw-Knox Co., Pittsburgh.

■ NATIONAL TUBE PREPARES TO MAKE 300-POUND SHELLS

MCKEESPORT, PA.—Christy Park Works, National Tube Co., soon will begin production of 240-millimeter shells weighing more than 300 pounds each.

■ JOSEPH L. BLOCK RETURNS TO INLAND STEEL

WASHINGTON—Joseph L. Block, executive vice president, Inland Steel Co., and deputy director, Steel Division, War Production Board, has left the division and will return to his Inland position. He will be succeeded by William B. Todd as deputy director.

■ OPA EXPECTED TO REVISE STEEL PRICE SCHEDULE SOON

WASHINGTON—OPA is expected to issue soon an amendment to its steel price schedule, increasing ceilings for 3100 and 4100 alloy steel and decreasing ceilings for 8600 and 8700 alloy steel.

■ CLEVELAND-CLIFFS CONTRACTS FOR STEEP ROCK ORE

CLEVELAND—Cleveland-Cliffs Iron Co. has contracted to purchase from Steep Rock Iron Mines Ltd. the entire 1944 output of iron ore from the latter's mines in Ontario.

Exterior view of the Yawata steel works, recently damaged by American bombs. In the foreground are the houses of the Japanese workers. This plant is estimated to produce 80 per cent of Japan's pig iron and at least 20 per cent of its steel. Long-range B-29s struck at the heart of the enemy's steel industry. United States Navy photos from NEA

Yawata Works, Bombed by B-29s, Largest of Nippon's Producers

Government-owned mill on island of Kyushu makes 80 per cent of Rising Sun's pig iron, more than 20 per cent of steel. Was first to copy western equipment and practices. Raw materials are scarce

YAWATA, the government-owned steel works which was the principal target of American B-29 bombers on their recent visit to the Land of the Rising Sun, produces 80 per cent of Japan's pig iron and more than 20 per cent of her raw steel. The latter figure may be ultra-conservative inasmuch as Japan has released no figures on steel production or capacity since mid-1937.

Construction of the Yawata works, which was begun in 1896, following an earlier Chinese "incident", marked the start of Japan's modern industrialization. Previous to the building of the Yawata works, Nippon's steel production amounted to only 5000 or 6000 tons annually, and this was produced by primitive methods. At Yawata, however, the Japs copied the most modern western machinery and practices which then were available.

The works are owned and operated under government direction to assure the militarists of a supply of iron and steel for war materiel. The original plant was completed in 1901 with an initial production capacity of 90,000 tons annually. Progress after this was rapid and by 1909, four years after the Russo-Japanese war, annual output had doubled to 180,000 tons annually.

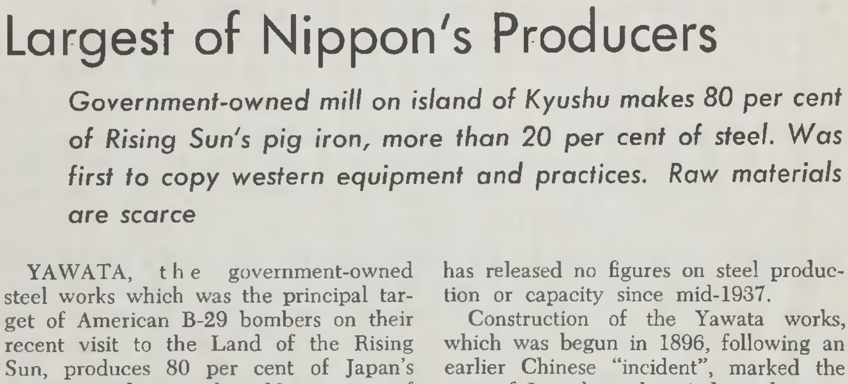
A second expansion plan, designed to again double the plant's output was adopted in 1911, to be completed in five years. However, the first world war brought a heavy increase in demand for iron and steel and the expansion of the works was speeded up.

Pig iron output increased from 242,000 tons in 1913 to 501,000 in 1917, and 694,000 tons in 1918. Steel production jumped from 254,000 tons in 1913 to 513,000 tons in 1917 and 539,000 tons in 1918. In these years the production of steel by the Yawata works was far more than double the combined output of private plants

The Japanese iron and steel industry hit a slump in the 20s from which it did not fully recover until the early 30s. However, up to 1932, Yawata produced three-fourths of the pig iron and more than half the raw steel made in Japan proper.

In 1934, the Yawata works was fused with six private companies into the Nippon Seitetsu or Japan Steel Mfg. Co. This amalgamation was capitalized at 360 million yen, of which 284 million yen represented the valuation placed on the Yawata works.

The Nippon Seitetsu in 1934 supplied 96 per cent of all Japan's pig iron, 52 per cent of its raw steel, and 44 per cent of its finished steel. The amalgamation always has been closely con-



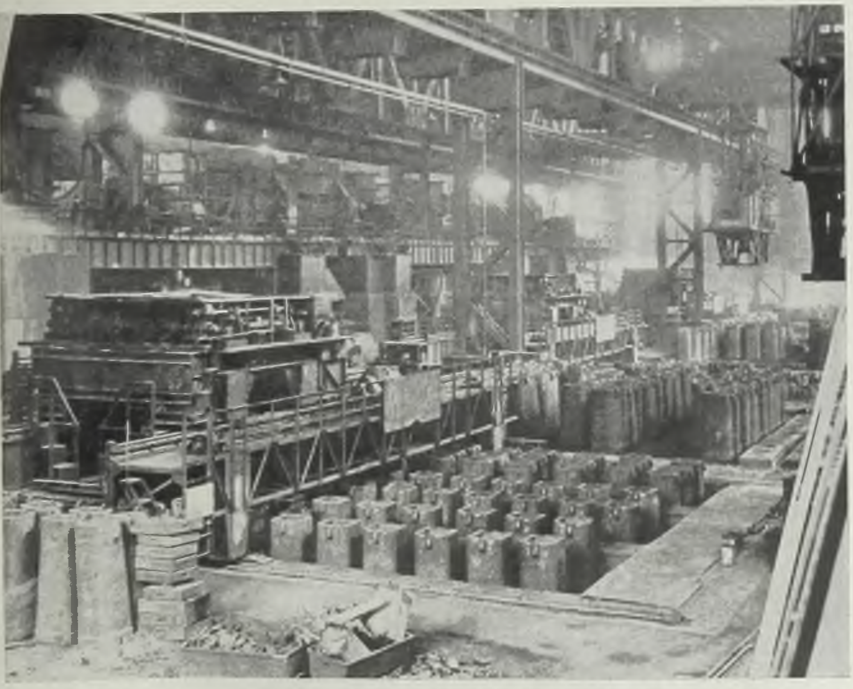
Government-owned Yawata steel works are located on the island of Kyushu along a narrow strip of coastline. Behind the mills is a squalid village housing the workers. NEA map trolled by the government and the articles for its establishment provided that shares could not be held by foreigners, that the government would supervise its operation, that no part of the plant could be suspended without permission of the government, and that losses to the company resulting from government orders should be offset by deducting dividends from the government-owned shares. The government owned 80 per cent of all shares.

Since its inception, Yawata has produced a relatively greater proportion of the country's total pig iron output than total steel production. This has been due in large part to Japan's precarious position in steelmaking raw materials. In iron ore, Japan proper is poor, producing only about 500,000 tons annually in the years before production figures were made secret. Korea and Manchuria have supplied substantial tonnages, while Malaya and some Indian states also supplied sizable quantities.

Before the war, Australia had become a substantial supplier of ore to Japan and an arrangement whereby the Japs were to gain control of a rich ore deposit (68 per cent iron) on Koolan Island in western Australia was scheduled to go into effect in 1938. However, the Australian government prohibited the export of ore after July 1, 1938, and blocked effectively this source.

The Philippines recently have become an important source for ore, being exploited by the Japs before Pearl Harbor to a considerable extent and probably to a much greater extent since. These ores are high grade, many containing 60 to 65 per cent iron.

Although Japan is well supplied with coal for fuel and power, the supply of coking coal is limited.



Above is an interior view of the Yawata works, first modern steel plant built in Japan, and patterned closely after western mills

Steel Industry's War Record

American Iron and Steel Institute issues booklet detailing industry's accomplishments in four years of war. Production and other pertinent data given

IN FOUR years of war (1940-43) the iron and steel industry of the United States produced 344,690,388 net tons of steel ingot; paid out $5,379,413,000 to employes; paid $2,209,314,000 in taxes, and had net earnings of $1,030,392,000, according to the American Iron and Steel Institute in a booklet, *Steel's War Record,* just issued.

Profusely illustrated with pictures and graphs the booklet points out that the industry earned only 5.1 per cent on its investment in 1943 contrasted with 9.1 per cent in the best peacetime year, 1929.

Maximum Output Increased

In 1939 the nation's steel furnaces were able to produce 81,600,000 tons of ingots annually, 60 per cent more than maximum output during World War 1, and nearly one-third above the tonnage produced in 1929, which stands as the best peacetime year for steel production. The attack on Pearl Harbor in December, 1941, found steel capacity up to 88,570,000 tons of ingots annually, 7,000,000 tons more than in January, 1940.

In a series of charts the institute shows that ingot production in 1943 totaled 88,835,512 tons, representing 98.1 per cent of capacity, compared with 52,798,714 tons or 64.5 per cent of capacity in 1939, and 63,205,490 tons or 88.5 per cent of capacity in 1929. Steel plate production increased from 3,101,981 tons in 1939 to 13,118,940 tons in 1943. Payrolls rose to $1,649,227,000 in 1943 from $812,775,000 in 1939, while tax payments increased to $617,119,000 from $141,123,000 in the last peacetime year. Net earnings since the boom year of 1929, however, dropped more than 50 per cent from $455,000,000 or 9.1 per cent on investment in 1929, to $200,754,000 or 5.1 per cent in 1943.

The booklet points out that despite higher wage costs and increases in cost of many raw materials steel prices remained virtually unchanged between September, 1939, and the end of 1943. The composite price of finished steel products as reported by leading trade journals stood at $56.27 per ton in September, 1939, and at $56.73 per ton in December, 1943. Higher costs with no advance in prices resulted in reducing net earnings of the industry in both 1942 and 1943.

The booklet is a factual record of the steel industry's contribution to the war effort and gives in detail production and related data on such important subjects as alloy steels, bessemer steel, blast furnace capacity, coal and coke consumption, alloy conservation, war steel demand, industry earnings on investment, steel employment, plant expansions and expenditures, iron ore statistics, new developments in steelmaking, open hearth steel production, payrolls, plate production, steel for shipbuilding, capacity, tax payments and other pertinent facts.

Alloy Steel Production Increased During May

Alloy steel production in May totaled 931,381 tons, about 12 per cent of total steel output during the month, according to the American Iron and Steel Institute. In April alloy totaled 889,051 tons and in May, 1943, it was 1,217,563 tons, or 16 per cent of total steel production. Openhearth furnaces produced 610,370 tons of alloy steel in May, the remaining 321,011 tons being produced in electric furnaces.

May Pig Iron Production Totals 5,300,036 Tons

Pig iron in production during May is reported by the American Iron and Steel Institute at 5,300,036 tons, bringing total output for the year to date to 26,137,203 tons. Of May production ferromanganese and spiegeleisen accounted for 42,830 tons with total output for the year to date 287,790 tons. Production in May was at the rate of 94 per cent of capacity.

Metals Engineering Major Theme Of A.S.M.E. Pittsburgh Meeting

Eighty-eight speakers, including Igor Sikorsky and many other noted figures in mechanical engineering, reveal technical developments vital to war production and foreshadowing new things for postwar era

PITTSBURGH, with its remarkable concentration of materials producing, manufacturing and technical education and technical research facilities, furnished a setting of remarkable suitability for the semi-annual meeting of the American Society of Mechanical Engineers. This event, held at the William Penn hotel, June 19-22, 1944, drew attendance of more than 1200, representing local sections all over the United States, together with many guests from the Engineering Society of Western Pennsylvania and from a number of foreign countries. Eighty-eight prominent speakers appeared on the program discussing prospective postwar developments from various angles.

Prophetic of the engineering stake of America in the affairs of the postwar world was the message brought to the meeting by K. Y. Chen, assistant chief, Far Eastern Division, United Nations Relief and Rehabilitation Administration, Washington, who delivered the Calvin W. Rice Memorial Lecture. Taking as his subject, "What Postwar China Hopes for from Engineers of the United States", Mr. Chen, who was born in China and who completed his engineering education in the United States, made this statement: "You in America are beginning to worry about postwar unemployment—about finding jobs for your boys when they return from the war. We of China, on the other hand have ahead of us such staggering industrial developments that we are worrying about finding experienced men to carry out this work."

As an important step in the rehabilitation and industrial development of China, Mr. Chen suggested the transfer to China of excess plant equipment after the war, in return for which we would receive some of China's riches in raw materials which we will lack.

In his address entitled "Direct Lift Aircraft" at the society's dinner meeting, Igor Sikorsky had this to say of the future of his helicopter: "I am convinced that ultimately the helicopter will become a very popular type of aircraft. Very likely its public acceptance will come about through commercial uses such as mail delivery, deluxe bus and taxi service, emergency air transportation, crop dusting, patrolling, etc."

Since the days of Frederick W. Taylor, the A.S.M.E. has maintained active interest in furtherance of the art of metalcutting. At present this interest is concentrated particularly on getting a firm technical foundation under the sensational new technique of high speed milling—an outgrowth of wartime aircraft production which bids fair to revolutionize some phases of postwar production machining.

This came in for thoughtful attention during the Pittsburgh meeting through papers by J. Q. Holmes, master mechanic, Eastern Aircraft Division, General Motors Corp., and by A. O. Schmidt and Joseph B. Armitage, respectively research engineer and chief engineer, Kearney & Trecker Corp. Announcement was made of recently launched research projects along this line at California Institute of Technology and University of Michigan.

With all our improvements in machining, there continues to be a strong undercurrent of thinking that one answer to the ever-growing problem of chip disposal is to make a smaller volume of chips by having parts nearer to size prior to machining. This thinking was reflected in a paper on "Stepped Extrusion of Aircraft Spars", by Kirby F. Thornton, aircraft service engineer, Aluminum Co. of America.

Randolph W. Mallick, section engineer, drove home the importance of improved materials handling throughout industry in these words: "Material handling is the greatest single item of labor cost in most industries. In the United States it represents 22 per cent of all labor cost and that means $4,000,000,000 annually."

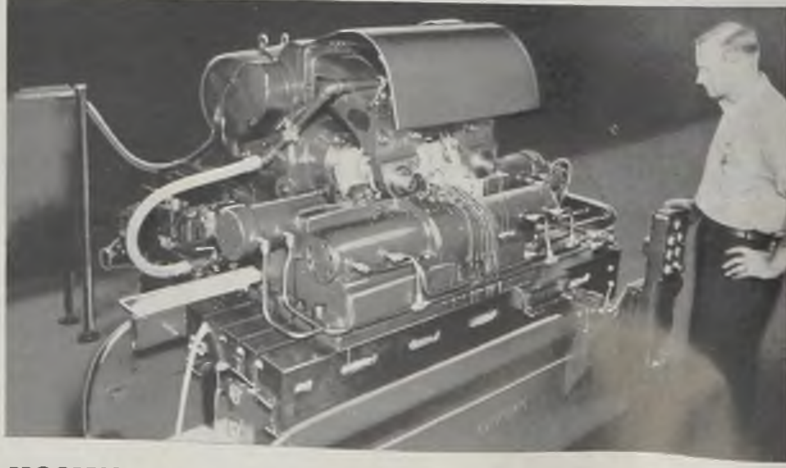
As to the postwar future of America, mechanical engineers are thoughtful but by no means pessimistic. For example, in his paper on "Management's Attitude Toward Methods Improvement", J. K. Loudon, production manager, Glass and Closure division, Armstrong Cork Co., said:

"Our country has demonstrated to the world beyond the shadow of doubt that we have both capacity and genius for production unequaled by any other nation. We have—in spite of many problems of conversion for war such as manpower dislocation, material shortages and the like—increased the productive capacity of this country to the point where the value of our production has reached the astounding total of $150,000,000,000 per year.

"Even taking into consideration the inflated value of munitions production as compared with peacetime products, this represents a tremendous increase over the 80 or 90 billion dollar production goals we were discussing just a few years ago. When we further realize that we have achieved this record at a time when we have been forced by circumstances to yield 11,000,000 of our finest men and women to the armed services, we begin to comprehend the tremendous potential of our postwar production capacity.

"We must find ways and means to direct and divert this productive ability

(*Please turn to Page* 139)



PROGRESS: Through its Manufacturing Engineering Committee, which compiles data for WPB distribution, and for its Production Engineering division, the American Society of Mechanical Engineers is active in the current upset of traditional ideas in milling practice and in cutter and milling machine design. Already, vital war work is being performed at hitherto "impossible" speeds and feeds in rigid, powerful machines, such as this dual-head Sundstrand on forge steel crankshafts. Still more startling developments will come with postwar industrial conversion

Los Angeles Employment Declining

Drop in district total is reported for third consecutive month. Largest losses are in the durable goods industries

LOS ANGELES

EMPLOYMENT situation remains confused. Factory employment dropped sharply during April in the Los Angeles area, marking the third consecutive month of job losses. The number of industrial wage earners showed an April decrease of 7200, dropping from 440,700 to 433,500 despite a sharp increase in the food processing industries.

As in preceding months of the year the largest job losses were centered in the durable goods industries. Among industries reporting job decreases were iron and steel, foundries, structural steel and ornamental metalworking, aircraft and parts, shipbuilding and repairing, nonferrous metals and their products, electrical machinery, construction, oil, mine and related machinery, general industrial and metalworking machinery, automobiles and automobile equipment.

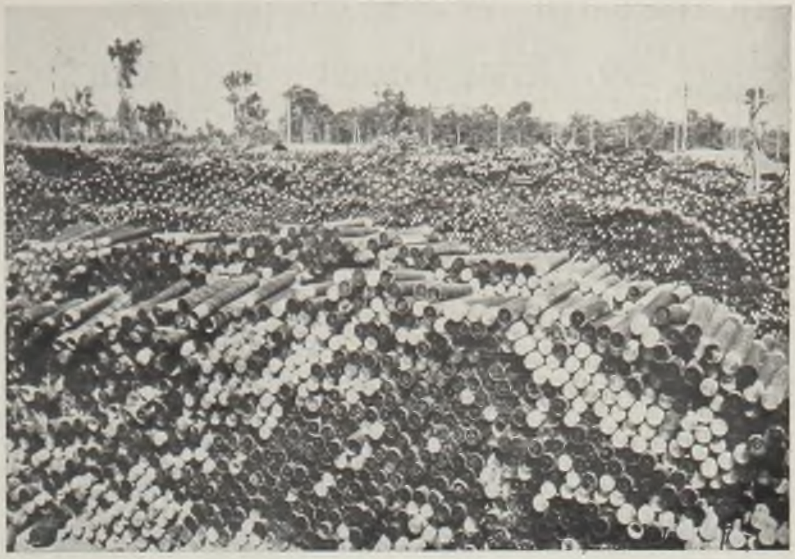
This is the first time in the history of Los Angeles that a job decline has been recorded from March to April. Factors combining to bring about this loss of jobs include: Labor turnover decrease in total labor force, due to many war workers returning to their homes, and to inroad of the draft; more efficient production in war plants; fewer design changes and more standardization; some contract cancellations.

Almost $12,000,000 in Los Angeles area construction projects were approved by the local office of the War Production Board during the first week of June.

The projects, 33 in number, range from food processing facilities, streets, sewers, and war plant alterations to secret military installations.

Army Ordnance buildings on the Santa Anita racetrack property which since Pearl Harbor have been successively a Japanese concentration camp and an Army ordnance depot are to be dismantled, moved to the Kaiser steel plant at Fontana and re-erected at a cost of $85,000. This project is in connection with the completion of the new shell forging plant, which was recently awarded a $25,000,000 contract for heavy projectiles.

Also at the Kaiser shell plant in Fontana railroad facilities are to be built at a cost of $40,254.



EXPENDED: This mass of empty artillery cases tells a mute tale of the fury of the Allied attack on a Jap-held island in the Pacific. NEA photo

Industries engaged in war work continue to add new equipment and to expand. Among projects provided for by WPB is a $3,156,379 alteration job at the Burbank plant of Lockeed Aircraft.

In the plant of the Weber Showcase & Fixture Co., Los Angeles, heavily engaged on metal life rafts, an enormous press is to be installed for forming leading edges for military aircraft wings. Cost of installation of this press, said to be the largest on the West Coast, a 1150-ton hydraulic, probably will run around $30,000.

Scrap Supplies Adequate in the San Francisco Industrial Area

SAN FRANCISCO

SCRAP stockpiles are comfortably adequate in the San Francisco industrial area, with no indication of any heavy depletion soon.

Steel producers in the region have been able to keep supply well above demand for more than a year and one large interest has approximately tripled its inventory since the beginning of the war. Considerable part of the favorable stock position results from a general low rate of foundry operations here currently, with a large number of installations working at not more than 50 per cent of capacity owing to reduction in orders. Any sudden and sustained increase in foundry production rates could easily reverse the picture, of course.

A major portion of shipyards scrap being salvaged in San Francisco and East Bay plants is moving east under WPB orders, a situation concerning which local steel producers are none too happy, especially as nearly all of this material is of high quality. This traffic is estimated to be running between 30,000 and 35,000 tons a month.

No heavy volume of battle demolition scrap is coming into the area from Pacific battle zones as yet. Virtually the only offshore movement is from Pearl Harbor which is sending in prepared scrap.

Posted prices for the main scrap grades are well under ceiling levels, and recently distressed tonnages have been appearing on the market below quoted prices. No. 1 heavy melting, prepared, is currently posted at $15.58 per gross ton, f.o.b. dealers yards, and No. 2 heavy melting, prepared, at $14.58, against ceilings of $17 for both grades. No. 1 and No. 2 dealers bundles are scheduled at $14.58.

J. & L. Subsidiary Purchases Draper Mfg. Co.

Jones & Laughlin Steel Corp. announced recently that its subsidiary, J. & L. Steel Barrel Co. has purchased the physical assets and business of the Draper Mfg. Co., Cleveland.

The Draper Mfg. Co. is the oldest manufacturer of steel barrels in the country and many of the improvements made in steel barrel construction have been developed by Draper Mfg. Co. over the years. The Draper division of the J. & L. Steel Barrel Co. will be operated under the present managing personnel.

Penalties for Work Stoppages Asked by Basic Steel Producers

Elimination of dues checkoff and maintenance of membership provisions also demanded as companies introduce evidence of union's irresponsibility. Show no-strike pledge not observed. Smaller companies insist wage differentials necessary

H. G. BATCHELLER

COUNTER demands of steel producers against the United Steelworkers of America were heard last week by a panel of the War Labor Board as the companies concluded their affirmative arguments in the steel wage case. Individual producers last week also presented supplementary arguments on the 14 demands of the union.

Generally the counter demands of the producers were similar and included elimination of the dues checkoff, maintenance of membership and the application of penalties for strikes and work stoppages. Many of the smaller companies asked for maintenance or restoration of wage differentials. Others asked for more stabilized wage rate determinations which in the past few years have caused a large number of grievances.

In supplementary presentation to the panel, the individual companies subscribed to the general arguments against the union's 14 demands as presented under the direction of the Steel Case Research Committee and pointed out how these demands would adversely affect their companies.

On June 27, another panel of the WLB will open hearings on the union's demands against iron ore producing companies at Duluth, Minn. Industry representatives of this panel are R. C. Allen and T. M. McCabe.

July 5 to 7 has been set aside by the steel wage panel for union rebuttal in Washington. On July 11, the steel panel will submit a list of questions to the union and the producers. On July 18, answers to these questions are to be returned to the panel.

Aug. 10 has been set as the tentative date on which the steel panel will submit its finding to the full War Labor Board.

At the close of last week, no decision had been reached on when the case of the 14 steel casting companies and the cases of more than 300 other companies which have contracts with the steelworkers' union will be heard.

Typical of the counter demands of the basic steel producers were those presented by Hiland G. Batcheller, president, Allegheny Ludlum Steel Corp., and until recently head of the Steel Division of the War Production Board, in his argument on behalf of Allegheny Ludlum. These counter demands included:

"1. Elimination of maintenance of membership requirements from the contract.

"2. Cancellation of checkoff provisions for union dues and initiation fees.

"3. Provision for NLRB supervised elections at regular intervals to determine if employes wish the union to continue as collective bargaining agent.

"4. Establishment of specific penalties for encouraging, aiding or taking part in any strike, slowdown or work stoppage, these penalties to take the form of suspension or discharge. To supplement this, a statement is requested from the president of the United Steelworkers of America, signed by the officers of the local and local shop stewards, setting forth the no-strike pledge of the union in such form that it may be enlarged and posted on the bulletin boards at each plant."

Mr. Batcheller pointed out that the reasons advanced for the inclusion of maintenance of membership and the checkoff was so the no-strike pledge given by the union should not operate to cause the weakening of the union labor movement under the impact of war conditions. "The avowed objective was to further the successful prosecution of the war."

Number of Work Stoppages Soar

The actual result in his own company, Mr. Batcheller pointed out, was: In 1940, there were no work stoppages. In 1941, there were two work stoppages. In 1942, there were likewise two work stoppages. But in 1943, there were no less than 26 work stoppages in the company's plants; and in the first three months of 1944, there were 12 work stoppages.

"Possibly this will give you a better idea of what we mean when we ask for some assurance or penalty to insure responsibility on the union's part to keep its contract. In the first three months of this critical war year, our plants lost 167,656 man-hours due to work stoppages and strikes as against 19,440 man-hours lost in the entire three years, 1940 through 1942."

Wheeling Steel Corp., Wheeling, W. Va., in a supplementary presentation by R. Conrad Cooper, assistant vice president, pointed out that the union's demand for a guaranteed wage in 1938 would have cost the company $9,997,367 for hours not needed or worked. In the same year, the corporation's profit before federal taxes amounted to only $581,721. "The significance of that demand is obvious," Mr. Cooper said.

The hidden wage increases incorporated in other demands of the union also were explained by Mr. Cooper, who presented figures showing the higher cost to the company would exceed the company's total profit before federal taxes.

As a counter demand, the corporation has requested "that the new collective bargaining agreement contain provisions for the exercise of effective discipline of employes of the corporation who engage in slowdowns of production, work stoppages, sitdown strikes or other activities in violation of the new agreement."

A. M. Oppenheimer, president, Apollo Steel Co., Apollo, Pa., told the panel that a guaranteed annual wage requirement would mean the immediate liquidation of Apollo Steel, as the additional cost would run into an amount exceeding any sum ever earned by Apollo in any year of its existence.

Mr. Oppenheimer also asked that the traditional wage differential between the smaller plants and the larger mills be retained to prevent a hardship on the smaller companies.

Continental Steel Corp., Kokomo, Ind., in a brief presented by Loren E. Souers, vice president and general counsel, also stressed the necessity for wage differentials if the smaller companies are to stay in business.

American Rolling Mill Co., Middletown, O., presented evidence to show the union has "forfeited all claim to union security" and requested that the board direct that no provision for union security by way of maintenance of membership, checkoff, or otherwise be included in the new collective bargaining agreement.

Among the evidence presented were registered letters from union members desiring to resign from the union during the 15-day escape period which were refused acceptance at local union headquarters.

Subsidiaries of the United States Steel Corp. offered a number of statements pertaining to experience in working with the union in an attempt to reach an agreement on handling alleged wage inequalities and to the development of mechanical and maintenance wage rates.

Calumet Steel Division of Borg-Warner

Corp., a rail rerolling company, argued that it could not absorb further labor costs even though it might receive special price treatment from the Office of Price Administration. Price increases, it was pointed out, constitute no solution because of the competitive situation.

Acme Steel Co., Chicago, argued that management must be free to establish incentive rates and to make necessary adjustments in existing rates in order to discharge the duties and obligations imposed by the wage stabilization law. The formula suggested by the union, it contended, would be impossible to follow while conforming to the law.

Follansbee Steel Corp., Pittsburgh, said that eight of the union's demands would cost that company more than its earnings before taxes in its best year. Cost of the other six demands, which, it said, were impossible to estimate accurately, would enlarge the deficit and ultimately kill the company.

Follansbee also asked for elimination of the checkoff and union maintenance and proposed that no demands be made upon the company unless these demands were approved by a majority vote of the local union. The company asked that wages be stabilized on the basis of rates prevailing Dec. 31, 1943, and that strikers who do not use existing grievance machinery be penalized through loss of seniority or vacation pay or both.

Reeves Steel & Mfg. Co., Dover, O., estimated that eight union demands on which added costs could be figured would cost that company $1,300,000, against a total payroll of $3,000,000 in 1943.

Says Underground Ore Mines Are Threatened

"Some modern Paul Revere should be riding night and day through the small mining towns of Michigan, Wisconsin and Minnesota, to arouse the people to an understanding of what the new wage demands of the CIO mean to them. Their entire economic future is at stake and they do not know it," Clarence B. Randall, vice president Inland Steel Co., Chicago, said as the union's wage demands were about to be presented to a War Labor Board panel.

"The iron ore companies will be answering these demands before a special panel of the War Labor Board meeting especially in Duluth, but it is the people in the underground mining towns who ought to be there rather than the employers. No company will close a mine unless it has to, but some mining communities will surely die if these new wage demands prevail.

"No underground mine could long survive under such a load. It might mean that one by one the Cuyuna, the Menominee, the Vermillion, the Gogebic, and the Marquette ranges would be closed.

"Each new wage demand that adds 1 cent per ton to cost on the Mesabi range adds five cents per ton to cost on the Cuyuna, the Menominee, and all of the other similar underground ore ranges.

"Unfortunately, it is the poor mines, the marginal, the underground mines that give the employment. Open pit mining does not employ much labor. Underground mining does. If the CIO destroys underground mining through a shortsighted policy of demanding more than the wage traffic will bear, it will destroy the prosperity of all mining towns in the Lake Superior district, outside of the open pits on the Mesabi range."

40% of Steel Sales Dollar Goes to Workers

Forty cents of every dollar received by steel companies during 1943 from the sale of their products were distributed in payrolls to employes, increasing the employes' share of the industry's sales dollar 10 per cent in a single year, says American Iron and Steel Institute.

In 1942, steel company payrolls absorbed 36½ cents of each sales dollar, one of the largest employes' shares on record up to that year.

Largely as a result of the substantial rise in payroll costs last year, the taxable income of the companies was reduced, with a corresponding reduction in federal income and profits taxes. Consequently, that part of the sales dollar required to meet tax bills dropped from 12½ cents in 1942 to 9 cents in 1943.

Meanwhile various other costs took out of the steel companies' 1943 sales dollar as much as or more than they called for in the preceding year. After meeting all such charges only 2½ cents remained out of each dollar received last year.

Two cents of the 1943 remainder was paid out in dividends to stockholders, and half a cent was left in the business as a reserve against the future and to build up credit. In 1942, dividends amounted to 2½ cents per dollar of sales, and one cent was left in the business.

Compared with a typical recent peacetime year such as 1937, the sales dollar in 1943 showed nearly 10 per cent more going into payrolls and over 60 per cent more going for taxes. The share going to stockholders in 1943 was 60 per cent less than in 1937, and the amount left in the business was 80 per cent less.

Value of Wage Incentive Plans Demonstrated

Value of wage incentive plans as aids to greater production is shown by the fact that, in the Chicago region of the War Labor Board, 86 plants using wage incentive systems found that productivity increased an average of 45 per cent within 90 days after the plans were installed, John W. Nickerson, director of the War Production Board's Management Consultant Division, told the Massachusetts Institute of Labor (AFL) at Wellesley, Mass., last week.

The wage incentive systems also increased the earnings of the workers in the 86 plants by 19 per cent, he said. At the same time, a decrease in labor costs amounting to 14 per cent was achieved, Mr. Nickerson reported.

POSTWAR PREVIEWS

RECONVERSION—WPB Chairman Donald Nelson outlines steps to be taken at once in preparation for return to civilian production. See page 55.

FINANCIAL AID—Maury Maverick, Smaller War Plants Corp. chairman, advocates credit insurance plan or establishment of government-owned and operated Industrial Development Bank as financial aid to small companies in reconverting from war to peace. Cites need of tax and patent law revisions. See page 64.

POWER—Latin American nations studying possibilities of utilizing vast, untapped hydroelectric resources in postwar era. See page 67.

INFLATION—WPB Vice Chairman Batt warns that more goods for more people at lower prices must be supplied after the war to prevent start of cycle of inflation. See page 69.

AUTOMOBILES—Rumors of new motor combine to enlarge Big Three to Big Four circulating in Detroit as jockeying for position in the race for postwar markets continues. See page 71.

STEEL RECLASSIFICATION—Plan for small-lot steel buyer to pare number and variety of steels used in products to bare essentials will aid in solving this vital postwar problem. See page 86.

QUALITY TESTING—Standard charts permit ready identification of microstructure and thus provide metallographic quality test for evaluating primary constituents in malleable iron. System is another milestone on road toward absolute control of quality and quantity in metals. See page 96.

WINDOWS of WASHINGTON

Maverick suggests two plans to facilitate loans to small business during transition period, including credit insurance similar to FHA plan, and an industrial development bank owned and operated by government. Cites weakness in S. 1718

UNLESS considerably revised, the partial-payment and guaranteed-bank-loan provisions of S. 1718, the Murray-George Contract Termination Bill, will greatly handicap small companies in reconverting from war to peace, Maury Maverick, chairman, Smaller War Plants Corp., told the House Special Committee on Postwar Economic Policy and Planning recently.

"I am not satisfied that this need can be met by a system which relies on individual scrutiny and guarantee of loans," he said. "I can't see how the little fellow is going to get aboard this band wagon when the rush starts.

"There is almost a complete absence of financial facilities for small business in the intermediate, long-term and equity-capital fields, except as these requirements are supplied by the investment market. In other words, small as well as large firms must generally secure funds of this type by making a public issue of bonds or stock.

Beset With Many Troubles

"A myriad of troubles besets the small business man who attempts to secure financing in this manner. His name and financial record are not such as to attract the investing public. The amount of money which he requires is too small to justify the overhead expense involved in qualifying his securities before government authorities and selling them to the public. It frequently happens that the general public's attitude towards the securities market is such as to prevent a favorable reception of the stock or bonds which he has to offer.

"This lack of intermediate, long-term and equity-capital financing facilities has been with us for a long time, and unless steps are taken by Congress such tendencies will continue. Furthermore, it will be in evidence during the reconversion period—just at the wrong time."

Mr. Maverick cited two methods which he thought would help in this situation. The first was his previous recommendation of a credit insurance plan along the lines of the plan used by the FHA. Qualified banks could automatically insure all or a percentage of their loans of a given type and size with a government or other insuring organization. The system would operate on the principle of spreading the risk and paying losses from resources built up out of small premiums. It would do away with "the necessity for individual examination of loans by the insuring organization." Under this system, said Mr. Maverick, the 15,000 banks of America would be the proper organizations to finance small business, and the government would not enter into competition with them.

The second method mentioned by Mr. Maverick would be similar to that suggested to the Canadian government by its Minister of Finance. Under this suggestion, an Industrial Development Bank, government-owned and operated, would be set up with broad power to make or guarantee loans and to acquire stocks, bonds or debentures, either by underwriting or purchasing direct from the

RALPH A. BARD

Appointed Under Secretary of the Navy last week by the President, Mr. Bard will play a more important role in the Navy Department's dealings with industry. Before he was appointed Assistant Secretary of the Navy in 1941, he was head of the investment banking concern of Ralph A. Bard & Co., Chicago

issuing corporation. While it draws no distinction between large and small business, its proponents have stated that it is intended to be used largely to finance new and existing small business.

"An interesting sidelight," said Mr. Maverick, "is the provision that the bank must operate 'on the assumption that there will be on the average a relatively high level of economic activity.' The Canadians have decided to be bold. They have faith in their future. And they intend to decide whether or not a borrower is credit-worthy against such a background. It seems to me that a plan similar to the one proposed by the Canadian government could be developed and adapted to the needs of small business in this country."

It would be the purpose of such an institution to fill gaps and to strengthen existing institutions rather than to weaken them, said Mr. Maverick. Its operation, he said, should not be in the nature of competition with existing banks, investment houses or other financial institutions.

The postwar tax policy is going to have a profound influence over creation of new enterprises, said Mr. Maverick. "Small business," he said, "must have a chance to get started by reasonable tax relief. We must have inducement taxation for the new free enterpriser." He called on Congress to formulate a tax policy that will give encouragement to new and expanding firms, regardless of their size. In particular, he recommended favorable treatment for small business.

"I believe that the specific exemption under the excess profits law should be increased well beyond the $10,000 provided by the Revenue Act of 1943," said Mr. Maverick. "This exemption might well be increased to something like $50,000, effective not later than the first taxable year beginning after the end of the war. If it is so desired, this exemption could be restricted to corporations with excess profits net income—before the exemption—of not over $50,000. Regardless of the precise form which this exemption might take, businesses of small and moderate size would be the principal beneficiaries. Obviously, the larger exemption would be regarded with favor by those contemplating the establishment of small business corporations after the war."

Also, said Mr. Maverick, if equity capital is to flow freely into business channels, and is to become available to small business on favorable terms, specific investment incentives in the form of preferred rates on dividend income on new equities might be granted to business.

"Must Not Overtax Dividends"

"If the small-time capitalist is to regain a place in the economy," he said, "we must not again try to operate the tax system on a 'heads, I win—tails, you lose' basis. We must not overtax dividend income, and we must allow liberal treatment carryovers or carrybacks—of operating losses. Liberal depreciation allowances on new plant and equipment are also essential.

"As the tax laws now stand, the exactions imposed by the federal and other governments appear to be a barrier to those who are contemplating the establishment of new enterprise. Therefore, everything possible should be done to minimize the forbidding appearance of the federal tax structure and to encourage the establishment of new companies . . . A specific suggestion that has been offered is that new corporations should be granted special treatment under the federal corporation income tax for a period of years. One proposal is that new manufacturing corporations might be exempted for the period of three years from whatever special tax is imposed on corporations after the war; for the fourth and fifth years one-half the regular rate has been suggested."

Mr. Maverick also complained that one of the greatest handicaps under which small business operates is the patent system which permits patent pools to be maintained and operated by large com-

There are many GOOD THINGS AHEAD . . .

Fins applied to the sides of aircraft tires have been found to reduce wear. When the landing gear is lowered, the air pressure spins the wheels and reduces the scuffing of the tires in their first contact with the ground.

The formerly worthless scrub palmetto, which grows like a weed on the Gulf Coast of Florida, is now ready to supply material for wallboard, brushes, binder twine, upholstery, insulation, and for use as a reinforcement for plastics and Portland cement.

A plastic molding powder is being made from potato starch.

Some engineers foresee the time when the refuse of cities—garbage, ashes, paper, etc.—will be removed continuously by underground tubes and burned in large incinerators to furnish power.

Shells are being tested by a new variation of the old trick of dropping a coin on the counter. When dropped on metal plates, the perfect shells make a particular sound that is detected and reported by an electronic "ear".

A fine finish may be put on stainless steel inexpensively by means of a newly patented electrolytic process.

