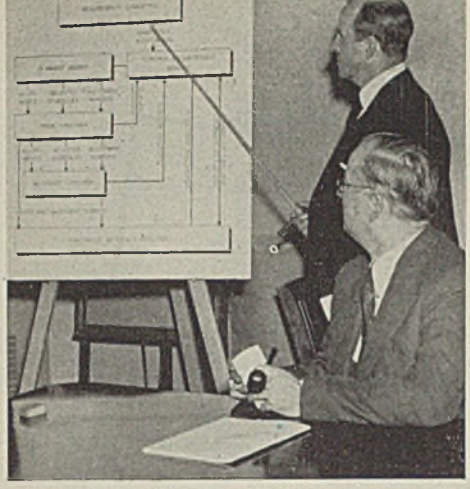

WPB Chief explains new control system to gear production to materials supply, p. 42

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Volume 111—No. 19 STEEL *November 9, 1942*

NEWS

FEATURES

TECHNICAL

PRODUCTION

MARKETS

YOU HELPED RENAME HIM A WAY-FINDER*

..by giving him jobs like these:

A COMPLETE SHUT-DOWN of a 300-man department working on bomber parts took place when the main service cables burned out one afternoon. Local stocks of cable of this size and type were exhausted—factory delivery was a matter of several weeks!

But the GRAYBAR Man you appealed to remembered that cable of the same size, though a different type, was being used in production quantities by another plant 30 miles away. He arranged to *borrow* enough of the cable to meet the emergency, and made the 60-mile drive to procure and deliver it to a waiting repair crew. When the night shift arrived, production was again ready to roll.

TO BUILD MORE SHIPS to beat the Axis, an Eastern shipyard needed more light for night work. 232 large floodlights had to be on the job with only a fortnight to go! Factories making floodlights were jammed with priority work. Warehouse stocks were touching bottom.

Finally, one of GRAYBAR'S Outside Lighting Specialists came through with a tip: a professional ball park in another city had a supply of floodlights that would fill the bill; lights previously purchased to illuminate their playing field which currently could not be installed. Once the greater need was explained, the lights were released for immediate shipment to the East . . . via GRAYBAR. They were delivered 5 days ahead of schedule.

***HERE'S HOW GRAYBAR "WAY-FINDER" SERVICE HELPS MEET YOUR ELECTRICAL NEEDS.**

1. AID ON WHAT TO ORDER . . . GRAYBAR "Way-Finders" keep well informed on delivery conditions, and can suggest practical substitutes for unavailable items.

2. AID ON HOW TO ORDER . . . GRAYBAR "Way-Finders" try to keep abreast of priority rules. Often, they can outline steps that save time and reduce "red tape".

3. AID IN "SHOPPING" FOR SCARCE ITEMS . . . GRAYBAR "Way-Finders" know where to go, whom to wire, to expedite inquiries that may bring to light the things you need to keep war work rolling. In an emergency, a network of over 80 branches speeds this job.

4. AID AS TO WHO MAY BE ABLE TO MAKE IT . . . GRAYBAR "Way-Finders'" knowledge of the products and facilities of more than 200 suppliers often brings to light possible sub-contractors or supply sources for special products.

GraybaR

IN OVER 80 PRINCIPAL CITIES

Everything Electrical . . . . THAT IT TAKES TO WIN!

GraybaR QUALITY SINCE 1869 *REG. U.S. PAT. OFF.

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

HIGHLIGHTING

this issue of STEEL

MATERIALS Closer control over raw materials to balance production and available supplies and to insure that first things come first is the aim of WPB's new Controlled Materials Plan (p. 42). It gradually will replace the priorities system and the Production Requirements Plan and is designed to eliminate the weaknesses of the earlier controls which permitted supposedly valid orders for materials which were nonexistent. . . Meanwhile, companies operating under PRP have been warned that applications for first quarter materials (p. 44) should be filed promptly. . . A compilation of what is being done by the petroleum industry to conserve alloy steels and other critical materials reveals a number of interesting suggestions which offer possibilities of value to those engaged in construction work (p. 92). . . Fifty charts (p. 96) present data on the latest NE steels, the 9500 and 9600 series. Each chart affords direct comparisons between three or four steels.

LABOR Pattern for deferment of industrial workers is contained in the "Manning Table Plan" released last week by the War Manpower Commission (p. 48). . . Penalty fines for striking steelworkers have been denied (p. 48) by the National War Labor Board. . . September steel payrolls established a new record (p. 48) exceeding the previous peak by $5,000,000. . . Foundry equipment manufacturers considering war problems (p. 69) were told that a pressing problem in the future will be manpower and that opportunity is offered to sell temporary employes on the value of private enterprise. . . Necessity is requiring the employment of more women in war plants (p. 73), for office and factory work.

TIMELY TOPICS Result of last week's elections is viewed by E. L. Shaner, STEEL's editor-in-chief, as a swing of the pendulum from the left to a more central position, as to social and individual rights of the citizen (p. 41).

Lend-lease has become a pool into which the United Nations are throwing whatever they have to offer and no longer can be considered simply as an outflow from the United States to our allies (p. 52).

How the city of Muskegon, Mich., fared through many vicissitudes since it was the "Lumber Queen of the World," to emerge as a great business community with well diversified industry is told in Mirrors of Motordom (p. 59).

Chrysler Corp. has introduced assembly line methods (p. 74) for the processing of War Bonds bought by employes (p. 74).

Successful development of training planes for the air forces from substitute materials such as plywood and plastics is discussed in Wing Tips (p. 62).

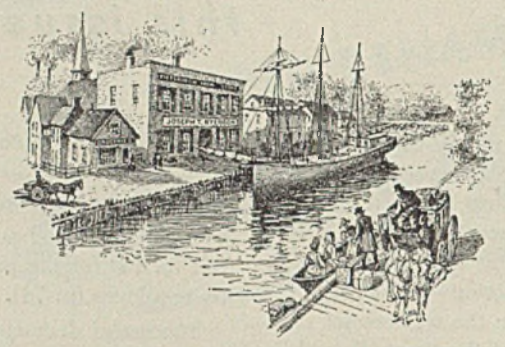
PRODUCTION After continuing at 99 per cent of capacity for three weeks, steel ingot output last week declined ½-point, due to need for repairs (p. 45). . . Carnegie-Illinois Steel Corp.'s furnaces in October produced more iron and steel than at any prior time in their history (p. 45). . . War Production Board presents an interesting series of charts showing progress in production and other war activities in Great Britain (p. 47).

TECHNICAL M. T. Ludwick outlines the important industrial applications of indium, one of the few unrestricted metals. Combined with silver in a plating process, it provides excellent resistance to wear and corrosion, inhibits fatigue and friction, imparts a lustrous finish. Details of an outstanding processing line are included (p. 80).

Some of the many important industrial uses for the spectrograph in steel plants are described by Charles C. Nitchie (p. 82) as he explains construction and operation of recently developed laboratory equipment of this type.

Molybdenum, an alloying element placed in the spotlight by war's demands, has its properties and uses, methods of detection and analysis, world production figures and its future analyzed (p. 86). Its growing importance can be judged from the 22,000 pounds produced in 1900 compared to 40,000,000 pounds in 1940.

H. P. White relates how one company successfully converted to 100 per cent war production work by changing over the design of its product to meet the specific needs of new and special war-time applications (p. 113). A wide-awake engineering staff developed many new types of fasteners for aircraft, tanks, jeeps to replace output formerly taken by automotive, refrigerator and similar peace-time industries.



RYERSON

Founded in 1842

Completes One Hundred Years of Steel-Service

One hundred years ago, on a bleak October day, Joseph T. Ryerson set out from Philadelphia for the West. On November 1, 1842, after nine days' travel by train, stagecoach and lake steamer, he arrived in Chicago, a small town of about 6,000 and set up his little iron store—the first west of Pittsburgh—and started a business which was destined to grow to be the largest steel warehouse organization in the world.

Through a century of peace and war—good times and bad—Ryerson has proved a prompt, reliable source for steel of dependable quality. From the pioneer establishment of 1842, has sprung a network of ten great steel-service plants, strategically located to serve the principal industrial areas.

Today the Ryerson organization is in the thick of the war production effort. Emergency calls are coming in for steel to open up production bottle necks and to maintain and repair over-worked plants and equipment. The skill which a century of experience has taught is now under constant pressure to make the *best use* of available stocks.

With this background of service to America, and looking forward to its second centennial, the Ryerson Organization pledges every resource until this war is won.

JOSEPH T. RYERSON & SON, INC.

STEEL FOR IMMEDIATE SHIPMENT

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STEEL
November 9, 1942

The Pendulum Swings Back

As this is being written, the experts are trying to interpret the outcome of last Tuesday's elections. Practically all agree that the gains won by the minority party are more substantial than can be attributed to the normal apathy of an off-year election. They feel that something of deeper significance is involved.

Most of the analysts seem to think that the vote is a protest against the way the war effort is being handled. Many contend that the vote reflects the people's resentment against the tardiness with which the administration has tackled major war problems. Some say it represents a revolt of the farm population against the administration's favoritism toward union labor. Others explain it as a widespread repudiation of machine politics dominated by bosses and gangs in big cities.

Dozens of similar explanations are being offered. Probably all of them had a bearing upon the outcome of the elections. But possibly there is a more basic factor—a principle which underlies all of these specific protests. Ever since 1933 the tendency in Washington has been toward a greater emphasis on a strong central government. The administration has tried to justify every new grant of power on the ground it was necessary to permit the government to provide adequately for the social needs of the public. Long before the war had imposed its burden upon Washington, the administration had gone so far in building machinery to administer to man's social needs that it had begun to trample upon man's individual rights.

Thus the present administration has been in the process of destroying the fine balance which the constitution provided for man's social and individual needs. Is it not possible that the protest vote of last Tuesday is in reality the reflection of an instinctive feeling on the part of the public that the pendulum had swung too far to the left and that it should be pushed back toward center?

E. L. Shaner
Editor-in-Chief

New Control Plan To Fit Output to Raw Materials

CMP to allow only as many orders as there are supplies available to fill them. Will gradually replace priorities system. Steel, copper and aluminum first metals to be affected

BALANCING production schedules with the limited supplies of raw materials available will be the aim of the latest control program of the war production agencies.

The program, called the "Controlled Materials Plan", is characterized by WPB Chairman Donald M. Nelson as "the most important thing the WPB has done to insure that first things come first" in the war effort.

CMP essentially is a system of controlling production in terms of raw materials. Each quarter, beginning April 1, WPB will parcel out to seven "claimant" agencies—Army, Navy, Maritime Commission, Aircraft Scheduling Unit, Lend-Lease, Board of Economic Warfare and the Office of Civilian Supply—an allotment of steel, copper and aluminum. The agencies must keep all production within these raw material allotments.

While steel, copper and aluminum are the only three materials under the plan at present, others will be drawn in later.

CMP gradually will replace the priorities system, including the Production Requirements Plan. CMP is designed to eliminate the weaknesses of the earlier control systems by limiting the number of orders to the supplies to be distributed.

The earlier systems, according to one WPB member, "sold more tickets than there were seats in the theatre . . . Now there won't be any more tickets than seats."

Announcing the plan at a Washington press conference last week, Mr. Nelson explained the three urgent demands for raw materials which make control of production essential to the war-time economy.

First, he said, munitions production must be scheduled according to urgency of need for the war effort.

Second, the civilian economy must be kept on a sound basis.

Third, the United States must supply war materials for other United Nations.

In view of these demands, the WPB chief said, "if we had 150,000,000 tons of steel, it wouldn't be any more than enough to do the job in the short time we have. Therefore, the WPB needs the best possible system for raw material control, and I hope the CMP is that plan."

The CMP establishes a vertical allotment system of distributing materials where the PRP was on a horizontal basis.

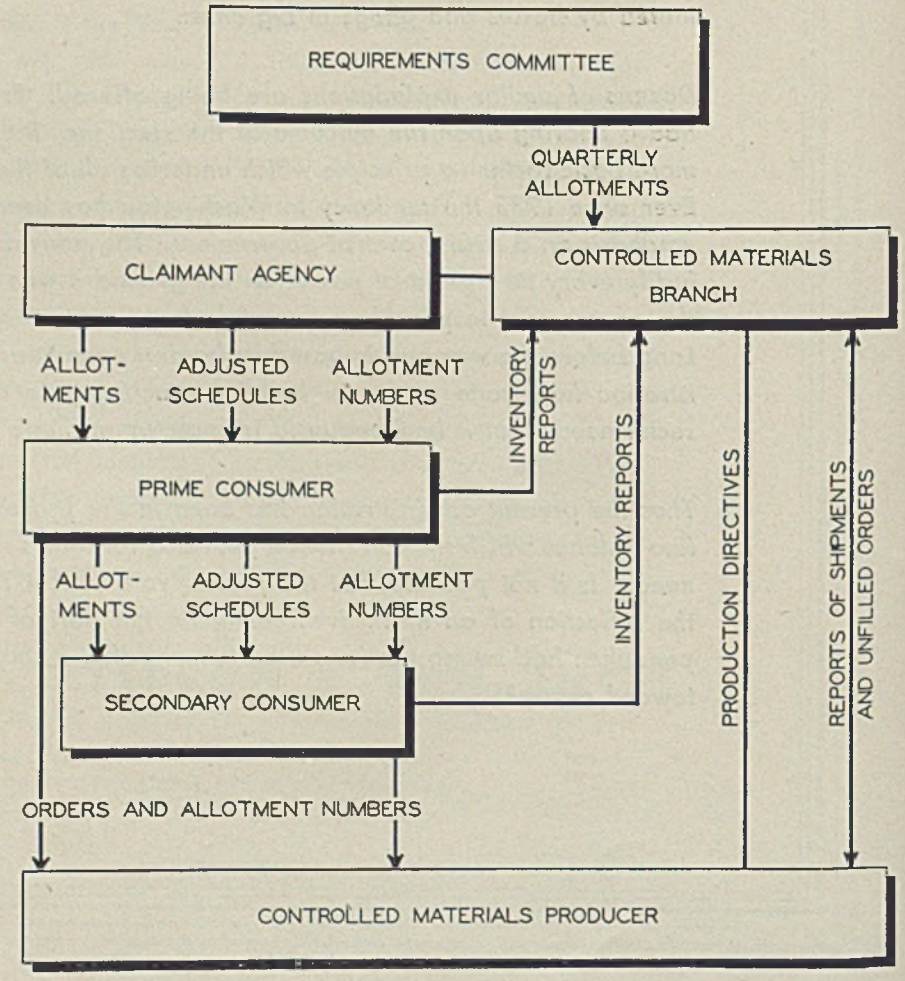
Under PRP each firm, large or small, prime contractor or subcontractor, submits his own requirements to WPB for approval, and receives an individual authorization to obtain materials.

Under the CMP, prime contractors will prepare and submit a breakdown of all materials required for the approved end-products on which they are working. The breakdown will comprise a "Bill of Materials" specifying not only what materials are required, but when they must be received to carry out the authorized program.

In making up his bill of materials, each prime contractor will include both the materials he puts into production himself, and those needed by his subcontractors and their suppliers. The bill of materials will cover requirements not only for controlled materials but also for other scarce materials listed in the outline of the plan.

The bills of materials obtained from prime contractors will be assembled by

FLOW OF ALLOTMENTS FOR SUPPLY



To illustrate how the Controlled Materials Plan will work, WPB produced these charts, "Flow of Allotments for Supply", right, and "Flow of Requirements for Demand", see facing page

each claimant agency and submitted to the WPB Requirements Committee, and to the respective Controlled Materials Branches, which will make the necessary adjustments to bring the whole program into balance with available supplies.

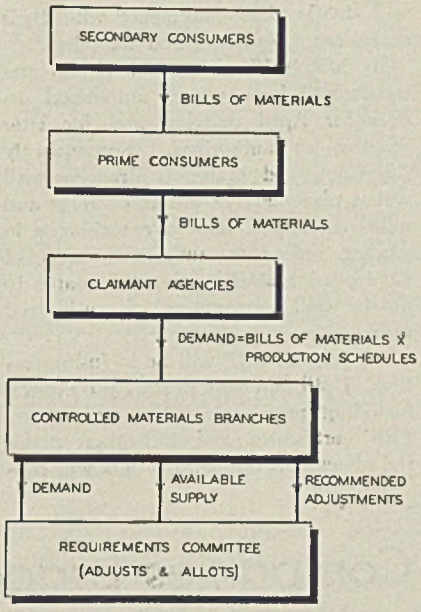
Each claimant agency will break down its submission of requirements into materials for (1) production; (2) construction and facilities; (3) maintenance, repair and operating supplies. Requirements for construction and facilities, including industrial machinery and equipment, will be channeled through the Construction and Facilities Branch of the Office of Program Determination.

When requirements have been brought into balance with supply and the programs of the various claimant agencies are approved, the WPB vice chairman on Program Determination—who also is chairman of the Requirements Committee—will allocate, with the advice of the Requirements Committee, authorized quantities of the three controlled materials to each.

The claimant agencies, in turn, will distribute these broad allotments among prime contractors by means of "allotment numbers," which will constitute a right to receive delivery. The prime contractors will pass on the allotment numbers as necessary to their subcontractors and suppliers.

Materials other than controlled materials will continue to be distributed through the priorities system. Each company receiving an allotment number carrying an allocation of controlled materials also will receive a preference rating for use in obtaining other materials. A

FLOW OF REQUIREMENTS FOR DEMAND



preference rating accompanied by an allotment number will be higher than other ratings of the same category, but will not take precedence over higher ratings. For example, AA-3, plus an allotment number, is higher than AA-3, without the number, but not as high as AA-2X. The preference ratings also will resolve conflicts which might otherwise occur in the production and delivery of manufactured items.

In order that sufficient amounts of materials in the form desired may be available, responsibility for directing the production of controlled materials rests in the Controlled Materials Branches of WPB. For instance, the Iron and Steel Branch is responsible for steel, and the Copper Branch for copper. "Production Directives," specifying the quantities and forms and shapes of material to be produced during a stated period of time, will be sent to most producers of controlled materials monthly. If orders beyond a specified capacity to produce are received, a producer must refuse them and notify the appropriate Controlled Materials Branch. If a consumer with an allotment number cannot place his order satisfactorily, he should appeal to and will be assisted by the branch.

It was explained that the aim of the plan is to use every bit of critical material in the place where it will do the most good toward winning the war. Each governmental agency participating in the plan, therefore, is being required to present programs for approval which will lead to the maximum production of the things needed most from the materials available in any given period of time.

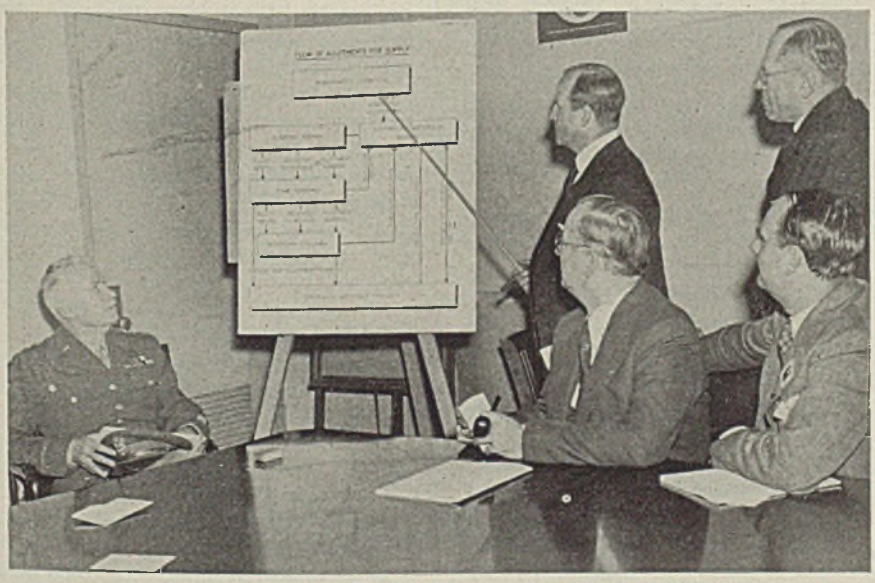
Each of the claimant agencies will be responsible for constructing a program making the best possible use of the materials allotted to it toward winning the war. At the same time, the plan provides centralized control over the division of materials among the agencies and appropriate accounting so that no agency nor contractor can over-draw its allotment.

Will Eliminate Nonessential Output

As CMP goes into effect, the job of cutting out all nonessential production, military and otherwise, will be completed.

Under CMP, each claimant agency will program the quantities of end-products —guns, planes, ships, railroad cars, bedsprings,—most urgently needed for each quarterly period. From the bills of materials for each of these items the agency will make up a consolidated estimate of its total requirements. These detailed estimates for the second quarter of 1943 must be submitted by Jan. 1, 1943. At the same time, similar estimates must be submitted for the remaining quarters of 1943 and the first quarter of 1944, together with general estimates for the first half of 1944, so that the Requirements Committee will have at all times a general picture of requirements 18 months in advance.

When the allotments are made by the Requirements Committee, they will be transmitted to prime contractors through the claimant agencies. Manufacturers working on items such as tanks, ships, aircraft, etc., which generally are contracted for by or through a claimant



Controlled Materials Plan was explained to the nation last week by a star-studded array of WPB, Army, Navy and other "claimant agencies" in Washington. Shown above, at a press conference are, left to right: Lieut. Gen. Brehon Somervell; WPB Chairman Donald M. Nelson; WPB Vice Chairman Ferdinand Eberstadt; and Rear Admiral Howard L. Vickery of the Maritime Commission. NEA photo

agency, and are called "Class A" products—will receive their allotment with an allotment number directly from the agency. Producers of a list of "Class B" products, such as generators, hardware, kitchenware, electrical appliances, parts frequently incorporated in other products, and civilian items generally, will receive their allotments from their WPB industry branches, which in turn will receive allotments through the Office of Civilian Supply.

Each claimant agency may allot for each month up to 105 per cent of its monthly allotment. This over-allotment is intended to stimulate increased production from producers of controlled materials. Claimant agencies also are authorized to make allotments for future quarters on the basis of declining percentages of allotments established for the current quarter. These percentages are: For the quarter immediately following the one for which a definite allotment has been made, 80 per cent; for the next following quarter, 60 per cent; for all later quarters, 40 per cent.

The plan will be flexible enough to permit limited amounts of material to be given out without allotment numbers. Special provision, for instance, is made for allotments of controlled materials to warehouses so that they may handle small orders without allotment numbers.

Time Table Provided

A new form of inventory control is to be established with the requirement that every primary or secondary consumer whose inventory of all controlled materials is in excess of a specified amount must submit an inventory statement showing his position at the end of each calendar quarter not more than 15 days later.

A time table for the transition from existing systems to full operation of the CMP is provided. The first bills of materials, will be assembled by the claimant agencies during November and December and on Jan. 1 the agencies will submit their first estimate of requirements to the branches handling controlled materials, with copies to the Requirements Committee.

By Jan. 15 the Controlled Materials Branches will have analyzed the requirements and made preliminary reconciliation to the extent possible between requirements and supply. At the same time, the claimant agencies and prime consumers will be developing information necessary in making final allotments, to be in readiness for distribution of allotments to them by the Requirements Committee.

On Feb. 1, the Requirements Committee will make allotments of controlled materials to claimant agencies for the second quarter of 1943. During February and early March, distribution of allotments will be made by claimant agencies to prime consumers, who in turn will divide their allotments with their secondary consumers and suppliers.

By March 15 users of controlled materials will have placed authorized orders for April delivery and for later months, as authorized. Subsequently the Controlled Materials Branches will watch placement of orders on mills and mills' shipments, and give assistance in placing orders to authorized users of Controlled Materials who are unable to obtain mill acceptance of authorized orders.

On July 1, CMP will be in full operation. Until that time existing precedures, including preference rating orders and PRP certificates and individual material allocations under M orders will continue in effect for consumers who have not been able to qualify under the new plan.

Those remote secondary consumers who have not obtained their allotments under CMP in time to meet requirements for the second quarter of 1943 will be authorized to continue purchases under PRP equal to their first quarter authorizations.

To prevent duplication, each company operating under PRP will be required to cancel authorizations made under PRP in equal amount for CMP allotments and the total authorizations outstanding at any time will not be permitted to exceed available supply. Orders bearing CMP allotment numbers will be given preference at mills over PRP orders and other rated orders not under CMP.

Companies Laggard in Filing PRP Applications Scored by Kanzler

AN EXTREMELY serious situation faces the many firms operating under the Production Requirements Plan which have not yet filed applications for the first quarter of 1943, according to Ernest Kanzler, Director General for Operations.

Tabulation of requests for material to be used during the first three months of next year started Nov. 5, and those firms expecting to operate under PRP whose applications were not received by that time may find that it will be impossible to include their requirements in the tabulation, and therefore they may not obtain the materials they require.

Mr. Kanzler said laggard firms not only were jeopardizing their own operations but were seriously hampering the war effort as a whole.

Priorities Regulation No. 11 as amended, Oct. 3, set Oct. 25 as the dead-line for filing PRP applications for the coming quarter. Those who failed either to apply or to request extensions of time by that date rendered themselves subject to penalty actions.

Mr. Kanzler also drew attention to two other provisions of Priorities Regulation No. 11, which are highly important to the orderly distribution of critical materials. The first of these requires that each PRP unit, not later than the fifth business day after the receipt of its PRP certificate for the fourth quarter of this year, or not later than Oct. 10, whichever is later, must adjust its outstanding purchase orders to the amounts and preference ratings authorized on the certificate. The other provision of Regulation No. 11, which Mr. Kanzler pointed out, is one prohibiting PRP units which did not file their applications for the first quarter of 1943 by Oct. 25 from extending any ratings, available under their current certificates, until such time as they shall have sent in their requests for the coming quarter.

The extreme tightness of all critical materials was reflected in Mr. Kanzler's statement that applications for supplementary assistance filed on PD-25F can be considered only for (1) minor adjustments between quantities of different materials authorized to a PRP unit and, (2) for additional material only if receipt of new war contracts makes this essential. No adjustments can be made in cases of firms which underestimated their requirements or whose rate of consumption for any reason, other than a new war contract, is greater than was expected.

All material authorizations for the fourth quarter were based on the findings of the Requirements Committee, and there remain only minimum stocks for emergency situations.

Total new construction in the continental United States amounted to $10,500,000,000 during the first nine months of 1942, compared to $8,000,000,000 for the corresponding period of 1941, according to the Department of Labor. War construction brought total for public work to $7,700,000,000, almost twice the volume of nine months in 1941.

Carnegie-Illinois Sets 22 All-Time Records

Furnaces of Carnegie-Illinois Steel Corp. in October produced more iron and steel than any month in the history of this United States Steel Corp. subsidiary. With individual all-time records, four blast furnaces and an electric furnace plant in the Chicago district contributed greatly to the output, 1,460,102 net tons of iron, and 1,936,489 tons of steel ingots and castings. Three blast furnaces and a merchant mill at the Gary works established new monthly highs.

At the South Chicago works, No. 1 blast furnace topped its best previous record of August, and the electric furnace department established three new records, representing an increase of almost 1000 tons over record in July.

Carnegie-Illinois steel men, harvesting 22 all-time records in furnace production alone, exclusive of all rolling mill operations, made it possible for the company to maintain melting activity at well above 100 per cent throughout the month.

Machine Tool Builders Asked To Reduce Production Time

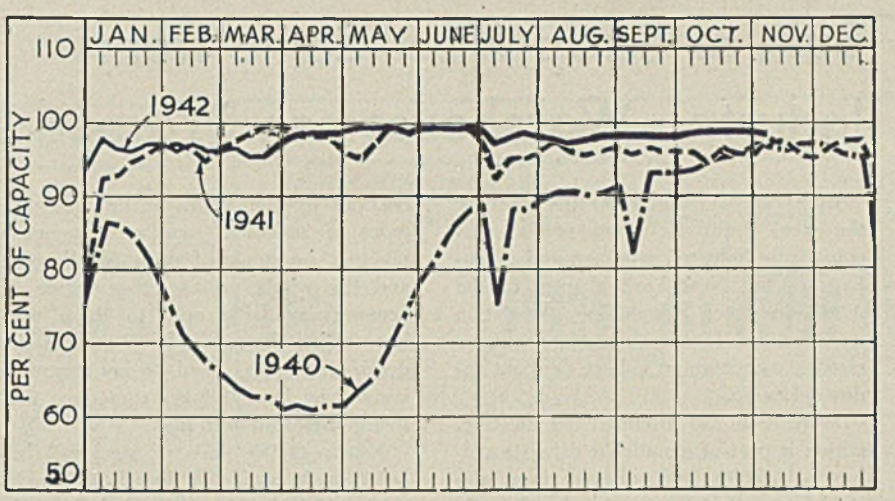
To fulfill developing requirements, machine tool producers last week were urged to cut overall production time by nearly a third by George C. Brainard, director, WPB Tools Division.

To do the job in time, he said, producers will have to distribute orders among themselves more evenly. Concerns with high backlogs will have to farm out work.

The current backlog on the books of machine tool builders alone is well in excess of $1,000,000,000.

"The nature of the machine tool industry," he continued, "is such that this backlog is not evenly distributed. One machine tool builder may be able to make delivery of a newly ordered tool in four months, while another builder of a comparable tool may have so many orders that he cannot deliver for 12 to 18 months. Obviously, the war will not wait for 18 months. Ways and means must be found to distribute the load. This means that orders will have to be transferred from one plant to another, to obtain earlier deliveries."

Mr. Brainard pointed out that the industry already has scored a noteworthy record of accomplishment. September production of more than $120,000,000 was almost seven times the normal peacetime output. Since the beginning of the year, production has advanced 40 per cent and is still climbing.



STEEL . . . . . DOWN

PRODUCTION of open-hearth, bessemer and electric furnace ingots last week dropped ½-point to 98½ per cent. Two districts advanced, nine declined and one was unchanged. A year ago the rate was 97½ per cent; two years ago it was 96½ per cent, both computed on the basis of capacity as of those dates.

Pittsburgh — Receded 1 point to 98 per cent as furnace repairs took off several units.

Wheeling — Gained 4 points to 81 per cent as additional open hearths were lighted.

Chicago — Down ½-point to 102½ per cent as open hearths were taken off for repairs.

Youngstown, O. — Advanced 1 point to 97 per cent, equal to the highest mark this year, with 77 open hearths and three bessemers active. Pig iron production is at the highest point in history with all 26 blast furnaces in operation.

Detroit — Off 1 point to 91 per cent of capacity.

St. Louis — Elimination of one open hearth for repair reduced production 1 point to 93 per cent.

Cincinnati — Three open hearths were out of commission part of the week, cutting output 4 points to 88 per cent.

Buffalo — Shutting down one open hearth for relining cut the district rate 2½ points to 90½ per cent.

Cleveland — Dropped 1 point to 97½ per cent as one interest slackened slightly.

Central eastern seaboard—With sufficient scrap, steelmakers held production at 96 per cent.

Birmingham, Ala. — An open hearth was taken off by Republic Steel Corp. at its Gadsden works, reducing the rate 6 points to 89 per cent.

New England — Necessity for furnace repairs cut the production rate 5 points to 90 per cent.

District Steel Rates

Percentage of Ingot Capacity Engaged in Leading Districts

	Week ended Nov. 7	Change	Same week 1941	1940
Pittsburgh	98	—1	99	97
Chicago	102.5	—0.5	101	97
Eastern Pa.	96	None	91	94
Youngstown	97	+1	97	92
Wheeling	81	+4	95	98.5
Cleveland	97.5	—1	93	86.5
Buffalo	90.5	—2.5	79	93
Birmingham	89	—6	95	100
New England	90	—5	90	85
Cincinnati	88	—4	87.5	94
St. Louis	93	—1	98	85
Detroit	91	—1	95	93
Average	98.5	—0.5	*97.5	*96.5

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

Heads Follansbee Steel

Lauson Stone has resigned as assistant to the president of Jones & Laughlin Steel Corp., Pittsburgh, to become president of Follansbee Steel Corp., John Follansbee, chairman, announced last week. Mr. Stone was associated with Jones & Laughlin for 23 years. In his new position he succeeds W. T. Brownscombe, who resigned because of ill health.

First two of fifteen 1500-horsepower motors for the War Emergency Oil Pipeline were recently shipped by General Electric Co., Schenectady, N. Y., five weeks ahead of schedule, company has announced. Since operation of the line is expected to begin in December, G-E is expediting production on other motors.

Bulk of Scrap Must Come from Industry, Warehousemen Warned

BETWEEN 70 and 80 per cent of the steel industry's scrap needs must come from industry, salesmen and executives of the New York chapter of the American Steel Warehouse Association were warned last week as they inaugurated a campaign to collect dormant industrial scrap.

More than 225 attended the meeting, which is part of a national drive to collect 2,000,000 tons of old iron and steel from industrial concerns by Dec. 31. Walter Ganong, Edgcomb Steel Co., Hillside, N. J., and chairman of the New York chapter of the association, presided.

While the value of household scrap was freely acknowledged, speakers emphasized that the bulk must be salvaged from industrial concerns. It was estimated that one-half of the production of vitally needed war materials depends upon scrap in one form or another.

Feature address at the New York meeting was presented by Lieut. A. J. Tucker, who was on active duty aboard the aircraft-carrier WASP when ste was sunk in Solomon Islands' waters. "I don't know how long it takes to collect 22,000 tons of scrap (the amount of Japanese scrap the marines are estimated to have piled up at Tulagi harbor and Henderson field, in the Solomons), but I do know," he said, "how long it takes to assemble that amount of steel into a big fighting ship, with an air group unexcelled, an internal organization, which has been cohered by the rigors of thousands of miles of steaming, months of gunnery practice, hundreds of drills of all sorts, and the whole possessing a degree of keenness available only to those who have sailed through a large part of the ocean war zones. And, to my sorrow, I know how long it takes to reduce that living organization to junk."

Nearly 60,000 tons of steel rail has been made available by the Pennsylvania railroad in recent months to help swell the supply of old metal needed for the war effort. The greater part of the rail was released as a result of relaying the main line trackage with new rail, much of it in heavier sections, in view of the greatly increased traffic. Some was recovered from side and yard tracks rendered unnecessary by changes in industrial conditions.

Lieutenant A. J. Tucker, U. S. N. R., and Walter S. Ganong, chairman, New York Chapter, American Steel Warehouse Association

Dies which the Pullman-Standard Car Mfg. Co., Chicago, used in building the nation's first streamlined trains have been scrapped in the company's campaign to clear its plant of dormant salvage that can be used in the war effort. Pullman plants have turned in 61,300 tons of metal in the continuous "attic cleaning" process carried on since last January. This includes 425 machines and pieces of equipment.

One of the nation's pioneer railway locomotive plants, built nearly 50 years ago by the Chicago & North Western railroad and used for the last 30 years as an instructional exhibit for railway engineering students at the University of Illinois, Urbana, Ill., has been scrapped by the university to aid the war effort. The machine weighs more than 20 tons. Based on ideas from this plan, the university built its own locomotive testing laboratory in 1912 and it is still in daily use.

5000 Tons Dormant Material Moved in Western Pennsylvania

In the first month of the scrap drive being conducted by the Industrial Salvage Section approximately 5000 tons of dormant scrap has been moved from industrial concerns in the Western Pennsylvania district. This drive, which is beginning to gain momentum, shows promise of excellent results in the near future.

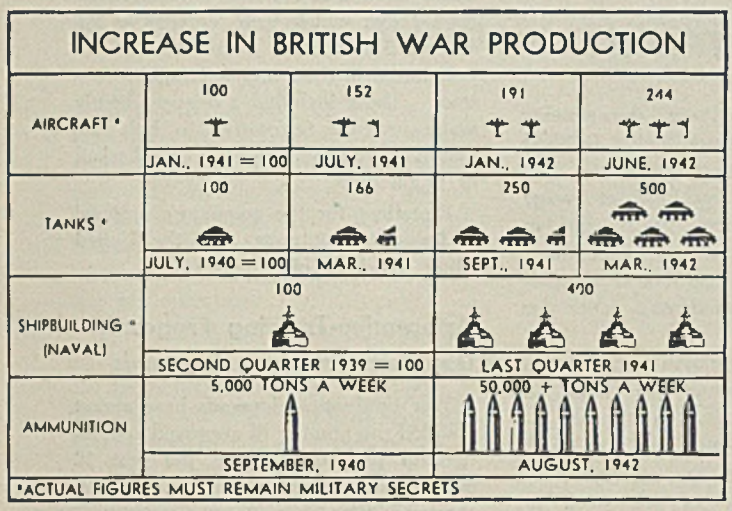
Under the system being installed, every industrial plant will be contacted by a volunteer worker and then will return monthly reports showing the amount of scrap moved. During the first month of the drive, 500 companies reported a total of 65,000 tons of scrap moved. The number of reporting companies is nearing 4000, which has been set as the approximate number of scrap producing concerns in the Western Pennsylvania district.

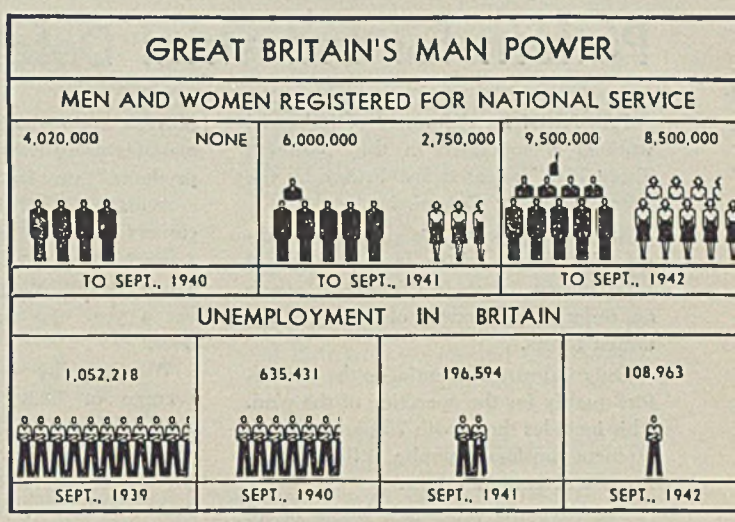
The drive has a dual purpose—first, to speed the movement of regular production scrap, and second, to seek out and bring to market dormant scrap. Because of the nature of the reports, it is difficult to indicate in every case how much of the scrap moved was dormant and how much production. During the last month, however, at least 5000 tons of dormant material, marked as such, moved into consumption and it is probable considerable additional tonnage moved which was not reported.

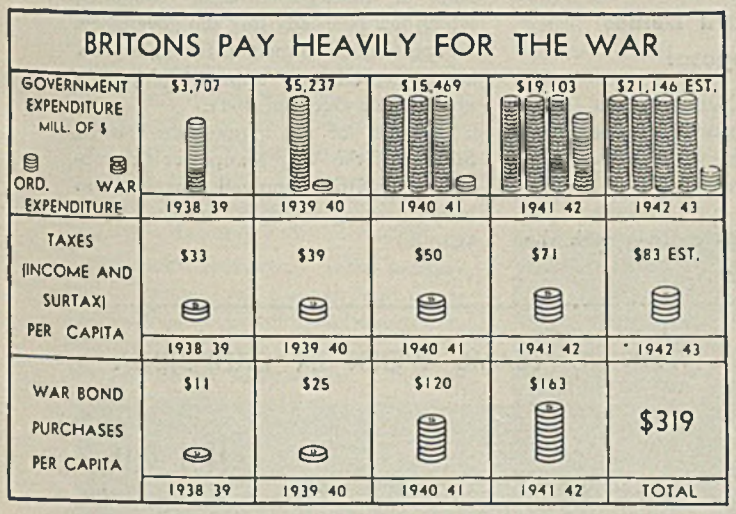
Horseshoe Output Quota Held to 75% of 1940-41

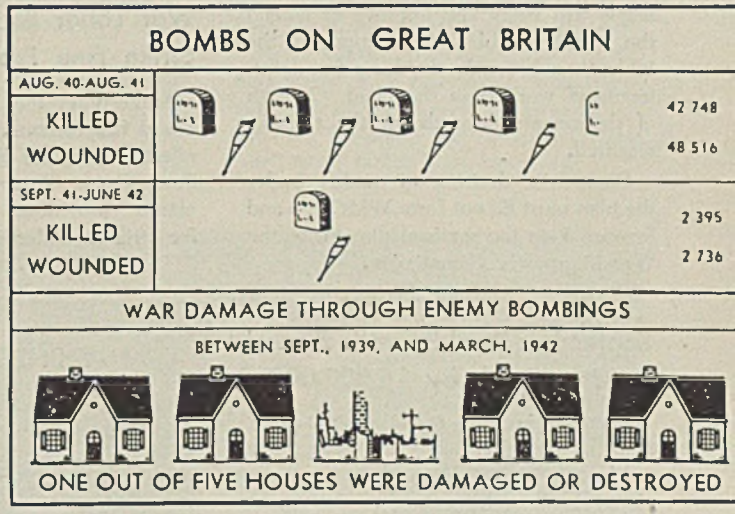
Despite a rising demand for horse and mule shoes, manufacturers have been limited to a production quota of 75 per cent of 1940 or 1941 output, whichever is greater. This is far under the amount asked by the Horse and Mule Association of America, Chicago. Minimum requirements to keep 12,000,000 horses at work, the association estimated, would by 100 per cent of the five-year average from 1937-41. Actually, they say, the increase in requirements may reach 150 per cent of the five-year average.

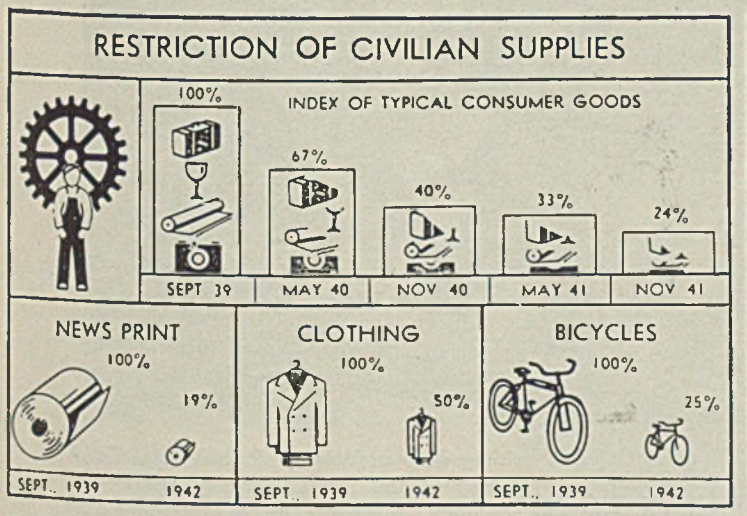
War Brings Profound Changes to Great Britain

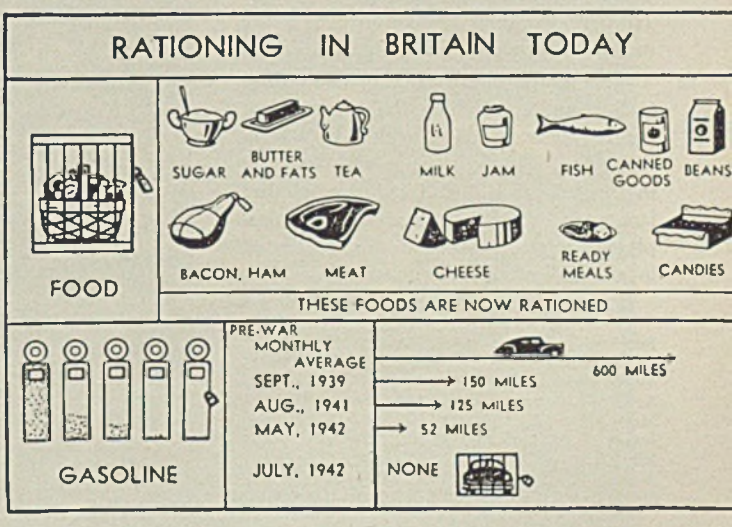












WHAT the war means to the people of Great Britain is illustrated by the above charts, released by the Labor Division of the United States War Production Board. In terms of war materiel production, mobilization of manpower, taxes, rationing and restrictions of civilian supplies, the sacrifices of the islanders is indicated. Almost every man and woman in England today is engaged either directly or indirectly in war work or is serving in armed forces; 18,000,000 registered for service in September

Manpower Commission Releases Pattern for Industrial Deferments

PATTERN for deferment of industrial workers is contained in the "Manning Table Plan" released last Friday by the War Manpower Commission.

Major purpose of the plan is to indicate the form in which employers should keep records of their workers to assure an orderly withdrawal of men for the armed forces.

Only industries essential to the war effort qualify for the operation of the plan. This includes those with 75 per cent government business, public utilities, railroads and certain others.

The Manning table is a listing of all jobs in a plant, describing the training required for each. Selective service officials will study and approve or amend the Manning table. After approval, the table then becomes the basis for deferments of workers in the plant. Length of deferments depends on the training required.

Companies desiring to qualify under the plan must fill out form WMC 500 and forward it to the regional director of the War Manpower Commission.

September Steel Payrolls Exceed Previous Peak by $5,000,000

Payrolls in the steel industry totaled $124,777,000 in September, nearly $5,000,000 more than the prior record in July, according to the American Iron and Steel Institute, New York. August payrolls stood at $118,718,000, while in September 1941, the industry disbursed $110,392,000.

Steel employment continued to drop in September, reaching the lowest point for the year to date, with 641,000 on the rolls. This compares with 647,000 in August and 652,000 in September last year. Monthly payrolls and employment since January are presented in the following table:

	Payrolls	Number of Employes
January	$118,785,000	651,000
February	108,563,000	651,000
March	116,998,000	653,000
April	118,568,000	654,000
May	117,403,000	656,000
June	118,067,000	659,000
July	120,671,000	665,000
August	118,718,000	647,000
September	124,777,000	641,000

"Factors contributing to the decline in employment include the effects of the draft and increasing emphasis on production of the so-called 'heavy' steels, with the result that fewer employes are required in departments manufacturing the more highly finished products," the institute reports.

Average hourly earnings of wage earners increased from 104.1 cents in August to 108.6 cents in September, a new record. Wage earners in September a year ago earned 98.2 cents per hour.

Wage-earning employes worked an average of 39.8 hours per week in September. This figure marks an increase over the average of 37.6 hours per week worked in August, and compares with 37.8 hours per week in September, 1941.

War Labor Board Denies Strike Fine Proposal

Majority of the National War Labor Board has recommended that the board reject a proposal by Jones & Laughlin Steel Corp., Pittsburgh, for a penalty clause providing for $1-a-day fine for strikers under its contract with the United Steelworkers of America, CIO.

The labor and public members of the board recommended that the same contract terms which were ordered in the United States Steel Corp. case be incorporated in the Jones & Laughlin contract. These included a 5½-cent hourly wage increase retroactive to Feb. 15, maintenance of membership and checkoff of union dues.

Precedent for the company's proposal is found in contracts with the United Mine Workers of America.

Apprentice-Training Programs Doubled by War's Demands

War production demands have almost doubled the number of approved apprenticeship programs during the past 12 months, according to Paul V. McNutt, chairman, War Manpower Commission.

The Federal Committee on Apprenticeship, a management-labor committee which has been advising the government on apprenticeship matters for eight years, has approved 908 apprenticeship programs since October, 1941.

Statistics of the Apprentice-Training Service of the War Manpower Commission show 1974 approved programs now in effect as against 1066 reported a year ago.

ALL-CHINESE WELDING TEAMS WORK IN CALIFORNIA

"WELDING TIGERS," an all-Chinese welding crew at Western Pipe & Steel Co., San Francisco, is the industrial counterpart of the famed "Flying Tigers" in China's service. A company official recently informed Lincoln Electric Co., Cleveland, that two additional Chinese crews had been formed, with the competitive spirit between each crew contributing to both quantity and quality of welding work. One of the factors which contributed to the success of the idea was said to be due to overcoming the language handicap that previously existed in mixed crews

Industry Branches Remodeled Under New Control System

REORGANIZATION of Industry Branches of the War Production Board, giving them greater strength, is being undertaken by the Office of Program Determination under the direction of Ferdinand Eberstadt, vice chairman, WPB, and Ernest Kanzler, director general for operations.

One of the major reasons for strengthening branches is to enable them to handle the additional burdens to be placed on them by the new Controlled Materials Plan announced last week (See p. 42).

To as great an extent as possible, each industry branch will follow a similar pattern. Many of the functions of the office of the Director General for Operations, not including the Bureau of Priorities Control, will be decentralized and assigned to branches, making them responsible for all operating phases such as the execution of programs, policies and procedures established for the resources assigned to branches. Branches will not, however, be responsible for policy, planning, co-ordination and supervision.

Permanent connection with industry will be maintained through active Industry Advisory Committees assigned to each branch. Claimant agencies—Army, Navy, Maritime Commission, Office of Civilian Supply, Lend-Lease, etc.—will assign permanent representatives to each branch. Permanent connection with labor also will be maintained through representatives assigned to each branch.

The pattern will apply to all material, product, facility or industry branches, although the detailed composition will depend on the individual branch.

Industry Advisory Committee assigned to the branch will endeavor to put upon a greater measure of responsibility for meeting war production problems. They will get advice from the industry on methods of increasing supply where shortages exist, of controlling the distribution of resources and of eliminating non-essential uses of resources. Likewise, they will obtain data on available and anticipated supply of resources and requirements for civilian use and for maintenance, repair and spare parts.

Resources, in this sense, include raw and industrial materials, processing and production capacities, facilities, tools, power and other items necessary to the production of end products, with the exception of manpower.

Representatives of government claimants in the industry branch will submit data on requirements for resources and advise and assist in apportioning the available supply in accordance with the determinations of the Requirements, Program Adjustment and Facilities Committees. Claimants, in addition, will assist in the processing of various forms controlling the distribution of resources.

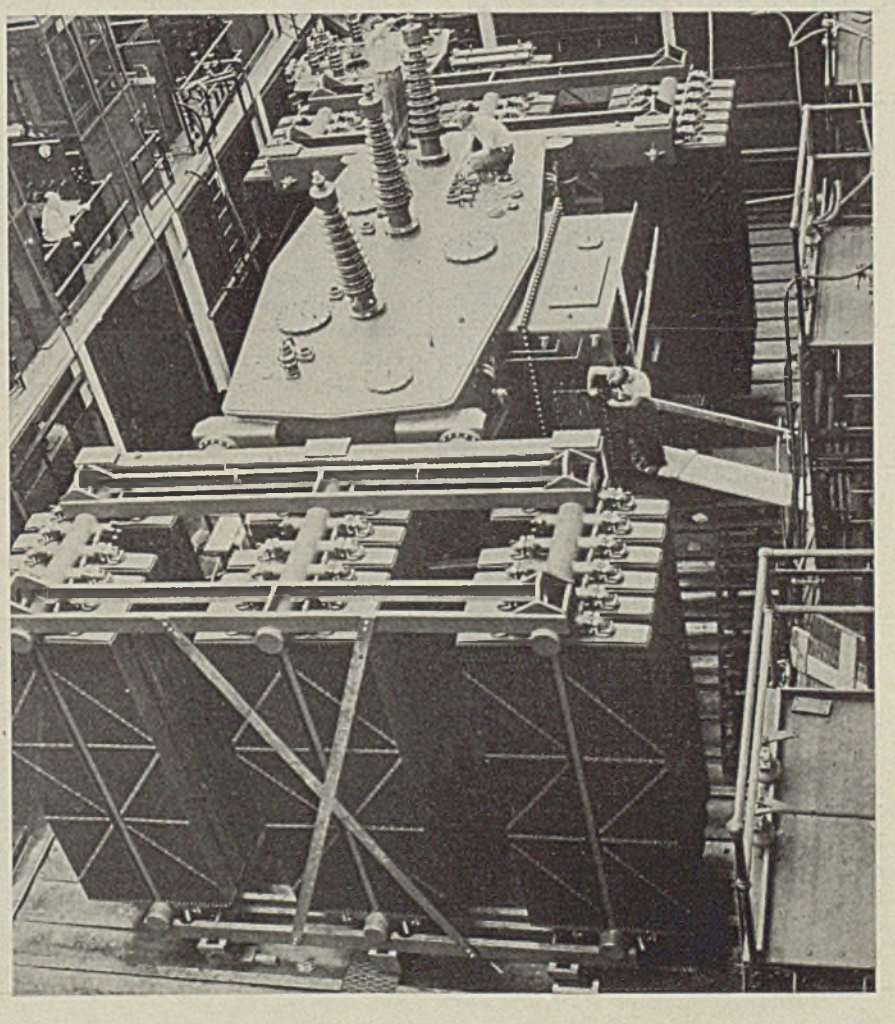
In effect, the permanently designated representatives of claimants in each branch will form and function as a subcommittee on resources and requirements under the chairmanship of the chief of the branch.

Methods by which branches will be assigned representatives of labor have not been finally determined but are being studied.

Under the present system, many of the staff functions of the branches are handled by bureaus and divisions under the Director General for Operations. To the extent that it is practicable these functions will be transferred to the branches, with the Office of the Director General supervising rather than executing.

STEEL SAVED IN BUILDING GIGANTIC TRANSFORMERS

TWO 257-ton electric transformers, each the size of a six-room house, have been built by Sharon Division of Westinghouse Electric & Mfg. Co. to power a new aluminum plant. Construction of the equipment, one unit of which is shown undergoing tests, required 188 tons of structural steel, 111 tons of "Hipersil," a special core steel recently developed by company, 130 miles of copper wire and 44,000 gallons of cooling oil. Unusual design made possible the saving of 40 tons of steel, four tons of copper and 6000 gallons of oil. New core steel carries one-third more magnetic flux than any steel formerly used for transformer cores



"Frozen" Steel Stocks To Form Basis for 15 Product Programs

REPORTS showing steel inventories on Form 1663 are being received by Steel Recovery Corp. in Pittsburgh at the rate of 10,000 per day. This form has been mailed to 200,000 potential holders of frozen steel inventories and to date half of these have been returned showing the amount of steel held, if any, and also the type.

Information gleaned from these reports by the three-headed agency, consisting of Steel Recovery Corp., the Steel Recovery Section of the Iron and Steel Branch, and the WPB Materials Redistribution Branch, will be used as the basis of 15 different product programs, all aimed at unfreezing steel now held by manufacturers in the United States.

All companies or persons holding any idle steel inventories which have been frozen as a result of any WPB order should by now have received a copy of Form 1663. The Steel Recovery Corp. has requested that anyone having steel who has not yet received the form write and ask for a copy, inasmuch as failure to report is now a federal offense.

Mailing has been on the first program covering stainless steels. All companies reporting stainless steel inventories soon will receive a copy of a report form on which they can list the inventory of this material they now hold, together with their willingness to sell. Within the next 90 days mailings will be completed on all steel products in the 15 groups, which include: (1) Carbon steel structural shapes, (2) carbon steel ingots, billets, blooms and slabs, (3) carbon steel forgings, (4) carbon steel bars, (5) carbon steel wire, (6) carbon steel plates, (7) carbon steel sheet and strip, (8) carbon steel pipe and tubing, (9) carbon steel castings, (10) alloy steel other than castings, (11) stainless steel other than castings, (12) alloy steel castings, including stainless steel castings, (13) tool steel, high speed, alloy or carbon in any form other than finished tools, dies and gages, (14) iron castings, (15) wrought iron.

As these completed forms are received by Steel Recovery Corp., they will be tabulated and analyzed. A force of steel salesmen will then attempt to bring the holder of this material and prospective buyers together so that sales agreements can be made. All WPB and OPA rules, including priority ratings, price ceilings, and limitation orders, will apply in the disposition of this material.

If the material is not in a form which can be used in the war effort, such as partially fabricated material, odd sizes, and the like, it will then be recommended for remelting. In such cases the government will purchase the material at a price between the value of the material as new steel and its value under OPA ceilings. Such scrap will subsequently be sold in the open market by the government at OPA ceilings and the loss will be absorbed.

Chief problem now confronting the triple agency is manpower. Offices have been established in Pittsburgh and equipped, but on some jobs only about 5 per cent of the required manpower has been hired. The primary manpower need is for steel salesmen familiar with products and buyers to aid in the disposition of material uncovered as a result of the questionnaires.

Returns show that approximately 400,000 separate inventories of material exist today, primarily in small quantities of less than 1000 pounds each, although in many cases, considerably greater than that. Replies on Form 1663 indicate that 22.7 per cent of persons replying have more than 1000 pounds of each item reported now in stock.

Steel Warehouse Deliveries Limited to AA-5 Ratings

Iron and steel warehouses, which for some time have been permitted to make deliveries on A-1-a and higher rated orders, have been instructed by the Director General for Operations to accept no orders rated lower than AA-5.

This action, taken to prevent the serious depletion of warehouse stocks of iron and steel products, is contained in Amendment No. 7 to M-21-b. The amendment lists the following exceptions to the above provision:

1. For essential repair and maintenance purposes, alloy iron and alloy steel can be delivered on A-1-k or higher rated orders. Such deliveries are restricted in any one quarter to 3 per cent of the warehouse's quota for alloy (including stainless) and tool steels, and 5 per cent of the quota for other iron and steel products (or 150 tons per quarter if that figure is greater).
2. Plate ends and short sheets, commonly known as wasters, can be delivered on A-1-k or higher rated orders.
3. Tubular products and wire rope can be delivered on A-10 or any orders which carry higher ratings.
4. Nails, bale ties and similar wire products, as well as roofing and siding sold primarily to the farm trade, can be delivered without a preference rating.

The amendment continues the provisions of the order which forbid delivery of carload lots from warehouse stocks, except in the case of mixed carloads. The amendment also adds a specific provision emphasizing the right of a warehouse to appeal where substantial deliveries, though less than carloads, would reduce its inventory to an extent which would hamper its ability to service the smaller requirements of many customers.

Organized Transportation Plans Required Under Rationing

To assure workers adequate means of getting to their jobs, certain industrial and other plants with 100 employes or more will be required to set up Organized Transportation Plans under nationwide mileage rationing, OPA has announced.

The Transportation Plan, in each case, will be organized under a committee, or individual, thoroughly familiar with transportation facilities around the plant, with distances employes must travel, their need for autos to get them to and from work, and their ability to share cars.

The committee, or official should be appointed by agreement between management and labor representatives.

Under the new OPA mileage regulations, this committee must review the applications of all employes at such establishments seeking more gasoline rations than the basic A book provides. Committee approval must be obtained before the application is submitted to a local War Price and Rationing Board.

Urging the affected plants to set up their transportation plans at once, OPA officials pointed out that local rationing boards will begin receiving applications for supplemental rations on Nov. 12. This means that transportation committees should be organized in the plants before that date.

Applications for Necessity Certificates Available

To expedite issuance of Certificates of War Necessity, application blanks are being made available at all district offices of the Office of Defense Transportation's Division of Motor Transport.

The application blanks are for the use of commercial motor vehicle operators who did not receive their application blanks by mail from the ODT central mailing office at Detroit.

PRIORITIES–ALLOCATIONS–PRICES

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

E ORDERS

E-6 (Amendment): Hand Tools, effective Oct. 29. Definition of hand service tools revised to cover following: metal working chisels, metal cutting files, machinists' ball pein hammers, metal cutting snips and shears, pliers of all types, metal working punches, screw drivers of all types, and all types of wrenches.

L ORDERS

L-23-c (Amendment): Stoves and Ranges, effective Dec. 26. Prohibits attaching of thermostats to cooking stoves.

L-117 (Amendment): Heavy Power and Steam Equipment, effective Nov. 2. Requires manufacturers to submit monthly reports covering existing production schedules and unfilled orders by the 15th of each month on form PD-665.

M ORDERS

M-9-a (Amendment): Copper, effective Oct. 30. Sales of brass mill and wire mill products prohibited, except on preference ratings of AA-5 or higher. All orders must be approved by WPB on form PD-59D. Toll agreements for processing of copper, brass mill or wire mill products do not require WPB approval, if the metal was acquired after June 30, 1942.

M-21-b (Amendment): Iron and Steel Warehouses, effective Oct. 30. Restricts deliveries to orders bearing rating of AA-5 or higher, except: for essential repair and maintenance purposes, alloy iron and steel can be delivered on A-1-k or higher; plate ends and short sheets can be delivered on A-1-k or higher; tubular products and wire rope can be delivered on A-10 or higher; nails, bale ties, and similar wire products, roofing and siding sold primarily to the farm trade, can be delivered without a preference rating.

M-40: (Amendment): Sperm Oil, effective, Oct. 27. Prohibits sale, delivery, and use, except when specifically authorized by WPB. Restrictions apply to armed forces, Maritime Commission and War Shipping Board only as to deliveries. Sales and use of 100 pounds or less per month are exempt, but sellers may not deliver more than 2000 pounds per month without authorization.

P ORDERS

P-55 (Instructions): Defense Housing Projects, effective Oct. 29. WPB field offices have been instructed to issue no new preference orders pending further allocation of critical materials for these purposes. No applications for reratings of outstanding P-55 orders will be processed with a rating higher than A-1-a.

P-110 (Instructions): Remodeling Projects, effective Oct. 29. WPB field offices have been instructed to issue no new preference orders pending further allocation of critical materials for these purposes. No applications for rerating of outstanding P-110 orders will be processed with a rating higher than A-1-a.

PRICE REGULATIONS

No. 204 (Amendments): Idle or Frozen Materials, issued Nov. 3. Establish maximum prices which Metals Reserve Co. and its agents, may pay for idle or excessive stocks of iridium, effective Oct. 20, at: $140 per troy ounce, f.o.b. National Bureau of Standards, Washington; $32 per contained troy ounce for other precious metals; $18 per contained troy ounce for palladium. If any lot of iridium scrap sold does not contain at least 10 per cent of iridium by weight, $25 shall be deducted from the purchase price of the lot; if content is less than 2½ per cent by weight of any class, $3 an ounce must be deducted from the price for that class. Baker & Co., Newark, N. J. will act as agent in buying iridium scrap materials.

Cadmium prices, f.o.b. plant of Udylite Corp., Detroit, effective Oct. 21, are on the basis of cents per pound of material: 95 for unused anodes, all shapes, and for cadmium oxide, dry and properly packaged; 94 for partly used anodes; 90 for pigs, slabs, bars, plates, sticks, pencils, rods, ingots, and all other "regular", straight, or flat forms. Price for cadmium is 35.00c per pound of cadmium contained.

Prices for copper-base alloy insect screening, effective Oct. 19, are: net price paid by the holder plus 10 per cent of the net price, f.o.b. cars and trucks, or if shipped by water, f.a.s. shipping point.

No. 246: Farm Equipment, effective Nov. 15. Establishes manufacturers' and wholesalers' prices for all items, except new ones, at levels prevailing on March 31, 1942. Permits adjustments of prices of items changed in design, specification or equipment since March 31. Price for new items are determined on the basis of labor rates and materials prices in effect on Oct. 1, 1941, and freight rates of March 31, 1942, and using the price-determining method used on Oct. 1, 1941.

No. 251: Construction of Buildings, effective Nov. 5. Establishes ceiling equivalent of those generally prevailing during March, 1942, adjusted for increases in labor costs between March 31, 1942, and July 1, 1942. Every contract entered into, excepting those of $500 or less, must be reported to the OPA within 10 days after the award.

No. 254: Small Firearms, effective Nov. 6. Establishes maximum prices for pistols, rifles, and other small firearms sold to civilians, police and defense forces. Prices are based upon the manufacturer's list prices of Jan. 10, 1942.

FINANCIAL

Jones & Laughlin Steel Corp.

Net income of Jones & Laughlin Steel Corp., Pittsburgh, and subsidiaries, for nine months ended Sept. 30, amounted to $7,470,186, compared with $12,040,384 in like period of prior year.

Provision for federal income and excess profits taxes was $17,000,000. against $9,031,475 in 1941. Third quarter net profit totaled $2,539,716, contrasting with $3,942,157 in corresponding 1941 quarter.

Colorado Fuel & Iron Corp.

Third quarter net income of Colorado Fuel & Iron Corp. and subsidiaries, Denver, totaled $400,250, after providing $539,100 for federal and state taxes. Net income in like 1941 quarter amounted to $679,164, after tax provision of $713,300.

Alan Wood Steel Co.

Nine months net profit of Alan Wood Steel Co., Conshohocken, Pa., totaled $519,044, after provision for federal and state income taxes based on the new revenue act. This compares with $791,214 in the corresponding period of 1941. Net income for third quarter was $130,191, after providing $238,000 for additional wages retroactive to Feb. 15 in conformity with National War Labor Board's order.

Sloss-Sheffield

September quarter net profit of Sloss-Sheffield Steel & Iron Co. totaled $333,-312, equal to $2.92 a common share, compared with $270,850, or $2.29 a share, earned in like 1941 period.

Nine months' net income aggregated $877,282, equal to $7.53 a share, against $1,134,314, or $10.12 on common, in corresponding period a year ago.

Republic Steel Corp.

Dividend of $1.50 per share on the 6 per cent Cumulative Convertible Prior Preference Stock, Series A, has been declared by board of directors of Republic Steel Corp., Cleveland. Dividend of $1.50 per share on the 6 per cent Cumulative Convertible Preferred was declared, payable Jan. 1, 1943, to stock of record Dec. 10. Dividend on common of 25 cents a share was announced, payable Dec. 21.

Continental Steel Corp.

Directors of Continental Steel Corp., Kokomo, Ind., have declared the regular quarterly dividend of $1.75 per share on the preferred stock, payable Dec. 20 to holders of record Nov. 20. Call of 7667 preferred shares on Jan. 1, 1943, has been authorized. Action on common dividend was deferred until Nov. 17.

Granite City Steel Co.

Granite City Steel Co., Granite City, Ill., reports net profit for nine months ended Sept. 30 as $405,108, after federal income taxes of $324,000. This compares with net of $203,032 in similar 1941 period.

Truscon Steel Co.

Truscon Steel Co., subsidiary of Republic Steel Corp., reported net profit for the third quarter as $244,746, after deduction for repairs and maintenance expense, provision for depreciation and federal income and excess profits taxes.

WINDOWS of WASHINGTON

Lend-Lease proving value as instrument of war. No longer considered simply outflow of United States materials, but as a pool to which all of the United Nations contribute a shore

LEND-LEASE has come a long way since the United States was at peace. Then it was purely a one-way mechanism through which the United States extended aid to those nations which we believed were fighting in our interests. Today, Lend-Lease is not simply an outflow from the United States. It is rapidly a pool into which all the United Nations throw whatever they have—men, weapons, food. Thus Great Britain provides labor, materials, ships and many other items. Russia throws five million men into the fight, Australia and New Zealand pour uniforms, labor, dairy products and other foodstuffs into the common reservoir.

Without the device of Lend-Lease the problem of financing the many transactions involved would be almost insuperable. Every day it is proving its worth as one of the principal instruments in fighting the war.

Another fine thing about Lend-Lease is that it provides the basis for arriving at an overall settlement after the war is over. The Lend-Lease agreements we have made with various United Nations stipulate that "the terms and conditions of the final determination of the benefits to be provided the United States in return for Lend-Lease aid shall be such as not to burden commerce between the countries but to promote mutually advantageous economic relations."

This means, as President Roosevelt explained it in his fifth Lend-Lease report to Congress, dated June 11, 1942, that neither the United States nor any other nation is going to get rich in this war at the expense of its allies. Sacrifice of lives and property, sacrifice by unremitting toil, are required on a large scale to win the war. The whole emphasis in Lend-Lease is on such sacrifice rather than on the money that is required to finance the war.

Broadly, anything that is essential for war is "lend-leasable". It may be tools or materials for the manufacture of implements of war. It may be bombers and guns for the troops in the various theaters. It may be food and supplies for soldiers and sailors. It may be food, clothing and medicine needed to keep home fronts healthy.

The sixth report to Congress on Lend-Lease operations for the period ended Sept. 11, 1942, described Lend-Lease business as falling within the following categories:

"Goods transferred consist of (a) military items such as planes, tanks, guns and ammunition; (b) industrial materials such as steel, petroleum products and machine tools; (c) agricultural commodities including principally foodstuffs. In August, military items comprised about 58 per cent of total transfers, industrial materials 29 per cent and foodstuffs 13 per cent.

Aid Nears 8 Billions Annually

For those who like figures, the following is quoted to give some idea of the vast size of Lend-Lease business:

"During the eighteen-month period, March, 1941 (when Lend-Lease went into effect), through August, 1942, the value of goods transferred and services rendered was $5,129,000,000. Goods transferred comprise 79 per cent of this amount and services rendered 21 per cent. In addition, the value of Lend-Lease goods in process on Aug. 21, 1942, was $1,360,000,000.

"Thus the total amount of Lend-Lease aid to the end of August was $6,489,000,000. This compares with $4,497,000,000 as reported in the fifth report to Congress, three months ago. Currently, aid is being provided at a rate of approximately $8,000,000,000 per year."

Lend-Lease exports are governed by strategy shaped by the conduct of the war. At first, when the battle of Britain was raging, they went primarily to the United Kingdom. When the war spread to Africa, the Middle East and Australia, aid was sent to those areas. With the signing of the Russian protocol in October of 1941, aid began to flow to Russia. Aid to China has been limited by the difficulty of transportation, "but", says the report, "the development of other means of transportation will relieve this situation". Currently about 35 per cent of Lend-Lease exports are going to the United Kingdom, 35 per cent to the U.S.S.R. and 30 per cent to the Middle East, Australia and other areas.

Under the law, signed by President Roosevelt on March 11, 1941, Lend-Lease may be provided to the government of any country whose defense the President deems vital to the defense of the United States. The list now includes the British Commonwealth of Nations and 35 other countries.

Of these 35 other countries Lend-Lease agreements have been signed with Belgium, Bolivia, Brazil, China, Colombia, Costa Rica, Cuba, Czechoslovakia, Dominican Republic, Ecuador, El Salvador, the Free French, Greece, Haiti, Honduras, Iceland, Mexico, The

E. R. Stettinius Jr.
Administrator, Office of Lend-Lease Administration

O. S. Cox
General Counsel for Lend-Lease and Assistant Solicitor General of the United States

Dean G. Acheson
Assistant Secretary of State, handles many Lend-Lease agreements with other countries

Dr. George B. Waterhouse
Has charge of metals and metallurgy in Office of Lend-Lease Administration

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Solves Your MANPOWER *Problem!*

UNLOADS 21 TONS IN 30 MINUTES

SPECIAL CRANE SAVED $600 PER YEAR

HANDLING COSTS CUT 64%

SAVED 32 MANHOURS IN CUPOLA CHARGE DELIVERY

2 MEN UNLOAD CAR IN 1½ HOURS

ONE-MAN CONTROL OF STOCK DELIVERY

STORAGE INCREASED 50%

PRODUCTION INCREASED FROM 26 TO 48 TONS PER DAY

★ Long before the war, American MonoRail equipment was solving manpower problems. Today, the job has been multiplied many times but American MonoRail equipment is meeting it with significant regularity.

American MonoRail equipment enables one man to do the work of many. It reduces fatigue caused by lifting and carrying. It reduces accidents. It keeps production on scheduled routes without delays and results in savings in time and money.

To achieve volume production at minimum costs with maximum speed, it will pay you to call in an American MonoRail Engineer. Let him show you how American MonoRail will solve your manpower problems and bring you increased production.

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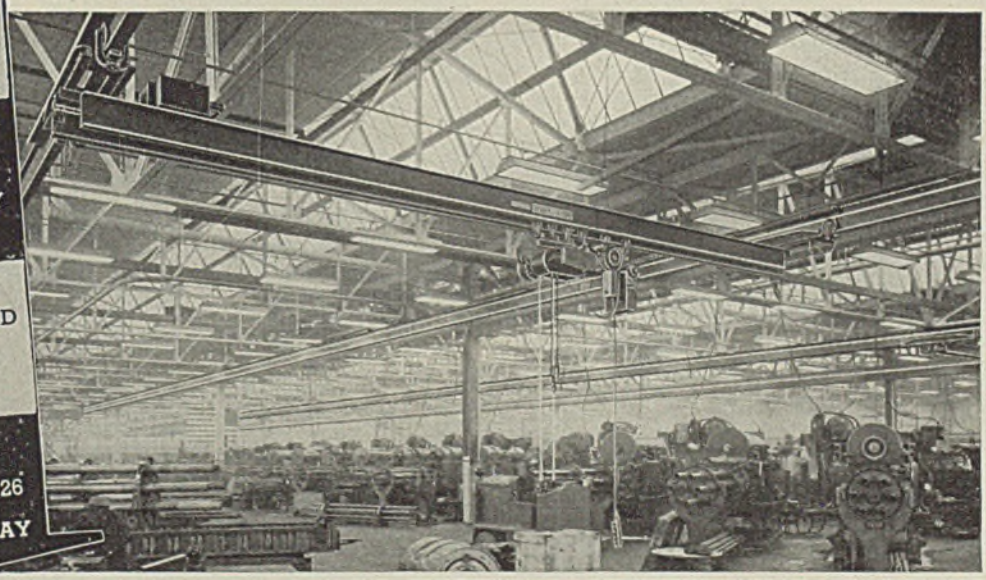
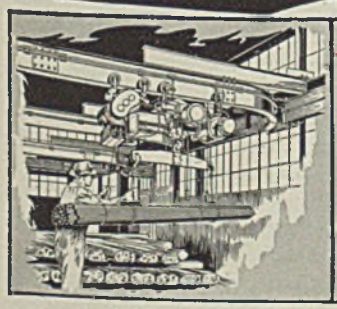
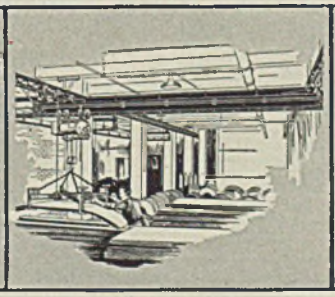
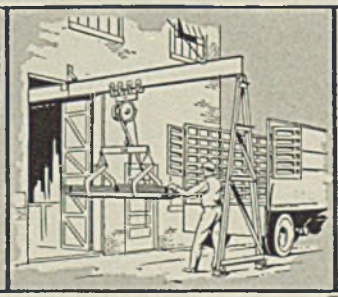
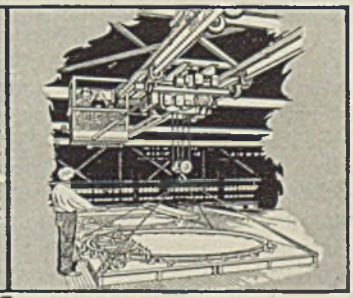






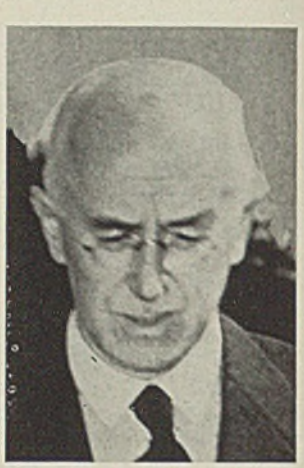




MAJ. GEN. A. I. BELAYEV
Heads Soviet government purchasing commission

MAJ. GEN. C. M. WESSON
In direct charge of the Russian Division, Lend-Lease

DR. T. V. SOONG
Chinese representative in charge of Lend-Lease



R. H. BRAND
Chairman, British Supply Council in North America

Netherlands, Nicaragua, Norway, Paraguay, Peru, Poland, U.S.S.R., Uruguay, Venezeula, Yugoslavia.

Others, with which such agreements have not yet been signed, are Argentina, Chile, Egypt, Guatemala, Iran, Iraq, Panama, Turkey.

Under authorizations that have been made from time to time, the Office of Lend-Lease Administration, as of Sept. 11, 1942, was in a position to furnish Lend-Lease aid up to a total of $18,410,000,000. In addition, the Army and Navy had been authorized to extend Lend-Lease aid out of their regular appropriations up to maximum of $35,488,000,000, and ships could be Lend-Leased up to maximum of $9,000,000,000.

A question frequently asked by industrialists is: "How efficiently is the Lend-Lease program directed?" Many of them have executed Lend-Lease orders and some have gotten the impression that not in all cases is the best use being made of our total resources. This question has been asked, among others, by machine tool manufacturers and by steel metallurgists.

Only Russia Was Prepared

The answer to this question is about as follows: Of all the United Nations the only one that was prepared for this war was Russia. Russia, as a result of her industrialization program, had developed a highly efficient "screening" system under which industry was permitted to have only what was essential and urgent. All of the others, including the United States, had to start almost from the ground up. We now can look back and see that many mistakes have been made. But we have learned a great many lessons and are not repeating past mistakes. We all the time are improving our organization so as to throw all our might into the fight.

That, essentially, is the picture in connection with Lend-Lease. As a result of the experience so far gained, a general "screening" system has been established which makes it almost impossible to get approval of any but the most urgent requisitions. This screening system begins with the responsible organization in each individual country and is concluded here in Washington. Each country must prove the urgency of what it requisitions. Then relative urgencies are compared against each other. The result is a system that seems to be as nearly foolproof as is possible in a business involving so many details and so many individual divergent groups.

ROY HENDRICKSON
Has charge of procurement of foodstuffs for Lend-Lease under the Department of Agriculture

LEWIS W. DOUGLAS
Deputy Administrator of the War Shipping Administration, who handles ocean transportation under Lend-Lease

At the top, directly under President Roosevelt and Prime Minister Churchill, is the organization known as the Combined Chiefs of Staff, composed of the ranking staff officers of the various branches of the American and British armed forces. It meets in Washington to formulate the broad strategic plans to which the actions of the other combined agencies are adjusted. Production requirements, raw materials allocations, munitions assignments, and ship routings are all related to the board's decisions.

Patterned to Overall Strategy

In the next layer of responsibility are the Munitions Assignments Board, the Combined Raw Materials Boards, the Combined Production and Resources Board, the Combined Food Board, the Combined Shipping Adjustment Board and the Joint Aircraft Committee.

Lend-Lease distribution of United States resources is in accordance with the overall military and production strategy as shaped by six combined boards in which the United States and the United Kingdom have representation. The boards were thus composed because these are the chief surplus producing countries among the United Nations. This setup is not entirely pleasing to our other allies but it was decided on to prevent un-

wieldy boards if a large number of nations all had equal voice in arriving at decisions.

In the making is another phase, that of linking the strategy of production to the strategy of war. This heads up in the Combined Production and Resources Board, which now is compiling an enormous balance sheet of total military and civilian requirements of the United States and the United Kingdom as well as a balance sheet showing the deficiency requirements of Russia, China and all of the other allied or friendly nations.

In this study, incidentally, the standard of living is to be leveled out in all these countries—to keep them all lean but healthy. In this respect Americans are due for some shocks.

That portion of the overall Lend-Lease program, that is to be executed in the United States, is referred to the Requirements Committee of the War Production Board. On this committee the following bodies have representation: the Office of Lend-Lease Administration, the Army, the Navy, the Maritime Commission, the British Supply Council in North America, the Board of Economic Warfare and the Office of Civilian Supply. It is this committee that cuts the pie in order that it may go around the table. To make certain that the slices are served at the right places the War Production Board has groups of Lend-Lease specialists who exercise tight control.

Latin American countries needing Lend-Lease aid from the United States place their requisitions through the Bureau of Economic Warfare. These and all other requisitions go to the Office of Lend-Lease Administration which first has its experts examine them to determine whether they conform to the definitions of the Lend-Lease Act. After requisitions have been "screened" the office allots the funds that are necessary and then refers them to the War Production Board, the Army and Navy Munitions Board or the Joint Aircraft Committee for priorities ratings.

The contracts then are placed with one or more suppliers, the procurement bodies including, depending on the nature of the requirements, the Army, the Navy, the Maritime Commission, the Treasury Department and the Department of Agriculture.

The next step is to determine the assignment of the completed product to the area where most needed, decisions that are made by one or another of the combined boards. Next comes the question of shipping goods to destination, a problem of the War Shipping Administration, for the United States, the Combined Shipping Adjustment Board, for the United States and Great Britain, and the Ministry of War Transport, for the United Kingdom. Last stage is a check by American inspectors in the various countries who report on the disposition of American goods and the use to which they have been put.

A large amount of bookkeeping is done to keep track of what we are sending abroad, but it is freely admitted that this cannot be accurate. An American officer in England may requisition services or supplies from the United Kingdom and sign a chit which is lost in a ship later sunk by a submarine. There is room for technicalities in forming a judgment as to who owes whom, for example, when American fliers operate Spitfire planes. There are always doubts about the ultimate value of any particular weapon.

There is a very delicate question involved in assessing the value of millions of lives, of destroyed industrial plants that our Allies are sacrificing. Under no circumstances can the nature of the coming settlement be foreseen. It will be a vast problem in which new conceptions as to values, about the use of money, will have to be settled by men of goodwill.

In view of the fact that the British are joined with us in the overall execution of the Lend-Lease program, some

AMERICAN AND BRITISH HIGH COMMANDS CONFER ON WAR STRATEGY

ONCE each week the eight highest ranking United States and British Army, Navy and air officers in this country meet in conference to co-ordinate and further the war effort of the two nations. Left to right: Commander R. D. Coleridge; Rear Admiral W. R. Patterson, representing Admiral Sir Andrew Cunningham; Field Marshal Sir John Dill, former chief of staff of the Imperial General Staff; Brig. Vivian Dykes, secretary to the British conferees; Lieut. Gen. G. N. MacReady, former assistant chief of the Imperial General Staff; Air Marshal D. C. S. Evill, senior air staff officer of the Royal Air Force fighter command during the battle of Britain; Lieut. Col. T. W. Hammond Jr.; Lieut. Gen. J. T. McNarney, assistant chief of staff, U. S. Army; Gen. George C. Marshall, chief of staff, U. S. Army; Brig. Gen. J. R. Deane, secretary to the U. S. conferees; Admiral William D. Leahy, chief of staff to President Roosevelt; Admiral Ernest J. King, commander in chief of the U. S. fleet and chief of naval operations; Vice Admiral F. J. Horne, vice chief of naval operations.
Official Navy photo from NEA

information as to how they are organized here is pertinent. Top British policy-maker on all British procurement from this continent is the British Supply Council in North America. This was organized in January of 1941 after the pattern of the proposed Lend-Lease act had become revealed. Under it are the British Ministry of Supply Mission which replaces the original British Purchasing Commission; the British Food Mission; the British Merchant Shipping Mission; the British Raw Materials Mission; the British Air Commission; the British Admiralty Delegation; the British Treasury Representatives Group. Close laison is maintained with the Canadian Department of Munitions and Supply Mission.

When the council convenes the heads of all these missions are present. Also taking part in these meetings are the British Ambassador and representatives of the Combined Chiefs of Staff. The council, therefore, unifies all British policy British policies, supplement their own expert staffs by bringing to the United States various experts of the British ministries in London. In many cases these experts have visited American manufacturing plants and have given us important help in stepping up arms production. For example, British experts on aircraft production and allocation of raw materials recently have visited the United States at the invitation of the War Production Board.

Another reflection of the size of Lend-Lease is the size of the organization required to keep the machine going. A good guess is that 12,000 to 15,000 people are occupied with Lend-Lease as their main concern. The British alone have about 3000 in Washington and 1900 in New York, and, incidentally, about 90 per cent of them are Americans. The Soviet Government Purchasing Commission has about 600. All of the other countries that come under Lend-Lease have missions large or small and superimposed are the many Americans who handle the United States end of Lend-Lease.

Defense Plant Corp. Authorizes New Facilities

New equipment and plant facilities were authorized last week by the Defense Plant Corp., R. F. C. subsidiary, for eight war factories. In each case the facilities will be operated by private companies and title will remain with Defense Plant Corp.

The authorizations include:

An increase in its contract with the Gerstenslager Co., Wooster, O., to provide additional equipment in a plant in Ohio, in excess of $150,000, making a total commitment of more than $450,000.

GEORGE H. JOHNSON

An increase in its contract with Goodyear Aircraft Corp., Akron, O., to provide additional machinery and equipment in a plant in Ohio. The increase will be in excess of $900,000, making a total commitment of more than $10,000,000.

K. H. ROCKEY

THOMAS M. WOODWARD

Mr. Rockey is chairman of the Navy Price Adjustment Board and Mr. Woodward is chairman of the Maritime Commission's Price Adjustment Board, figures in the article on renegotiation in STEEL, Nov. 2, p. 48.

An increase in its contract with the National Aluminum Cylinder Head Co., Cleveland, to provide additional plant facilities in Ohio. The increase will be in excess of $850,000, making a total commitment of more than $3,500,000.

An increase in its contract with Chrysler Corp., Detroit, to provide additional plant facilities in Michigan. The increase will be in excess of $35,000, making a total commitment of more than $750,000.

An increase in its contract with Air Reduction Sales Co., New York, to provide for additional plant facilities in New York. The increase will be in excess of $35,000, making a total commitment of more than $500,000.

An increase in its contract with Brewster Aeronautical Corp., Long Island City, N. Y., to provide for additional equipment in a plant in Pennsylvania, in excess of $75,000, making a total commitment of more than $8,000,000.

Gisholt President Becomes Head of Tool Division

George H. Johnson, president, Gisholt Machine Co., Madison, Wis., has been appointed director of the WPB Tools Division. He will succeed George C. Brainard who will return to his position as president of the General Fireproofing Co., Youngstown, O. The change will become effective Nov. 23.

John Chafee, formerly vice president, Brown & Sharpe Mfg. Co., Providence, R. I., has been appointed deputy director of the Tools Division.

A. I. Henderson, deputy director general for industry operations, has resigned to accept a commission in the Army.

Merrill C. Meigs, deputy director, Aircraft Production Division, has been called back to his position with the Hearst Corp., after serving without compensation in the war production agencies for two years.

Charles E. Wilson, WPB vice chairman in charge of production, has appointed Dr. Mordecai Ezekiel as his executive assistant.

Walter S. Doxsey, president, American Steel Warehouse Association, has been appointed chairman of the OPA Steel Warehouse and Jobbers' Advisory Committee.

At a recent meeting of the committee OPA authorized a survey of the industry with a view to obtaining additional information with respect to pricing and other pertinent data. Sub-committees are being appointed in the various areas to carry out this work.

Output Quadrupled since Pearl Harbor; Up 7% in September

OVERALL munitions production in September increased 7 per cent over the preceding month and American factories now are turning out war goods at about four times the rate at the time this country entered the war.

Airplane output advanced 10 per cent; ordnance manufacture, 7 per cent; Navy and Army vessel construction, 22 per cent; merchant ships, 10 per cent; and miscellaneous munitions held even.

This was the gist of WPB Chairman Donald M. Nelson's monthly report on war production.

The gains reported, according to Mr. Nelson, are not simple numerical increases, but are weighted to more closely reflect the actual increase; for example, a heavy bomber is weighted for more than a lighter plane.

Detailed analysis of war production:

Airplanes—During September, four-engined bombers rolled off the assembly lines very nearly on schedule. Acceptances of all heavy tactical types increased substantially. The result of a marked increase in the output of heavy aircraft and a decrease in light planes was a small overall increase measured numerically; but measured by total value which takes into account the difference between large and small planes, the volume of output in September was up 10 per cent, compared with an increase of 5 per cent in August.

Propeller production continues to present a serious problem. Plane construction may increase in the months ahead more rapidly than propeller production, unless propeller output can be greatly increased. Thus far, however enough propellers have been made to fly all planes.

Mass production methods have been greatly improved; many engineering difficulties have been overcome; skills of new workers are being improved and training is proceeding well.

Ordnance—Ordnance production continued to move slowly, and as between the various items of production, unevenly. Tank production was up 3 per cent and the production of tank guns was ahead of schedule. September was a good month for antiaircraft gun output.

Production of ammunition for the various types of guns was spotty, excellent records being made in some areas and disappointing results were reported in others. Overall ordnance output rose 7 per cent in the month.

Navy and Army Vessels—During the month 12 major combat vessels were launched. Deliveries of major combat vessels were greater than forecast, but deliveries of other types of naval vessels did not measure up to expectations.

Measured in terms of actual additional construction in shipyards, the gain in September for Army and Navy vessels, including transports, was 22 per cent over August.

Merchant Vessels — Construction of merchant vessels increased 10 per cent over August measured by the value of new construction in shipyards. But measured by the tonnage of vessels delivered, it rose 34 per cent in the month, and was 12 per cent ahead of first-of-the-month forecasts.

Ninety-two new merchant vessels were placed in actual service—21 more than in the previously top month of July. Deadweight tonnage of these vessels was 1,009,000 compared with 753,000 deadweight tons in August. Thus production in a single month closely approached the total output of American merchant shipyards last year.

Machine Tools—Machine tool production totaled $120,118,000 in dollar volume, compared with $117,343,000 in August, a gain of 2.4 per cent.

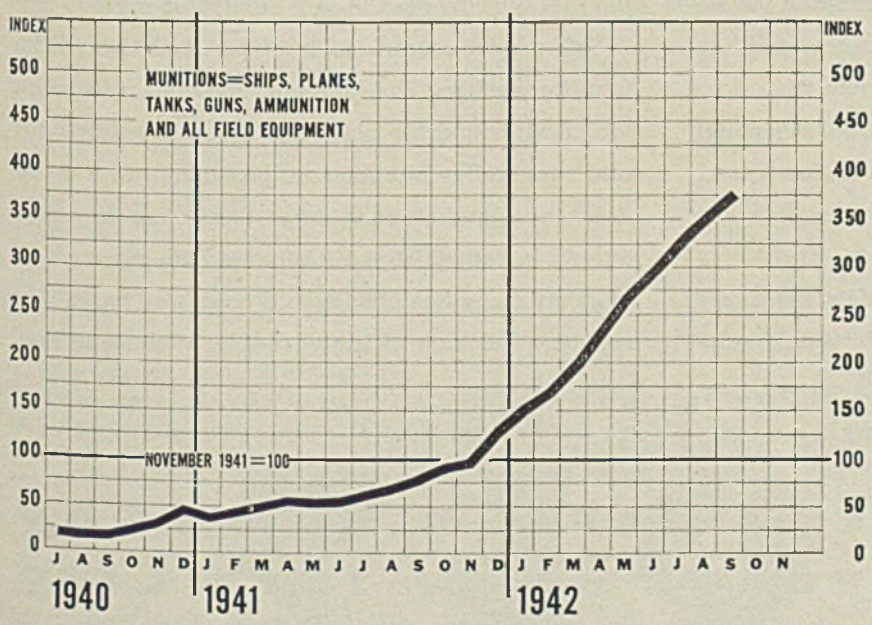
Until recently new machine tool orders have been in excess of deliveries, causing a persistent increase in the backlog of unfilled orders. Production now is higher than new orders currently received, so that the backlog is being worked off. The trend in new orders has been downward since last spring.

Construction — Government financed construction for war purposes in September, including military construction, munitions plants and the machinery to equip them, was estimated at $1,540,000,000. This was slightly less than in August, which probably was the peak month.

Government-financed war construction for 1942 is estimated at about $14,400,000,000. This represents about one-fourth of all government war expenditures. From now on the proportion will decline.

Cost—In September the Treasury and government corporations paid out $5,500,000,000 for war purposes, an increase from August of $300,000,000. The average amount spent each day was $220,000,000 compared with $198,000,000 in August. By the end of September, war expenditures since July, 1940, had reached $50,000,000,000, and the total program, including commitments of government corporations, called for the disbursement of $224,000,000,000. This was increased in October to about $240,000,000,000.

Expenditures of such magnitude take up an increasing proportion of total payments for goods and services within the United States. In September, about two-fifths of all such payments consisted of war disbursements by the Treasury or government corporations.



WPB's index of munitions production has increased nearly four-fold since Pearl Harbor and in September stood at 381, based on November, 1941, as 100

Information supplied by the National Safety Council

Labor, particularly inexperienced labor, cannot be expected to recognize the full penalties of carelessness in the shop. Management has assumed the responsibility of supervising safety measures, and has cooperated in establishing sound safety rules.

Nevertheless, the large increase in labor personnel due to war needs, plus the influx of inexperienced men, have resulted in a substantial increase in lost time accidents.

Even assuming that the obvious safety measures with regard to operating machinery, electrical equipment and shop traffic have been installed, two factors — education and eternal vigilance — determine the real effectiveness of any safety program.

Both are the responsibility of the supervisory staff, from foremen up. The foreman who does a thorough job of educating his particular group in safety rules and cooperative enforcement has done much to cut down accidents. Management that takes an active interest in both safety education and the enforcement of safety measures has taken a great step forward in reducing wastage of irreplaceable production time.

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MIRRORS of MOTORDOM

Former Lumber Queen of the World now a leading industrial community supplying engines and war products in metals field. . . Industry says CMP needs flexibility

MUSKEGON, MICH.

ONE of the important industrial "feeder" cities for the automotive industry, this community now has been fairly well converted to war production jobs. Greater Muskegon, comprising three separate but adjacent cities, has population of only 73,000 but is surprisingly well fortified with good-sized industries which in recent years have attempted to diversify their production to level off the sharp upswings and downswings of the motor industry.

Rebirth of Continental Motors Corp. in the years since 1938 has been the most important single development affecting Muskegon prosperity. Continental came here from Chicago in 1906 to build gasoline engines, its first 4-cylinder 4-cycle motor having been assembled in 1902. Gradually, with the steady expansion of the automobile industry, the company moved to a period of tremendous prosperity during the 20's, when sales were running in excess of $27,000,000 yearly. Continental Red Seal engines were standard equipment in a long line of names in the motor industry, now dead and gone. Growth of the Big Three—General Motors, Ford and Chrysler—and their emergence with 85 per cent of the industry's sales, meant dwindling fortunes for Continental, since the leaders were building their own engines in a volume which the Muskegon company would in no wise satisfy.

Fortunes Shift With War

Sales dropped until nine years ago when they were barely $1,800,000. Cost of operating plants in Detroit as well as in Muskegon on a volume of business insufficient to keep one plant going four days a week exhausted the company's credit and an RFC first mortgage of $1,000,000. The Detroit plant went on the auction block in 1938 but found no takers. Veterans at the Muskegon plant found their life's work and savings slowly ebbing away.

Then came the war! With ample capacity but no business, Continental was in perfect shape to shoulder early orders for engines in a war of internal combustion engines. The RFC advanced another $300,000 to move operations entirely to Muskegon, on condition the city put up an additional $45,000 to build test cells for airplane engines. This was done, with the assistance of civic leaders in Muskegon, employes of Continental and interested financiers. C. J. Reese, one-time purchasing official with Chevrolet and later a buyer for Continental, meanwhile had taken over the reins of the company from president W. R. Angell.

Orders for small aviation engines as well as industrial engines poured in. New and old equipment was scraped up throughout the country to handle the mounting production load, one carload of tools coming all the way from an auction in North Carolina. They proved to be machines which at one time had been used in production of the Wills-St. Clair automobile. Then came orders to build the Wright R975 radial engine for installation in tanks. Contract was awarded Continental on Sept. 9, 1940, and the first engine was delivered in June, 1941.

C. J. REESE
Guided Continental Motors back from the doldrums to $135,000,000 worth of business in 1941, and $500,000,000 now on the books

Things were definitely looking up for Continental, so much so that last year total business ran to $135,000,000, or far beyond what the company had experienced even in its heyday. Currently, orders on the books run to something like $500,000,000. The Muskegon plant is going full blast, with around 6000 men on the payroll. The Detroit plant is once more booming. A new plant in Texas has been taken over by Continental and is being retooled for manufacture of a Wright engine. It formerly had been operated by Guiberson in production of a radial diesel.

In April 1940, Continental Aviation & Engineering Corp. was organized to experiment with high-output airplane engines, and the fruits of its early efforts are about ready to be harvested. A large new plant near the company's west Michigan operations probably will be turning out engines in December. This plant, with close to half a million square feet of floor space, will build a Pratt & Whitney engine of around 550-horsepower for training planes, and later will undertake construction of a Continental-designed high-output liquid-cooled engine for combat planes. Great things are expected of the latter, which has been designed to weigh under 1 pound per horsepower, a goal which few air engines have yet attained.

Building Variety of Engines

Ground for the new plant was broken July 1 and construction is now well along, with much of the equipment ready to be moved into position. The building, with the exception of steel window sash, is almost 100 per cent wood, concrete and brick. Approximately 4,000,000 board feet of Douglas fir was required for wood trusses, roof, stairways, etc. Trusses are cut to shape and assembled right on the job of 3x12 timbers bolted together.

Continental now builds a wide variety of engines for airplanes, agricultural and oil field equipment, and industrial and marine purposes. It has been estimated that about one-half of the present engines for light planes are supplied by the company. One of its newer engines is built to power the so-called "grasshopper fleet"—small aircraft for liaison work with ground troops and control of artillery fire.

Virtually all engines supplied thus far for the M-3 and M-4 medium tanks are of the Wright design, built by Continental. This is an important contract and requires a large share of the plant's facilities, but even if ordnance officers should decide on some other type of power plant for these tanks—and this is considered a distinct possibility—Continental probably will have plenty of other jobs on the books to absorb the displaced capacity.

But Muskegon industrially is not all Continental—far from it. The city is one of the steel foundry centers of the world, boasting three large plants in this field, all of them exceptionally busy supplying a wide range of steel castings for war products. The largest is Campbell, Wyant & Cannon Foundry Co. which operates three separate plants in the city, the latest being a foundry built during the last war and operated only intermittently by the Shaw-Box Crane & Hoist division of Manning, Maxwell & Moore. The main or Henry street plant of C-W-C is the largest Muskegon op-

eration, the third plant being known as No. 1, on Sanford street. An idea of the extent of C-W-C melting operations can be gained from the fact that daily scrap requirements are something like 300 tons.

Other foundry producers here include the West Michigan Steel Foundry Co. and the Lakey Foundry & Machine Co., the latter adjoining the Continental plant and supplying most of the gray iron requirements of its neighbor. Lakey recently converted a section of its plant from melting of iron to steel by the triplex process of cupola, converter and electric furnace. In peacetime, Muskegon foundries were estimated to be supplying 750-850 tons of gray iron castings daily, the bulk of this of course automotive requirements. Lakey, for example, was a principal supplier of cylinder blocks for Chrysler.

Two leading sources for piston rings—Sealed Power Corp. and Muskegon Piston Ring Co.—operate plants here, the former now in process of erecting an addition to its facilities in connection with war activity. Morton Mfg. Co., for many years a builder of shapers, also is erecting an addition to its plant. Two aluminum foundries—Muskegon Aluminum Foundry and Quality Aluminum Casting Co.—play a leading role in the city's industrial activity.

Many Plants in War Work

Other important links in the chain of Muskegon industries include the American Seating Co., Brunswick-Balke-Collender Co. (now making parachute flares instead of billiard tables), Agerstrand Co., American Coil Spring Co., Muskegon Motor Specialties Co., Norge Machine Products division of Borg-Warner Corp. (now making gun mounts instead of refrigerators), and Shaw-Box Crane & Hoist. In addition, there are a dozen or more small enterprises, such as tool and die shops, specialized engineering services and the like which have been drawn to Muskegon by efforts of the city's Industrial Foundation, organized years ago to attract diversified industries to the city by offering special inducements such as buildings, reduced taxes or ample labor supply. This effort has been eminently successful and although activities are pretty well suspended for the duration, the foundation is a potent force in industrial life of the city.

Starting from a wilderness trading post in 1810 which the Indians called Maskigon, meaning "marshy place," Muskegon has had a checkered industrial history. At one time it had the name of the "lumber queen of the world," a sawmill erected in 1837 developing into a lumber industry which 50 years later was cutting 700,000,000 board feet a year. The panic of 1893 and a great fire reshaped the city's destiny from wood into the field of metals, although remnants of the furniture industry remain.

Muskegon boasts a fine land-locked harbor, 10 miles of waterfront along Lake Michigan and the Muskegon river (or lake as it is called there), a $2,500,000 arrow-head breakwater built by the federal government, and a $2,000,000 rail and water terminal, with carferries operating across the lake to cities in Wisconsin. Muskegon is about equidistant —185 miles— by rail from Chicago and Detroit. It rates high as a summer resort, but the vacationers have gone from hundreds of cottages along the lakeshore, which instead of being boarded up for the winter are occupied this season by families of workmen in war plants in and around the town.

Controlled Materials Plan

Although full details of the new Controlled Materials Plan announced last week by the WPB have not been available long enough for complete analysis, essential features appear to embody many of the recommendations made by the automobile industry to improve the distribution of basic materials, chiefly steel. Speaking for the industry, George Romney, managing director of the Automotive Council for War Production, states:

"The test of whether a material control plan is workable comes in its operation. The members of the automotive industry will exert themselves to make this one work. They count, too, on the material producers and the government agencies doing their utmost to make it work.

"Scheduling of the numbers of units to be produced, based on the amount of material actually available, as undertaken in this plan, is the only sound approach to materials control under present conditions.

"This industry's decades of mass production experience dictate, however, that care is needed in operating any such plan to assure flexibility of material flow, so as to keep the hundreds of components of each finished product coming at balanced rates. In addition, flexibility is required to meet emergencies and the changing strategic requirements of military operations by putting promptly into production necessary changes, improvements and new products.

"Flexibility may be jeopardized by the method of handling the paper work under this new plan, but in the evolution of what is otherwise a sound approach, it is hoped any such impediment to balanced mass production of armaments will be eliminated. The automotive industry believes that kind of administration will develop. Companies in this industry will do their part."

Protests Building of "Fire Trap Hospitals for Wounded"

"How do you think the general public will react if they suddenly discover that you are forcing the construction of non-fireproof hospitals?"

This question was asked the War Production Board in a letter, dated Nov. 2, by Isaac Hausman, Hausman Steel Co., Toledo, O., protesting against erection of "fire trap" hospitals for wounded soldiers and sailors because of WPB restrictions on the use of structural steel.

Mr. Hausman said this situation could be corrected by utilizing the monthly accumulation of 70,000 tons of off-heat, crop ends and excess bessemer steel from new billet rolling mills, plus 30,000 tons of concrete bars from re-rolling rail mills out of material allocated for this purpose, to make available 100,000 tons of concrete bars each month. Combined with concrete, the building material thereby obtained would help to offset the lumber shortage which threatens.

The letter also objected to prohibitions against steel forms in building construction, pointing out that enough forms are already in existence to build "all of the hospitals you will normally require for the next five years."

Urges Women Doctors As Plant Health Heads

Women doctors as chiefs of factory health departments, a comparatively new idea in the field of industrial medicine, will be urged on management by Dr. Victor G. Heiser in his address before the Wartime Health-in-Industry clinic in Camden, N. J., Nov. 4. Dr. Heiser is consultant to the committee on healthful working conditions of the National Manufacturers' Association.

This clinic, sponsored by the NAM and the manufacturers' committee of the Camden county chamber of commerce, is the first of a series to stress need for advancing the war effort by health and nutrition programs in factories.

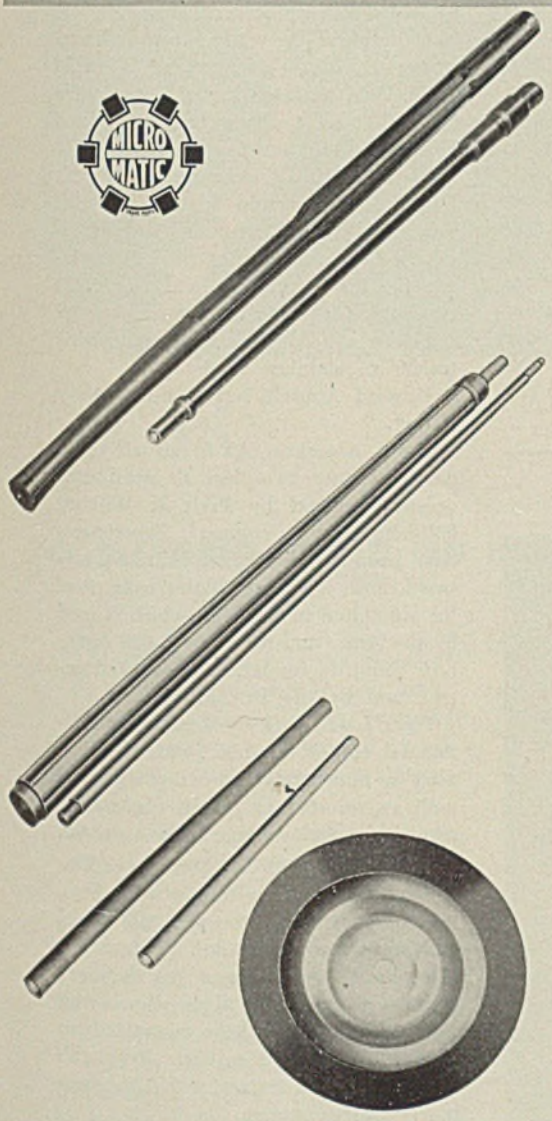
New industrial construction and expansions in the Chicago area in October totaled $3,867,000, bringing the total for the first ten months of 1942 to $559,732,000, according to the industrial department, Chicago Association of Commerce. This compares with the total for 1941, through October, of $217,355,000.

MORE AND MORE *Production*

"ON THE WAY"

With Microfinished Precision

Stock removal, up to .060" or .075" at rates as high as 65 cubic inches per hour, to generate correct size, straightness and roundness, is the dominant feature of Micromatic Honing. The Micromatic Honing Process (available with Automatic Microsize for bores up to 2" in diameter and 6" long) will generate uniform size within .0002" to .0005"—bore accuracy within .0001" to .0002"—removing sufficient stock to get the desired results. Applications to ordnance have included gun tube honing, before and after rifling—gun case honing—internal honing of recoil cylinders—external honing of recoil pistons—reconditioning in placement of worn gun tubes up to 16" caliber.



Typical gun barrels regularly honed in production by Micromatic equipment include 50 caliber machine guns—20 millimeter cannon, 37 millimeter cannon, as well as other and larger calibers up to and including 16" and 18", and from 30" up to 75 feet in length.

★

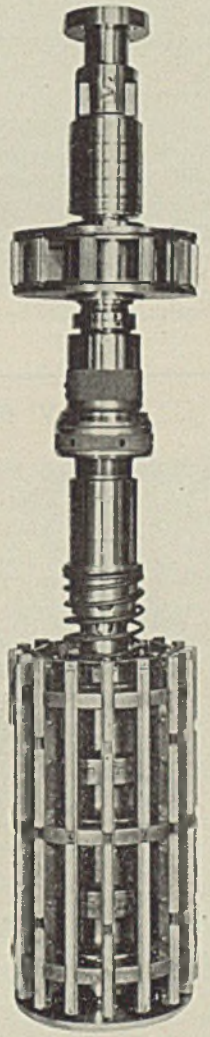
External honing of recoil piston rods generates accuracy within .0001" to .0003" and any desirable finish.

★

Recoil cylinders Micromatic honed. Circular illustration—looking down the bore. The regularity of the eccentric rings (a phenomenon of smooth surface finish) evidences round and straight accuracy generated in typical ordnance applications within .0005" to .0007" as measured with both star and electric gauges.

★

Typical of tooling used for honing large caliber guns is this hydraulically actuated tool. This tool was designed for bores 18" in diameter, 62 feet long.



MICROMATIC HONE CORPORATION

1345 E. MILWAUKEE AVE. DETROIT, MICHIGAN

WING TIPS

Builders of training planes substituting for critical metals and materials which must be conserved for combat craft. . . Navy gets funds for 14,600 fighters and bombers

AIRCRAFT now has the green light on the war production road and heads the list as far as material requirements are concerned. Planes take precedence over ordnance and ships now in the reshuffled preference ratings which should subdue the clamor of some airplane manufacturing executives that they were forced to take a backseat in favor of other military needs.

In the airplane production picture, large bombers are rated ahead of other types, suggesting staff experts now are committed to an all-out air war. Assemblies of present types, such as the Boeing Flying Fortress and the Consolidated Liberator, are being stepped up at an encouraging rate, and the incidence of production of new and larger types is not far off. Statement by the Japanese radio that Americans are building super-bombers capable of carrying 10,000 pounds of bombs and with range of 10,000 miles shortly may prove to be not so far from the actual facts.

Projected air force of better than 2,000,000 men, including both flying and ground personnel, plus a first-line fleet of 100,000 combat planes, appears a reasonable possibility by the end of 1943 when plans call for this country to be at the peak of its military offensive might.

The training of such a large force is a vastly complex problem, calling for an appreciable share of total aircraft equipment output. Some estimates place trainer production as high as 40 per cent of the total. On the basis of 5000 planes a month, somewhere near current production, this would mean 2000 trainer planes and 3000 combat planes. Naturally, as the aircraft program matures, the proportion of trainers will decline slowly, because sufficient equipment eventually will be on hand, and losses in training planes are well below losses in combat operations. However, for some months to come, trainer production likely will hold to a high level.

Not much is heard about these training ships, but there are about 15 aircraft companies making them for both Army and Navy pilot training, as well as civilian pilot training. A listing of some of the types now in use may be interesting:

Aeronca L-38, light primary trainer used by the Army for training glider pilots; powered by either Franklin, Lycoming or Continental 65-horsepower engine. Boeing PT-17, primary biplane trainer for the Army, powered by a 220-horsepower Continental; also built for the Navy under designation N2S-4.

Boeing AT-15, twin-engine advanced trainer for the Army.

Beech AT-10, advanced trainer with two 280-horsepower Lycoming engines; of wood construction except for the engine nacelles and cowling, pilot's compartment, landing gear and engine support structure. Even gas tanks are of plywood, with synthetic rubber lining.

Beech AT-11, all-metal advanced trainer for bomber crews, with two 450-horsepower Pratt & Whitney engines; AT-7 model is a similar type for long-range navigational training.

Cessna AT-17 Bobcat, with two 225-horsepower Jacobs engines, a three-place model, being used both in Canada and at Army training centers.

Curtiss AT-9, with two 280-horsepower Lycoming engines, an all-metal transitional trainer duplicating for the pilot the flight characteristics he will find in the multi-engine bomber.