The strength of spot-welded aircraft joints is being successfully tested by X-ray.

Because of its peculiar stretch and slow recovery, as well as its light weight and resistance to rot, Nylon rope is expected to have many postwar uses where a shock absorbing effect is required.

A new flexible tubing is made of woven glass fiber covered with plastic.

A new street cleaner sucks up leaves and compresses them for fertilizer.

A new ignition cable is made of monel and is insulated with synthetic rubber and glass fabric.

Pure tungsten can now be produced directly from the ore by a newly reported electrolytic process.

A patent assigned to a large truck manufacturer permits the conversion of a regular truck to a half-track crawler.

The Office of War Information has an exhibit of new materials, methods, and products in the Social Security Building in Washington.

Echo sounders, intended to measure the depth of water under a ship, are being used to locate schools of fish.

Experiments are being made with alloys of wrought iron and nickel.

Machinery has been designed for the high-speed, mass-production baking of bread with infra-red lamps.

Neon lights will be standardized in 98 colors.

Several manufacturers of air-conditioning equipment are working on plans for a $1,000 unit suitable for a six-room house.

At least 30 aircraft parts of laminated plastic paper are in production.

Lamp bulbs are being made shatterproof by a coating of lacquer.

A new double-barrelled spray gun that can handle two fluids at once has just been patented.

A novel mail box answers audibly any spoken request for the zone number of any address in the city.

When you look ahead Look at metal cutting costs

This part was produced on an 8 Spindle Conomatic from SAE 4615 seamless tube stock. The 16 machining operations, performed without rehandling, include hole and groove burnishing, threading, and internal recessing. Time—37 seconds. Conomatics cut metal cutting costs.

CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U. S. A.

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panies. "Possession of these large numbers of patents plus the financial resources with which to back them up through endless litigation," he said, "is usually sufficient to expel all small businessmen from any particularly lucrative field. I suggest for your consideration the bill prepared by the Antitrust Division of the Department of Justice; it suggests that patent combinations be subject to the antitrust laws in the same manner as other combinations."

Improved products and processes growing out of the war, said Mr. Maverick, should be put at the disposal of small business. "This tremendous array of technological improvements, although paid for largely by the people through their government, will, unless something is done, probably become the private property of big business. Although most of these improvements have been created at government expense and under government direction, their actual development has physically taken place in the laboratories and plants of large corporations. The corporations have already started to obtain patents on the more valuable of these developments. It can be expected that, before long, most of the more desirable of these developments will have been patented by the large corporations." To prevent such a result, he said, suitable legislation is needed.

The Murray-George bill fails in still another respect to safeguard the interests of small business, said Mr. Maverick. It does not protect subcontractors when their prime contractors go into bankruptcy. He recommended that the Smaller War Plants Corp. be authorized to buy the claims of subcontractors when the prime contractors are insolvent. Even in cases where payment covering a subcontractor already has been made by the government to a prime contractor who subsequently has become insolvent, the government should pay the subcontractor in full, even though this may involve paying twice for the same work.

Lend-Lease Shipments to Russia Continue Heavy

Lend-lease shipments from the United States to the Soviet Union during the first four months of this year amounted to almost two million tons, including more than 2200 planes, 800 tanks and tank-destroyers, over 40,000 military trucks, 6300 jeeps, 6600 other military motor vehicles, and war production materials and equipment for Soviet factories and railroads, and food for the Soviet Army.

This brought total shipments of the Soviet aid program to 10,400,000 tons of supplies, including: 10,000 planes; 5600 tanks and tank destroyers; 210,000 military trucks; 40,000 jeeps; 30,000 other military motor vehicles; 414,000 tons of railroad rails, car wheels and axles; 249 locomotives; 900,000 miles of field telephone wire; about 300,000 field telephones; 1,500,000 tons of steel; 460,000 tons of nonferrous metals; and $500,000,000 worth of equipment.

BOMBED RAIL YARDS: Two Allied flyers inspect the damage wrought to railway yards at Littorio in the northern suburbs of Rome. The yards, which were torn asunder by air attacks, now are being repaired for Allied use. British official photo from NEA

Postwar Tax Policy Study To Be Launched by Senate-House Group

Representative Doughton skeptical about framing legislation now. Believes it is impractical to write law until postwar revenue needs, level of national income and yields from present taxes are known. Republicans plan separate study

DESPITE the recent declaration by Chairman Robert L. Doughton (Dem., N. C.), of the House Ways and Means Committee that it is not feasible to draft a postwar revenue bill now, he has joined with Chairman Walter F. George (Dem., Ga.) of the Senate Finance Committee in announcing a Senate-House study of postwar tax policies.

Purpose is a swift tax revision when the war ends in Europe, along lines recommended in the Baruch-Hancock report which called for preparation of a bill "to be put on the shelf until after the war." The study will be made by the Joint Committee on Internal Revenue, whose membership has been increased from 10 to 12 in order to assure party equality and thus take the matter of postwar taxation out of the realm of politics.

Whether a postwar tax bill actually will be prepared as a result of this study appears doubtful in view of Mr. Doughton's continued skeptical attitude.

"I have a high regard for Mr. Baruch, but this is our responsibility," said Mr. Doughton. "In my opinion, it is impractical to attempt to write the actual tax legislation before we know the postwar revenue needs, the level of national income and the yield we could expect from present taxes. We will get all the facts and be just as ready as we can when the war ends."

Senator George said everything would depend on how long the war lasts, but if Germany collapses in six months to a year "we should have ready at least the outlines of the legislation." Mr. George thought the joint committee should be able to make estimates of postwar obligations and tax needs at this time and later revise these estimates to meet the facts. In particular, Messrs. Doughton and George expressed hope that agreement may be reached as to what taxes may be repealed and which may be reduced after the war.

Decision to launch the study came following an urgent recommendation by War Mobilization Director James F. Byrnes that Congress begin study immediately of postwar tax policies.

In addition to the study to be undertaken by the Joint Committee on Internal Revenue, the House Republican Postwar Tax Study Committee has an ambitious program for the early fall months. Its membership of 25 will be organized into nine subcommittees which, according to the present plan, will hold hearings in Washington, Philadelphia, New York, Boston, Detroit, Chicago, Cincinnati, St. Louis, Atlanta, Birmingham, New Orleans, Houston, Kansas City, Minneapolis and St. Paul, Salt Lake City, Los Angeles, San Francisco and Denver.

"Representatives of business, agriculture, labor and other groups will be invited to give their views at these hearings as to postwar changes in rates and provisions of present law," said Chairman Daniel W. Reed (Rep., N. Y.) of the House Republican Postwar Tax Study Committee. "It is the intention of the committee to embody a constructive postwar tax program in a bill to be introduced as soon as practicable. We are unanimously agreed that no time should be lost. Wartime taxes cannot be safely projected into the peacetime era."

Surplus Disposal Plan May Solve Problem

Henry P. Nelson, material co-ordinator for the National Aircraft War Production Council Inc., Washington, comments on the surplus material disposal plan outlined in STEEL for June 5, p. 72, as follows: "The surplus property disposal plan as developed by the Metals Reserve Co., ASU, WPB, in consultation with the aircraft industry, the metals producing industry and the warehouse people, should solve most of the surplus headaches of the aircraft industry.

"The objective of the plan is to remove the material from the plants promptly and to provide a mechanism for the return of material through production channels with the least possible amount of red tape."

WPB Establishes Office of Labor Advisory Committees

Office of Labor Advisory Committees is being established as part of the War Production Board's Office of Labor Production. Joseph D. Keenan is vice chairman in charge of labor production and Clinton S. Golden is vice chairman for manpower requirements.

Administrative procedures have been formulated through which WPB will consult with labor on problems of war output, production readjustments, and planning for reconversion. An important provision of the order reads as follows: "Whenever any proposed WPB order or program would (in the opinion of either of the above mentioned vice chairmen) result in a substantial curtailment, expansion or other change in the rate of operations of any industry affecting labor, such vice chairman may recommend to the director of the industry division sponsoring the proposal consultation with the appropriate labor advisory committee. After concurrence by the division director, the appropriate division labor assistant shall make arrangements for consultation with such labor advisory committee as soon as practicable in the development of the order or program."

Hydroelectric Power Scrutinized

Latin American nations, threatened by fuel shortages for their expanding industries, studying possibilities of utilizing vast, untapped hydroelectric resources in postwar era

MANY South American nations, faced with possible fuel shortages for their expanding industries, are turning their attention to vast, untapped sources of hydroelectric power as a postwar solution to the problem, according to the Office of the Co-ordinator of Inter-American Affairs.

Chile, Uruguay, Argentina, Bolivia, Brazil, Colombia and Peru already have begun work on important power and irrigation projects or have completed surveys of their hydroelectric resources for future use.

Uruguay, which has nationalized future electric power production as part of a program of complete electrification for railroads, public services and industry, has a well-advanced power program which includes the 3850-foot Rio Negro dam, 150 miles from Montevideo. The dam was begun in 1937 and when completed will impound the largest artificial lake in South America—87 miles long by 18 miles wide—for flood control and irrigation, navigation and electric power production. A 30,400-kilowatt generator will soon be installed by a United States firm and a transmission line built to Montevideo. Total cost of the Rio Negro project is estimated at $35,000,000.

Long-range hydroelectric and irrigation projects in Uruguay include the Quequay river dam, north of Paysandu, to develop 8000 kilowatts, the Arroyo Cunapiru dam, to develop 10,000 kilowatts, and the Cebollati river dam to develop 11,000 kilowatts.

Chile has surveyed sites for dams at Tocopilla, Copiaco, La Serena, Pilmaiquen, El Volcan, Coquimbo, Sauzal, Ovalle, Lontue, Maule and Laja. The Ralun project near Puerto Montt will use the waters of Lake Todos los Santos for an initial output of 50,000 kilowatts, to be increased later to 126,000 kilowatts. The Manio plant on the San Pedro river will have approximately the same potential. The Abanico dam on the River Laja can produce up to 100,000 kilowatts when completed, and the Rapel generators, just south of Santiago, have a potential of 60,000 to 120,000 kilowatts.

Bolivia is now developing approximately 30,000 kilowatts and has an estimated potential of 4,000,000 kilowatts more from waterways on the eastern slope of the Andes. Lake Titicaca alone is believed to be capable of producing 700,000 kilowatts, a greater output than that of Boulder Dam.

Colombia has a total of 346 electric plants with estimated production of 161,000 kilowatts. Six of these plants belong to the government, 199 to cities and 141 to private enterprises. Proposed projects include a plant near Manizales to cost about $650,000, a 12,000-kilowatt plant on the Paez river in the Department of Huila, another near Florencia in the Caqueta region, completion of one plant at Trumeaque and construction of another near Titiribi, and building of a dam at Soacha, near Bogota, with a potential of 60,000 kilowatts.

Peru is building a huge hydroelectric plant on the Santa river, near Canon del Plato, which will produce more than 500,000 kilowatts by means of five generators. Another dam east of Lima will produce 91,000 kilowatts for use by the capital area, and construction on 11 smaller plants has been authorized although delayed by shortages of equipment.

Brazil plans a huge dam to harness the 265-foot Paulo Alfonso Falls on the Sao Francisco river, for an estimated output of 600,000 horsepower. Another falls nearby has a potential of about 200,000 horsepower. Two other plants have been proposed for points further upstream.

Argentina, with only 31,000 kilowatts of hydroelectric power of a total of 700,000 kilowatts of installed electric power, is considering projects to impound large lakes, with irrigation the principal objective.

Additional Iron Production Quotas Assigned by WPB

Production quotas for 832,900 electric irons, bringing total authorizations to produce irons in fulfillment of the 1944 program for 2,000,000 well beyond the three-quarter mark, have been assigned to five additional manufacturers, the War Production Board has announced. The manufacturers and the quotas assigned to them are: General Electric Co., Ontario, Calif., 421,500; Chicago Flexible Shaft Co., Chicago, 162,500; Proctor Electric Co., Philadelphia, 137,800; Son-Chief Electrics Inc., Winsted, Conn., 72,600; and Sampson United Corp., Rochester, N. Y., 38,500.

FEA Modifies Rules on Exports to Latin America

All commodities except a relatively few categories have been removed, effective July 1, from the decentralization procedure in 13 Latin American republics, according to the Foreign Economic Administration. This procedure had required exporters to submit Import Recommendations with applications to export. Commodities for which Import Recommendations still must accompany license applications for shipments to Latin American countries include carbon and alloy steel, coal and coke.

PRIORITIES—ALLOCATIONS—PRICES

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

INDEX OF ORDER REVISIONS

Subject	Designations
Copper	M-9-c, 9-c-1
Hangers, Garment	L-30-d
Machinery, Food Processing	L-292
Meters, Water	L-154
Power Transmission Equipment	L-193-a
Tools, Hand	L-157
Zinc	M-11-a
Price Regulations	
Batteries	GMPR
Equi-ment, Farm	No. 246
Machines, Office	No. 188

INSTRUCTIONS

STEEL TUBING: Eligible users of alloy steel tubing, other than airframe and engine types, now are permitted to accept deliveries of the following amounts, even though their resulting inventories may exceed their requirements for the following 60-day period: A minimum mill production run or 5 tons of a given size, up to and including 7½ inches outside diameter, or 10 tons of a given size, over 7½ inches outside diameter. Users who receive such deliveries will not be eligible to receive further deliveries of the same item of tubing until their inventories again are within the limits prescribed by CMP regulation No. 2.

INVENTORIES: Persons whose war contracts are reduced or canceled will not be in violation of WPB inventory regulations merely because amounts of materials they hold after a cutback are in excess of a practicable working inventory or, in the case of controlled materials, in excess of a 60-day supply.

TRANSFER OF MATERIALS: Transfers of materials and products from a plant whose contract has been terminated to another plant that is making the same product for which materials were acquired are subject to the following conditions: (1) Special items which are not readily usable in the manufacture of other items than those for which they were originally acquired, and which have only a scrap value if not so used, may be received by the contractor continuing production if (a) the procuring agency authorizes the transaction in writing and (b) the amounts of any items which the continuing contractor receives do not exceed his contract requirements, after taking into consideration amounts of the item which he has on hand plus the amount ordered which cannot be canceled.

(2) Standard materials and products may be received by the contractors who continue to manufacture the item if the procuring agency authorizes the transaction in writing and the amount of an item of material or product so received is not more than the receiving contractor will require for the program for the next four months and his total supply after receipt is not in excess of his requirements for the next six months.

These rules apply in cases where a procuring agency (the Army and Navy departments, U. S. Maritime Commission, War Shipping Administration, and the Army Air Forces or Navy Bureau of Aeronautics) authorizes the transaction in writing a contractor whose contract has been canceled or reduced to deliver idle materials either for direct or through the procuring agency to another contractor who is producing a product in the same major program for the same procuring agency.

A manufacturer who receives such material through a transfer is required to promptly adjust the purchase orders he has placed on his suppliers so that his inventory of the particular items received is reduced to a practicable minimum working level. Users must return promptly any unused allotments that result from having received controlled materials through such a transaction.

HOUSE TRAILERS: Production of 3000 house trailers in the third quarter of 1944 has been authorized. Participation in the program is limited to manufacturers who made trailers between Jan. 1 and Sept. 30, 1942.

L ORDERS

GARMENT HANGERS: Garment hanger manufacturers are permitted to use, in the second quarter of this year, 35 per cent of the average quarterly amount of iron and steel used by him in making garment hangers in the year ended June 30, 1941. This is in addition to iron and steel used to make garment hangers for military purposes as well as any unused part of the first-quarter quota. Steel wire of any gage, obtained from any source, may now be used to make garment hangers. (L-30-d)

WATER METERS: Use of an alloy containing up to 82 per cent copper and 3 per cent tin has been authorized in main casings, register boxes and lids for water meters of 1-inch or less, to be delivered beginning July 1. (L-154)

HAND TOOLS: One type of furnace scoop and two types of snow shovels have been added to schedule 1 of the hand tool simplification order, permitting the manufacture of these items. Specifications are given in the schedule. (L-157)

POWER TRANSMISSION EQUIPMENT: Inventory restrictions on sprocket chains, sprocket chain attachment links and wheels do not apply to stocks of such items for automotive replacement parts. Minimum production runs of manufacturers of such equipment may be taken into account by users who place purchase orders for such items. (L-193-a)

FOOD PROCESSING MACHINERY: Manufacturers will be permitted to use during the year ending Sept. 30, 1944, controlled materials in manufacture of grinding, mixing, feed separating and grading machinery at 150 per cent of the rate such materials were used during the base period. Base period use is the average tonnage of controlled materials used to complete such items of machinery and equipment during the years 1939, 1940, and 1941. Producers of other types of cereal, flour, and grain milling machinery and equipment will be permitted to use controlled materials for making such items at 100 per cent of base period usage. (L-292)

M ORDERS

COPPER: Residual frozen stocks of completely fabricated copper and copper-base alloy shoe findings in manufacturers' inventories will be freed from all restrictions on sale, delivery and use, beginning July 16. Use of copper is now permitted in the manufacture of conductive and nonsparking shoes for use in explosives and combustible solvents plants, and in findings for loggers' boots. (M-9-c-1)

Limited use of copper in experimental models and for test runs is now permitted. The number of models to be made is limited and use of models to promote sales or create consumer demand is prohibited. Specific restrictions contained in "L" orders are continued. Limited quantities of copper in controlled material form may be obtained for experimental purposes as provided in order P-42. (M-9-c)

ZINC: WPB has authorized the use of lead free zinc oxide in laboratory reagent chemicals, cellulose nitrate plastics, vulcanized fibre and toilet soap. (M-11-a)

PRICE REGULATIONS

BATTERIES: Military salvage dry batteries may be sold for 80 per cent, and military scrap dry batteries may be sold for up to 50 per cent of March, 1942, prices for the most closely comparable civilian battery, upon approval of the prices by OPA district officers (GMPR)

OFFICE MACHINES: Office machine manufacturers are now permitted to devalue traded-in equipment, as its age increases, by the same method of depreciation he had in effect in March, 1942. (No. 188)

FARM EQUIPMENT: One of the conditions under which manufacturers of farm equipment may adjust maximum prices in line with "substantial changes in design, specifications or equipment made since March 31, 1942," is when the manufacturer assigns a new catalog number and description of the product because of the change. Manufacturers' maximum prices for repair parts may be changed only where the increase in factory cost resulting from the change is 10 per cent or more; they must be adjusted downward in cases where factory cost is decreased by 10 per cent or more. If the seller wishes, he may agree with the buyer to charge a price which can be increased up to the maximum price in effect at the time of delivery. (No. 246)

War Agencies Complete Renegotiation of About 20 Per Cent of Their 1943 Business

WAR Department has virtually completed the renegotiation of its 1942 business and has completed renegotiation of about 20 per cent of its 1943 business, Maurice Hirsch, vice chairman, War Production Price Adjustment Board, declared recently at a roundtable meeting on contract renegotiation sponsored by the Commerce and Industry Association, New York.

He said the number of cases considered by the War Department as part of the 1942 business aggregated 20,200, of which more than 19,000 had been concluded by clearances, cancellations or assignment for renegotiation or refund agreements by June 3, 1944. Similar progress, he disclosed, had been made by other services. All services, he continued, have recovered to date approximately $7,700,000,000 in excess profits through refunds and price agreements.

War contractors whose lowered costs result from their "own proved efficiencies" would receive more favorable treatment in renegotiation than those citing reductions from mere spread of overhead or increased volume.

Military Demand for Flat-Rolled Steel Limits Container Output

Sheet steel for cans and shipping drums for civilian goods cannot be rolled in greater quantities until requirements for combat goods slacken, says War Production Board. Output of tin plate for non-food cans drops far below 1940 figure

INCREASES in production of metal cans and metal shipping drums for civilian goods cannot be expected at present, the War Production Board announced last week.

Rolling capacity for processing of steel for containers is under great strain in the preparation of sheet metal for landing barge plate, aircraft landing mats and shell cases, WPB officials said, and until requirements for these direct military goods slacken, sheet metal for cans and drums cannot be rolled in greater quantities.

Current production of tin plate for food cans, military and civilian, is established at approximately 2,100,000 tons for 1944, slightly in excess of 1940's production figure. Production of tin plate for non-food cans, however, has dropped to approximately one-third of the 1940 figure. More metal will be used this year than last to pack food because, weather and manpower permitting, 1944's food pack is expected to about equal the all-time high of 1942, according to WPB officials.

Shipping Drum Needs Heavy

Heavy sheet steel production, for industrial shipping drums, is expected to total more than 650,000 tons this year, about even with 1940. To this production figure must be added the sheet steel required for shipping drums ordered directly by the services. To supplement steel drums in the domestic movement of goods, the production of fibre drums has been more than doubled since 1940.

The competition for rolling capacity, between metal containers and combat goods requiring sheet steel, occurs primarily at the "strip" and "reducing" stages. Capacity for these processes is limited to about thirty plants, and production is fully scheduled by WPB a month or more in advance of anticipated need. Scheduling of rolling mill "space" assures maximum production for military requirements and, at the same time, protects output for metal containers to carry the most essential civilian goods.

Antifriction Bearing Supply Situation Improves Slightly

Slight improvement is apparent in the overall antifriction bearing situation, but medium and heavy ball bearings are still in the category of items in short supply, the War Production Board has reported. The shortage of skilled workers is the chief limiting factor in bearing production.

Despite a decline in production during April, as compared with March output, a concurrent reduction in incoming orders has made it possible for the industry to cut its backlog. At present, the industry is down to a backlog of unfilled orders totaling approximately 7 months' production compared with an eight-month backlog in March. According to present indications, the May trend of incoming orders and backlog followed the April pattern, with the possibility of a slight increase in overall production totals.

Present increased capacity will be sufficient to take care of bearing needs for consumer and industrial products as soon as military operations permit a substantial cut in the armament program, representatives of the industry say.

Organizes New Stockpiling And Transportation Bureau

Bureau of Stockpiling and Transportation has been established within the War Production Board. It will be responsible to the program vice chairman, S. W. Anderson, and will consist of the Office of the Director, a Division of Stockpiling and Shipping, and a Division of Transportation and Storage.

Edward Browning Jr., Bar Harbor, Me., who was acting director of the former Division of Stockpiling and Transportation, heads the new bureau. Edwin E. Frost, who was chief of the Stockpiling Branch of the old division, and E. J. Sette, formerly assistant division director, have been appointed, respectively, to head the Stockpiling and Shipping and the Transportation and Storage divisions.

The new bureau is charged with exercising the responsibilities of WPB with respect to the importation, stockpiling, transportation and storage of commodities and materials necessary to the war effort and to the maintenance of the essential civilian economy.

Appointments-Resignations

Frederic S. Glover has been appointed deputy director, Automotive Division, Equipment Bureau, War Production Board. Mr. Glover has been with WPB since December, 1941, and his previous experience included presidencies of Reo Motor Car Co., Reo Motors Inc., and Timken Detroit Axle Co.

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Comdr. Roger Hyatt, USNR, has been named assistant to the foreign economic administrator in charge of surplus property. He will serve as Leo T. Crowley's alternate on the Surplus War Property Board and will direct functions of FEA in connection with transfer and disposition of surplus war property.

Postwar Scramble for Consumer Goods Would Start Cycle of Inflation, Warns Batt

WITH consumer goods in short supply after the war, a competitive scramble to supply the first "12,000,000 to 15,000,000 automobiles needed" would precipitate a cycle of inflation, warned William L. Batt, vice chairman of the War Production Board, and president of SKF Industries Inc., at the recent annual business meeting of the American Management Association in New York.

"More goods for more people at lower prices must be our paramount consideration," he declared.

Mr. Batt was re-elected chairman of the board of the association and Alvin E. Dodd, president. Other officers named were Thomas Roy Jones, chairman of the executive committee; James L. Madden, treasurer; Henry J. Howlett, secretary; James O. Rice, editor and assistant secretary; and Kieth S. McHugh, vice president at large.

In his comments, Mr. Batt asserted there were several critical sectors of war production which were still substantially behind schedule, and he continued, "I am not referring to cutbacks." He said the country would have "one overwhelming and far-reaching obligation after the war to provide work at fair wages for all who want work."

The American citizen has noticed, he declared, the national income and the "good" year of 1929 reached $83 billion and that now, with 11,000,000 not producing goods, the country has an annual income of about $150 billion.

"Make no mistake," he warned, "the average citizen has clearly concluded that we ought to be smart enough to provide work for him."

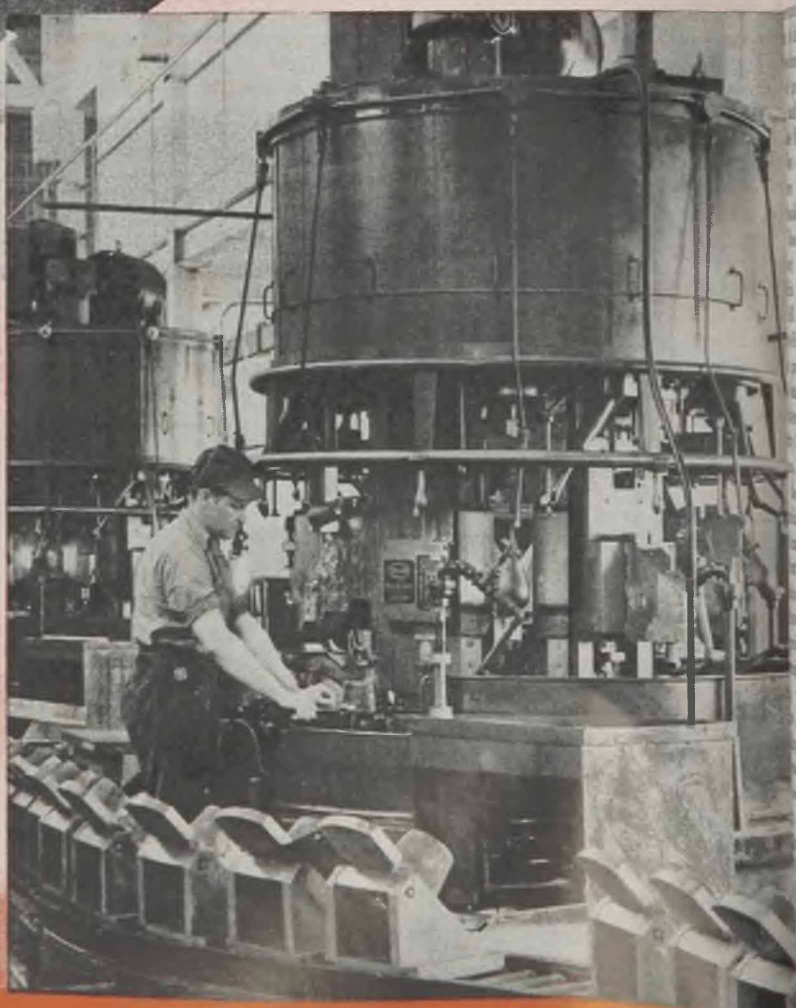
Mr. Dodd said that the job of re-converting to peacetime production is "much too large for the amount of time that management has been able to give it," since business has been "completely harnessed to war production." He warned that "severe jolts in contract termination and lack of planning might wreck our economy for years to come."

The two Bullard Mult-Au-Matics you see here are keeping that conveyor filled with parts for aviation engine crankshafts. It takes a lot of crankshafts for America's current output of more than 10,000 motors per month.

Since each Mult-Au-Matic processes 8 parts simultaneously, it materially lowers production time on scores of precision jobs like this. That's *one* big reason for its widespread use today. Another, equally important, is that the Mult-Au-Matics are readily adaptable. Long after the engines of war have finished their task, the Mult-Au-Matics that built them will be hard at work, lowering costs by increasing output on the host of new comforts and necessities we shall need in a world at peace.

CRANKSHAFTS

Coming up



BULLARD

THE BULLARD COMPANY

By A. H. ALLEN Detroit Editor, STEEL

MIRRORS of MOTORDOM

Appointment of C. E. Sorenson as chief executive officer at Willys stimulates rumors of new motor combine to enlarge Big Three to Big Four. Nelson says Detroit needs 200,000 more workers now, but where can they be housed?

INDUCTION of C. E. Sorensen as head man at Willys-Overland in Toledo has again stirred up the automotive kibitzers on the subject of the big three —General Motors, Chrysler and Ford— at some early date being enlarged to the big four, this time including a new combine which might be based on the Sorensen-directed Willys operations. Other elements in such a group could only be Hudson, Packard, Studebaker or Nash, and the latter can almost automatically be ruled out because some of the ex-Ford men now in the Nash-Kelvinator official family would not be likely to relish teaming up with Sorensen again.

As far as Studebaker is concerned, its one venture into a merger was an unhappy one and its directors are likely to be wary of any further moves along this line. In the case of Packard, despite a financial position which could not be described as exactly rosy, an association with Willys would appear to have little to recommend it. While Alvan Macauley is in the driver's seat, along with the present board of directors, Packard probably will go it alone. This leaves only Hudson and there may be more than a little sense behind a Willys-Hudson marriage. For one thing, the Hudson properties here would give the company a good toehold in Detroit and would provide a line of higher-priced cars to round out the large-volume low-price line which Willys is aiming at after the war. Still it is difficult to conceive of a Willys-Hudson merger even approaching the proportions of the big three.

Too many people are thinking that all it takes to be successful in the motor industry is to have a Sorensen building the cars. This is definitely not true. To gage the possible effect of Sorensen's leadership on the Toledo producer, several things should be kept in mind. In the first place, he rose to his eminent position at Ford the hard way—40 years up through the ranks, from patternmaker to production chief. He did not do this overnight and his administrative methods, while efficient over the years, were not always, shall we say, benign. Today the motor industry in its relations between management and men has moved beyond the tight-fisted Sorensen era, and whether he too has changed remains to be seen.

For another thing, it takes considerably more than production talent to sell automobiles. In his years at the Ford plants, Sorensen was never particularly sales minded. He was of the school which was inclined to "cram cars down dealers' throats" and to tell the public that it "could have any color it wanted so long as it was black."

Fortunately, the name Ford has always been magic as far as buyers of automobiles have been concerned, and the need for a concerted selling effort was not so essential. This has not been as true in the last ten years as prior to that time, but certainly Ford merchandising techniques have never been as thorough or as spectacular as those of Chevrolet, for example. The point is that, even in the face of a booming postwar market for automobiles, Willys will need something more than production genius to graduate to a principal position in the motor industry. And as the years roll on, this need will, if anything, increase as the pressure for aggressive sales methods mounts.

Affiliation with Willys Discounted

These are some reasons why observers do not attach too much importance to Sorensen's affiliation with Willys. In fact some of them maintain Sorensen would have preferred to remain in retirement and that his parting with Ford was really of his own working, but that he accepted the Willys post because of allegations that he had been discharged by Ford, which led to his determination to "show up" these disparagers.

The WPB announcement of relaxation of restrictions on the use of aluminum and magnesium, together with the extension of permission to manufacturers to build single pilot models of proposed postwar products, and then the easing of restrictions on steel and copper, are of minor significance to the automotive industry. The principal reason is that automotive planning, despite public reports to the contrary, is well advanced. The various manufacturers know what they want to build, they know what plants will be required to build it, they know what materials will be needed, what equipment will be needed. There will be no need for pilot models, unless they be models which will be built the year following the first postwar models, and the personnel is not available now to put much concentrated effort on such future activities. Doubtless the WPB relaxations will be welcomed by the smaller manufacturers of consumer goods, of which there are more than a few in this area.

The announcement was followed up by Donald Nelson's declaration that Detroit is the most critical labor area in the country, with something like 200,000 more workers needed now. The only answer to this seemed to be, "God forbid." If there are any more people crowded into the Detroit area, it will simply burst, for the seams are badly stretched now. It is reported there are areas in this city where rooming houses have beds which never grow cold, being occupied around the clock by three shifts of workers. Negroes, hill-billies and thousands of itinerants have built up Detroit's internal pressure to serious proportions. It would be fatal to at-

350,000TH: Army ordnance officials inspect 350,000th General Motors "six-by-six" military truck. Left to right: I. B. Babcock, general manager, GMC Truck and Coach division; Brig. Gen. W. P. Boatwright, commanding general, Office of Chief of Ordnance, Detroit; Brig. Gen. J. K. Christmas, deputy chief of ordnance, Detroit; Brig. Gen. A. B. Quinton, Jr., chief of the Detroit Ordnance District; R. J. Emmert, GMC's factory manager tempt to bring in any more large numbers. What is needed is efficient utilization of the labor here now, a realistic reshuffling of war contracts in force and their adjustment to actual and foreseeable needs.

Nelson lately seems to have gone out of his way to "give the needle" to Detroit, apparently because of the lack of acceptance which his labor-management committee plan has had among industry here. While such committees may have worked miracles in other areas, they simply will not be helpful here, no matter how wishfully they are discussed by outsiders. There are established procedures defining the relationships between management and labor in the automotive plants, and to pile another system on top of them only would add to the confusion. One immediate problem would be the rise of factionalism within the ranks of union labor itself. This would result from one group being represented on a labor-management committee and pitting its strength against another group represented by union stewards, for example.

There has of course been no complete rejection of the labor-management committee idea in Detroit. Packard has developed such a system and apparently is able to function reasonably well under it. But to say that labor-management committees would cure many of the ills which beset this area industrially is just shutting one's eyes to the facts.

Manufacturing programs for 155-millimeter shells, organized about ten weeks ago at Pontiac, Oldsmobile and Fisher Body divisions of General Motors are well along toward the production stage. Most equipment needs were filled from tools on hand or readily obtainable from the WPB pool. The same is true of rocket shells and rocket launcher programs undertaken by Chrysler and Oldsmobile.

Top priority in war production activity, ahead of even radar and landing craft, continues to be held by the mysterious Manhattan or Pasco projects, in which certain automotive interests along with a score or more of other companies are participating. While news dispatches from Europe have referred to a number of secret weapons already in use in the invasion, there is nothing to indicate field use of the highly secret Manhattan development, whatever it may be.

Machines Engine Parts

One phase of radar equipment has been in production here at the Dodge division of Chrysler and lately has been terminated, leading to the transfer of a considerable volume of equipment and plant rearrangement to handle machining of several parts for the Wright 2200-horsepower aircraft engine being built by the Dodge Chicago division. More of this work is understood to be in process of transfer to Detroit, and there are even reports that one Dodge production executive is being urged to take over a new post at the Chicago engine plant to aid in smoothing out production problems.

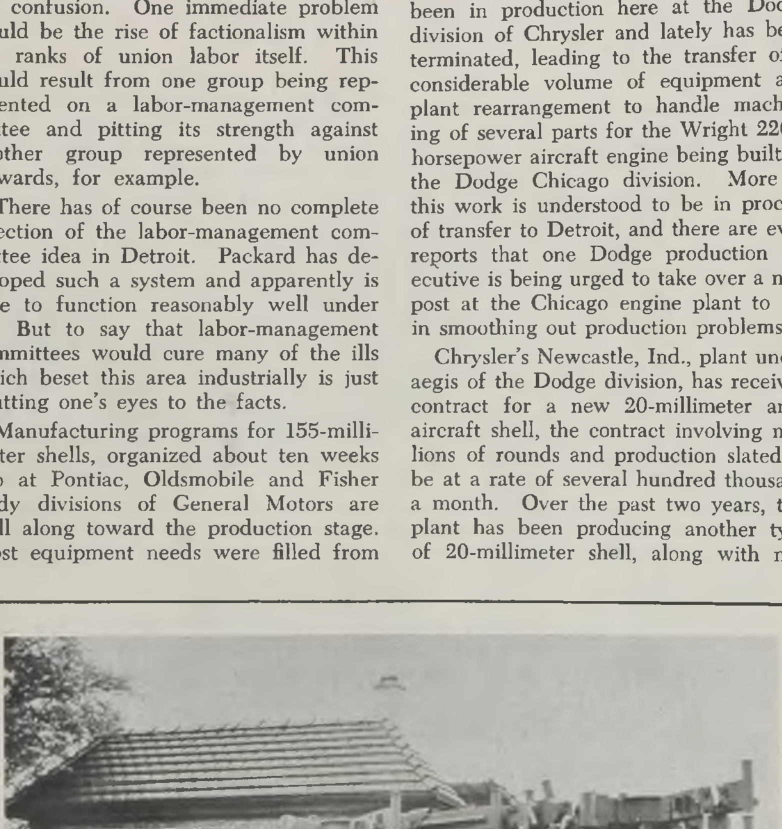
Chrysler's Newcastle, Ind., plant under aegis of the Dodge division, has received contract for a new 20-millimeter antiaircraft shell, the contract involving millions of rounds and production slated to be at a rate of several hundred thousand a month. Over the past two years, this plant has been producing another type of 20-millimeter shell, along with millions of armor-piercing cores for 0.50-caliber ammunition.

Ford laboratories are using an electron diffraction camera to study oxidized surfaces on aluminum incident to their spot welding for airframe parts. The equipment includes a high-voltage (40,000) source, an electron gun and an electron diffraction vacuum camera. In operation the gun fires a stream of electrons against the surface to be analyzed, while the diffraction camera photographs the angle at which the electrons bounce off, the latter angle being the determinant of the chemical structure of the material tested.

The camera was acquired following difficulties encountered in obtaining uniformly good spot welds in aluminum sheets. Particularly puzzling was the fact the aluminum sheets were identical in appearance and specifications, but originated from different suppliers and produced welds of varying quality. With the aid of the camera nine different oxides were detected and isolated on the surfaces, conditions of fabrication apparently determining the type of oxide. It was also found that while various chemical cleaners removed antiwelding oxides, they would often deposit other oxides equally undesirable.

Increase in tank contracts by the Army following the tabulation of invasion losses, is said to involve about 6000 additional units, which can be taken in stride by the Chrysler and Fisher tank arsenals here, as far as the medium tank model is concerned. It is not at all likely the Ford tank assembly plant, closed since last summer, will be reopened. Chrysler, incidentally, is producing four different types of tanks and self-propelled guns at its arsenal which is operating two 9-hour shifts currently.

Two restricted types of mobile attack weapons, built by Buick and Chevrolet, respectively, are reported to have been active in the European invasion but are still being kept under wraps by the Army as far as publicity goes.



WARTIME FREIGHT: Mounted on this Fruehauf truck-trailer drawn by a Ford Tractor is a load of 16,000 pounds of gun mounts, leaving Detroit for Akron, O. On the return trip, the unit will carry a load of steel from the Mahoning Valley to Detroit

Says Auto Industry Can Provide 10,000,000 Jobs

The automobile industry can provide jobs for nearly 10,000,000 persons when the war ends if, in its first year of unrestricted production, it builds the approximately 6,000,000 units which probably will be required over a period of years.

That opinion was expressed recently by Ward M. Canaday, Willys-Overland Motors Inc.

In an average prewar year, he pointed out, it purchased approximately 20 per cent of all American steel; 73 per cent of the plate glass; 75 per cent of the rubber; 36 per cent of the lead; 6 per cent of the hardwood lumber; 17 per cent of the copper; 11 per cent of the zinc; 14 per cent of the tin; 12 per cent of the aluminum; and 28 per cent of the nickel.