Fairchild PT-19, primary trainer built largely of Duramold plastic plywood, powered by 175-horsepower Ranger engine. Fairchild also has two new trainers, the PT-23 primary, and the AT-13 two-engine advanced Army trainer.

Fleetwings BT-12, single-engine basic trainer of stainless steel.

Howard Aircraft NH-1, a new Navy trainer.

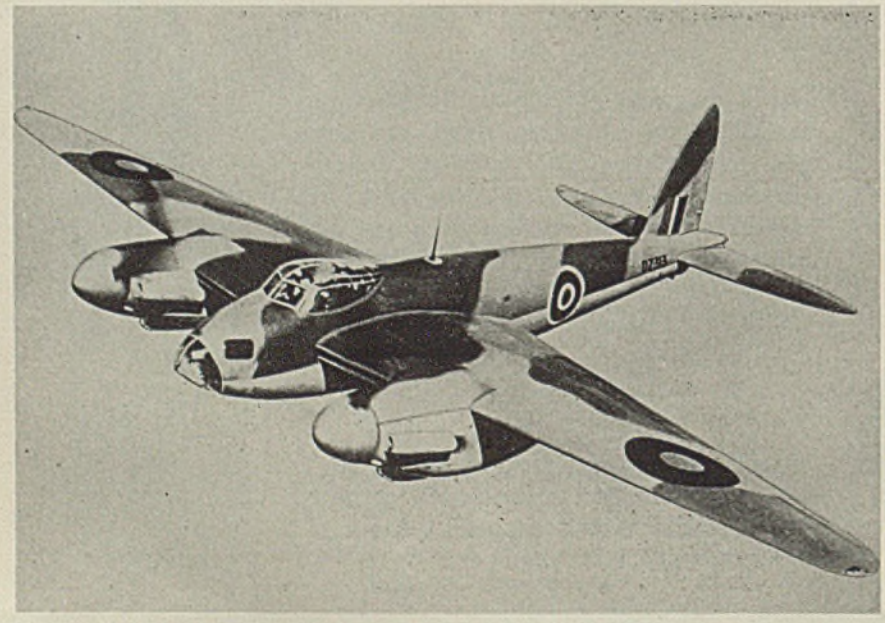
North American AT-6, an advanced combat trainer, two-place all-metal monoplane powered by Pratt & Whitney 650-horsepower engine. Experiments have been successful in substituting plywood and low-alloy high-tensile steel for aluminum in this ship which is used by the Army and Navy, by Latin American countries for both training and patrol, and by the British.

Piper L-4B, with 65-horsepower Continental engine, tandem primary trainer used by both Army and Navy; equipped with swivel seat to permit observer to about face and work as radio operator.

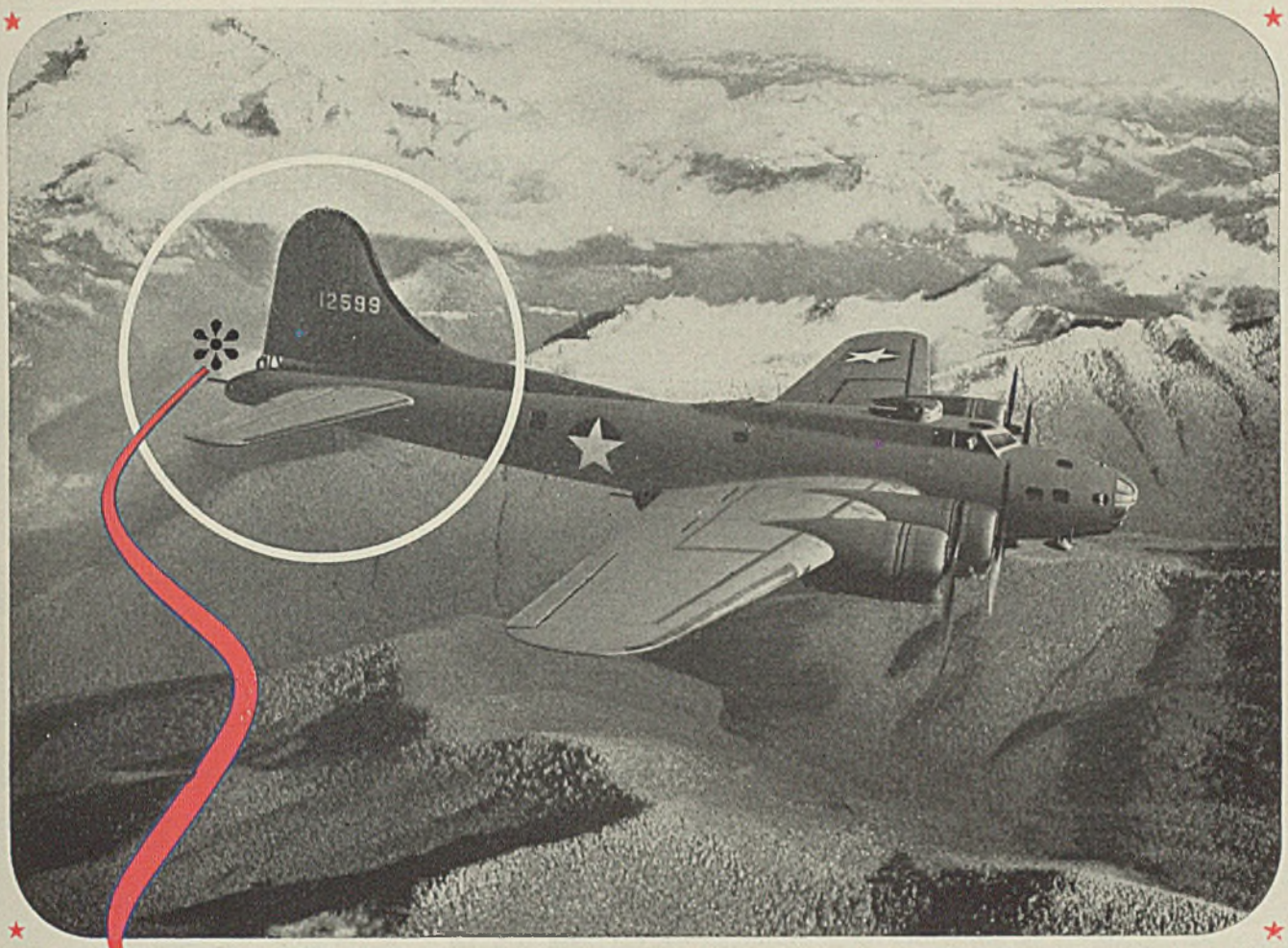
Ryan PT-22, with 160-horsepower Kinner engine, primary trainer with flaps, brakes, trim tabs, steerable tail wheel and other new accessories. This ship is being mass flown from the builder's plant to many civilian flying schools with which the air forces have contracted for training of aviation cadets. Ryan also builds the PT-21 trainer, with 132-horsepower Kinner engine.

Ryan PT-25 two-place primary trainer, powered by 185-horsepower Lycoming 6-cylinder horizontal-opposed air-cooled engine; plastic bonded plywood, fabric and wood construction have eliminated all aluminum and other strategic metals,

NEW BRITISH BOMBER BUILT OF WOOD



FIRST photo to be released of the new British De Havilland "Mosquito" reconnaissance bomber which has done excellent work in recent raids over France and Germany. The plane is of simple wooden construction, is powered by two Rolls Royce engines and armed with four 20-millimeter cannon and four 303-calibre machine guns. NEA photo, passed by censors



How does a Bomber Pilot

COMMAND TONS OF PRESSURE WITH POUNDS OF EFFORT?

YOU'VE seen a heavy bomber change direction in the air—climb, bank or nose down. It looks easy, although the airstream is actually piling tons of pressure against the rudder and tail surfaces.

It even looks easy in the cabin, as you watch the pilot handle his controls. And it is easy, because a little trick called an "amplidyne"—which steps up electrical power input to the control motors about 10,000 times—is doing the work for him.

This mechanism, a development of one of the nation's largest electrical manufacturers, depends upon the special properties of an Allegheny Ludlum Electrical Steel to achieve its results. Into the steel, as it must be in the amplidyne itself, is built reliability, uniformity and stamina.

Although important, this is only one of the dozens of wartime electrical devices to which Allegheny Ludlum Electrical Alloys have lent desirable qualities of magnetism, high permeability, or high resistance. The list covers control, detection and communications equipment for all the services.

For engineers and production men desiring certified technical information on these special alloys, write for a copy of the *"Electrical Materials Blue Sheet."* If you need assistance on fabricating problems, our Technical Staff is at your service.

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with the exception of the engine cowling. No forgings, castings or extrusions are used; no critical steels used for any fittings or structural parts.

Taylorcraft L-2B, with 65-horsepower Continental engine, light primary Army trainer, used widely at military schools in training men to spot enemy positions, directing artillery fire and performing liaison work.

Vultee BT-15 transitional trainer, with 420-horsepower Wright engine, two-place low-wing monoplane; for instrument flying it is equipped with blind flying hoods and two-way radio for ground contact. Vultee BT-13A is similar but uses 450-horsepower Pratt & Whitney engine. Vultee also builds the AT-19, a single-engine advanced trainer. Company has progressed through the experimental stage in work leading to substitution of a composite steel sheet and expanded mesh construction for the conventional aluminum alloy "skin".

Waco UPF-7, biplane primary trainer, used widely in the civilian pilot training program, also by the Army; powered by Continental engines.

This is by no means a complete list of training planes built by the aviation industry, but it is representative of the diversity of types being supplied. In trainer production at the moment, efforts are being redoubled in the direction of conserving critical metals and materials for use in combat planes. While substitutions for structural parts in wings, tails and fuselages have been fairly successful, it is difficult to make any important changes in such things as instruments and engines.

More Planes for Navy

Naval aviation received an important boost with passage of the $32,000,000,000 supplemental appropriations bill, carrying with it an allotment for some 14,600 bombers and fighters costing $2,870,000,000. There is a strong suspicion the Navy is going in for land-based bombers, thereby adding to the confusion in jurisdiction between the Army and Navy as far as air power is concerned. A retired Army officer who protested strongly in print over this encroachment was hurriedly taken back into the service where his views will have to remain with himself.

Transfer of Rear Admiral John H. Towers, formerly chief of the Navy's bureau of aeronautics, to active combat duty, is taken to indicate greater emphasis on air power in future naval tactics. Admiral Towers performed an exceptionally fine job both as assistant chief and later chief of the bureau of aeronautics, sister organization to the Army air corps, and should lead the Navy into new achievements in the field of aviation. Restrictions to either flying boats or carrier-based aircraft, under which the naval aviation arm hitherto has operated, now may be lifting.

Gas Power Auxiliaries

Carbon dioxide gas is finding new applications in the aircraft field. Two established uses—inflated rubber rafts and automatic fire extinguishing systems—have been supplemented by four further adaptations. One is a carbon dioxide power actuator, an emergency source of power which can lower landing gear, apply brakes or open bomb bay doors if the regular hydraulic system should be shot away. The actuator comprises a steel cylinder in which the CO_2 is stored under high pressure. It is hooked into the hydraulic system near the point where the power is to be applied. If the regular system is damaged, a turn of a valve releases the gas into the hydraulic line.

Second application is the explosion-proofing of wings and fuselages, a system involving release of carbon dioxide gas from a steel bottle into spaces surrounding fuel tanks, making it impossible for explosive vapors to accumulate should gas tanks be punctured in combat. Although the tanks are self-sealing, there is some slight spillage when they are pierced by a bullet, and the resulting vapors constitute a serious fire hazard.

Two other CO_2 innovations are an automatic "pop-out" raft which is thrown clear and inflates itself as soon as a disabled plane strikes water; and a special one-man parachute raft worn by the flier as a seat pack. The latter collapses into a pack 17 inches square and 4 inches deep, and inflates to a seaworthy boat 5½ feet in length.

No All-Purpose Planes

Office of War Information has released a 32-page document summarizing the performance of military and naval aircraft which has been given wide prominence in the press. Inasmuch as the report was prepared for public consumption, it cannot be considered a technical review, and in fact suffers to some extent on this score. However, there can be no contention with observations that there is no all-purpose plane, that a "balanced air force" is the goal toward which all warring powers are working, that different theaters of warfare require different types of combat planes, that U. S. four-motor bombers have not been outmatched in any war sector.

There may be considerable questioning of the OWI statement that the Allison engine still rates below the British Rolls-Royce by 100 horsepower. In fact the effort was made to find the OWI official responsible for this pronouncement and to learn the source of his data, but according to an Allison spokesman he could not be located. Suggested explanation is that the Rolls-Royce "war emergency rating" was compared with the standard present military rating of the Allison, not a fair comparison since the former is said to be the rating of the engine under "bursts", at which the Allison can exceed the Rolls-Royce by 200 horsepower, but it does not provide a true rating of the engine's flight horsepower.

Of interest is the OWI report that a two-stage, two-speed supercharger has been developed for the Allison engine and power plants so equipped now are being built, with quantity production almost at hand.

Chooses Stainless Steel

"Airplane builders are searching for some 'Lydia Pinkham remedy' with which to cure structural ailments," Col. E. J. W. Ragsdale, chief engineer of the stainless steel division of the Edward G. Budd Mfg. Co., told members of the Philadelphia chapter of the American Society for Metals recently.

"Aviation has been floundering around for over 30 years, trying to decide what to build airplanes out of," Col. Ragsdale said. "Almost every other art has some one material which is peculiarly suited to the needs of that art. But this does not hold for airplane building.

"At first planes were made of wood with its iniquity hidden behind cloth. Then came wood with plywood covering. We had steel tubing shrouded in fine linen. The lighter alloys of magnesium and aluminum have come into their own. England played with heat treated steels —umbrella stock—but the stuff rusted and busted. Stainless steel entered the picture, and now to complete the confusion we have plastics.

"My choice is stainless steel and I won't go into the laboratory to prove my point. Tensile strength, the lab teaches, generally follows weight. Stainless is three times stronger than aluminum but it weighs three times more. Other metals, wood, and plastics follow the same weight-strength pattern.

"Stainless steel is among the few metals which can be actually toughened by welding. It is also corrosion and fire resistant. It is the only metal whose impact resistance is not affected by cold. It has a high fatigue ratio. Its capacity to be highly stressed is greatly in its favor. Crinkling or corrugating increases its strength, especially when a corrugated sheet is welded to a flat one."


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A SYMBOL OF HOBART BROTHERS CO.'S
"Will to Win"
We want YOU to have the advantages of Hobart Simplified Arc Welders on YOUR production, and are exerting every effort to build more and more of them. A letter or card today will bring you valuable information on how welding can help speed your production—how you can train your men at the Hobart Welding School.
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MEN of INDUSTRY

R. W. HULL

H. W. RENICK

EARL WESSELHOFF

ALLEN P. LIVAR

R. W. Hull, since 1937 assistant manager of sales, Carbon Bar Division, Republic Steel Corp., Cleveland, has been appointed manager of sales of that division, succeeding **W. F. Vosmer,** who has been in Washington as manager of the War Production Board's hot rolled carbon bars and semifinished units.

J. V. Burley, manager of sales for Republic's Sheet and Strip Division, has been appointed general manager of sales, Steel and Tubes Division. **John W. Carpenter,** assistant manager of sales, Sheet and Strip Division, has been named acting manager of that division.

—o—

Harry W. Renick has been appointed a vice president of the Brake Shoe & Castings Division of American Brake Shoe & Foundry Co., New York, in addition to his present duties as vice president of Brake Shoe's Ramapo Ajax Division.

—o—

H. L. Bodwell has been named manager of the Pittsburgh office of A. Milne & Co., New York. He formerly had been associated with the Pittsburgh Ordnance District, Industrial Division.

—o—

Norris E. Crull, associated with Carnegie-Illinois Steel Corp., Chicago, since 1919, has been appointed assistant treasurer, western area. He will continue as credit manager, western area, which position he has held since 1935.

—o—

George E. Clifford has been elected a vice president, National Supply Co., Pittsburgh. He will supervise sales of certain munitions, in addition to his present duties as vice president in charge of sales, Spang Chalfant Inc.

—o—

James J. Grogan, assistant traffic vice president, Atchison, Topeka & Santa Fe railroad, Chicago, has been promoted to vice president in charge of traffic, succeeding **Paul P. Hastings,** retired.

—o—

Earl Wesselhoff has been named manager of the Boston branch of Morse Chain Co., Ithaca, N. Y., succeeding **C. L. Pratt Jr.,** resigned. Mr. Wesselhoff goes to Boston from the Detroit plant where his first association started 22 years ago as automotive timing chain drive engineer. He has served in various engineering capacities and was subsequently promoted to chief engineer and sales director of the Morse indexing and free-wheeling clutch lines.

—o—

John Berry Jr. has been appointed to the newly created position of comptroller, Bell Aircraft Corp., Buffalo. He formerly was assistant treasurer.

—o—

Harry K. Yontz, associated with Pittsburgh Coal Co., Pittsburgh, 28 years, has been elected auditor, succeeding **Charles L. Snyder,** resigned. **Howard D. McPeake** succeeds Mr. Yontz as assistant auditor.

—o—

George C. Johnson, president, Enamel Products Co., Cleveland, has been elected president, Cleveland Hobbing Machine Co., Cleveland, succeeding the late Carl W. Blossom. He will continue as president of Enamel Products.

—o—

W. J. Reuscher, formerly assistant treasurer and resident comptroller, Firestone Tire & Rubber Co. of Tennessee, has been named secretary-treasurer, Bendix Home Appliances Inc., South Bend, Ind.

—o—

William J. Simpson has joined the engineering staff of Milton Roy Pumps, Philadelphia, manufacturer of chemical, high-pressure and controlled-volume pumps. A graduate engineer of Pennsylvania State College, Mr. Simpson was for several years design engineer for Baldwin Locomotive Works, Baldwin-Southwark Corp. and J. G. Brill Co.

—o—

Allen P. Livar has been appointed chief engineer, Airtemp Division, Chrysler Corp., Dayton, O. Mr. Livar has served Airtemp since 1937 as chief heating engineer, and in his new capacity will take over the duties of **R. G. Wyld,** who has accepted the commission of lieutenant, senior grade, in the United States Navy. A veteran in the heating and air conditioning industry, Mr. Livar was general manager of the Air Conditioning Division of Reynolds Metals Co. prior to joining Chrysler Airtemp.

—o—

George B. Shaw has been appointed sales engineer, Keystone Carbon Co., Saint Marys, Pa. Mr. Shaw will devote his efforts to promotion of Keystone negative temperature coefficient resistance material, a recent development of the company.

—o—

E. J. Hammerly, salesman in the Philadelphia district of the Industrial Products Sales Division of B. F. Goodrich Co., Akron, O., completed 30 years of service with his organization in October.

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Raymond J. Spaeth, the past two years business manager, Illinois Institute of Technology, Chicago, has been appointed treasurer. He succeeds **George S. Allison,** now engaged in war work.

—o—

A. J. Baker, administrator of B. F. Goodrich Co.'s war production drive in the Akron, O., plants which resulted in the company being awarded the Army-Navy "E'", has been named manager of factory personnel. He has been succeeded as war drive administrator by

Preston B. Bergin, of the public relations department. **J. J. Feeley**, a member of the labor department the past 26 years, has been made manager of the company's suggestion program.

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George Walton, former vice president and secretary, Madison Foundry Co., Cleveland, has been elected president, succeeding the late Michael Merriman.

—o—

W. L. Ennis, since 1930 manager of refrigeration service, merchandise service and claim prevention, Chicago, Milwaukee, St. Paul & Pacific railroad, Chicago, has been named assistant to chief operating officer.

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Damon deB. Wack, assistant to president, National Bearing Metals Corp., St. Louis, has been elected executive vice president in charge of all plants. Formerly vice president of the Pacific Coast division of the parent company, American Brake Shoe & Foundry Co., Mr. Wack went to St. Louis about a year ago.

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Charles R. Foreman, formerly in the metallurgical department of Olds Motor Works, Lansing, Mich., is now associated with the metallurgical department of Park Chemical Co., Detroit.

Earl H. Seelbach, P. O. Box 56, Kenmore station, Buffalo, has been appointed representative for Park Chemical in the territory west of Syracuse to Buffalo, and including Ontario, Canada. He has represented the Mahr Mfg. Co. of Minneapolis, in this area for many years.

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L. Clayton Hill, recently resigned as vice president of the Murray Corp. of America, Detroit, has joined the executive staff of American Metal Products Co., Detroit, and will devote himself primarily to manufacturing operations.

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C. D. Partridge, assistant branch manager at Cleveland for International Harvester Co., has been commissioned a major in the Army Ordnance Department.

—o—

Max McGraw, president, McGraw Electric Co., Chicago, has been elected president, National Electrical Manufacturers Association, New York. The following were elected vice presidents: **Howard Blood**, president and general manager, Norge Division, Borg-Warner Corp., Detroit; **Leonard Kebler**, president, Ward Leonard Electric Co., Mount Vernon, N. Y.; **F. W. Magin**, president, Square D Co., Detroit; **W. E. Sprackling**, vice president, Anaconda Wire & Cable Co., New York; and **A. C. Streamer**, vice president, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.. **F. T. Wheeler**, vice president, Trumbull Electric Co., Plainville, Conn., was elected treasurer.

—o—

C. J. Backstrand has resigned as general manager, Floor Division, Armstrong Cork Co., Lancaster, Pa., and will work directly with the president's office in the administration of the company's general affairs.

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Dr. A. M. Hageman has been appointed general engineering manager, Westinghouse Electric & Mfg. Co. Lamp Division, Bloomfield, N. J.

D. S. Gustin has been named manager, lamp engineering section, succeeding Dr. Hageman, while **E. R. Schmid** has become manager of a new chemical and metallurgical section.

Officers Elected by National Safety Council

Sections of the National Safety Council elected the following officers for 1942-43 at the conclusion of the thirty-first National Safety Congress and Exposition in Chicago. (STEEL, Nov. 2, p. 46).

Metals Section — General Chairman, R. H. Ferguson, Republic Steel Corp., Cleveland; vice chairmen, John P. O'Rourk, Bethlehem Steel Co., Sparrows Point, Md., and Earl Fyler, Carnegie-Illinois Steel Corp., Gary, Ind.; secretary and news letter editor, J. L. Ridinger, Inland Steel Co., East Chicago, Ind.

Automotive and Machine Shop Section—General chairman, C. E. Wooliever, Aviation Engine Plant, General Motors Corp., Melrose Park, Ill.; vice chairmen, H. B. Duffus, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and O. F. Lehman, Chrysler Corp., Detroit; secretary, R. E. Frederick, International Business Machines Corp., Endicott, N. Y.; news letter editor, L. Gately, General Motors Truck Corp., Pontiac, Mich.

Mining Section—General Chairman, John Treweek, Homestake Mining Co., Lead, S. Dak.; vice chairmen, M. L. Coulter, Clearfield Bituminous Coal Co., Indiana, Pa.; C. M. Fellman, Montreal Mining Co., Montreal, Wis.; C. E. McKnight, Lake Shore Gold Mines Ltd., Kirkland Lake, Ont.; secretary and news letter editor, Daniel Harrington, United States Bureau of Mines, Washington.

OBITUARIES . . .

W. B. Weston, who retired in 1937 as assistant to the vice president and general manager of sales, Carnegie-Illinois Steel Corp., Pittsburgh, died at his home in Detroit, Oct. 28. He joined the corporation in 1888 as an office boy, and following numerous promotions, subsequently served as manager of sales in New Orleans, St. Louis and Detroit. In 1935 he was transferred to Pittsburgh to the post from which he retired.

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Arthur L. Wheeler, former executive of the Eberhard Mfg. Co., Cleveland, and manager of that organization after it became Eberhard Mfg. Co. Division of Eastern Malleable Iron Co., died Oct. 25 in Minneapolis. Recently Mr. Wheeler was associated with Cargil Inc., Minneapolis.

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James B. Turpin, 62, St. Louis representative for Midwest Steel Co., died Oct. 27, in that city. Prior to joining Midwest Steel he was secretary-treasurer, Continental Portland Cement Co.

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Robins Fleming, 86, retired structural engineer, died Nov. 2, in New York. Mr. Fleming was associated with American Bridge Co. from 1900 to 1931, first as a designer at Philadelphia and later with the New York office.

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Henry Lee Rawlings, 45, manager, warehouse division, Ceco Steel Products Corp., Minneapolis, died in that city, recently.

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Albert L. Armstrong, 54, chief safety engineer, Kingsbury Ordnance Plant, LaPorte, Ind., died Oct. 28.

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John McNichols, 72, superintendent, Thompson-Starret Co. Inc., Chicago, died Oct. 28, in that city.

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Samuel M. Hastings, 82, a director, International Business Machines Corp., died in Highland Park, Ill., Oct. 23. He was one of the organizers of the Computing Scale Co. of America, a holding company for Dayton Scale Co., of which he was president for many years. The holding company became International Business Machines Corp. in 1924.

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Earl H. McCarty, 56, former president, Nash Motors Co., Kenosha, Wis., died Nov. 2, at his winter home in Del Ray Beach, Fla.

Industry's Conversion Gigantic "But Harder Task Is Ahead"

BOSTON

"WHEN we think back to two years ago when our industrial system was practically confined to making goods for peacetime needs and realize that within that brief time almost the entire system has been converted to production of weapons for war, a new industry for us, we can grasp what American ingenuity and resourcefulness have accomplished. Never before has such a gigantic change been effected, and never before has need been so great."

This tribute was paid to American industry by Robert P. Patterson, under secretary of war, at the twenty-seventh annual meeting and wartime conference of the Associated Industries of Massachusetts here Oct. 29.

"But a harder task lies ahead," he continued. "Output must steadily increase, despite the fact we already feel shortages of a number of raw materials. These troubles will be overcome. Production of critical materials will be stepped up and they will be confined to making weapons of war. Collection of scrap must be pushed to the limit, taking in things that have not heretofore been looked on as scrap. The Army and Navy must continue to review their specifications, to replace critical materials with non-critical."

The address was made before a massed ceremonial re-dedicating the more than 47 Army and Navy "E" pennants which have been awarded to Massachusetts manufacturers. Rear Admiral C. H. Woodward, U. S. N., retired, chief of the Incentive Division of the Navy, spoke of the prevalence of "loose thinking", namely that production alone will win the war; that time is on our side; that the enemy is dull witted, slow, dumb and yellow; that war is futile; that this is not our war.

Voluntary Effort Needed

Speaking of the Incentive Division the admiral said: "It is our duty to help increase production by arousing management and men alike to greater voluntary effort. If all you men on the production lines could see the courage and self-sacrifice of the men doing battle for you, there would be no such thing as an industrial dispute."

Importance of the small manufacturing plant was stressed by S. Abbot Smith, director of the Small War Plants Corp. He drew a picture of thousands of small plants "starving" because they do not know how to obtain government contracts or because their plants cannot be converted to war work.

"Some of the largest companies realize that small business is their best customer," he said. "Recently one large concern delegated an official to spend his entire time helping small business men because it found that 80 per cent of its peacetime business was done with small companies. Out of 184,000 manufacturing companies in the United States 169,000 employ 100 or less. If those concerns were closed, could the remaining 15,000—no matter how big—assume the staggering burden of taxes thrown upon them?"

The Small War Plants Corp. has $150,000,000 to use in helping manufacturers convert to war production, supplementing usual lending agencies. The corporation is directing work to manufacturers whose full machine time is not being utilized. This critical tool service is placing 2,000,000 hours of work per week. He reported an order for 3,700,000 incendiary bombs was divided and awarded to 15 small concerns. Lend-lease wanted a large number of tools, including left-hand twist drills for Russia, which none of the large machine tool companies wanted to handle. Small War Plants Corp. placed this with small concerns in a few hours.

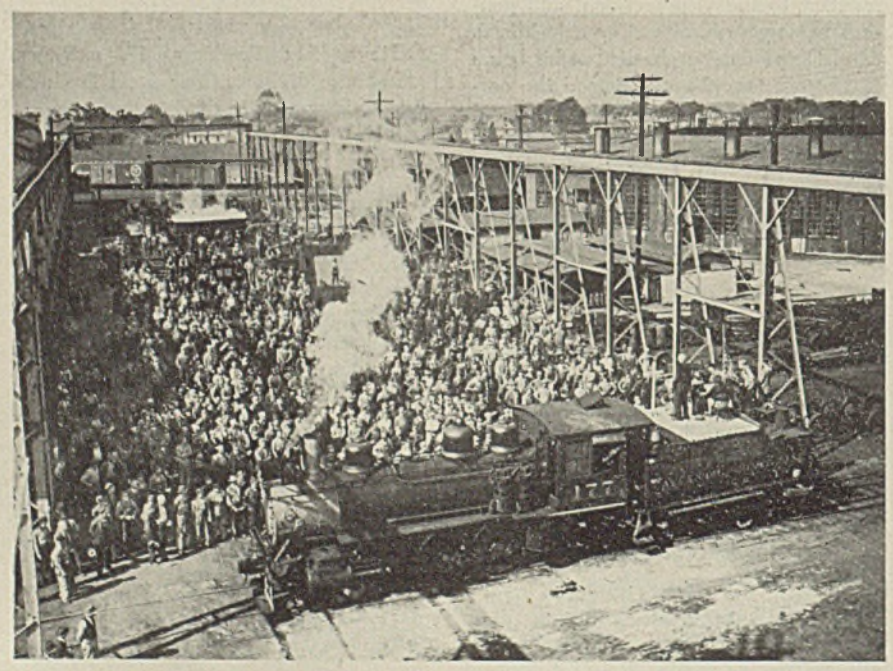
Joseph C. Grew, former United States ambassador to Tokio, described the preparations of Japan for domination of the Pacific.

Free Spirit Will Win

"Japan could win if it did not face the indomitable spirit of China and America and the other United Nations," he said. "If our common effort achieves its full promise, if we answer the Japanese slave mobilization with our own free mobilization we shall win gloriously and well. But if we are slow in exerting our full efforts victory will recede further and further and will be purchased ultimately at a terribly high cost of blood and disappointment."

Brig. Gen. Burton O. Lewis, U. S. A., chief of the Boston ordnance district, explained the organization and aims of his office in aiding manufacturers obtain war work and handle it effectively. He called attention to the fact that New England does not manufacture complete tanks, airplanes or artillery units, but produces the tools that make them, the instruments and equipment by which they operate and the fuzes, primers, boosters and shell cases with which they are armed.

RAILROAD MECHANICS PRAY AND WORK FOR VICTORY



MASS prayer for victory goes up from more than 700 mechanics of the Atlantic Coast Line railroad's shops at Rocky Mount, N. C. This photo was taken during a recent religious service, one of the regular prayer meetings which have been held each Friday since 1890. Locomotive in foreground carries minister, organist and men's choir. NEA photo

Foundry Equipment Manufacturers Have Record Attendance

ANNUAL meeting of the Foundry Equipment Manufacturers' Association in Cleveland, Oct. 30-31, was devoted chiefly to consideration of problems of manpower, salvage, the procurement of materials, and the field of foundry equipment after the war. Attendance was the largest in the history of the association.

In his opening remarks President Potter emphasized the importance of foundry equipment in the manufacture of war materials. In his opinion, the industry has the immediate responsibility to the war effort of completing its backlog of orders as quickly as possible. He pointed out that the time probably is coming when the manufacturers of foundry equipment will be called upon to use their facilities for production of direct war materiel instead of peace time products. He praised the work of W. R. Bean, chief, Foundry Equipment and Supply Unit, Tools Division, War Production Board, Washington, for his able assistance which has made it possible for the foundry equipment industry to provide maximum service to the American war effort. The president also described the work of Arthur J. Tuscany, executive secretary of the association, in connection with the Washington scene.

In the first paper of the meeting, J. K. Johnson, regional office, War Manpower Commission, Cleveland, discussed "The Manpower Problem—Today and Tomorrow". Mr. Johnson stated that industry cannot possibly hope to retain many of the men they considered necessary six months ago. To fill in the needs, industry must make maximum use of men above the military age, of women, of the handicapped, and of the wounded who have been returned to civilian life. Other problems facing industry include training, pirating, turnover, and absenteeism.

J. C. Diebel, regional chief, Industrial Salvage Section, Conservation Division, WPB, Cleveland, in stressing the importance of the organized salvage effort, stated that we cannot win the war if we do not have the materials to give the boys on the fighting front and that we cannot have these materials unless we have sufficient quantities of scrap. He said it was the duty of every manufacturer to go over the plant and to get the materials moving to the scrap piles, if they have not been used for some time and probably will not be used in the near future. A sound film, shown in connection with this address, emphasized the idea that if a machine or material has not been used for three months, and it will not be used for the next three months, "find a use for it or scrap it."

Looks Into the Future

At the noon luncheon, Earl L. Shaner, president, Penton Publishing Co., publisher of STEEL, *The Foundry*, and other business papers, spoke on "What Lies Ahead for American Industry". He paid tribute to the magnificent way in which the manufacturers of foundry equipment have met every challenge of the rapidly expanding war production program. Future success of all industry will require more efficient management, he stated. First of all, management must get along with manpower that is much less efficient.

As this problem of manpower becomes more acute, men and women who never have had any contact with industry will be employed at the bench and the machine. The impression which these temporary employes form of industry will depend much on the ability of management. For instance, when it is considered that these people will have much to do in deciding whether we will have private enterprise or some other form of economy in the post-war period, the importance of this phase of the management problem is apparent. In discussing the post-war period, he said that in his opinion it is not proper to do any "freezing" of plans while problems are so indefinite. Nevertheless, certain factors, such as the tremendous developments in the airplane, indicate some of the trends which may be expected in the period following the war.

In the afternoon Mr. Bean discussed problems of the foundry equipment industry in meeting the demands of the war effort, answering many questions pertaining to various phases of WPB control. Lewis M. Lind, Board of Economic Warfare, Washington, discussed "Foundry Equipment and the Post-War Period." After outlining the organization and work of the board, he stated that the post-war profits which will affect the foundry equipment industry and which in turn can be influenced by equipment manufacturers are as follows: Post-war status of the durable goods industries in the United States; labor rela-

Present at speakers' table at luncheon of the Foundry Equipment Manufacturers' Association Inc., at its twenty-fourth annual convention, Cleveland, Oct. 30-31, were: Left to right, Arthur J. Tuscany, executive secretary, Foundry Equipment Manufacturers' Association Inc., Cleveland; Frank G. Steinebach, editor, The Foundry, Cleveland; W. R. Bean, chief, Foundry Equipment and Supplies Unit, Tools Division, WPB, Washington; P. J. Potter, vice-president, Pangborn Corp., and retiring president of the association; E. L. Shaner, president, Penton Publishing Co., Cleveland, and feature speaker, who talked on "What Lies Ahead for American Industry"; Thomas Kaveny Jr., vice president, Herman Pneumatic Machine Co., Pittsburgh, president-elect of the association; W. L. Dean, secretary-treasurer, Mathews Conveyer Co., association director

tions; plant modernization and development of new plants. He suggested that equipment manufacturers endeavor to find what other organizations are considering in their post-war planning, and then determine where castings can fit into these plans.

Saturday morning was devoted to a round table discussion of various problems of the industry, with one representative of each company in attendance reporting.

Thomas Kaveny Jr., vice president, Herman Pneumatic Machine Co., Pittsburgh, was elected president, succeeding P. J. Potter, vice president, Pangborn Corp., Hagerstown, Md. Otto A. Pfaff, president and general manager, American Foundry Equipment Co., Mishawaka, Ind., was elected vice president of the association. Directors elected are Mr. Kaveny, Ralph W. Hisey, Osborn Mfg. Co., Cleveland, and B. C. O'Brien, vice president, Roots Connersville Blower Corp., Connersville, Ind. Other directors are Messrs. Potter, Pfaff, William L. Dean, Mathews Conveyer Co., Ellwood City, Pa., R. S. Hammond, Whiting Corp., Chicago, H. S. Hersey, C. O. Bartlett & Snow Co., Cleveland, and Orin C. Sabin, Steelblast Abrasives Co., Cleveland.

Manpower and Scrap Shortages Hinder Electric Furnace Operators

SHORTAGE of suitable scrap and the increasing time required for determination of control analyses from the laboratory, the latter as a result of manpower difficulties, were set forth as the chief difficulties confronting operators of electric furnaces at a sectional meeting of the Electric Metal Makers Guild, held at Hotel Roosevelt in Pittsburgh Oct. 31.

Discussion among Guild members, all of whom are electric furnace operating men, centered primarily on these problems, their causes and possible solutions. Leader of the discussion was Harry McQuaid, WPB industry consultant, and A. F. Danzer of the scrap unit of the Iron & Steel Branch, outlined the scrap situation. Presiding was Harry F. Walther, Timken Roller Bearing Co., Canton, O., Guild president.

Use of turnings, either in crushed or briquetted form, was suggested as the best method of easing the scrap shortage. It was also recommended that OPA study possibilities of increasing ceiling prices on turnings which have been freed of all cutting oils by the seller.

Because of the critical situation in electric furnace steels, it is probable that more consideration will be given to applications from electric furnaces for allocation of suitable scrap. However, members were warned that the general level of scrap quality is declining, and they must be ready to melt inferior scrap in greater quantities.

Loss of men in the laboratories, either to the armed forces or to other industries, has resulted in the employment of less efficient workers, in many cases women, with the result that production has been slowed down while the furnace operator waits for laboratory reports. It was recommended that WPB consider the construction and use of spectrographic equipment for analysis, as one method of eliminating this lost time.

Brigadier Gen. H. C. Minton, chief of the Pittsburgh Ordnance District, outlined the organization of Army Ordnance at the evening session. Short talks were made at this meeting by Richard Read, Halcomb works, Crucible Steel Co., Harrison, N. J., who poured the first heat of electric steel ever made in this country; E. L. Shaner, president, Penton Publishing Co., and editor-in-chief of STEEL; T. J. Ess, editor, *Iron and Steel Engineer;* E. E. Thum, editor, *Metal Progress;* and W. B. Wallis, president, Pittsburgh Lectromelt Furnace Co.

Distributors To Deal with War Program Problems

Central States Mill Supply Association—Problems and conditions facing distributors and the part distributors play in the war effort will be the theme at the tenth annual conference, Palmer House, Chicago, Nov. 16. This year's meeting is being confined to association members and to those of the American Supply & Machinery Manufacturers' Association Inc.

Porcelain Enamel Institute—A short course in heat treating for porcelain enamelers will be held in the Ceramics building, University of Illinois, Urbana, Ill., Nov. 2-5. New headquarters of the Porcelain Enamel Institute are located on the fifth floor of the Denrike building, 1010 Vermont avenue, N.W., Washington.

Technical Valuation Society Inc. — Annual forum of the society will be held at the Engineering Societies building, 33 West Thirty-ninth street, New York, Dec. 12. Morning session will be devoted to papers and discussion on many pressing valuation problems in relation to war effort and the afternoon session to committee and annual business meetings.

Purchasing Agents' Association of Chicago—An ordnance conference instead of the traditional Products Exposition will be held at the Lake Shore Club, Chicago, Nov. 17 for the purpose of studying various elements of the war program. Subjects to be discussed include price control, fuel conversion, steel facts, copper recovery and priorities.

American Petroleum Institute—Twenty-third annual meeting will be held at the Palmer House, Chicago, Nov. 9-13.

National Founders Association—Forty-sixth annual meeting is scheduled for the Waldorf-Astoria, New York, Nov. 18-19.

New England Council — Eighteenth annual conference will be held in the Statler hotel, Boston, Nov. 19-20.

National Industrial Chemical Conference and Exposition—Meetings and exhibits at Hotel Sherman, Chicago, Nov. 24-29.

National Association of Manufacturers—Annual conference has been announced for the Waldorf-Astoria, Dec. 2-4.

Sees World Reconstruction Market for Machine Tools

The machine tool industry, after the war, will find its markets through new progress in machine design, through rehabilitation of Axis nations as well as United Nations, and in the fact that "we are heading for a socialized world" when the United States "must bring to the rest of the world the benefits of the social and economic life which we live."

This was expressed by E. Payson Blanchard, sales manager, the Bullard Co., Bridgeport, Conn., at a meeting of business men, including suppliers for the company.

Mr. Blanchard said the machine tool industry "is looking forward to new achievements that will keep us from the depths of the industrial declines that we have experienced in the past. We will have the most magnificent collection of plants ever imagined and now all producing war time needs. That collection of plants can produce peace time needs to a large extent just as well."

Iron and steel works in Scotland are operating at a high rate to supply war demands, according to a government report on the industry in the United Kingdom. Pig iron production is considered adequate to essential requirements. Shipbuilding materials and plates for tanks and boilers are receiving most attention. Good progress is reported in the scrap collection program.

War Equipment Output Doubled; Will Build Heavy Aircraft

TORONTO, ONT.

WITH war equipment production this year almost double that of 1941 the general situation as to munitions is well up to schedule, C. D. Howe, minister of munitions and supply, stated last week. A further increase will be made in 1943, he added. Improvement in steel shipments from the United States will enable schedules for this year to be met. Maximum production is expected to be attained in February.

Improved technique and efficiency of production will be mainly responsible for increased output from now forward. War materials output has reached the stage where any existing fighting unit can be equipped for overseas service.

Commenting on aircraft production, Mr. Howe stated that the program for Fleet trainers has been completed, meeting requirements of the British Commonwealth air training plan, as well as various other types of aircraft. Heavier war planes will be built in future, requiring many times the man-hours necessary for a trainer or fighter. The program, now approaching the assembly line stage, will include Lancaster bombers, Mosquito combination reconnaissance, fighter, bomber planes, Curtis dive bombers and PBY flying boats. A start on these types has been made in some Canadian plants and others will go into production soon.

Metals Reserve Corp., of the United States, will assist in financing two new copper developments in Canada, G. C. Bateman, metals controller, announced. The properties to be brought into production are the Tyee mine on Vancouver island in British Columbia and the Kam-Kotia Porcupine property at Timmins, Ont. It is understood the copper produced will be available to the United States. The Tyee is an old development. The Kam-Kotia, owned by Hollinger Consolidated Gold Mines Ltd., Canada's leading gold producer, is a new development, though it received preliminary exploration work several years ago.

Reopen Molybdenite Mine

Department of Munitions and Supply has announced that Wartime Metals Corp., a government-owned company, has taken over and will bring into renewed production the old Zenith molybdenite mine near Renfrew. This property has been idle since World War I but has come into prominence because of sharply increased demand for molybdenum in the war effort. New buildings are being erected and a custom smelter will be operated to handle ore from the Zenith and other properties in the district.

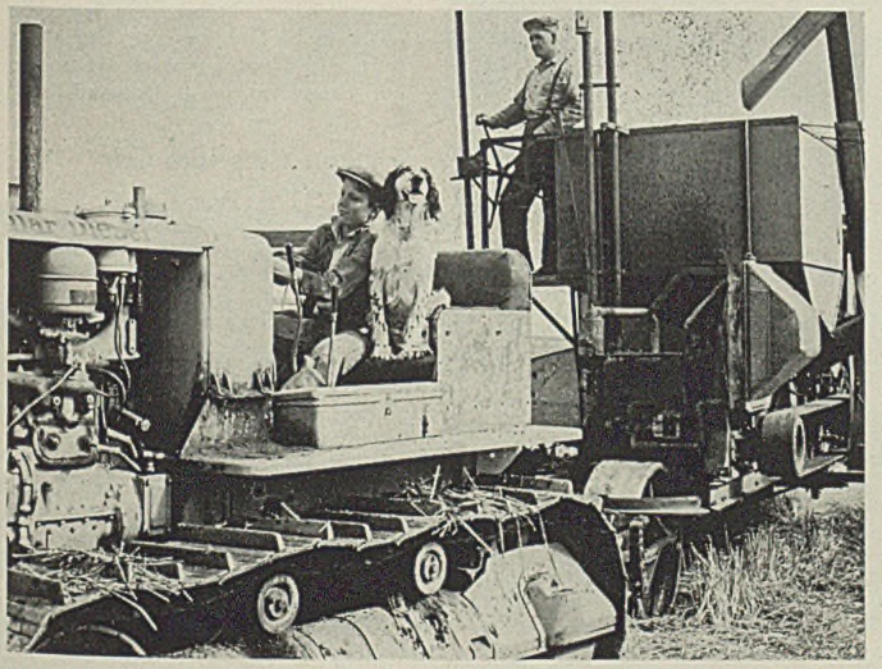
Under a new order by the metals controller no person now can produce nonferrous castings containing tin except by permit, or under alloy specifications prescribed in the order. The order is designed to conserve tin by using much smaller quantities, now found to serve the same purpose.

Steel Co. of Canada Ltd. is meeting delay in obtaining material for completion of the electric furnace and bessemer converter for its works at Hamilton, Ont. Schedule called for starting electric furnace operation by the end of the year and the converter in March. Completion dates now are indefinite. Ross H. McMaster, president, states rolled steel production to Sept. 30 was 25 per cent larger than in the same period last year.

During the third quarter the increase was 10 per cent. Additions are being made to annealing capacity for armor-piercing steel and to facilities for production of welding wire. A new plate mill has been placed in operation which has rolled 1000 tons per 24 hours on several days.

Limited deductions from income and excess profits taxes are allowed in Canada for contributions to registered prospecting syndicates and to mining and exploratory syndicates, to encourage search for base metals and strategic materials, it is reported. The government has assigned 28 geological parties to search for metals and minerals in Canada, the Northwest Territories and the Yukon.

FARM BOYS HARVESTING BUMPER CANADIAN CROPS



THIS picture portrays the manpower shortage in Canada, as bumper crops await harvesting. Many farm hands are at work in munitions plants, or at the fighting fronts; many boys must take their places at home. NEA photo passed by Canadian censor

NAM Sponsors Wartime Industrial Health Clinics

First of a series of Wartime Clinics on Health in Industry was held last week in Camden, N. J., under joint sponsorship of the National Association of Manufacturers and the Manufacturers' Committee of the Camden County Chamber of Commerce.

Dr. Victor G. Heiser, author and consultant to the NAM Committee on Healthful Working Conditions, and Dr. William M. Gafafer, chief of the statistical unit, United States Public Health Service, Washington, were the principal speakers.

Arrangements are being made with a number of trade associations for other wartime clinics this winter.

Reynolds Metals Co. Plans To Reduce Aluminum Sheet Waste

Reynolds Metals Co. is converting a former tobacco warehouse in Louisville, Ky., into an aluminum stamping plant, with an area of 250,000 square feet. Aircraft parts of many shapes and sizes will be made, so that as much of the aluminum sheet as possible can be utilized. Considerable material often is wasted when a plant produces only a few parts. Reynolds expects to convert at least 80 per cent of sheet area into useful parts. Size of the sheets generally is 48 by 144 inches.

Some of the presses going into war service formerly were used in manufacture of civilian products. One, for instance, once made burial caskets.

The scheduling unit of WPB Aluminum and Magnesium Branch at Wright Field, Dayton, O., is co-operating with Reynolds in setting up the new facilities.

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Bokum Tool Co., Detroit, is now located at 14775 Wildemere, in a modern building having floor space several times the area of its former quarters.

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Grobet File Co. of America, distributor of Swiss pattern files and rotary files, has moved to larger quarters at 421 Canal street, New York.

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B. F. Sturtevant Co., Hyde Park, Boston, has opened a new branch plant at LaSalle, Ill., to serve the mid-west territory. The new plant, superseding the factory at Sturtevant, Wis., which has been recently closed, will be operated by J. F. Gibson as superintendent under the supervision of F. Herlan, general manager of the company's mid-western division.

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United Precision Products Co. has moved to new quarters at 3524 West Belmont avenue, Chicago.

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New Chicago plant of Amertorp Corp., subsidiary of American Can Co., was opened at ceremonies, Oct. 28. Principal speaker was Rear Admiral William H. P. Blandy, chief, Bureau of Ordnance, United States Navy, Washington. The plant, built with Defense Plant Corp. funds, will manufacture torpedoes for the navy.

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Midwest Foundry Supply Co., Chicago, has moved its office and warehouse to 270 West Union street. The building is a two-story brick structure with capacity for storing 30 carloads of foundry and patternshop materials and supplies. T. C. Hamlin and Walter Zies are owners, and T. C. Hamlin Jr. is secretary and sales manager.

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Steel Heddle Mfg. Co., Philadelphia, manufacturer of loom harness equipment, has acquired the business of J. F. Johnson & Co., Philadelphia, manufacturer of precision tools, ordnance gages and special machinery. Equipment and most of the employes of the latter company have been moved to the Steel Heddle plant at 2100 West Allegheny avenue.

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Carver Pump Co. has moved its factory and offices from Rock Island, Ill., to Muscatine, Iowa, where it will occupy a building containing 60,000 square feet of space, providing room for complete foundry, machine shop, assembly and testing departments.

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Universal Crusher Co., Cedar Rapids, Iowa, has changed its name to Universal Engineering Co. Officers and personnel remain unchanged.

U. S. STEEL GROUP PLANS SAFETY DRIVE

CONSERVATION of manpower as well as record-breaking production of steel by subsidiaries of the United States Steel Corp. is the aim of these safety representatives. In this group are 80 safety men who attended a recent meeting at Chicago to arrange for the corporation's Accident Prevention and Industrial Safety Campaign which began Nov. 2

Contract for First Seamobile Let to U. S. Shipbuilding Corp.

Contract for the construction of the first full-scale Seamobile has been let by Cargoes Inc. to U. S. Shipbuilding Corp., Yonkers, N. Y.

Cargoes Inc. is the instrumentality through which the lend-lease administration is carrying on the development of the Seamobile, or re-designed Sea Otter. The experimental Seamobile will be about the same size as the Sea Otter II.

"The directors of Cargoes Inc. advised me," E. R. Stettinius Jr., lend-lease administrator, said, "that the contract calls for completion of the vessel within 90 days after delivery of the structural steel for the hull. When the vessel has been completely and thoroughly tested, we will know whether more Seamobiles ought to be built or not. Our aim is to give this novel type of vessel every fair chance to prove its worth."

Timken Cuts Idle Car Time 37.5 Per Cent

Timken Roller Bearing Co., Canton, O., has had in effect for 11 months a freight car time conservation program which has released for other use the equivalent of 157 freight trains of 100 cars each for 24 hours.

Since November, 1941, the company has eliminated demurrage on all freight cars, inbound or outbound at its ten plants. In that time 20,395 cars were held for an average of 29 hours and 29 minutes, which is 18 hours and 31 minutes less per car than the free time allowed by railroads.

Malleable castings production in August was 56,304 net tons, compared with 61,434 tons in July and 68,570 tons in August, 1941, according to the Bureau of the Census.

Replace Men in Engineering Detail and Factory Jobs

Central Iron & Steel Co. hires women employes for factory work. No discrimination against negroes.

Training courses for technical and engineering work in war plants are attracting an increasing number of women who, when trained, will move into jobs formerly held by men.

Young women in the upper right photo have shown aptitude for blueprint reading and mechanical drawing in Caterpillar Tractor Co.'s training school and soon will be placed in full-time jobs.

Federal Shipbuilding & Dry Dock Co., United States Steel subsidiary, is conducting night courses, middle right, for office employes with suitable qualifications to prepare them for engineering detail work in the shipyards.

Recently-trained women workers at Central Iron & Steel Co., Harrisburg, Pa., lower left, operate an electric grinder in the fabricating department. At lower right, negro women employes unload runner brick in Central Iron & Steel's open hearth department. At the outbreak of the war there were no women employed by the company; since then 226 male employes have enlisted or been drafted, and now 75 women are employed in plant and office jobs.

First woman employe started working at the plant May 11 and now the female working force has been extended to practically every department.

Assembly Line Established by Chrysler To Promote Sales

TO PROCESS the more than 60,000 bonds purchased each month by employes, Chrysler Corp., Detroit, has set up a "machine department" and a system of "bench assembly" to enable delivery of the securities to purchasers promptly. Deliveries are possible in not more than one week after pay day through the system.

When the bond drive was first started, purchases had to be certified to the Federal Reserve Bank, along with purchases of hundreds of other companies in the district. The result was an overload of the bank's machinery and personnel, and a delay in delivery.

Then Chrysler organization "tooled up" for quantity production.

An employe signs an authorization, and after a sufficient amount has been deducted to entitle him to a bond, the payroll department certifies his name to the War Bond department. This department requisitions the proper bond from the Treasury Department and it is filled out mechanically.

All the necessary information on the authorization is stamped onto a metal addressing plate. From that time on, no typing is necessary to fill out the bond. An operator puts the plate in a machine and with one stamp everything except the validation appears on the face.

Then it goes to one of six girls who "validate" the bond with an official stamp the corporation is authorized to use.

Aside from the payroll department employes, who spend considerable time working on the bond purchases, there are 20 people who do nothing but work on the bond assembly line. Six girls spent several weeks stamping out the addressing plates that make the system possible. Two still work steadily stamping plates for new subscribers.

Each week four girls work from three to four days just to insert carbons between the three sections of the 16,000 bonds bought that week. One girl—and sometimes two—spends her entire time feeding bonds into the addressing machines. Other girls separate the sections and remove the carbons. Four are required to place the bonds in envelopes and staple the necessary information to the envelope.

Pass 10 Per Cent Mark

In between these, are other girls who check the operations for accurary of names, addresses and amounts.

During the past 16 months, more than 336,500 bonds at a total cost of more than $7,500,000 have been purchased by the corporation's employes. As of Nov. 2, better than 94 per cent of the workers were subscribing 10 per cent of their earnings. Average weekly purchases now are about 16,000, costing approximately $390,000.

Largest number of bonds purchased in any one day was Oct. 23, when more than 21,000 were bought at a cost of $312,500.

During the first year of the payroll deduction plan, from July 1, 1941, to June 30, 1942, Chrysler workers bought 133,275 bonds at a cost of $3,087,456.

From four to six girls, above, worked three to four days each week just to insert carbon paper in the thousands of bonds that Chrysler employes buy each week. It took these girls, lower right, several weeks to cut the metal plates used to imprint the bonds

However, during the next four months the rate of purchases was greatly accelerated and the total reached 218,585, at a cost of $4,773,450.

Simple Campaign Triumphs in a Month

A picked group of men at Diamond T Motor Car Co., Chicago, recently wound up a War Bond sales campaign distinguished for its simplicity and dispatch. No giant rallies were called, no bands played. Except for the presence of bulletin boards indicating the status of employe participation in each department, there was no visible evidence that a bond drive was in progress. Yet one month from the day Diamond T's sales crews "closed" with their first prospects, final reports were in and checked. The campaign culminated in a plant-wide subscription of 10 per cent of payroll for the purchase of bonds.

The committee directing the drive marshalled facts of the government's difficult problem in financing the war, prepared a case for the bonds based on their intrinsic value as investments, and incorporated the whole story in a simple, easy-to-read brochure, a copy of which went to each worker. This pamphlet and two pledge cards were the only sales-aids used by the selling crews.

Pledge Card Gets Results

The pledge card is credited by W. D. Baldwin, advertising manager of the company and a key man in the bond sales organization, with contributing most to ultimate accomplishment of their goal. For all standard cases, the card called for a flat 10 per cent deduction each pay day from an employe's wages. Its unequivocal make-up eliminated the individual consideration and decision of each man as to how much he could afford to devote to the bond savings plan. This card was given the concentrated attention of salesmen, but for exceptional cases where workers manifestly were unable to meet the full 10 per cent quota, the crew man also carried a second card for an unstated amount. While the bond selling committee was determined to see their efforts bear fruit, they nevertheless avoided pressing for the full amount where it would work undue hardship.

Operation of the Diamond T plan was exceedingly simple and direct. As an example, a foreman representing the committee called together the 51 employes in his department and delivered a ten-minute address on the virtues of the payroll-savings bond-buying plan. When

A Chrysler employe displays a collection of bonds bought during the campaign

finished, he called for a showing of hands of those who were willing to sign a 10 per cent card at once. All 51 workers accepted on the spot, and the foreman's part in the drive was complete. The entire plant was broken up into groups such as this one, with either a union shop steward or foreman responsible for each group. There was no mass movement through the factory divisions and, accordingly, very little interruption of war production.

Booklet Tells the Story

Equally effective as an instrument to boost sales was the committee's brochure, issued with full approval of the union's shop stewards who, according to the company, gave enthusiastic aid and support throughout the drive. Entitled *War Bonds—Our Share in Winning the War,* the booklet set forth the arithmetic of war finance, showing a glaring discrepancy between war expenditures which this year will exceed $60,000,000,000 and the estimated $48,000,000,000 which government may be able to raise through taxation, bank loans, etc. The difference of $12,000,000,000, it was emphasized, must be made up through purchase of War Bonds on the voluntary plan. It pointed out that such purchases were a patriotic duty as well as a necessity, warning that the "situation does not permit of halfway measures. Nothing less than 10 per cent will do. If the country's voluntary purchases are not increased to approximately $1,000,000,000 per month in the next 60 days, we can expect compulsory collection to be

TWO Navy men who saw action at Pearl Harbor and other Pacific battles were entertained by Scully Steel Products Co., United States Steel Corp. subsidiary, as a part of the Victory Week Bond drive. Above, the Navy men show fragments of Japanese bombers shot down at Pearl Harbor and at the raid on the Marshall and Gilbert Islands, following a tour of the company's plant

Life-sized cut-outs, like the one at left, are being used by the War Production Drive committee at South Works of Carnegie-Illinois Steel Corp., Chicago, to impress workers with the necessity for buying War Bonds. The cut-outs have been set up at all plant entrances

adopted," warned the brochure's author.

"Dodgers," those who declined for various reasons to make a commitment, were informed through the brochure that there was no question of the ability of practically all Diamond T employes to make this saving. "The records show that between increases of pay and longer time schedules, the average factory pay check last month was 48 per cent greater than in the same month two years ago." Increases in living costs were acknowledged, but were shown to be still well below the rise in pay. In addition, the booklet told workers, company had paid a bonus for the last four consecutive quarters averaging about 9 per cent to all but the newest employes.

Offer War Bonds for Salvage, Maintenance Suggestions

To promote industrial conservation and to help speed up production, Metallizing Engineering Co. Inc., New York, is offering a total of $650.00 in War Bonds for details of maintenance and salvage procedures with the metal spraying process.

First prize is $250, second prize, $150, third prize, $100 and three prizes of $50 each. Contest closes Dec. 15. Complete information and entry forms obtainable from *Metco News*, 21-07 Forty-first avenue, Long Island City, New York.

'V Depends on Me" is the slogan which won for John T. Nevitt Jr., inspector at Leeds & Northrup Co., Philadelphia, the first-prize War Bond in the company's production slogan contest. Above, Nevitt is receiving the bond from C. S. Redding, Leeds & Northrup president

"Need Profit Motive in Building After War"

Private enterprise and the profit motive must be relied on to do the main job of creating and maintaining full employment after the war, is the conclusion reached by Stuart Chase, writer on economic subjects, in a special report on postwar problems to the Twentieth Century Fund, New York. Mr. Chase warns we should be prepared to supplement private enterprise by a program of public works and government expenditures large enough to provide needed facilities and services and take up the slack in employment.

Pointing to the universally acknowledged goal of full employment and production in the United States after the war, he warns against ill-advised attempts to overturn the economic system in order to achieve it. His report is titled: "Goals for America; A Budget of Our Needs and Resources".

Forecast Car Demand Up 6% for Fourth Quarter

Regional shippers' advisory boards forecast a 6 per cent increase in freight car requirements for the fourth quarter, covering 27 principal commodities, as furnished to the car service division of the Association of American Railroads.

Increased demand for cars to transport steel and iron products is estimated at ½-per cent, of machinery and boilers, 13 per cent. A reduction in car needs for transporting agricultural implements and vehicles other than automobiles is estimated as 45.5 per cent. All comparisons are with actual carloadings during the same quarter in 1941.

In recognition of a successful scrap salvage campaign and outstanding record for participation in the war bond drive, a new tanker launched at Bethlehem's Sparrows Point Shipyard Inc. Oct. 17, was named SPARROWS POINT.

Index of Activity Continues To Advance

STEEL's monthly index average recorded the seventh consecutive advance in October to reach a new peak level. During that period the index averaged 176.9, compared with 174.8 in September. In April this year, the beginning of the sharp upward trend, the index stood at 166.7.

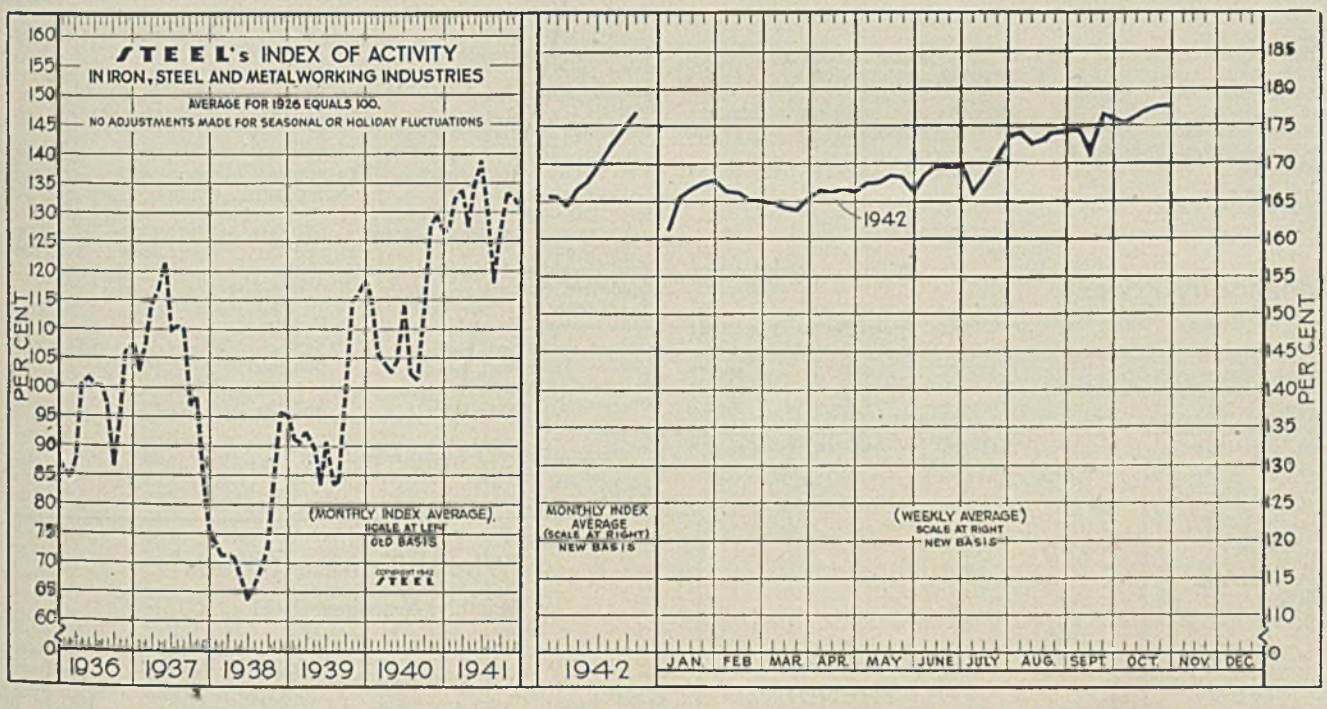
For the latest weekly period STEEL's index also advanced, gaining 0.1 point to 177.8. The weekly index has been edging upward in recent weeks, reflecting general improvement in electric power consumption and revenue freight carloadings.

Recent War Production Board report on progress made in munitions production is encouraging. The board states that September output of military goods was 7 per cent above the preceding month, bringing the munitions index up to 381. In the past eleven months production has been quadrupled.

Compared with the previous month, September production of naval and army vessels was up 22 per cent; airplanes, 10 per cent and tank production 3 per cent. Machine tool output in September was 2.4 per cent ahead of August, but backlogs now are declining.

Government financed construction for war purposes in September was slightly less than in August and is expected to decline further over the coming months. For all 1942 it is expected to total $14,400,000,000, or about one-fourth of all government expenditures.

Other industrial indicators that advanced during September include production of steel ingots and commercial steel castings, building construction, cement and bituminous coal production. Those indices which recorded moderate declines during the latest period for which



STEEL's index of activity gained 0.1 point to 177.8 in the week ending Oct. 31:

Week Ended	1942	1941*
Aug. 29	174.5	118.2
Sept. 5	174.8	111.8
Sept. 12	171.2	131.3
Sept. 19	176.8	130.6
Sept. 26	176.0	132.0
Oct. 3	175.5	132.7
Oct. 10	176.5	132.3
Oct. 17	176.9	133.4
Oct. 24	177.7	133.5
Oct. 31	177.8†	133.8

†Preliminary.

Mo. Data	1942	1941	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931
Jan.	165.7	127.3	114.7	91.1	73.3	102.9	85.9	74.2	58.8	48.6	54.6	69.1
Feb.	165.6	132.3	105.8	90.8	71.1	106.8	84.3	82.0	73.9	48.2	55.3	75.5
March	164.6	133.9	104.1	92.6	71.2	114.4	87.7	83.1	78.9	44.5	54.2	80.4
April	166.7	127.2	102.7	89.8	70.8	116.6	100.8	85.0	83.6	52.4	52.8	81.0
May	167.7	134.8	104.6	83.4	67.4	121.7	101.8	81.8	83.7	63.5	54.8	78.6
June	169.4	138.7	114.1	90.9	63.4	109.9	100.3	77.4	80.6	70.3	51.4	72.1
July	171.0	128.7	102.4	83.5	66.2	110.4	100.1	75.3	63.7	77.1	47.1	67.3
Aug.	173.5	118.1	101.1	83.9	68.7	110.0	97.1	76.7	63.0	74.1	45.0	67.4
Sept.	174.8	126.4	113.5	98.0	72.5	96.8	86.7	69.7	56.9	68.0	46.5	64.8
Oct.	176.9	133.1	127.8	114.9	83.6	98.1	94.8	77.0	56.4	63.1	48.4	59.2
Nov.	....	132.2	129.5	116.2	95.9	84.1	106.4	88.1	54.9	52.8	47.5	54.4
Dec.	....	130.2	126.3	118.9	95.1	74.7	107.6	88.2	58.9	54.0	46.2	51.8

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

figures are available, include fabricated structural steel shipments, foundry equipment orders, gear sales and steel scrap consumption.

A slight advance in inventories and shipments occurred during September, according to the Department of Commerce survey of manufacturing concerns. Volume of new orders registered a moderate decline during the period.

During the period ended Oct. 31 steel ingot production held at 99 per cent of capacity, for the third consecutive week. Steel scrap supplies are better than at any time in recent months. In some instances steel producers are building up stocks and are now more confident than in some time that current peak steel output can be sustained throughout the winter months.

Early estimate of electric power consumption for the latest period shows a slight gain to about 3,755,000,000 kilowatts. This represents an increase of 12.5 per cent above that recorded in the like week a year ago.

BUSINESS BAROMETER

Financial Indicators

	Sept., 1942	Aug., 1942	Sept., 1941
30 Industrial Stocks†	107.41	106.08	127.35
20 Rail Stocks†	26.76	26.19	29.28
15 Utilities†	11.76	11.51	18.62
Average Price of all listed bonds (N.Y.S.E.)	$96.18	$96.08	$94.74
Bank Clear'gs daily average (000 omitted)	$1,245,176	$1,120,946	$1,069,375
Commercial Paper, interest rate, % (4-6 months)	0.69	0.69	0.69
Com'l loans (000 omitted)*	$10,361,000	$10,382,000	$11,024,000
Federal Reserve ratio (per cent)	85.6	86.3	91.2
Capital flotations			
New Capital	$45,085,000	$103,072,000	$64,840,000
Refunding	$55,893,000	$58,573,000	$209,122,000
Federal gross debt (millions of dollars	$86,483	$81,685	$51,371
Railroad earnings	$154,631,717	$135,264,074	$104,357,836
Stock sales, New York Stock Exchange	9,449,934	7,387,341	13,546,161

†Dow-Jones series.
*Leading member banks Federal Reserve System.

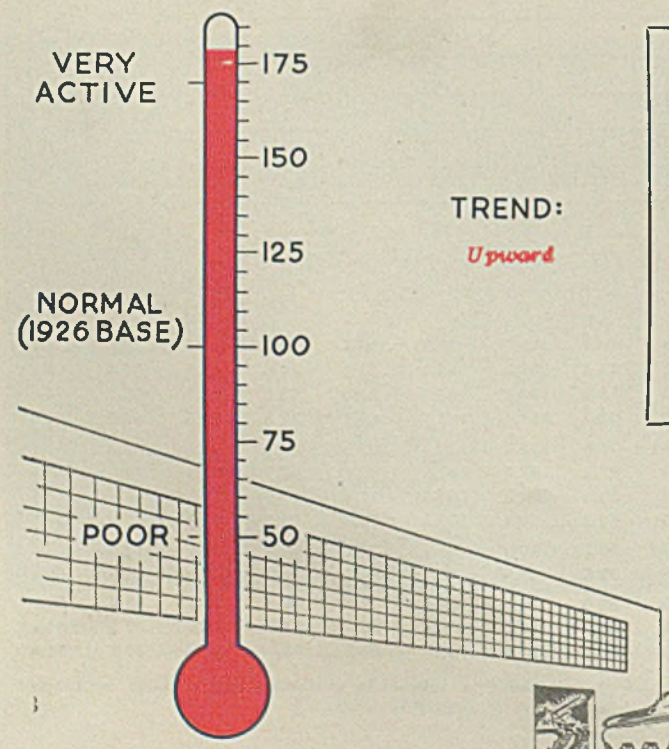
Commodity Prices

	Sept., 1942	Aug., 1942	Sept., 1941
STEEL's composite finished steel price average	$56.73	$56.73	$56.73
U. S. Bureau of Labor's index (1926 = 100)	99.6	99.2	91.8
Wheat, cash (bushel)	$1.36	$1.29	$1.17
Corn, cash (bushel)	$1.125	$1.045	$0.815

Industrial Indicators

	Sept., 1942	Aug., 1942	Sept., 1941
Munitions Output Index (WPB)	381	357	83
Commerce Dept.'s Mfgs. Index†			
Orders	245	256	196
Shipments	213	207	168
Inventories	175.4	174.2	140.0
Iron and Steel Scrap consumption (tons)	4,556,000	4,645,000	4,392,000
Gear Sales Index	351	380	243
Foundry equipment new order index	446.4	510.8	363.8
Finished steel shipments (Net tons)	1,703,570	1,788,650	1,664,227
Ingot output (average weekly; net tons)	1,651,188	1,632,833	1,591,531
Dodge bldg. awards in 37 states ($ Valuation)	$723,216,000	$721,028,000	$623,292,000
Fabricated structural steel shipments (Tons)	164,561	166,959	204,085
Steel castings output (Net Tons)	135,855	133,845	117,703
Coal output, tons	48,760,000	47,160,000	47,505,000
Coke Production (Daily Ave.)			
By-product	172,110	171,443	160,400
Beehive	23,051	22,333	20,200
U. S. Dept. of Labor (90 industries, factory):			
Av. wkly. hrs. per worker†	42.4	42.6	41.0
Av. weekly earnings†	$39.42	$38.56	$31.66
Cement production, bbls.	17,527,000	17,605,000	16,115,000
Cotton consumption, bales	996,149	925,089	877,971
Freight Car Awards	1,863	0	4,470
Car loadings (weekly av.)	882,253	871,855	885,000

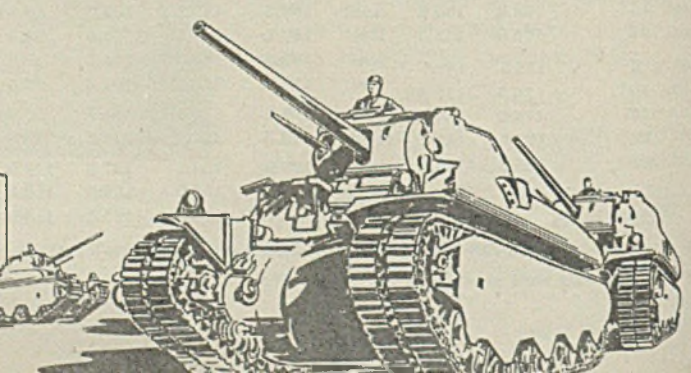
†August, July and August respectively.



Where Business Stands

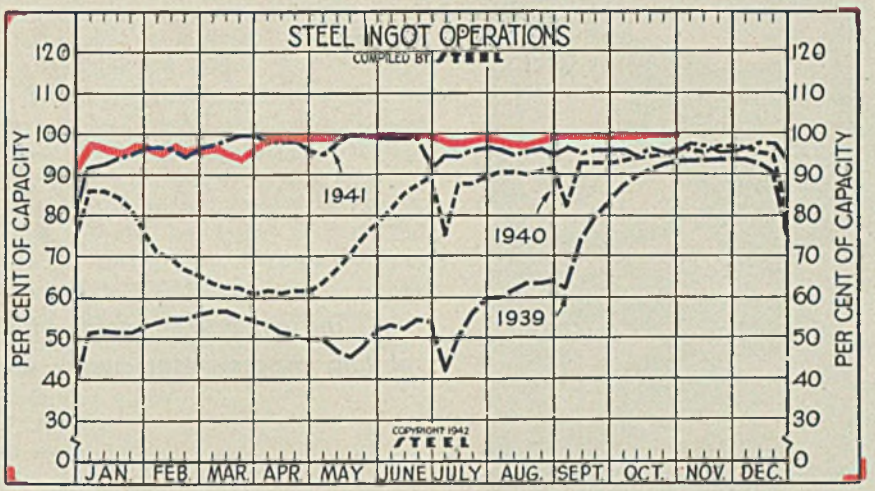
Monthly Averages, 1941 = 100

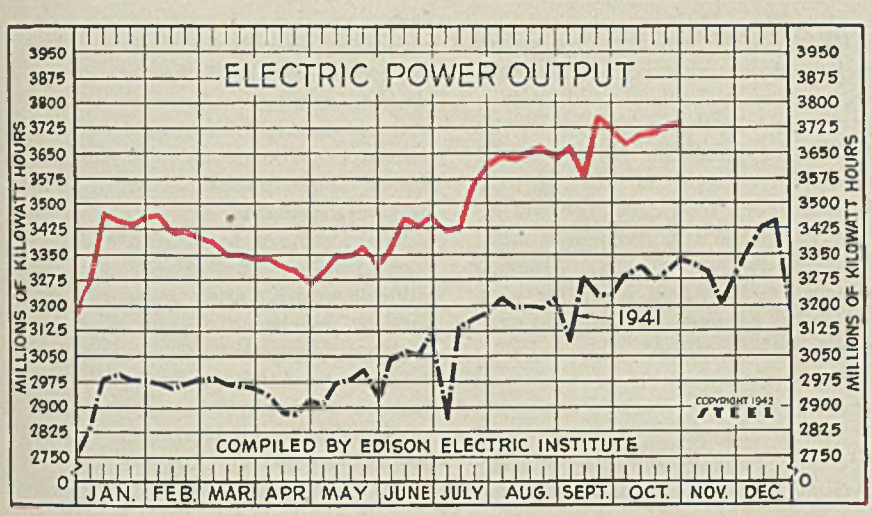
	Sept., 1942	Aug., 1942	Sept., 1941
Steel Ingot Output	103.8	102.7	100.1
Finished Steel Shipments	99.9	104.9	97.6
Structural Steel Shipments	87.7	88.1	108.8
Building Construction	144.5.	144.0	124.5
Wholesale Prices	114.1	113.2	105.2
Freight Carloadings	108.5	107.2	108.9



Steel Ingot Operations
(Per Cent)

Week ended	1942	1941	1940	1939
Oct. 31	99.0	95.5	96.5	93.0
Oct. 24	99.0	95.5	95.5	92.0
Oct. 17	99.0	96.5	95.0	91.0
Oct. 10	98.5	94.5	94.5	89.5
Oct. 3	98.0	96.0	93.5	87.5
Sept. 26	98.0	96.0	93.0	84.0
Sept. 19	98.0	96.0	93.0	79.5
Sept. 12	98.0	96.5	93.0	74.0
Sept. 5	98.0	95.5	82.0	62.0
Aug. 29	98.0	96.5	91.5	64.0
Aug. 22	97.5	96.0	90.5	63.5
Aug. 15	97.0	95.5	90.0	63.5
Aug. 8	97.5	96.5	90.5	62.0
Aug. 1	98.0	97.5	90.5	60.0
July 25	98.5	96.0	89.5	60.0
July 18	98.0	95.0	88.0	56.5
July 11	97.5	95.0	88.0	50.5





Electric Power Output
(Million KWH)

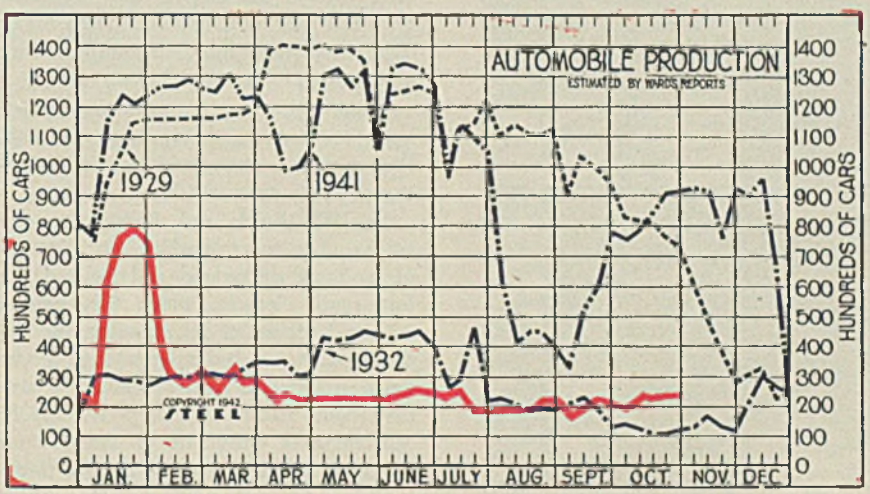
Week ended	1942	1941	1940	1939
Oct. 31	3,755†	3,339	2,882	2,609
Oct. 24	3,753	3,299	2,867	2,622
Oct. 17	3,717	3,273	2,838	2,576
Oct. 10	3,702	3,315	2,817	2,583
Oct. 3	3,683	3,290	2,792	2,554
Sept. 26	3,720	3,233	2,816	2,559
Sept. 19	3,757	3,232	2,769	2,538
Sept. 12	3,571	3,281	2,773	2,532
Sept. 5	3,673	3,096	2,592	2,376
Aug. 29	3,640	3,224	2,736	2,442
Aug. 22	3,674	3,193	2,714	2,434
Aug. 15	3,655	3,201	2,746	2,454
Aug. 8	3,649	3,196	2,743	2,414
Aug. 1	3,649	3,226	2,762	2,400
July 25	3,626	3,184	2,761	2,427

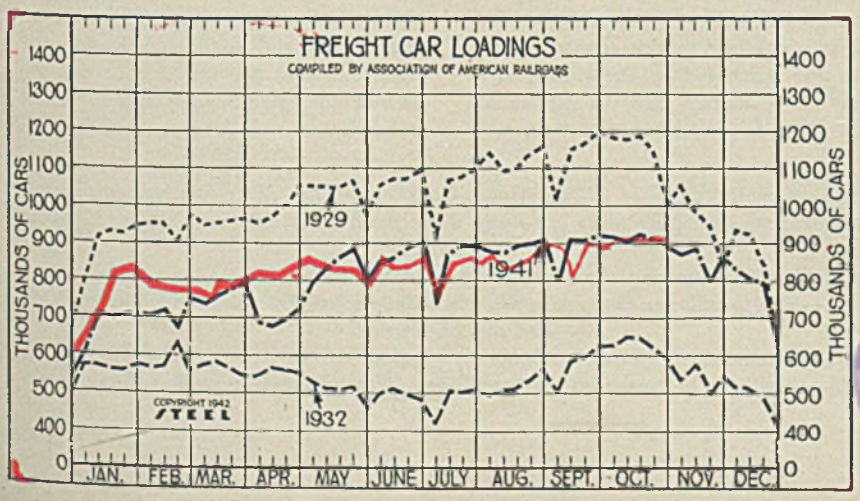
†Preliminary.

Auto Production
(1000 Units)

Week ended	1942	1941	1940	1939
Oct. 31	20.9	92.9	118.1	82.7
Oct. 24	20.8	91.9	117.1	78.2
Oct. 17	20.2	85.6	114.7	70.1
Oct. 10	20.3	79.1	108.0	75.9
Oct. 3	19.9	76.8	105.2	76.1
Sept. 26	20.9	78.5	96.0	62.8
Sept. 19	21.0	60.6	78.8	54.0
Sept. 12	19.6	53.2	66.6	41.2
Sept. 5	16.9	32.9	39.7	26.9
Aug. 29	21.1	40.0	27.6	25.2
Aug. 22	20.2	45.5	23.7	17.5
Aug. 15	19.2	45.6	20.5	13.0
Aug. 8	19.2	41.8	12.6	24.9
Aug. 1	18.3	62.1	17.4	28.3
July 25	18.3	105.6	34.8	40.6

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

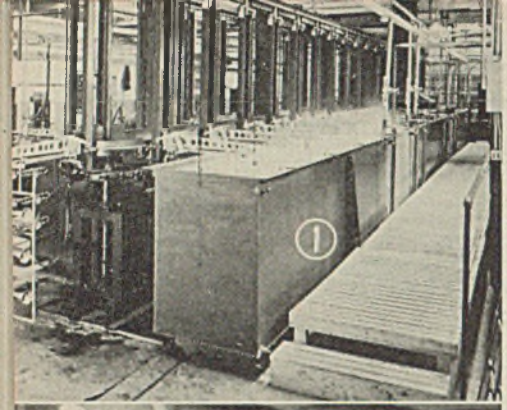


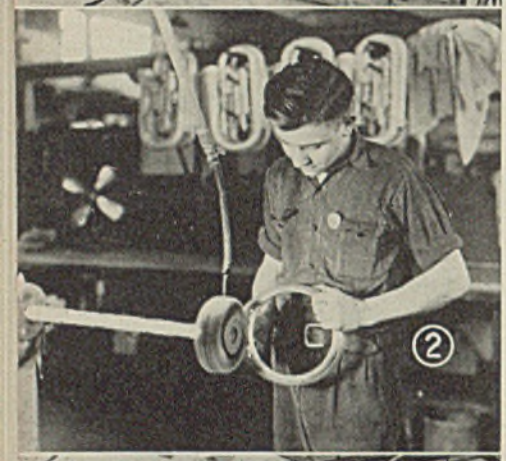


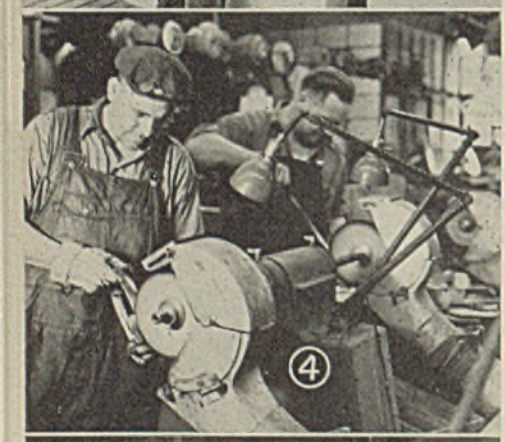
Freight Car Loadings
(1000 Cars)

Week ended	1942	1941	1940	1939
Oct. 31	900†	895	795	806
Oct. 24	903	914	838	834
Oct. 17	901	923	814	861
Oct. 10	910	904	812	845
Oct. 3	908	918	806	835
Sept. 26	898	920	822	835
Sept. 19	903	908	813	815
Sept. 12	815	914	804	806
Sept. 5	888	798	695	667
Aug. 29	899	913	769	722
Aug. 22	869	900	761	689
Aug. 15	869	890	743	674
Aug. 8	850	879	727	665
Aug. 1	864	883	718	661

†Preliminary.







INDIUM

. . . an unrestricted metal with many industrial uses. Silver-indium plating process offers many advantages in the present emergency

By M. T. LUDWICK
Indium Corp. of America
Utica, N. Y.

THERE NOW are only five metals unrestricted by wartime regulations—lead, osmium, palladium, gold, sodium and indium. It is most fortunate in this crisis that indium—the long neglected forty-ninth element in the periodic table—has been fully developed and recently introduced as a commercial metal with many uses for industry. Although not as yet a household word, for some time indium has been a full-fledged commercial metal of proved value.

In general, indium is to nonferrous metals what chromium is to ferrous metals. These qualities have been utilized successfully for a wide variety of functional and decorative purposes; for marine diesel, automotive and aviation-type bearings by Cummins, White Super Truck and many others; for bright work and hardware by Studebaker.

Indium provides extraordinary resistance to wear and corrosion, inhibits fatigue and friction, and imparts a lustrous, continuous finish.

In 1863 Reich and Richter, in the course of a spectrographic investigation of thallium, discovered and isolated the forty-ninth element, which they named indium because of its characteristic indigo spectrum. Indium remained a virtually unknown and exceedingly rare metal until 1924, when Dr. William S. Murray, now president of the Indium Corp. of America, decided to investigate its properties. It was only after a two months' search that a single gram of indium was found in this country. This gram was purchased by Dr. Murray at a price much higher than of platinum.

Dr. Murray undertook the necessary pioneering research with indium. When he became certain of the ability of indium to stabilize nonferrous metals, and was convinced of the commercial usefulness of indium, he began the quest for an ample source of supply. Most metallurgists and mining authorities considered indium to be nonexistent in paying quantities. But after a long and difficult search, after examining hundreds of specimens of gold, silver, lead and zinc ores, indium of commercial interest was found in a sample of zinc ore near Kingman, Ariz.

This extensive property was acquired and developed. The first bar of indium metal to be produced in this country came from this mine. The current demand for indium is satisfied by recovery from the scoria of zinc refinement. However, the ever-increasing demand for indium will soon necessitate the exploitation of these rich deposits.

The first commercial use of indium was for dental alloys. Indium-gold alloys provided an improved inlay which possessed greater tensile strength, ductility and immunity from discoloration. Indium-gold alloys were next used in the tiny hinge pins of spectacle frames to eliminate "freezing" often caused by perspiration.

Indium has received its greatest publicity for its use in bearings of lead, cadmium, silver or copper. Such bearings have been most successful in high-speed aviation-type bearings, for heavy-duty trucks and for diesel marine engines. Indium provides the needed resistance to organic acids often present in lubricants used in such engines. In-

Fig. 1—General view of C. G. Conn Co.'s automatic silver plating equipment. Transfer arms on which racks are hung move work from bath to bath in sequence automatically

Fig. 2—Scratch brushing the silver plate is second step

Fig. 3—Now headlamp rims are ready for indium plating, having been silver plated and scratch brushed

Fig. 4—Indium plated surface is being Lea buffed here

Fig. 5—Coating is processed by heating in oven. Note channels to guide rollers of racks

dium-treated bearings have increased longevity, added stamina and make possible more efficient operation.

In the present emergency, due to the extreme shortage of tin and the need for its conservation, indium presents a worthy remedy for the replacement of tin babbitts used for many bearings. An interesting example of the ability of indium to give added stamina to bearings used in industrial operations was its use in a certain heavy-duty screw machine in which the bronze bearings had to be replaced every three or four weeks of operation. Indium-treated bronze bearings were introduced, and after nine months of continuous service they are reported as still going strong!

A number of possible uses for indium suggest themselves in fields which are not as yet thoroughly explored. However, experimental work is under way. The 1941 Bureau of Mines *Mineral Year Book* mentions some of these possibilities, including glass colorant, jewelry, low-melting alloys, electrical contacts. Other uses suggested are for washers, automatic fire alarms, temperature controls, light reflectors, office machinery, household appliances, stereotypes and electrotype metals, precision instruments, plumbing fixtures.

Two of the most promising applications are for brazing and soldering alloys. Here a small quantity of indium improves the soundness of the braze, due to the greater fluidity and adhesion produced. Indium itself has excellent "wetting" properties on steel.

Indium is a member of the aluminum group as regards properties. It is softer than lead, silvery and resistant to air and water. Indium has a melting point of 155 degrees Cent. (311 degrees Fahr.) and boils at 1450 degrees Cent. Its specific gravity is 7.31, atomic weight 114.76 and its hardness is 1 brinell.

While indium alloys readily with all nonferrous metals, it seems of importance at this time to consider particularly the value of indium with silver. A growing demand for silver exists due to a shortage of other materials. An extremely small proportion of indium, added to silver, will improve its resistance to tarnish as well as add wearing qualities to such surfaces. For instance, the addition of 1 per cent of indium to cast silver increased the hardness from 46 to 92 rockwell H. Indium-silver-plated finishes have a beautiful, rich luster and excellent wearing qualities. This finish is, in effect, an actual alloy—a hard, nonporous surface that will not chip, flake or peel. It is capable of taking a high polish and is suggested for reflectors, searchlights and lamps.

With the recent listing of lead in group 3 of needed war materials, lead now is available for many industrial purposes from which it had been excluded. This makes the subject of indium-lead alloys of interest to industry, and we are glad to give herewith a few of the results obtained on tests of various such alloys. Tests were conducted according to E-18-36 ASTM specifications for rockwell hardness, scale R, with the following results:

Lead	17
1% Indium	46
2% Indium	49
3% Indium	83
4% Indium	106
6% Indium	130

The tensile strength of pure lead should be approximately 1600 pounds per square inch. The addition of 1 per cent of indium will raise that value to between 2400 and 3000 pounds per square inch. Alloys up to 6 per cent show regular solid solutions as the addition of indium affects the size of the crystals from the start. Dendrides begin at 8 per cent.

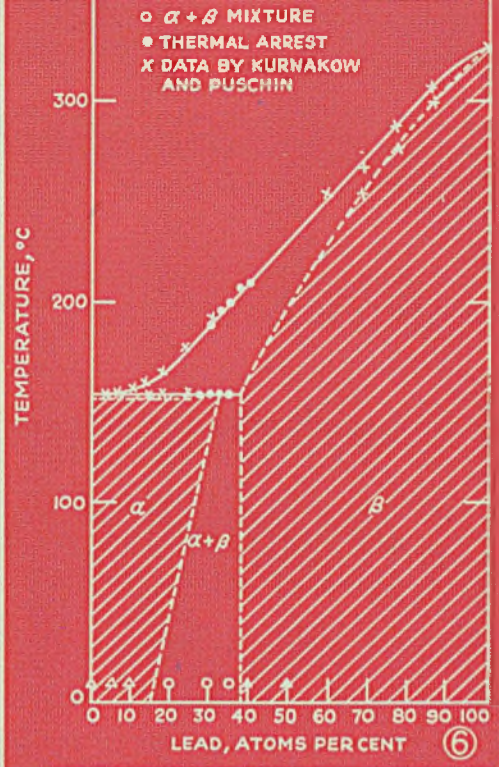
Indium plates readily and is easy to handle in the plating and heating procedures. The most widely used procedure is the patented cyanide bath followed by heat treatment.

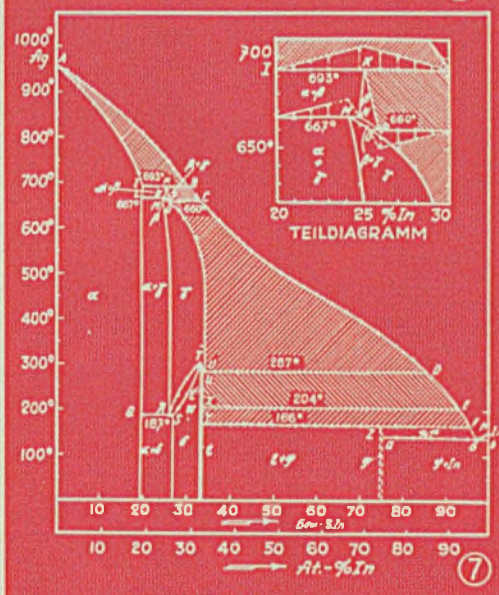
Experienced platers have expressed their enthusiasm for this procedure, as they appreciate the speed and ease of its operation and the accurate control that can be maintained throughout the entire treatment. There is no waste, either, as excess indium residues are easily recovered. Moreover, this solution has excellent throwing powers and distributes evenly. After plating, the indium deposit is soft, gray and matte in appearance.

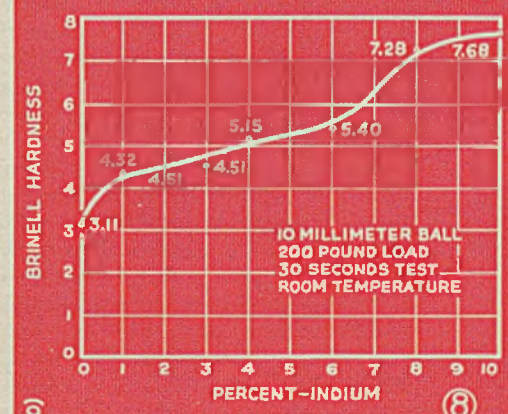
The heat treatment thoroughly diffuses the indium into the underlying metal so that it becomes an integral part of the base metal, diffusing vertically as well as horizontally. Thus, it becomes an actual alloy with the base metal, assuring a continuous nonporous coating that will not chip or peel. The diffusion is carried out in the majority of instances at 350 degrees Fahr. for approximately 2 hours. The indium finish thus achieved is capable of being highly polished.

A practical example of the silver-indium plating process, as developed by

(*Please turn to Page* 122)







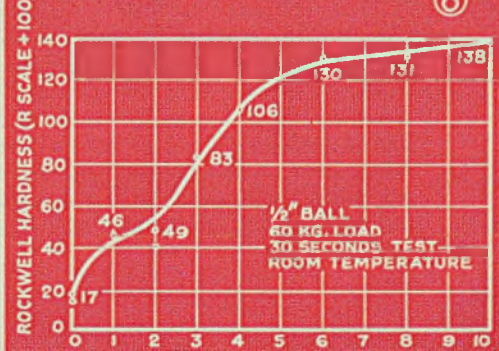
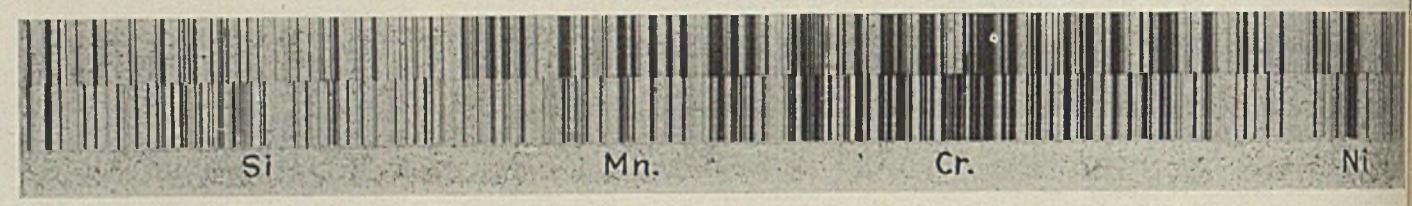


Fig. 6—Constitutional diagram of the indium-lead alloys
Fig. 7—Constitutional diagram of the silver-indium alloys
Fig. 8—Charts showing how hardness increases with increased amount of indium in the lead-indium alloys

Application of the Spectrograph in Steel



IN HIS treatise on "The Manufacture of Iron and Steel", in 1868, Ferdinand Kohn remarked that it was a fortunate coincidence that the bessemer process and the spectroscope were developed at nearly the same time.

To many who are unfamiliar with this early period and think of spectroscopic and spectrographic analysis in the iron and steel industry as an entirely new thing, this comment, indicating that it was an important factor in the successful development of the bessemer process, will come as somewhat of a surprise.

It is true that in the early days of the industry, the spectroscope was not used for the analysis of the steel itself. It was not until later that close attention was paid to the composition of the metal as a governing factor in its quality and properties. For many years, however, it was general practice in the steelworks in England and the European continent to observe and regulate the progress of the bessemer blow and to determine the time for turning the vessel down with a spectroscope, the visual prototype of the modern spectrograph. This was largely the result of the pioneer work of Henry E. Roscoe, (later Sir Henry, the eminent British chemist) at the works of John Brown & Co. in Sheffield. As early as 1863 he had found that the spectrum of the converter flame underwent changes at different stages of the blow that provided clearer evidence of the progress of the chemical reactions and a more definite indication of their completion than could be obtained by simply watching the flame. In time the blowers gained sufficient experience so that they could recognize these changes by visual observation, without the aid of the spectroscope and it gradually fell into disuse, but it was in the steel industry that the spectroscope found its first important industrial application.

During the past few years, with the necessity for closer control of all factors in steel production, there has been a renewal of interest in methods of control in the bessemer process that do not depend on personal judgment and do not require the long experience on the part of the observer that is necessary to be sure that that judgment is right. The system recently developed by the Jones & Laughlin Steel Corp., Pittsburgh, is fundamentally an adaptation of that of Roscoe. Instead of the spectroscope, however, filters are used to isolate from the light of the converter flame those portions of the spectrum that are significant and the trained eye of the experienced blower is replaced by photoelectric cells that register and record their observations on electrical instruments.

Applications that have attracted the greatest attention in recent years are those for the analysis of the steel. For this work a spectrograph is generally used, rather than a spectroscope. The former is a photographic instrument, the latter a visual one. Several distinct advantages are thus gained. The photographic plate provides a permanent record which may be retained as long as necessary. From it the results of the original analysis may be checked at any later time if its accuracy is questioned. It records simultaneously the spectrum lines of all elements in the sample that are susceptible of spectrographic detection, whether or not there is reason to anticipate their presence. With the spectroscope, on the other hand, specific search must be made, while the analysis is in progress, for the spectrum lines of each element. Those that are not expected will usually be overlooked and will thus fail of detection. Sometimes lines may be present that are too faint to see, but which will appear in the photograph because of the cumulative action of the photographic emulsion. Many of the elements, particularly when present at low concentration, give no indications in the limited region of the spectrum that can be seen by the human eye, but are readily found in the ultra-violet, which cannot be seen but which does affect the photographic plate.

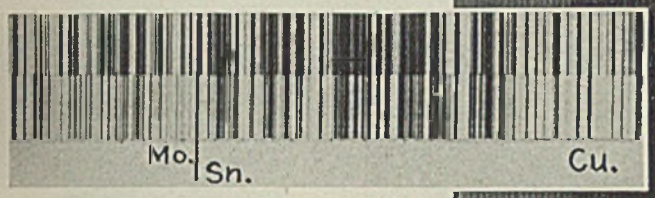
Finally, the photographic record of the spectrum provides a far more accurate basis for quantitative determinations than any visual observation. This is because the various elements are vaporized at different rates during the process of excitation of the spectrum. Those that are highly volatile will appear in the early stages, while the more refractory ones may not appear at all until a later stage. Since the eye sees only an instantaneous aspect of the spectrum, it will at no time receive a true indication of the average composition. The photographic plate, on the other hand, integrates these variables and gives, in its records, a true average.

A spectroscope is sometimes used for qualitative studies to discover whether certain elements are present in a sample. Under carefully controlled conditions it may even give rough indications of the amounts[1], sufficient to identify the general type of alloy, but when really accurate quantitative analyses are required, the spectrograph is invariably used.

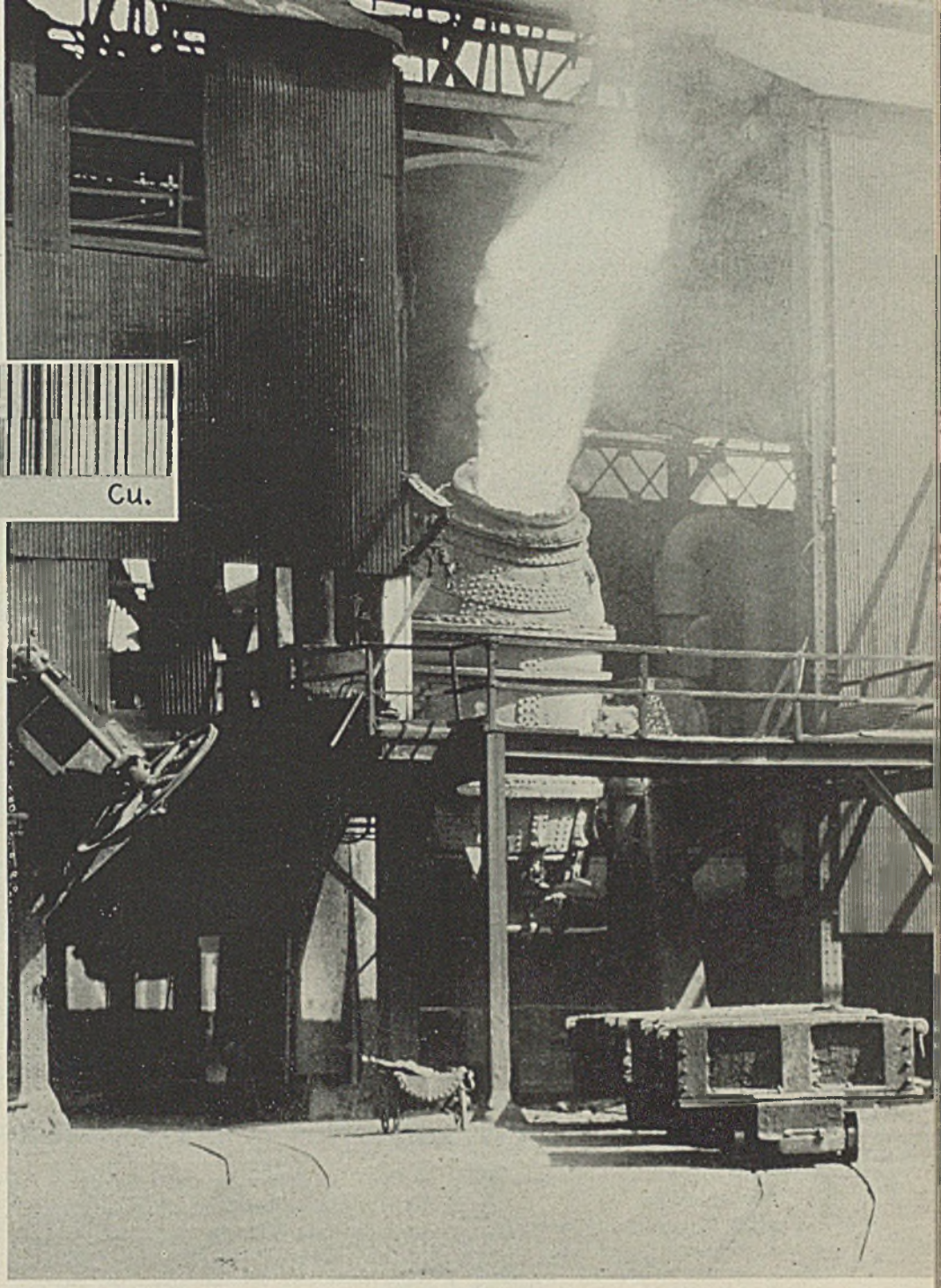
The fundamental basis for all these procedures is the fact that each of the chemical elements, when in the form of

[1]Emery, "Commercial Applications of Visual Spectroscopic Analysis," Journal Optical Society of America, 31:160 (1941).

Plants



By CHARLES C. NITCHIE
Bausch & Lomb Optical Co.,
Rochester, N. Y.



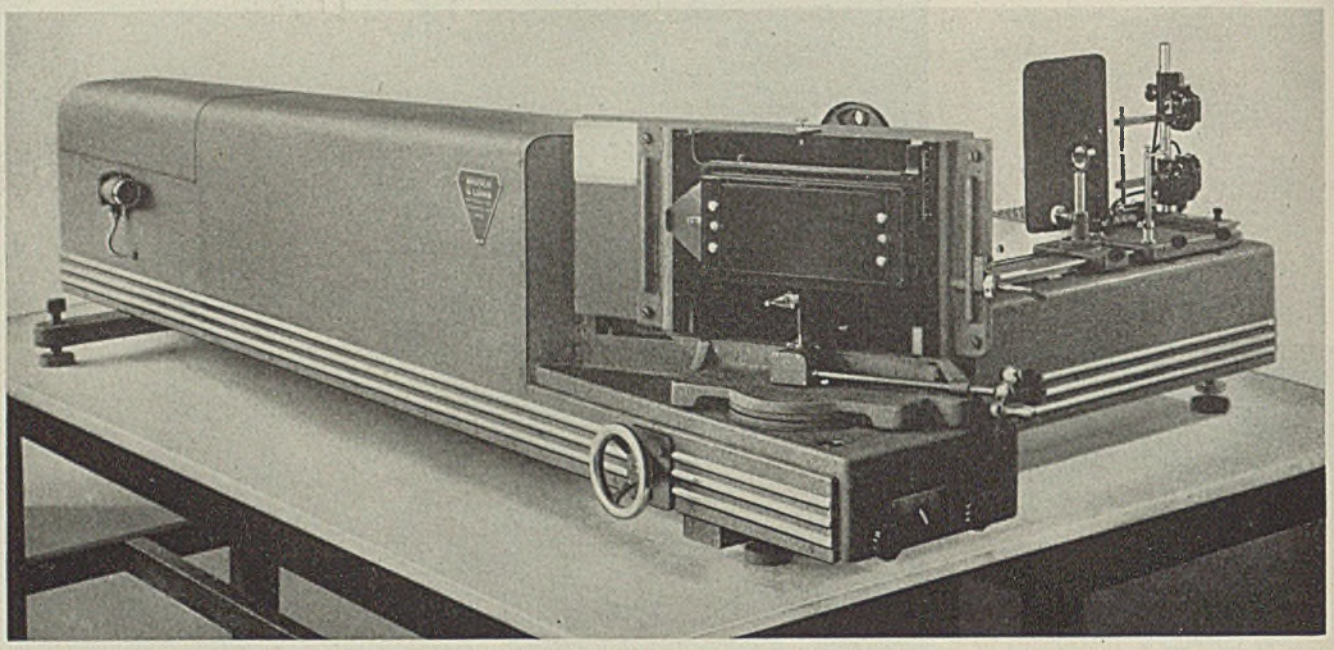
Directly above, a part of the spectra of iron is shown above centerline, and stainless steel below centerline. Important lines of alloy and impurity elements are indicated. Lines common to both spectra and darker above the centerline than below are those of iron. Difference in density is attributed to lower concentration of iron in alloy steel. Lines of other elements than iron are either absent from upper spectrum or appear more faintly because they are present only as minor impurities

Blowing practice at bessemer plants, right, can be controlled by the use of the spectrograph

a luminous vapor, emits light which is made up of discrete wavelengths — determined by the structure of its atoms and the electrical charges occurring in them under the conditions of excitation. Since no two elements have the same atomic structure the radiations emitted differ and each element gives out light which differs in its wavelength distribution from that of all others and is uniquely characteristic of it. If two or more elements are present, each yields its own radiations and the resultant spectrum includes the characteristic lines of all the components, which may be positively identified once their wavelengths are measured.

The function of the spectrograph is to break up the light coming from the vapor into its individual wavelengths and to register them as separate lines on the photographic plate. These lines are simply images of a narrow slit through which the light enters the instrument. Their positions on the plate are determined by the wavelengths of the radiations producing them and the amounts by which they are displaced by the dispersing medium used, which may be either a prism or a diffraction grating. In either case lines of short wavelength are recorded at one end of spectrum, long wavelengths at the other. The wavelength of any selected line can then be found by measuring its position along the length of the spectrum with reference to lines of known wavelength either in the same spectrum or in an adjacent spectrum obtained from a standard material of known composition. Knowing the wavelength of the line, the element producing it can then be identified by reference to published tables.

Quantitative determinations are based on the fact that under given conditions of excitation, the intensity of the light emitted by an element is a



Large Littrow-type quartz spectrograph

direct function of the number of its atoms in the radiating vapor. If the concentration is high in the sample being analyzed, its radiations are correspondingly strong; if the concentration is low, the radiations are weak. These differences in intensity are indicated on the photographic plate by the relative densities or opacities of the recorded lines. The exact relationships between concentration and line density are determined by preliminary calibration, using the spectra of samples of known composition. From the data thus obtained curves are plotted from which the concentrations in other samples may be determined.

Details of the procedures used are beyond the scope of the present article but may be found in numerous published papers. Briefly, those that are in general use in steel laboratories include the following steps.

A sample of the steel to be analyzed is taken from the liquid metal in the furnace or ladle and cast in a suitable mold in the form of small rods which are sent to the spectrographic laboratory for analysis. In the laboratory the tips of these rods are ground to a standard form. Two of them then are mounted in clamps which hold them in definite position with reference to the spectrograph, and at a definite distance apart. In this position they serve as the terminals for an electric discharge circuit which produces an arc or a high-tension spark between them when the circuit is closed. The heat of the discharge vaporizes the metal and raises the vapor to a high temperature so that it becomes luminous. The light from this luminous vapor enters the slit of the spectrograph from which it passes to the prism or diffraction grating within the instrument and is there dispersed into a spectrum which is focused on a photographic plate.

When sufficient exposure has been given, the plate is developed, fixed, washed, and dried in much the same way as in other branches of photography, except that special plates and solutions are often used to speed up the process.

The plate then is transferred to a densitometer with which the densities of selected spectrum lines, characteristic of the elements to be determined are measured photoelectrically and the readings reduced to percentage figures by reference to the curves previously mentioned.

Under favorable circumstances, when all details have been reduced to a definite routine, these operations can be carried out rapidly. In the Ford Motor Co. laboratory, for example, it is stated that on a single sample a complete analysis for five elements can be made and reported in six minutes after the sample reaches the laboratory[2].

When several samples are recorded on the plate the average time per sample is considerably reduced, since the same photographic processing time then serves for all.