Wraps shrouding B-29 Superfortress partially removed after sky giants bomb Japan. Development of plant dates back to spring of 1942 when four-company pool was organized to build big bomber in quantity. Many changes have been made since

AT LONG last some of the wraps have been removed from the Boeing B-29 Superfortress by the War Department's Bureau of Public Relations, and the flood of publicity which emanated in newspapers about ten days ago following the first full-scale bombing raid of the 20th Air Force has an interesting background.

The B-29 has been in production for well over a year, but as far as the press was concerned it was a tightly restricted item. STEEL attempted to clear brief summaries of the manufacturing program as far back as August, 1942, and again in October, 1943, but met with flat refusal from Washington. A couple of months ago, the Bureau of Public Relations arranged a comprehensive trip for editors and writers in the aviation field, spending considerable time at Wright Field, Dayton, O., inspecting a number of new airplane developments, including the B-29, and then at Wichita, Kans., where Boeing is building the ships. Most of the correspondents rode in the plane but were not permitted to release any articles at that time. (This writer was not among the group, and STEEL received no invitation to participate. Actually, there was considerable minor grousing among the newspaper men on the trip over what they considered the "excessive" number of business paper editors.)

At any rate, the reporters readied their stories awaiting the propitious moment for their release by the bureau. Obviously the carefully drawn plans called for withholding all details until the attack on the Yawata steel center on Kyushu island, and seldom has the press seen anything like the flood of publicity on the B-29 which followed this raid.

Although elaborate precautions were taken to enforce censorship restrictions on the B-29 and its operational functions, the Japanese apparently have been fully informed on its development. The Tokyo radio, well in advance of the raid on the Yawata steelworks, broadcast reports of the organization of a 20th Air Force and 20th Bomber Command by the AAF, and also reported arrival of 18 of the B-29s in Karachi, India, even mentioning the serial numbers painted on the bombers. A few days before the raid, special air raid drills were held throughout the island empire.

Program Initiated in 1936

Conception of the B-29 at Boeing dates back to 1936, the year after the building of the original B-17 Flying Fortress, known then as Model 299. During the next three years eight different large bombers reached the preliminary design stage at Boeing. One, the 87,600-pound XB-15, was built and delivered to the Army in 1937. It is still in service. Late in 1939 the AAF asked several aircraft companies to submit designs for a larger, long-range bomber, and Boeing engineers submitted a design known as Model 341. Then the Army again increased its specifications for size and armament, so Boeing revised its designs and submitted Model 345, an enlarged version of 341, in May, 1940. The 345 was accepted as the type desired and a formal contract was drawn up covering construction of experimental models, known in military records as the XB-29 bomber.

Since it is now relatively ancient history, it may be permissible to review sketchily the development of the B-29 "program." It dates back roughly to the spring of 1942 when a four-way pool comprising Boeing, Bell, Fisher Body and North American Aviation was organized to build the new Boeing design in quantity—one flyaway a day was being talked at that time. A B-29 liaison committee was organized by three of the contractors—Boeing, Bell and Fisher—and it set about to arrange interchange of parts and subassemblies between the plants, the idea being that all three would make final assemblies, but each would concentrate on certain subassemblies and supply them to the other two. North American's part in the program was never too clear, and eventually this contractor dropped out.

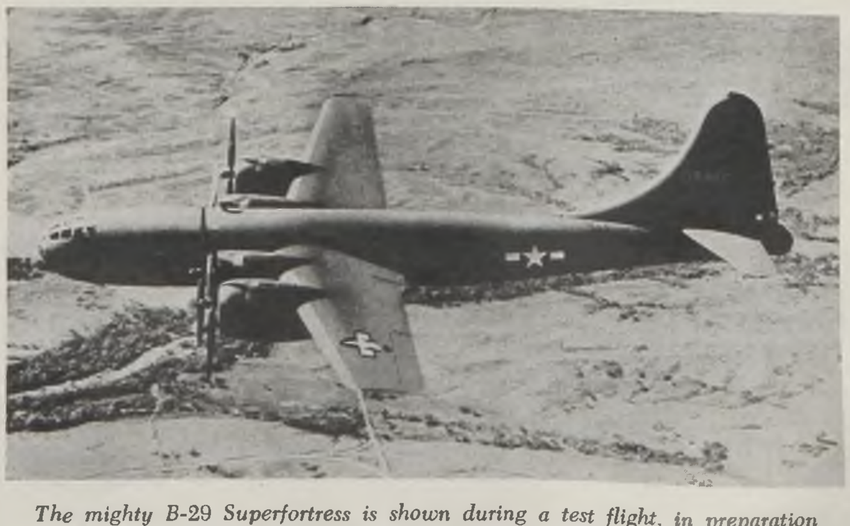
Of course, all contractors were working closely with the AAF at Wright Field, and in particular with Brig. Gen. K. B. Wolfe who is now in charge of the 20th Bomber Command. Much of the credit for the success of the program should go to him. He is greatly respected by all companies participating in the program, some officials even referring to him as "K.B.-29" Wolfe.

As has happened with a number of other new model military airplanes, an early fatal crackup nearly disrupted the B-29 program. First flight of the ship was in September, 1942, but on a special test flight, Feb. 18, 1943, engine failures led to the crash of the bomber on a Seattle packing plant, killing Boeing's chief test pilot Edmund T. Allen and a score of other Boeing engineering personnel on board. It was said at the time that all four engines failed as the result of fires, forcing the pilot to try a glide to the airport, which he failed to make.

A few months later, another large experimental bomber built by Consolidated Vultee cracked up in an accident at San Diego, killing the company's chief test pilot and others. Similarly it will be recalled that the first flight of the Glenn L. Martin four-engine Mars flying boat was marred by an engine failure and a propeller flying off and cutting through the hull.

In the past two years there have been innumerable changes, both in the design of the B-29 Superfortress itself and in the manufacturing setup. One of the first developments of major importance was the changed status of Fisher Body Division of General Motors which originally was to be one of the assembly units and built a huge new plant at Cleveland to handle the work. Then a new fighter plane design came along which the Army felt important enough to reconstitute the Cleveland plant for its production and retain only subassembly manufacture on B-29 parts. Then it was decided to discontinue the Martin B-26 medium bomber assembly operations at Omaha, Nebr., and make this plant a B-29 assembly point, meantime switching over the principal automotive company suppliers on the B-26 program to the B-29. These included Hudson, De Soto Division of Chrysler Corp. and Goodyear Aircraft.

Hudson now supplies rear fuselage sections and wing sections on the B-29;



The mighty B-29 Superfortress is shown during a test flight, in preparation for the heavy raid on the Japanese homeland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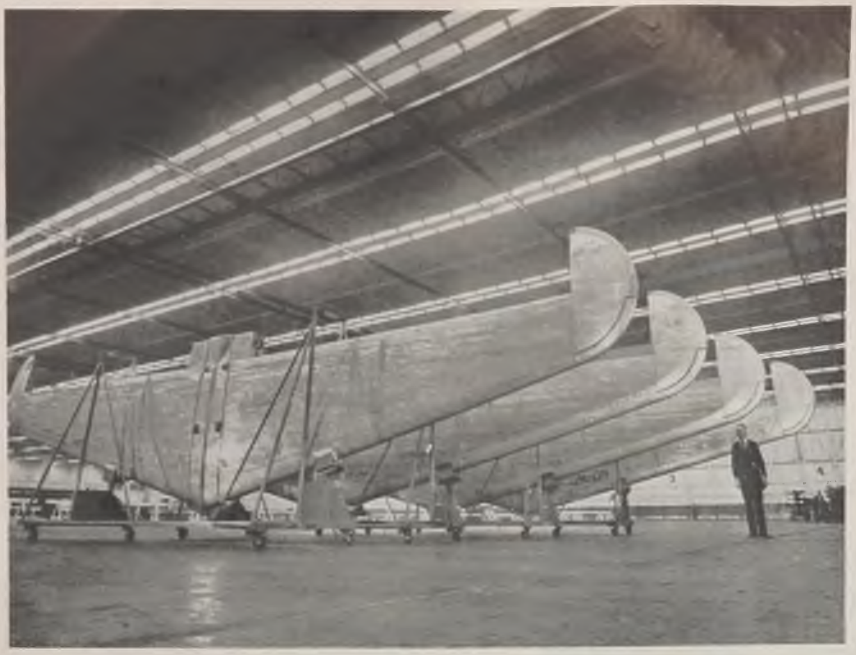

Size of the B-29 is indicated by the size of these completed stabilizers, shown here in Fisher Body's Cleveland Aircraft Plant No. 2

De Soto furnishes nose sections, leading edges for wings, and cowling; Goodyear Aircraft supplies a number of smaller parts. Other automotive companies also have been brought into the program, Murray Corp. supplying wing tips, Briggs making wing flaps, doors, dorsal fin and stabilizer. Fisher Body continues to be a prime contractor, supplying engine nacelles, outboard wings, stabilizers, dorsal fins and a number of other parts. There are literally hundreds of other companies contributing vital parts, all being dovetailed together in one of the largest co-operative manufacturing programs ever developed.

Most of the subassemblies produced by automotive plants go to the Omaha assembly plant, but other assembly plants are located at Marietta, Ga. (Bell), Wichita, Kans. (Boeing), and Renton, Wash. (Boeing). Hundreds of the B-29s have been delivered to the AAF, and the "pipeline" to combat theaters can now be considered filled.

Size is of course the striking thing about the B-29, although it is by no means the largest airplane ever built. Wingspread is slightly over 141 feet, comparing with 123 feet for the giant Lockheed Constellation or C-69 which recently set a transcontinental speed record, 110 feet for the Consolidated B-24 Liberator, and 104 feet for the Boeing B-17 Flying Fortress. Length of the B-29 is 98 feet, the Constellation 95 feet, the B-24 and B-17 about 75 feet. Height of the tail section on the B-29 is 27 feet, on the Constellation about 24 feet and on the B-17 19 feet.

Fuselage of the B-29 is cylindrical, for purposes which may well be imagined. It is a mid-wing monoplane design, in contrast to the low-wing design of the earlier offspring in the Boeing family, the Flying Fortress. Dorsal fins of both ships have the same characteristic extended sweeping design, making for additional stability in flight. The B-24 Liberator is a high or shoulder-wing monoplane design and, of course, has the characteristic double rudder.

Other features of the B-29 should be mentioned. It is powered by four 2200-horsepower Wright 18-cylinder radial engines, each with two turbosuperchargers. This model engine is built by Wright at Wood Ridge, N. J., and by Chrysler Corp. at its Dodge-Chicago engine plant. Similar engines power the Martin Mars flying boat and the Lockheed Constellation. Propellers are of the four-blade type, 16 feet in diameter, with blades 6 inches wide, said to be the largest in use today. They are geared down to a 1:3 ratio with engine speed, making them relatively slow in comparison with normal propeller speeds.

Armor Details Remain Secret

The B-29 is claimed to have the most nearly all-electric system of operating auxiliaries yet devised. Over 150 fractional-horsepower motors of 49 types are installed to manipulate various control surfaces and accessories. The motors are driven by auxiliary gas engine-generator sets. Armament comprises 0.50-caliber machine guns in power turrets and "a 20-millimeter cannon," according to the publicity released. This appears somewhat surprising, since 20-millimeter cannons are now being installed on many warplanes and are more destructive than 0.50-caliber machine guns, although doubtless more difficult to install in power turrets. Beyond the fact that it is heavily armored, no details are given of this phase of the B-29 design.

As is the case with most large airplanes, the B-29 has a tricycle type landing gear, each wheel being of the double type with two tires. Forward wheel retracts into the nose, the other two into the wings. So clean is the wing and fuselage design that drag or wind resistance is said to be doubled when the wheels are down.

Altitude limit is well over 30,000 feet, and speed in excess of 300 miles per hour. Range with full load is not disclosed, but is well into the thousands of miles.

The wing design of the B-29 is interesting in that it carries the highest wing loading of any aircraft yet built. Flaps, 38 feet long in themselves, are of the type which can be extended from the trailing edge to provide extra lifting area for takeoffs and landings. Area of the flaps is equivalent to one-fifth of the entire wing area.

Other news in the field of large planes indicates Lockheed is now in "limited production" of the C-69 Constellation previously mentioned. Production rate is undisclosed, but an approved photograph of the Constellation assembly building shows four ships in process of construction. All will go to the Army when completed, although both Transcontinental & Western Air Inc., and Pan American World Airways System have a number of the Constellations on order. The military model now in production seats 60, with alternative sleeping accommodations for 22, plus berths for a relief crew of four.

Interesting disclosure with respect to the four-engine Constellation, which mounts the same engines as those used in the B-29 (an alternative installation of four Pratt & Whitney R-2800-C engines is possible), is that at the "economy" cruising speed of 275 miles per hour, gasoline consumption is exactly one gallon per mile. Complete engine installation is in the form of a so-called "power egg" which can be changed in a matter of 27 minutes.

As a point of interest, the C-69 Constellation is comparable in many respects with the new Boeing B-29, if you add roughly 15-20 per cent to the Constellation. The Constellation has weight empty of a little better than 27 tons, and can get off the ground with gross weight of 43 tons. It has top speed of 340 and landing speed of 80.

The Bureau of Public Relations also has relaxed restrictions on mention of several other military planes which have been in production for a number of months. One is the P-63 King-Cobra fighter plane which Bell is producing in quantity at Buffalo (see STEEL, June 12, p. 80). The jet propulsion airplane, with twin compressor-turbine propulsion engines built by General Electric, also under construction by Bell Aircraft, has been assigned an AAF designation P-59A and has been dubbed the Airacomet by the manufacturer. The new Douglas medium or attack bomber now in production, succeeding the former A-20 Havoc, is known as the A-26 Invader. Resembling its predecessor in general aspects, the Invader has been "cleaned up" considerably aerodynamically, and has increased firepower.

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MEN of INDUSTRY

C. N. LAGE

JOHN A. FALER

C. H. Lage has been appointed general works manager of LaPlant-Choate Mfg. Co. Inc., Cedar Rapids, Iowa. He previously was vice president in charge of manufacture, Universal Unit Power Shovel Corp., Milwaukee, and at the same time was works manager of Davis Thompson Co. For 12 years prior to 1941, Mr. Lage was associated with Caterpillar Tractor Co., Peoria, Ill., as factory division superintendent in charge of the parts machine shop.

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Herman M. Brown has been appointed general manager of the Huntington Works of International Nickel Co. Inc., New York, succeeding **Arthur S. Shoffstall,** retired. Mr. Shoffstall will continue as consultant to the head office of the company. **John A. Marsh** succeeds Mr. Brown as assistant general manager, Huntington Works.

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Warren K. Lee, formerly factory manager of the Scranton, Pa., plant of Wilkening Mfg. Co., Philadelphia, has been appointed factory manager at the company's Philadelphia headquarters.

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James F. Howard and **E. G. Gardner** have been appointed vice presidents of National Enameling & Stamping Co., Milwaukee. Mr. Howard continues as secretary and treasurer, and Mr. Gardner continues in charge of manufacturing in the company's five Milwaukee plants.

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J. W. Fogg, former general sales representative of Cherry-Burrell Corp., Chicago, has been appointed general manager of the company's Milwaukee factory, succeeding **Edward W. Neumeister,** who remains a director and member of the executive committee. **Theodore H. Kummer** has been named chief engineer at Milwaukee, succeeding **A. J. Lippold,** who remains as consulting design engineer.

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W. K. Hyslop has been elected president of the Massey-Harris Co., Racine, Wis., succeeding **James S. Duncan,** who has been elected board chairman. Mr. Hyslop continues as general manager. Mr. Duncan is president of the parent company, Massey-Harris Co. Ltd., Toronto, Ont. Other new appointments in the subsidiary company include: **J. M. Tucker,** vice president and assistant general manager; **C. E. Krause,** secretary and manager of manufacturing; **L. M. Sweeney,** sales manager, and **L. W. Petersen,** assistant treasurer. **E. G. Burgess** leaves the Racine organization to become vice president of manufacturing for the Toronto company.

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William L. Rodgers has joined the Goodyear Tire & Rubber Co., Akron, O., to handle V-belt sales in the Chicago territory for the mechanical goods department.

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William P. Cochran, Central Station division manager, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and **Franklin P. Bell,** Middle Atlantic district treasury manager, have retired. Both men were honored at a dinner held in Philadelphia recently.

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Chester E. Haring, former vice president and director of marketing for Batten, Barton, Durstine & Osborn Inc., New York, has assumed charge of the Postwar Marketing Research Project of the Committee for Economic Development. **J. L. Barrett,** until recently administrative engineer with George S. May, Chicago and New York, has been appointed assistant director of the project. **Ferdinand C. Wheeler,** who was director of the project until illness forced his withdrawal, remains as marketing consultant and committee member.

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Millard W. Merrill, purchasing agent, United States Metals Refining Co., Carteret, N. J., has been elected president of the Purchasing Agents Association of New York.

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Dr. Zay Jeffries, noted scientist and a pioneer in tungsten metallurgy and in the development of high-strength aluminum alloys, has been elected to the board of trustees of Battelle Memorial Institute, Columbus, O. Dr. Jeffries is technical director of the lamp department, General Electric Co., Cleveland; chairman, Carboloy Co. Inc., Detroit, and vice chairman of the War Metallurgy Committee of the National Academy of Sciences and National Research Council.

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V. H. Hiermeier has been named industrial manager of the St. Louis office of Brown Instrument Co., Philadelphia, succeeding I. K. Farley.

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Two appointments in the engineering department of Detrex Corp., Detroit, are those of **Thomas J. Kearney,** formerly technical advisor to the director of sales, to assistant chief engineer in charge of industrial equipment design and detailing, and **John A. Faler,** assistant chief engineer, to take charge of extraction equipment development.

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F. Edward O'Neill, president, Fulton Iron Works, St. Louis, has been re-elected president of the Safety Council of greater St. Louis.

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J. K. Gannett, vice president of the Austin Co., Cleveland, and recently appointed director of engineering and research, has been elected to the board of directors, filling the vacancy caused by the recent death of George W. Plaisted.

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Joseph D. Oliver Jr., formerly treasurer and a director, Oliver Chilled Plow Works, South Bend, Ind., which became a part of Oliver Farm Equipment Co., Chicago, about five years ago, and **C. Frederick Cunningham,** president, National Bank & Trust Co., South Bend, have been elected directors of Oliver Farm Equipment Co.

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Kuhlman Electric Co., Bay City, Mich., has announced the following promotions: **A. E. Rhoads,** formerly manager of the company's Detroit Electric Furnace division, has been elected executive vice president and general manager; **W. I. Foss Jr.** has been made sales

FRANK W. BEMIS

Who has been appointed sales manager, American Cable and Hazard Wire Rope divisions, American Chain & Cable Co. Inc., Bridgeport, Conn., reported in STEEL, June 12, p. 85.

THOMAS J. KEARNEY

ALAN D. DAUCH

S. F. UDSTAD

manager, Transformer division; **A. H. Ellerman** is assistant sales manager, Transformer division; **J. H. Steele** has been assigned to the sales department, Transformer division, and **J. E. Bevan** is manager of the company's New York office, replacing the late D. F. Potter Jr.

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Marcel A. Cordovi, formerly research assistant, Welding Research Council of the Engineering Foundation, has joined the metallurgical staff of Babcock & Wilcox Tube Co., Beaver Falls, Pa., as research metallurgist.

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Lloyd E. Kennedy has been elected vice president of Deere & Co., Moline, Ill., and will be in charge of financial and related policies. This is a newly-created office. **B. H. E. Gill** has been elected secretary and treasurer to succeed Mr. Kennedy, and **E. F. Curtis** succeeds Mr. Gill as comptroller.

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John W. Kelin has been appointed sales manager in the St. Louis district, Federated Metals division, American Smelting & Refining Co., New York. He succeeds **Arthur Fritschle** who has been promoted to general manager of the type metal sales department of Federated's midwestern and eastern divisions.

GEORGE A. LAMB

Who has been appointed assistant director of the Bureau of Mines, as announced in STEEL, May 22, p. 73.

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Alan D. Dauch, vice president, George J. Hagan Co., Pittsburgh, has been elected president of the Industrial Furnace Manufacturers' Association.

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Samuel J. Kornhauser has been elected president of National Tool Co., Cleveland, succeeding Arthur J. Brandt, who died May 30. Prior to being made executive vice president of National Tool in November, 1941, Mr. Kornhauser had been affiliated with the company for 25 years as general counsel, secretary, director and member of the executive committee.

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J. H. Fall Jr., since 1928 chairman and chief executive officer, Benjamin Electric Mfg. Co., Des Plaines, Ill., has retired from active participation in company management. He has been associated with the organization 32 years. **Walter D. Steele**, president since 1928, will direct all operations in the future.

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John M. Otter and **Walter H. Eichelberger** have been named sales managers of the Home Radio and the Refrigerator divisions, respectively, of Philco Corp., Philadelphia.

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Maj. Gen. John "Peter" Mackenzie, D.S.O., has been appointed associate controller of construction, Department of Munitions and Supply, Canada.

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B. L. McCarthy, formerly chief metallurgist for Wickwire Spencer Steel Co., New York, has been named assistant general superintendent of the company's Buffalo plant. **C. A. Gordon** has been appointed superintendent of hot departments at the Buffalo plant.

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Recent additions to the staff of field engineers of Quaker Chemical Products Corp., Conshohocken, Pa., include: **Stanley Brink**; **J. D. Neville**, who represents the company in western Connecticut; **J. H. Lightner**, representative in northeastern Pennsylvania, and **Burdette F. Wilson**, formerly chief chemist at the Studebaker Corp.'s Aviation division in South Bend, Ind., who will do liaison work between the Quaker company's research laboratories, manufacturing plants and the field.

—o—

S. F. Udstad has returned to American Car & Foundry Co., New York, as assistant to the general mechanical engineer, with headquarters at Berwick, Pa. Mr. Udstad returns after an absence of two years, during which time he was loaned to the War Production Board as assistant chief of the Rolling Stock Section, Transportation Equipment Division.

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Edward H. Rice has been appointed assistant director of property operations, New York regional office, Highway Transport Department, Office of Defense Transportation, and **George W. Anderson** has been named assistant director of passenger operations. **P. N. Simmons** is director of Region I, which includes New York, New England and northern New Jersey.

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El Roy L. Payne has been elected president of Payne Furnace & Supply Co. Inc., Los Angeles, succeeding his father, the late Daniel W. Payne. **John H. Keber** has been elected vice president, and **J. H. Wilson**, treasurer, has been elected a director.

—o—

James E. Britt has been appointed general sales manager, Contract division, Mullins Mfg. Corp., Warren, O., succeeding **O. L. Earl**, who has joined Acme Aluminum Foundries Co., Chicago, as vice president and a member of the board.

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S. D. Yardley, formerly assistant manager of sales, Sheet and Strip division, Republic Steel Corp., Cleveland, has been appointed assistant district sales manager for the corporation at Birmingham, Ala.

—o—

Dr. E. H. Armstrong, professor of electrical engineering, Columbia university, New York, has been awarded the chief signal officer's certificate of appreciation by the War Department for outstanding contributions to the signal corps, Army Services Forces. The certificate has been awarded to nine other individuals or companies, including **Peter L. Schauble,** vice president, Bell Telephone Co. of Pennsylvania, Philadelphia; **Samuel Ruben,** New Rochelle, N. Y.; **Gail Feil,** B. F. Goodrich Co., Akron, O.; and **Walter R. Laudenslager,** municipal airport, Springfield, O.

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Girard B. Rosenblatt, Pacific Coast district manager of the Industrial and Marine divisions, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been awarded the Westinghouse Order of Merit for distinguished service.

—o—

L. J. Fletcher, training director, Caterpillar Tractor Co., Peoria, Ill., and **William J. Hebard,** personnel director, Continental Foundry & Machine Co., East Chicago, Ind., have been elected president and vice president, respectively, of the Industrial Training Directors' Association.

ROBERT S. PEARE

Who has been elected a vice president of General Electric Co., Schenectady, N. Y., reported in STEEL, May 8, p. 90.

—o—

E. L. Gartner has been appointed manager of the Metal and Ore division, Grasselli Chemical department, E. I. du Pont de Nemours & Co. Inc., Wilmington, Del. **V. R. Daub** and **L. C. Pejeau** will serve as assistant managers. Mr. Gartner succeeds C. H. Klaustermeyer, who died May 5.

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William C. Robinson, founder and president, National Electric Products Corp., Pittsburgh, has been elected a director of Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. Robinson also is a director of Jones & Laughlin Steel Corp., Pittsburgh, and of several other companies.

OBITUARIES . . .

William C. Reilly, 76, retired vice president of the Youngstown Sheet & Tube Co., Youngstown, O., died there June 20. He was identified with the steel industry for more than 60 years, having been affiliated with the Youngstown company since its incorporation in 1900. He retired in 1936, ten years after assuming charge of operations for the company.

—o—

Henry C. Atkins Sr., 75, internationally known industrialist who has been president of E. C. Atkins & Co., Indianapolis, Ind., since 1901, died June 15 in Indianapolis following an illness of several months. In 1889 Mr. Atkins became superintendent of the company, which was founded by his father, Elias C. Atkins. In 1892 he was elected vice president, and nine years later became president. Mr. Atkins' civic and character-building interests in Indianapolis were many and varied. He was a director of the Fletcher Trust Co. and of the National Association of Manufacturers.

—o—

Edward W. Ihrig, 73, president and treasurer of the Pine Ihrig Machine Co., Oshkosh, Wis., died June 12 of injuries received in an automobile accident.

—o—

L. R. Heston, 50, partner in Heston & Anderson, Fairfield, Iowa, since 1921, died recently in Iowa City, Iowa.

—o—

Charles Clare, 47, president of Blue Jay Aeronautical Co. and Clarenden Corp., Madison, Wis., and general manager of Midwest Dehydrating Co., Duluth, died June 11. Two of Mr. Clare's contributions to the construction field were a new type of concrete slab for railroad crossings and cribbing for retaining walls. Under contract with the Springfield armory, Springfield, Mass., he perfected a heat-resisting hand guard for the Garand and Remington rifles.

—o—

Herman J. Stuckstede, 81, who with his brother, John, operated the St. Louis Bell Foundry Co., St. Louis, died recently in that city. The foundry was established by his father, and casts church bells exclusively.

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Walter L. Reid, 68, retired metallurgical engineer, died June 10 in Los Angeles.

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Rhoderick M. Bennett, 36, a construction engineer for Chain Belt Co., Milwaukee, for more than 12 years, died June 12 in Ashland, Ky.

—o—

E. E. Lombard, 59, superintendent of the Mercer Tube Co., Sharon, Pa., died recently in Youngstown, O. Before his connection with the Mercer company, Mr. Lombard was identified with Youngstown Sheet & Tube Co., Youngstown, and Republic Steel Corp., Cleveland.

—o—

John T. Wickersham, 68, former treasurer of the New York Shipbuilding Corp., Camden, N. J., died June 15 in Woodbury, N. J.

—o—

Oliver W. Spencer, 52, vice president, Southern Wheel division, American Brake Shoe Co., New York, died June 18 in White Plains, N. Y.

—o—

Robert Grant, 77, head of the Robert Grant Co., New York, died there June 18. He had been identified with the steel industry for 57 years, coming to this country from Scotland as a young man and obtaining work in the mills of the Jones & Laughlin Steel Corp., Pittsburgh. Forty years ago he established his own export business in New York.

—o—

C. C. Levy, industry engineer, Metal Working section, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., died June 5 in Wilkinsburg, Pa. At the time of his death Mr. Levy was chairman of the Committee on Electrochemistry and Electrometallurgy of the American Institute of Electrical Engineers and was vice chairman of the Electrothermal division of the Electrochemical Society.

—o—

Ira Greenwood Whitney, 66, president, A. Y. McDonald Mfg. Co., Dubuque, Iowa, died there recently.

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Lyle W. Bowers, 46, who represented the Alvey Conveyor Mfg. Co., St. Louis, and the International Conveyor Co., Detroit, in northern Ohio for a number of years, died June 17 in Cleveland.

—o—

S. Karl Johns, 67, former general manager, Bardons & Oliver Co., Cleveland, and for several years designer for A. W. Hecker, manufacturer of airplane parts, Cleveland, died recently in that city.

—o—

Arthur V. Dearden, 65, for 25 years president of Peerless Unit Ventilating Co., Bridgeport, Conn., died June 18 in that city.

—o—

Philip J. O'Brien, 52, purchasing agent for American Can Co., New York, died June 18 in Queens, N. Y. He had been associated with the company for 35 years.

—o—

Archie D. Wilson, 52, manager of the Brush division, Osborn Mfg. Co., Cleveland, died there June 18. Prior to his three-year association with the Osborn company, Mr. Wilson had done maintenance engineering with the May Engineering Co., New York.

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Hugh N. Hunter, 67, an engineer for National Acme Co., Cleveland, died June 20 in Aurora, O. A native of Glasgow, Scotland, Mr. Hunter began working for National Acme 43 years ago in Hartford, Conn.

Steel Shipments In Four Months Up Million Tons

April movement falls below March peak in most products, capacity engaged dropping from 102.4 to 98.1 per cent

STEEL production and shipment figures for April and four months by the American Iron and Steel Institute show April was third largest month so far this year, only January showing a smaller total, while the short month of February exceeded April. A peak was reached in March. March shipments totaled 6,146,595 net tons, February 5,767,687 tons, April 5,744,177 tons and January 5,700,673 tons.

April shipments showed a decline from March in practically every item, in part accounted for by the shorter month.

Total shipments of steel products for four months were 23,359,177 net tons, of which 2,058,314 tons went to members of the industry for conversion into further finished products. This compares with 22,196,829 tons in the comparable period in 1943. Companies included in the compilation for April, this year, represented 98.7 per cent of total output of rolled steel products. Of effective steel finishing capacity 98.1 per cent was engaged in April and 99.5 per cent for the first four months this year.

Wounded Veterans To Get Copies of Business Papers

Co-operation of 2500 advertising executives comprising the membership of the National Industrial Advertisers' Association, as well as the members of the Associated Business Papers and the American Association of Advertising Agencies is being sought in an educational campaign among war-wounded veterans just launched by the Cleveland chapter of the N.I.A.A.

Plan calls for distribution among hospitals housing wounded veterans of thousands of copies of technical, business and trade papers obtained from the current files of advertising agencies. Behind the program is the need for placing in the hands of wounded soldiers and sailors technical and business information which will keep them abreast with engineering and economic developments.

Only the files of advertising agencies will be tapped for copies of the various publications since it is felt industry members need their files intact for constant reference in the conduct of their business. Distribution of advertising agency copies of these publications, in a sense, will be a highly effective paper conservation measure, making available to a broader audience at no extra cost in paper the valuable information only to be obtained in these publications. It is estimated Cleveland agencies alone discard waste paper represented by these technical, business and trade publications in a weight up to 10 tons a month.

The program, started last week with distribution of hundreds of copies of the various publications obtained from Cleveland advertising agencies, is being promoted by the Committee on Technical Training Rehabilitation of the Cleveland chapter of the N.I.A.A. This committee is made up of the following: John C. Stephan, Stephan National Industrial Advertising Agency, chairman; Ralph C. Leavenworth, vice president, Fuller & Smith & Ross; Harry F. Melville, Simmons-Boardman Publishing Co.; Harry C. Grinton, McGraw-Hill Publishing Co.; Ernest C. Roberts, Clark Controller Co.; Wilmer Cordes, American Steel & Wire Co. The committee was named by Mr. Cordes who is president of the chapter.

AMERICAN IRON AND STEEL INSTITUTE
CAPACITY, PRODUCTION AND SHIPMENTS
Period APRIL - 1944

Steel Products	Number of companies	Items	Maximum Annual Capacity Net Tons	Current Month: Production: Net Tons	Current Month: Production: Per cent of capacity	Current Month: Shipments (Net Tons): Total	Current Month: Shipments (Net Tons): To members of the industry for conversion into further finished products	To Date This Year: Production: Net Tons	To Date This Year: Production: Per cent of capacity	To Date This Year: Shipments (Net Tons): Total	To Date This Year: Shipments (Net Tons): To members of the industry for conversion into further finished products
Ingots, blooms, billets, tube rounds, sheet and tin bars, etc.	46	1	x x x x	x x x x	x x x	703,547	218,984	x x x x	x x x	2,833,452	868,491
Structural shapes (heavy)	10	2	8,977,450	327,883	45.8	319,038	x x x x	1,402,319	47.9	1,366,590	x x x x
Steel piling	4	3		9,431		9,961	x x x x	18,836		19,237	x x x x
Plates (sheared and universal)	23	4	15,990,020	1,150,643	87.7	1,129,750	56,407	4,708,385	89.0	4,587,621	180,052
Skelp	6	5	x x x x	x x x x	x x x	69,022	55,630	x x x x	x x x	288,238	225,720
Rails—Standard (over 60 lbs.)	4	6	3,625,000	181,901	61.1	176,975	x x x x	778,115	64.9	769,950	x x x x
—All other	6	7	518,600	20,921	49.2	19,689	x x x x	63,268	36.9	65,203	x x x x
Splice bars and tie plates	13	8	1,703,700	66,678	47.7	71,564	x x x x	271,255	48.1	278,508	x x x x
Track spikes	10	9	373,200	12,793	41.8	14,448	x x x x	48,969	39.7	52,010	x x x x
Hot Rolled Bars—Carbon	36	10	x x x x	699,023	x x x	585,289	76,969	2,942,287	x x x	2,473,441	321,113
—Reinforcing—New billet	13	11	x x x x	35,485	x x x	40,989	x x x x	145,734	x x x	153,740	x x x x
—Rerolled	15	12	x x x x	7,784	x x x	9,236	x x x x	33,070	x x x	38,132	x x x x
—Alloy	22	13	x x x x	259,808	x x x	190,044	40,325	1,098,224	x x x	800,781	150,965
—Total	44	14	21,207,210	1,002,100	57.6	825,558	117,294	4,219,315	60.2	3,466,094	472,078
Cold Finished Bars—Carbon	25	15	x x x x	153,682	x x x	148,640	x x x x	618,045	x x x	609,817	x x x x
—Alloy	22	16	x x x x	32,216	x x x	27,770	x x x x	142,183	x x x	125,544	x x x x
—Total	31	17	2,694,110	185,898	84.1	176,410	x x x x	760,228	85.3	735,361	x x x x
Tool steel bars	18	18	214,970	11,276	63.9	10,742	x x x x	48,818	68.7	46,061	x x x x
Pipe and Tubes—Butt weld	16	19	2,289,130	112,326	59.8	117,876	x x x x	480,185	63.4	465,431	x x x x
—Lap weld	8	20	967,900	45,163	56.9	50,152	x x x x	200,471	62.6	198,586	x x x x
—Electric weld	9	21	1,225,170	68,427	68.1	67,840	x x x x	233,398	57.6	232,102	x x x x
—Seamless	15	22	2,659,250	182,685	83.7	185,677	x x x x	787,050	89.5	775,654	x x x x
—Conduit	7	23	184,500	4,706	31.1	5,391	x x x x	16,815	27.6	17,216	x x x x
—Mechanical tubing	11	24	1,004,450	65,977	80.0	68,970	x x x x	280,490	84.4	288,445	x x x x
Wire rods	25	25	6,840,210	354,568	63.2	105,229	26,816	1,471,368	65.0	415,481	112,428
Wire—Drawn	40	26	5,468,830	286,622	63.9	163,379	4,084	1,192,865	66.0	668,870	16,624
—Nails and staples	18	27	1,224,880	53,805	53.5	51,934	x x x x	237,552	58.6	231,037	x x x x
—Barbed and twisted	15	28	551,720	20,537	45.4	19,761	x x x x	85,082	46.6	83,326	x x x x
—Woven wire fence	15	29	1,101,090	31,049	34.4	30,431	x x x x	128,137	35.2	127,752	x x x x
—Bale ties	12	30	150,660	6,664	53.9	6,894	x x x x	27,758	55.7	26,136	x x x x
Black Plate—Ordinary	9	31	x x x x	x x x x	x x x	42,379	55	x x x x	x x x	146,324	616
—Chemically treated	8	32	464,000	13,708	36.0	12,769	x x x x	58,076	37.8	55,022	x x x x
Tin and Terne Plate—Hot dipped	9	33	3,452,400	140,318	49.5	157,758	x x x x	540,479	47.3	602,784	x x x x
—Electrolytic	10	34	1,780,450	62,140	42.5	58,274	x x x x	200,764	34.1	186,781	x x x x
Sheets—Hot rolled	28	35	19,611,270	1,014,579	63.0	520,318	26,010	4,134,072	63.7	2,136,055	89,238
—Cold rolled	14	36	7,318,780	299,496	49.9	172,209	x x x x	1,183,593	48.9	665,795	x x x x
—Galvanized	15	37	2,686,410	99,814	45.3	101,589	x x x x	406,559	45.8	404,793	x x x x
Strip—Hot rolled	22	38	7,307,280	223,592	37.3	142,907	27,880	878,643	36.4	575,314	93,067
—Cold rolled	34	39	3,236,940	98,937	37.2	88,662	x x x x	381,010	35.6	356,671	x x x x
Wheels (car, rolled steel)	5	40	348,800	23,604	82.5	24,384	x x x x	98,711	85.6	99,070	x x x x
Axles	6	41	416,170	18,101	53.0	17,173	x x x x	72,070	52.4	71,329	x x x x
All other	6	42	150,270	3,601	29.2	5,517	x x x x	12,956	26.1	20,878	x x x x
Total steel products	154	43	x x x x	x x x x	x x x	5,744,177	533,160	x x x x	x x x	23,359,177	2,058,314
Effective steel finishing capacity	154	44	64,722,000	x x x x	x x x	x x x x	x x x x	x x x x	x x x	x x x x	x x x x
Percent of shipments to effective finishing capacity	154	45	x x x x	x x x x	x x x	98.1 %	x x x x	x x x x	x x x	99.5 %	x x x x

Productio

DESPITE difficulties in meeting production schedules caused by critical military demands, output of farm machinery is proceeding at a high level and by the close of the current fiscal year June 30 will be only 10 per cent behind schedule. On May 1 last the entire program was 13 per cent behind schedule, in sharp contrast with 23 per cent behind last February.

The farm equipment program for the fiscal year drawing to a close called for consumption of 1,200,000 tons of carbon steel; of which 88 per cent was scheduled for production of equipment for the domestic farmer, 5 per cent for military and industrial needs and 7 per cent for export. This program called for about twice the amount of steel consumed in the preceding year.

No change in carbon steel requirements for the 1944-45 program is indicated. However, the manufacture of some of the most important agricultural implements, including combines, will be stepped up this year far beyond the peacetime rate. Overall production in April rose to 38.3 per cent above average monthly output during the last nine months, with a few items showing in-

uct0% Behind Schedule

Industry is reported producing at record-breaking pace. Program for fiscal year ending June 30 calls for consumption of 1,200,000 tons of carbon steel, about twice the amount consumed during the preceding year

creases, some amounting to more than 100 per cent. However, output of two major classes of farm machinery, harvesting and haying equipment, still was running more than 30 per cent behind schedule as of May 1. One of the most critical items, combines, is among the farthest behind. The $196 million program for production of repair parts for farm machinery was running 15 per cent behind schedule as of May 1.

Manufacturers who have not completed the machinery authorized for the current year may continue to operate under this year's authorizations through July 31, 1944, simultaneously operating under the new year's authorizations.

War Production Board recently announced removal of all quota restrictions permitting small manufacturers to engage in unlimited production of farm machinery equipment and repair parts made entirely from surplus materials or materials obtained with an AA-4 preference rating. Participation in this program is limited to plants regularly employing 100 or fewer workers and which are located in other than No. 1 labor areas. In the case of the latter, participation is restricted to plants which regularly employ not more than 50 workers.

WPB recently established a reserve of 15,000 tons of carbon steel and proportionate amounts of other controlled materials to be used with idle and excess inventories in production of farm machinery and equipment over and above regular quotas and for delivery under third quarter 1944 allotments. This action was taken in direction 4 to limitation order L-257, which further permits participation in this special program of all manufacturers who can qualify, including those not already engaged in the production of farm machinery. WPB officials pointed out, however, that applications would not be granted if participation involved substantial allotments of plates, sheets, strip, tin mill products, forgings, seamless tubing, wire rope and strand; also if it appeared likely that critical non-controlled materials and components would be needed.

Pointing out that need for enormous quantities of food and other farm products will continue even after the war ends, War Food Administration officials do not expect the recent war developments to modify materially their plans calling for all-out output in 1945.

WFA has issued a temporary order applying to distribution of farm machinery and equipment to be produced in the new machinery production year beginning July 1, 1944. The temporary order (amendment 2 to supplementary order I, war food order 14—formerly FPO 14) provides principally that:

1—Each manufacturer is authorized to distribute up to 70 per cent of his scheduled production of schedule I and II items—those for which there are both state and county quotas or state quotas —and 100 per cent of schedule III items.

2—When any manufacturer has transferred 50 per cent of his scheduled production of schedule I and II items, he shall notify the WFA so that timely releases of additional quantities may be authorized.

3—To reduce possibilities for concentrations of schedule 1 equipment in some counties, a limit is placed on the amount of equipment which manufacturers may transfer into any single county without approval of the state AAA committee.

4—To facilitate rationing, manufacturers will provide state AAA committees with advance notice of shipments of schedule I and II equipment.

In commenting on the status of the farm implement program, War Production Board Chairman, Donald M. Nelson, said some of the most important items are moving much beter than others. Tractors, for instance, are in fine shape. The agricultural equipment schedule called for output of 209,000 units for current fiscal year, and up to May 6 more than 182,000 had been produced. Average

(*Continued on* 140)

Considerable farm manpower is conserved by machines which bale hay in the field, top of page, left, eliminating unnecessary handling. Huge combines, such as shown at top right, speed harvesting on the larger western grain farms. Electrification of farm buildings permits double shifts during the busy harvest season. Photo at upper left shows hay loft illuminated by floodlights. Soybeans, which comparatively recently have become one of our most important crops, are harvested mechanically, center left. Lower left, despite a strong trend toward combines, the standard threshing machine still holds favor in many sections of the country. Below, small combines rapidly were becoming standard equipment on small and medium-size farms before the war slowed down production

THE BUSINESS TREND

Production Unity a "Must" To Meet War Schedules

OUTPUT of essential war materiel recorded further slight gains during the past week, with recent war developments stimulating production efforts of both labor and management. Unsettled labor conditions, resulting in numerous wildcat strikes of short duration, at least temporarily appear to have given way to the more pressing need of achieving unity in the present critical period. This unity of the production effort is of prime importance to get output of war materiel up to schedule and keep it there.

Steel industry's production has been fluctuating between 98 and 99 per cent of capacity the past month or so. But lower levels are in prospect because of the manpower shortage which is expected to be accentuated during the hot summer months. New steel bookings continue to exceed output with consequent lengthening of deliveries in plates, sheets and bars particularly.

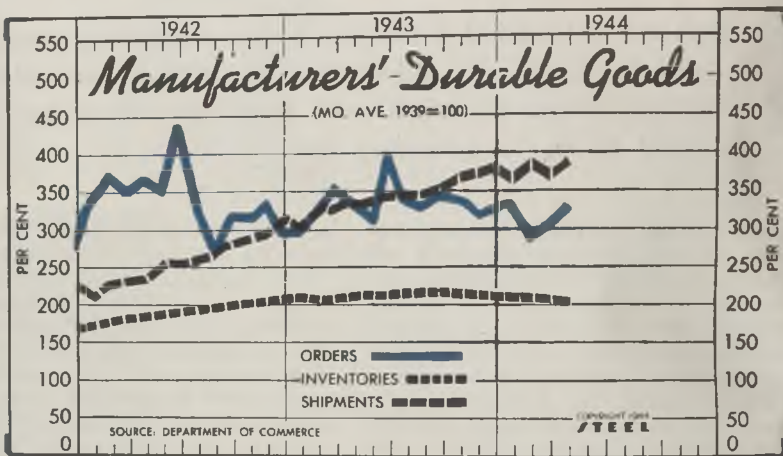
EMPLOYMENT—Completion of many war contracts, curtailments in others, and decreases in consumer goods production are reflected in a recent further decline in manufacturing wage-earner employment to 13,007,000 at the close of May. This represents a decline of 165,000 from the close of April and is a million below the November, 1943 peak. War Mobilizer James F. Byrnes recently predicted unemployment before the year is out because of heavy war production cutbacks to come, even though the war with Germany continues.

INVENTORIES—In the past few months manufacturers have become increasingly conservative in their inventory policy. During the first four months this year the value of manufacturers' inventories was reduced by more than $400 million, with almost half of the reduction occurring in April alone. On April 30 these inventories totaled $17.4 billion, or slightly below the like 1943 period, and represents a sharp contrast to the 11 per cent increase in shipments during the period.

Value of stocks held by war contractors reached an all-time record on Sept. 30 last, but have tended downward each month since and by the close of April reached the lowest level recorded in any month for the past year and a half. The entire inventory reduction occurred in the raw materials and goods in process holdings, indicating that these firms are tending to hold their inventory needs more closely in line with production and delivery schedules.

Since war production is near scheduled peak levels, the war inventory needs are expected to hold at present volume or even decline with the easier supply situation in some lines and continued increase in operating efficiency.

WAR EXPENDITURES—An increase of 5.7 per cent was recorded in war expenditures during May to $7.9 billion, but remained slightly under the March peak. Daily rate of expenditures amounted to $293.3 million last month, or 2.1 per cent below the April rate and compares with the peak of $312.3 million in February. Total money outlay since July 1, 1940 aggregates $192 billion.



Index of Manufacturers Durable Goods

	Orders		Shipments		Inventories	
	1944	1943	1944	1943	1944	1943
January	331.5	293.5	365	208	212.0	211.3
February	294.4	326.6	384	337	208.6	209.6
March	309.7	349.2	369	330	207.2	210.7
April	327.4	329.8	387	338	204.4	213.5
May	....	313.0	....	338	....	213.5
June	....	392.7	....	343	....	212.5
July	....	338.7	....	346	....	211.4
August	....	325.0	....	354	....	213.4
September	....	339.5	....	356	....	214.9
October	....	339.5	....	371	....	214.0
November	....	316.1	....	373	....	213.3
December	....	324.2	....	380	....	212.8
Average	....	332.3	....	339	....	212.7

FIGURES THIS WEEK

INDUSTRY	Latest Period*	Prior Week	Month Ago	Year Ago
Steel Ingot Output (per cent of capacity)	98.0	98.0	98.5	98.5
Electric Power Distributed (million kilowatt hours)	4,098	4,264	4,246	4,098
Bituminous Coal Production (daily av.—1000 tons)	2,093	1,978	2,095	1,942
Petroleum Production (daily av.—1000 bbls.)	4,569	4,523	4,513	3,966
Construction Volume (ENR—unit $1,000,000)	$29.2	$42.9	$26.9	$44.2
Automobile and Truck Output (Ward's—number units)	18,985	18,930	17,770	19,080

*Dates on request.

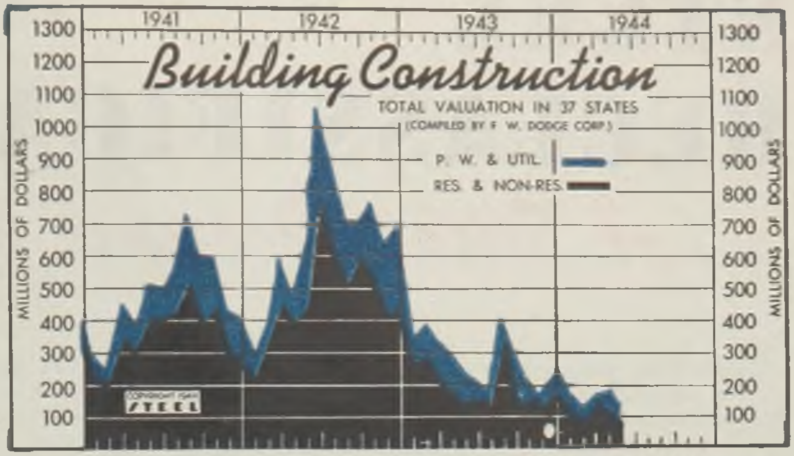
TRADE	Latest Period	Prior Week	Month Ago	Year Ago
Freight Carloadings (unit—1000 cars)	875†	874	871	868
Business Failures (Dun & Bradstreet, number)	30	22	28	78
Money in Circulation (in millions of dollars)‡	$22,333	$22,255	$21,846	$17,189
Department Store Sales (change from like week a year ago)‡	+7%	+11%	+9%	+2%

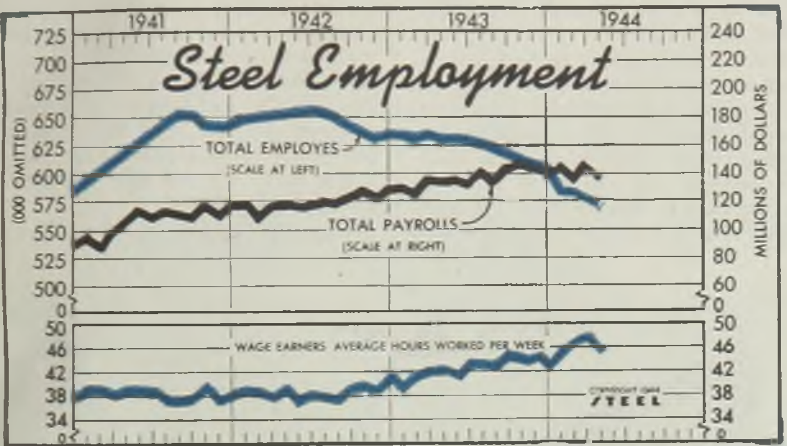
†Preliminary. ‡Federal Reserve Board.

Construction Valuation In 37 States

(Unit—$1,000,000)

		Public Works-Utilities		Residential-Non.-Res.	
	Total	1944	1943	1944	1943
Jan.	159.2	50.3	85.8	108.9	264.3
Feb.	137.2	55.1	112.9	82.1	280.5
Mar.	176.4	61.3	123.0	115.1	216.7
April	179.3	72.0	127.7	107.3	175.6
May	144.2	55.8	95.8	88.4	138.6
June	.....	.....	73.3	.....	156.3
July	.....	.....	50.0	.....	133.7
Aug.	.....	.....	73.4	.....	340.3
Sept.	.....	.....	175.1	.....	125.0
Oct.	.....	.....	63.5	.....	150.0
Nov.	.....	.....	59.0	.....	125.4
Dec.	.....	.....	67.4	.....	184.9
Total	.....	.....	1,106.9	.....	2,106.4





Steel Employment

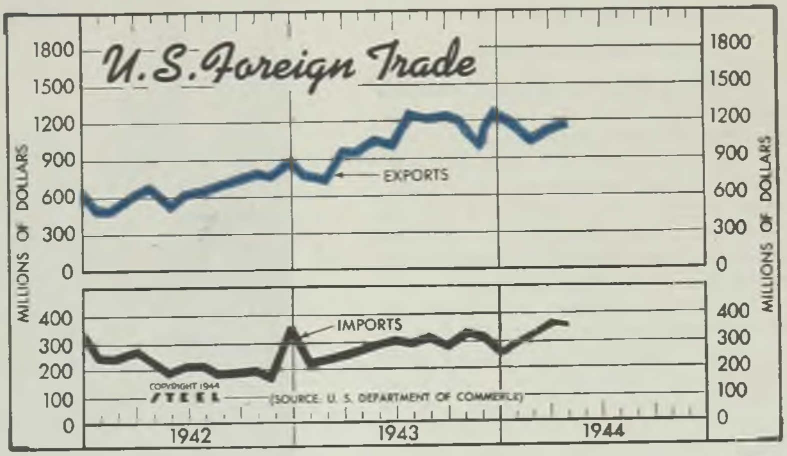
	—Employes— (000 omitted)			—Total Payrolls— (Unit—$1,000,000)		
	1944†	1943	1942	1944	1943	1942
Jan.	583	637	651	$141.8	$129.7	$118.8
Feb.	583	635	651	137.6	122.8	108.5
March	578	637	653	145.3	136.8	117.0
April	573	634	654	138.9	133.3	118.5
May	...	632	656	.....	137.4	117.4
June	...	631	659	.....	136.2	118.0
July	...	627	655	.....	142.8	120.7
Aug.	...	625	647	.....	139.9	118.7
Sept.	...	620	641	.....	143.8	124.8
Oct.	...	615	635	.....	144.9	126.6
Nov.	...	611	632	.....	141.5	122.8
Dec.	...	605	633	.....	140.2	129.3

†Monthly average; previous reports showed total number regardless of whether they worked one day or full month.

Foreign Trade
Bureau of Foreign and Domestic Commerce

(Unit Value—$1,000,000)

	Exports			Imports		
	1944	1943	1942	1944	1943	1942
Jan.	1,192	730	481	300	228	254
Feb.	1,086	719	480	313	234	254
Mar.	1,160	988	628	359	249	272
Apr.	1,192	980	717	356	258	235
May	.....	1,085	535	...	281	191
June	.....	1,002	648	...	295	215
July	.....	1,262	650	...	300	213
Aug.	.....	1,204	703	...	315	186
Sept.	.....	1,233	732	...	285	196
Oct.	.....	1,193	802	...	329	200
Nov.	.....	1,074	787	...	317	168
Dec.	.....	1,241	873	...	278	358
Total	.....	12,716	8,035	...	3,369	2,742



FINANCE

	Latest Period°	Prior Week	Month Ago	Year Ago
Bank Clearings (Dun & Bradstreet—millions)	$8,735	$8,676	$8,864	$8,586
Federal Gross Debt (billions)	$189.2	$188.5	$187.4	$140.9
Bond Volume, NYSE (millions)	$61.7	$55.8	$50.5	$27.5
Stocks Sales, NYSE (thousands)	11,443	5,943	3,786	1,704
Loans and Investments (millions)†	$50,032	$49,988	$50,611	$46,808
United States Government Obligations Held (millions)†	$37,027	$37,029	$37,635	$34,141

†Member banks, Federal Reserve System.

PRICES

STEEL's composite finished steel price average	$56.73	$56.73	$56.73	$56.73
Spot Commodity Index (Moody's, 15 items)†	250.0	250.3	250.1	243.8
Industrial Raw Materials (Bureau of Labor index)‡	114.4	113.8	112.8	114.8
Manufactured Products (Bureau of Labor index)‡	101.0	101.1	101.0	100.7

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

STEEL RECLASSIFICATION

... A Vital Postwar Problem

EXECUTIVE personnel of all progressive organizations are giving postwar problems serious consideration. We all know of remarkable new products that many manufacturers expect to produce. But they must be produced at minimum cost if they are to be sold at a profit. Unit production cost will necessarily be appreciably higher than ever before because of the higher direct labor cost and higher taxes.

There are many ways in which progressive manufacturers will counteract these conditions. Ingenious basic designs, carefully planned production procedure, and highly mechanized manufacturing methods will be important factors. These are primarily the problems of each individual manufacturer. However, there is one factor which is not only an individual problem of each producer of equipment fabricated from steel but is also a collective problem of all manufacturers who consume steel in comparatively small quantities.

Not Heat Lot Buyers

Possibly a definition of small quantities might be in order. In brief, we would describe the small consumer as one who is not in position to consistently purchase his steel requirements in heat lots. Most machine tool builders would be classified in this category. In addition, there are numerous other industries that fall in this same classification.

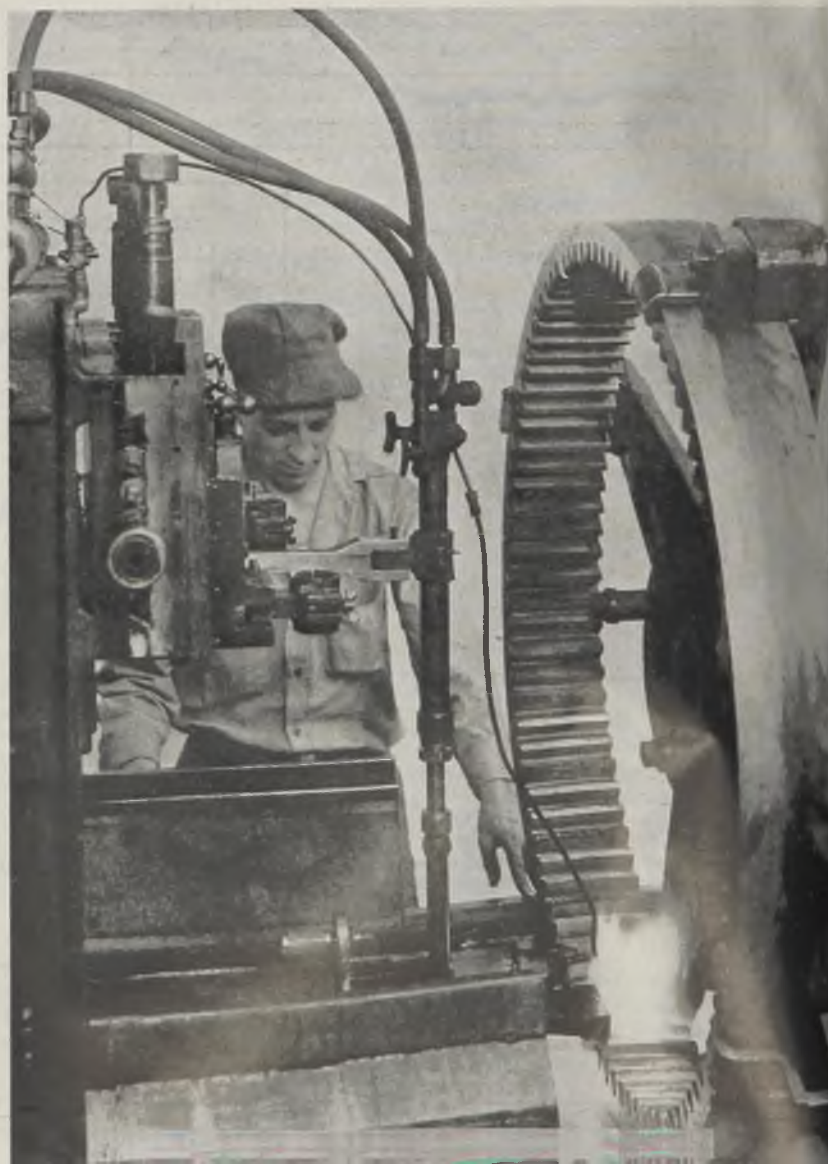
The small consumers of steel can be divided into two general groups, namely, those who purchase the most of their requirements from the mill and those who procure an appreciable amount from warehouse sources. It is the intention here to briefly outline a simplification program highly suitable to the needs of both groups.

Prior to the emergency period, it would have been almost an impossibility to have given the slightest consideration to reducing the number of standard steels being produced. The SAE group was the recognized minimum list and any reduction was considered impractical.

The writer recalls a conversation which took place in the office of a vice president of one of our Midwest cold-drawn mills as late as 1940. The statement was made that 90 to 95 per cent of all machine tool parts could be made from four or five grades of steel. The tremendous overlapping of the physical properties of the SAE grades was pointed out. The steel mill executives agreed with all statements but advised that the sales resistance to a simplification program would make it impractical if not entirely impossible. We were forced to admit that inducing a manufacturer to change a grade of steel was a Herculean task.

It was not uncommon to find a manufacturer using three or four grades of steel, all having essentially the same physical properties. This condition was especially true where trade-name materials were in use. In many instances, this duplication was because the engineering department was not given a steel standardization program. The problem of a designing engineer is essentially to design the mechanism of a machine and select the materials from which it can be satisfactorily fabricated. He cannot find the time to study all the production and metallurgical problems contingent to the manufacture of the equipment, but must be guided by the advice of the metallurgists and production engineers for such information. If this is not made available, the only recourse is to use his own judgment in selecting the material.

This will usually result in the use



By A. L. HARTLEY
Metallurgist
R. K. LeBlond Machine Tool Co.
Cincinnati

of overlapping grades of steel, overlapping finishes and sizes. This overlapping can be eliminated by a carefully worked out steel standardization program.

The most important factor in the successful installation of a steel standardization program is the complete co-operation of the executive personnel. A program of this nature cannot be installed successfully without the complete co-operation of the production manager, the chief engineer, and the chief metallurgist.

Brief Outline of a General Procedure for the Establishment of a Steel Standardization Program

1. A careful study of all types of steel required to produce the product. For example, in the case of a machine tool manufacturer the types of steel which could be satisfactorily adopted would be:

(a) **General Purpose**

—A plain carbon carburizing steel. In many instances it may be found practical to use this material as the free machining grade. However, the addition of a separate grade is frequently advantageous.

—A carbon or carbon manganese steel of a medium carbon content (0.40 to 0.50 per cent carbon).

—An alloy carburizing grade.

—An alloy oil hardening grade.

(b) **Special Purpose**

—A carbon tool steel.

—A nondeforming oil-hardening grade of tool steel.

—A shock-resisting grade of tool steel.

—An abrasive-resisting grade of tool steel.

The special purpose grades make up a small percentage of the total requirements. It will usually be found that the above mentioned types of steel will produce almost any machine tool, and, no doubt, many other products.

It is usually not necessary to have more than one grade of a given type of steel and there are many organizations which would not require all of the types mentioned above.

2. A complete comparison of the physical properties of each of the types of steel required.

Although it may be a rather laborious task, a complete tabulation of the physical properties and mass effect characteristics of all of the steels of a given type will show the remarkable similarities and will clearly confirm the above remark in which it was stated that it was not necessary to carry more than one steel of a given type. A tabulated chart of this nature, carefully and conscientiously prepared by a competent metallurgist, will greatly aid the production manager and chief engineer in making their decisions as to the necessity of a given grade of steel.

3. A comparison of the machining characteristics of the various grades of steel.

This comparison resolves itself into two separate problems. The first is the machinability of the material in the as-purchased condition. This study is applicable to all grades. In making a study of the machining characteristics of the material in the initial condition, extreme care must be taken to be sure that incorrect results are not obtained because the material was not properly processed (such as insufficient annealing).

Study Maximum Hardness

The second is a study of the maximum hardness at which a given grade of steel can be machined. In making this analysis, precautions must be taken to be sure the limits are within a practical range.

4. The final selection of the steels required to produce the products.

This selection can only be made after extensive preliminary work has been conducted. In making the final decision it is of the utmost importance that all of the newer types of heat treatment be given careful consideration. Fig. 2 shows a small pinion and clutch set up for spin flame hardening of the clutch teeth. This is a typical example of a small part that can be more efficiently treated by this method. Fig. 1 shows a typical example of a larger part in process of being flame hardened by the progressive method.

These illustrations were incorporated to show the wide range of work that can be handled by flame hardening. Similar examples could be incorporated to show an almost equally wide range of work that could be efficiently treated by electric induction hardening.

Most organizations have hundreds of applications that are suitable for one or the other of these methods. Their use will definitely affect the selection of the most suitable steels.

5. A carefully prepared set of sym-

(Please turn to Page 136)

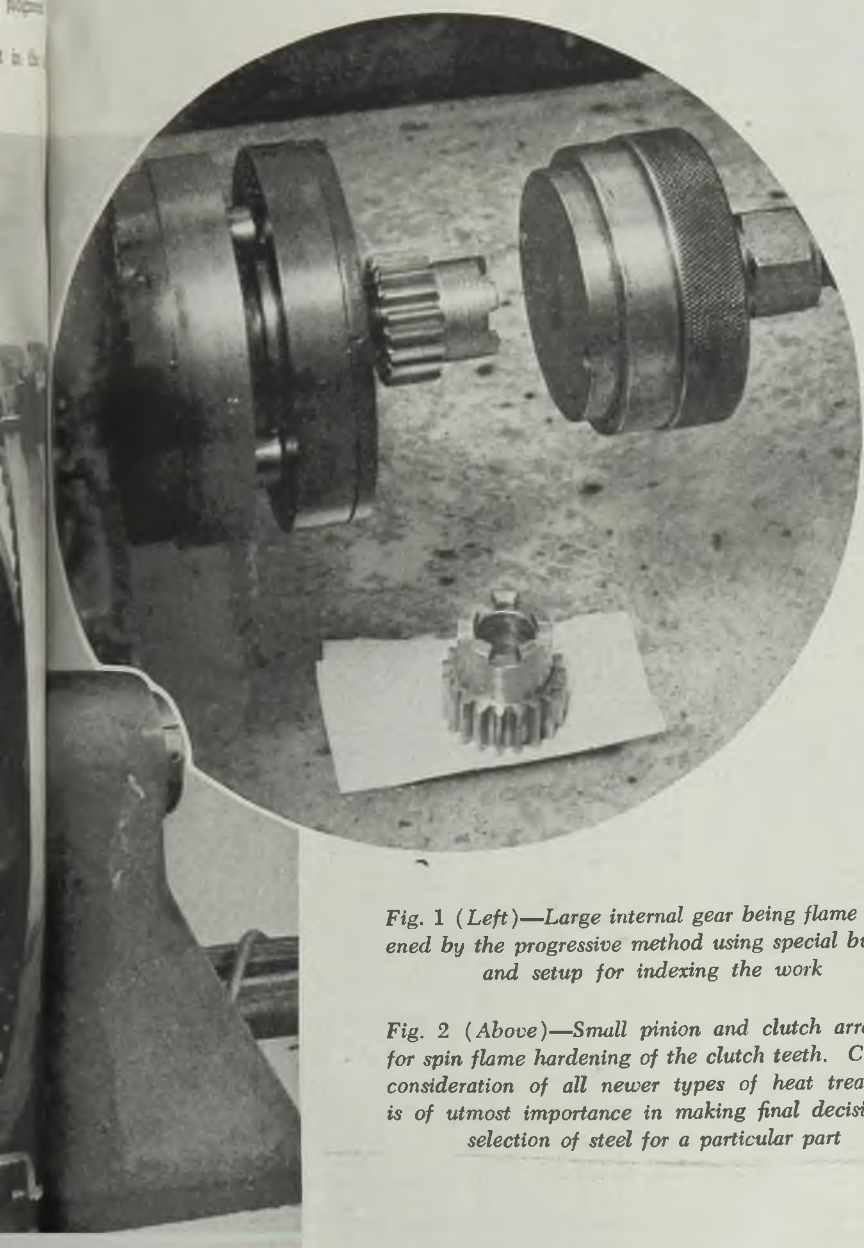
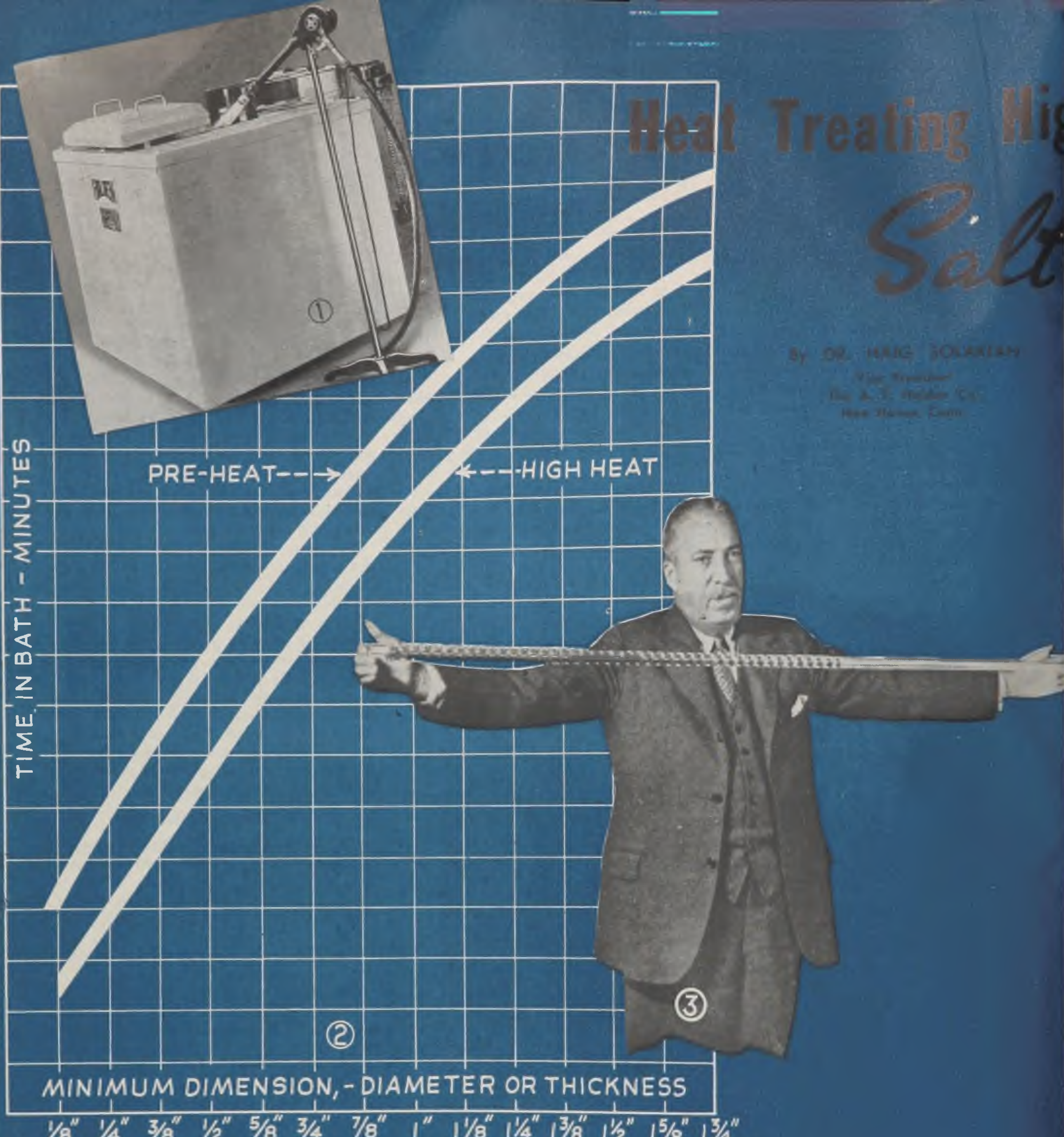


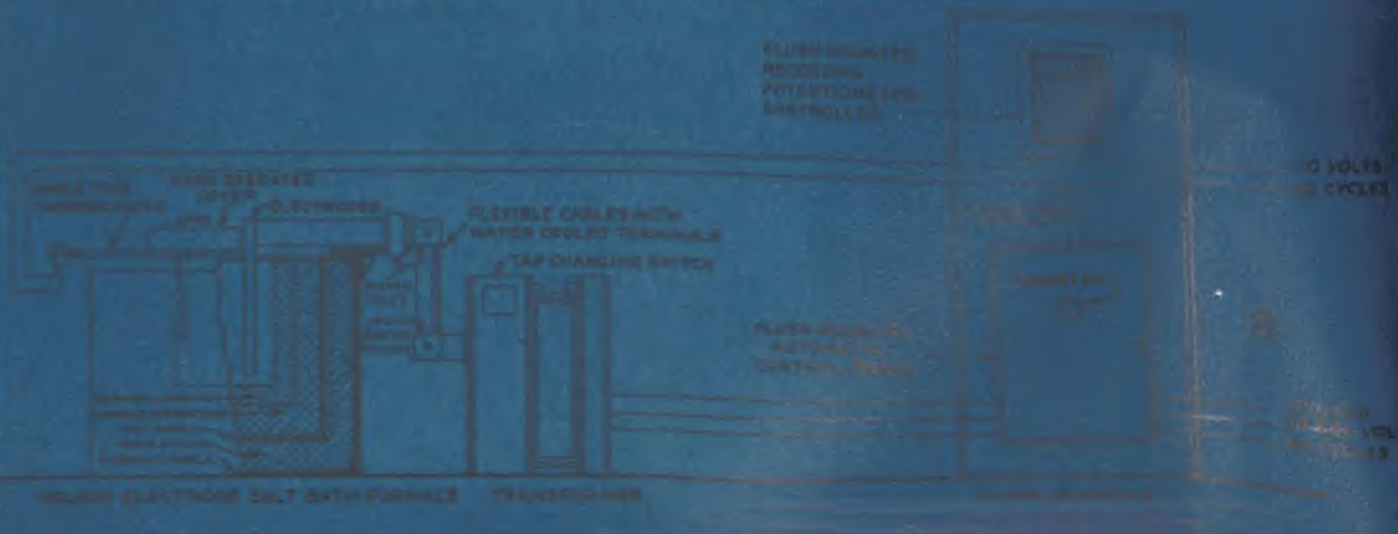
Fig. 1 (Left)—Large internal gear being flame hardened by the progressive method using special burners and setup for indexing the work

Fig. 2 (Above)—Small pinion and clutch arranged for spin flame hardening of the clutch teeth. Careful consideration of all newer types of heat treatment is of utmost importance in making final decision in selection of steel for a particular part

Heat Treating High Speed ... Salt ...

By DR. HAIG SOLAKIAN
Vice President
The A. F. Holden Co.
New Haven, Conn.





Speed Steels in Bath Furnaces

Reasonable care and attention to details and instructions for proper operation of the salt bath pays large dividends in high-quality products and low maintenance of equipment

DURING the past 25 years, the art and technique of heat treating metals and particularly high-speed steels has taken great strides. Most of the guesswork has been eliminated from these operations and results can be duplicated continuously. However, in spite of such notable progress, there are certain troubles commonly encountered at the elevated temperatures necessary for the proper hardening of high-speed steels. These troubles are: Scaling, decarburization, pitting, fusion, grain growth and distortion.

Scaling: Steel begins to oxidize slowly and forms scale at 1000 degrees Fahr. This reaction is accelerated and takes place at a rapid rate at the hardening temperatures (2100 to 2350 degrees Fahr.) of high-speed steel. The surface of the tool has to be protected from oxygen to prevent this condition. Besides loss of form due to scale, the tool requires expensive cleaning, such as pickling and shot blasting.

Decarburization: This is caused by the loss of carbon from the surface of the tool, producing what is known as soft skin. This condition becomes a serious handicap if the tool has been finished to size and no grinding after hardening is planned. In a muffle furnace, oxygen, carbon dioxide, and water vapor will decarburize steel at elevated temperatures. In a salt bath, contamination and breakdown of the bath, and also accumulation of metallic oxides will produce soft skin.

Pitting: This condition takes place invariably when the temperature is too high and the atmosphere is oxidizing. In a salt bath, the presence of impurities, such as sulphur or water vapor will cause pitting. Like the trouble of decarburization, it requires grinding to correct the condition, but where no grinding is scheduled, this trouble may cause spoilage of the tool.