At the same time it has been conclusively proven that the accuracy of these analyses is at least as good as, and frequently better than, that in the chemical laboratory, using the older chemical methods. Vincent and Sawyer[1] report a series of repeated analyses for silicon in an iron containing a little over 2 per cent of that element. They state that among 34 separate determinations, made on the same sample but on different days and on different photographic plates by different operators, the lowest determination was 2.00 per cent, the highest, 2.08 per cent with an average of 2.04 per cent. Similarly Gregg and Irish, Bethlehem Steel Co., found in a series of 51 determinations of manganese, a minimum of 0.396 per cent and a maximum of 0.415 per cent with an average of 0.405 per cent. Molybdenum determinations were run on a group of different steels by both chemical and spectographic methods in the range from 0.18 to 0.30 per cent. On 13 samples the maximum difference was 0.02 per cent[3]. Others have stated that in cases of dispute between the chemical and spectographic analyses, the latter usually are found to be nearer to the true values.

With spectrographic analyses the uncertainties to be expected are in fairly constant ratio to the amounts being determined. With good technique, close attention to all details of procedure and adequate experience, a precision of 2 to 3 per cent of the amounts being estimated can be obtained and this holds through a wide range of concentrations. This means, however, that high concentrations cannot be determined with the same absolute accuracy as low. For this reason the use of spectrographic methods usually is confined to the determination of elements that do not exceed 4 or 5 per cent in concentra-

(*Please turn to Page* 124)

[2]Vincent and Sawyer, "Routine Spectroscopic Analysis in Ford Motor Co. Foundry," *Metal Progress* 36:35, (1939).

[3]Gregg and Irish, "Spectrographic Analysis of Steel," *Iron Age*, 145:33 (1940).

[4]Nusbaum and Hackett, "Spectrographic Analysis of Iron for Tellurium," Journal Optical Society of America, 31:620 (1941).

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MOLYBDENUM

Its properties and uses; methods of detection and analysis; world production; future of molybdenum

IN THE SIXTEENTH to eighteenth centuries the terms "molybditis," molybdena," were used to designate materials that appeared deadlike. These terms were derived from a Greek word meaning lead. In all probability galena (PbS), stibnite (Sb_2S_3), graphite (C), and even some of the sulfides of copper and silver were at one time or another grouped under these headings. It was not until 1778-79 that molybdenite was identified as a distinct mineral and not to be confused with any one of several similar materials including plumbago and graphite. This identification is still a problem under some circumstances. Other workers produced metallic molybdenum soon after, chemistry of the element was established early in the nineteenth century.

The chief interest in molybdenum when it was first established seems to have been just as another element added to the growing list, and it was not until the nineties that its metallurgy and possible use in steel were seriously investigated. The general interest in molybdenum is best shown by its record of world production, which increased from about 22,000 pounds annually in 1900 to between 35,000,000 and 40,000,000 pounds in 1941, with further increases in prospect due to the present emergency. The greatest part of this increase since 1900 has been in the last ten years; hence it can be stated that the great interest in molybdenum is quite recent.

Properties and Uses: Molybdenum metal closely resembles steel in color. Its specific gravity is 8.6 and its melting point about 2600 degrees Cent. The metal is as hard as common iron and soft steel, is ductile, and is resistant to hydrochloric and sulfuric acids except when they are hot and concentrated. At low and ordinary temperatures the metal resists oxidation, but it combines with oxygen readily at high temperatures forming a yellow powder.

These properties, hardness, ductility, resistance to some of the common acids and to oxygen at low temperatures, are imparted in some degree to its alloys.

The most important use for molybdenum and the greatest volume of the metal is in the iron and steel industry, where many new alloys have been developed in recent years. Its benefits as an alloy addition are due to true alloying effects rather than cleaning or deoxidizing action, which is an important function of some alloy elements.

The chief source of molybdenum is molybdenite, which has to be roasted for conversion to three forms for adding to steel:

1. Ferro-molybdenum containing 50 to 65 per cent molybdenum.
2. Calcium molybdate containing 45 to 50 per cent molybdenum.
3. Molybdenum trioxide formed in briquettes.

About one-half million pounds of molybdenum is used annually by the chemical industry. A large use is in pigment colors in paint, lacquer and printing inks. Molybdenum dye, particularly for furs, is an interesting development.

Molybdenum is being used as a catalyst by the oil industry in the distillation of high-grade gasoline. This use has been greater in Europe than in the United States.

The use of metallic molybdenum is limited largely to the electrical and radio industries. Because of its high melting point it is adaptable for uses related to the high-temperature hydrogen furnace. Another important use is in radio tubes, especially receiving tubes.

Analysis: In ores the presence of molybdenum usually is determined by the identity of the sulfide molybdenite, which is the most common molybdenum-bearing mineral. Molybdite, an oxidation product; wulfenite ($PbMoO_4$), characteristic of certain oxidized lead deposits; and powellite ($CaMoO_4$), more common than is generally realized, are easily recognized when well developed. Means of identification are given in this paper with the descriptions of the molybdenum minerals.

Frequently the minerals are not well developed, or they are too fine grained to establish their identify, and a chemical test is necessary to determine the presence of molybdenum. Usually it is possible to isolate a small quantity of the material suspected of being molybdenum mineral and satisfactory tests then are not difficult. Various tests are given in chemistry and mineralogy books.

M. N. Short in *The Microscopic Determination of Ore Minerals*, U. S. Geol. Survey bull. 914, pp. 233-234, 1940, recommends two microchemical tests suitable for very small grains, but the method can be used equally well on larger grains by keeping the amounts of reagents used somewhat proportional to the size of the grain to be tested. The procedure recommended by Short is given in detail and should be studied carefully by all who wish reliable results;

Abstracted from *The Occurrence and Production of Molybdenum*, by John W. Vanderwilt, special lecturer in geology, Colorado School of Mines, Golden, Colo., and consulting geologist, Denver, published by Colorado School of Mines.

TABLE I—Sources and Production of Molybdenum in Metric Tons (2204 Pounds) 1901 to 1940[1]

	1900	1902	1904	1906	1908	1910	1912	1914	1916	1918	1920	1922	1924	1926	1928	1930	1932	1934	1936	1938	1939	1940
Austria	..	..	..	..	..	..	..	..	..	12	11	..	39	18	3	..	..	..	..	..	..	..
Australia																						
New South Wales	..	8	13	17	5	25	29	37	26	44	29	1	6	..	..	..	4	3	..	9	(†)	(†)
Queensland	6	20	11	54	45	60	52	40	42	56	60	1	2	..	..	..	2	1	20	14	20	(†)
Victoria	..	..	..	..	..	..	..	..	..	..	2	..	22	22	..	..	..	..	..	36	26	(†)
West Australia	..	..	..	..	..	..	..	..	..	3	..	31	..	..	..	..	..	..	..	..	..	..
Canada	..	..	..	..	..	..	..	1	43	103	..	..	5	6	..	..	..	..	..	..	..	..
Chile	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	1	(†)
Chosen	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	30	(†)
Germany (Saxony)	..	..	..	..	..	..	..	1	1	1	..	..	..	..	..	..	45	104	80	(†)	(†)	(†)
Greece	..	..	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	(†)	(†)	(†)
Italy	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	860	12	(†)	(†)
Japan	..	..	..	..	39	..	95	..	8	4	53	..	..	..	..	..	..	5	7	(†)	(†)	(†)
Mexico	..	..	..	..	..	..	..	..	..	1	2	..	..	..	..	..	3	467	534	483	523	310
Morocco	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	(†)	149	187	258	(†)	(†)
Norway	4	11	17	14	13	..	4	32	58	67	..	..	43	70	101	128	158	146	422	462	423	450
Peru	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7	15	19	185	342	293
Rumania	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	(†)	6	46	160	(†)	(†)
Sweden	..	..	..	..	..	..	..	1	1	25	..	..	..	3	..	..	..	..	..	..	..	..
Spain	..	..	..	..	..	..	..	14	136	20	11	..	..	3	..	..	..	..	..	..	..	..
Turkey	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	80	(†)	(†)
United States	..	7	7	..	..	..	..	1	94	391	16	..	135	649	1555	1688	1103	4247	7795	15103	13755	15564
Yugoslavia	..	..	..	..	..	..	..	5	5	..	..	..	..	..	..	..	..	..	..	19	60	(†)

[1]1900-1930—Petar, A. M., Molybdenum; U. S. Bur. Mines Econ. Paper 15, p. 16, 1932. 1939-1940—Mineral Yearbook, U. S. Bur. Mines. Because of war, totals for 1941 are unavailable. (†) Production figures not available.

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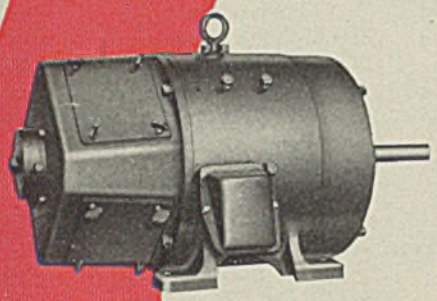

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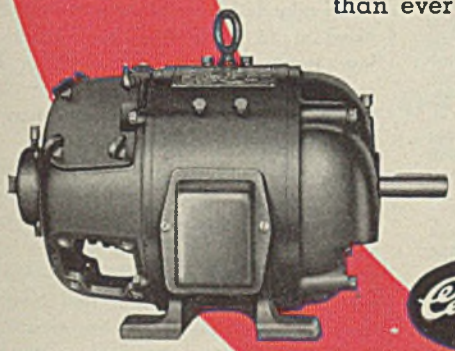

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for although tests can be simplified under ideal conditions, these conditions are seldom met with in practice. The methods recommended by Short are given in full below:

Potassium Tiocyanate Test: Reagents used are 10-per cent solutions KCNS in H_2O and granulated zinc metal. Product: A complexion of orange to red color. Limit is 0.003 milligram of molybdenum.

When thiocyanate ions are added to a molybdate solution, in a reducing environment, the solution is colored orange to red, the color depending on the concentration of molybdenum. The fact that a reducing environment is essential serves to distinguish molybdenum from iron. When H_2O_2 is added to the solution, the red color disappears. With iron the reverse is true, the red color being apparent only when the iron is in the ferric condition. Hence when H_2O_2 is added to a solution containing ferric and thiocyanate ions, the red color persists. Molybdenite is the only metallic mineral containing molybdenum described in this (Short's) bulletin, and the following description applies to it, although the test works equally well on any molybdenum compound.

A flake of molybdenite measuring 0.2 to 0.5 millimeter in diameter is fused in a platinum wire loop with Na_2CO_3, KNO_3 flux. After fusion, the wire is lowered until the bead is immersed in a porcelain capsule containing 0.5 cubic centimeter of 1:5 HCl. When the bead has dissolved, 0.2 cubic centimeter of 10 per cent KCNS is added to the solution. This is colored light yellow, but the color may not be apparent if the concentration in molybdenum is low. If iron is present the solution is colored pink to red. From 5-10 fragments of 20 mesh metallic zinc are added to the solution. Nascent hydrogen is liberated as the zinc is attacked by HCl. This has a powerful reducing action, which colors the solution from orange to red. The compound formed has the composition $K_3(Mo(CNS)_6)$.

Several drops of H_2O_2 are now added. Unless iron is also present in solution, the color disappears immediately. Most textbooks on microchemistry advocate adding phosphoric acid to the solution. This prevents the reddish iron coloration from forming. However, this precaution is unnecessary.

If other metallic elements besides molybdenum are present in the mineral, it is better to immerse the bead in hot water instead of 1:5 HCl. The reason for this variation in procedure is that most metallic elements form carbonates that are insoluble in water when fused in a sodium carbonate bead, but molybdenum forms sodium molybdate, which is soluble. Hence, when the bead is immersed in hot water the sodium molybdate dissolves but lead or other insoluble carbonates do not. The insoluble residue is filtered off and the filtrate evaporated to dryness in the porcelain capsule. After cooling, 0.5 cubic centimeter of 1:5 HCl is added to the capsule, and from then on the test is carried out in the same way as with molybdenite.

Tungsten interferes with the test, producing an insoluble blue oxide when the zinc is added to the acid. This should be filtered off, or most of the liquid can be withdrawn from the precipitate by means of a pipette. Titanium, vanadium, and uranium do not influence the reaction.

Sulphuric Acid Test: Reagent is 1:3 H_2SO_4, product is a deep blue molybdenum oxide of unknown composition. Limit is 0.03 milligram of molybdenum.

This is a modification of the familiar test described in most textbooks of mineralogy. Although it does not involve a fusion, it is included here for convenience.

The test is most applicable to molybdenite, MoS_2, and is the best one for distinguishing this mineral from graphite. The minimum amount of material required to give a satisfactory test is a flake of molybdenite about 0.5 millimeter in diameter. The weight of molybdenum in this flake, on the assumption that its thickness is one-tenth its diameter, is 0.03 milligram. Molybdenum must be in the molybdic state (valence 6), hence the sulphur of molybdenite must be roasted off before making the test. The flake is placed in a small porcelain crucible and the crucible tilted at an angle from the vertical. A low bunsen flame is turned on the crucible. It must not be high enough to heat the crucible to redness; otherwise the molybdic oxide formed may volatilize. If the heat is too low the mineral will not oxidize. Some experience is needed to determine how much heat should be used. Usually it requires from 10 to 20 minutes to complete the oxidation. The flake should be observed from time to time, if necessary with a hand lens. As oxidation proceeds, the flake loses its luster and becomes coated with white (pale yellow when hot) crystals of MoO_3. When the oxidation is complete the black core disappears, and nothing but the white crystals is visible. This oxidation is the most important part of the test. If the fragment is comparatively large, say 2 millimeters or more in maximum diameter, the oxidation need not be carried to completion. In any event, it is the white oxide and not the sulphide which gives the test.

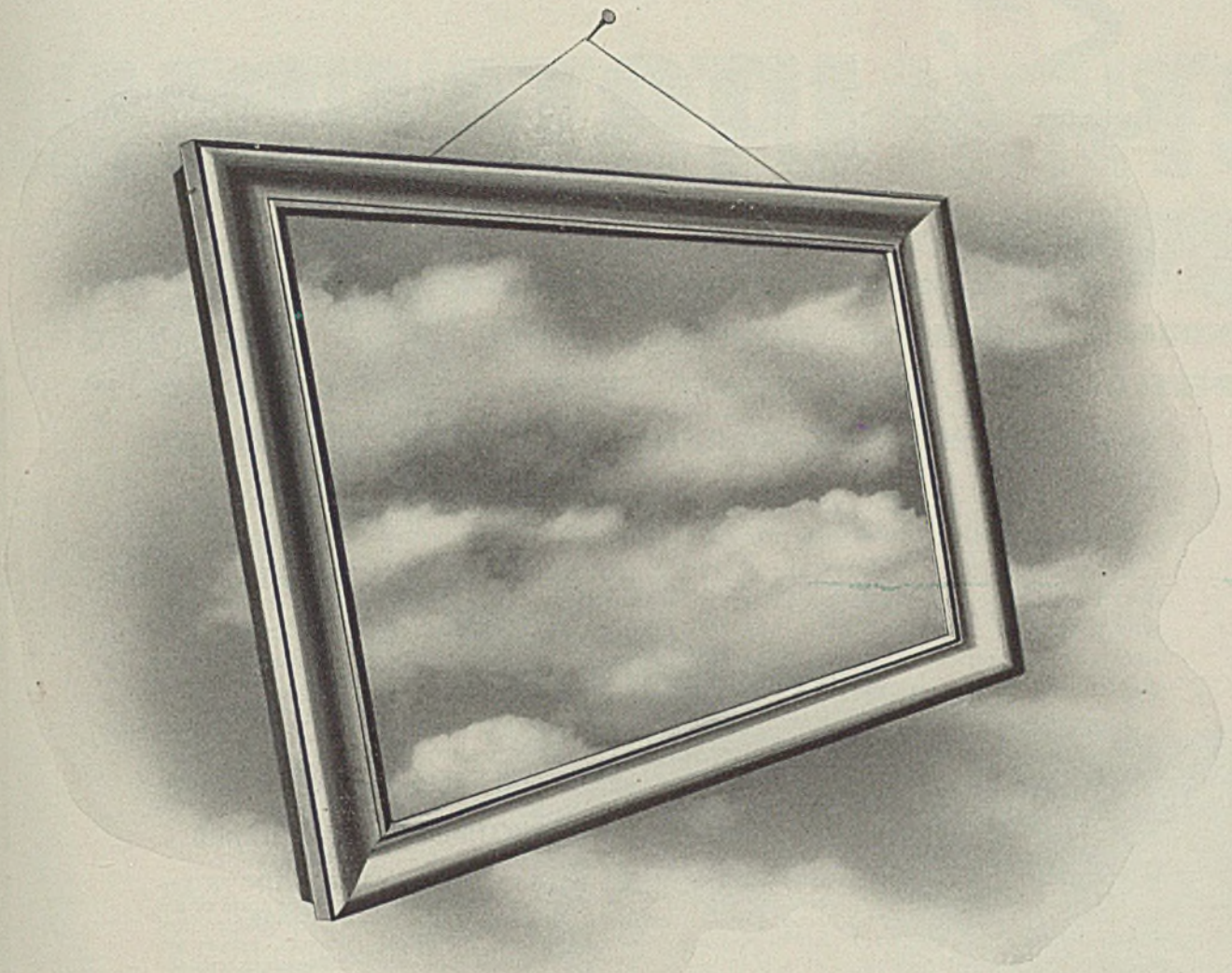
The crucible is cooled and a drop of 1:3 H_2SO_4 is added to the MoO_3 residue. The crucible is again heated over a low

(*Please turn to Page* 125)

TABLE II—Production in Pounds of Molybdenum in the United States and Comparison with World Production

Year	Climax[1] Colo.	Questa[2] N. M.	Mammoth Arizona	Copper Creek Arizona	Copper[3] byproduct	Total U. S.	Total[4] outside U. S.
1909	.....	.....	.....	.....	.....	.....	170,000
1910	.....	.....	.....	.....	.....	.....	187,000
1911	.....	.....	.....	.....	.....	.....	139,000
1912	.....	.....	.....	.....	.....	.....	397,000
1913	.....	.....	.....	.....	.....	.....	201,000
1914	.....	.....	.....	.....	.....	1,297	286,520
1915	.....	.....	.....	.....	.....	181,769	308,560
1916	Small	.....	.....	.....	.....	206,740	687,648
1917	Small	.....	.....	.....	.....	350,200	744,952
1918	342,000	.....	.....	.....	.....	861,637	617,120
1919	152,648	.....	.....	.....	.....	297,926	321,784
1920	.....	.....	.....	.....	.....	34,900	371,272
1921	.....	.....	.....	.....	.....	.....	68,324
1922	.....	.....	.....	.....	.....	.....	72,732
1923	22,667	15,236	.....	.....	.....	37,903	196,156
1924	297,174	135,546	.....	.....	.....	432,720	279,908
1925	1,154,050	313,684	.....	.....	.....	1,467,734	287,540
1926	1,431,830	334,397	.....	.....	.....	1,766,229	306,356
1927	2,286,075	293,513	.....	.....	.....	2,579,588	163,096
1928	3,329,214	460,907	.....	.....	.....	3,790,121	229,216
1929	3,904,648	493,399	.....	.....	.....	4,397,847	257,868
1930	3,759,269	639,280	.....	.....	.....	4,398,549	282,112
1931	3,157,000	480,541	.....	.....	.....	3,157,541	306,356
1932	2,373,000	521,541	.....	.....	.....	2,894,541	492,676
1933	5,761,000	577,537	.....	.....	.....	6,338,537	1,170,325
1934	9,377,000	572,303	.....	69,336	.....	10,018,639	1,199,592
1935	10,892,000	334,287	(†)	356,054	.....	11,582,241	3,158,332
1936	17,959,000	405,638	(†)	1,320,891	480,000	20,155,529	4,793,700
1937	30,122,000	499,232	227,630	943,512	4,890,000	36,681,874	3,266,328
1938	25,414,000	442,133	481,156	607,605	3,480,000	30,450,308	2,940,136
1939	32,414,000	470,314	(†)	.....	7,166,395	40,050,709	3,140,700
1940	25,300,000	484,120	(†)	.....	9,882,597	35,666,597	2,320,812
1941	24,641,000	470,428	(†)	.....	10,051,003	35,162,431	(†)

[1]Coulter, Wm. J., Molybdenum operation at Climax, Colorado Min. Assoc. Yearbook 1942, p. 31.
[2]Vanderwilt, J. W., Geology of the Questa molybdenite deposit, Taos County, N. M. Colo. Sci. Soc. Proc. vol. 13, no. 11, page 602, 1938, and Carman, J. R., personal communication.
[3]Annual report for year ending 1941, Kennecott Copper Corporation. Figures given in report included production from Braden, Chile, which were deducted as follows: 1939—66,937; 1940—1,000,000; 1941—1,500,000 pounds.
[4]Totals from Table 1. (†) Production figures not available.



PICTURE OF A *Military Secret*

It concerns air—and air conditioning.

Naturally, we cannot reveal all the details. But we *can* say something about the tremendous advances in air conditioning . . . that have made many new "secret weapons" possible.

We can tell you that temperature and humidity are maintained far more precisely than ever before. That it is possible to reproduce faithfully any required *climate*. That the equipment that does this is *more compact . . . more flexible . . . more efficient.*

And it is no secret that General Electric research is busy on many new developments to speed up the nation's war effort. From the beginning, General Electric has played a pioneering role in developing the new precision air conditioning.

After the war, *all* users of air conditioning will benefit from today's technical advances. In factories and offices, establishment of an exact efficiency climate . . . including humidity . . . will not only vastly increase workers' output, but will also add greatly to their comfort and morale. Machines will operate better . . . production will be speeded.

With more economical . . . more compact equipment . . . the use of air conditioning will be widespread. More people will enjoy it in ever increasing numbers of homes, stores, restaurants, theatres . . . even in cars and planes.

General Electric will take a leading part in the providing of peacetime equipment for every use, just as it is taking an outstanding part in meeting today's wartime air conditioning needs.

Air Conditioning and Commercial Refrigeration Department, Division 425, General Electric Company, Bloomfield, New Jersey.

Air Conditioning by

GENERAL ELECTRIC

Six OUTSTANDING

★ WHEREVER HEAT IS USED IN INDUSTRY, LOOK TO SC FOR MODERN ENGINEERING FEATURES . . . MONEY SAVING, TIME SAVING DEVELOPMENTS . . . THE RESULT OF 35 YEARS' EXPERIENCE IN BUILDING HEATING AND HEAT TREATING EQUIPMENT

It is neither coincidence nor accident that America's steel industry at war relies on Surface Combustion for its heating and heat treating equipment.

SC production schedules are geared to war needs. SC delivery commitments mean what they say and dates are met unfailingly. Even more important to the war program, SC equipment has the features that the emergency demands to produce tremendous volumes of war material of uniformly high quality, at a continuing high rate, and at low cost.

Fortunately, for all of us, these unique SC features had been perfected years before, for peace-time production. To adapt them for war was simple. They are the cumulative result of a generation's work in research and engineering development.

A FEW NOTEWORTHY CONTRIBUTIONS TO SCIENTIFIC HEATING AND HEAT TREATING

1 ORIGINAL ONE-WAY FIRED SOAKING PITS. The first improvement in soaking pits was the SC One-Way Fired Pit. Today, over two hundred of these pits are operating and being built in America's leading steel mills. Firing is in one direction—above the ingots. Heat travels in horseshoe fashion, enveloping ingots and providing uniform heating. Scale conditions can be regulated much more closely because of uniform heating and accurate atmosphere control. Complete automatic control of temperature, pressure and atmosphere is provided.

2 TRIPLE-ZONE SLAB HEATING as developed by Surface Combustion in SC furnaces is helping in the establishment of new records in fuel economy and continuous service. Over and under firing has greatly increased furnace output and product quality . . . keeps mills rolling better, and faster. Complete automatic temperature and combustion control is provided in all zones.

3 THE WALKING BEAM and other material handling mechanisms. No matter how severe the service these SC mechanisms stand up. They move through high temperatures, without lubrication. They travel at variable speeds, under close control. Whether walking beam, disc type or chain type conveyor, roller hearth or pusher or any other type, you can be certain SC mechanisms will work dependably and with minimum attention.

4 PREPARED ATMOSPHERE UNITS. Perhaps the greatest single contribution of gas to heat treating is the accurate, scientific control of atmospheres. With SC Furnaces, metals are hardened, annealed or carburized with exactly the right degree of heat and exactly the right mixture of gases. Outstanding SC developments are the DX, RX, and Char-Mo atmosphere units.

5 RADIANT HEATING ELEMENTS. It is this unique development which permits the utilization of gas in large controlled-atmosphere furnaces. Gas burns in a long, luminous flame within an alloy tube. Work is entirely protected from all products of combustion making it possible to utilize the atmosphere best suited for the work. Scale and decarburization are entirely eliminated.

6 FORCED CONVECTION HEATING. This efficient method of high temperature heating was introduced several years ago in a Surface Combustion furnace built for a steel mill. Now it is used throughout the metal working industry. Forced convection heating removes temperature limitations, eliminates distortion, simplifies material handling, increases production, saves floor space and reduces operating costs.

SURFACE COMBUSTION • TOLEDO, OHIO

SC Gas and Oil Fired Equipment For Every Industrial Need: FORGING, NORMALIZING, ANNEALING, HARDENING, DRAWING, HEATING, CARBURIZING, NITRIDING, SPECIAL ATMOSPHERES. FOR DRY BLAST USE SC KATHABAR MOISTURE CONTROL SYSTEMS.

SURFACE COMBUSTION

MANUFACTURERS OF INDUSTRIAL FURNACES • JANITROL GAS-FIRED SPACE HEATING EQUIPMENT • AND KATHABAR SYSTEMS FOR DRY BLAST

SC DEVELOPMENTS

CUT DOWN MAN HOURS... SPEED UP PRODUCTION ON BOMBS, BOMBERS AND BATTLESHIPS FOR *Victory!*

WARTIME PLANT DESIGN

. . . . centers about new ways to save critical materials such as alloy steels, bronzes, aluminum and similar metals. Reconditioning and repairing programs also emphasized to reduce replacement needs

A COMPILATION of what is being done by the petroleum industry to conserve alloy steels and other critical materials reveals a number of interesting suggestions which offer possibilities of value to others involved in construction work under present conditions. The following is from information made available by Max B. Miller, chief, Construction Section, Office of Petroleum Coordinator, United States Department of Interior, Washington.

For example, Atlantic Refining Co., Philadelphia, reports the adoption of the following in connection with their construction work:

Used tubes from salvage are being utilized for pipe.

Universal plates are being ordered—and have been for some time—in place of sheared square-edge plates.

Every individual item of critical material carried in stores stock is examined to determine whether or not less critical material can be substituted.

Codes are being revised to conform to government regulations.

After a study of flange faces about a year ago, a standard ring-type joint—a V-shaped groove with an oval-shaped ring gasket—was adopted for all new work involving pressure of 600 pounds and higher.

Eleven and a half to thirteen per cent chromium caps on header plugs have been developed, saving chromium in the body of the plugs.

An overlay of 25 to 20 per cent chromium nickel on flanges and fittings in place of chromium content in flanges and fittings has also been developed.

No aluminum is being ordered, substitutions having been found.

High-ten studs are being re-machined to smaller sizes when threads are poor in order to conserve this critical material.

Chromium pump shafts are being plated to recondition and to save the material.

Flanges from salvage are being rebored for slip-on welding flanges.

When reparable items, such as headers, plugs, valves, babbitted bearings, etc., are removed from stores stock and used for maintenance of stills, a check-up is made so that the worn articles which are being replaced are inspected and, if approved for reconditioning, sent to the shop for repair and return to stores stock.

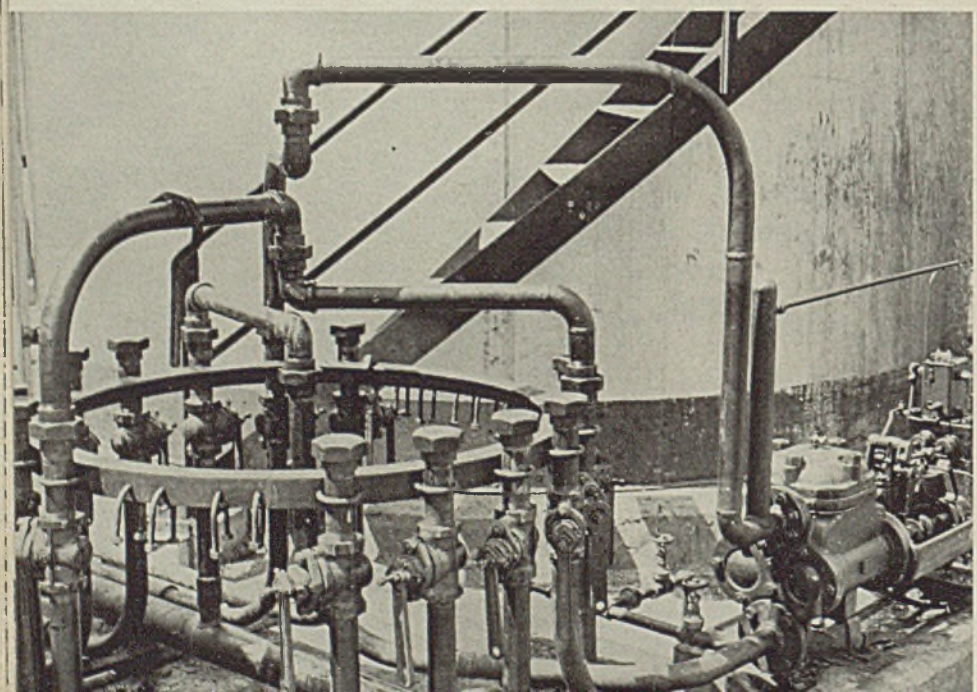
Babcock & Wilcox Co. reports adoption of a number of schemes to curtail the use of plate. For instance, this company has urged for some time the elimination of steel casings around the boiler unit. Where the boiler unit is in a refinery and is in the category of a so-called "outside plant", the user is quite likely to specify steel casings. The company points out that this is unnecessary since the unit can be covered with an insulation and some other form of material such as transite or even waterproof. When a plant is inside, there appears no reason whatever for steel casing the boiler unit when steel plate is so scarce.

Continental Oil Co. reports successfully securing used material from abandoned refineries, salvaged material firms and other sources for the construction of the alkylation unit at its Wichita Falls, Tex., refinery. Most of the equipment secured was readily adaptable to the conditions for which the plant was designed with the exception of some of the towers, which required new nozzles and some new bubble trays. By using discarded sucker rod, no new steel was required for reinforcing. All pumps were designed for outdoor installation using standard motors where explosionproof design could not be secured.

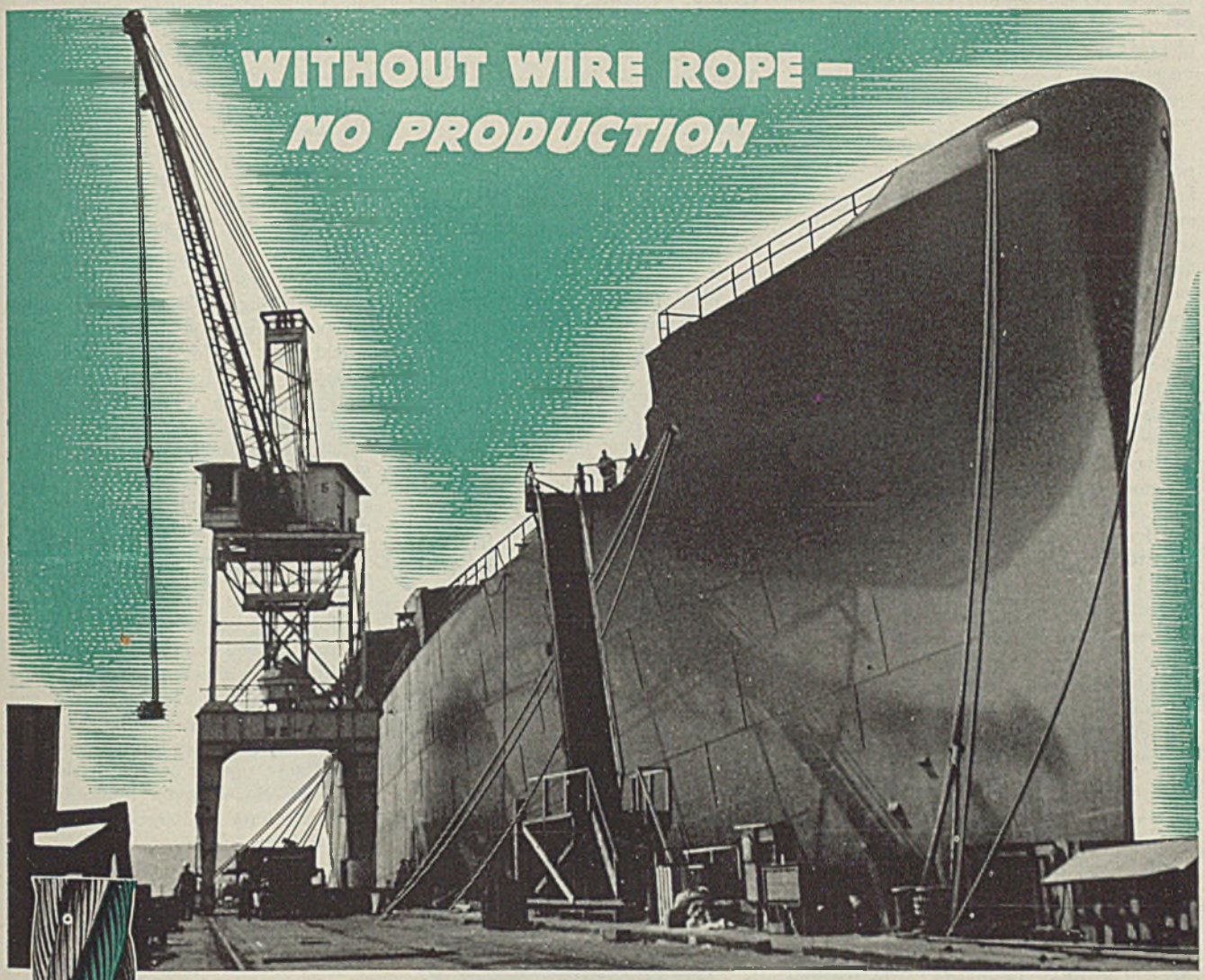
Towers, drums, boilers, exchangers, pumps, instruments, compressors, motors were all purchased second hand. All structural steel was obtained second hand, and second-hand pipe was used for all framing. As mentioned before, 30 tons of sucker rod was used for reinforcing steel. Other second-hand material purchased included 70 tons of steel pipe. Of the 12 tons of cast steel and forged steel valves and fittings, 90 per cent was second hand. Of the 4 tons of cast iron valves and fittings, 90 per cent was second hand. Of the electrical switchgear and copper wire, 50 per cent was purchased second hand. All the firebrick requirements and material for control building and pump house were secured locally or second hand except ventilating and electrical wiring and fixtures. The roof was supported on joists made of second-hand pipe and sucker rod.

Foster Wheeler Corp. reports the following recommendations:

Structurals: Endeavor to eliminate tube bundle handling of steel within



This design of radial type manifold was developed by Standard Oil Co. of California. It permits several operations to be conducted simultaneously, requires only one valve per line instead of two, reduces valve servicing and replacement costs, requires less time for lining up for pumping, permits lines to be added or removed and valves to be serviced without disturbing other lines



WITH TRU-LAY *Preformed* WIRE ROPE—

MORE PRODUCTION Your machines will operate with fewer interruptions for wire rope replacement if they are equipped with American Cable TRU-LAY PREFORMED. That means steadier production; time and money saved; steel conserved. . . . Regardless of application, American Cable TRU-LAY PREFORMED WIRE ROPE invariably lasts longer than ordinary non-preformed rope. It gives you greater dollar value in increased service alone. But TRU-LAY does much more than this. It handles much easier, faster, *safer.* It is a flexible, tractable, willing-to-work rope—not the kinky, unruly kind that fights the men who are working with it. It spools on the drum better; runs true and straight over sheaves; requires no seizing when cut. . . . Aid production—conserve steel—save money by using American Cable TRU-LAY PREFORMED WIRE ROPE.

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ESSENTIAL PRODUCTS . . . AMERICAN CABLE Wire Rope, TRU-STOP Emergency Brakes, TRU-LAY Control Cables, AMERICAN Chain, WEED Tire Chains, ACCO Malleable Iron Castings, CAMPBELL Cutting Machines, FORD Hoists and Trolleys, HAZARD Wire Rope, Yacht Rigging, Aircraft Control Cables, MANLEY Auto Service Equipment, OWEN Springs, PAGE Fence, Shaped Wire, Welding Wire, READING-PRATT & CADY Valves, READING Electric Steel Castings, WRIGHT Hoists, Cranes, Presses . . . *In Business for Your Safety*

range of gin pole heights. Reduce manhole excess steel, possibly to the point of providing knee braces only, on which maintenance crews easily could rig wooden flooring and railing when wanted.

Substitute ladders for stairways where permissible. Limit fully floored and hand-railed platforms to important operating levels. Limit maintenance access platforms to steel for frames and floor beams only, suitable for planking on shutdown. Substitute precast concrete for structurals on pipe support and light standards.

Buildings and Structures: Substitute reinforced concrete construction for steel-frame construction where feasible. Substitute glass blocks for window frames and sash, and precast lintels for steel.

Trench Covers: Substitute wood for plate or grating.

Valves: Follow recommendations of OPC where possible. Substitute figure-eight blinds for valves installed on vessels solely for testing purposes.

Sumps: Use concrete instead of steel where possible.

Water Lines or Sewers: Consider transits or concrete for large sizes.

Stacks: Substitute brick or concrete for steel.

Heaters: Substitute mesh, plastic insulation and weatherproofing for steel casing on tied back walls.

Tube Supports: Limit use of alloy to radiant, intermediate and top of convection bank supports.

Wall Ties: Substitute calorized steel for alloy.

Heater Roof and Trusses: Eliminate these entirely where design permits.

Pumps: Reduce inndividual spares to common spares.

M. W. Kellogg Co. reports concrete storage tanks are now being built by the Preload Co., 47-38 Fifth street, Long Island City, N. Y., consisting of a prestressed reinforced-concrete tank in which the concrete is thrown into compression by pulling up horizontal steel circumferential rods in the reinforcing to a predetermined initial stress.

The tank walls are formed by gunite and the prices are fairly well in line with steel tankage for atmospheric pressure, it is said. Recently a number of large gas holders were constructed of this design, 150 feet in diameter and approximately 36 feet high, a double concrete tank of this design being employed for the water seals of the holders.

A similar type of tank is being used for fuel oil storage in Canada and a number of other locations. They appear to be tight and entirely satisfactory. In the case of the tanks for the gas holder seals, some 750 tons of steel plate were saved involving some plate as thick as 1¼ inches. The reinforcing steel required for the concrete construction is only about 25 per cent of this amount.

Lummus Co. reports a number of substitutions and simplifications being incorporated on current 100-octane gasoline plant designs. As a substitute for copper tubing hookups on delicate instruments where steel pipe, scale or rust would make the instrument inoperative, a welded steel tubing that is laminated and coated with copper is being employed. Originally made for the automobile industry, this material is available in commercial tubing sizes.

Structural steel platforms and checkered floor plate requirements are being reduced by providing access platforms only at essential operating points. Clips and connections are provided for future platform extensions.

Treated wood flooring is being used as a substitute for checkered floor plates and gratings. Existing abandoned steel mill buildings are being purchased for reerection as substitutes for new buildings. Wood stave pipe is under consideration for above-ground water return systems as a substitute for large-size cast iron and steel pipe.

Universal Oil Products Co. makes the following suggestions:

For condenser and cooler boxes, use reinforced concrete instead of steel plate. Wood baffles serve instead of sheet steel.

Radial brick with firebrick lining can be used for stacks. For design against earthquakes, use reinforced concrete.

Size of buildings is reduced by locating pumps outside. They also recommend use of wood sash and doors and glass block in place of fixed sash. Likewise, this company recommends eliminating casing plate for heaters and boilers by use of a suitable hard coat applied to the wall insulation for weatherproofing.

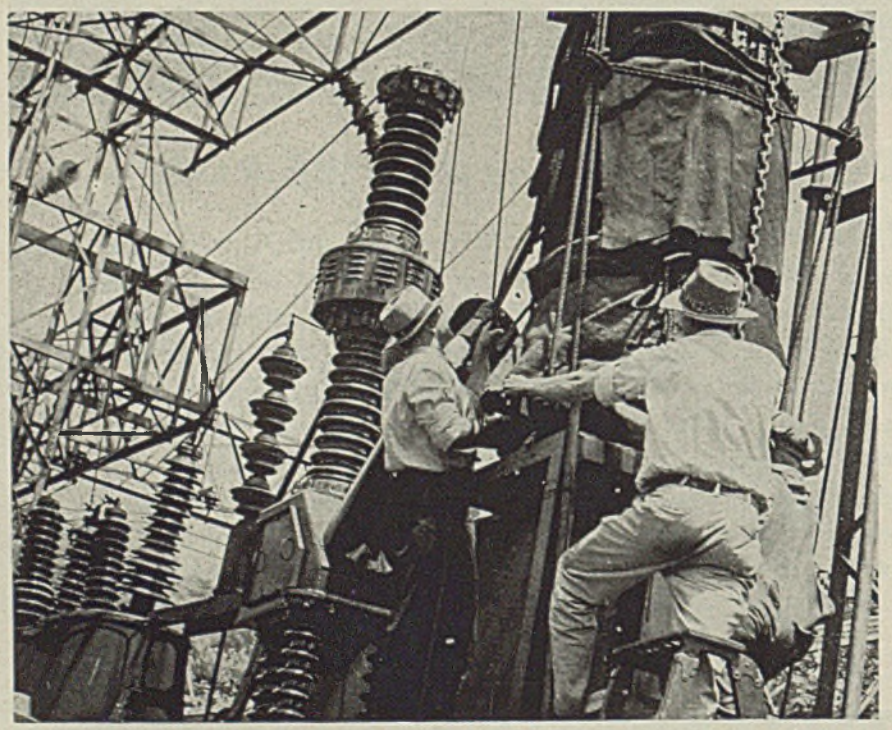
Steel skirts for vessels can be made short. The additional required height can be made of reinforced concrete. This saves steel plate and insulation required for fireproofing the skirt.

Omit concrete pipe trenches with plate covering. Trenches have been found to constitute a fire hazard due to the accumulation of oil or gas. Lines should be buried or run overhead on concrete supports.

Where corrosion is a problem in lining vessels, use gannister or cement lining wherever possible. For instrument boards, substitute transite for steel plate. For instrument airlines, use plastic tubing instead of copper. While some of

(*Please turn to Page* 127)

LARGEST WESTINGHOUSE CIRCUIT BREAKER



LARGEST air circuit breaker ever built by Westinghouse: Shortly to go in service at one of the West Penn Power Co. substations, this 138 kilovolt compressed air breaker with an interrupting capacity of 1,500,000 kilovolt amperes will serve on a tie line connecting two important systems. The breaker contains no oil; interruption takes place in air in an enclosed arcing chamber. The current transformers are filled with Inerteen. Workmen are shown here positioning the current transformer on the first of the three single pole units

DOW

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THE SUCCESS of Dow technicians in extracting magnesium from sea water came at the very time when it was most needed for fighting aircraft and other weapons for our armed forces. But the ultimate wider applications of this extraordinary weight-saving metal carry far-reaching social implications. Industrial designers will see endless possibilities for usefulness in the vast quantities of magnesium to be available when Victory is won. Out of their imaginations will come applications affecting every phase of American life.

MAGNESIUM

The Lightest Structural Metal . . . One-third Lighter Than Any Other in Common Use

NE (National Emergency) ALLOY STEELS

IN THE following group of charts will be found data on the newest of the NE steels—the NE 9500 and 9600 series. Note these charts do not bear the notation, "Single Heat Results."

This latest group of charts was included in a recent report presented to the War Production Board by the Technical committee on alloy steel of the American Iron and Steel Institute. For the latest list of NE steels, see p. 81, Aug. 31, 1942, issue of STEEL. For additional information, see STEEL, June 8, p. 66; June 15, p. 66; July 13, p. 80; July 20, p. 86; Aug. 3, p. 70; Aug. 31, p. 41 and 76; Oct. 19, p. 66.

Most of the information so far available applies to sections less than 10 x 10 inches, except where noted specifically. However, tests have been made and will soon be available on sections up through 15½ inches.

The latest list of NE steels (STEEL, Aug. 31, p. 81) is a revision of the first lists published in STEEL June 8, p. 66. These revisions have been made to meet certain requirements including limitations on the various alloying elements.

Manganese: When the carbon content required in the steel is 0.25 per cent or higher, no limitation is recommended for the use of ferromanganese. When manganese is over 1.30 per cent but under 1.60, carbon content should be limited to a minimum of 0.20 per cent. When manganese is over 1.00 but under 1.30 per cent, carbon content should be limited to 0.18 per cent minimum. This applies to steel containing no chromium.

When chromium is required in addition to manganese contents in excess of 1 per cent, carbon content must be modified to a correspondingly higher level.

Silicon: The silicon content of the new series of steels was arbitrarily placed at 0.60 per cent maximum, although maximum permissible is left open for use with other chemical compositions which might require a higher silicon content.

Nickel and Chromium: For the new series of steels, the nickel and chromium contents were set at 0.20 to 0.40 per cent each, although the NE 9500 series, NE 8600 series and NE 8700 series of steels contain 0.40 to 0.60 per cent each of nickel and chromium and were retained in the list of alternate steels at the request of the War Production Board.

Molybdenum: In the new steels, the recommended range for molybdenum is 0.08 to 0.15 per cent, except in the case of the NE 9500 series which contains 0.15 to 0.25 per cent. NE 8020, 8022, 8339, 8442 containing higher percentages of molybdenum were retained in the new list at the specific request of the War Production Board.

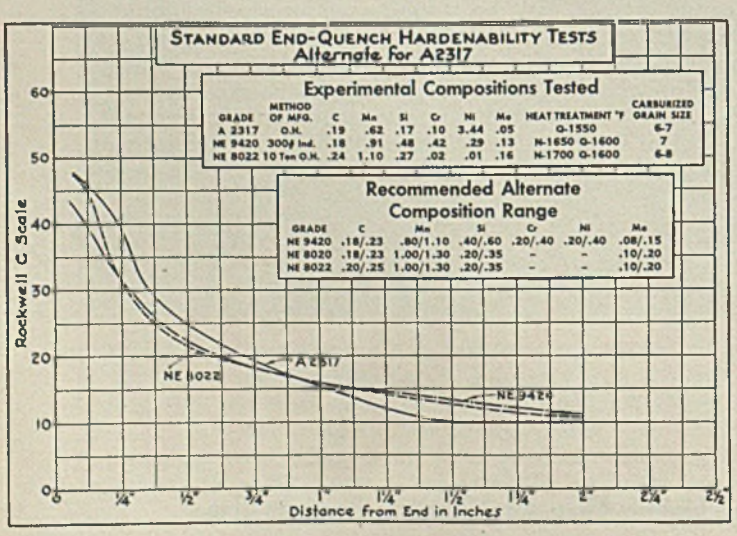
Vanadium and Tungsten: Both elements are under restrictions in War Production Board Order M-21a and subsequent modifications, and no recommendations were considered necessary.

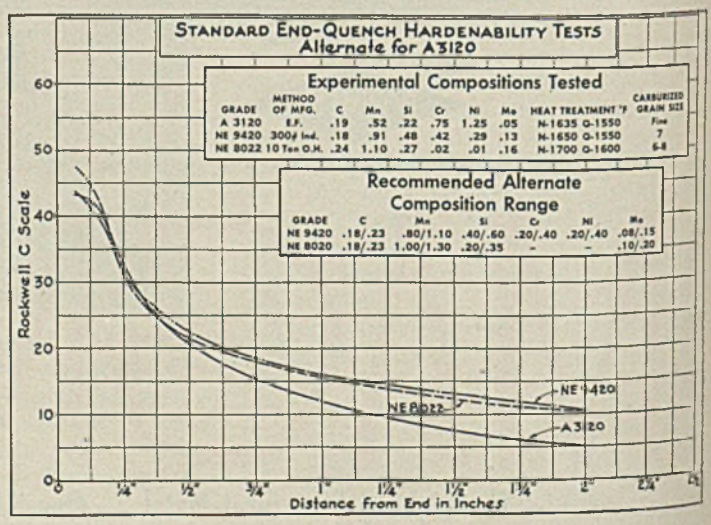
Special Addition Agents: Special alloying compounds known as addition agents or reaction alloys, which contain varying amounts of or combinations of boron, silicon, titanium, vanadium, zirconium and other elements have been used in some types of steel with rather remarkable results.

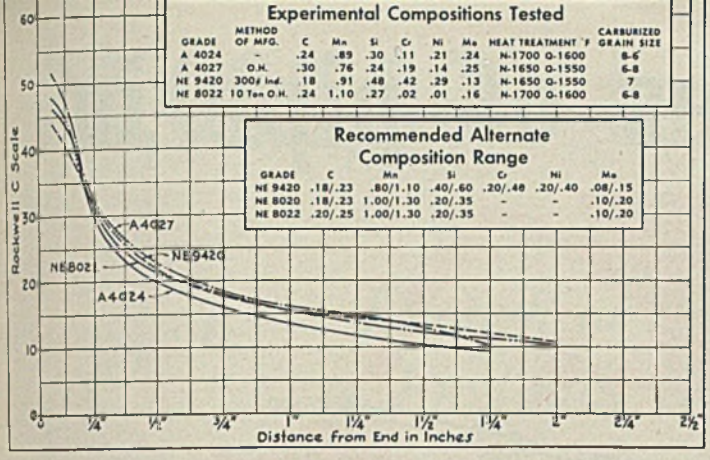
At the present time, their field of utilization appears to be best suited for those applications where a certain performance of the end product is required rather than a definite chemical composition.

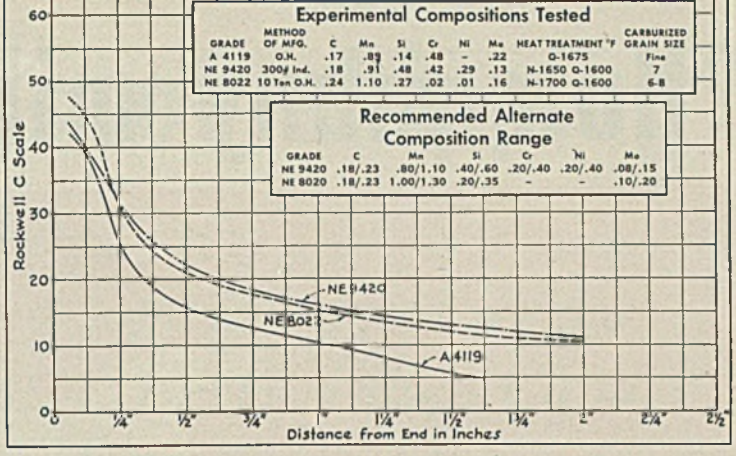
A special committee of the American Iron and Steel Institute, producers and users of these special addition agents is now preparing a comprehensive report concerning these agents. It will be available shortly.

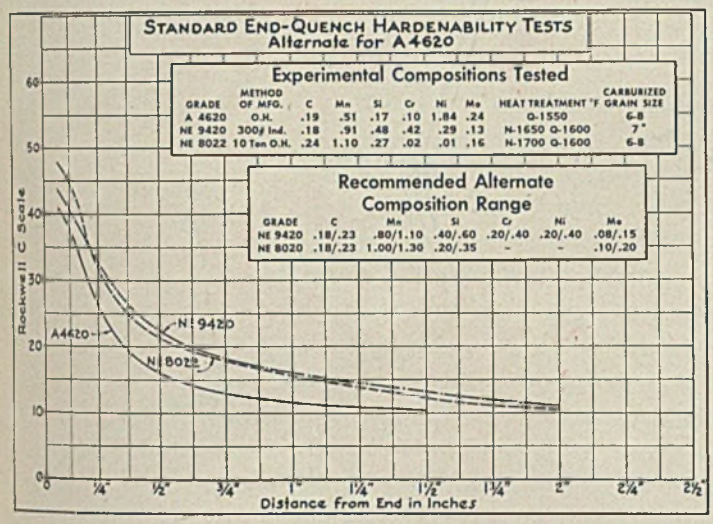
Charts accompanying this article appear on pages 97, 100, 102, 104, 107 and 108.