Fusion: Certain parts of the tool or the cutting edge may actually fuse and,

(*Please turn to Page* 111)

Fig. 1—Gas-fired portable torch is used to melt salt between furnace electrodes and start the bath. After a pool is created to permit passage of current, more salt is slowly added until pot is filled within 2 inches of top

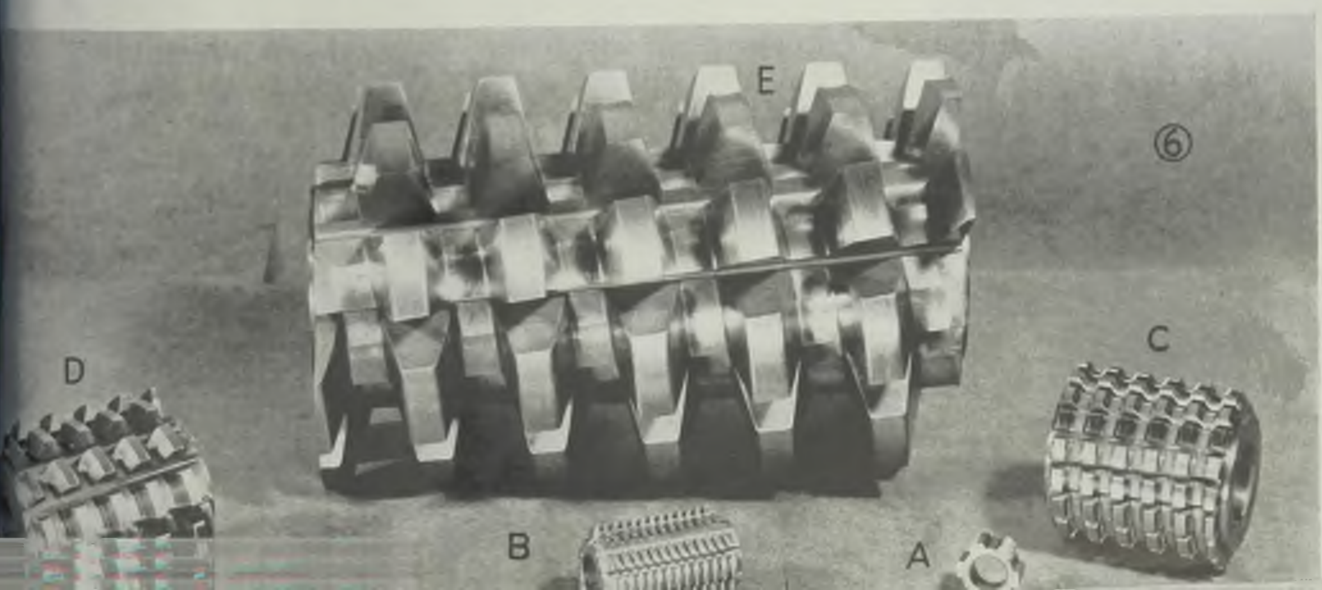
Fig. 2—Curves of this graph demonstrate relationship between minimum dimension and time required in preheat as well as high-heat baths

Fig. 3—This broach, 60 inches long, has been hardened in an electrode-type furnace and though subject to distortion, has been straightened after quenching to within 0.005-inch

Fig. 4—Schematic diagram showing arrangement of electrodes in ceramic pot, transformers and control panel

Fig. 5—Overall dimensions are of little help in finding proper bath times. This high-speed hob is much larger than those in Fig. 6, yet it receives the same time at high temperature. Minimum dimensions are relatively close

Fig. 6—Estimating time at high temperature necessary for various high-speed parts is facilitated by checking minimum dimension in each of the hobs shown ("A", "B", "C", etc.) against Time in Bath—Minutes scale as charted in Fig. 2



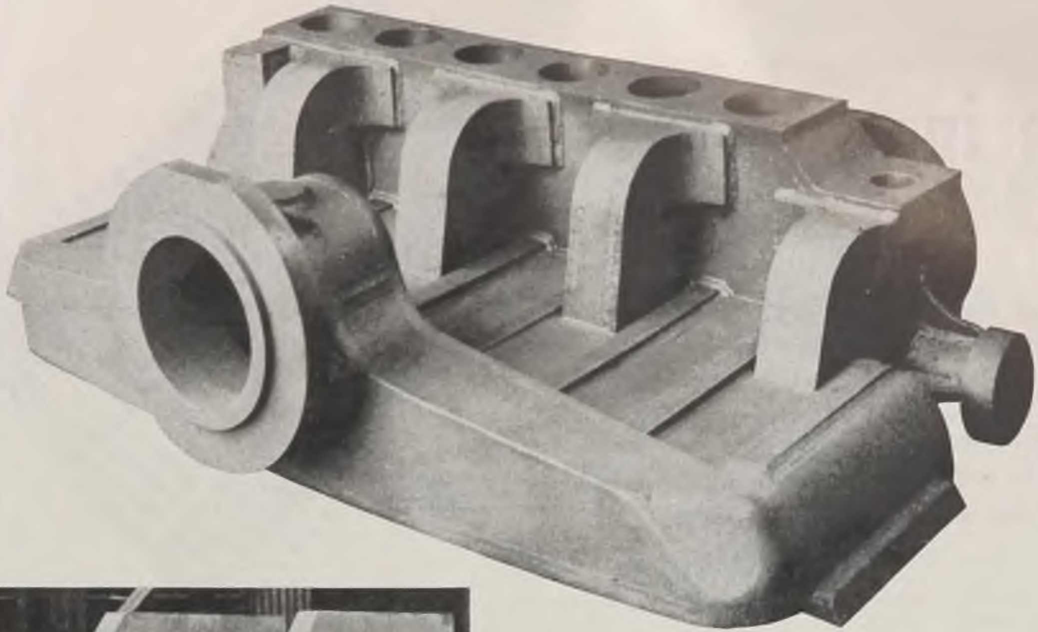


Fig. 5 (Above)—Water-jacketed diesel engine exhaust manifold was fabricated from ⅛-inch sheets

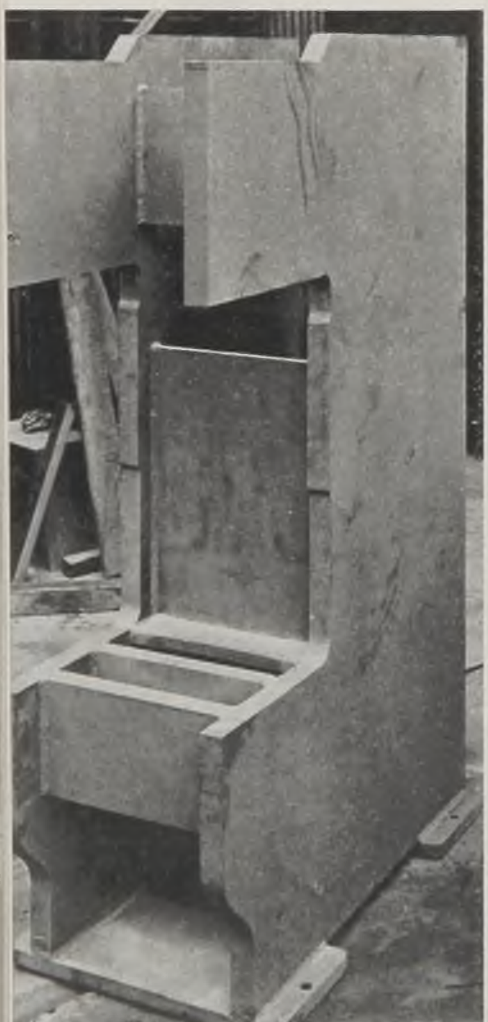


Fig. 1 (Above)—Complicated all-welded steel throttle header for a steam locomotive may be fabricated easily by working out sequence of operations

Fig. 2 (Left)—The 2½-inch side plates take up most of the load in this 150-ton hydraulic press frame

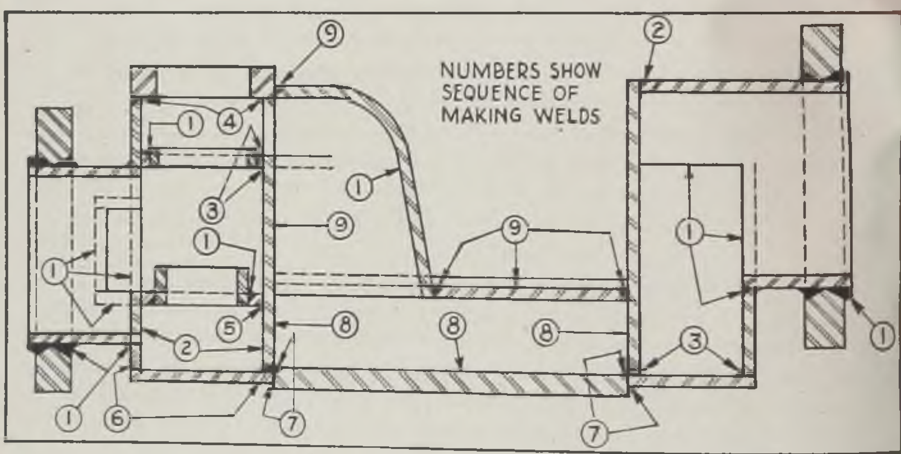


Fig. 4 (Above)—This diagram shows sequence of welding operations in fabricating the header shown in Fig. 1

Fig. 3 (Below)—Bed plate for a 38-foot mill roll lathe made up from standard rolled sections

intricate machine parts

. . . . are readily fabricated by joining simple geometric elements cut from sheets, plate, shapes or piping. Proper design and sequence of assembly are important

By A. E. BEDELL, *Chief Engineer*
and
T. G. MORRISON, *Weldery Engineer*
Graver Tank & Mfg. Co. Inc.
East Chicago, Ind.

THERE IS an understandable tendency on the part of the proponents of any method of fabrication to present their procedure to its best advantage. Hence it is only natural for them to make comparisons under most favorable circumstances. Unfortunately, it all too frequently follows that broad, sweeping conclusions are drawn from isolated or inconclusive instances, or even from erroneous data mistakenly, though honestly, obtained. This often results in the process being damned by too much praise.

There is little question but that weldments have suffered in the past because of this. Claims made that most any part previously made by castings or forgings can be duplicated or improved by welded parts at two-thirds the weight and less than half the cost, have not proven true in practice, except in a few isolated cases. Consequently, all too often the whole art has been either summarily condemned or else given insufficient opportunity to prove itself in its rightful place.

Fundamentals Are Threefold

On the other hand, numerous machine designers and builders have found that weldery offers a simple solution for a number of problems. Many machine parts can be fabricated by welding in such a way as to simplify construction, lighten the machine, increase structural strength, improve appearances and, at the same time, reduce manufacturing costs. Any art with such possibilities deserves careful study and consideration. This article will attempt to point out some of the advantages of welded construction, but with no thought of disparaging either castings or forgings, which always have and will continue to have their rightful and useful place.

The fundamental requirements of weldments, as in any other machine parts, are threefold: (a) They must fulfill their functional duties; (b) they must meet proper physical appearances, consistent with proper design, and (c) they must be designed for economic fabrication, particularly if produced in quantities.

These three requirements are influenced by other factors and their relative importance is in turn unavoidably affected by these secondary, but important considerations. Among these influences are those which are controllable, such as knowledge of structural design, suitable machinery and equipment and skilled personnel. Other factors, such as available materials, permissible weight, permissible size as affected by assembly or shipping limitations, desired service life, interchangeability and number of units to be fabricated, are either partially or entirely uncontrollable.

When, however, the problem is placed unreservedly in the hands of an experienced weldery, the controllable factors are automatically taken care of and they, in close co-operation with the customer, can usually work out the uncontrollable factors in some satisfactory way. It is very important to bear in mind that since a skilled designer usually can arrive at several possible solutions to any welded design problem, that he be furnished with all possible information, as well as limiting factors, in addition to the fundamental duties of the weldment, so that his final design meets with the customer's requirements to the best possible advantage.

Mutual Understanding of Problems

This necessity of close co-operation between the customer and the weldery cannot be emphasized too strongly; a lack of this is one of the chief reasons why in the past numerous potential users have been disappointed or discouraged in their attempt to make satisfactory and economical use of welded construction and oftentimes makes the weldery feel that their best efforts to please the customer are useless. There is no reasonable excuse, except for the failure of both parties concerned, to have a mutual understanding of the other's respective problems and limitations.

The function of a weldery is simple. Briefly, it is to fabricate, by welded construction, semifinished structures which in the past have been universally produced by other methods. Further, it permits the fabrication of parts which previously could not be made. The materials used are rolled steel plate, slabs, structural shapes, pipe, tubing; and supplemented when desired by castings or forgings. A first class weldery must be equipped with facilities for welding, flame cutting, bending, forming and pressing, supplemented by shot blasting, grinding, machining, stress relieving and radiographing equipment. All these must be complemented by skilled personnel and competent supervision.

Welded construction's principal advantage lies in its extreme flexibility. The familiar limits imposed on the size, shape, thickness, and location of elements of members made by the original methods of casting or forging are practically eliminated from weldment design. It can be appreciated that two or more different materials can be welded into an integral assembly and thus full advantage taken of the wide selection of steels and alloys now available.

Another advantage offered by weldments is accomplished by the simple, elemental construction used, and no matter how intricate the nature of the work being fabricated the procedure is always identical. The unit is divided and subdivided into simple geometric elements which can be flame cut or sheared from sheets, plate, standard shapes or piping. These elements can be bent, blanked, formed or machined so that when assembled and welded, the completed structure can have any conceivable shape. Furthermore, the proper design and sequence of assembly, units that would be difficult or impossible to make by any other means, can be fabricated with comparative ease.

All weldments fall into three general classifications; those in which it is mandatory that the welded design conform substantially in all physical dimensions to the structures it replaces; secondly those which, due to the necessity of replacement, interchangeability or other functional reasons, permit redesign only to a limited extent, and finally those whose final form is limited only by their functional duties and load conditions, thus permitting the designer ample latitude.

It is obvious that weldments falling into the first category, where it is necessary to closely adhere to fixed dimensions and physical appearances, offer the least chance for welding to show any advantages over other types of construction, especially if the parts are light, small or simple in design and where cost is the principal consideration. As a matter of fact, no first class weldery, with its large investment in special equipment, operated by skilled and highly paid personnel would attempt to compete with any hope of success on a basis of price alone against simple cast or forged parts. There are places where quick replacements may be required in an emergency; or where only a few parts are to be made and consequently the cost of patterns or dies are unjustified, and other such special cases where weldments are indicated; but such cases are the exception.

There are numerous instances, nevertheless, where a given part can be duplicated to advantage by welding. This is particularly true if the structure is so involved that it presents production difficulties. Such a unit is shown in Fig. 1, which is an all-welded steel throttle header for use in a steam locomotive. This unit is more involved than is usually required of a weldery and Fig. 4 illustrates diagrammatically the elaborate internal construction and sequence of assembly necessary, but which permits comparatively easy fabrication. The completed unit was subjected to 1000 pounds hydrostatic test pressure.

Most weldments being made at present fall into the second classification, where for obvious reasons, certain dimensional boundaries must remain fixed; such as finished surfaces, bearings and bolt holes. Even under such restrictions, permitting only limited redesign, weldments frequently can be made to pay handsome dividends. Webs can be reduced considerably in cross-section braces and stiffeners can be made from standard rolled sections and ribs, pads and other extraneous appurtenances can be simplified or entirely eliminated.

An example of what can be accomplished by limited redesign is illustrated by the bed plate for a 38-foot mill roll lathe, Fig. 3. The machined surfaces and foundation bolt holes are identical to those of the previous design, but the rails and cross braces are made from standard wide flange beams. Cost of the welded construction was 60 per cent of the duplicated design, even though its weight of 46,000 pounds was only 4 per cent less. This saving in cost was due to the large reduction in flame cutting and welding offered by the accepted design.

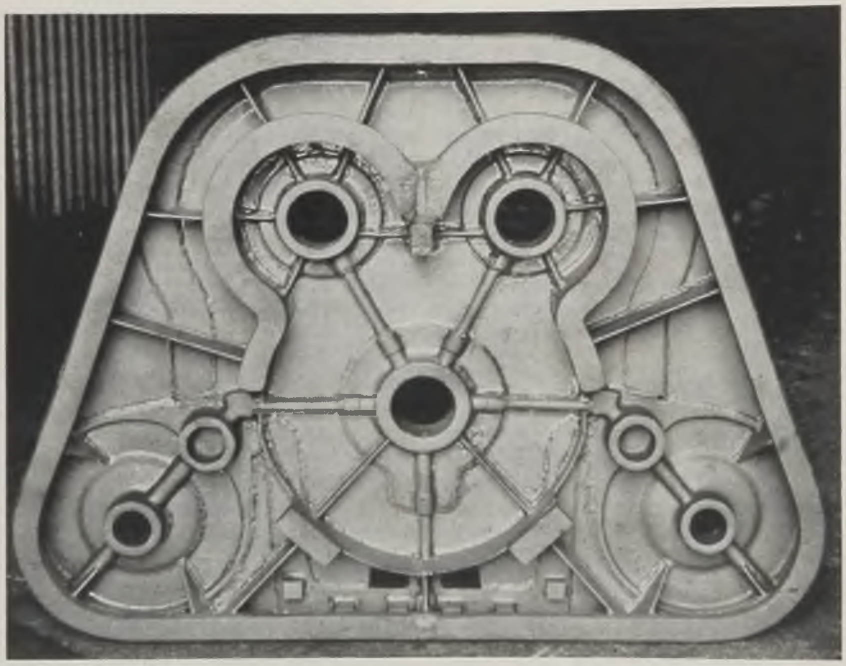


Fig. 6—Combination of castings and plate sections were used in building this diesel engine blower drive housing

The 150-ton hydraulic open side press frame, Fig. 2, illustrates the simple and economical construction possible with weldments classed in the last category, namely those which are designed especially for welding and in which full benefit may be taken of the inherent advantages of this type of construction. The 2½-inch thick side plates take almost the entire load of the press. These were flame cut from hot rolled plate and were then ready for assembly. The only other stressed members are the vertical web plate at the throat of the press and the two cross plates which stiffen the frame and transmit the load from the table (not shown) to the frame. This design places a relatively low stress at the joints between the members, and thus the largest required weld is a ½-inch fillet, while most of the stiffeners (three of which are hidden in the picture) and base plates are attached with only ⅜-inch fillets.

Weight and Space Important Factors

When, as is frequently the case, weight and space saving become factors of major importance, welded design shows up to its best advantage. This is illustrated by the water jacketed exhaust manifold, Fig. 5. This unit, for a 10-cylinder diesel engine, is 11 feet long, with an internal cross-sectional area of 67 square inches. It weighs only 585 pounds rough, and the main portion of the manifold can be passed through an 11 x 9¾-inch rectangle. The unit is fabricated principally from ⅛-inch steel sheet, although maximum flange thickness reaches 1⅛ inches. Extremely close tolerances are maintained and it is tested at 100 pounds hydrostatic pressure. A cast manifold for identical service would weigh at least twice as much and would occupy at least a third more space.

An example of the possibilities of the intelligent and effective use of castings in combination with weldments is illustrated in Fig. 6, which is a diesel engine blower drive housing. The five bearings are steel castings welded to an assembly of mild steel elements. Such possibilities of combining two or more different metals or alloys with mild steel to meet special requirements surely offers a challenge to the imagination of machine builders and to the ingenuity of weldment designers.

There is perhaps a tendency to place too much emphasis on the question of residual stresses in weldments. However, such stresses are fundamentally no different from those encountered in the making of forgings and castings, which

How Good Is Your Score On These Questions?

Test your knowledge of tool steel selection and heat treating

The questions listed below come up frequently in every tool room. The right answer makes possible longer tool life, fewer shut downs for regrinding and greater safety in hardening. The wrong answer costs money through short tool life, production shut downs and greater tool costs.

See if you can select the right answers. Pick the correct one (A, B or C) and check your answers against the list printed in the box at the bottom of the page.

1 **—You should use a *tough-timbre* water-hardening high carbon tool steel**

- ☐ A—For dies with intricate shapes and thin sections
- ☐ B—For a wider margin of safety in hardening
- ☐ C—For tools that require red-hard properties

2 **—When straight carbon tool steel is not tough enough for a job requiring maximum hardness**

- ☐ A—You draw it below C-60/61 Rockwell
- ☐ B—You go to a high speed steel
- ☐ C—You use a .50% carbon silicon-molybdenum water-hardening steel (Carpenter Solar)

3 **—The most useful characteristic of an oil-hardening tool steel is**

- ☐ A—It hardens with a hard case and a tough core
- ☐ B—Safety in hardening and freedom from size change
- ☐ C—Furnace atmosphere does not affect surface hardness

4 **—To increase the toughness of high speed cutting tools**

- ☐ A—Draw at 900°F. for 8 hours
- ☐ B—Quenching in oil instead of cooling in air
- ☐ C—Draw at 1050°/1100° F. for two hours

5 **—The ability to produce a fine grained case and tough core over a wide range of hardening temperatures is an indication of**

- ☐ A—The analysis of the steel
- ☐ B—A low drawing temperature
- ☐ C—Tough-timbre quality tool steel

6 **—Hot acid disc inspected tool steel is insurance against**

- ☐ A—Freedom from decarburization in heat treatment
- ☐ B—Minimum of internal defects
- ☐ C—Excessive size change in hardening

7 **—In order to get maximum wear resistance in a water-hardening tool steel you use**

- ☐ A—A high carbon-tungsten steel (Carpenter K-W)
- ☐ B—You heat treat from a lower hardening temperature
- ☐ C—You quench with fresh water

8 **—To help prevent cracking or splitting of hot forging tools**

- ☐ A—Use a lower forging temperature
- ☐ B—Water cool the dies during operation
- ☐ C—Always preheat tools before putting in service

Did you score 100%? Getting the right answers to your tool steel problems is considerably easier when you use the Carpenter Matched Set Method. In addition to simplifying the selection of the right steel for any type of tool—complete and detailed heat treating instructions are supplied by Carpenter to assure best results. Full information to answer these and other tool steel questions is given in the Carpenter Matched Tool Steel Manual. (Free to tool steel users in the U. S. A.) A request on your company letterhead stating position or title will start your copy on its way.

CORRECT ANSWERS

1.	B
2.	C
3.	B
4.	A
5.	C
6.	B
7.	A
8.	C

Carpenter
MATCHED TOOL STEELS

The Carpenter Steel Co., 139 W. Bern St., Reading, Pa.

retain stresses set up during their cooling period. Metal deposited by welding reacts as a cast metal and, contracting as it cools, its shrinkage is volumetric and in all directions. Then, since the weld and parent metal are fused together, the drawing of the cooling deposited weld leaves residual stresses in the structure after cooling is complete. The unequal cooling of the metal adjacent to the weld, which had been heated to a variable and uncontrollable degree during the welding process, also sets up residual stresses.

The nature and magnitude of the stresses occasioned by the cooling of both the weld metal and the heat affected zone is naturally influenced by the physical shape of the weldment and its resistance to subsequent distortion. Proper welding technique and procedure, as well as correct welding sequence and rate of application, will do much to reduce residual stresses, but it must be recognized that the required construction method of most weldments does not allow much latitude in fabrication procedure.

Such unavoidable residual stresses are not necessarily serious, but they must be considered in the light of the ultimate service for which the weldment is intended. Fortunately, the elimination of such stresses is a simple and economical matter and if there is any question of doubt as to their undesirability, they should be removed. When, in service loads are suddenly applied or are of unknown and variable intensity, or when subject to considerable vibration, it is quite possible that the combined residual and load stresses may approach the yield point, and hence become of serious moment. Also, since most weldments are subject to subsequent machining operations, the removal of metal in stressed areas is apt to make for a redistribution of stress and hence lead to ultimate distortion of the machined part.

Price Important Single Factor

It has been the accepted practice for years to relieve residual stresses by some form of heat treatment. Residual stresses in weldments are almost completely eliminated by stress relieving, which is defined by the American Welding Society as "the uniform heating of a structure or portion thereof, to a sufficient temperature below the critical range, to relieve the major portion of the residual stresses, followed by uniform cooling." In a properly designed furnace, with which all first class welderies are equipped, such an operation is routine. Structures as large as 15 x 15 feet and 80 feet long can be treated in specially designed furnaces.

Of all the components that enter into the problem of whether or not weldments are the final answer in a given situation, unquestionably price is the most important single factor. And, in a majority of instances, it is an element that cannot either be minimized or neglected. But when comparing costs, in all fairness to weldments, it should be on the basis of finished parts and not on the initial cost. Most weldments are delivered by the supplier in the rough form and require further machining. Weldments can be held to very close tolerances and thus machining allowances can be greatly reduced. The smooth, clean rolled surfaces of the plate or structural section stock used are excellent for finishing. Furthermore, when properly stress relieved, there is no fear that residual stresses will cause deformation after machining.

Even in some cases where costs might be slightly higher, weldments offer certain advantages that frequently more than justify their use. Ship construction, where weight and space saving are vital factors, is a typical example. The manifold, Fig. 5, previously described, is a case in point. The requirements of many modern gun mountings present such problems in combining light weight with unusual functional requirements that only welded construction has been able successfully to meet them. Steel plate construction is especially adaptable where high stresses are encountered, in such services as flywheels, since stronger units in ratio to weight are obtained and higher speeds are permitted. Peripheral speeds as high as 14,000 feet per minute have been reported. Other examples are innumerable.

It cannot help but be obvious that if all the advantages, and at the same time the maximum economy obtainable, be realized with welded construction that it is essential the welding engineer be given not only all functional and operational data but he be allowed the freedom in the execution of his design. In this lies the greatest potential field for the future value of welded construction to industry as a whole. All too [illegible] prospective weldment user submits drawings of a casting and expects the weldery to duplicate it, section for section, rib for rib, all with full penetration welds; and at the same time expects to gain all of the advantages, including price saving, claimed for welded construction.

One of the most productive sources of saving in costs of weldments, if the designing engineer is made fully cognizant of all limiting factors, is in the elimination of unnecessary welding; and the use of bent or formed sections frequently permit considerable saving in this direction. Necessary welds should be located along lines of low stress insofar as is possible, and in such cases need only be a fraction of the thickness of the members connected. Inasmuch as the cost of a weld is roughly proportional to its cross-sectional area, and which is in turn proportional to the square of the strength of the weld, it can be seen that reduction in deposited weld metal produces substantial economy. Excess weld deposition is not only wasted but often weakens a joint instead of strengthening it. It has been demonstrated by polarized light examination of plastic models that excessive crown on a weld tends to concentrate stresses and reduces the overall strength of the joint. Cost of excessive weld is increased not in direct ratio to its lineal dimensions but by at least the square of its size, depending on the type of joint involved.

Enough Weld for the Load

Frequently weldments, such as mill table beams, press frames and kindred machines, incorporate compression members of considerable thickness in order to obtain elastic stability. If the span is large the compressive loads may be quite small and therefore seemingly disproportionately small welds are ample. For instance, in a mill table beam with webs an inch or more in thickness and with base plates somewhat thicker, ¼-inch fillet welds on both sides for welding the beam to the base plate are usually sufficient. At first glance such welds seem all out of proportion, but actually their combined transverse strength of about 4000 pounds per lineal inch is far beyond any load it is necessary to carry.

Obviously the intelligent thing to do in weldment design is to provide only enough deposition to accommodate the loads and forces in determinate joints and to develop the members connected in indeterminate joints. Members that are designed for stability or bending require welds considerably smaller than proportion would seem to indicate. This point is frequently overlooked by those who are unduly influenced by appearances alone.

The potential value of welded construction reaches deeper than even the redesign of individual members or the component parts of the complete assembly to suit such type of construction. Merely because two parts had been

(*Please turn to Page 139*)

Speed Nut Approved By Army Air Forces

The Army Air Forces has approved a new Hi-Stress speed nut conforming to AAF specification No. 25531 which was developed by Tinnerman Products Inc., 2039 Fulton road, Cleveland 13. This nut, lighter in weight, is a one-piece integral unit

with an unusually low installation torque that allows speedy insertion of screws and bolts. It is interchangeable with nut plate AN362, for high temperature applications in all structures. Even after many removals under service conditions it retains its self-locking torque. It is identified by No. A6103H-1032.

A METALLOGRAPHIC QUALITY TEST

...for Malleable Iron

Photomicrographic standards are used to evaluate malleable iron in terms of amounts of primary graphite, primary cementite and pearlite present. Some possibilities of nondestructive microsampling by means of a core drill are described

By H. W. LOWNIE
And
C. T. EAKIN
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

THERE HAS been a marked tendency during recent months toward the use of malleable iron castings for increasingly exacting applications where strength, ductility, shock resistance and dependability are of prime importance. Combined with this there has been a trend in some industrial fields toward the use of malleable iron in castings of large and relatively heavy sections. Castings for such specialized applications naturally require more positive assurance that the critically stressed sections will withstand the service than do castings intended for the more normal applications. In addition to the methods normally employed in determining the quality of the metal, microexamination is suggested as a means for making this assurance more complete.

"Malleable iron" as used here refers to completely annealed white iron free from primary graphite, pearlite and primary cementite and conforming to ASTM Specification A-47-33, Grade 35018. There are, of course, other types of malleable iron such as "alloy malleable" and "pearlitic malleable" which are definitely useful.

From a report to American Foundrymen's Association.

Factors Affecting Quality: The quality of malleable iron is adversely affected by the presence of one or more of the microconstituents — primary graphite, pearlite, and primary cementite.

Primary graphite consists of flake graphite which forms during solidification of the metal. This constituent is most likely to be found in heavy sections, as the cooling rates of such sections allow more time for its formation. These flakes reduce the effective section and thus have a deleterious effect upon the strength, ductility, and shock resistance of the metal. Once it has formed, primary graphite can not be eliminated from the castings.

Pearlite normally is the result of failure of the iron to respond completely to the annealing treatment. It is harder and less ductile than the normal ferritic structure and, consequently, impairs ductility, shock resistance and machinability.

Undecomposed primary cementite, also

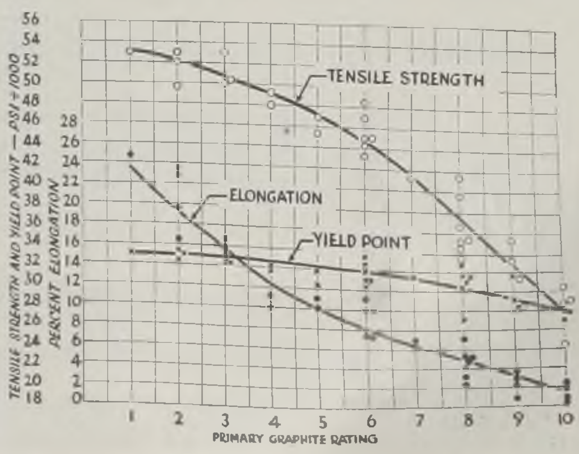


Fig. 1 (Left)—Effect of primary graphite on tensile properties of some heavy section malleable iron castings

Fig. 2 (Extreme left) Photomicrographic chart rating malleable iron containing primary graphite. Dark field illumination. White network structures represent primary graphite. Unetched; 8 diameters

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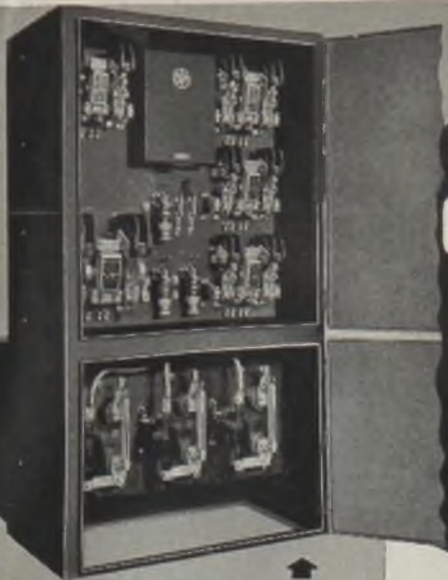

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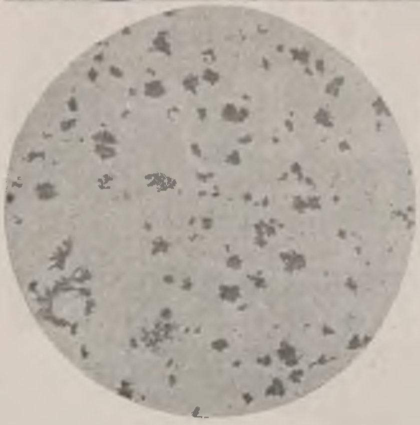
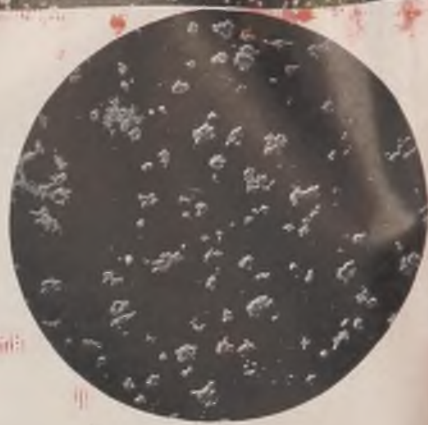



Fig. 3—Rectangular strips (A) illustrate structure shown in rating 3, Fig. 2 under both bright and dark field illumination at 8 diameters. Circles (B) show areas enclosed in strips, at 25 diameters

the result of unsuccessful annealing, is an extremely hard constituent. Its chief effect is to dull the cutting tool and, to some extent, reduce the ductility and shock resistance of the iron. In general, assuming correct composition and practice, both pearlite and primary cementite can be eliminated by reannealing.

Effect of Primary Graphite: In the microexamination of malleable iron castings for primary graphite it is found, as might be expected, that this constituent may be present in amounts varying from none to that of a typical gray iron structure. The problem of determining the seriousness of the presence of small amounts of primary graphite and other microconstituents in malleable iron led to the development of the micrographic test method about to be described.

Examination of the microstructure of tensile test specimens cut from a number of castings (of approximately 1-inch section thickness) containing primary graphite has verified that the amount and distribution of this constituent is closely related to both the strength and ductility of the metal. This effect is illustrated in Fig. 1 in which tensile properties are compared with rating numbers indicating varying amounts of primary graphite. The rating numbers refer to corresponding photomicrographs in the series shown in Fig. 2.

Photomicrographic Standards: The results of the foregoing work suggested that photomicrographs of the structures of malleable irons containing primary graphite arranged in the order of increasing amounts, may be used as standards for rating other irons. Fig. 2, showing such a series, was developed as the result of the correlation of primary graphite with tensile properties of a considerable number of castings. These photomicrographs are shown in oblique illumination (dark field) at a magnification of 8 diameters for ease of direct comparison with the specimen.

The photomicrographs in Fig. 3A illustrate the relative appearance of the specimen shown in rating No. 3 of Fig. 2 under both bright and dark field illumination at 8 diameters. Fig. 3B illustrates a section of the area shown in Fig. 3A (indicated by the circle) in both bright and dark field illumination at a magnification of 25 diameters.

In addition to the determination of the primary graphite rating, the same specimen may be examined for the possible presence of primary cementite and rated by comparison with standard photomicrographs such as are illustrated in Fig. 6.

The amount of pearlite is conveniently expressed as a percentage of the specimen area as shown in Fig. 4. The polished face of this specimen is estimated to consist of 35 per cent pearlite. No attempt has been made to correlate the effect of different percentages of pearlite with the strength and ductility of the iron because it is felt that such a correlation more properly belongs in the field of pearlitic malleable and hence is beyond the scope of this work.

Evaluation of metals by means of photographic standards is by no means a new method. Notable examples of this method are the charts used by the steel industry for rating austenitic grain-size and for rating the inclusion content of steel, and by the gray iron industry for evaluating the microstructure of graphite in gray iron.

Sampling: In selecting the location in a casting from which the sample is to be taken, it is important to bear two factors in mind; (1) sections to be subjected to high stress and (2) relative solidification rates of the various sections of the casting. As indicated previously, primary graphite is most likely to be found in sections of slowest solidification rate. This generally is in the heaviest sections, but may be in a lighter section where the tendency for the formation of primary graphite has been intensified by prolonged solidification time due to adjacent heavy sections, proximity to gates, or by other factors.

Sampling for metallographic examination is greatly facilitated by the use of a small core drill such as is shown in Fig. 5. In most cases, the use of this type of drill permits sampling without impairing the casting for the intended

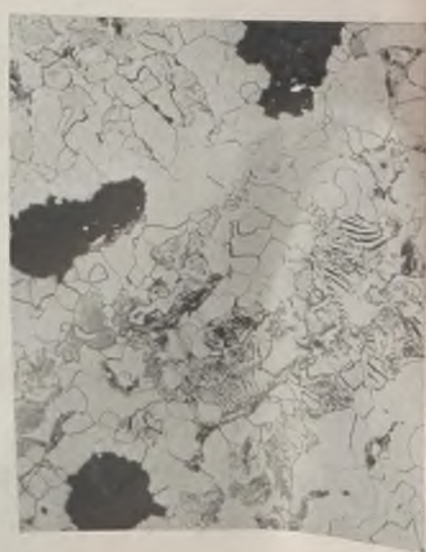


Fig. 4—Malleable iron with 35 per cent pearlite; 100 diameters; bright field illumination

TABLE I—TYPICAL LABORATORY REPORT FORM FOR METALLOGRAPHIC EXAMINATION OF MALLEABLE IRON CASTINGS

Sample	Micro No.	Primary Graphite Rating	Per Cent Pearlite	Cementite Rating	Remarks
11G	6529–1	2	0	A	
12G	–3	2	0	A	
13G	–3	2	3	A	Pearlite Layer
14G	–4	6	0	B	
15G	6530–5	1	0	A	
16G	–6	1	20	A	

Remember the old copy book axiom, "You can do a better job if you have the right tools"? Well, your machinery can do a better job, too, if properly equipped . . . properly equipped with the right motor . . . one that meets all the requirements of the job . . . "right on the nose".

For example look at the Master motor drive on the right below. By incorporating a motor, an electric brake, a mechanical variable speed unit, and a gear reduction . . . all designed and built into one compact integral power drive . . . it provides variable speed, at exactly the right range, and in addition can be quickly stopped and started again for increased production.

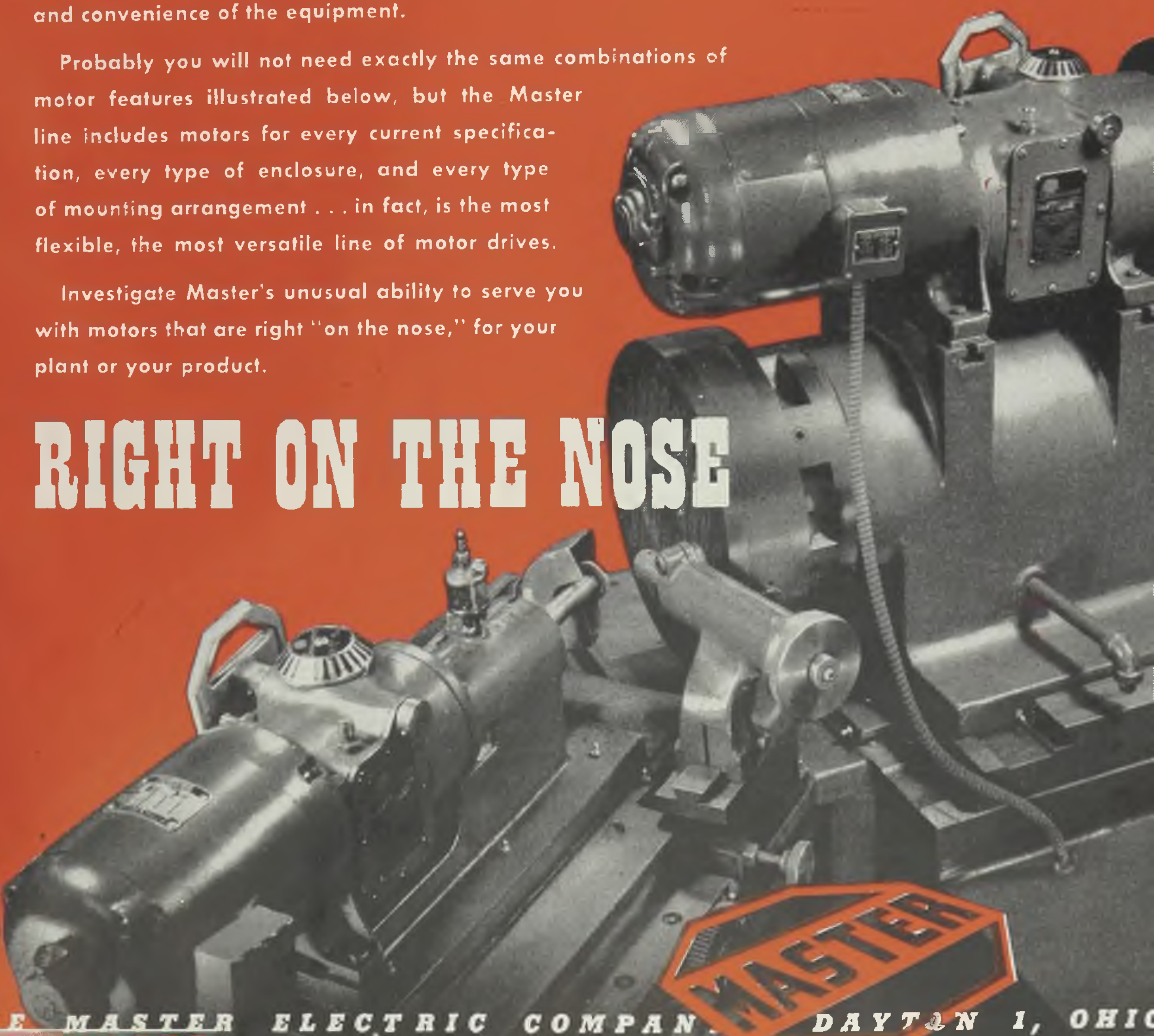
The other unit consists of a motor and a mechanical variable speed drive which are easily combined into an integral unit that gives smooth stepless variable speeds from 600 to 5000 RPM.

Each motor drive mounts neatly on the machine, saves space, saves money and greatly improves the output, safety, appearance and convenience of the equipment.

Probably you will not need exactly the same combinations of motor features illustrated below, but the Master line includes motors for every current specification, every type of enclosure, and every type of mounting arrangement . . . in fact, is the most flexible, the most versatile line of motor drives.

Investigate Master's unusual ability to serve you with motors that are right "on the nose," for your plant or your product.

RIGHT ON THE NOSE



MASTER

THE MASTER ELECTRIC COMPANY · DAYTON 1, OHIO service as a sample of convenient size can be drilled from a section that is lightly stressed or subsequently machined off but which is still representative of the highly stressed portions of the casting.

The size of the core-drilled sample for microexamination may vary considerably. A diameter of 3/16-inch is quite satisfactory. Its length should be governed by the thickness of the casting. The drilling should extend through at least two-thirds of the casting thickness and preferably entirely through.

Laboratory Procedure: The core-drilled samples are conveniently mounted in plastic (Fig. 5) and polished metallographically. In the illustrated mounting, four samples are mounted side by side. The unetched polished specimen is examined for primary graphite by means of binocular microscope at a magnification of 8 diameters. This permits

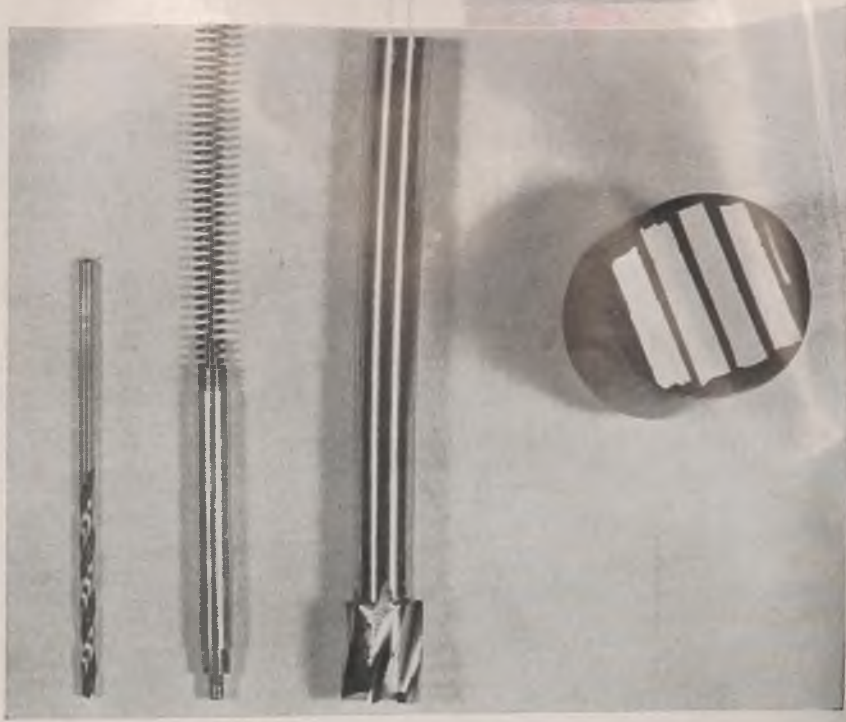


Fig. 5 (Above)—Core drill assembly and typical samples mounted in plastic for metallurgical examination under microscope

Fig. 6 (Left)—Photomicrographic chart for rating malleable iron containing primary cementite, shown as white angular structures. Light nital etch; at 100 diameters; light field illumination. Rating A—no primary cementite; B—small amount; C—considerable amount; D—large amount of primary cementite

a full view of the polished face of the specimen and facilitates its direct comparison with the standard at the same magnification. At times, a higher magnification may be desirable for a more detailed study of certain structures.

After determination of the primary graphite rating, the specimen may be lightly etched in nital and examined at 100 diameters for detection of the possible presence of undecomposed primary cementite. This constituent may be rated by comparison with the amounts shown in Fig. 6 in a manner similar to that described for primary graphite except that the specimen is viewed by means of a metallographic instead of a binocular microscope.

The same specimen then may be given a somewhat deeper etch in nital and examined for the possible presence of pearlite and the iron rated in terms of percentage of pearlite in the polished face of the specimen. A magnification of 100 diameters usually is satisfactory for this operation.

Simultaneously with the determination of the above ratings, the presence of any other unusual conditions, such as a pearlitic layer, unusual size or distribution of graphite nodules, etc., should be noted.

After determination of the ratings as described, the results may be recorded in some such manner as shown in Table I. The data thus obtained may be used to augment the results of other tests in determining the suitability of the casting for the intended application.

It is not the intention of the authors to convey the impression that any considerable proportion of the malleable iron being produced contains the microconstituents mentioned above. The aim is rather to suggest a method by which their absence can be verified and, if present, provide a method by which some evaluation can be placed upon their effect upon the properties of the casting.

Crane Arm Attachment Handles Unwieldy Objects

Rigidhobbers and Rigidturners, manufactured by Cleveland Hobbing Machine Co., Cleveland, are being handled quickly and easily by a standard Towmotor fork lift truck equipped with a crane arm and hook attachment. The crane arm is adaptable for specialized lifting operations that require reaching over obstacles such as highway truck bodies, flat cars, stock piles and shop machines as well as moving materials which have little or no underclearance, such as engines, castings, die and other things commonly carried by chains, slings, chain hoists and cranes.

The crane arm attachment is quickly and easily interchanged with the standard forks of the lift truck. Suspended from the lifting carriage of the lift truck in the same manner as the forks, the entire crane arm attachment rides up and down with the lifting carriage. Lifting is accomplished by the regular mechanism of the lift truck, with the standard control at the operator's position.

Mass Production Techniques **are applied to** *Intricate Assemblies*

Martin reduces number of man-hours required for assembling 26-ton patrol bombers by 61.5 per cent in 18 months. Lessons may prove useful in making other types of large assemblies

By **WILLIAM H. HILMER**
Plant 1 Superintendent
The Glenn L. Martin Co.
Baltimore

BETWEEN October, 1942, and April, 1944, the number of man-hours needed to build a hull for the Martin PBM-3 Mariner, 26-ton Navy patrol bomber, was reduced 61.5 per cent. During the same period a 72 per cent saving has been effected in the number of operators needed, and a 69 per cent saving in the number of hull fixtures.

Behind these figures lies a story of adapting mass production techniques to the intricacies of flying boat construction, some of which might well be pertinent to manufacture of other types of large assemblies, now and in the future.

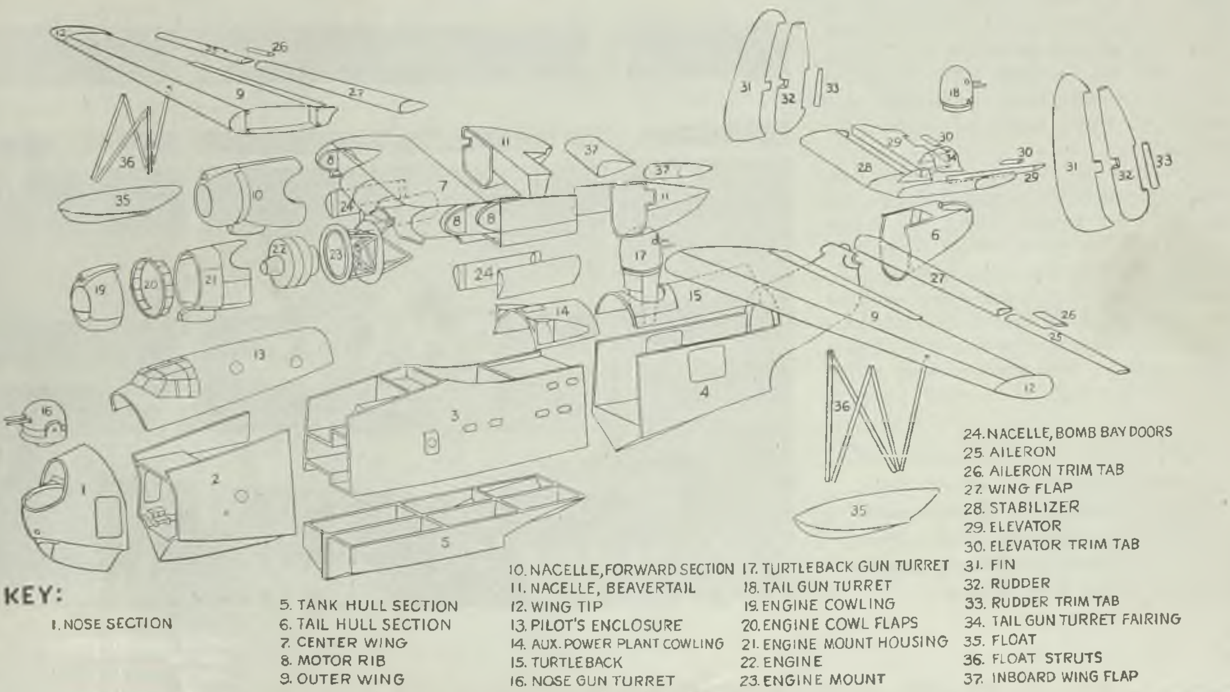
In October, 1942, having surmounted the initial hurdle of putting these large flying boats on a quantity production basis, the body division undertook a study of the entire hull fabrication problem and methods by which it could be improved. Since it was imperative that this study in no way interfere with current production, one hull fixture was set aside in which all suggestions, experiments and new ideas could be tried out in actual practice before they were introduced into the line. Temporary tools were built for use with this "special fixture" and in some cases small subassembly fixtures were assigned to the project.

For purposes of this study, the PBM hull was broken down into six major sections. These sections were, as shown in the accompanying exploded view of the Mariner: (1) nose; (2) forward hull; (3) center hull; (4) after hull; (5) tank hull, (6) tail. Each section was subjected to a searching analysis. Could it be broken down into more sub and sub-sub-assemblies? Could the tooling be im-

(Below)—Exploded drawing of Martin PBM-3 patrol bomber, with major hull sections indicated at Nos. 1 through 6

(Top left)—In making side panels as an assembly, locating holes are first drilled in the panels from skin templates. The panel then is sprayed through a spray template in preparation for riveting on an automatic piercer and riveter

(Top right)—After locating holes have been drilled and the template sprayed, the template is removed leaving the spray spots as shown here as a guide for the automatic riveting operation which follows



(Above left)—After sealing, the stringers are attached to the skin through the locating holes and the assembly is riveted on an automatic riveting machine using the spray spots as a guide. Overhead sling permits one man to do the job formerly done by two

(Above)—As part of the production breakdown, the aft hull bottom is made as a subassembly. Shown here, an operator is installing a bulkhead in this section. When completed, the section will be moved into the hull fixture and handled as a unit

proved? What were the major production obstacles? Could the job be simplified to permit the use of inexperienced operators? Could production be improved by design changes which would not affect the performance of the airplane? Could an operation be adapted to the use of power tools?

Everyone associated with the project was invited to offer suggestions, and many of the ideas which are today paying dividends were contributed by employes. Where design changes were involved, a close liaison was maintained with the engineering department. New tools and fixtures were supplied by tool design and toolroom departments and the entire project was co-ordinated by the industrial engineering unit.

Universal Riveting Used

On the nose section some minor tool changes were made and the number of subassemblies was increased to make the work more accessible. The most important single item was an engineering change from flush to universal riveting which eliminated the time-consuming dimpling and countersinking operations.

The forward hull section was a far more difficult proposition. Here there were many serious problems to be overcome, not the least of which was that of skinning the bottom, a long and tedious procedure. A new procedure was set up in which the stringers were predrilled for match holes and galvanized skin templates were made to match the stringers.

The skins and stringers then were held together with Cleco pins through the match holes located about 18 inches apart, and the skins drilled from pilot holes in the stringer. After drilling, skins and stringers were disassembled, and the stringers and bulkheads assembled on a trunnion fixture and permanently bolted into position. The skins, already sealed for waterproofing, then were replaced on the stringers, picking up the match drilled holes, and were ready for riveting. Thanks to the flexibility of the trunnion fixture, riveting of the V-bottom, formerly awkward and difficult, became a relatively simple procedure.

The operation was simplified further by including stops and locators on the trunnion fixture from which the chines and keels could be located easily, saving much of the time formerly needed to install these items in the main assembly fixture. Further time was saved by introducing several power tools. These included power shears for trimming skins, power wrenches with a special universal joint socket for the many bolts used to attach stringers to bulkheads, and power crimpers for use on long sheets which had previously required two men.

After these improvements were made, a peculiar problem arose. Due to the size of these assemblies, it was almost impossible to hold them to the minute tolerances required between the various sections. This was overcome by devising inserts which were installed between the assembled sections. These are small pieces of keel or chine extrusion slightly over an inch long drilled with eight holes. After the assemblies are installed in the main hull fixture, the inserts are butted to the forward and aft chine or keel, drilled and riveted to the corresponding splice.

Problems of a different nature were presented by another subassembly—the pilot house crown. Here the skins and frames were not fairing, causing buckles and much rework. This condition was remedied by inserting another set of contour boards spaced between the sets on

Skin panel for the forward hull bottom is riveted on an automatic riveter. Previously, all such work had to be done by hand. Note sling to enable one man to handle the large section

Outside strip template is used to drill the skins of the waist gunner's hatch in the aft hull section. After drilling, the skin is removed for sealing before the assembly is permanently riveted

the original fixture. Further difficulty was experienced in assembling the longeron and crown. This was overcome by combining the two assemblies, formerly built separately and spliced together, and prepositioning clips, previously assembled by hand, and bolting or riveting them to the longeron.

The pilot house cab, consisting of well over a hundred individual pieces, was obviously far too complicated and intricate a job for new and inexperienced employes. This riveted assembly was finally replaced by an all-welded structure in which simplicity prevailed.

While side skin panels presented a problem similar to that of the bottom skins, a different solution was applied. Only the frames were made with location holes and the skins were left blank. A template then was designated for each different skin, laid out with bushings in the locating holes and the rest drilled for spraying. Locating holes then were drilled in the skins, and other holes indicated by spraying. The frames were sealed, positioned and "Clecoed" to the skin, and the panel assembly sent to an automatic piercing and riveting machine where it was a simple matter to rivet the complete panel using the spray spots as a guide. More time was saved by this single operation than any other in the hull assembly. Using the machine, one man could do twice as much work as was formerly done by four men, two drilling and two riveting.

After the panels are completely assembled and riveted under this procedure, they are carried to the main hull fixtures and installed as a single unit. In some cases it has been found necessary to increase the size of the rivet diameter to permit use of the automatic machines, but the engineering change proved slight and fully warranted by the production hours saved.

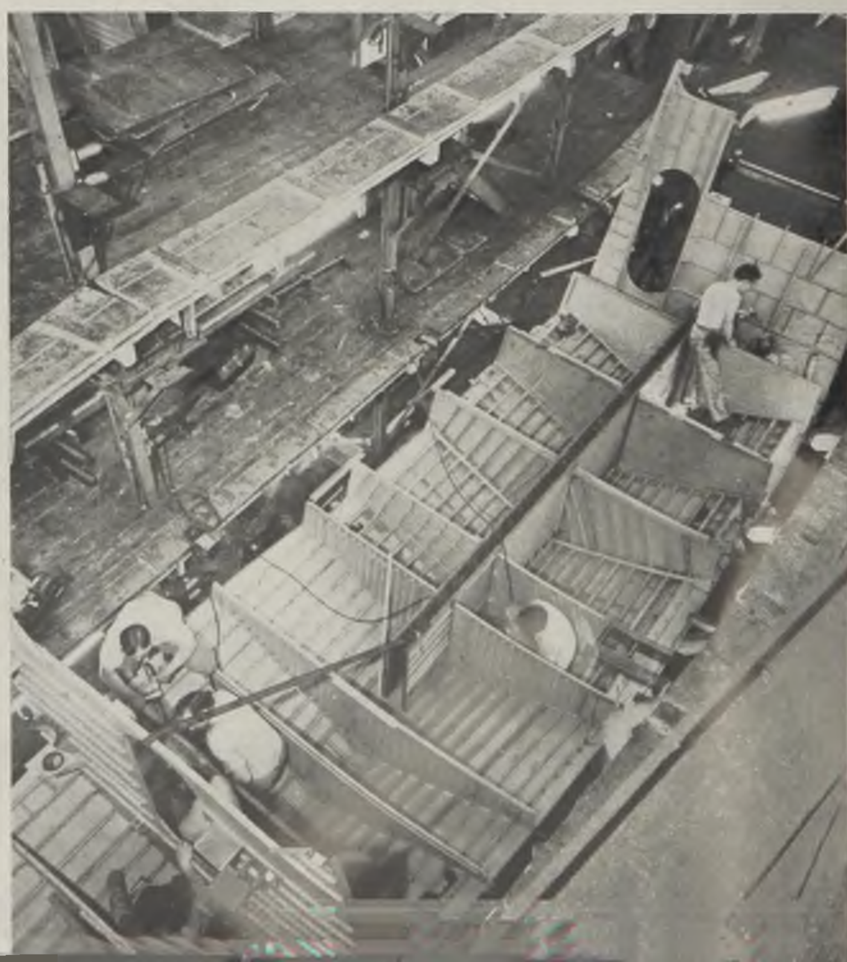
Several new problems were uncovered and overcome; while many of the improvements already described were likewise applied to this section. One of the innovations was the use of strip templates. Here the stringers were set-up with location holes about 24 inches apart, and all other holes entirely omitted. Skins were located on the stringers, and the stringer locating holes drilled through the skins.

Then the templates, consisting of a strip of ¼-inch band iron 1 inch wide, with the complete hole layout including the locating points drilled into it so that an automatic drill bushing could be used, was fastened to the skin and stringers with a special Cleco pin. Previously when the skins were drilled from predrilled holes in the stringers, two men were required, one to drill from the inside and another to buck the skin with a piece of wood from the outside. With the new method the bucker has been eliminated since the stringer is sturdy enough to make this operation unnecessary.

Another improvement was the introduction of match drilling for drilling the frame to the keelson. While this helped simplify a tedious job requiring considerable skill, it raised another problem, namely that of reaming the undersize drill holes. In order to maintain a close tolerance for the bolts after reaming, these holes had to be drilled undersize. The reaming difficulty was overcome by developing a new type reamer chuck so that the tool could be drawn through the hole rather than pushed, allowing the shank of the reamer to act as a pilot for the flutes, and insuring a true, accurate and even hole.

Still another delay in this section was occasioned by the tank installation. Under the original procedure, once the tank was completed, it was transported by crane to the empty hull fixture and set into position. A bulkhead then was installed at either end of the tank, and the positioning of the forward and after hull sections was delayed until these bulkheads were installed, drilled and riveted. A whole day of fixture time thus was lost. This was eliminated by installing the bulkheads before the tank was positioned, a procedure which proved completely satisfactory when tested.

Buckles and oil cans in the auxiliary power plant crown skins were another source of trouble. The cause was traced to the unique contours of these skins and the large skins that were being used. By reducing the size of the individual skins



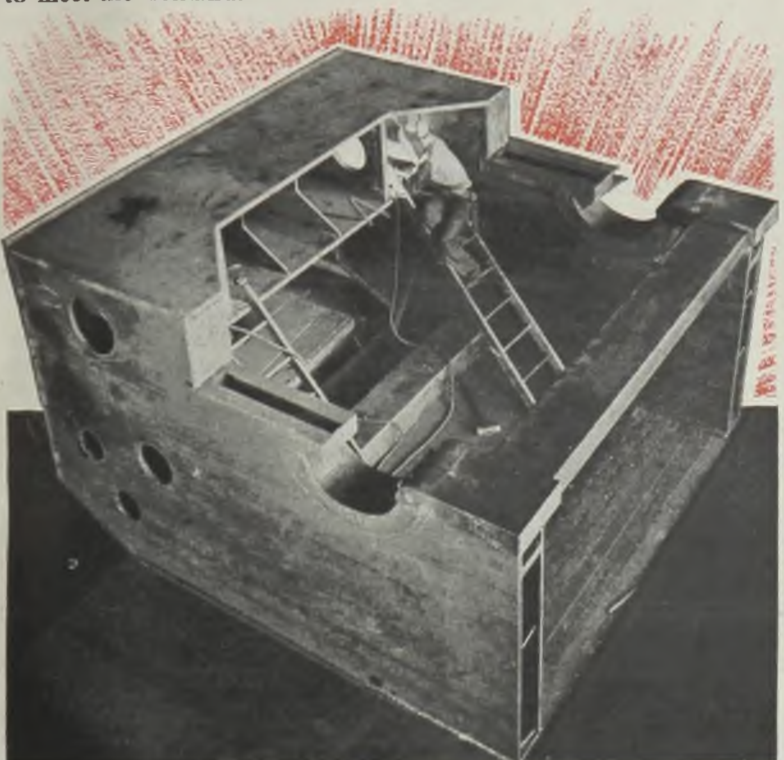
The entire section between the two end bulkheads in this view is made as a subassembly. The bulkheads are installed to the section on the floor before it is placed in the fixture. This permits the forward and aft sections to be installed in the fixture immediately following the placing of this section. Prior to the installation of the bulkheads on the floor, much time was lost awaiting the installation in the fixture

ARC WELDING HIGHLIGHTS

THE POSTWAR WORLD is going to see the production of many new, high-strength alloy steels. This means new arc welding electrodes to meet the new metallurgical requirements.

As in the past, Metal & Thermit intends to be ready and whenever one of these new rods is required, there will be a Murex Electrode to meet the demand.

THIS COUPLING SHAFT, used by Caterpillar Tractor Co. in a running-in stand for testing Diesel engines, is subject to extreme tension and torsional stresses. In case of breakage, it is repaired with Murex Electrodes because of the high tensile strength and excellent physical properties of the weld metal.



HUGE BENDING PRESSES, manufactured by The Cleveland Crane and Engineering Company, have bending capacities up to 220 tons. All-welded frames, fabricated with Murex Electrodes, have greater strength and rigidity for weight of metal used than is possible by any other method. A feature of the design is that distortions and strains are not concentrated but are absorbed by frame as a whole.

CRAWLER FRAMES of high speed tractors are welded with Murex Genex Electrodes by International Harvester Company. Positioning enables the frames to be tilted to the most advantageous angle for each operation.

WHEN WORK cannot be positioned and where welds of good quality must be made overhead, specify Murex Vertex Electrodes. A combination gas and slag shielded rod, Vertex induces flat or slightly convex fillets. Uses D.C., reverse polarity.

Send for your copy of the new Murex Wall Chart, a guide to the right electrode to use for the job. Also contains application data and physical properties.

MUREX

ARC WELDING ELECTRODES

•

METAL & THERMIT CORPORATION

120 Broadway, New York 5, N. Y.

ALBANY · CHICAGO · PITTSBURGH
SOUTH SAN FRANCISCO · TORONTO

Specialists in welding for nearly forty years. Manufacturers of Murex Electrodes for arc welding, and of Thermit for repair and fabrication of heavy parts.

Trunnion fixture is used to p- assembly of the forward V-bottom as a subassembly. Shown here, the bottom skins are being attached after sealing. When this work was done in the main fixture, operators had to work in cramped quarters and awkward positions

to about one half of those previously used this obstacle was readily overcome.

On the after hull section, the bottom was worked under a similar procedure to that used with the forward hull bottom, but a new method of construction was devised for the turtle back turret ring. This involved the designing of a new tool and use of a machine riveter and resulted in cutting the time for this particular job in half.

A further improvement on the same assembly resulted from the use of match drilled frames and stringers permitting the parts to be aligned by means of the drilled holes without need for a large and complicated assembly fixture. The crown and longeron assemblies on this part were combined the same way previously described for the pilot house.

Skin panels for the after hull were handled similarly to those of the forward and center hull sections with the exception of the waist gun hatch. This is a complicated structure and required a lot of work on a small area in a congested section. The situation was remedied by constructing a special tool and building the panels as a subassembly. This brought up an interesting feature of the subassembly method in that when it was found one tool could not supply the fixtures, it was simple to build another tool and so balance production.

In the tail section as in the nose section, the changes made were minor and consisted in the main of revising the breakdown and distributing the work more evenly. This can be largely accounted for by the fact that these assemblies were already small by comparison and did not need breaking down into sub and sub-subassemblies as in the case of larger hull sections.

Before the PBM hull study was undertaken, many aircraft engineers were inclined to believe that mass production techniques just were not applicable to a product like the PBM hull. At the time they were suggested, many of the methods now being used were almost dismissed as unworkable. Fortunately they were not dismissed, but were given a fair trial in the fixture set aside for that purpose. Today the wisdom of that procedure has been fully justified. The figures speak for themselves—a 61.5 per cent reduction in man-hours, a 72 per cent reduction in number of operators, a 69 per cent reduction in number of hull fixtures.

Army Refrigerator Tests Equipment for Arctic Use

To test the ability of Air Forces equipment to take the punishment of arctic weather, the Equipment Laboratory of the Engineering Division research engineers is using a refrigerator which is large enough to put an entire fuel servicing truck "on ice".

The refrigeration equipment was built by York Corp. after having been designed by its engineers in collaboration with Materiel Command Aircraft Laboratory engineers. The 80-foot long cold chamber is capable of operating at temperatures lower than 70 degrees Fahr. below zero. In it the Army gives a "pre-induction" to all types and descriptions of Army Air Forces equipment. One of the chief uses for the low-temperature tests is to determine the starting and running efficiency of internal combustion equipment in sub-zero climates.

The refrigerator, 25 feet high and 25 feet wide, is divided into two compartments so that separate tests can be carried on simultaneously at different temperatures. Its 16-inch thick double doors weigh 4½ tons. Cooling equipment for the cold room is located in the ceiling where 60,000 cubic feet of chilled air is circulated each minute during the temperature pull-down period. Observation windows contain eight thicknesses of glass to prevent frosting which would obscure vision.

At 70 degrees Fahr. below zero, workmen in the room must wear helmets to prevent sudden freezing of the nasal and throat passages as well as lung tissues.

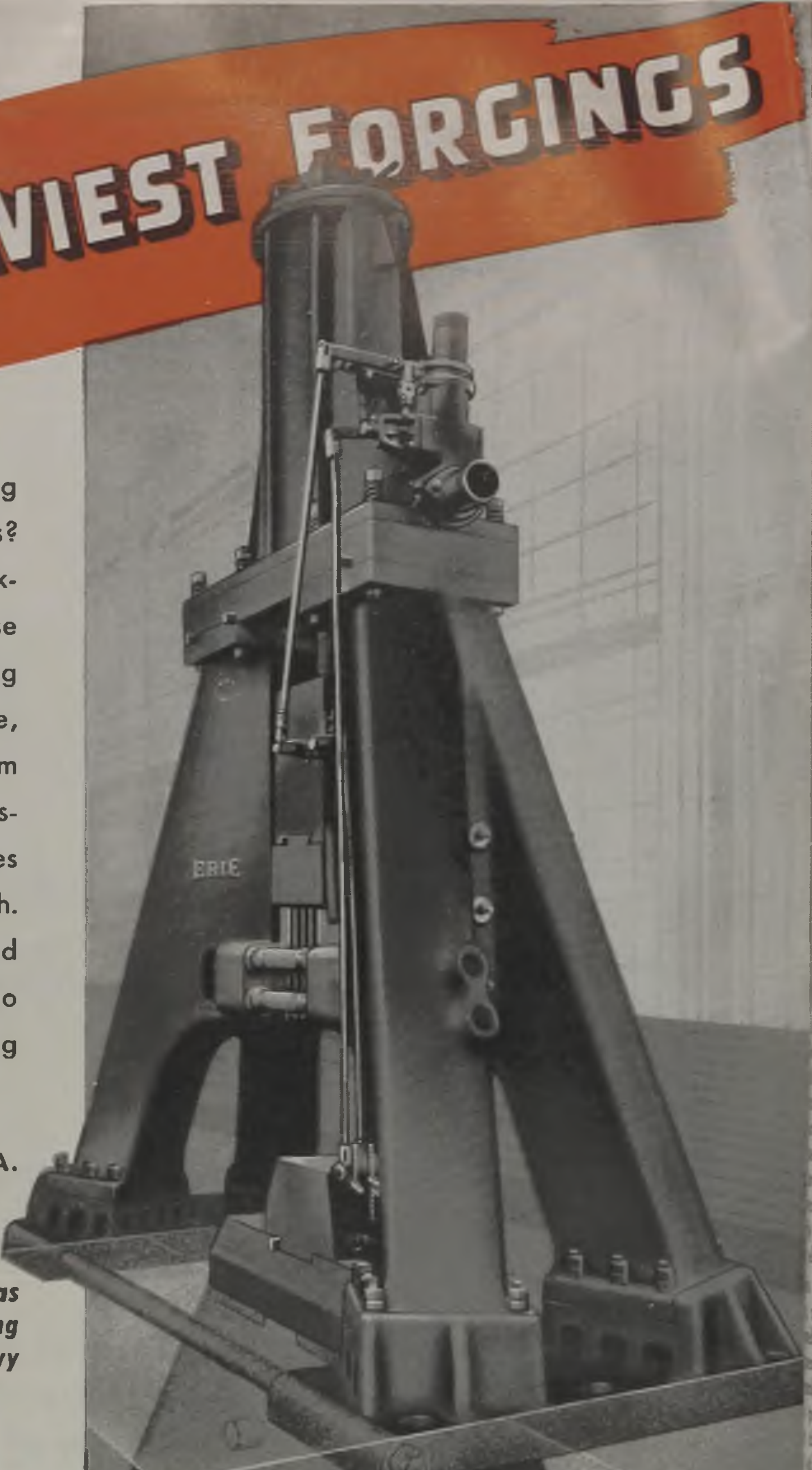
Spectroscopy for Use in Laboratory Experiments

Experimental Spectroscopy, by Ralph A. Sawyer; cloth, 323 pages, 6 x 9 inches; published by Prentice-Hall Inc., 70 Fifth avenue, New York, for $5.

Discussion of prism and grating spectrographs and techniques of their use in research is the aim of this work. It is designed for students and those in research laboratories who wish to make use of spectroscopic procedures. For this reason extensive mathematical treatments have been avoided and a background of general physics and some physical optics is deemed sufficient for understanding the presentation.

Primary emphasis has been placed on principles and techniques fundamental to practically all uses of spectroscopic equipment. These include general principles of spectroscopic apparatus, theory and use of prisms and gratings, photographic procedures, wavelength and intensity determination, which are discussed in extensive practical detail. Some related topics and special applications have been discussed more lightly.

Other more specialized topics have been omitted because of thorough coverage in recent texts, including absorption spectrophotometry, the Raman, Stark and Zeeman effects. Reference is made to original sources and chapter bibliographies have been given of some of the more useful and accessible works.



ERIE

Salt Bath Furnaces

(*Continued from Page 89*)

if on a large enough scale, would definitely spoil the tool. This happens in a muffle furnace or salt bath when the tool comes in contact with carbon or carbonaceous materials. When the steel absorbs carbon, its melting point gradually decreases so that it is lowered below the temperature at which the steel is heat treated, finally causing fusion and flow of the metal.

Grain Growth: This usually is caused by the prolonged heating at high temperature. The tools, if heated longer than necessary (beyond the time needed), the extra time given would cause the grains to grow larger. If this condition is allowed to go too far, the tool becomes coarse grained with a fracture that is dull and almost like a refined cast iron. A tool in this condition is not ordinarily efficient, is subject to premature chipping, breakage, and failure.

Distortion: Once the high-speed steel is hardened, it is a difficult and costly operation to correct any distortion brought about during the hardening. Improper handling during hardening, excessively high temperature, and also too long a time period would contribute to this trouble.

After briefly reviewing the common troubles to be met or overcome, the present day methods available for heat treating high-speed steels may now be considered. There are two distinct methods available for hardening high speed steels: (a) Controlled atmosphere in a muffle furnace heated by either gas, oil, or electricity, and (b) molten salt bath heated by electrodes in either metallic or ceramic pots. The troubles enumerated are likely to occur in either of these two methods, if proper care and precaution are not taken. In this article only the second method of heat treatment, namely the application of salt baths heated by electrodes, will be considered.

This method, as generally practiced today, requires three pot furnaces—one for preheat, one for high heat, and one for quench. These three sometimes may be combined into a single unit, that is, three pot furnaces in one shell. Schematic drawing Fig. 4 illustrates arrangement of electrodes, transformers and control panel for salt bath operation.

Since the proper hardening temperatures of high-speed steels are from 2100 to 2300 degrees Fahr., it is not always advisable to introduce high-speed tools, especially those of large size and intricate design, directly into a temperature above 2150 degrees Fahr. This would be too severe a shock and might cause distortion, and requires prolonged time at the high temperature. Therefore, in order to prepare the tool gradually for the high temperature and also take the load off the furnace at high temperature, it is highly desirable to preheat high-speed tools at low temperatures, such as 1450 to 1600 degrees Fahr. Thus, by preheating tools at 1550 degrees, the time required at the high temperature, say 2200 degrees, would be decidedly less, and the shorter the time at the high temperature, the less the danger of spoiling the tool.

High-speed tools, therefore, are preheated in the first bath, called the *preheat bath*, long enough to reach the temperature of the bath at 1550 degrees Fahr. From here, the tools are carried into the second bath, called the *high-temperature bath*, maintained at 2150 to 2300 degrees, depending on the type of steel. Here they are held for a predetermined length of time, and then carried into a third bath, called the *quenching bath*, maintained at around 1100 to 1200 degrees Fahr.

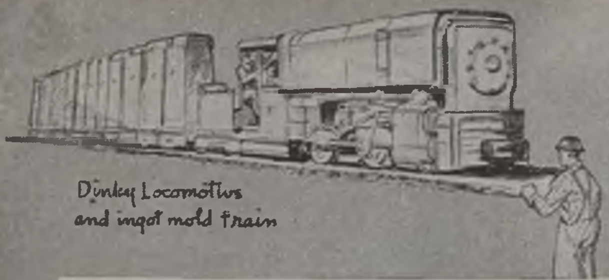
Now, the three units—preheat, high-heat and quench—may be discussed separately and in more detail.

The Preheat Bath: This is a combination of neutral salts and is maintained during actual operation within 1450 to 1550 degrees Fahr. This bath should be kept free from dirt, scale, oil and contamination, particularly from the quenching bath. Since the tools after being preheated are carried into the higher temperature at 2200 degrees, some impurities that may be harmless at 1550 degrees Fahr. would be serious and dangerous at the higher temperature, and hence, great care should be exercised to keep the preheat bath as clean and free from dirt and sludge as possible. Tools are held in this bath long enough to thoroughly and completely bring them to the same temperature.

The necessary time for high-speed tools in the preheat is shown in graph, Fig. 2, which also contains relative high heat curve for stock of the same dimensions. In actual operation the time may be varied a minute or two, either one way or the other, but the time indicated by the curve should serve as a guide to prevent prolonged and unnecessary heating and soaking in the preheat.

The Furnace: Equipment to heat the preheat bath may be either gas, oil-fired, or electrode type. For gas or oil-fired, an alloy pot of 35 per cent nickel, 15 or 28 chromium and 8 per cent nickel may be used. When an electrode type furnace is used, the pot may be either a pressed-steel pot, welded steel, alloy or ceramic. Any of these materials would be satisfactory. However, when a metallic pot is used it slowly but surely oxidizes, and the scale falling into the bath may build up into a concentration that will interfere with the proper operation of the preheat bath. These

HIGH-SPEED RESILIENCE TEST:—Heat-treated bayonets must withstand a bend both ways to a radius of 18 inches without breaking or taking a permanent set. To match high production rates in its bayonet plant at Ashtabula, O., American Fork & Hoe Co. employs this setup using an air-operated cylinder to compress the blade to the desired curvature between dies as shown. Operator works tester by means of foot controlled valve



TEEMING THE MIGHTY STEEL INGOT

Steel takes its first solid form with the teeming or pouring of the ingot, an operation in which skill and experience contribute to the control of quality.

The ingot is the measure of steel production. Its teeming is the culmination of the mining of iron ore and coal, the quarrying of limestone, the production of iron in blast furnaces and the making of molten steel in open hearths and converters.

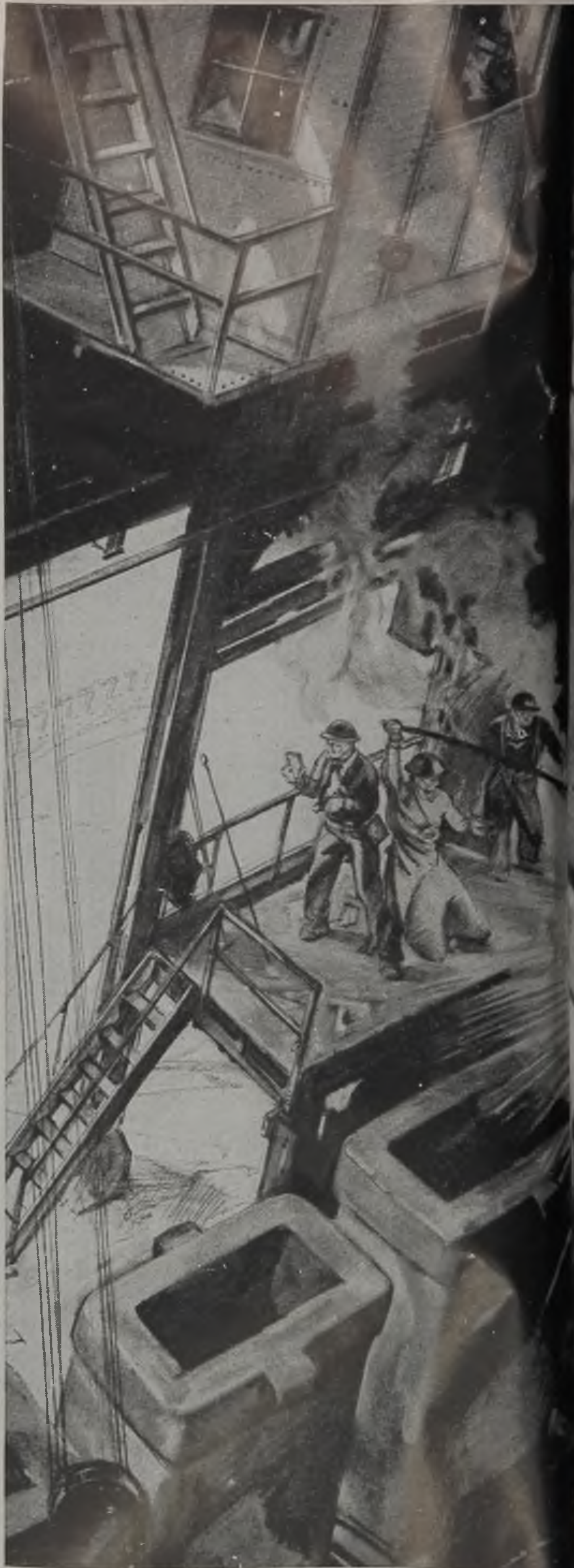
Vast quantities of raw materials are consumed and immense equipment and the labor and skill of hundreds of thousands of American workers are engaged in the processes leading up to production of the mighty steel ingot — ninety million tons of which were produced in this country last year.

Steel from these millions of tons of ingots now moves forward to invasion, arming our fighting men, affording them maximum protection as they achieve victory. And with the peace to come, new steels will serve us in new and better ways.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

CONTROLLED QUALITY STEEL FOR WAR



FROM AN ORIGINAL DRAWING AND SKETCHES BY ORISON MACPHERSON, AT J&L PITTSBURGH WORKS

J&L STEEL RECORDS

Three world records for the production of steel and more than two thousand of its own production records (total of 2,018) were broken by Jones & Laughlin Steel Corporation works in 1942, 1943 and 4 months of 1944. "These 2,018 records since Pearl Harbor," President H. E. Lewis said, "made possible by the many thousands of men and women of J&L working in close cooperation with management, in mines, quarries, transportation lines, furnaces, mills and plants, are indeed an achievement in which all may take gratification for a job well done, and be inspired to do even better in the critical days of invasion." The records Mr. Lewis pointed out, included daily, weekly, monthly and yearly records, with 882 new highs at Pittsburgh Works, 791 at Aliquippa Works, 300 at Otis Works, Cleveland, and 45 at McKeesport, Pa., (a special ordnance plant). During this record-making period, J&L operated, and is still operating, above 100% of rated capacity.