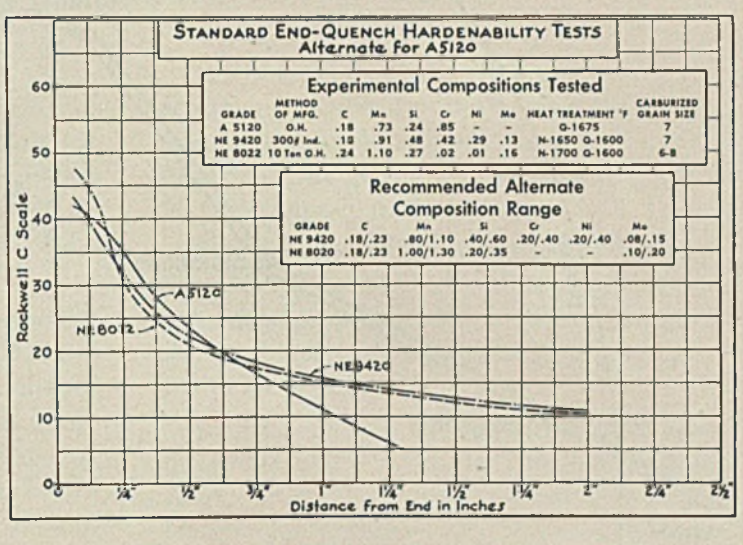


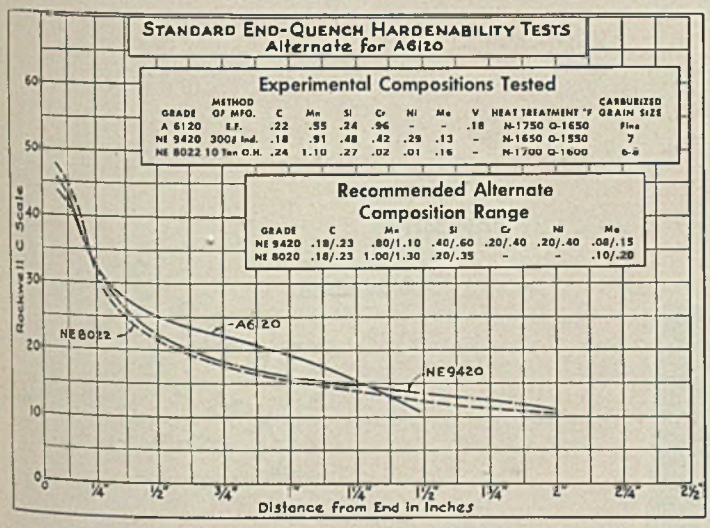


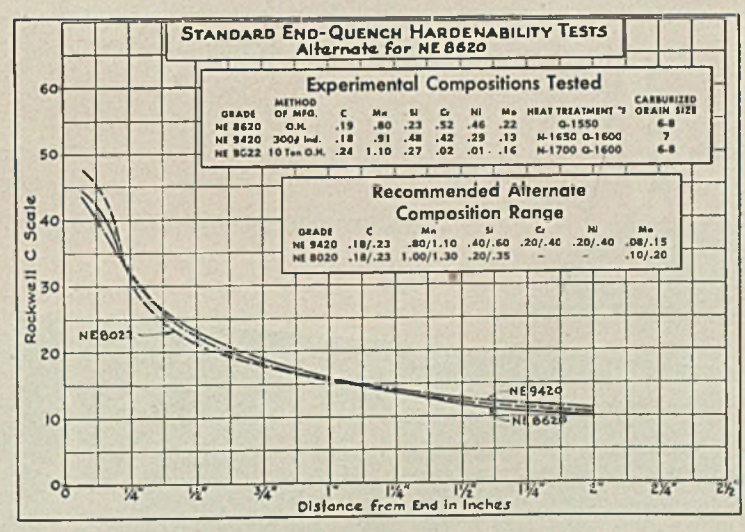

Experimental Compositions Tested
GRADE | METHOD OF MFG. | C | Mn | Si | Cr | Ni | Mo | HEAT TREATMENT °F | CARBURIZED GRAIN SIZE
A 4024 | - | .24 | .89 | .30 | .11 | .21 | .24 | N-1700 Q-1600 | 6-6
A 4027 | O.H. | .30 | .76 | .24 | .19 | .14 | .25 | N-1650 Q-1550 | 6-8
NE 9420 | 300# Ind. | .18 | .91 | .48 | .42 | .29 | .13 | N-1650 Q-1550 | 7
NE 8022 | 10 Ton O.H. | .24 | 1.10 | .27 | .02 | .01 | .16 | N-1700 Q-1600 | 6-8
Recommended Alternate Composition Range
GRADE | C | Mn | Si | Cr | Ni | Mo
NE 9420 | .18/.23 | .80/1.10 | .40/.60 | .20/.40 | .20/.40 | .08/.15
NE 8020 | .18/.23 | 1.00/1.30 | .20/.35 | - | - | .10/.20
NE 8022 | .20/.25 | 1.00/1.30 | .20/.35 | - | - | .10/.20
A4027
NE9420
NE8021
A4024
Rockwell C Scale
Distance from End in Inches

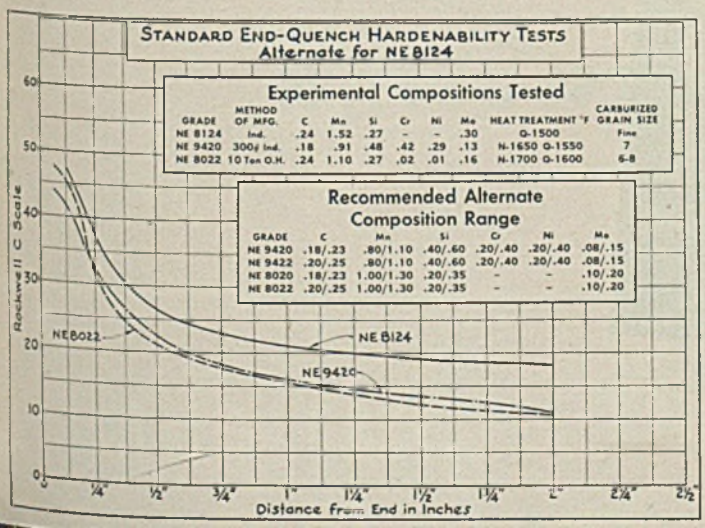

Experimental Compositions Tested
GRADE | METHOD OF MFG. | C | Mn | Si | Cr | Ni | Mo | HEAT TREATMENT °F | CARBURIZED GRAIN SIZE
A 4119 | O.H. | .17 | .89 | .14 | .48 | - | .22 | Q-1675 | Fine
NE 9420 | 300# Ind. | .18 | .91 | .48 | .42 | .29 | .13 | N-1650 Q-1600 | 7
NE 8022 | 10 Ton O.H. | .24 | 1.10 | .27 | .02 | .01 | .16 | N-1700 Q-1600 | 6-8
Recommended Alternate Composition Range
GRADE | C | Mn | Si | Cr | Ni | Mo
NE 9420 | .18/.23 | .80/1.10 | .40/.60 | .20/.40 | .20/.40 | .08/.15
NE 8020 | .18/.23 | 1.00/1.30 | .20/.35 | - | - | .10/.20
NE9420
NE8022
A4119
Rockwell C Scale
Distance from End in Inches

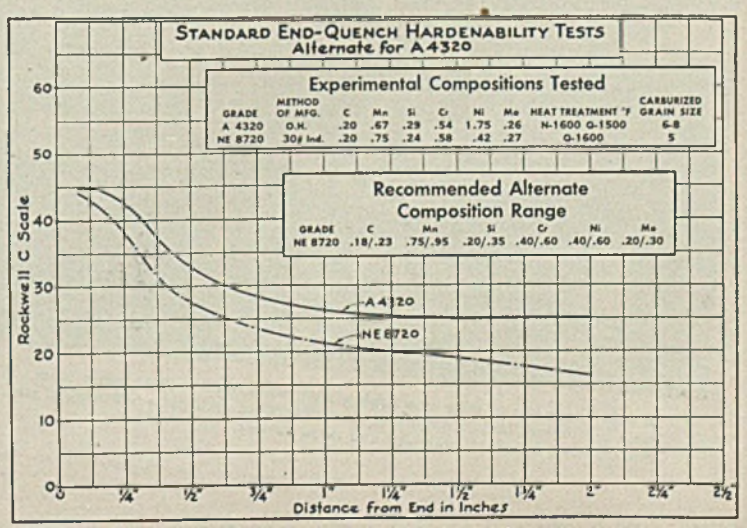

Standard End-Quench Hardenability Tests
Alternate for A4620
Experimental Compositions Tested
GRADE | METHOD OF MFG. | C | Mn | Si | Cr | Ni | Mo | HEAT TREATMENT °F | CARBURIZED GRAIN SIZE
A 4620 | O.H. | .19 | .51 | .17 | .10 | 1.84 | .24 | Q-1550 | 6-8
NE 9420 | 300# Ind. | .18 | .91 | .48 | .42 | .29 | .13 | N-1650 Q-1600 | 7
NE 8022 | 10 Ton O.H. | .24 | 1.10 | .27 | .02 | .01 | .16 | N-1700 Q-1600 | 6-8
Recommended Alternate Composition Range
GRADE | C | Mn | Si | Cr | Ni | Mo
NE 9420 | .18/.23 | .80/1.10 | .40/.60 | .20/.40 | .20/.40 | .08/.15
NE 8020 | .18/.23 | 1.00/1.30 | .20/.35 | - | - | .10/.20
A4620
NE9420
NE8022
Rockwell C Scale
Distance from End in Inches


Standard End-Quench Hardenability Tests
Alternate for A5120
Experimental Compositions Tested
GRADE | METHOD OF MFG. | C | Mn | Si | Cr | Ni | Mo | HEAT TREATMENT °F | CARBURIZED GRAIN SIZE
A 5120 | O.H. | .18 | .73 | .24 | .85 | - | - | Q-1675 | 7
NE 9420 | 300# Ind. | .18 | .91 | .48 | .42 | .29 | .13 | N-1650 Q-1600 | 7
NE 8022 | 10 Ton O.H. | .24 | 1.10 | .27 | .02 | .01 | .16 | N-1700 Q-1600 | 6-8
Recommended Alternate Composition Range
GRADE | C | Mn | Si | Cr | Ni | Mo
NE 9420 | .18/.23 | .80/1.10 | .40/.60 | .20/.40 | .20/.40 | .08/.15
NE 8020 | .18/.23 | 1.00/1.30 | .20/.35 | - | - | .10/.20
A5120
NE8022
NE9420
Rockwell C Scale
Distance from End in Inches


Standard End-Quench Hardenability Tests
Alternate for A6120
Experimental Compositions Tested
GRADE | METHOD OF MFG. | C | Mn | Si | Cr | Ni | Mo | V | HEAT TREATMENT °F | CARBURIZED GRAIN SIZE
A 6120 | E.F. | .22 | .55 | .24 | .96 | - | - | .18 | N-1750 Q-1650 | Fine
NE 9420 | 300# Ind. | .18 | .91 | .48 | .42 | .29 | .13 | - | N-1650 Q-1550 | 7
NE 8022 | 10 Ton O.H. | .24 | 1.10 | .27 | .02 | .01 | .16 | - | N-1700 Q-1600 | 6-8
Recommended Alternate Composition Range
GRADE | C | Mn | Si | Cr | Ni | Mo
NE 9420 | .18/.23 | .80/1.10 | .40/.60 | .20/.40 | .20/.40 | .08/.15
NE 8020 | .18/.23 | 1.00/1.30 | .20/.35 | - | - | .10/.20
NE8022
A6120
NE9420
Rockwell C Scale
Distance from End in Inches


Standard End-Quench Hardenability Tests
Alternate for NE 8620
Experimental Compositions Tested
GRADE | METHOD OF MFG. | C | Mn | Si | Cr | Ni | Mo | HEAT TREATMENT °F | CARBURIZED GRAIN SIZE
NE 8620 | O.H. | .19 | .80 | .23 | .52 | .46 | .22 | Q-1550 | 6-8
NE 9420 | 300# Ind. | .18 | .91 | .48 | .42 | .29 | .13 | N-1650 Q-1600 | 7
NE 8022 | 10 Ton O.H. | .24 | 1.10 | .27 | .02 | .01 | .16 | N-1700 Q-1600 | 6-8
Recommended Alternate Composition Range
GRADE | C | Mn | Si | Cr | Ni | Mo
NE 9420 | .18/.23 | .80/1.10 | .40/.60 | .20/.40 | .20/.40 | .08/.15
NE 8020 | .18/.23 | 1.00/1.30 | .20/.35 | - | - | .10/.20
NE8022
NE9420
NE8620
Rockwell C Scale
Distance from End in Inches

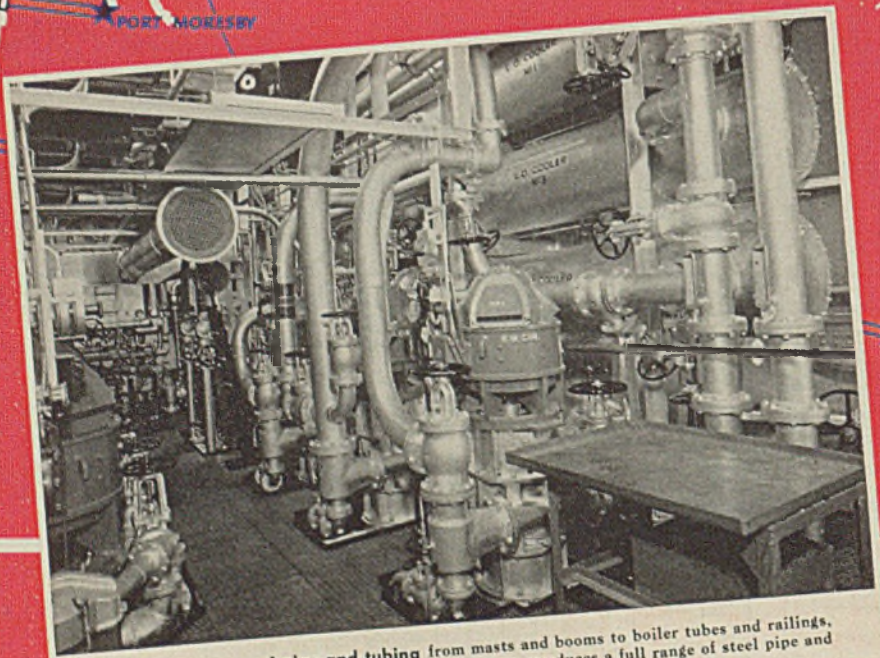

Standard End-Quench Hardenability Tests
Alternate for NE 8124
Experimental Compositions Tested
GRADE | METHOD OF MFG. | C | Mn | Si | Cr | Ni | Mo | HEAT TREATMENT °F | CARBURIZED GRAIN SIZE
NE 8124 | Ind. | .24 | 1.52 | .27 | - | - | .30 | Q-1500 | Fine
NE 9420 | 300# Ind. | .18 | .91 | .48 | .42 | .29 | .13 | N-1650 Q-1550 | 7
NE 8022 | 10 Ton O.H. | .24 | 1.10 | .27 | .02 | .01 | .16 | N-1700 Q-1600 | 6-8
Recommended Alternate Composition Range
GRADE | C | Mn | Si | Cr | Ni | Mo
NE 9420 | .18/.23 | .80/1.10 | .40/.60 | .20/.40 | .20/.40 | .08/.15
NE 9422 | .20/.25 | .80/1.10 | .40/.60 | .20/.40 | .20/.40 | .08/.15
NE 8020 | .18/.23 | 1.00/1.30 | .20/.35 | - | - | .10/.20
NE 8022 | .20/.25 | 1.00/1.30 | .20/.35 | - | - | .10/.20
NE8022
NE8124
NE9420
Rockwell C Scale
Distance from End in Inches


Standard End-Quench Hardenability Tests
Alternate for A4320
Experimental Compositions Tested
GRADE | METHOD OF MFG. | C | Mn | Si | Cr | Ni | Mo | HEAT TREATMENT °F | CARBURIZED GRAIN SIZE
A 4320 | O.H. | .20 | .67 | .29 | .54 | 1.75 | .26 | N-1600 Q-1500 | 6-8
NE 8720 | 30# Ind. | .20 | .75 | .24 | .58 | .42 | .27 | Q-1600 | 5
Recommended Alternate Composition Range
GRADE | C | Mn | Si | Cr | Ni | Mo
NE 8720 | .18/.23 | .75/.95 | .20/.35 | .40/.60 | .40/.60 | .20/.30
A4320
NE8720
Rockwell C Scale
Distance from End in Inches

How many miles of pipe in

AFRICA
CAIRO
MEDITERRANEAN SEA
DELHI
EQUATOR
Sumatra
ASIA
MOSCOW
LONDON
Borneo
CHUNGKING
Iceland
REYKJAVIK
Philippines
NORTH POLE
Greenland
DARWIN
Japan
New Guinea
NEW YORK
PORT MORESBY
NORTH AMERICA
DALLAS
SAN FRANCISCO
HONOLULU

Looking down on the world from above the North Pole. This map may look distorted to you, but actually it shows the relative position of the land masses in the northern hemisphere with very little lineal distortion. Below the equator the distortion increases more rapidly, but there is no distortion north and south.



A ship is a maze of pipe and tubing from masts and booms to boiler tubes and railings, bilge and ballast, fuel oil and water lines. NATIONAL produces a full range of steel pipe and tubes needed in today's warships and cargo vessels.

NATIONAL..

23,000,000 tons of shipping?

Enough to run a pipe line from Texas to England, Russia, Egypt, India, China, Australia, Hawaii and back

TWENTY-THREE million tons of merchant shipping, the program for 1942-43, will require approximately 35,000 miles of pipe and tubing. This would be enough to run a pipe line to every one of the United Nations shown above.

One 30,000-ton vessel consumes as much as 50 miles of pipe. Another 10,000-ton freighter requires more than 15 miles of pipe. Smaller ships use as much or more piping in proportion to their tonnage. A conservative rough average might be 15 miles of pipe for every 10,000 tons of shipping.

35,000 miles of pipe is a lot of pipe—stretching almost one and one-half times around the world. That gives you a clear picture of the enormous job ahead for the Nation's pipe manufacturers.

But the pipe industry is used to big orders. NATIONAL Tube alone has often turned out seamless pipe orders in terms of hundreds of miles. Big pipe, too, in all sizes up to 24 inches.

If you could see the ceaseless 24-hour a day activity at our mills, you, too, would share our confidence that, whatever the call for tubular products—for ships or planes, tanks or bombs, NATIONAL Tube will do its full share in meeting the emergency.

NATIONAL TUBULAR PRODUCTS FOR MARINE APPLICATIONS

STANDARD PIPE (Butt Weld) — for general ship applications requiring good, strong pipe.

SEAMLESS PIPE—pierced from solid steel billets for maximum safety in high-pressure lines.

SEAMLESS BOILER TUBES — Completely annealed to provide balance between ductility needed for fast installation and strength for safety.

DUROLINE PIPE — Steel pipe with a special cement lining, recommended especially for hot or cold salt water and other corrosive waters and for protection against tuberculation.

STAINLESS TUBES—higher strength and permanent surface finish. Used for railings, ornamental work, small flagpoles, and other uses where a lasting, clean surface is desired.

NATIONAL

NATIONAL TUBE COMPANY

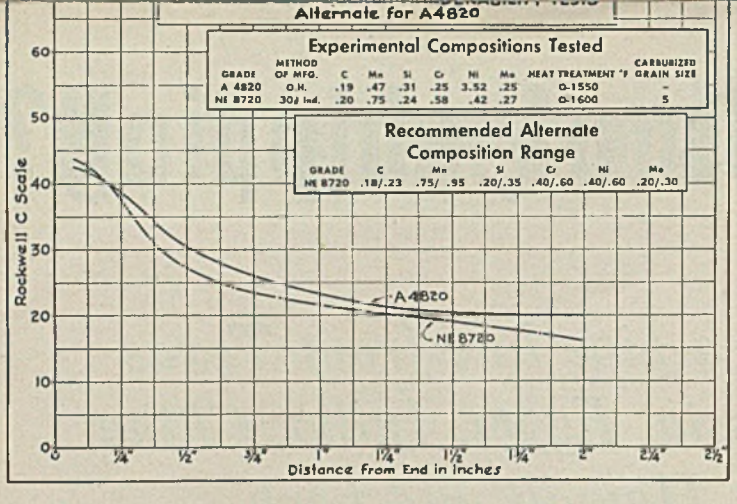
Pittsburgh, Pa.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

USS

... AMERICA'S STANDARD WROUGHT PIPE

Standard End-Quench Hardenability Tests
Alternate for A4820



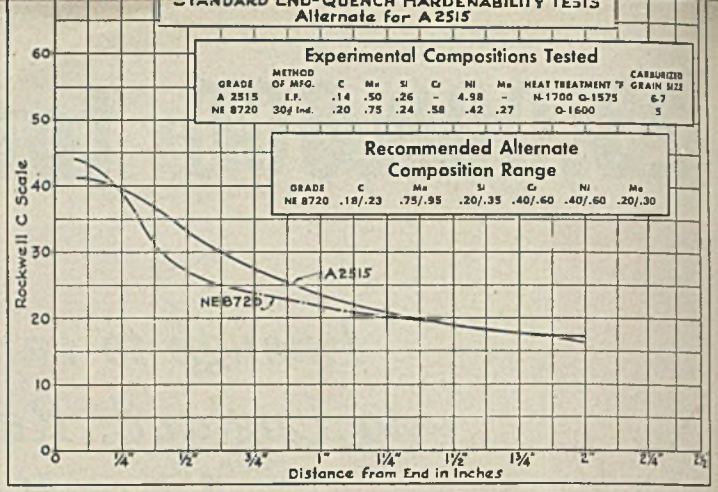
Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 4820	O.H.	.19	.47	.31	.25	3.52	.25	Q-1550	-
NE 8720	30# Ind.	.20	.75	.24	.58	.42	.27	Q-1600	5

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 8720	.18/.23	.75/.95	.20/.35	.40/.60	.40/.60	.20/.30

Standard End-Quench Hardenability Tests
Alternate for A2515



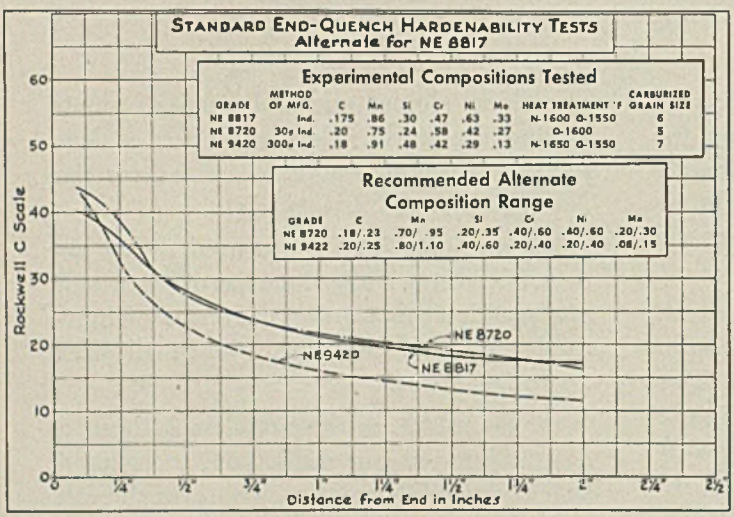
Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 2515	E.F.	.14	.50	.26	-	4.98	-	N-1700 Q-1575	6-7
NE 8720	30# Ind.	.20	.75	.24	.58	.42	.27	Q-1600	5

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 8720	.18/.23	.75/.95	.20/.35	.40/.60	.40/.60	.20/.30

Standard End-Quench Hardenability Tests
Alternate for NE 8817



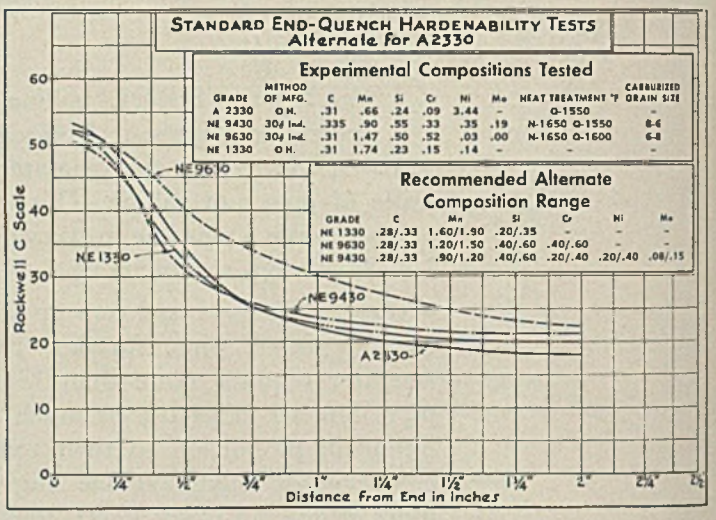
Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
NE 8817	Ind.	.175	.86	.30	.47	.63	.33	N-1600 Q-1550	6
NE 8720	30# Ind.	.20	.75	.24	.58	.42	.27	Q-1600	5
NE 9420	300# Ind.	.18	.91	.48	.42	.29	.13	N-1650 Q-1550	7

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 8720	.18/.23	.70/ 95	.20/.35	.40/.60	.40/.60	.20/.30
NE 9422	.20/.25	.80/1.10	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for A2330



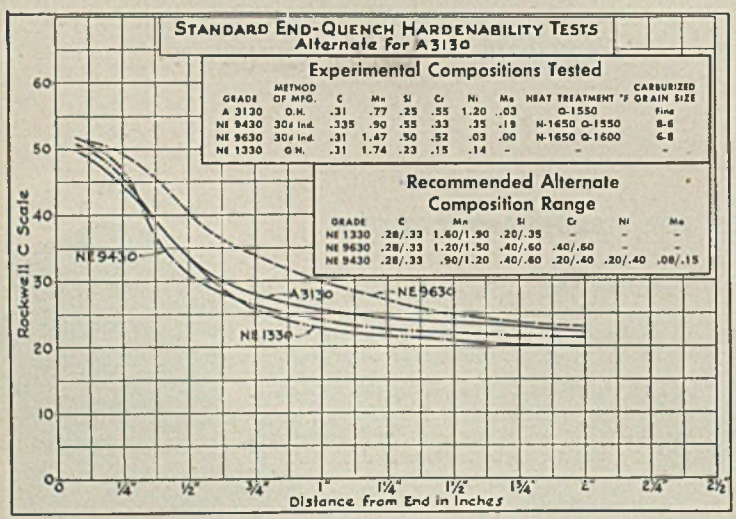
Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 2330	O.H.	.31	.66	.24	.09	3.44	-	Q-1550	-
NE 9430	30# Ind.	.335	.90	.55	.33	.35	.19	N-1650 Q-1550	8-6
NE 9630	30# Ind.	.31	1.47	.50	.52	.03	.00	N-1650 Q-1600	6-8
NE 1330	O.H.	.31	1.74	.23	.15	.14	-	-	-

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1330	.28/.33	1.60/1.90	.20/.35	-	-	-
NE 9630	.28/.33	1.20/1.50	.40/.60	.40/.60	-	-
NE 9430	.28/.33	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for A3130



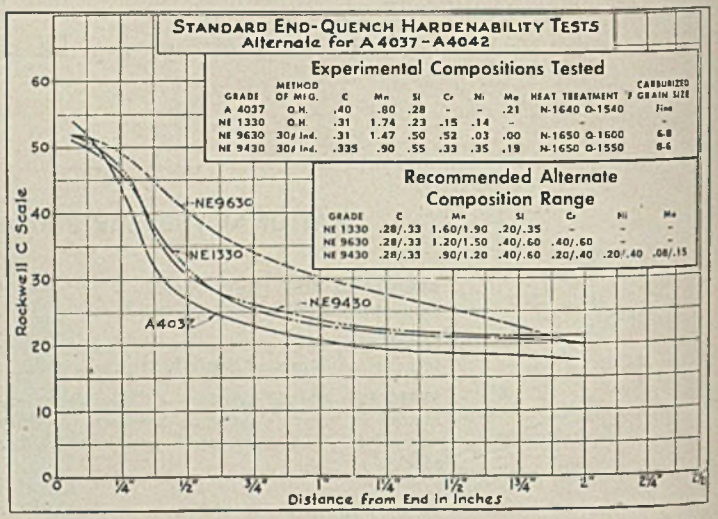
Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 3130	O.H.	.31	.77	.25	.55	1.20	.03	Q-1550	Fine
NE 9430	30# Ind.	.335	.90	.55	.33	.35	.19	N-1650 Q-1550	8-6
NE 9630	30# Ind.	.31	1.47	.50	.52	.03	.00	N-1650 Q-1600	6-8
NE 1330	O.H.	.31	1.74	.23	.15	.14	-	-	-

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1330	.28/.33	1.60/1.90	.20/.35	-	-	-
NE 9630	.28/.33	1.20/1.50	.40/.60	.40/.60	-	-
NE 9430	.28/.33	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for A4037–A4042



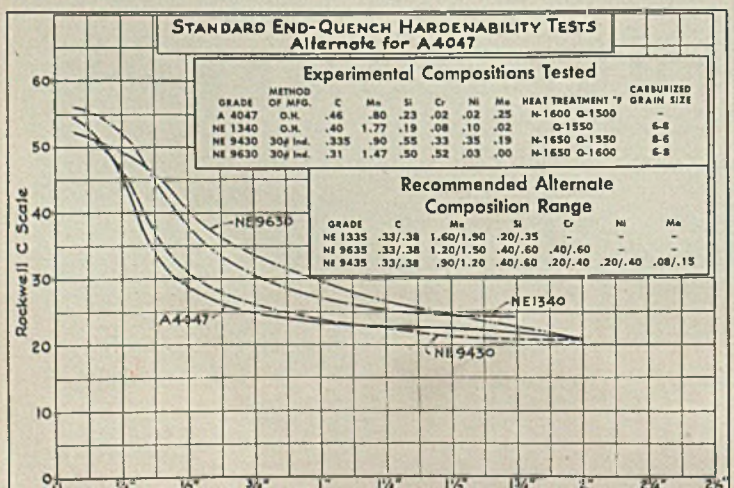
Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 4037	O.H.	.40	.80	.28	-	-	.21	N-1640 Q-1540	Fine
NE 1330	O.H.	.31	1.74	.23	.15	.14	-	-	-
NE 9630	30# Ind.	.31	1.47	.50	.52	.03	.00	N-1650 Q-1600	6-8
NE 9430	30# Ind.	.335	.90	.55	.33	.35	.19	N-1650 Q-1550	8-6

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1330	.28/.33	1.60/1.90	.20/.35	-	-	-
NE 9630	.28/.33	1.20/1.50	.40/.60	.40/.60	-	-
NE 9430	.28/.33	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for A4047



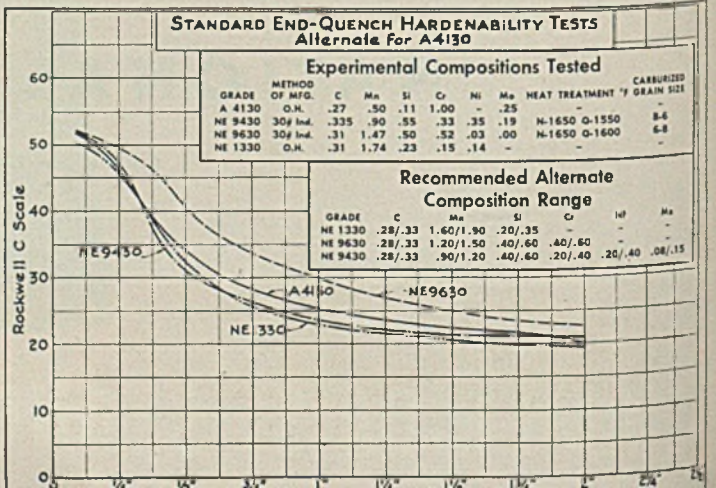
Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 4047	O.H.	.46	.80	.23	.02	.02	.25	N-1600 Q-1500	-
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1550	6-8
NE 9430	30# Ind.	.335	.90	.55	.33	.35	.19	N-1650 Q-1550	8-6
NE 9630	30# Ind.	.31	1.47	.50	.52	.03	.00	N-1650 Q-1600	6-8

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1335	.33/.38	1.60/1.90	.20/.35	-	-	-
NE 9635	.33/.38	1.20/1.50	.40/.60	.40/.60	-	-
NE 9435	.33/.38	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for A4130



Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 4130	O.H.	.27	.50	.11	1.00	-	.25	-	-
NE 9430	30# Ind.	.335	.90	.55	.33	.35	.19	N-1650 Q-1550	8-6
NE 9630	30# Ind.	.31	1.47	.50	.52	.03	.00	N-1650 Q-1600	6-8
NE 1330	O.H.	.31	1.74	.23	.15	.14	-	-	-

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1330	.28/.33	1.60/1.90	.20/.35	-	-	-
NE 9630	.28/.33	1.20/1.50	.40/.60	.40/.60	-	-
NE 9430	.28/.33	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

IGLOO WIGWAM

With the armed forces—In Iceland they call these huts "igloos," in Panama they're "wigwams." At widely-separated points, in the Americas and overseas, structures of this type are housing men of the U. S. Army. This is but one of the many ways in which Bethlehem Galvanized Sheets are serving the armed forces.

SHEETS in the war effort

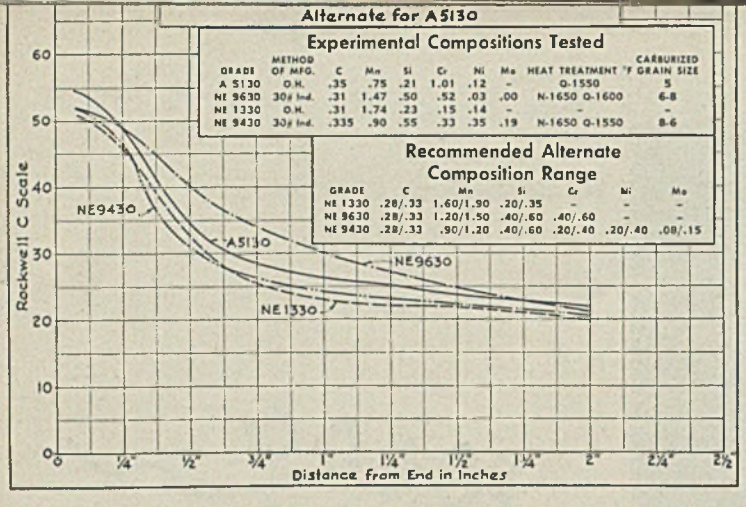
On the home front—Bethlehem Galvanized Steel Sheets are helping in the war effort along the home front, too. In war housing the nation over, warm-air ducts, ventilators and stacks of Bethlehem Galvanized Sheets are on the job. In Army camps and training centers, in Navy establishments and Air Corps training schools, Bethlehem Galvanized Sheets are doing routine but important work.

On the production line—In war production plants Bethlehem Galvanized Sheets are serving as roofing and siding, in air ducts and many other applications. Bethlehem Hot- and Cold-Rolled Sheets in large tonnages are going into war products ranging from powder cans, ammunition racks and bomb fins to anti-submarine net buoys, hatch coamings and extensive uses on destroyers and battleships.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

Alternate for A5130



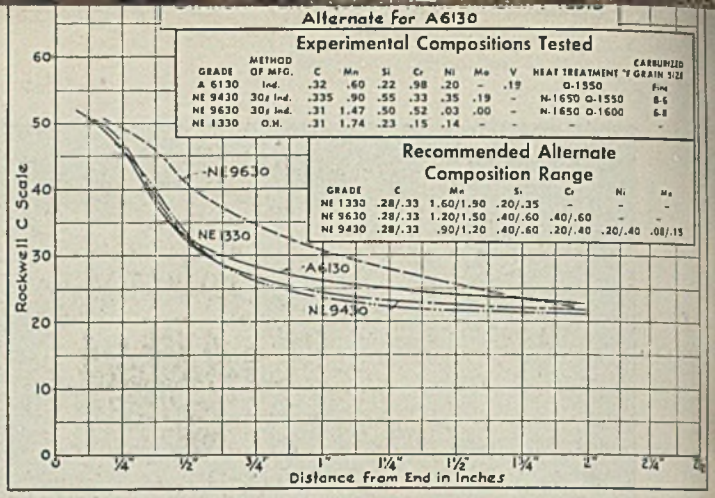
Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 5130	O.H.	.35	.75	.21	1.01	.12	–	Q-1550	5
NE 9630	30# Ind.	.31	1.47	.50	.52	.03	.00	N-1650 Q-1600	6-8
NE 1330	O.H.	.31	1.74	.23	.15	.14	–	–	–
NE 9430	30# Ind.	.335	.90	.55	.33	.35	.19	N-1650 Q-1550	8-6

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1330	.28/.33	1.60/1.90	.20/.35	–	–	–
NE 9630	.28/.33	1.20/1.50	.40/.60	.40/.60	–	–
NE 9430	.28/.33	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Alternate for A6130



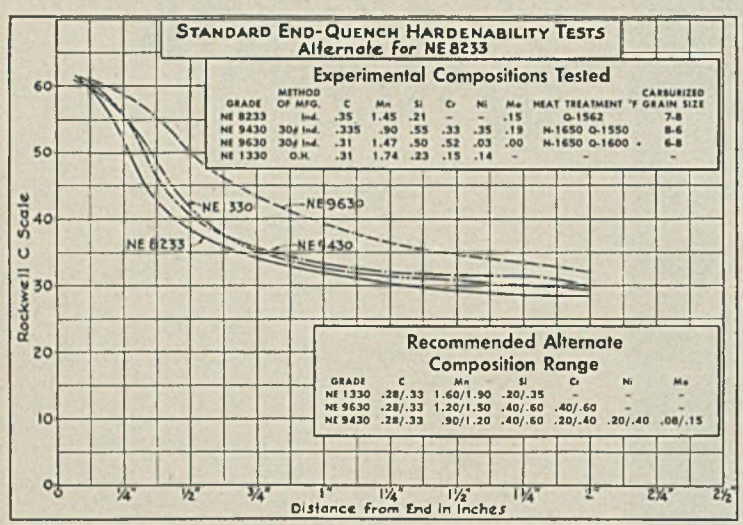
Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	V	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 6130	Ind.	.32	.60	.22	.98	.20	–	.19	Q-1550	Fine
NE 9430	30# Ind.	.335	.90	.55	.33	.35	.19	–	N-1650 Q-1550	8-6
NE 9630	30# Ind.	.31	1.47	.50	.52	.03	.00	–	N-1650 Q-1600	6-8
NE 1330	O.H.	.31	1.74	.23	.15	.14	–	–	–	–

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1330	.28/.33	1.60/1.90	.20/.35	–	–	–
NE 9630	.28/.33	1.20/1.50	.40/.60	.40/.60	–	–
NE 9430	.28/.33	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for NE 8233



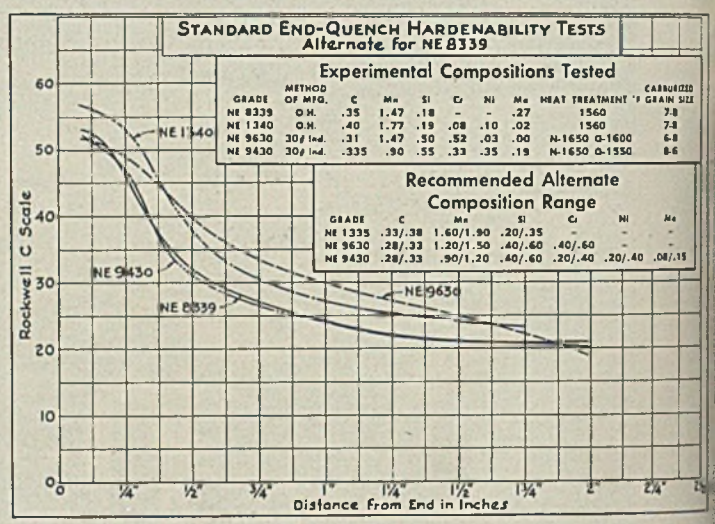
Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
NE 8233	Ind.	.35	1.45	.21	–	–	.15	Q-1562	7-8
NE 9430	30# Ind.	.335	.90	.55	.33	.35	.19	N-1650 Q-1550	8-6
NE 9630	30# Ind.	.31	1.47	.50	.52	.03	.00	N-1650 Q-1600	6-8
NE 1330	O.H.	.31	1.74	.23	.15	.14	–	–	–

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1330	.28/.33	1.60/1.90	.20/.35	–	–	–
NE 9630	.28/.33	1.20/1.50	.40/.60	.40/.60	–	–
NE 9430	.28/.33	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for NE 8339



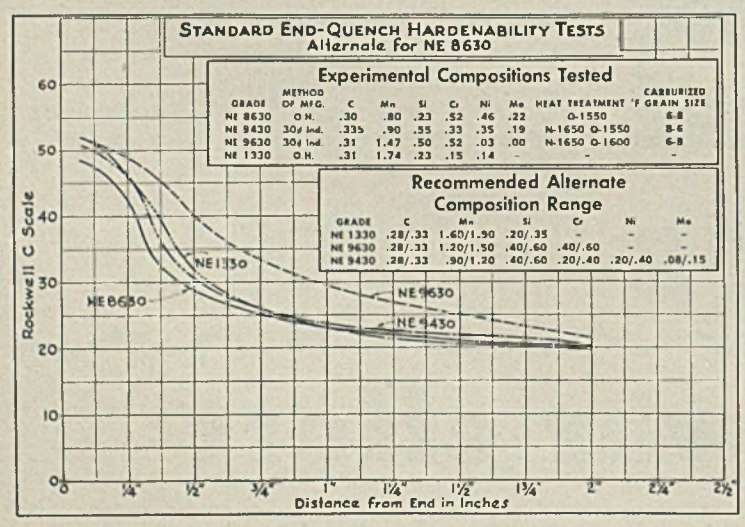
Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
NE 8339	O.H.	.35	1.47	.18	–	–	.27	1560	7-8
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	1560	7-8
NE 9630	30# Ind.	.31	1.47	.50	.52	.03	.00	N-1650 Q-1600	6-8
NE 9430	30# Ind.	.335	.90	.55	.33	.35	.19	N-1650 Q-1550	8-6

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1335	.33/.38	1.60/1.90	.20/.35	–	–	–
NE 9630	.28/.33	1.20/1.50	.40/.60	.40/.60	–	–
NE 9430	.28/.33	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for NE 8630



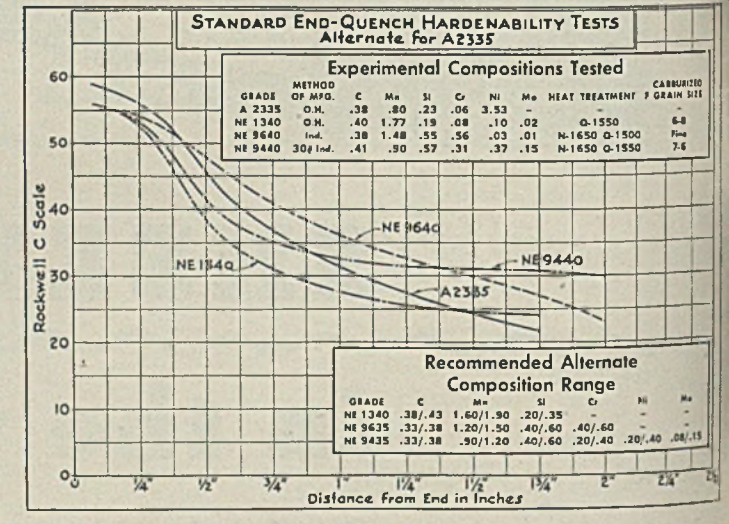
Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
NE 8630	O.H.	.30	.80	.23	.52	.46	.22	Q-1550	6-8
NE 9430	30# Ind.	.335	.90	.55	.33	.35	.19	N-1650 Q-1550	8-6
NE 9630	30# Ind.	.31	1.47	.50	.52	.03	.00	N-1650 Q-1600	6-8
NE 1330	O.H.	.31	1.74	.23	.15	.14	–	–	–

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1330	.28/.33	1.60/1.90	.20/.35	–	–	–
NE 9630	.28/.33	1.20/1.50	.40/.60	.40/.60	–	–
NE 9430	.28/.33	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for A2335



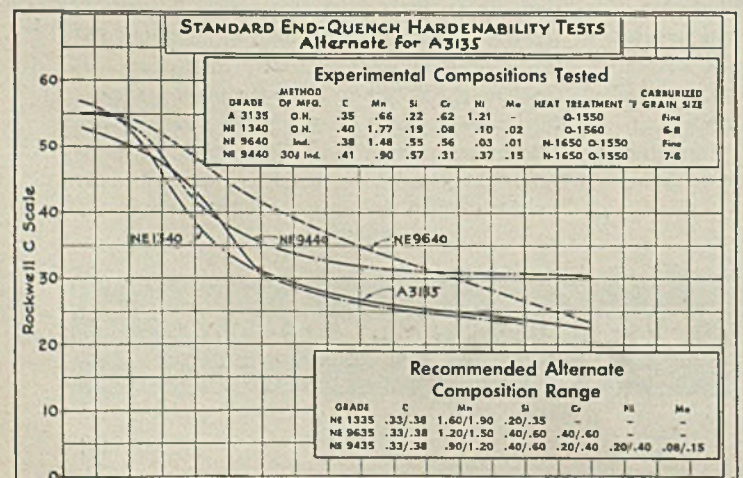
Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 2335	O.H.	.38	.80	.23	.06	3.53	–	–	–
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1550	6-8
NE 9640	Ind.	.38	1.48	.55	.56	.03	.01	N-1650 Q-1500	Fine
NE 9440	30# Ind.	.41	.90	.57	.31	.37	.15	N-1650 Q-1550	7-6

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1340	.38/.43	1.60/1.90	.20/.35	–	–	–
NE 9635	.33/.38	1.20/1.50	.40/.60	.40/.60	–	–
NE 9435	.33/.38	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for A3135



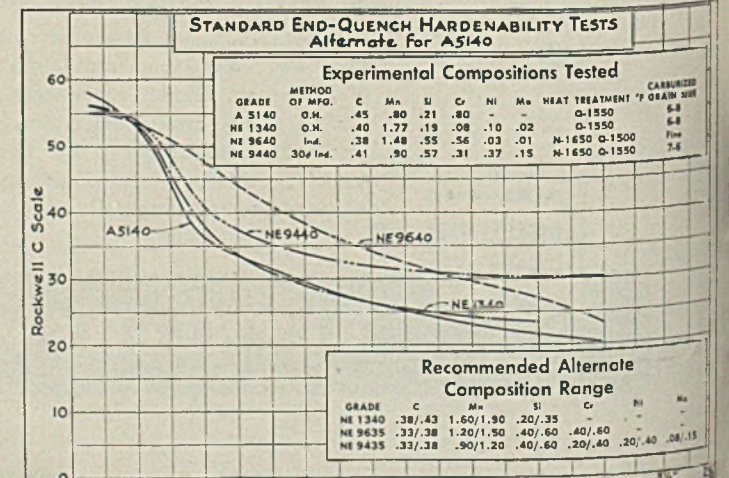
Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 3135	O.H.	.35	.66	.22	.62	1.21	–	Q-1550	Fine
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1560	6-8
NE 9640	Ind.	.38	1.48	.55	.56	.03	.01	N-1650 Q-1550	Fine
NE 9440	30# Ind.	.41	.90	.57	.31	.37	.15	N-1650 Q-1550	7-6

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1335	.33/.38	1.60/1.90	.20/.35	–	–	–
NE 9635	.33/.38	1.20/1.50	.40/.60	.40/.60	–	–
NE 9435	.33/.38	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for A5140



Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 5140	O.H.	.45	.80	.21	.80	–	–	Q-1550	6-8
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1550	6-8
NE 9640	Ind.	.38	1.48	.55	.56	.03	.01	N-1650 Q-1500	Fine
NE 9440	30# Ind.	.41	.90	.57	.31	.37	.15	N-1650 Q-1550	7-6

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1340	.38/.43	1.60/1.90	.20/.35	–	–	–
NE 9635	.33/.38	1.20/1.50	.40/.60	.40/.60	–	–
NE 9435	.33/.38	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

How to get the most out of your CRAWLER CRANE!

YOUR crawler crane is the most versatile yard tool in existence. It goes anywhere and handles anything within its rated capacity. It permits additions to your plant without regard to present handling systems and it makes available for storage those odd corners that are normally regarded as waste space.

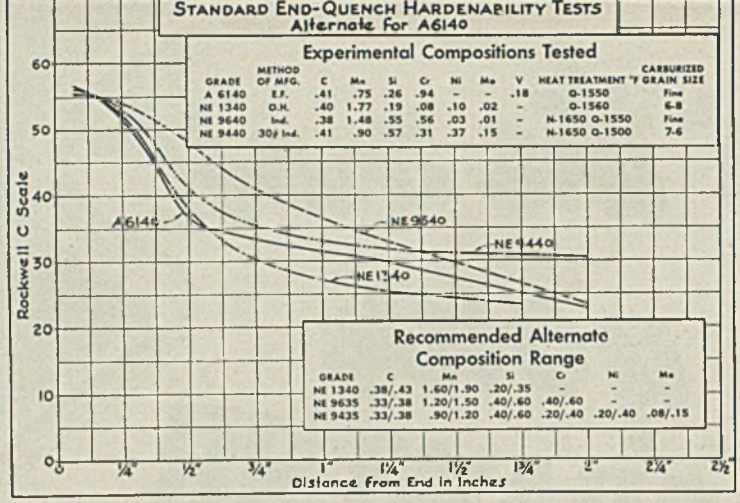
Your crawler crane is the only type of machine that you can route from job to job and keep busy all day long at any point in the plant. It will handle coal and ashes at the power house. It can move on to sorting scrap or to handling any type of goods in the store yard, finishing up at the loading ramp. It does all this in a day's work and any other odd job too. Northwest Crawler Cranes get things done! If you are faced with emergency speed up, let one of our engineers survey your situation. He can tell you how a crawler crane will help you.