U. S. Maritime Commission has awarded the Pittsburgh Works of Jones & Laughlin Steel Corporation its Gold Star to be added to the "M" Pennant presented last September, in recognition of continued production achievement. In congratulating the company, Admiral H. L. Vickery, Maritime Commissioner, said: "As our fighting forces press forward the advance on Berlin and Tokyo, it is my sincere hope that your company will continue to maintain or better its production record until victory is achieved." The Pittsburgh Works and the Aliquippa Works of J&L have both won the Army-Navy "E" flag with star for excellence in War production.

Fiery rivers of steel for war continuously pour out of open hearth and electric furnaces and Bessemer converters in the steel works of America into heavy cast iron ingot molds, tall as a man. The molds may be square, round, rectangular or truncated, according to ultimate shape the steel is to take in rolling and finishing mills. Each mold may have capacity for 5, 10, 12 or even 15 tons of molten steel. As easily as you would handle a bucket of water, metal crane operators adroitly swing great, thimble-shaped ladles full of tons of molten steel over the row of waiting ingot molds on low cars ("buggies") into which the steel will be teemed.

On the "teeming" platform (see illustration) the skilled steel pourer, nozzle setter, capper and metallurgical inspector move into action. First the nozzle in bottom of great ladle is cleared out, a sharp rod is pushed in, stopper handle is raised and steel bursts out in a bright stream that runs gurgling into the mold. When mold is filled, the steel pourer shuts off the fiery stream and signals craneman (upper left in illustration) to move to next mold, which he does with skill to prevent splashing. This goes on until the ladle is empty. From 10 to 40 ingots are thus teemed, depending upon sizes of molds and ladle.

pots, made to any size, are inert or neutral to the bath. Therefore, the bath remains free of metallic oxides and relatively pure. Such a pot, operating between 1450 and 1550 degrees Fahr., may last 2 to 4 years, the only necessary replacement being the electrodes which last 8 to 12 months.

If a fuel-fired furnace is used, the furnace may be idled overnight with the control instrument set at 1200, just above the melting point of the bath. With this arrangement, the bath next morning may be brought to the operating temperature more quickly, and a great deal of time is saved. Over the weekend, the furnace may be shut off completely, and started again on Monday.

When an electrode furnace is used with a ceramic or metallic pot, the furnace can be idled overnight and for the weekend at 1200 degrees Fahr. The bath can be brought up to temperature in about 30 minutes.

Since the salt bath in the solidified condition is not a conductor of electricity, the idling temperature should be just above the melting point of the bath, so that it would carry enough current to remain liquid. When the temperature is set higher, the bath immediately carries a higher current and the temperature is brought automatically to the desired point. If the salt should be allowed to freeze, it necessitates melting enough salt between the electrodes with a torch, to permit the passage of current. Thus it will draw current and will gradually melt the remainder of the salt. A suitable melting torch to start the bath is shown in Fig. 1.

High-Temperature Bath: This also is a combination of neutral chemicals and is liquid enough to operate between 1800 and 2350 degrees Fahr. It may be idled overnight and weekends at 1800 degrees. Since this is a compound with a relatively high melting point, it is strongly suggested that the bath be idled all the time (throughout the working week) instead of being shut down and started over again from a cold condition. Because the action of impurities is more critical at the high temperatures, this bath should be kept clean and free from contamination.

As mentioned before, when a metallic pot is employed at 1550 degrees Fahr., a certain amount of oxidation takes place and metallic oxides contaminate the bath. This condition is naturally aggravated at high temperatures. No matter what the nature of the bath, above 3 per cent metallic oxides are built up and react with the tool being heat treated to produce soft skin.

In order to overcome this handicap and eliminate the possibility of decarburization during hardening, a ceramic pot should be used in connection with electrodes at these high temperatures. It is not only neutral to the salt bath heated therein, but eliminates metallic oxides in the bath. Before melting a salt bath in a new ceramic pot, it should be slowly preheated with a diffused flame torch and aged slowly. This preheat may require 4 to 8 hours, the slower and longer, the better the results will be.

When the ceramic pot and the electrodes placed therein are properly preheated, the pot is filled to about one-fourth of its depth with the high-temperature salt, and the torch is applied to melt a pool between the electrodes to permit the passage of current. Then the salt is added slowly as the melting progresses, until the pot is filled within 2 inches of the top.

High-speed tools, after preheating, are carried into the high-temperature bath at a temperature governed by the analysis type of steel. For high speed steels of 18-4-1 analysis, the temperature may be 2250 to 2325 degrees Fahr.; for the high-speed steels of molybdenum type, temperature may be 2100 to 2225 degrees. Where the tool is subject to shock or impact, the lower temperature of the range is not only advisable but generally requisite.

Time is very important in the hardening of high-speed steel. At such extremely high temperatures, the chemical reaction takes place at a terrific speed; 15 or 20 seconds at low temperatures may not mean much, but at 2200 degrees, it means the difference between success and failure.

In timing a tool for heat treating in the bath, its maximum dimension should always be considered. Other factors are shape of the tool, support at the cutting edge, type of machine tool to be used, and type of material to be cut. With all this, dimension of the tool is the chief consideration in determining the necessary time. For example, a ¼ x 4 x 8 inches would require the same time as one ¼ x 6 x 14 inches, namely about 2 minutes to heat across the ¼-inch thickness, or minimum dimension. Again, a tool ⅜-inch in diameter, by 6 inches long, and another tool ⅜-inch in diameter, by 10 inches long would require the same time, about 2½ minutes to heat the ⅜-inch round metal.

A tentative time schedule for different minimum dimensions is given in Fig. 2. For any minimum size, the approximate time may be obtained here. Actual time may be slightly more or less than that indicated. Calculation of time is further delineated by the tools shown in Figs. 6 and 5:

—Small tool marked "A" is ⅛-inch thick at minimum dimension, hence it will require about 2 minutes to preheat and 1¼ minutes in high heat.

—Thread hob marked "B" is 3/16-inch thick and will need about 2½ minutes in preheat, 1½ minutes in high heat.

—Hobs marked "C" and "D" are ⅜-inch thick and will take about 3½ minutes in preheat, 2¾ minutes in high heat.

—Hob marked "E" is ¾-inch thick and needs about 6 minutes in preheat and 4½ minutes in high heat.

—Thread hob in Fig. 5, nearly 6 inches long and 4 inches outside diameter, has a minimum dimension at the cutting edge of about ¾-inch and the time in preheat will be 6 minutes and in the high heat 4½ minutes.

The tools, after remaining in the high temperature bath for the predetermined length of time, are removed and carried into the quenching bath.

Quenching Bath: This, unlike the preheat and high heat, is an alkaline bath maintained between 1100 and 1250 degrees Fahr. The high-speed tools are allowed to remain here long enough to reach the temperature of the quenching bath. This may mean 2 or 3 minutes for small tools and 5 to 10 minutes for larger tools, but this bath should never be used to keep the tools after quenching for an indefinite period, such as ½ to 2 hours, or it will impair the efficiency and quality of the finished tool.

The quenching bath serves two purposes: First, it cools the tools to a lower and safer temperature, at which there is little danger of scaling; second, it helps to wash away the high-speed salt dragged and carried into it. Due to its chemical nature, the quench salt should not be allowed to contaminate either the preheat or high heat baths. Hooks or fixtures carried into the quench should be thoroughly washed in cold water before they are used again in the high-heat bath. When the tools are quenched from the high temperature into the quench bath, a material of high melting point settles into the quench bath and forms sludge. If this sludge is not removed periodically, it will raise the melting point, increase viscosity and seriously interfere with satisfactory performance.

The quenching bath may be heated in a fuel-fired or electrode furnace, us-

SUGGESTIONS FOR HARDENING HIGH-SPEED STEEL —FURNACE OPERATION—

1. Tools should not carry sulphurated oils when introduced into the bath. Sulphur, carried into the high-temperature bath may cause pitting and any oil that burns or cokes on tools may cause fusion.
2. Pyrometers should be checked regularly for accuracy. For high-temperature baths, rayotube arrangement is ideal.
3. Contact of high-speed steel tools with lead or aluminum paint is to be avoided because of the possibility of fusion on tools at high temperatures.
4. After the quench, tools should be washed free of all quench salt and completely dry before they are introduced into tempering salt for the drawing operation.
5. Pots, whether ceramic or metallic, should be kept clean. Separate ladles of suitable size should be provided for each pot, and these should be cleaned out regularly at least every other day.
6. To prevent thermal shock in starting a ceramic pot, dry slowly and carefully and preheat with a torch. It is better to preheat overnight, before starting the bath. In starting bath, do not use carbon or graphite rods to short across metal electrodes, as this damages the latter and carbon fragments remaining in bath may fuse to the tools.
7. Preheat and high-heat baths should remain neutral. Rectifying chemicals should be added regularly to prevent pitting and decarburization of tools caused by dirt, oil, impurities or the slow breaking down and gradual decomposition of the baths.
8. Reasonable care and attention to details and instructions for proper operation of the salt-bath method pays handsome dividends. Only a few days are required to gain the necessary experience.

ing in each case, a metallic pot. Due to the nature of the chemicals involved, a quenching bath cannot be used in a ceramic pot. The furnace equipment recommendations for all three baths may be briefly reviewed.

For a proper hardening setup, a preheat, high heat and a quenching bath are required. Sometimes two quenching baths, one operating at 1250 degrees Fahr., and the other at 1000 degrees, are used, which not only helps to produce cleaner tools but seems to enhance physical properties of the tools. The high-heat bath must be heated by electrodes in a ceramic pot, but the preheat and the quench bath may be heated by gas, oil or electrodes. For the preheat bath, a ceramic or metallic pot may be used. In the quench, only a metallic pot can be used. These three furnaces may be built separately or combined as one large unit.

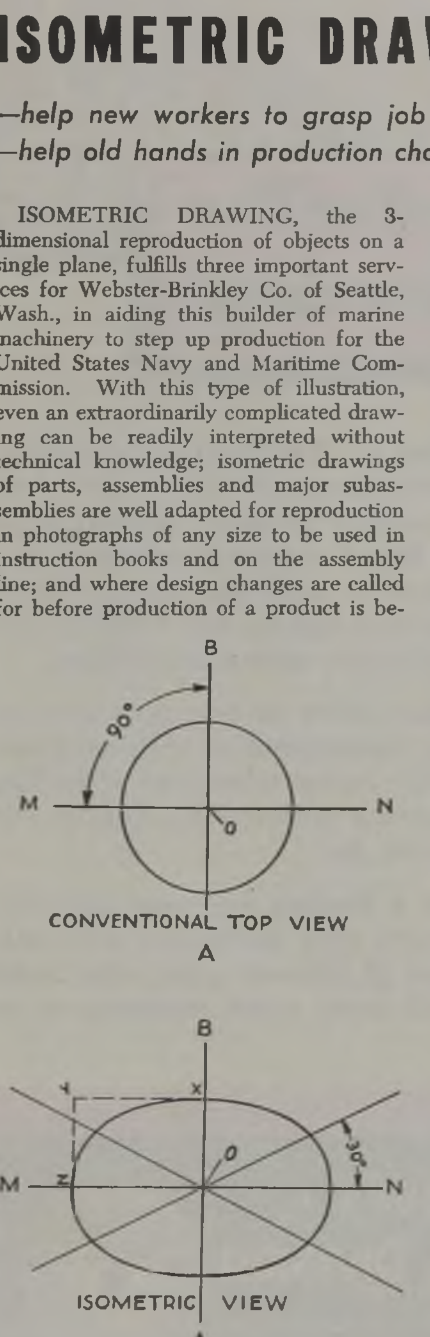
We have, thus far, followed the course of the high-speed steel tool in processing it through the three operations. The tool, after remaining in the quench bath for a few minutes, is taken out. Some tools, such as long reamers and broaches, are subject to distortion and may require straightening. This should be done just after quenching and before cooling to room temperature. With proper handling and technique, the salt bath offers the ideal method for hardening such tools with minimum distortion, and then straightening after hardening and quenching. Fig. 3 shows a broach 60 inches long, which has been hardened in an electrode type furnace and straightened just after quenching to within 0.005-inch. As soon as, and not before, the tool is cold enough to handle with hands, it is washed and cleaned in hot water.

The heat treatment of the high-speed steel tool, thus far, is partially completed. In the as-quenched and washed condition, the tool is not ready for service. To complete the heat treatment, it requires a drawing operation to relieve the stress and bring about the desired structural transformation. For this reason, the tool is tempered from 2 to 3 hours, preferably twice, 1 to 1½ hours at a time at 1025 to 1050 degrees Fahr. In case of tempering twice, the tool is allowed to cool to room temperature before tempering again. After the completion of tempering, tool is washed free of tempering salt and may be shot blasted; then it is ready for final grinding to specified dimensions.

ISOMETRIC DRAWINGS

—help new workers to grasp job quickly, —help old hands in production changes

ISOMETRIC DRAWING, the 3-dimensional reproduction of objects on a single plane, fulfills three important services for Webster-Brinkley Co. of Seattle, Wash., in aiding this builder of marine machinery to step up production for the United States Navy and Maritime Commission. With this type of illustration, even an extraordinarily complicated drawing can be readily interpreted without technical knowledge; isometric drawings of parts, assemblies and major subassemblies are well adapted for reproduction in photographs of any size to be used in instruction books and on the assembly line; and where design changes are called for before production of a product is begun, isometric projections provide the designing engineer with a clear, factual picture of its intricacies.



In the case of new production schedules, this 3-dimensional presentation —preliminary procedure for which is outlined in Fig. 1—introduces an interesting and simple means of putting across an idea in the fastest possible way; that is, to draw the machine or machine part showing top, front and side views simultaneously, thereby giving a complete picture at a glance. This eliminates the necessity of trying to visualize a part in three dimensions, as must be done with conventional presentation.

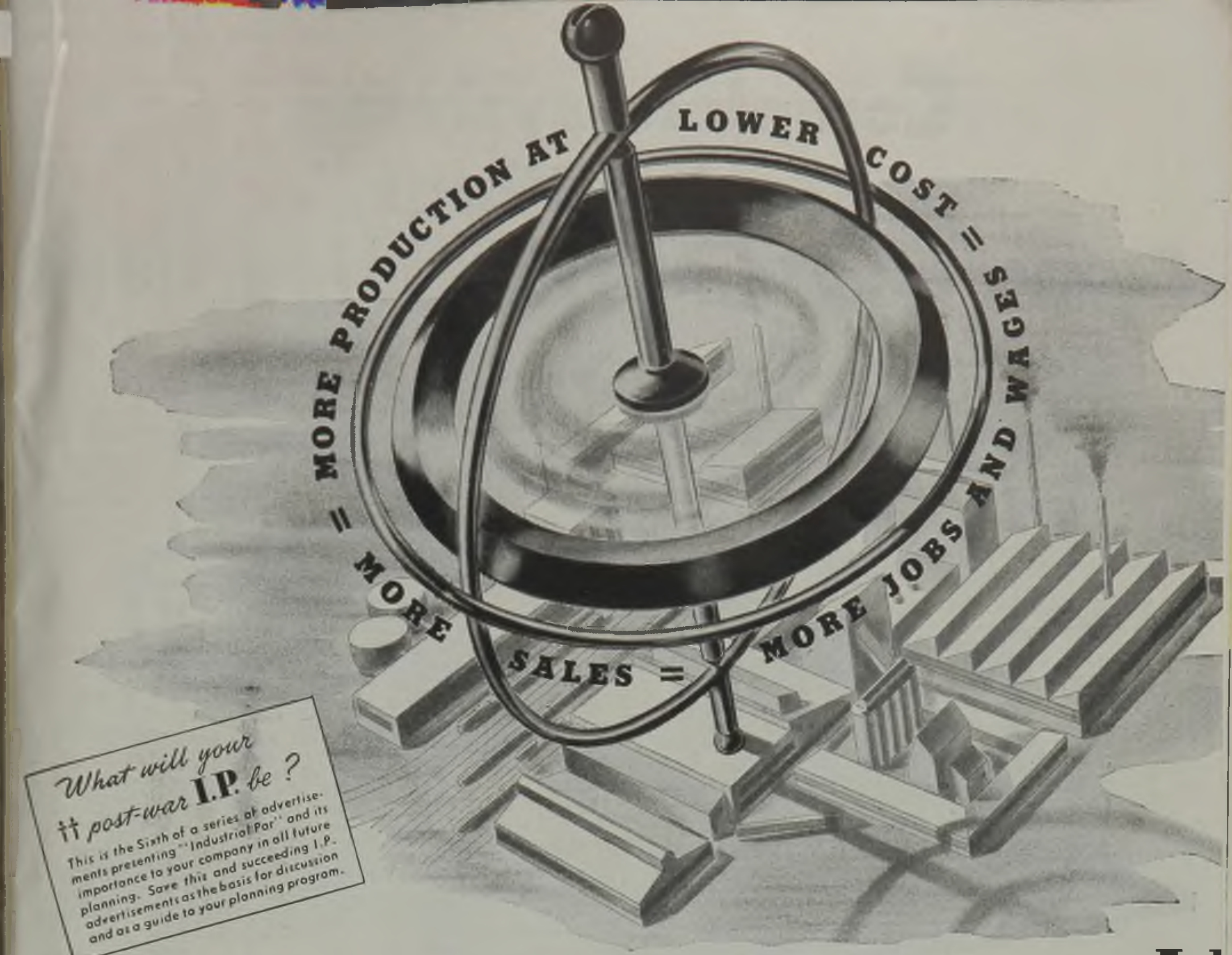
From the regular detail or sketch, the major axes are laid out, as shown in Fig. 1. MN and AB are center lines on the plan view of a conventional presentation MN and AB similar center lines on the isometric. From that foundation, the drawing is built up, using a 30-degree projection line. The important thing to remember is that *true measurements can only be made on the lines in the isometric plane along both of the MN axes.* In other words, any measurements not in the plane must be projected to it. Thus, to find dimension OX in the isometric in Fig. 1, point X is projected to the 30-degree line at point Y, which then is projected to the isometric plane at Z, and distance OX found to be equivalent to OZ.

Fig. 1 (Left)—Conventional presentation of a circle at top and isometric presentation at bottom. Three-dimensional quality is obtained by use of 30-degree projection plane. Distances can be measured here only in the isometric plane, along axis MN. Thus to find OX, X is projected to Y, Y is projected to Z; distance OX being found same as OZ

Fig. 2 (Right)—Completed isometric drawing of capstan-windlass has three-dimensional quality that helps workers visualize relation of parts, helps speed assembly and manufacturing work

The isometric drawing of a cross section of the Webster-Brinkley-designed 24-inch planetary capstan-windlass shown in Fig. 2, is an interesting instance of such composite work, dramatizing with meticulous regard for detail the complicated planetary mechanism in the head as well as other features of the piece. Perspective is achieved through this medium. The highlights and shadows added in the pencil rendering give the feeling of substance.

During the general skilled-labor shortage when most of the new employes have little if any technical training and virtually no experience in reading blueprints, the company has found the isometric illustration method especially valuable.



Keeping the Business Gyroscope Balanced Is All a Matter of I.I

Remember the gyroscope you had as a kid. You gave it a flip with a bit of string and there it stood spinning and gracefully balanced. As it lost its spinning momentum it began to wobble, and finally, as its motion was spent, it just keeled over.

That toy gyroscope symbolizes an important principle in the making and selling of goods. When we are able to produce more at lower cost we sell more. When mechanical refrigerators cost about $400, they sold at the rate of 50,000 a year. When lowered production costs brought the price down to around $160.00, a million and a half were sold every year. Increased sales call for increased production and increased production means more jobs. More jobs and wages, in turn, contribute to making more sales possible and those, in turn, mean even greater production at still lower costs. As long as nothing disturbs the cycle the wheels of business and industry keep spinning in balance, like the gyroscope.

To produce more at lower cost calls for increased output per man-hour. America's industrial greatness was founded on the fact that we were able to increase our output per man-hour progressiv through the years.

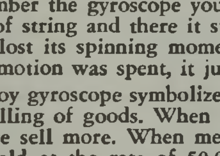
In fact, we have established a national industrial par — a constan increasing output per man-hour equal to approximately 50% ev 10 years. Our ability to maintain or excel this industrial par s our level of national prosperity.

To increase output — to make better products at lower cost demands production engineering skill, implemented with the b and most modern machine tools.

Machine tool productive power today is one-third to one-h greater than it was in 1939. Their increased effectiveness sprii from vastly improved design and performance, rather than sh numbers in use. Only with the most modern machine tools can a manufacturer hope to compete successfully over a period of ye — make workers' jobs safer — more productive — more sec in the postwar days to come.

Let's All Back the Attack! **BUY MORE BONDS**

Spotlight facts for your post-war **I.P.** *planning*



*Production methods — developed in wartime — increase man-hour output; pent-up buying power — released in peacetime — demands increased production.

*The rate of 2½% increase per year output per man-hour, established by a 12 year record of industrial production, can be expected to reach at least 4% per year — compounded.

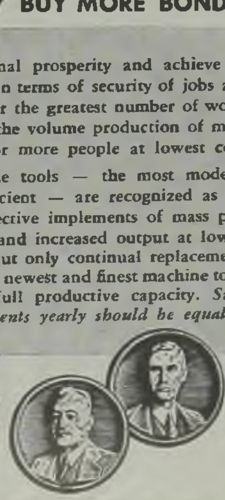
*Manufacturers must set a goal of 50% increased output per man-hour every 10 years — to maintain a high level of national prosperity and achieve its benefits in terms of security of jobs and wages for the greatest number of workers and the volume production of more goods for more people at lowest cost.

*Machine tools — the most modern, most efficient — are recognized as the most effective implements of mass production and increased output at lowest cost — but only continual replacements with the newest and finest machine tools assures full productive capacity. *Such replacements yearly should be equal to 10% of the total machine tool inv ment—in keeping with increased outp*

*The cost of machine tools is ins nificant in terms of their product power . . . from 1927 to 1937, acco ing to census reports, American ma facturers had only a total of about . invested yearly in machine tools ratio to a total volume of 9 billi dollars' worth of production annua

††**Industrial Par** — *the constai increasing output per man-hour eq to approximately 50% every 10 ye*

Milwaukee Machine Tools



KEARNEY & TRECKI
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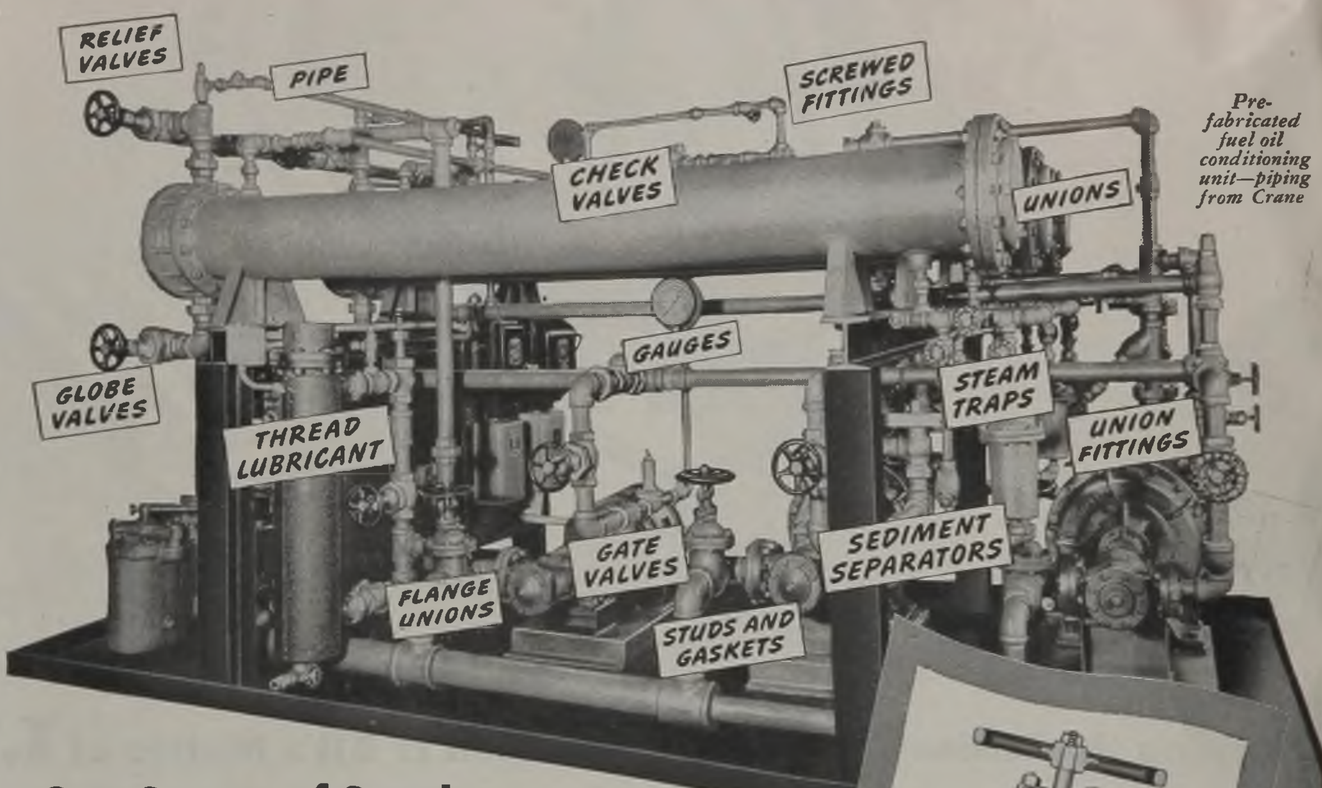
Complete systems or single fittings . . . Crane meets every piping need



Pre-fabricated fuel oil conditioning unit—piping from Crane

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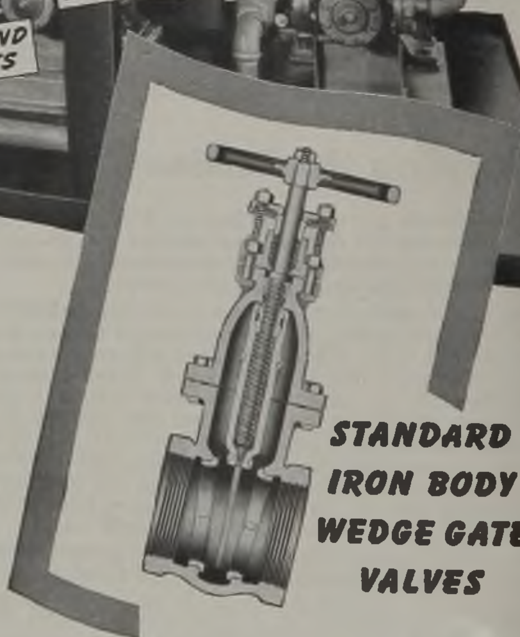
CRANE CO., 836 S. Michigan Ave., Chicago, Ill.



STANDARD IRON BODY WEDGE GATE VALVES

One Standard of Quality . . .

Because there is adequate quality in every part, the whole system is thoroughly dependable when it's Crane equipped. Such quality is typified by Crane Iron Body Gate Valve design: Strong body sections resist severest line strains. Straight-through ports give streamline flow. A deeper stuffing box lengthens packing life. Extra long guides keep disc travel true, while balanced stem design maintains smooth and positive operation.

CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

By C. F. HOFFMAN*
Superintendent, Blast Furnaces
Bethlehem Steel Co.
Sparrows Point, Md.

Blast Furnace Tap Hole Area

cooled by efficient coil system

Severe erosion of brickwork beneath iron notch occurs when cast-iron segments with cast-in pipes are employed for cooling. Condition is eliminated by installing jackets and coolers in well and then driving bottom blocks, carefully sized and properly cut and ground, into position

BLAST FURNACES at Sparrows Point are equipped with hearth jackets of two complete rings, one on top of the other of all-welded construction. Each ring is made up of six plates of equal width and height, all 2 inches thick except the two plates in the tap hole area which are 2¼ inches thick. The rings are erected in such a manner that the vertical joints of the top and bottom rings are offset 12 inches in the same direction. See illustration above.

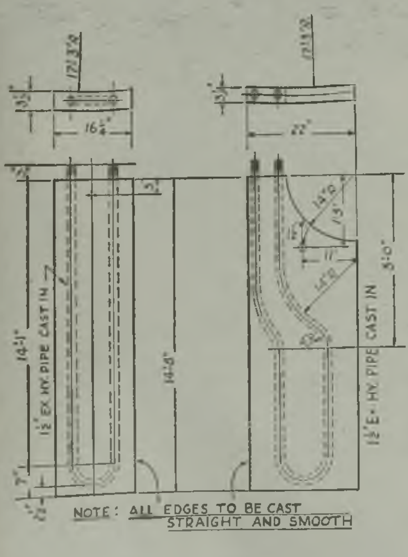
All vertical joints are 45 degrees double V-butt joints, having a 5/32-inch gap prior to welding. The horizontal joint is a 45-degree double bevel, butting the square edge of the top of the bottom ring. This joint also has a 5/32-inch gap prior to welding.

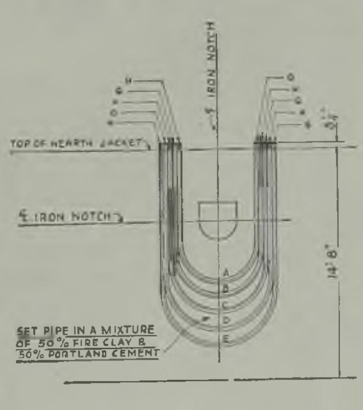
The entire hearth area except the tap hole section is cooled by means of cast-iron staves with a U-bend made up of 1½-inch extra-heavy pipe, cast in. The staves are 14 feet 8 inches long, 16¼ inches wide and 3½ inches thick, as shown below, left.

In the construction formerly used, the tap hole area was also cooled by means of a cast-iron segment with cast-in pipes. After blowing out, the most severe erosion of the brickwork in the hearth was always found underneath the tap hole. In several instances where the molten iron hit the coolers it followed around for some distance, thereby eliminating much of the cooling in the tap hole area. It was thought that this could be avoided by having a refractory, rather than metal, between the cooling coils. This led to the present construction which consists of five U-bends made up of 2½-inch double, extra-heavy seamless tubes, the centerlines of which lie in a plane parallel to the interior surface of the furnace hearth jacket.

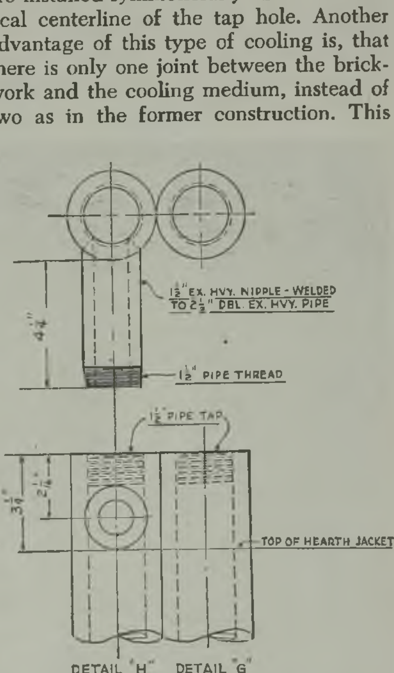
Coils (below, center and right) having a minimum spread of 4 feet 11 inches, are installed symmetrically about the vertical centerline of the tap hole. Another advantage of this type of cooling is, that there is only one joint between the brickwork and the cooling medium, instead of two as in the former construction. This

*Presented before Eastern States Blast Furnace and Coke Oven Association, Pittsburgh.





HEARTH COOLERS AT IRON NOTCH



DETAIL FOR ENDS

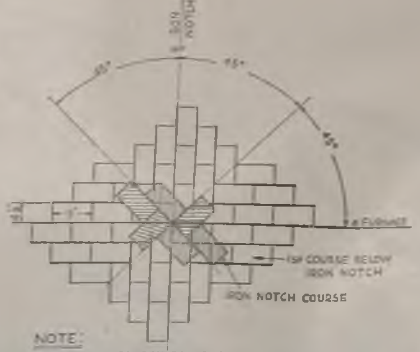
decreases the resistance to the flow of heat to the cooling medium.

Jackets and the coolers are supported on a third-quality brick wall which forms a well 36 inches deep, the inside diameter of which is 72 inches less than the inside diameter of the jacket. The well is laid up with bottom blocks of hearth and bosh quality, 4½ x 9 x 18 inches, carefully sized, cut and ground to a proper fit around the circumference so that they must be driven into position, as shown at right.

Above this well are laid six additional courses of bottom blocks, which also are cut and ground to a proper fit where they meet the hearth staves. All bottom blocks are laid up on 9-inch face and all joints are made with a fire clay wash. As each course is completed, any space between the cooling staves and the jacket is filled with a grout of a 1:1 fireclay-portland cement mixture. The surface is also ground with portable grinders to eliminate high spots and present a smooth, level surface for the next course.

To prevent the joints of all courses from lying in a common vertical plane, the center line of each succeeding course is rotated 45 degrees.

The hearth wall is laid up with standard 9 and 13½-inch straight and key bricks of hearth and bosh quality.



CASINGS "ROLL"

after large fabricator combines induction heating and automatic spinning to reduce steps in production of ordnance items

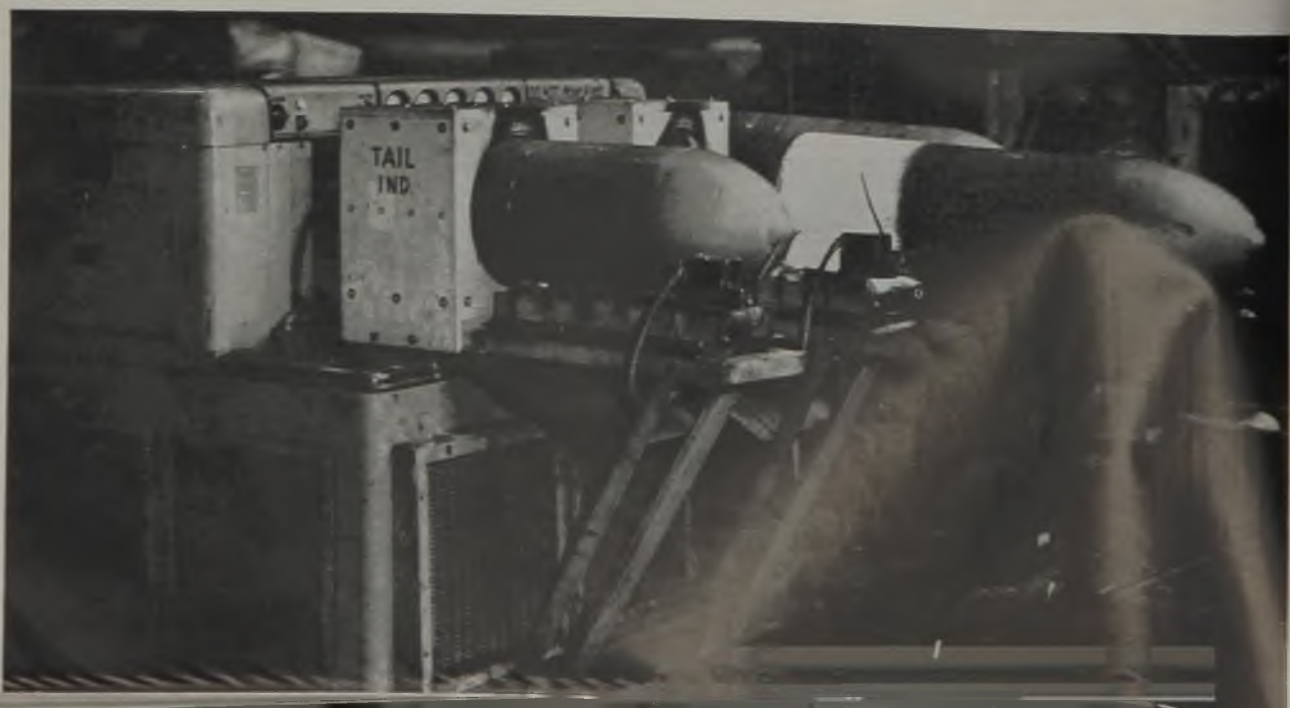
INDUCTION HEATING, employed in combination with an automatically controlled spinner, has aided production of 250 and 500-pound bomb casings at Wheeling Steel Corp. Applying a production line technique to the shaping of casings, the company placed a battery of 200-kilowatt 3000-cycle Tocco Jr. induction heating machines, manufactured by the Ohio Crankshaft Co., Cleveland, near the spinners, thereby making a 2-stage operation out of work which previously required 10 steps by other methods. The procedure is here briefly described:

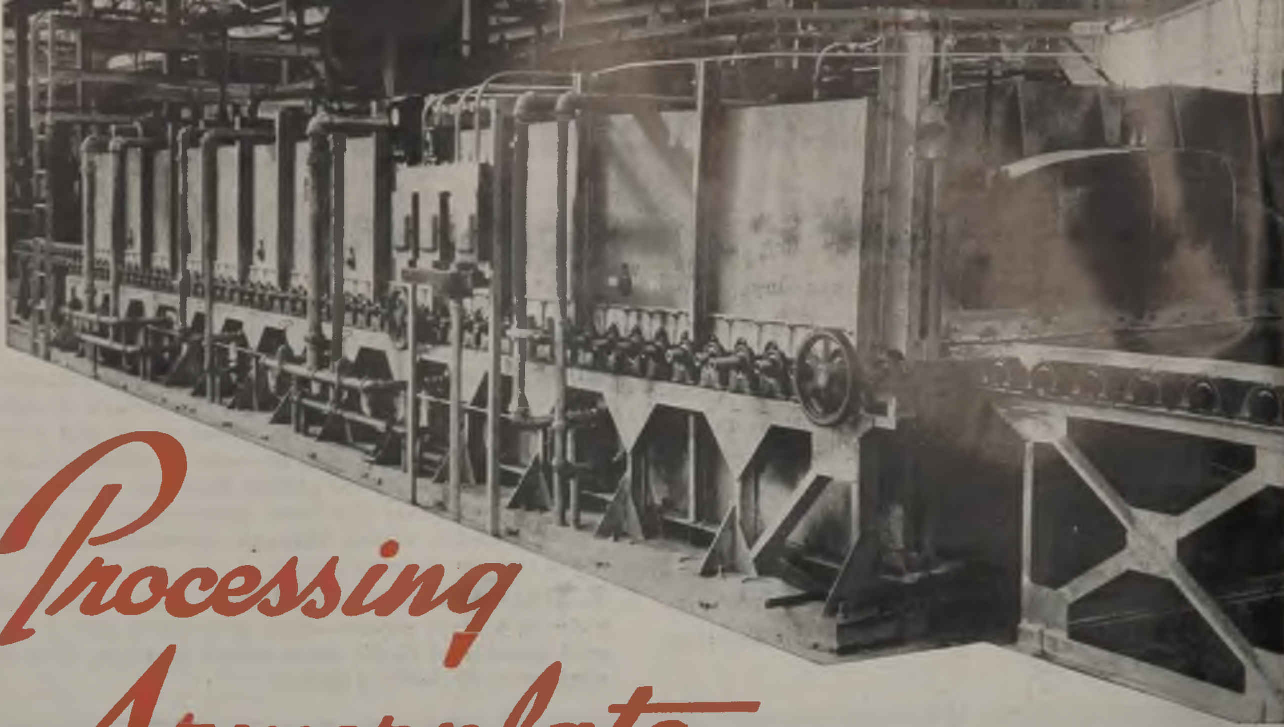
Both casings are made of plain carbon steel pipe, the outside diameter of the pieces being approximately 11 inches for the 250-pound casing and 15 inches for the larger one. After being cut to length, they are rolled onto gravity conveyors to be transported to the heaters. Each of the Tocco heating units is a 2-station machine made to operate on a 400-volt hookup, with push-button control panel conveniently located at hip level beside the fixtures controlling each station. It is equipped with inductors designed especially for ordnance work with water-cooled coils having a diameter sufficient to give ½-inch clearance between metal and coil.