NORTHWEST ENGINEERING COMPANY
1805 Steger Building, 28 E. Jackson Blvd.
Chicago, Illinois

NORTHWEST

4½ TO 40 TONS CAPACITY

Standard End-Quench Hardenability Tests
Alternate for A6140



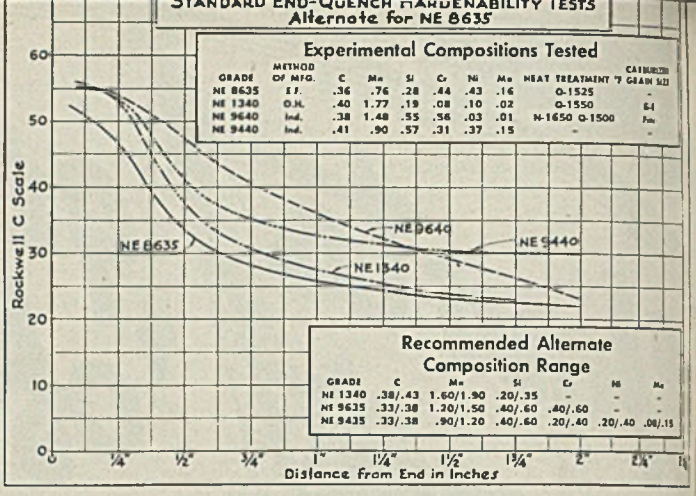
Experimental Compositions Tested

Grade	Method of Mfg.	C	Mn	Si	Cr	Ni	Mo	V	Heat Treatment °F	Carburized Grain Size
A 6140	E.F.	.41	.75	.26	.94	–	–	.18	Q-1550	Fine
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	–	Q-1560	6-8
NE 9640	Ind.	.38	1.48	.55	.56	.03	.01	–	N-1650 Q-1550	Fine
NE 9440	30# Ind.	.41	.90	.57	.31	.37	.15	–	N-1650 Q-1500	7-6

Recommended Alternate Composition Range

Grade	C	Mn	Si	Cr	Ni	Mo
NE 1340	.38/.43	1.60/1.90	.20/.35	–	–	–
NE 9635	.33/.38	1.20/1.50	.40/.60	.40/.60	–	–
NE 9435	.33/.38	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for NE 8635



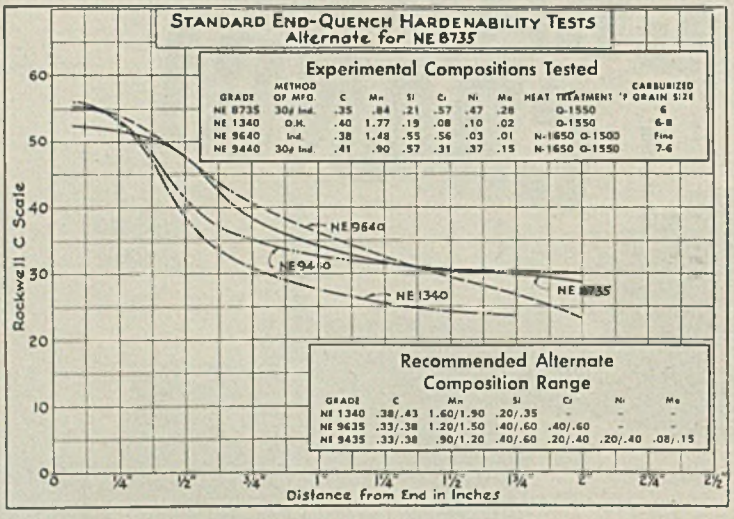
Experimental Compositions Tested

Grade	Method of Mfg.	C	Mn	Si	Cr	Ni	Mo	Heat Treatment °F	Carburized Grain Size
NE 8635	E.F.	.36	.76	.28	.44	.43	.16	Q-1525	–
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1550	6-8
NE 9640	Ind.	.38	1.48	.55	.56	.03	.01	N-1650 Q-1500	Fine
NE 9440	Ind.	.41	.90	.57	.31	.37	.15	–	–

Recommended Alternate Composition Range

Grade	C	Mn	Si	Cr	Ni	Mo
NE 1340	.38/.43	1.60/1.90	.20/.35	–	–	–
NE 9635	.33/.38	1.20/1.50	.40/.60	.40/.60	–	–
NE 9435	.33/.38	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for NE 8735



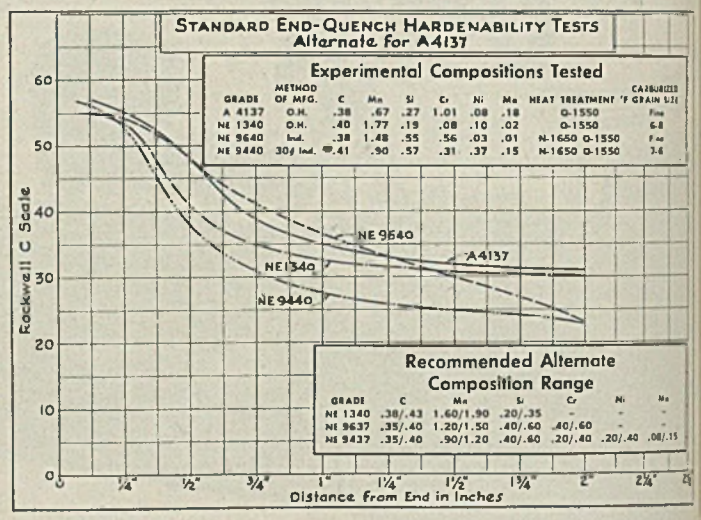
Experimental Compositions Tested

Grade	Method of Mfg.	C	Mn	Si	Cr	Ni	Mo	Heat Treatment °F	Carburized Grain Size
NE 8735	30# Ind.	.35	.84	.21	.57	.47	.28	Q-1550	6
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1550	6-8
NE 9640	Ind.	.38	1.48	.55	.56	.03	.01	N-1650 Q-1500	Fine
NE 9440	30# Ind.	.41	.90	.57	.31	.37	.15	N-1650 Q-1550	7-6

Recommended Alternate Composition Range

Grade	C	Mn	Si	Cr	Ni	Mo
NE 1340	.38/.43	1.60/1.90	.20/.35	–	–	–
NE 9635	.33/.38	1.20/1.50	.40/.60	.40/.60	–	–
NE 9435	.33/.38	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for A4137



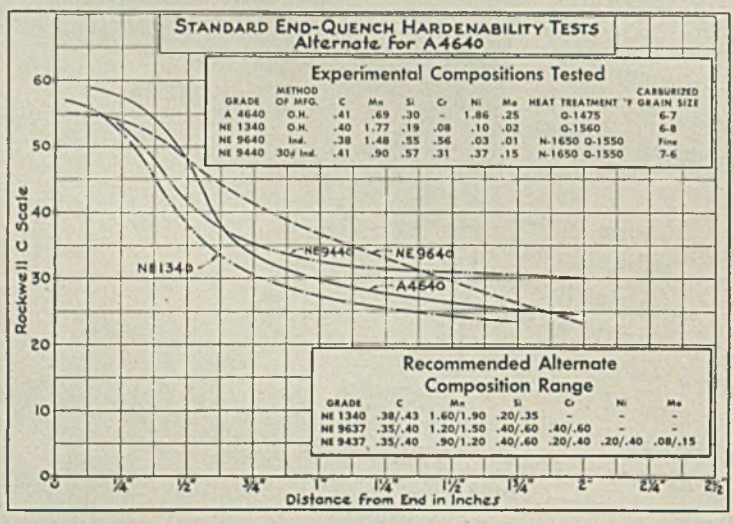
Experimental Compositions Tested

Grade	Method of Mfg.	C	Mn	Si	Cr	Ni	Mo	Heat Treatment °F	Carburized Grain Size
A 4137	O.H.	.38	.67	.27	1.01	.08	.18	Q-1550	Fine
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1550	6-8
NE 9640	Ind.	.38	1.48	.55	.56	.03	.01	N-1650 Q-1550	Fine
NE 9440	30# Ind.	.41	.90	.57	.31	.37	.15	N-1650 Q-1550	7-6

Recommended Alternate Composition Range

Grade	C	Mn	Si	Cr	Ni	Mo
NE 1340	.38/.43	1.60/1.90	.20/.35	–	–	–
NE 9637	.35/.40	1.20/1.50	.40/.60	.40/.60	–	–
NE 9437	.35/.40	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for A4640



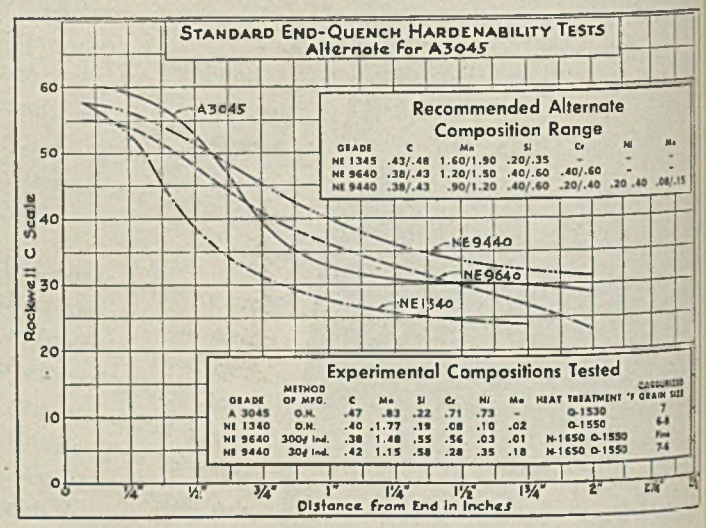
Experimental Compositions Tested

Grade	Method of Mfg.	C	Mn	Si	Cr	Ni	Mo	Heat Treatment °F	Carburized Grain Size
A 4640	O.H.	.41	.69	.30	–	1.86	.25	Q-1475	6-7
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1560	6-8
NE 9640	Ind.	.38	1.48	.55	.56	.03	.01	N-1650 Q-1550	Fine
NE 9440	30# Ind.	.41	.90	.57	.31	.37	.15	N-1650 Q-1550	7-6

Recommended Alternate Composition Range

Grade	C	Mn	Si	Cr	Ni	Mo
NE 1340	.38/.43	1.60/1.90	.20/.35	–	–	–
NE 9637	.35/.40	1.20/1.50	.40/.60	.40/.60	–	–
NE 9437	.35/.40	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Standard End-Quench Hardenability Tests
Alternate for A3045



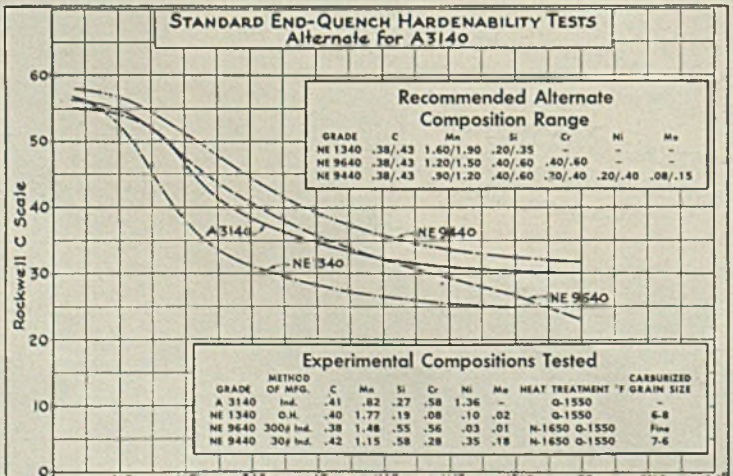
Recommended Alternate Composition Range

Grade	C	Mn	Si	Cr	Ni	Mo
NE 1345	.43/.48	1.60/1.90	.20/.35	–	–	–
NE 9640	.38/.43	1.20/1.50	.40/.60	.40/.60	–	–
NE 9440	.38/.43	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Experimental Compositions Tested

Grade	Method of Mfg.	C	Mn	Si	Cr	Ni	Mo	Heat Treatment °F	Carburized Grain Size
A 3045	O.H.	.47	.83	.22	.71	.73	–	Q-1530	7
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1550	6-8
NE 9640	300# Ind.	.38	1.48	.55	.56	.03	.01	N-1650 Q-1550	Fine
NE 9440	30# Ind.	.42	1.15	.58	.28	.35	.18	N-1650 Q-1550	7-6

Standard End-Quench Hardenability Tests
Alternate for A3140



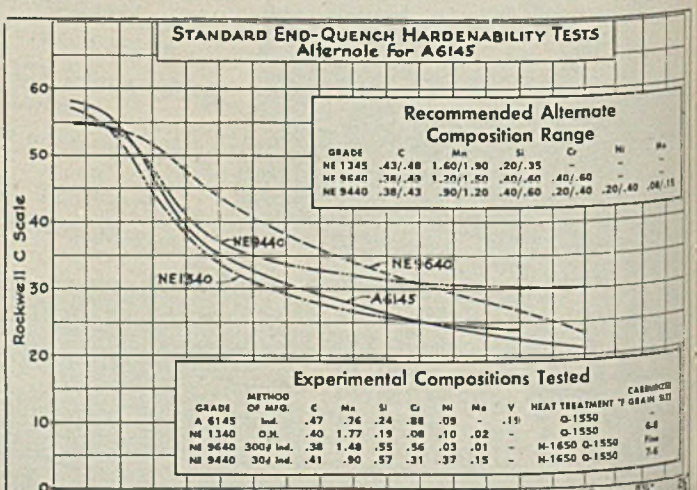
Recommended Alternate Composition Range

Grade	C	Mn	Si	Cr	Ni	Mo
NE 1340	.38/.43	1.60/1.90	.20/.35	–	–	–
NE 9640	.38/.43	1.20/1.50	.40/.60	.40/.60	–	–
NE 9440	.38/.43	.90/1.20	.40/.60	.70/.40	.20/.40	.08/.15

Experimental Compositions Tested

Grade	Method of Mfg.	C	Mn	Si	Cr	Ni	Mo	Heat Treatment °F	Carburized Grain Size
A 3140	Ind.	.41	.82	.27	.58	1.36	–	Q-1550	–
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1550	6-8
NE 9640	300# Ind.	.38	1.48	.55	.56	.03	.01	N-1650 Q-1550	Fine
NE 9440	30# Ind.	.42	1.15	.58	.28	.35	.18	N-1650 Q-1550	7-6

Standard End-Quench Hardenability Tests
Alternate for A6145



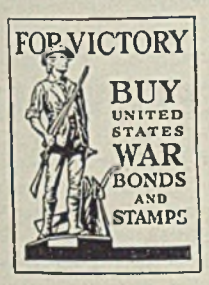
Recommended Alternate Composition Range

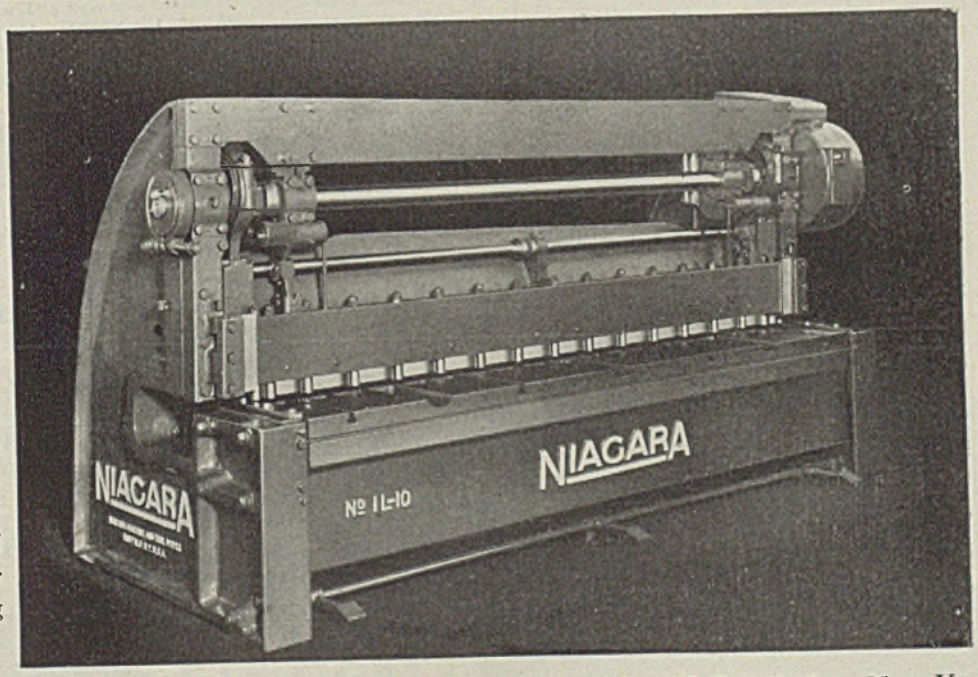
Grade	C	Mn	Si	Cr	Ni	Mo
NE 1345	.43/.48	1.60/1.90	.20/.35	–	–	–
NE 9640	.38/.43	1.20/1.50	.40/.60	.40/.60	–	–
NE 9440	.38/.43	.90/1.20	.40/.60	.20/.40	.20/.40	.08/.15

Experimental Compositions Tested

Grade	Method of Mfg.	C	Mn	Si	Cr	Ni	Mo	V	Heat Treatment °F	Carburized Grain Size
A 6145	Ind.	.47	.76	.24	.88	.09	–	.19	Q-1550	–
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	–	Q-1550	6-8
NE 9640	300# Ind.	.38	1.48	.55	.56	.03	.01	–	N-1650 Q-1550	Fine
NE 9440	30# Ind.	.41	.90	.57	.31	.37	.15	–	N-1650 Q-1550	7-6

INTERNATIONAL NEWS PHOTO





Production machines as well as fighting machines must be tough. Reliability built into Niagara Presses and Shears is standing the gaff during 24-hour-a-day, 7-day-a-week wartime requirements. Leading American manufacturers of tanks, ships, airplanes, and other fighting equipment are depending on Niagara.

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Greenlee AUTOMATIC NEWS

PREPARED BY GREENLEE BROS. & CO., ROCKFORD, ILL.

GREENLEE BROS. & CO. WORKERS SALUTED BY ARMY AND NAVY

Honored With The Army-Navy Production Award

In an impressive ceremony on the company grounds, Greenlee Bros. & Co., Rockford, Illinois, was presented with the prized Army-Navy "E" Production Award, Thursday, September 3.

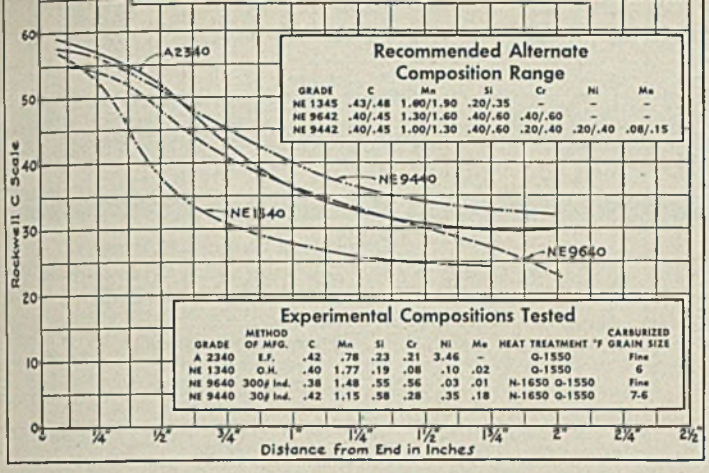
This proud citation to the Greenlee Organization and its workers is in recognition of outstanding services in the production of machinery and tools vital to the war effort.

The award, consisting of an "E" flag to be flown above the plant and a lapel pin for every Greenlee employee, was presented by Lieut. Colonel Edward H. Bowman, chief of Chicago Procurement District, and Lieut. Commander R. J. Twyman, District Personnel Office, 9th Naval District.

Lieut. Colonel Bowman is shown above presenting the Army-Navy "E" Flag to Mr. George C. Purdy, president of the company. In making the pennant award, Lieut. Col. Bowman declared, "The Army Air Force congratulates the management, and you, the workers, for your excellency in workmanship on the critical machines you are manufacturing. . . ."

EMPLOYEES GIVEN PINS

All employees of the plant — most of whom work 12 hours or more each day turning out the machine tools needed to produce the weapons of war — received silver pins, symbolic of the Government's appreciation of the fine work they are doing. The photograph at the left shows Lieut. Commander Twyman presenting lapel pins to representatives of the employees. Lieut. Commander Twyman saluted the Greenlee Men and Women for their exceptional performance in turning out Greenlee Automatic Screw Machines, Greenlee Special Transfer Machines for machining airplane engine parts, Greenlee Woodworking Machinery and Greenlee Tools.

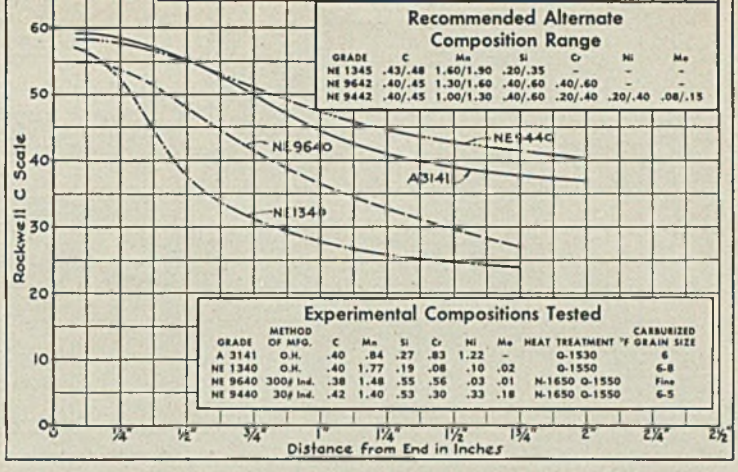


Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1345	.43/.48	1.60/1.90	.20/.35	-	-	-
NE 9642	.40/.45	1.30/1.60	.40/.60	.40/.60	-	-
NE 9442	.40/.45	1.00/1.30	.40/.60	.20/.40	.20/.40	.08/.15

Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 2340	E.F.	.42	.78	.23	.21	3.46	-	Q-1550	Fine
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1550	6
NE 9640	300# Ind.	.38	1.48	.55	.56	.03	.01	N-1650 Q-1550	Fine
NE 9440	30# Ind.	.42	1.15	.58	.28	.35	.18	N-1650 Q-1550	7-6

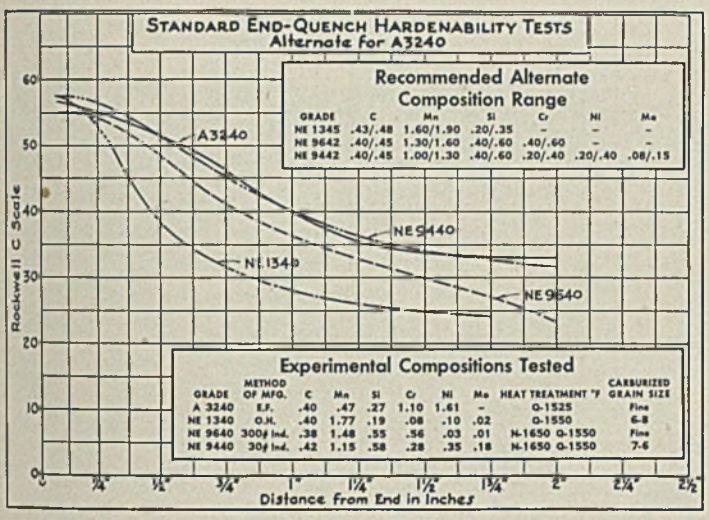


Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1345	.43/.48	1.60/1.90	.20/.35	-	-	-
NE 9642	.40/.45	1.30/1.60	.40/.60	.40/.60	-	-
NE 9442	.40/.45	1.00/1.30	.40/.60	.20/.40	.20/.40	.08/.15

Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 3141	O.H.	.40	.84	.27	.83	1.22	-	Q-1530	6
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1550	6-8
NE 9640	300# Ind.	.38	1.48	.55	.56	.03	.01	N-1650 Q-1550	Fine
NE 9440	30# Ind.	.42	1.40	.53	.30	.33	.18	N-1650 Q-1550	6-5

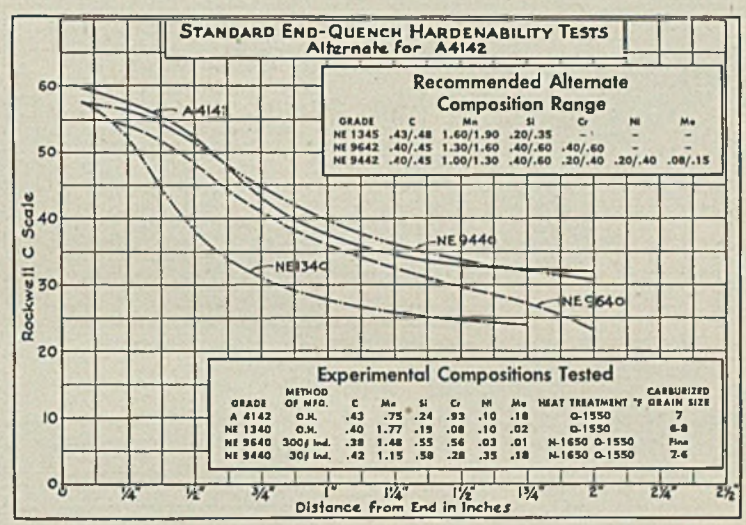


Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1345	.43/.48	1.60/1.90	.20/.35	-	-	-
NE 9642	.40/.45	1.30/1.60	.40/.60	.40/.60	-	-
NE 9442	.40/.45	1.00/1.30	.40/.60	.20/.40	.20/.40	.08/.15

Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 3240	E.F.	.40	.47	.27	1.10	1.61	-	Q-1525	Fine
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1550	6-8
NE 9640	300# Ind.	.38	1.48	.55	.56	.03	.01	N-1650 Q-1550	Fine
NE 9440	30# Ind.	.42	1.15	.58	.28	.35	.18	N-1650 Q-1550	7-6

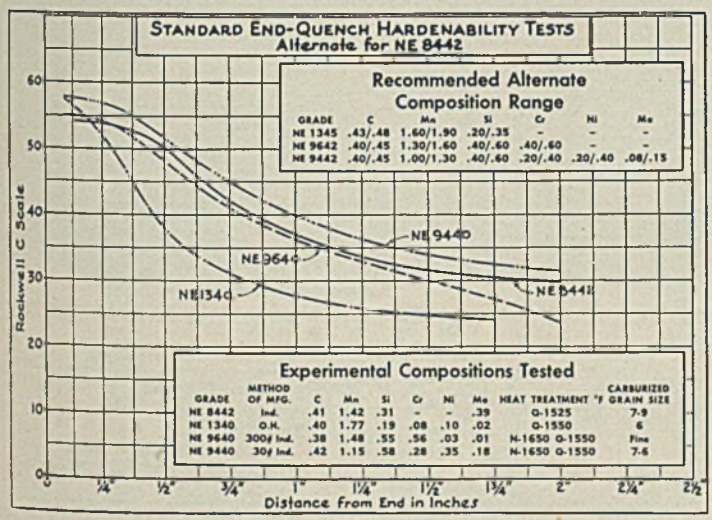


Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1345	.43/.48	1.60/1.90	.20/.35	-	-	-
NE 9642	.40/.45	1.30/1.60	.40/.60	.40/.60	-	-
NE 9442	.40/.45	1.00/1.30	.40/.60	.20/.40	.20/.40	.08/.15

Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 4142	O.H.	.43	.75	.24	.93	.10	.18	Q-1550	7
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1550	6-8
NE 9640	300# Ind.	.38	1.48	.55	.56	.03	.01	N-1650 Q-1550	Fine
NE 9440	30# Ind.	.42	1.15	.58	.28	.35	.18	N-1650 Q-1550	7-6

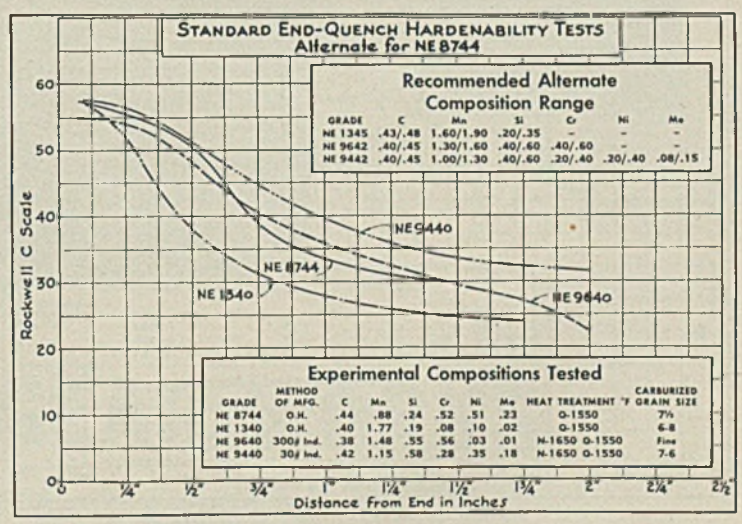


Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1345	.43/.48	1.60/1.90	.20/.35	-	-	-
NE 9642	.40/.45	1.30/1.60	.40/.60	.40/.60	-	-
NE 9442	.40/.45	1.00/1.30	.40/.60	.20/.40	.20/.40	.08/.15

Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
NE 8442	Ind.	.41	1.42	.31	-	-	.39	Q-1525	7-9
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1550	6
NE 9640	300# Ind.	.38	1.48	.55	.56	.03	.01	N-1650 Q-1550	Fine
NE 9440	30# Ind.	.42	1.15	.58	.28	.35	.18	N-1650 Q-1550	7-6

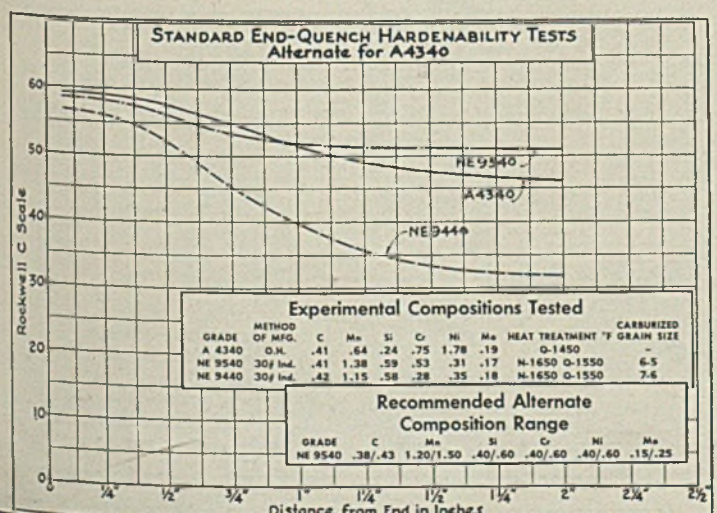


Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 1345	.43/.48	1.60/1.90	.20/.35	-	-	-
NE 9642	.40/.45	1.30/1.60	.40/.60	.40/.60	-	-
NE 9442	.40/.45	1.00/1.30	.40/.60	.20/.40	.20/.40	.08/.15

Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
NE 8744	O.H.	.44	.88	.24	.52	.51	.23	Q-1550	7½
NE 1340	O.H.	.40	1.77	.19	.08	.10	.02	Q-1550	6-8
NE 9640	300# Ind.	.38	1.48	.55	.56	.03	.01	N-1650 Q-1550	Fine
NE 9440	30# Ind.	.42	1.15	.58	.28	.35	.18	N-1650 Q-1550	7-6

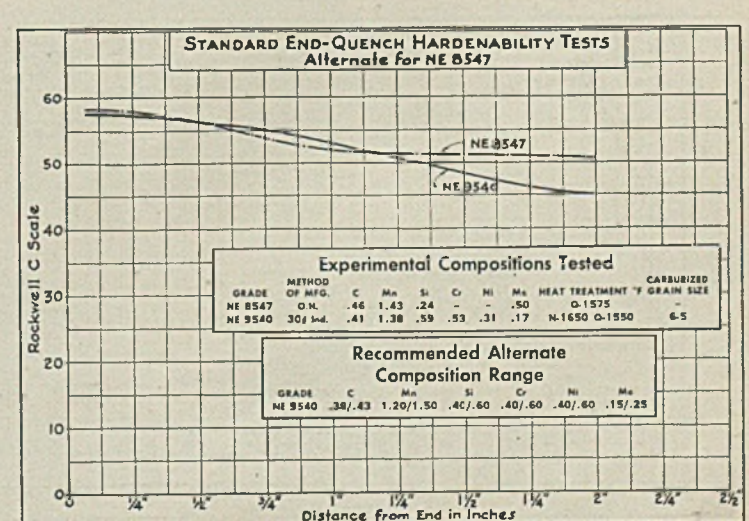


Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 4340	O.H.	.41	.64	.24	.75	1.78	.19	Q-1450	-
NE 9540	30# Ind.	.41	1.38	.59	.53	.31	.17	N-1650 Q-1550	6-5
NE 9440	30# Ind.	.42	1.15	.58	.28	.35	.18	N-1650 Q-1550	7-6

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 9540	.38/.43	1.20/1.50	.40/.60	.40/.60	.40/.60	.15/.25

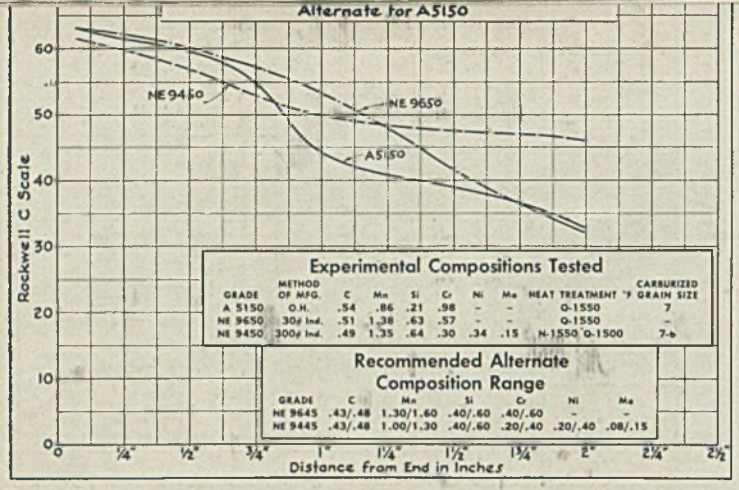


Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
NE 8547	O.H.	.46	1.43	.24	-	-	.50	Q-1575	-
NE 9540	30# Ind.	.41	1.38	.59	.53	.31	.17	N-1650 Q-1550	6-5

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 9540	.38/.43	1.20/1.50	.40/.60	.40/.60	.40/.60	.15/.25

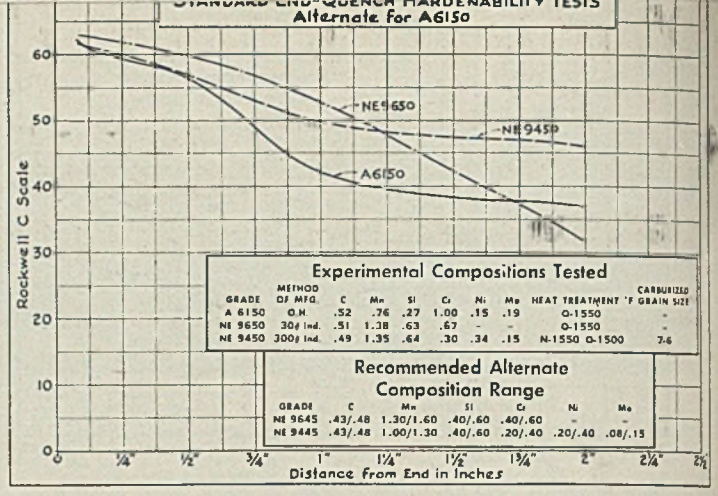


Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 5150	O.H.	.54	.86	.21	.98	-	-	Q-1550	7
NE 9650	30# Ind.	.51	1.38	.63	.57	-	-	Q-1550	-
NE 9450	300# Ind.	.49	1.35	.64	.30	.34	.15	N-1550 Q-1500	7-6

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 9645	.43/.48	1.30/1.60	.40/.60	.40/.60	-	-
NE 9445	.43/.48	1.00/1.30	.40/.60	.20/.40	.20/.40	.08/.15

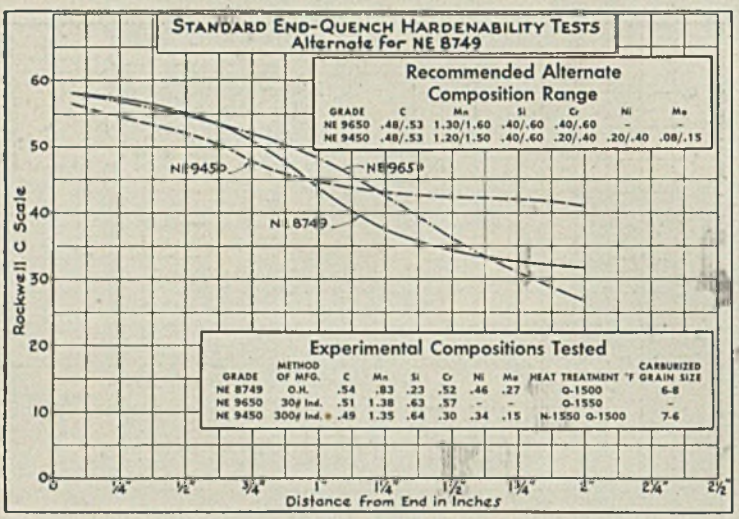


Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 6150	O.H.	.52	.76	.27	1.00	.15	.19	Q-1550	-
NE 9650	30# Ind.	.51	1.38	.63	.67	-	-	Q-1550	-
NE 9450	300# Ind.	.49	1.35	.64	.30	.34	.15	N-1550 Q-1500	7-6

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 9645	.43/.48	1.30/1.60	.40/.60	.40/.60	-	-
NE 9445	.43/.48	1.00/1.30	.40/.60	.20/.40	.20/.40	.08/.15

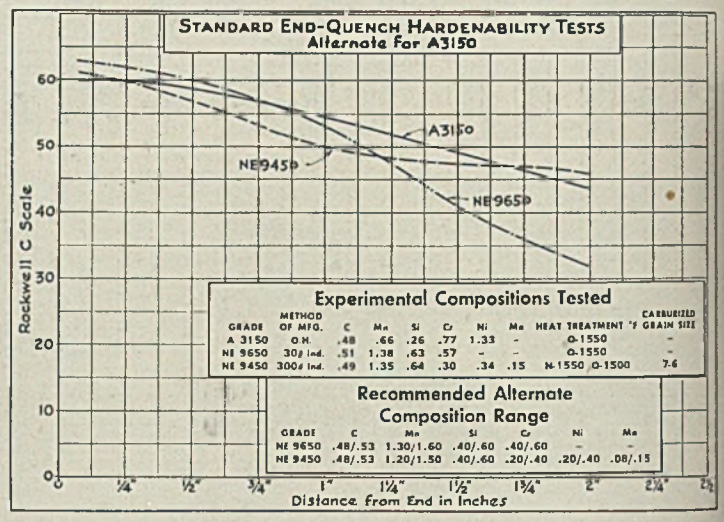


Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 9650	.48/.53	1.30/1.60	.40/.60	.40/.60	-	-
NE 9450	.48/.53	1.20/1.50	.40/.60	.20/.40	.20/.40	.08/.15

Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
NE 8749	O.H.	.54	.83	.23	.52	.46	.27	Q-1500	6-8
NE 9650	30# Ind.	.51	1.38	.63	.57	-	-	Q-1550	-
NE 9450	300# Ind.	.49	1.35	.64	.30	.34	.15	N-1550 Q-1500	7-6

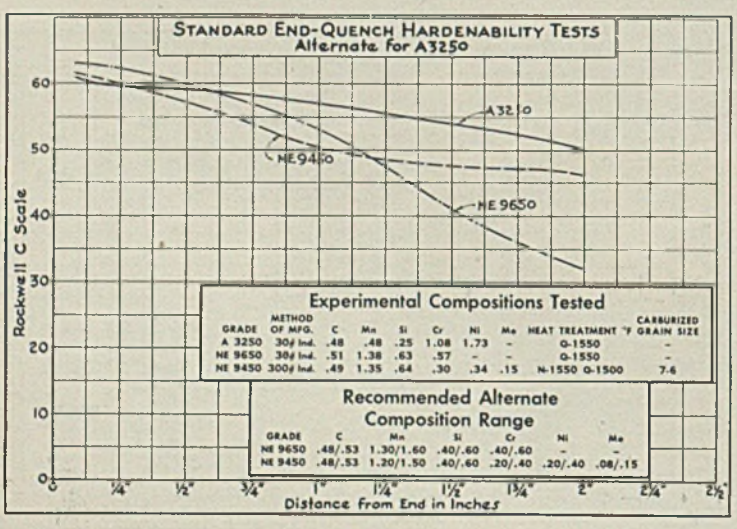


Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 3150	O.H.	.48	.66	.26	.77	1.33	-	Q-1550	-
NE 9650	30# Ind.	.51	1.38	.63	.57	-	-	Q-1550	-
NE 9450	300# Ind.	.49	1.35	.64	.30	.34	.15	N-1550 Q-1500	7-6

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 9650	.48/.53	1.30/1.60	.40/.60	.40/.60	-	-
NE 9450	.48/.53	1.20/1.50	.40/.60	.20/.40	.20/.40	.08/.15

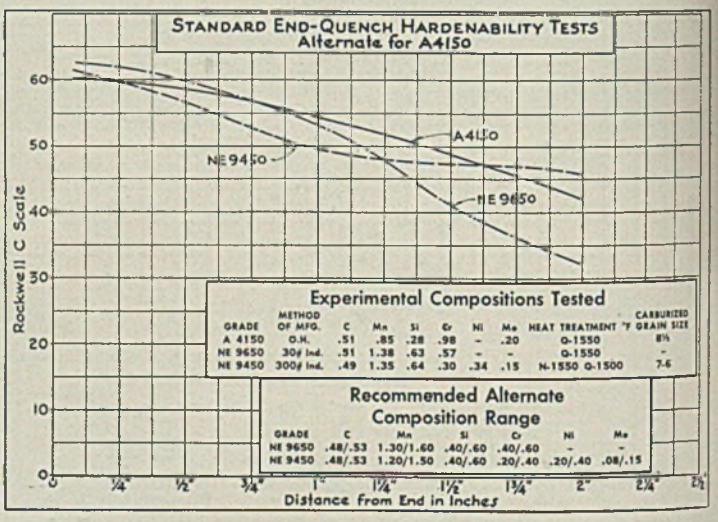


Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 3250	30# Ind.	.48	.48	.25	1.08	1.73	-	Q-1500	-
NE 9650	30# Ind.	.51	1.38	.63	.57	-	-	Q-1550	-
NE 9450	300# Ind.	.49	1.35	.64	.30	.34	.15	N-1550 Q-1500	7-6

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 9650	.48/.53	1.30/1.60	.40/.60	.40/.60	-	-
NE 9450	.48/.53	1.20/1.50	.40/.60	.20/.40	.20/.40	.08/.15

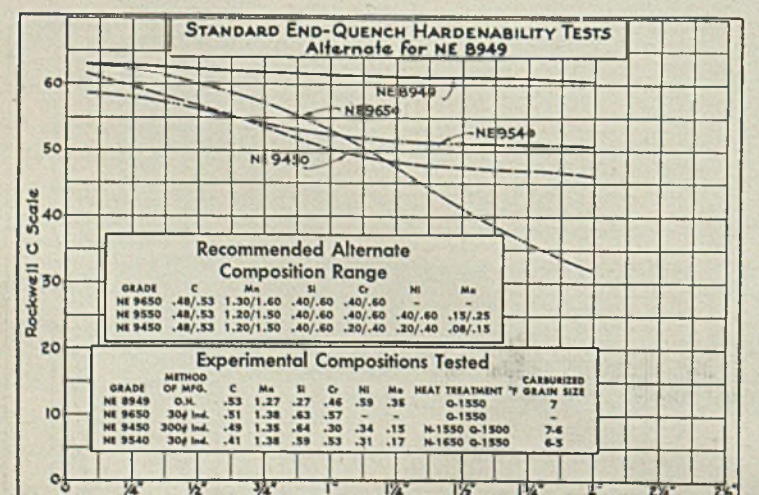


Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
A 4150	O.H.	.51	.85	.28	.98	-	.20	Q-1550	8½
NE 9650	30# Ind.	.51	1.38	.63	.57	-	-	Q-1550	-
NE 9450	300# Ind.	.49	1.35	.64	.30	.34	.15	N-1550 Q-1500	7-6

Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 9650	.48/.53	1.30/1.60	.40/.60	.40/.60	-	-
NE 9450	.48/.53	1.20/1.50	.40/.60	.20/.40	.20/.40	.08/.15

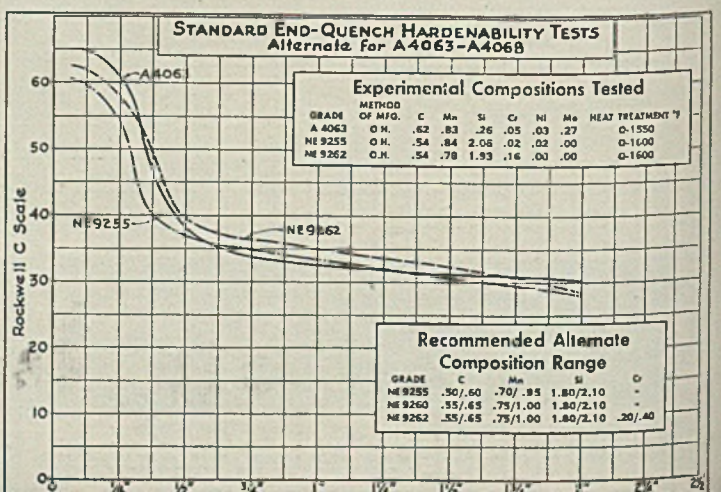


Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr	Ni	Mo
NE 9650	.48/.53	1.30/1.60	.40/.60	.40/.60	-	-
NE 9550	.48/.53	1.20/1.50	.40/.60	.40/.60	.40/.60	.15/.25
NE 9450	.48/.53	1.20/1.50	.40/.60	.20/.40	.20/.40	.08/.15

Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F	CARBURIZED GRAIN SIZE
NE 8949	O.H.	.53	1.27	.27	.46	.59	.35	Q-1550	7
NE 9650	30# Ind.	.51	1.38	.63	.57	-	-	Q-1550	-
NE 9450	300# Ind.	.49	1.35	.64	.30	.34	.15	N-1550 Q-1500	7-6
NE 9540	30# Ind.	.41	1.38	.59	.53	.31	.17	N-1650 Q-1550	6-5



Experimental Compositions Tested

GRADE	METHOD OF MFG.	C	Mn	Si	Cr	Ni	Mo	HEAT TREATMENT °F
A 4063	O.H.	.62	.83	.26	.05	.03	.27	Q-1550
NE 9255	O.H.	.54	.84	2.06	.02	.02	.00	Q-1600
NE 9262	O.H.	.54	.78	1.93	.16	.00	.00	Q-1600

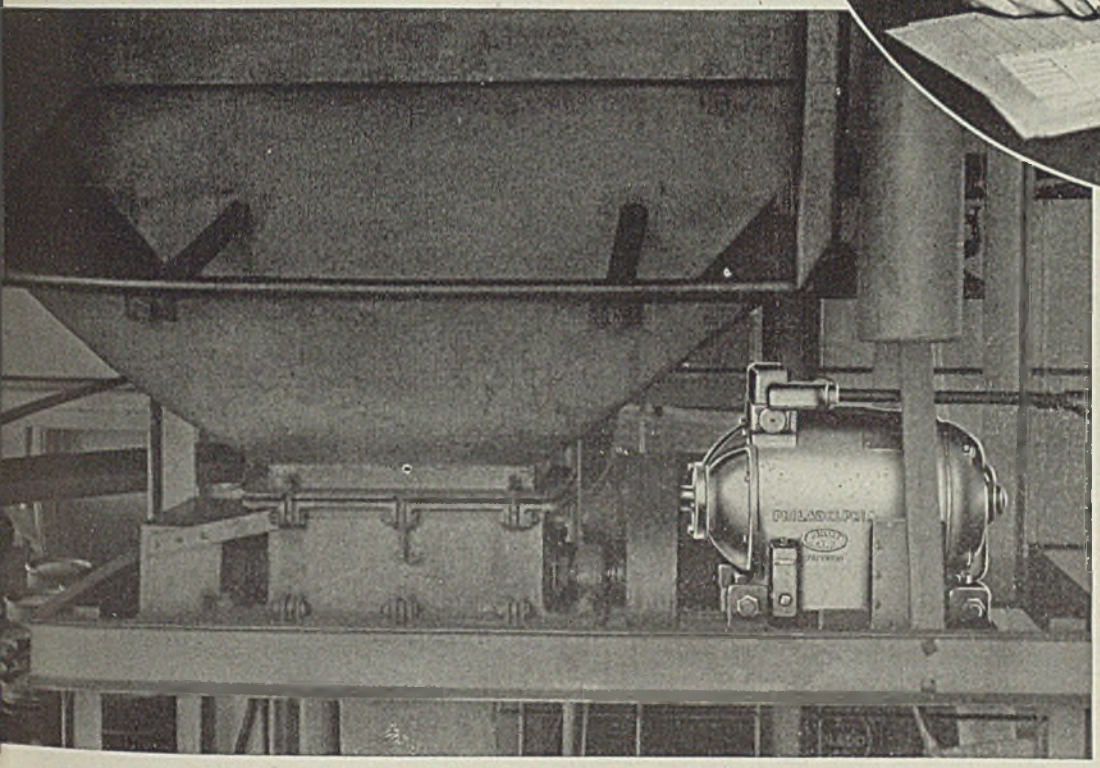
Recommended Alternate Composition Range

GRADE	C	Mn	Si	Cr
NE 9255	.50/.60	.70/.95	1.80/2.10	-
NE 9260	.55/.65	.75/1.00	1.80/2.10	-
NE 9262	.55/.65	.75/1.00	1.80/2.10	.20/.40

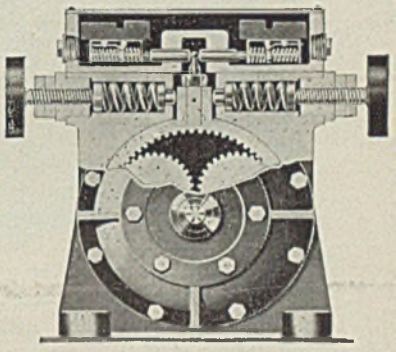
You just can't overload a PlaneTorque-MotoReduceR

Here's a protection that's as positive as the fuse in your electric line . . . and as necessary, too. The PlaneTorque, MotoReduceR, the built-in drive with the safety feature that's constantly on guard, preventing damage to jammed or overloaded equipment. Instantly, when the load gets too heavy, power is shut off, breakdowns avoided, production delays eliminated. Yet, the drive is ready for action again as soon as the overload is removed . . . no switches or other gadgets to reset.

Install PlaneTorque MotoReduceR for operating conveyors, stokers, mixers, roll drives, and similar installations. It is compact and highly efficient with a dependability that's proven in service, again and again. Both horizontal and vertical types are available in a wide range of output speeds. Get our catalog M. R. 40 for more details.



Type HS Horizontal MotoReduceR with PlaneTorque feature driving a color crusher



Cut-away view showing internal construction. PlaneTorque switch responds to overloads more quickly than electrical thermal relays since the mechanical action of the overload operates the cut out switch directly.

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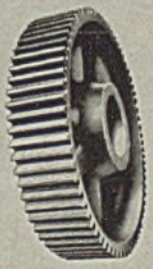

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HOW TO SHIP

More Economically in Corrugated Boxes

(Concluded from Last Week)

ECONOMIES of time and material were never more vital than today. This is as true in the field of packaging and shipment as in any other field. Manufacturers who ship their products in corrugated boxes will find the following practical suggestions offered by the Hinde & Dauch Paper Co., Sandusky, O., helpful in eliminating wasted time and materials from receipt of boxes at their warehouse to delivery of their contents. Perhaps no one saving will be great, but if attention is paid to every small economy along the line, the result will be considerable in both time and money.

Corrugated shipping boxes are shipped to you flat and then assembled at your plant. This cuts storage space. Before your boxes arrive, be sure your storage space is clean. Sweep it out, wiping dry any damp or oily spots. Cover such spots with protective paper. Corrugated boxes can be damaged with oil, water and dirt, and such damage may be transferred to the costlier materials the boxes are designed to protect.

Eliminate protruding nails or other obstructions which may punch holes or otherwise weaken boxes.

Be sure enough space is provided for the inventory of boxes required at any one time. This eliminates the necessity of makeshift storage where boxes may be exposed to weather, dirt or traffic. Often makeshift storage results in an undue amount of handling, and every handling opens up new possibilities for damage as well as increasing handling costs and time consumed.

When boxes are stored where plant traffic is likely to be heavy, protect the boxes so that traffic cannot injure them. Corner protectors high enough to prevent damage from passing trucks, workers, etc., and heavy enough to stay in place often will very satisfactorily fill the bill. See Fig. 1.

Temperature and Humidity: Both temperature and humidity affect corrugated boxes. At what temperatures and humidities should they be kept authoritative sources vary in their recommendations. However, here are a few simple rules that it will pay you to follow.

Temperatures between 20 and 100 degrees Fahr. will not cause boxes to deteriorate if humidity is not too low or too high. However, sudden changes from low to high temperatures may cause trouble. For instance, if boxes are stored in a cold warehouse and are then suddenly placed where temperatures are much higher, the boxes may be temporarily weakened. The ideal temperature range is from 50 to 70 degrees Fahr.

Relative humidities from 50 to 55 per cent are ideal, although corrugated boxes have been stored for long periods of time without serious adverse effects in relative humidities from 35 to 80 per cent. When boxes become too dry in winter, they may cause trouble in packing and other handling operations.

To keep both humidity and temperatures within narrow limits is most often too costly for the results obtained. However, excellent results can be achieved by very simple, inexpensive methods. Here are some suggestions:

When humidity is found to be low in winter, place open vessels of water near the heating units. Or put some pet-cocks on the steam radiators and let steam blow out continuously. Although not automatic, this method has proved highly satisfactory. There are also a number of inexpensive plant humidifiers on the market, and if considerable difficulty has been experienced, a study of the relative cost and loss involved will reveal whether the investment in a humidifier is justified.

During long cold periods, remove boxes from unheated warehouse to packing room two or three days before using.

Efficient design and engineering of the package will save corrugated board, packing time and materials as well as cut shipping losses. See Part I of this article in STEEL, Nov. 2, p. 88.

Packing: Here are several easy ways to save in actual packing operations:

—Make sure that no operation unduly "softens up" the corrugated boxes so that their strength is reduced before they leave your plant. See that neither manual nor automatic handling is unnecessarily rough.

—See that boxes are handled a minimum number of times.

—Discard boxes that are damaged in storage to prevent loss of or damage to contents in transit.

—Make sure that products are always properly packed within the box so that they will not be damaged in transit.

Shipping: The shipping room is the key to the safe conduct of the corrugated box and its contents from plant to destination. The shipping room organization should be carefully set up. By time studies and efficient layout, a greater number of boxes can often be prepared for shipment in a given time. So shipments may proceed from order-filling to final dispatch with a minimum of confusion and congestion, a clear, unhampered line of movement should be charted and followed: Here, as in the packing operation, the box should be handled as few times as possible.

Sealing: Corrugated box protection is no better than the sealing job. The secret of proper sealing is to utilize to the fullest degree the protection built into corrugated boxes. Here are a few suggestions:

—Make sure there is not excess use of glue, tape, wire or staples. Where tape is used, be sure to use only necessary lengths. Measure and chart the tape lengths for regular packing operations. Savings up to $400 a year and more have been reported by the use of an automatic cut-off sealing tape moistener and by confining overlap to a maximum of 3 inches.

—Standardize operations so that there is a minimum of waste motion and loss by spoilage.

—Be sure that when sealing is completed there are no open seams.

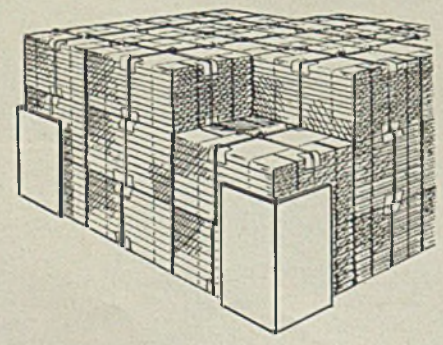
—Boxes should always be sealed "on the square".

—Check your sealing method—is it the most efficient, the most economical for the type of corrugated box you use?

—If a change of sealing method or procedure is proposed, check to make

(*Please turn to Page* 137)

Fig. 9—These ingenious but simple homemade corner guards prevent traffic from damaging boxes while they are stored



THE HANDLE WITH CARE sign is important today. It belongs on every tool and on every piece of equipment in America. We can't afford a speck of waste, and even the toughest equipment will last longer when cared for properly.

For example, your sturdy, long-lived, dependable Exide Batteries will last even longer if you follow the simple maintenance steps given on this page. The rule of the day is *Handle With Care.* Treat your batteries right . . . and you help treat the Axis rough.

MAKING BATTERIES LAST HELPS STOP THE AXIS!

1 Keep adding approved water at regular intervals. Most local water is safe. Ask us if yours is safe.

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

3 Keep the battery fully charged—but avoid excessive over-charge. A storage battery will last longer when charged at its proper voltage.

4 Record water additions, voltage, and gravity readings. Don't trust your memory. Write down a complete record of your battery's life history. Compare readings.

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

Exide
IRONCLAD
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

Designs Speed Conversion

To War Production Work

Plant making joining and fastening devices for automotive, radio, refrigerator and stove industries does successful job of conversion to war work by redesigning its product to fit needs of aircraft industry

By H. P. WHITE

WIDELY ACCEPTED by automotive, refrigerator, radio and stove engineers as an extremely efficient method of fastening sheet metal and plastic assemblies, Speed nuts and clips were being used at the rate of nearly 3,000,000 a day at the beginning of this war.

Many standard and special Speed nuts and their development and manufacture by Tinnerman Products Inc., Cleveland, have been described in STEEL in a number of different articles. See STEEL, March 24, 1941, p. 44; Aug. 25, 1941, p. 74; Feb. 9, 1942, p. 92; April 13, 1942, p. 113; April 27, 1942, p. 98; June 8, 1942, p. 110.

The company management saw the coming of the war early in 1941 and realized that it might have a heavy impact on the industries utilizing the company's products. At the same time, it became apparent that aircraft was going to be one of the most important items of war production. Thus to aid our war effort and to get directly into some phase of war production which best fitted the company's abilities, experience and production equipment, it became obvious that aircraft applications of the Speed nut system of joining parts should be developed as fast as possible.