In heating the smaller casing prior to the nosing operation, a temperature of 2000 degrees Fahr. is reached and held for 2 minutes and 15 seconds. Temperature required for the 500 pounder is 2200 degrees Fahr., while the heating cycle is just 4 minutes and 20 seconds. High heat is confined to the specified area on the pipe, making it possible for the operators to handle the casings from inductor to spinner without tongs. After the nose has been spun, the casing is again lifted to the gravity conveyor which takes it to the next heating unit for tailing operation, going through a cooling compartment enroute. Heating cycle for the tail is only 90 seconds in the case of the smaller bomb; the tail of the 500 pounder is heated to required temperature in 3 minutes and 15 seconds. First phase of this second operation in case forming is shown in accompanying photo. Operator has just removed a casing from the inductor. A second aerial egg is heating, while in the background can be seen a third case ready at the end of the gravity conveyor. After heating, tail areas are spun into truncated cones with ends open.

"Results are exceeding those which other methods originally considered would have given us," states Andrew Toth, bomb plant supervisor. "There is no waste of fuel or heat. This makes working conditions cleaner and many times cooler. Over and above that, we get greater uniformity of heat in the casings."

Five-hundred-pound bomb casings being heated prior to tail spinning. A casing here has been removed from the inductor. Note absence of tongs though tail has been heated to over 2000 degrees. Second case is heating while in the background can be seen a third ready at the end of the gravity conveyor





Processing Armorplate

Is Speeded by Newly Developed Continuous Lines

Fig. 1—*Continuous roller-hearth armorplate hardening furnace in the plant of E. C. Atkins & Co., Indianapolis. Plate is loaded on charging table in extreme background and emerges at exit side in foreground ready for pressure-quenching*

PRODUCTION of light armorplate for mechanized equipment, gun mounts and other military equipment has been greatly facilitated through the application of straight-line production methods and modern equipment in the Fall Creek Ordnance Plant operated by E. C. Atkins & Co., Indianapolis, which went into operation late in '43.

In World War I, the sawmakers were called upon to aid in producing armorplate since the problems and skills involved were akin to those in making saws. Well-known sawmakers again are prominently in the picture but, in this war, there has been added the complication of volume production arising out of the necessity to produce tens of thousands of armored vehicles needed to beat the Axis legions.

Fabrication and treatment of armorplate is extremely difficult due to the character of the material and the extremely close tolerances which must be met in making all parts interchangeable and close-fitting for welding. However, so well have these problems been licked in the Atkins ordnance plant that production of fully machined, heat-treated parts now is on a basis previously thought impossible.

The "raw" material, hot-rolled armor quality steel, arrives at the unloading platforms in the south end of the plant from a number of midwestern plate mills in standard sizes and in thicknesses ranging from 3/16 to 7/8-inch. Each piece of steel carries a heat number which immediately identifies it with heats which have met the ballistic requirements set up by the Ordnance Department.

The material then is cut to size prior to heat treatment, two alternate methods being employed, flame cutting and shearing. Some flame cutting also is done following heat treatment, especially where dimensional requirements are extremely rigid for sections which will subsequently be welded. It may be explained that the effects of flame cutting are not deleterious because the heat-affected zone is not materially different than that from the welding operation itself.

Most parts are odd-shaped as may be expected when it is considered that tanks and armored vehicles must have side plates, doors, hull assemblies, superstructures, hood panels, windshields, track housings, louvres, gun armor, battery box covers and sides along with numerous other parts, all of which must fit precisely in the assembly plants to which they are subsequently shipped.

All of these pieces require considerable machine work, including drilling, boring, milling and grinding. The latter operation is performed invariably follow-

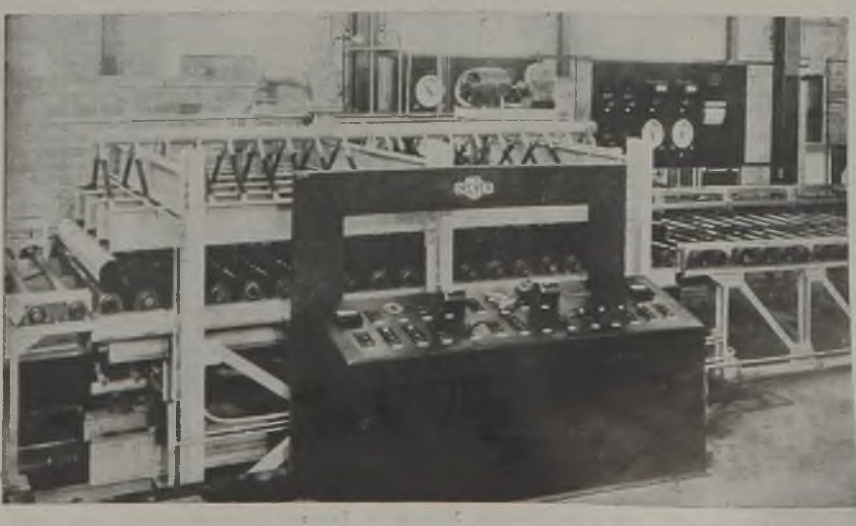
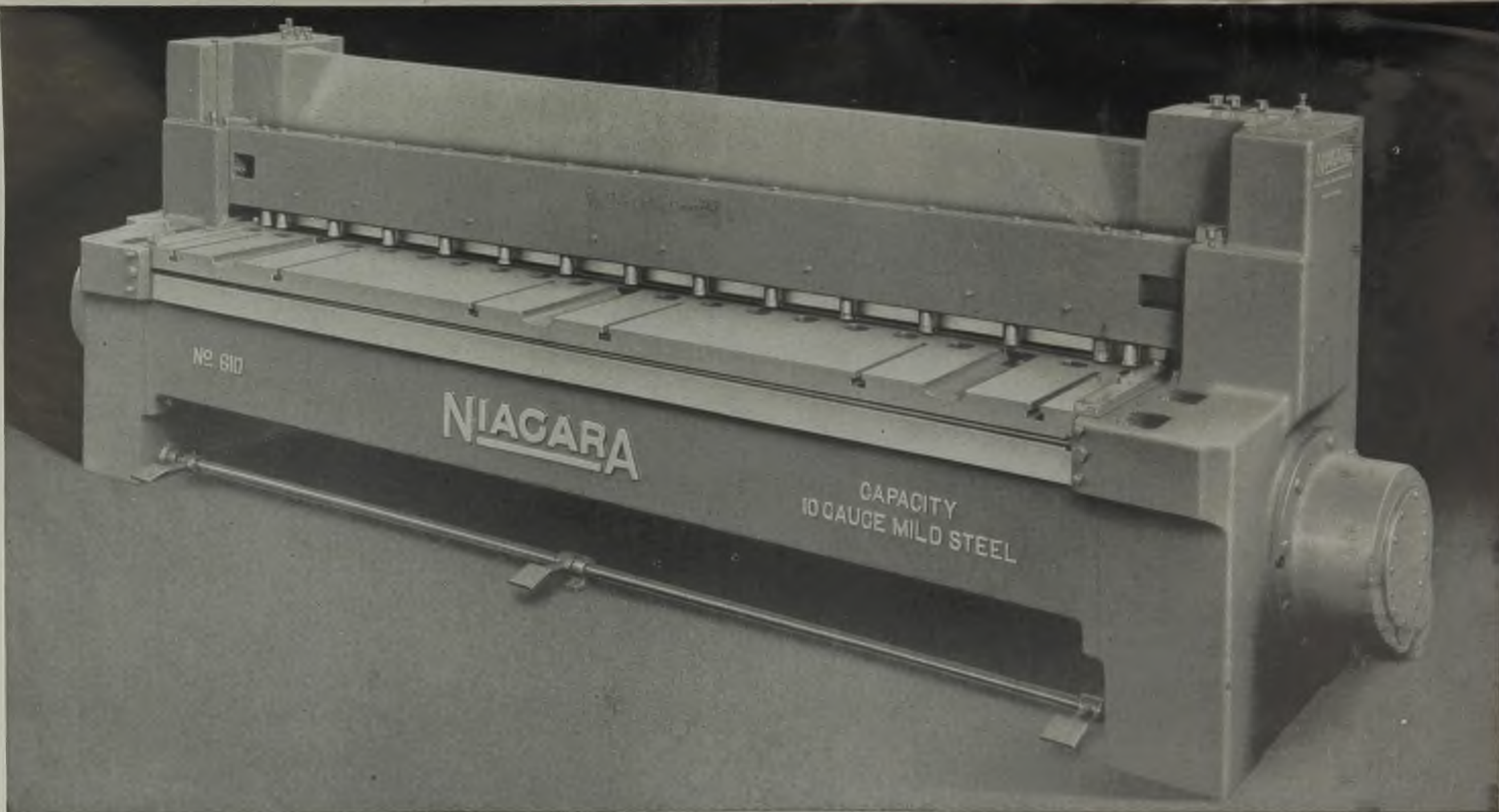


Fig. 2—*Controls for both the hardening furnace and the pressure quench system are centralized in this pulpit. Spray arrangement shown immediately in back of pulpit is located between the hardening and tempering furnaces. A similar unit is used for cooling after the armorplate leaves the tempering furnace*



War plants are obtaining more production per man-hour with Niagara Power Squaring Shears because of accurate cutting, quick setting, ball bearing, self-measuring parallel back gages, full visibility of cutting line, instant acting Niagara sleeve clutch and other modern features.

Enclosed drive with gears, clutch and eccentrics running in oil assure long life and low maintenance cost. Four-edge, solid tool steel knives are standard equipment. Niagara Machine & Tool Works, Buffalo, N. Y. District Offices: Detroit, Cleveland, New York.

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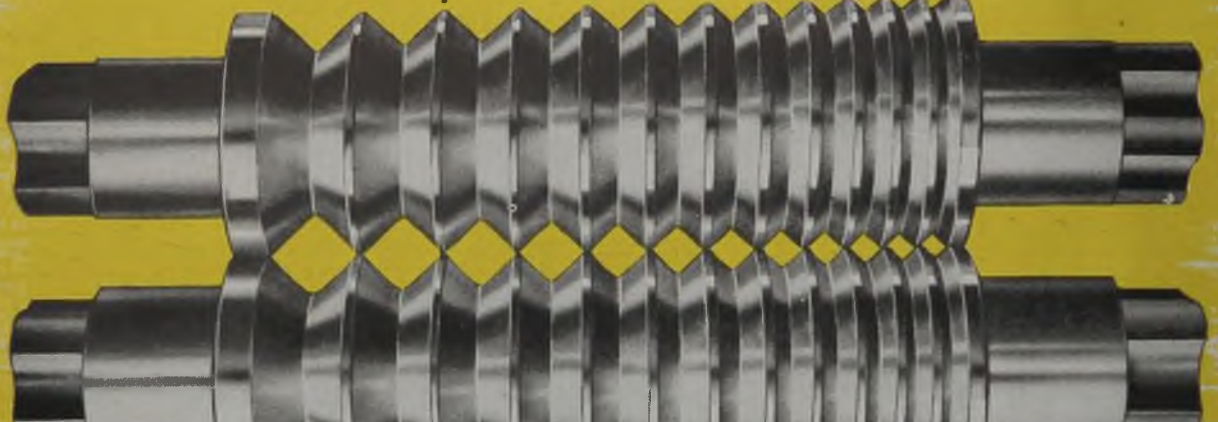
Perfection in Roll

DESIGN AND MANUFACTURE



MERCHANT MILL ROLLS

Because they meet those important requirements of low cost, high speed, quality steel production, Continental Rolls are the choice of mill operators everywhere. Continental Rolls reflect the engineering skill of fine design combined with highest manufacturing craftsmanship to achieve roll perfection.

Continental offers a ready solution to your roll problem, no matter what it may be,—with structural rolls designed to roll the simplest or most intricate shapes, to hot and cold strip mill rolls made to roll plate or high quality, satin smooth, strip steel. Next time specify Continental—it's a wise choice.

In addition, Continental manufactures Carbon and Alloy Steel Casting, designs and builds complete mills, mill equipment and special machinery. *Continental Foundry & Machine Company, Chicago · Pittsburgh*

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ing heat treatment but the first two may take place either before or after, depending upon dimensional requirements as in the case of flame-cut edges. Milling invariably is done prior to heat treatment. As a sidelight on tools, it may be pointed out that the company used chromium-plated drills for a time but now has standardized on a high-speed steel.

While the most efficient types of machine tools are employed in the machining operations, innovations in heat-treating methods undoubtedly have contributed most to the increase in production. No "green" straightening is done before heat treatment as is necessary in other types of operations. The type of armorplate produced by the heat-treatment cycles described here is known as homogeneous, meaning that it is hardened all the way through and not just on the surface as is some armorplate.

The heat-treating department has three lines, the first two of which are identical and will be described in detail. Each of these first two lines has, in sequence, a 40-foot hardening furnace, a pressure quench system, drawing or tempering furnace, a second pressure-quench system identical with the first, and necessary charging and discharging roll tables for complete mechanical handling through all stations.

The third line differs only from the first in that standard spray quench booths are substituted for the pressure quench for the reason that pieces formed to shape are handled. The pressure-quench system could not be used unless special holding fixtures were constructed for each shape and this is impractical due to the many types handled. Surprisingly little distortion of the sprayed, bent pieces results although all require straightening to form on press brakes. All three lines were constructed by the Drever Co., Philadelphia.

The tempering furnaces have a capacity of 50,000 to 70,000 pounds of armorplate per 24 hours depending upon size and shape of the material and a top temperature rating of 1650 degrees Fahr. Working chamber is 39 feet and 9 inches long by 6 feet wide with 12 inches clearance above the rolls. The furnace shells are of heavy steel plate braced by channel buckstays tied across the top by channels and gusset plates. Interior walls are insulated with 9 inches of 2500 degrees Fahr. insulating refractory brick backed up by 2 inches of block insulation.

Heat is supplied by 13 return-type combustion chambers, a gas burner firing into the end of each. The hot gases thus pass across the furnace and return to the firing side of the chamber and then are further utilized by passing them into the heating chamber of the furnace above the material being treated.

Rolls Amply Powered

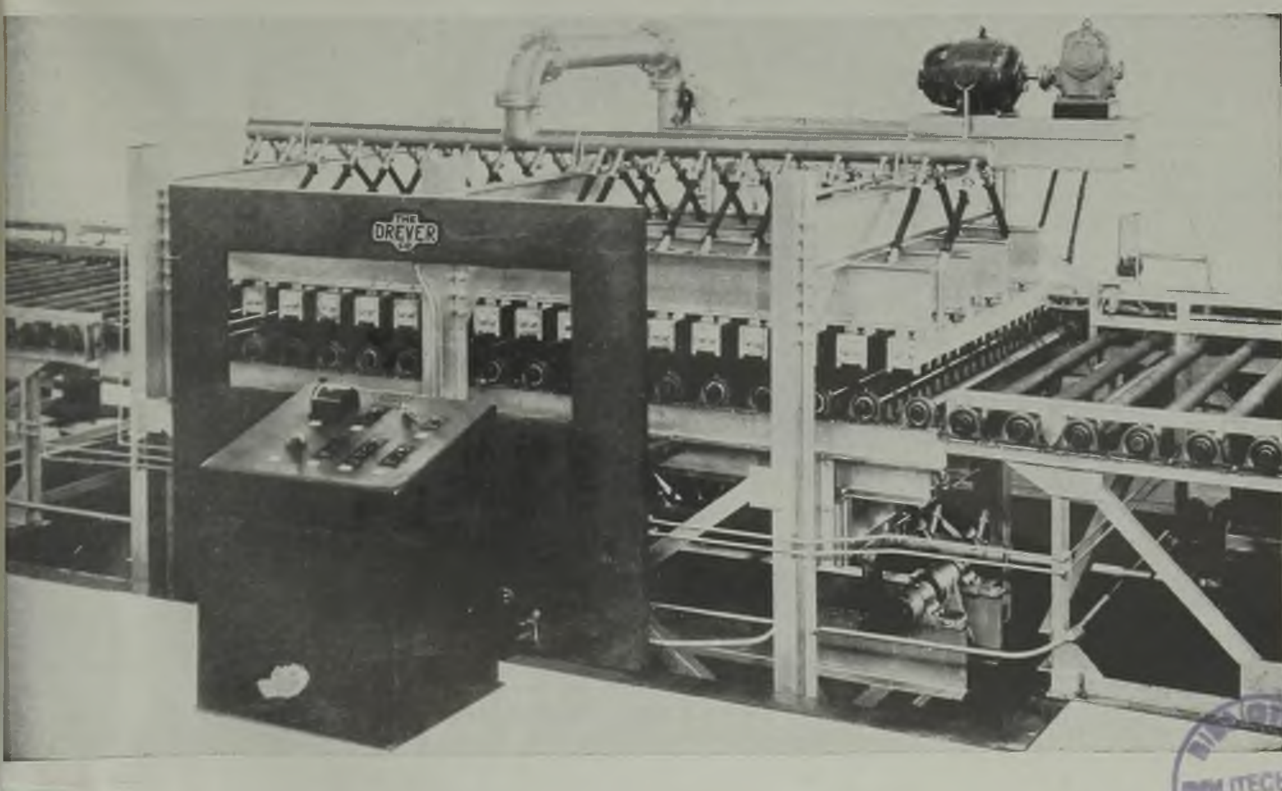
The furnaces are provided with a charging roller table 14 feet 3 inches long with 3½-inch solid steel rollers set on 9-inch centers and equipped with self-aligning antifriction bearings. The charging table and the furnace rolls, which are 5½ inches in diameter, are driven by a 3-horsepower 60-cycle 3-phase 440-volt motor through a gear reduction and variable speed drive. Rolls in the last 12 feet of the furnace also are equipped with a 3-horsepower 230-volt direct-current variable-speed drive to permit an increase to 60 feet per minute and making for fast discharge from the furnace.

Furnace temperature control is divided into four zones, making it possible to bring the steel progressively up to the desired heat. Each zone is provided with a Brown indicating potentiometer-type controller and a 4-point temperature recorder for checking purposes. As a safety measure, two thermocouples are provided for each control instrument. Four motor-operated 3-position A.T.C. control valves regulate the air and gas supply. Artificial gas is used mixed with air supplied by a motor-driven blower. Operating costs are exceedingly low.

All control instruments, the controller for the furnace runout table and the starting switch for the main furnace drive are all mounted on a pulpit adjacent to the discharge end of furnace and in front of the pressure quench system. This same pulpit also serves as the mounting for a push-button switch for operating the discharge door hoist, a push button for operating the air blower, a time clock with an alarm and reset feature to permit timing of the quenching operation, a quench tank water valve and a valve for operating the hydraulic mechanism of the quenching press.

The steel comes out of the furnace at a predetermined hardening temperature which is dependent upon the type of

Fig. 3—Details of pressure-quench spray equipment. Overhead manifolds supply quenching water to the upper or stationary platen just above the roller table. A similar platen is forced up between the rolls hydraulically to hold the steel while it is being quenched. Note lugs extending down from upper platen. The plate is held between these and a similar set which rise from the lower platen. Lugs afford clearance necessary for the spray jets



steel being processed and its thickness. Rate at which the material is fed through the furnace also depends on these factors. The steel emerges from the furnace perfectly flat although it may have been warped when it arrived from the mills. This flattening process is attributed to the slight working given the steel as it passes from roll to roll at high temperature.

The furnace is loaded so that one "platen-full" of steel will reach the 12-foot speed-up section of the hardening furnace roller table at the same time for transfer to the pressure quench system.

The pressure quench system consists essentially of a spray booth equipped with a roller hearth conveyor for conveying the material into and out of the quenching area and a press for holding the plate during the quenching process.

The spray booth is of steel plate construction reinforced with structural members mounted across the width of the booth. The quenching press itself comprises an upper stationary platen with projecting lugs against which the plate is pressed. The lower platen is mounted on a moving platform which is actuated by a hydraulic cylinder supplied from a self-contained motor-operated hydraulic system. The hollow castings which comprise the platens are supplied with water under pressure which is forced out directly on the work through multiple spray nozzles drilled in the castings.

Pressure Platens Reduce Distortion

The material is conveyed into and out of the quenching area by independently driven motorized conveyor, rolls of which also are on 9-inch centers. Length of the table between the end of the hardening furnace and the quench is 5 feet 3 inches. Quenching area is 14 feet 3 inches or approximately the same as the fast-discharge area of the hardening furnace. The discharge table extending to the recirculating tempering furnace next in line is 15 feet long.

The table between the hardening furnace and the spray booth and the table between the spray booth and the tempering furnace are driven by a 3-horsepower 230-volt direct-current variable-speed motor with a reverse drive. For the purpose of caring for all possible contingencies, the quench and auxiliary tables are arranged for connection through clutches to the tempering furnace drive and to the runout drive of the hardening furnace. The quench drive, therefore, may be operated as a separate unit or synchronized with the furnace drives.

Flow of water to the spray nozzles is controlled by two air-operated diaphragm type reverse acting valves. Flow of air to the valve diaphragms is regulated by two 3-way solenoid valves actuated by a push button on the control pulpit.

The sequence of operations is as follows: When a platen-full of steel reaches the fast discharge end of the hardening furnace, the operator transfers it to the correct position between the two quench platens; the lower platen lifts it from the rolls and presses it against the upper platen; the .... turned on spraying both sides of the plate for an average of about one minute; the lower platen withdraws and the steel is discharged and ready for further treatment in the tempering furnace.

Time in the quench varies greatly, depending upon the gage of the plate and the analysis of the steel. The important feature of the platen-type pressure quench is that it holds the plate in a horizontal plane while it is being chilled through the critical zone. This prevents the distortion ordinarily resulting from the many stresses and apparent in the warping of steel not so held. Apparently all that is required is sufficient pressure to hold the plate, pressures employed by Atkins being about 60 to 70 pounds per square inch of platen contact area.

The continuous roller-hearth tempering or drawing furnace is of the recirculating type with the same tonnage capacity as the hardening furnace but with a maximum temperature rating of 1250 degrees Fahr. The working chamber is 6 feet wide and 40 feet long with 12-inch clearance above the rolls. The furnace is heated by two recirculating-type air heaters mounted on top of the structure. Each heater has separately fired combustion chambers equipped a 7900-foot-per-minute fan dri... 10-horsepower 440-volt 3-phase 60-cycle motor through a V-belt.

The furnace has an outside steel casing with a minimum lining of 7½ inches of brick and block insulation. Refractory-lined ducts for distribution of the hot air are located above the furnace arch and are equipped with dampers for manually controlling distribution of air. A longitudinal duct runs under the furnace rolls, resting on the bottom brickwork of the furnace.

Furnace rolls and also rolls of the tempering furnace discharge table are driven by a 10-horsepower 440-volt 3-phase 60-cycle motor through a gear reduction and variable speed drive controlled by a push button operated from a smaller control pulpit at the exit side of the furnace.

Temperature control is effected by a 2-zone control, one being equipped with an indicating controller and the other with a controller-recorder. Both are of the potentiometer type and actuate an automatic 3-position control valve mechanism for regulating the air flow to the burners. The control instruments, push buttons for the air blower and fan motors and the motors for the furnace drive mechanism all are mounted on the smaller pulpit mentioned above.

Purpose of the second furnace is to temper the steel to develop maximum ductility, ballistic properties and resistance to shock. The material, of course, is extremely hard and brittle after the first heating and quenching operation. Temperatures and time cycles employed in the tempering operation cannot be disclosed for military reasons but the same variables are encountered as in the hardening operation.

Pressure Quenched for Cooling

After the steel passes through the tempering furnace, it is again pressure quenched in equipment precisely duplicating that previously described. In this case, however, the pressure quench is used principally for the purpose of cooling the plate so that it may be handled immediately. At the end of the furnace line, the steel is checked for brinell hardness and then is ready for any further straightening that is necessary which is done on brake presses. Astounding as it may seem, in handling this type of material some pieces require no further straightening whatsoever and the overall reduction straightening is close to 75 per cent. This avoidance of distortion can be credited to the pressure platens which hold the plate flat while being quenched.

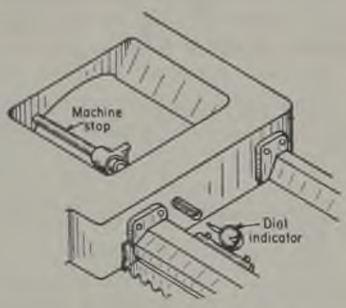
Atkins finds that some pieces cannot be held flat with the pressure quench nor can they be flattened on brake presses for the reason that some pieces are unequal in length from edge to edge as they come from the mills. This condition is overcome on a stretcher-roller designed by Atkins which employs a very narrow crowned roll with the degree of

(*Please turn to Page 135*)

Dial Indicator for Hand Turret Lathe

Addition of a dial indicator to the carriage of a hand turret lathe, enabling the operator to run the carriage to the correct testing, adjust the stop and set the dial indicator to zero has resulted in savings per machine which may amount annually to 225 hours each of machine and man-hours at General Electric Co.'s Fort Wayne, Ind., works.

Foreman Norman Bender of the



Fort Wayne Works suggested the idea diagrammed above because he saw that the "touch" of different operators varied and the regular machine stop would have to be reset by trial and error to suit each operator before good pieces could be obtained. Such guesswork resulted in the spoiling of about 1000 pounds of close limits for all operators regardless of differences in touch.

Locking System

For Threaded Inserts and Studs

WHEN THE STUD was first devised, engineers thought one of their major troubles had been solved. In practice, however, studs come loose. To solve this difficulty, a simple ring with serrations inside and out has been developed to lock the stud in place after installation by customary methods. See accompanying illustrations. Similarly, a threaded insert may be locked in place by the serrated ring.

The Rosan locking system, units of which are manufactured under license by Bardwell & McAlister Inc. at Hollywood, Calif., has many applications. The locking system can be adapted to any function performed by ordinary studs and inserts.

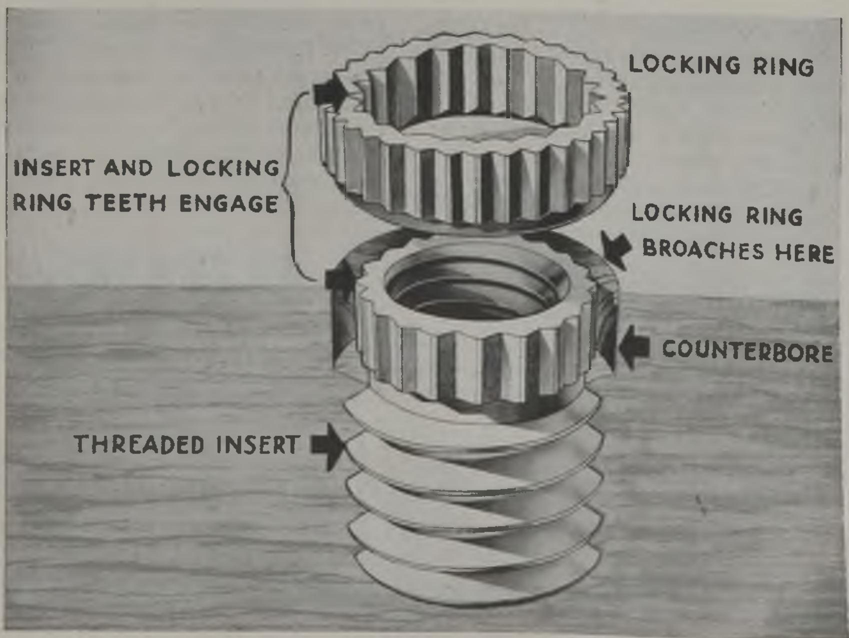
In a series of tension tests the insert has been demonstrated to be stronger than the bolt that is screwed into it when installed in magnesium alloy and aluminum alloy. In torsion, the insert has the advantage over the bolt, because the teeth in the locking ring which broach their way into the surrounding material create a connection of great strength. Other applications include drill bushings, spark plugs, plugging holes and electric terminals, to name a few. One form has been developed as a hydraulic or gas seal.

In original installations, the use of a threaded and locked insert permits a capscrew where formerly a stud was necessary. In service an insert can be installed in place of a stud which has pulled out, and a capscrew or similar stud used. Scrapping of castings and forgings necessitated by cross-threading or because the studs pull out is eliminated.

To install the insert, only a bolt, a lock nut and a hammer are required. For added efficiency, a threaded tool and lock nut to install the insert and a driving tool with which to force the ring in place have been made available.

To install the insert, drill counterbore and tap the material. Screw the tool into the insert and tighten the nut against the insert. Screw insert into the material, using a wrench on the nut, until the nut contacts the surface of the material. Loosen the nut and remove tool from the insert. Locate locking ring on top of insert. Drive ring into position with the drive tool, using a hammer or press. The ring falls automatically into place, and in production would be pressed, not hammered.

Installation may be made by using an ordinary bolt and nut to screw the insert into position and by using a hammer to drive in the locking ring.



This shows design and operation of locking system used with threaded insert. Locking ring broaches way into material, preventing threaded insert from unscrewing out of hole by engaging in splines of insert

Clear plastic block is used to show system of locking. Stud, center, is locked in place by driving locking ring, left, using hollow driving tool as at right

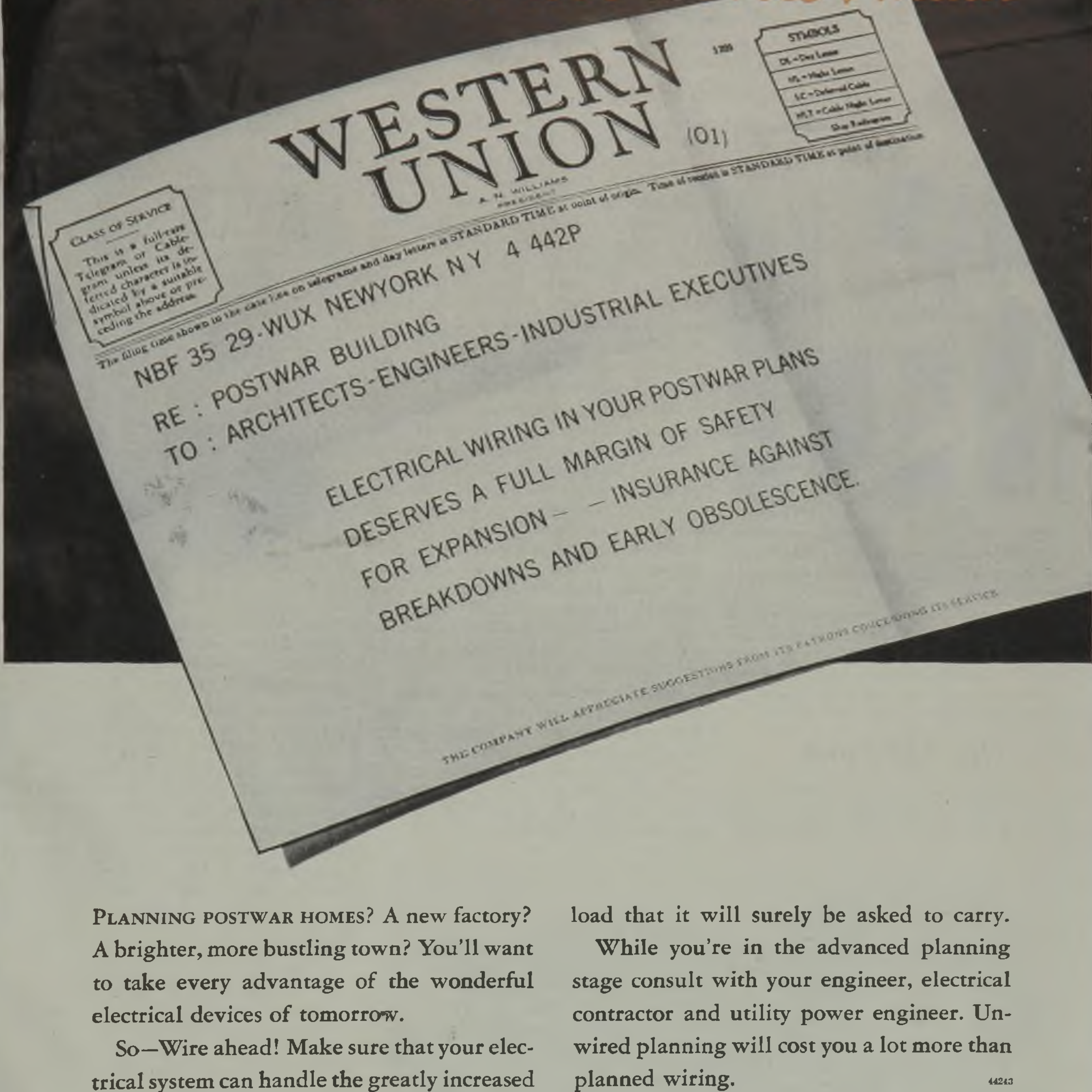
To remove the insert, drill to a depth equal to that of the serrations between ring and insert. Insert then is lifted out.

The stud resembles an ordinary stud, except for the portion equipped with teeth. It is installed like the usual stud, being screwed in until the top flange of the serration is flush with or slightly below the surface of the material. The ring then falls into place. With the special tool or a short length of bar steel bored to clear the stud, the operator drives the ring into place. Following are the steps in detail:

Drill, counterbore and tap material. Screw stud into material, locating upper surface of serrated flange flush with surface, or not more than 0.010-inch below. Drop the lock ring over stud and line up inner teeth of lock ring with teeth on the stud. Drive lock ring into place with drive tool until upper surface of lock ring is flush with upper surface of stud.

The stud may be removed by either of two methods: By milling to a depth equal to the thickness of the ring, with a hollow mill equal in outside diameter to that of the serrations between the ring and the stud, and unscrewing the stud; or by first sawing off the end and drilling with a pilot drill to the bottom of the stud. Then, drilling to a depth equal to the thickness of the ring, with a drill equal in diameter to that of the serrations between the ring and the stud is necessary. The stud then may be removed with an "easy out" tool.

IT'S ALWAYS *Wiser* TO *Wire Ahead*



PLANNING POSTWAR HOMES? A new factory? A brighter, more bustling town? You'll want to take every advantage of the wonderful electrical devices of tomorrow.

So—Wire ahead! Make sure that your electrical system can handle the greatly increased load that it will surely be asked to carry.

While you're in the advanced planning stage consult with your engineer, electrical contractor and utility power engineer. Unwired planning will cost you a lot more than planned wiring. 44243

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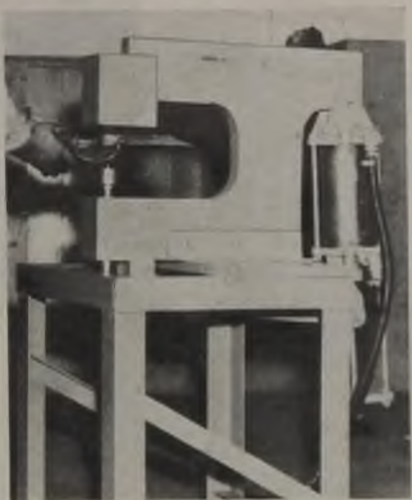
INDUSTRIAL EQUIPMENT

Piercing Machine

Designed and built by the American Central Mfg. Corp., Connersville, Ind., a pneumatic piercing machine has speeded the accurate trim of stamped collector ring sections prior to welding.

Applied to the juncture of a port branch and the main ring, where a saw



cannot turn, the piercing machine punches out a perfect radius while maintaining a 3/32-inch edge flash for welding purposes.

Ten tons of pressure applied to a standard wave cut punch pierces the 0.050-inch stainless steel for collector rings. A spring stripper which clears the punch also acts as a gage to insure an even flash edge margin.

Ram-Type Bed Turret

A hexagon bed turret, available with power feed or hand feed only, now is supplied on the 13 and 15-inch Regal lathes, it is announced by R. K. Le Blond Machine Tool Co., Cincinnati. The turret, 9 inches across faces, contributes to a considerable life in alignment and accuracy. It is a 6-station head, supported on double, preloaded, adjustable precision roller bearings, rolling on a large bearing face. The bearings automatically are indexed to the next station when the ram is returned against the indexing trip by the pilot wheel, or it can be spun by hand to any face of the turret in either direction.

The forward feeding motion of the ram is disengaged automatically when the stop screws move against the trip. The total length of travel of the ram with either hand or power feed, is 6¼ inches. The face dimensions of the turret are 3¼ x 4½ inches. The bored hole in the face is 1 inch. Drive for the turret apron is taken from the feed rod, thus the full range of feeds (0.0025 to 0.144) is available and selected quickly by the quick change feed box.

The saddle casting takes the same bearing on the ways as the tailstock. The turret lock bolt has hardened and ground flat taper faces on both sides to hold the turret on center. When wear occurs, the bolt moves forward freely and seats solidly like a wedge, without lifting the turret. A clamp is not necessary to hold the ram when the tools are feeding into the work. However, the ram can be clamped against backward movement when a center is placed in a turret hole and the lathe is used for turning instead of exchanging the turret for tailstock.

Holes in the turret can be bored to customer's specifications up to 1 inch. The turret will take No. 2 tools projecting 9½ inches. The distance from the end of the spindle nose to the face of the turret with the end of the saddle flush with the end of the bed on a 6-inch bed lathe is 40 inches.

Removable Overarm

Benchmaster Mfg. Co., 2952 West Pico, Los Angeles, has developed a removable overarm that will greatly increase the versatility of combination, horizontal and vertical milling machines. Consisting of three parts, this removable overarm makes it possible to use a regular milling machine arbor in a horizontal mill. It is readily mounted on the ma-

chine by removing the driving pulley from the rear of the horizontal spindle, slipping out the spindle itself by releasing two accessible screws.

A heavy semisteel casting is mounted on the horizontal spindle which holds a precision-ground stress-proof overarm carrying the outboard support. This particular attachment is desirable in that it is easily attached to the machine and at the same time creates extra rigidity and support for arbors, boring bars and special tools. The attachment can be used on old as well as new machines.

Grinder

A new heavy-duty chip breaker and diamond finishing grinder is announced by Hammond Machinery Builders Inc., 1611 Douglas avenue, Kalamazoo 54, Mich. Known as model CB-76, it is designed for accurately grinding chip breaker grooves and for precision finishing of all single-point carbide-tipped tools requiring smooth, sharp cutting edges. It features a newly designed any-angle vise as standard equipment that will handle all types of box and single point tools up to 2 inches (and larger if required). The any-angle vise has universal adjustments and the dials are of the direct-reading type.

The diamond finishing grinding (left side of illustration) is designed for use of either a 6 or 7-inch diameter cup wheel. The tilting table assembly is moved in and out by screw adjustment which

(All claims are those of the manufacturer of the equipment being described.)