The line of thinking pursued by company engineers was something like this: First of all, they knew that weight saving is even more important in aircraft design than in automotive vehicles, since the average Speed nut or clip

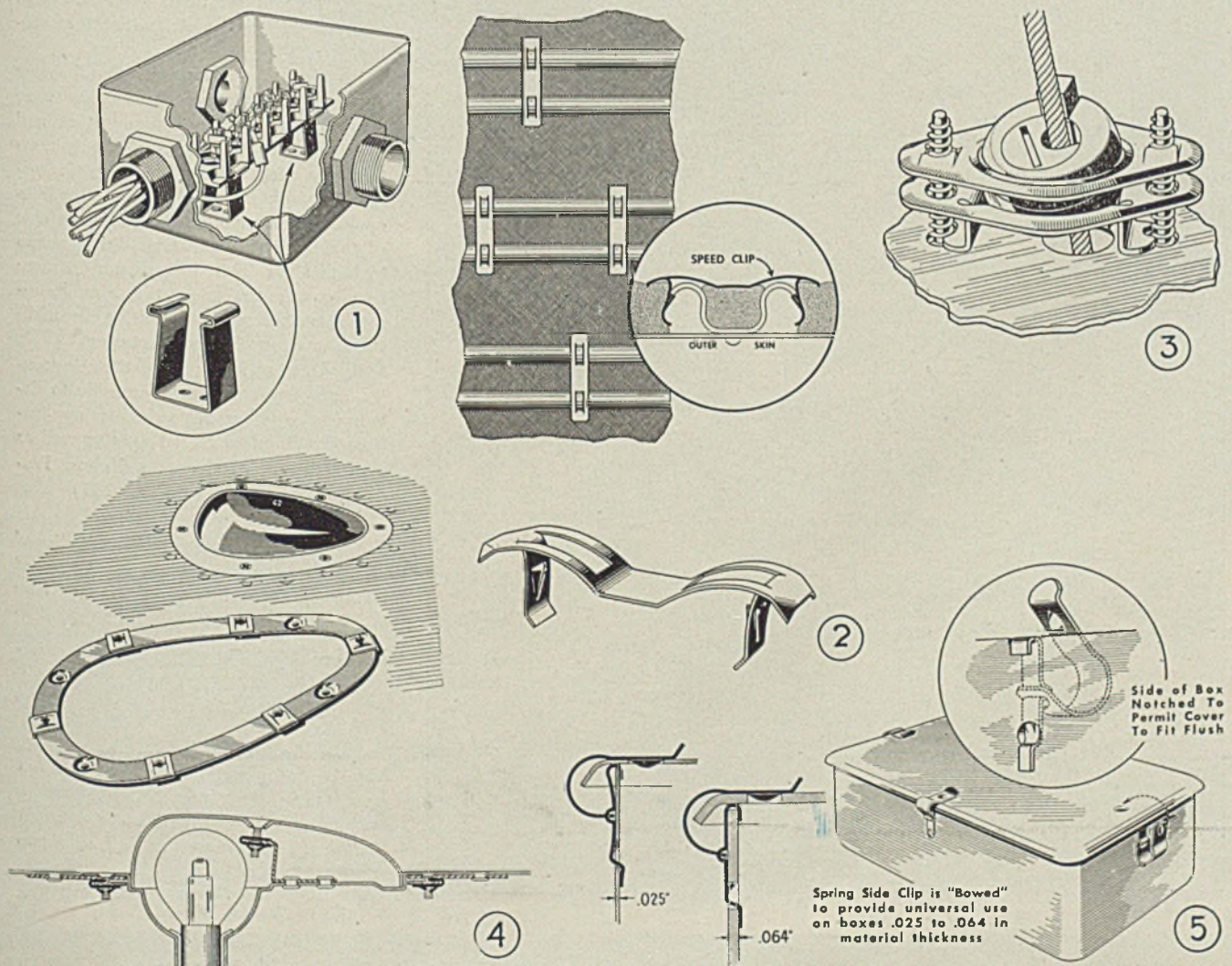
Fig. 1—Speed clip for junction box terminal permits connection to be made outside box

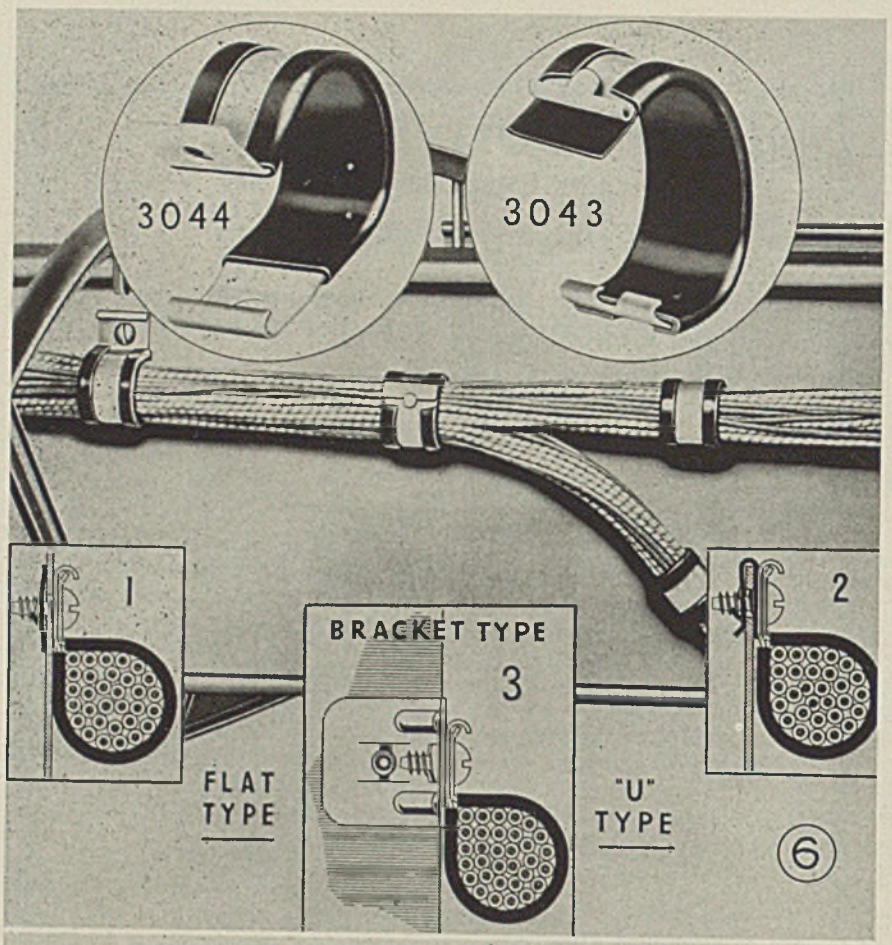
Fig. 2—Special Speed clip for holding insulation in place in aircraft

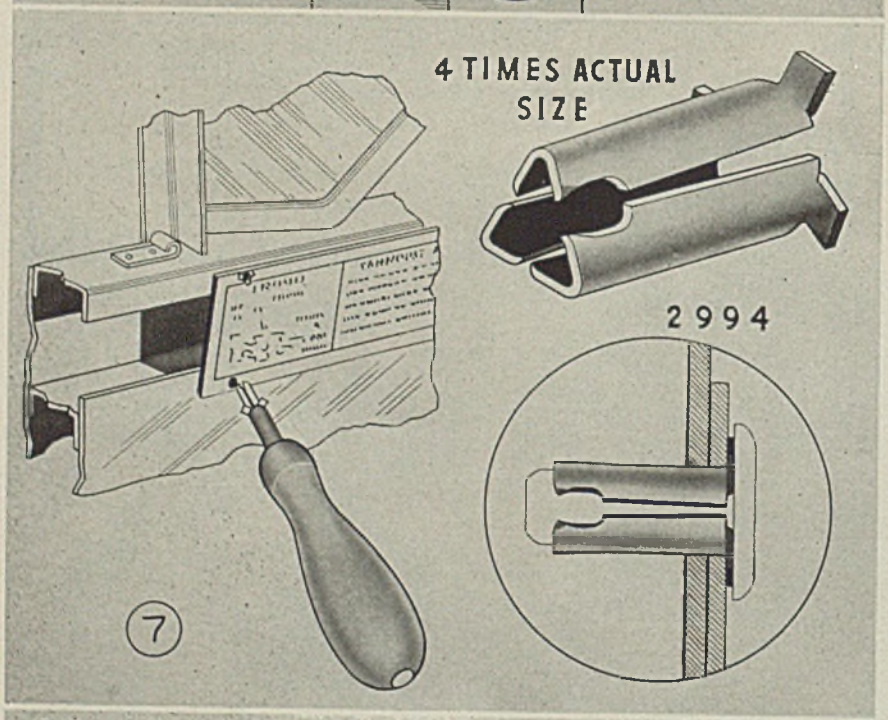
Fig. 3—Universal fairlead guide block with Speed nut fasteners integral

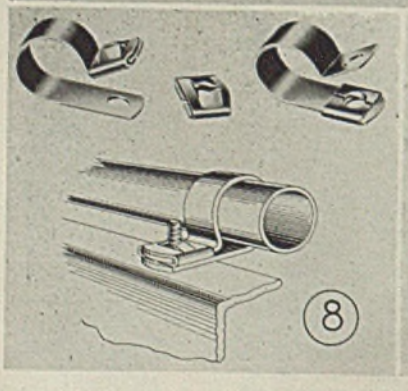
Fig. 4—Standard Speed nuts of the self-locating J-type snapped over this aluminum carrying ring make up a method for quick attachment of recognition lights, access doors and the like

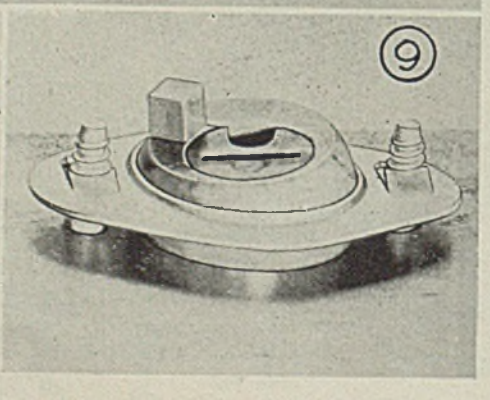
Fig. 5—Junction box fastening works in metal from 0.025 to 0.064-inch thick











weighs from 50 per cent to 80 per cent less than the fastening that it replaces. This important advantage is rapidly finding ready acceptance in aircraft work, where engineering minds are notably open to new production methods, designs and equipment. As a matter of fact, some Speed nut designs actually weigh only one-fifth as much as the fastenings formerly used on the same job because the Speed nut not only can replace the usual nut and lock-washer but it can frequent be engineered to replace certain functional parts as well.

Backed with years of experience in assembly engineering and with over a billion Speed nuts already used on peace time products, the Tinnerman organization was thoroughly equipped to improve aircraft assembly.

The double spring-tension lock developed in this fastener was seen as a valuable feature in aircraft assembly work, where even more violent vibration is encountered.

The Speed nut is made of high-carbon spring steel and is arched to provide a double-locking spring-tension grip. As the bolt is turned and tightened, the main arch of the Speed nut is brought down and the prongs are forced deeper into the roots of the threads to double-locked position. This gives an arched spring-lock and an inward thread-lock at the same time. Vibration tests have shown what the Speed nut will stand from three to six times more vibration than conventional nuts, without loosening.

Among other advantages that became apparent as aviation applications were studied were reduced assembly time and lowered costs. In addition, certain units specially designed for blind location assembly work meant that the assemblies could be completed from only one side of the work instead of requiring access to both sides. This, in turn, meant more freedom in designing the aircraft assemblies themselves, resulting in additional savings in manufacturing.

By drawing freely upon their ingenuity, company engineers were able to develop a number of valuable applications for standard Speed nuts as well as a number of special nuts and clips. Pos-

(*Please turn to Page* 131)

Fig. 6—Standard flat and U-type Speed nuts hold these new latching type Speed clamps for faster attachment of wire "bundles" in aircraft

Fig. 7—Speed clip makes efficient name-plate fastener

Fig. 8—Self-retaining Speed nut used with conduit clamp

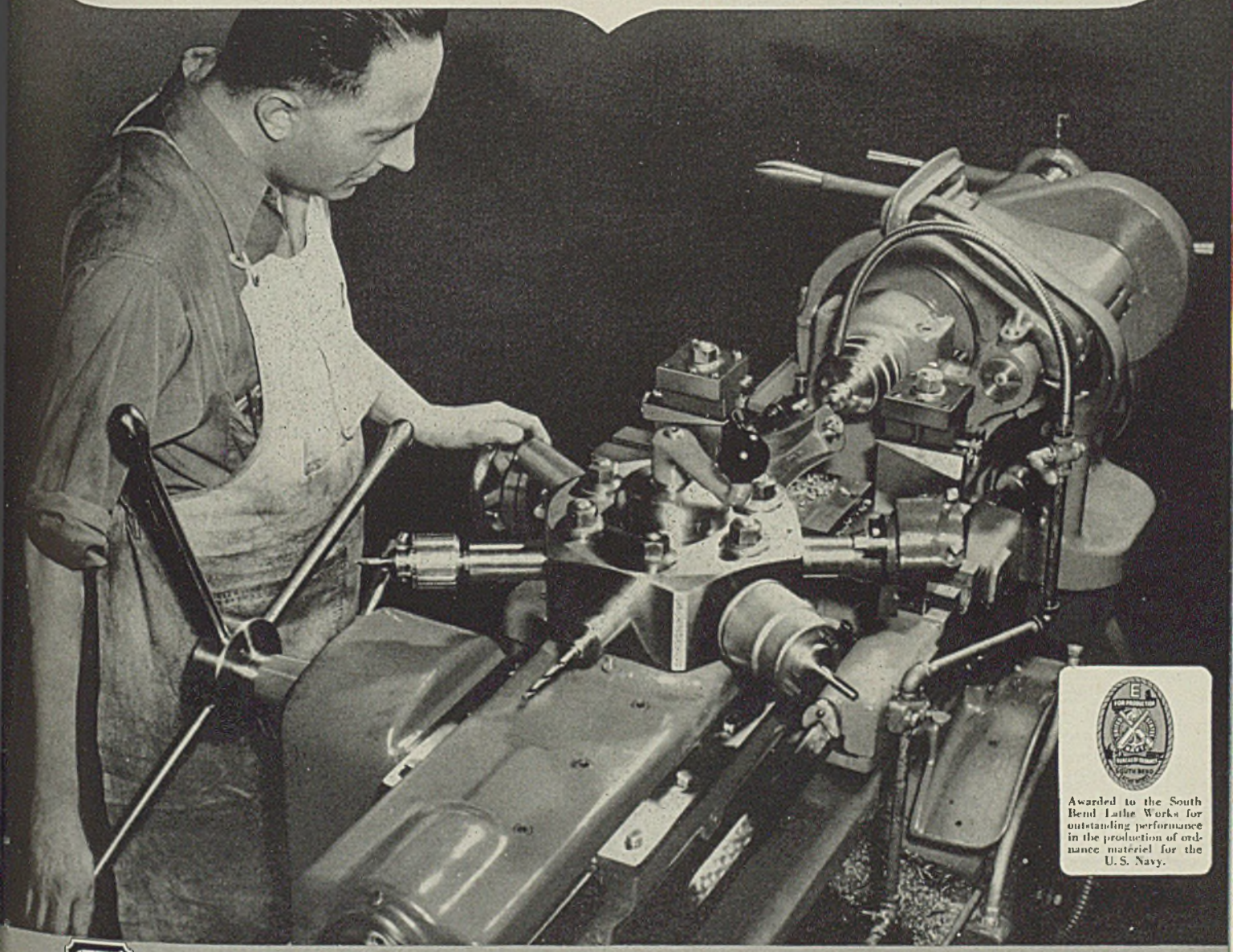
Fig. 9—Same guide as in Fig. 3 but here only upper section of clamp is utilized, a hole in the sheet to which it is attached forming other half of clamp

KEEPING PRECISION IN PACE WITH PRODUCTION

War production is urgent—that's certain. But production *without precision* is wasteful, even though quantities may be large and deliveries rush. Today, in hundreds of war production plants, precision keeps pace with production through the use of South Bend No. 2-H Turret Lathes.

Features responsible for the efficient performance of these Turret Lathes include an exceptionally rigid turret and carriage construction—a quick change gear box providing a wide range of power feeds for the universal carriage and turret—complete thread cutting range through lead screw and split nut, and a wide selection of spindle speeds.

The No. 2-H Turret Lathe has 16″ swing, 1⅜″ spindle hole, and 1″ collet capacity. South Bend Turret Lathes are also available in smaller sizes. Toolroom and Quick Change Gear Lathes are manufactured in 5 sizes, 9″ to 16″ swings. Write for information, specifying sizes and types of lathes in which you are interested.



Awarded to the South Bend Lathe Works for outstanding performance in the production of ordnance matériel for the U. S. Navy.

SOUTH BEND LATHE WORKS

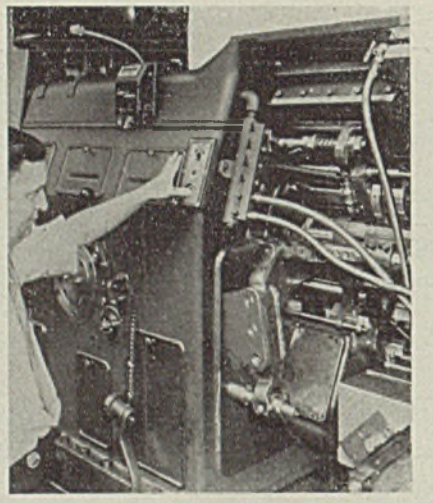
South Bend, Ind., U. S. A. — *Lathe Builders For 35 Years*

Control Switch

Electrical Division, National Acme Co., Cleveland, is offering a new Snap-Lock station control switch for use on machine tools. All of its parts are interchangeable—readily adaptable to multiple assembly for use in connection with magnetic motor starters, or any normal control circuit.

Standard assemblies consist of 3, 2 or 1-button combinations furnished either in flush type for mounting in standard cavity, or box type for surface or pendant mounting. Buttons supplied are either of the push or turn type.

Other features include: Heavy molded case using selected dielectric plastic material, gasketed cover with six screws—highly resistant to oil, dust and moisture; single pole, double break, double throw—

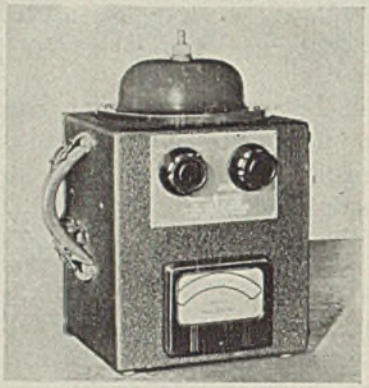


either circuit normally open with other normally closed; coin-silver contacts, heavy, wide faced, self-wiping on both make and break action.

The snap make and break of contacts and positive locking in either position are safeguarded by spring pressure and hardened steel cadmium coated parts. Unit's push mechanism is closely fitted in the housing, with 1/16-inch cushioning overtravel. It passes through the mechanical side of the unit thus eliminating chance of electric shock to operator from flashback. The company, in addition to the standard heavy duty types, is offering a unit for hazardous locations in a heavily constructed case—resistant to oil, water, vapors and designed to withstand internal explosions. Levers are provided for either momentary or maintained contact.

Electronic Voltmeter

General Electric Co., Schenectady, N. Y., is offering a new electronic crest voltmeter to measure ignition voltages of internal combustion engines; surge voltages caused by corona and surface discharges in the insulation on such electric equipment as motors, generators, and ca-



bles; and other repeated-impulse voltages up to 30,000 volts.

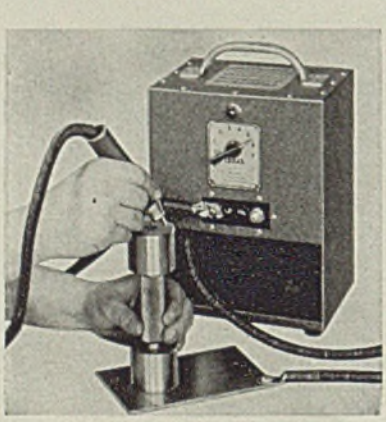
Weighing only 23 pounds, it is portable for use in both laboratory and production testing. It is suitable for field measurement, such as trouble shooting and the determination of actual operating conditions and also can be used for testing aircraft engines in flight.

The voltmeter can be used in areas where no electric power is available, since it has a self-contained battery power supply. It is equipped with an aircraft-instrument movement to provide resistance to vibration.

Metal Etcher

Ideal Commutator Dresser Co., 5076 Park avenue, Sycamore, Ill., announces a new No. 18 electric etcher said to mark permanently anything of steel, iron or their alloys. According to the company, to etch small tools and parts one simply places them on the work plate, turns switch "on" to proper heat and starts writing.

A ground clamp attached to the

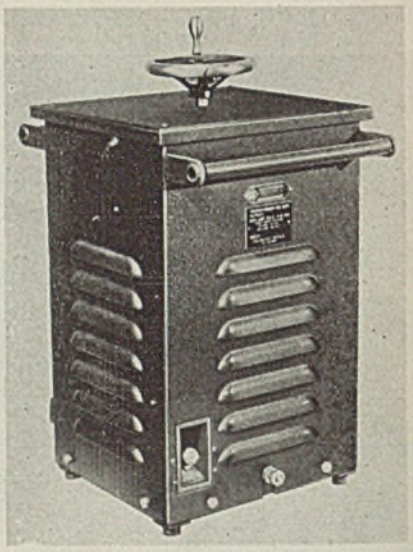


work plate is provided for etching large, heavy parts and castings. Hi-Lo taps and a 7-point switch give 14 etchings heats between 115 to 1300 watts. A red lamp on front of etcher indicates when power is "on" and burns brighter as each higher heat is used.

Depth of mark also can be controlled by speed of writing. The tool has special heat radiating fins and an alloy tip point. Its work plate is 4 x 7 inches with ground clamp attachment.

Welding Machine

Allis-Chalmers Mfg. Co., Milwaukee, announces a new alternating-current welder claimed to operate on a perfect electrical circuit that produces just the proper voltage for every current setting. It is used to step up speed of welding heavier, thicker metals. Welder's construction is based on a principle said to be revolutionary in welder design in that the transformer and reactor are built as



an integral unit, and the reactor coils surround the air gap, eliminating magnetic leakage.

This arrangement provides continuous control from 35 to 250 amperes. The welder is built without plugs, taps or switches of any kind. Manual control at the top of the unit covers the entire welding range from maximum to minimum setting with less than a dozen turns of the control handle.

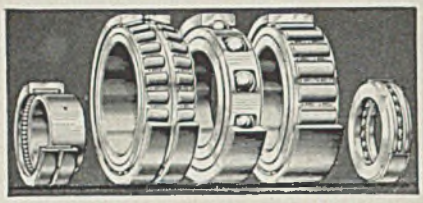
Finishing Wheels

The Carborundum Co., Niagara Falls, N. Y., is offering new MX wheels made up of thin disks of cotton fibers impregnated with either graded grains of Aloxite aluminum oxide or Carborundum silicon carbide. These are for use dry—on any flexible shaft machine or electric hand grinder.

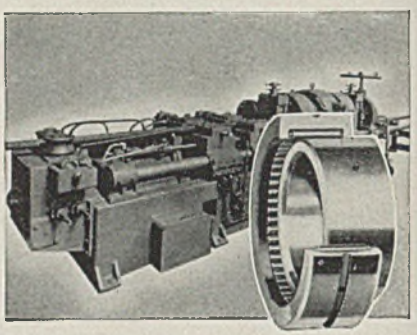
The thin disks are bonded or built up in form of wheels of various diameters and thicknesses. These are fabricated to


THROW YOUR SCRAP INTO THE FIGHT!
VICTORY
ON EVERY FRONT
CONTINENTAL ROLL AND STEEL FOUNDRY COMPANY
CHICAGO · PITTSBURGH
ROLLS
ROLLING MILL EQUIPMENT
SPECIAL MACHINERY

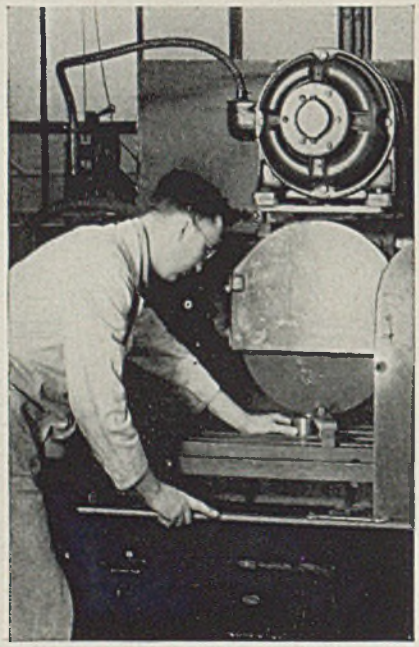
ON THE 1000-POUND LANDING GEAR of many giant bombers, you will find Bantam Needle Bearings contributing to smooth, dependable operation of the "Up-Latch" which locks the gear in flight position. This is just one of the ways that the many types of Bantam Bearings are helping to assure the successful functioning both of the weapons for Victory and of the machines that produce them.



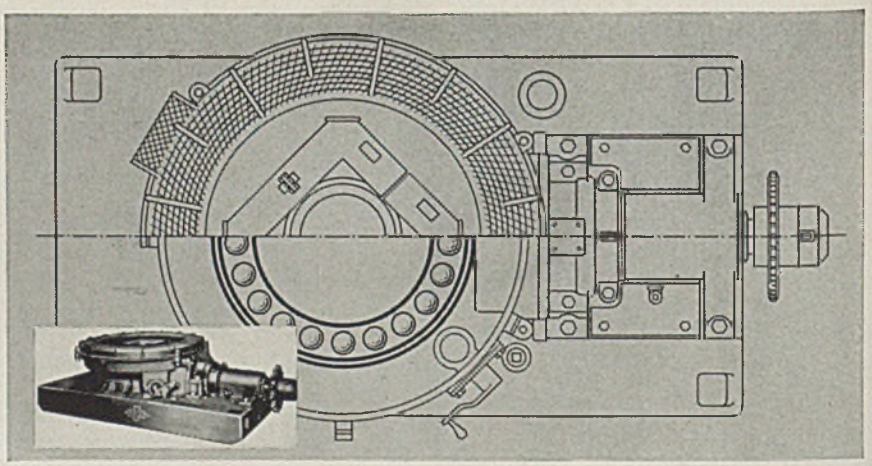
BANTAM'S ENGINEERING COOPERATION is especially valuable in meeting new and unusual requirements. Bantam makes every major type of anti-friction bearing—straight roller, tapered roller, needle, and ball. Bantam engineers aid in the selection of the most suitable type, or design special bearings to meet your requirements. If you have a difficult bearing problem, TURN TO BANTAM.



SPEED AND ACCURACY characterize the operation of centerless bar turners built by The Medart Company and used for precision finishing of bars and tubular products. In an ingenious feeding device combining hydraulic and mechanical action, standard Bantam Quill Bearings serve a novel application in cam rollers on the feeding grip jaws.



RIGID LABORATORY CONTROL contributes to the successful performance of Bantam Quill Bearings—the unusual anti-friction bearings that combine high radial load capacity, small size, ease of installation and lubrication. Samples from daily production runs are regularly tested for adherence to metallurgical and machining specifications. For further information on the Quill Bearing, write for Bulletin H-104.



OIL FOR A WAR OF MACHINES is needed in ever-increasing quantities—and the drill bits are turning faster, boring deeper into the earth. This cut-away view shows one of The Wheland Company's High-speed Oil Bath Rotaries, designed to meet every requirement of present-day drilling practice—and large Bantam Precision Ball Bearings are used to take both thrust and radial loads on the rotary table.

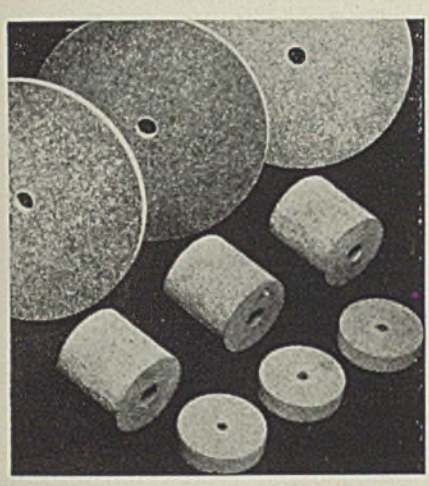
BANTAM BEARINGS

STRAIGHT ROLLER · TAPERED ROLLER · NEEDLE · BALL

BANTAM BEARINGS CORPORATION • SOUTH BEND • INDIANA

give variable degrees of resiliency and flexibility, and are made in six grades or degrees of hardness, Nos. 1, 2, 3, 4, 5, and 6.

Wheels are recommended for operating speeds ranging from 6000 to 8000 sur-

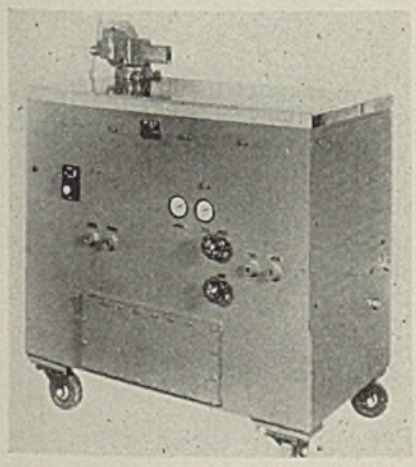


face feet per minute. Made in grits 50, 60, 120, 180 and 320, the wheels have wide application in finishing and polishing of out-of-the-way places or airplane engine parts and similar work.

Test Bench

Hydraulic Machinery Inc., Detroit, announces a portable hydraulic test bench for pre-flight checking of the hydraulic circuit of planes before leaving the ground. It enables the plane to be put through all of its hydraulic functions without running its motors.

Equipment of the testing bench consists of a hydraulically-operated air compressor for charging hydraulic accummulators. Unit also can be used to



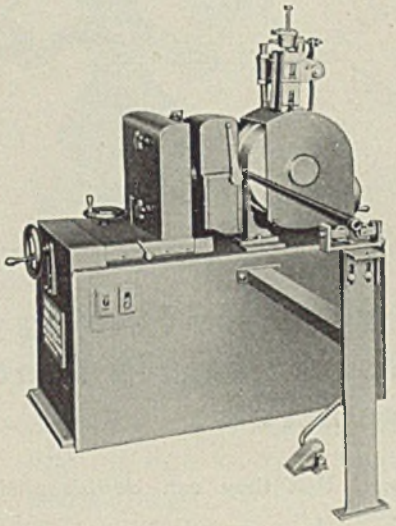
pump hydraulic fluid in and out of the plane.

A variable displacement pump permits the tester to operate the hydraulic circuit at different speeds, an adjustable pressure range of 0 to 1000 pounds per square inch being available. All tester controls are labeled and are easily accessible from the outside of the unit. Unit can be wheeled to any part of an aircraft plant or field.

Polishing Machine

Hammond Machinery Builders Inc., 1611 Douglas avenue, Kalamazoo, Mich., announces an outside diameter cylindrical finishing machine suitable for a wide variety of applications. It also may be arranged with backstand idler pulley and patented segment face contact wheel permitting use of surface-coated abrasive belts which run over the face of the wheel and to the back stand, for polishing and finishing on many materials.

The machine handles parts from ¼ to

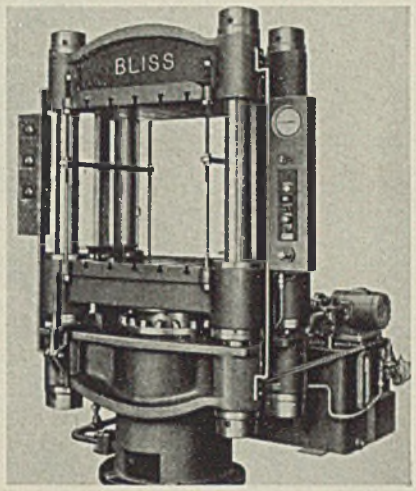


9 inches outside diameters. It is designed with a range of feed of 9 to 50 feet per minute for 1-inch diameter work, forward or reverse. A quick-release lever enables operator to control the work being fed through the machine by disengaging the work from the face of the wheel. Work support of the finisher is adjustable to the wheel. All parts of the machine are guarded and readily accessible.

Molding Press

Hydraulic Press Sales Division, E. W. Bliss Co., Fifty-third street and Second avenue, Brooklyn, N. Y. announces a new 250-ton hydraulic press—a semi-automatic hot molding type with a completely electrically timed cycle which permits independent adjustment of the lengths of preliminary cure, gassing period and final cure.

According to the company, a variation of this control affords independent timing of a chilling period if required and an independent timing of the flushing of the mold passages at the completion of the cycle. The ability to change from quick advance speed to pressing speed before contact insures entrance into the mold at a slow gentle

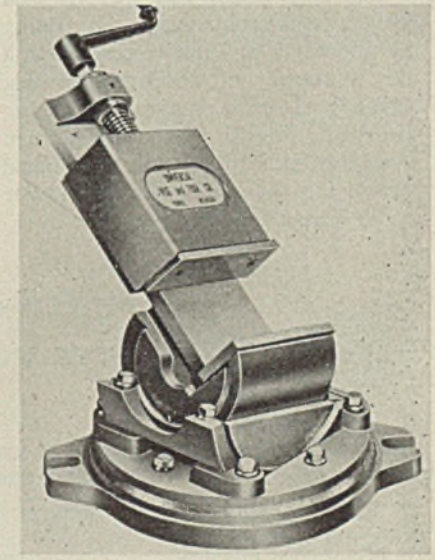


speed, and is particularly advantageous when working fine molding powders.

Pressure is adjustable over at least a 10:1 range while the automatic cycle may be stopped in any portion of its cycle by means of the emergency stop button. No mechanical connection is used between the press and the pumping unit. Thus the pumping unit can be placed some distance from the press or immediately behind the press.

Angle-Set Vise

Universal Vise & Tool Co., Parma, Mich., announces a new angle-set vise which features a graduated 3-way adjustment for holding work during mill-



ing, drilling, boring, reaming, grinding, shaping, die sinking operations. It is said to be ideal for grinding complex toolbit shapes and for drilling holes at

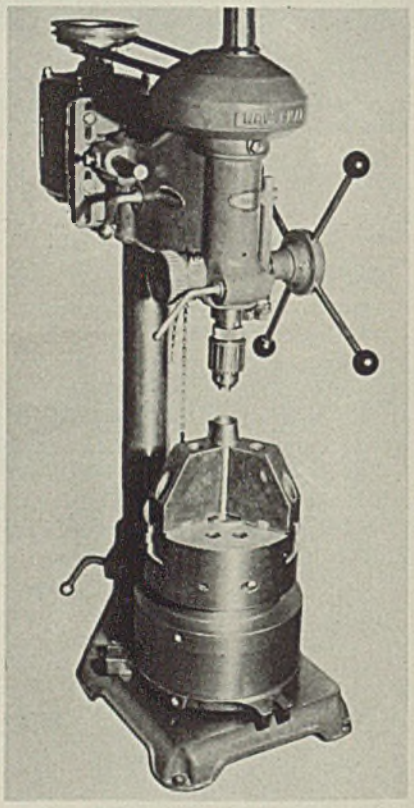
hard-to-get-at angles.

Ease of setting any complex angle and interchangeability of jaw plates, make the unit a versatile fixture for short or preproduction runs. It is fully portable and may be moved from machine to machine without removing the work or disturbing the work angle.

The double swivel cradles of the vise (each allowing 90-degree adjustment), over a full swiveling base (allowing 360-degree rotation), provide three separate motions, individually adjustable and lockable. The wedge locks are torque tested for 2000 pounds.

Chucking Device

Anker-Holth Mfg. Co., Chicago, announces a new combination air-cylinder and air-operated chucking device for converting lathes and vertical milling machines into production machines. Illus-



tration shows a drill press thus equipped—a three-jaw universal chuck being used to perform all internal machining operations on high-explosive shell. Combinations are offered in sizes from 37 to and including 105 millimeters.

Evaporative Condensers

Westinghouse Electric & Mfg. Co., 653 Page boulevard, Springfield, Mass., announces a new line of type EVS Aquamisers (evaporative condensers) in a complete range of sizes from 5 to 100 tons normal refrigeration capacity for use in Freon refrigeration compressors

and process liquid coolers.

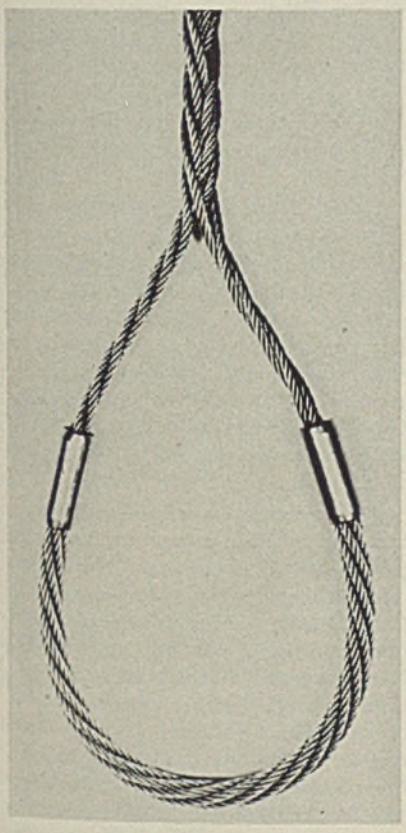
Units consist of three major sections: Fan, condenser and sump. Individual sections are of size and weight to permit easy handling and erection. All parts are adequately protected against corrosion and operating conditions.

Temperatures to which liquid can be cooled by this means depend upon the wet bulb temperature of the air, the kind of liquid and its entering temperature. Few typical applications include: Jacket water cooling for diesel engines and air compressors; quenching oil cooling and anode cooling.

Wire Rope Sling

John A. Roebling's Sons Co., Trenton, N. J., announces a new Flatweave wire rope sling for lifting light and medium loads where the legs choke the load or the sling comes in direct contact with the load being lifted. It is said to be a flexible, nonkinking, and nonspiralling sling.

The flat bearing surface of the sling allows an even pressure on each of the six ropes which comprise the sling. The



six ropes are arranged so two pairs of two ropes each are laid in opposite directions. These are united into a finished sling unit by two single tie ropes which alternately pass back and forth around one pair and then the other in a spiral figure 8. This is said to eliminate possibility of any scissors or shearing action between the various ropes.

Indium—Its Advantages

(*Continued from Page* 81)

Frank K. Savage of Conn Ltd., in Elkhart, Ind., in conjunction with technicians of The Indium Corp. of America, is described here. Studebaker finish flow sheet with make-up and nominal compositions of cleaning and plating solutions follows:

No. 1 solution is a bonderize cleaner (soak); time is 2 minutes; make-up is 4 ounces per gallon of 70 C. cleaner made by J. C. Miller Co., Grand Rapids, Mich. Analysis (nominal) is P—phenolphthalein titration, 20.1 mil-liters 0.1N hydrochloric acid; M—methyl orange, 27.0 mil-liters 0.1N hydrochloric acid. Temperature of this bath is between 185 and 212 degrees Fahr.

No. 2 solution is a bonderize cleaner (anodic); Time is 2 minutes; make-up is 8 ounces per gallon of the same material as above, 70 C. cleaner. Analysis (nominal) is P—phenolphthalein titration, 40 mil-liters 0.1N hydrochloric acid; M—methyl orange, 53 mil-liters 0.1N hydrochloric acid. Temperature of this bath is kept between 185 and 212 degrees Fahr.

No. 3 solution is a hot-water rinse.

No. 4 solution is a cold-water rinse.

No. 5 solution is an acid pickle; time is 1 to 4 minutes; make-up and analysis, 11 to 13 per cent hydrochloric acid by weight.

Note: Rinse in hot water and cold water thoroughly and return to anodic cleaner for 10 seconds, and then two hot rinses and directly into bonderize. This step seems to be essential, as a great deal of blistering was encountered before this operation was introduced. The 10 seconds in the cleaner after pickling helps remove carbon and smut. Also it neutralizes any free acid on work which would poison the bonderite bath.

No. 6 solution is for bonderizing; time is 2 to 4 minutes; make-up is 12 ounces per gallon of Bonderite "T" make-up chemical, made by Parker Rust Proof Co., Detroit. Analysis (nominal) is M—free acid (2 mil-liter sample against N/50 sodium hydroxide) 1.5 to 2.0; P—total acid (2 mil-liter sample against N/50 sodium hydroxide) 14 to 16. Ratio of free acid to total acid is 1:9 to 1:11. Temperature of this bath is kept between 140 and 150 degrees Fahr. It is important that temperature be kept below 165 degree Fahr. Do not boil.

No. 7 solution is a cold-water rinse.

No. 8 solution is a cold-water rinse.

No. 9 solution is a silver strike, in two steps. First employs 140 to 150 amperes per rack, applied for 2½ minutes. Second is at 100 to 110 amperes per rack, same period. Analysis (nominal) of this bath is silver (as metal), 0.4 to

0.6 Troy ounces per gallon; sodium cyanide, free, 6 to 7 ounces per gallon. No brightener is used in this solution.

No. 10 solution is for silver plating. The automatic machine has 12 stations. Racks dwell 2½ minutes at each station, with 20-second transfer. Analysis (nominal) of this bath is silver (as metal), 2.0 to 2.25 Troy ounces per gallon; sodium cyanide, free, 2.3 to 3.4 ounces per gallon; potassium nitrate, 16 ounces per gallon. Add brightener as needed. Agitation of 40 cycles per minute, 3-inch stroke, is maintained. Temperature of this bath is 38 to 40 degrees Cent. Current density is 10 amperes per square foot, 100 amperes per rack.

Brightener formula includes 1 gallon of silver solution, 10 ounces of sodium cyanide and 2 drams of carbon disulphide. Shake or stir periodically for several days. Add as needed 1/62-ounce per gallon to silver plating solution. An overdose of brightener may cause black spots or rough and sandy deposit all over the work. The remedy is air agitation and heat of 45 degrees Cent. Parts to be finished in silver only (inside parts) are scratch brushed and lacquered following this step. Parts to be finished in indium are scratch brushed and continued through following steps.

No. 11 solution is drag-out recovery.

No. 12 solution is drag-out recovery.

No. 13 solution is a hot-water rinse. This is followed by a scratch brush operation.

No. 14 solution is indium potash (cathodic). Time is 20 seconds, and make-up is 12 ounces per gallon of regular potash for nonferrous metals (C. G. Conn formula). Analysis is P—phenolphthalein titration, 7.0 mil-liters 0.1N hydrochloric acid; M—methyl orange, 14.0 mil-liters 0.1N hydrochloric acid. P must be equal to or greater than ½ M. Temperature is 190 to 212 degrees Fahr.

No. 15 solution is a cold-water rinse.

No. 16 solution is indium cyanide, make-up and analysis being 4 ounces per gallon sodium cyanide; temperature is 40 degrees Cent.

No. 17 solution is a cold-water rinse. This rinse must be rapid as any dwell over 20 seconds will tend to induce blistering.

No. 18 solution is for indium plating and is made up of 4 Troy ounces per gallon of indium (7.7 Troy ounces per gallon of indium chloride and 11.5 to 13 ounces per gallon of free sodium cyanide. Current density is 35 amperes per square foot (350 amperes per rack); temperature is 50 to 55 degrees Cent.; approximate deposit is 7 to 10 milligrams per ampere-minute. Parts after plating are placed in 350-degrees Fahr. oven and held at temperature for 2 hours. Oven is shut off and allowed to cool

gradually to 250 degrees Fahr. before epening.. Parts are then Lea finished using their "B" grade compound on a 6 to 8-inch buff traveling at 1750 to 2200 revolutions per minute. This operation is similar to a light color buff. Parts are then cleaned and lacquered with heat-dry lacquer and baked at 250 to 270 degrees Fahr. for one hour. O'Brien lacquer LI 469B was used.

The Spectrograph

(*Continued from Page* 84)

tion, leaving to the chemist those in the higher range.

Spectrographic analysis, in general, is restricted to the detection and determination of the metallic alloying elements and impurities. The nonmetal, carbon and sulphur, are not determined in this way. Their spectrum lines are not brought out with sufficient intensity to permit their detection at low concentrations with the methods of excitation that serve for the metallic elements or else they occur at wavelengths beyond the range of ordinary spectrographs, working in air which is opaque to extremely short wavelengths.

Phosphorus is being determined in a few laboratories, but in most cases is still handled by the usual chemical methods. The General Motors Laboratories have reported success in the determination of tellerium in steel.[4]

Intensive study is still going on in many laboratories; improved methods of excitation are being developed as well as refinements of apparatus, of procedures, and of means for controlling the numerous variables inherent in the various steps. As a result the precision and reliability of analyses made in this way already have reached a point where many plants are relying on them to the exclusion of those made by other methods.

Among the advantages that are gained from spectrographic methods the speed of getting out the analyses is probably the greatest. The progress of the heat can be checked at frequent intervals. Errors in alloy additions can be discovered before the metal leaves the furnace and assurance is provided that every heat is of the intended composition before it is tapped.

Another advantage is the completeness of the analysis, permitting the prompt detection of objectionable impurities which might get in with scrap. This is of particular importance under present conditions, with scrap coming from many unusual sources and with the possibility of its including unsuspected constituents that would affect the quality of the steel, but would not

otherwise be found until the damage was done.

The steel industry was the first to see and to take advantage of the service these instruments are capable of rendering. Now, after a lapse of 80 years it has found additional reasons why the spectrograph is just as necessary a part of the equipment of an effective control laboratory as the chemical balance, the microscope and the testing machine.

Molybdenum

(*Continued from Page* 88)

flame. As fumes of SO_3 appear, they are blown away with short puffs. This is continued until the evaporation is nearly complete. When this stage seems to have been reached the crucible is removed with tongs and righted. When the proper state of evaporation is reached no fluid will flow to the bottom of the crucible, but the sides will be moist. The crucible is then cooled. If the test has been carried out correctly a beautiful blue coating will appear in places on the inside wall of the crucible. Its exact composition is unknown, but it consists of an oxide or mixture of oxides of molybdenum of lower valence than 6. The reduction is accomplished by means of the human breath. According to some mineralogist it is not the breath itself which accomplishes the reduction, but the breath carries reducing dust to the mineral.

And, according to others, the saliva carried by the breath is the reducing agent. Still others state that moisture is the active agent.

When the molybdenum is already in the molybdate state (as, in wulfenite, $PbMoO_4$) no roasting is required.

A real difficulty arises when a test has to be made on a bulk sample, because other elements, particularly iron, lead and tungsten, if present, may interfere with the results. Spectroscopic determinations for molybdenum are becoming common, particularly when it is present only in traces.

The potassium thiocyanate test also is recommended for testing bulky low-grade samples. Some claim it is accurate for one part per million of molybdenum. Qualitative tests for molybdenum, although not difficult to make, require a technique than can be learned satisfactorily only through practice. Quantitative analyses should be left for competent assayers who have had considerable experience with molybdenum.

Detailed studies have been made in recent years of qualitative and quantitative analyses of molybdenum by the research staffs of organizations interested in molybdenum alloys. Reliable analyses to a few hundredths of one per cent appear practical. Tungsten seems to be

the most difficult interfering element.

Production: World production of molybdenum is shown in Table I which includes available figures from 1900 to 1940. This tabulation also brings out how small the production is and has been outside the United States. Although records from a number of countries are incomplete for recent years, there is no reason to believe that there has been any important change.

The preponderance of production in the United States since 1925 is evident. Table II shows the distribution of production within the United States. At present the production figures of individual disseminated copper deposits are not known, and, therefore, these are grouped together; although the Bingham Canyon copper deposit is by far the largest individual producer. The greater part of the molybdenum produced outside the United States is about as follows: Knaben, Norway, 800,000 pounds; and Cananea, Mexico, since 1936 about 1,250,000 pounds. Production from Braden, Chile, began only in 1939, and figures as to the amount of production have not been available. Chuquicamati, Chile, might also become a producer.

The growth of molybdenite production in the last 10 years is phenomenal, and the effect of the present emergency points to further increases. Ultimate peaks may be reached within a few years, but a maximum production cannot be predicted with certainty.

Future of Molybdenum: Continued increase of the use of molybdenum, as of all other metals, is assured for the duration of the present war. Prior to the war the industrial uses of molybdenum in the United States increased from a few hundred thousand pounds annually in 1925 to several million pounds annually in 1939 and 1940. Still greater increases occurred in Europe, although it is not known how much may have been due to the preparations for war.

Steel and iron alloys using molybdenum, nickel, chromium, vanadium, and manganese made possible many industrial developments in the automobile, the airplane, and the railroad, because these alloys were stronger, tougher, or harder and frequently cheaper and, therefore, more suitable than ordinary iron and steel for particular uses. These properties place the alloys in a position of obvious importance in the production of various implements of war. A natural outcome of these increased uses due to the war is that in a short time the industries will become better educated as to the advantages of alloys as a whole and molybdenum alloys in particular than could have been expected in several years of normal industrial development.

Molybdenum is the newest metal to have been introduced as an alloy addition. Competition of other metals, the reluctance of many manufacturers to change alloys, and a tendency on the part of some to be suspicious of a new product have retarded the more general adoption of molybdenum. Each alloy addition in turn has faced and still faces a similar sales resistance. The tremendous demands made by a war tend to break down such barriers to new uses, and because molybdenum is a new product it probably will benefit relatively more from the changes than other metals, and it may be that it will suffer less in a postwar adjustment. In the long run the alloys will continue and probably increase in importance, and therefore the future of all alloy additions is promising.

The relation of production to demand is less certain. Prior to the war, production for a time exceeded demand, and large stock piles of molybdenite concentrates were accumulated. War uses, however, are so great that production capacities have been increasing and will probably continue to increase for another year or two in order to keep up with an ever-increasing demand.

It would seem inevitable that any anticipated initial postwar demand will be less than the ability of the several

mines to produce, and a curtailment of postwar production can be expected; a decrease in price of molybdenum could result. Thus the competition among producers of molybdenite for the molybdenum market may become a more serious matter in the future than it has been in the past.

Naturally these factors should be considered seriously by those contemplating the development of any new deposit as well as those who may be searching for occurrences of molybdenite worthy of development.

(Concluded next week)

Wartime Plant Design

(Continued from Page 94)

these suggestions will increase the cost, the company feels that the saving of critical materials justifies the increased expenditure.

Standard Oil Co. of California has developed a unique radial-type manifold which possesses a number of important advantages over the ordinary square-type blinded manifold. As will be noted in the accompanying illustration, several operations may be conducted over the manifold simultaneously. These are accomplished by installing one or more crossover connectors between pairs of spots on the manifold. These connectors permit the flow of stock through the manifold or the washing of lines without interfering with the manifold pump connections.

Less material is required, too. On the radial manifold only one valve is required per line instead of two. The hook-up of connectors is apparent at a glance so that rising stem valves are not necessary. Also, if one connecting line to a square manifold handles stock requiring an alloy valve, every valve in the manifold has to be of that material, whereas with a radial manifold of the type shown, only those lines carrying the particular stock require the special valve.

Valve servicing and replacement costs are reduced because there are only half as many valves. When corrosive stocks are being handled, only the valves on the lines carrying the corrosive stocks are subjected to the corrosion. Less time is required for lining up the radial manifold for pumping because it is simpler to break unions than to change blinds in crowded locations. Lines can be added or removed and valves serviced with little difficulty because individual lines can be worked on without disturbing the remainder of the manifold.

In addition to the design, there are many other possible variations such as use of flanged valves in larger pipe sizes and other modifications. A number of these are already in use.

Because it represents typical thought of engineers in meeting the wartime emergency and because it contains so many valuable suggestions, the modifications in material and construction specifications and in basis of design as suggested by Standard Oil Development Co. are abstracted below at some length. These data are a compilation by the Standard Oil Development Co. of waivers to its usual construction standards. With only minor exceptions, these are being followed generally on new construction in refineries of various affiliates of the Standard Oil Co. of New Jersey both in company construction and in those plants being built under contracts with the Defense Plant Corp.

Substitution of bessemer for open-hearth carbon-steel plate, sheet, bars, etc., is permissible in concrete reinforcing bars; plates and sheets for tanks, condenser boxes and stacks; structural shapes except for main supporting members for heavy vessels, standard-weight lap welded pipe; floor plate, expanded metal and galvanized sheet. Bessemer quality will be individually considered for other uses, the decision to be based on the service conditions prevailing. Narrow plate should be used as a contribution to the national materials situation unless the increased welding time required

would cause delay in completion of the unit.

Specifications for ferrous materials and deposited weld metal for service temperature below minum 25 degrees Fahr. are modified to permit acceptance of all low-temperature materials with an impact of 10 foot-pounds.

Specifications for alloy steel bolt studs for high-pressure and high-temperature service are modified to permit substitution of the new NE steels for the grades they are recommended to replace. Note that none of these NE steels is suitable for what is ordinarily regarded as high-temperature service.

Shop-assembled fusion-welded pressure and vacuum vessels have all specifications waived except as follows: Pressure vessels must at least conform to the API-ASME code. Vessels fabricated of carbon-molybdenum steel must be preheated during fabrication and when over 1-inch thick shall be X-rayed and stress relieved. Welds of all vessels of any material which are not X-rayed shall be trepanned or spot X-rayed sufficiently to demonstrate that the welds are sound. All pressure vessels welded by the Unionmelt process are to be completely X-rayed unless this is waived by the company inspector.

For cast steel flanged fittings, emergency specifications for steels issued by the American Iron and Steel Institute (NE steels) and American Society for Testing Materials may be used. Materials used shall be limited to carbon steel and 4 to 6 per cent chromium, ½ per cent molybdenum, as far possible.

Centrifugal pump specifications are modified as follows:

Temperature limit for use of horizontally split centrifugal pump is raised from 350 to 500 degrees Fahr. The requirements for machining of surfaces for confined gasket of vertically split pumps between end covers and casings is deleted, allowing use of manufacturer's standard design.

—Manufacturer's standard nozzle thicknesses are permissible, even though stud bolts may be required on account of excessive thickness instead of through bolted connections normally used. Manufacturer's standard specifications for bolting materials are acceptable.

—The exemption from the requirement of water-cooled support pedestals is increased from 350 to 500 degrees Fahr. Welding of parts of steel and alloy steel pumps is encouraged in order to simplify complicated pattern designs.

—Manufacturer's specifications on materials, shop test data, etc., are acceptable in lieu of company detail inspection and witnessing of shop performance tests. Magnitude of shop hydrostatic test pressure is materially reduced.

A manufacturer is authorized to proceed immediately with work on receipt of purchaser's verbal or written order without awaiting receipt of purchaser's approval of certified outline drawings. Manufacturer's standard practice is acceptable in regard to data appearing on pump drawings. Manufacturer's standard designs and materials of construction are acceptable for all services involving moderate normal temperature, pressure, corrosion and relatively low hazard operation. Manufacturer's standard water pumps are acceptable, except for highly corrosive sea water.

Explosion-proof motor specifications are modified as follows:

Such motors for speeds up to and including 1800 revolutions per minute may have cartridge-type grease-lubricated ball bearings of manufacturer's standard design and arrangement.

Explosion-proof motors for use in Class 1 Group D locations may be furnished without the underwriter's label provided the design meets the underwriter's standard for this service.

—Critical materials used in motor manufacture such as bronze, aluminum, stainless steel, etc., for such parts as fans, air intake screens, nameplates, shaft collars etc., may be replaced with substitute material as adopted by the

motor manufacturer. A modification in design basis of particular importance should be noticed. As recommended by the conference called by the War Production Board on March 31, 1942, at Cleveland, nickel and chromium are used in reduced amounts. Where nickel and chromium are employed to extend the life of the plant, the basis of design of new plants should be an estimated 3-year life without the necessity for major repairs that might reduce the normal service factor more than 2 per cent. The principle of this recommendation is to apply to all planned alterations and maintenance of existing plants. In line with this conservation effort, furnace castings for metal temperatures below 1400 degrees Fahr. shall not contain more than 1½ per cent of nickel and 1½ per cent chromium.

Construction simplification recommendations to save steel include the following: Steel structures shall be confined to those necessary for the support of equipment. Plan forms and stairways shall be cut to a minimum. Reinforced concrete shall be used for support of equipment to effect a saving in steel wherever possible.

To reduce amount of piping, eliminate lines normally installed for extreme operating flexibility or to permit future production of products not at present contemplated. Eliminate all cocks on the discharge side of safety valves. Block valves on either side of control valves and orifice meters are to be eliminated, except in cases where trouble is definitely anticipated. Sufficient valves shall be included to permit hand control. Eliminate vents and valving around pressure gage installations wherever possible.

Provide minimum pump-out facilities required for emptying main equipment and simplify system all possible. Eliminate check valves on pumps where damage to pump is not likely to occur and where automatic spare service is not required. Reduce the use of double valving to a minimum.

Towers and Drums: The use of manholes and hand holes is to be kept to a minimum. Only one manhead is to be provided on all drums without internal equipment. Permanent piping connections shall not be provided for auxiliary flushing and steaming of equipment when it can be accomplished by the use of a temporary hoop-up.

Spare Equipment: The use of spare equipment such as surge drums, extra exchanger tube bundles and similar equipment is to be kept to a minimum consistent with a reasonable service factor.

Instruments: Only sufficient control equipment shall be provided to insure satisfactory operation of the equipment. Instruments usually provided for test and process control data purposes shall be eliminated.

Control houses are to be simplified by eliminating all unnecessary trim. Use as little steel in their construction as possible.

Emergency stop pushbuttons for all pumps shall be eliminated. Separately mounted circuit breakers ahead of all 440-volt magnetic motor starters shall be eliminated by substituting the combination circuit-breaker type starter.

Cast iron shall be used for all live steam valves and fittings except for the following services, where steel is required: Steam mains 10 inches and larger where failure would cause a shutdown of an important section of the plant; branch lines inside of battery limits where failure would cause a serious shutdown of units producing vital war products, sizes 14 inches and larger, steam lines within the limits of boiler and power houses where the steam pressure is over 125 pounds per square inch.

Cast iron shall be used wherever it is considered reasonably safe including lines within battery limits and around operating equipment.

To reduce amount of steel in structures and buildings, note the following:

Reduce the amount of steel structural work by eliminating permanent construction for trolley systems for handling heavy equipment, space being provided for a crawler crane or temporary rigging and no provision being made for cleaning exchanger bundles in place.

Eliminate some convenient platforms and reduce size of others. Confine operating platforms to lower levels of structure and bracket maintenance platforms above this level with access provided by ladders instead of stairways.

—Reinforced concrete and wood are to be used in place of structural steel framing and checkered plate wherever practicable. Use reinforced concrete column beams on lower operating levels and up to the supports of the principal pieces of equipment. Use wood for all stringers and treads of stairways, ladders, railings, flooring of platforms and no framing wherever practicable.

—All wood load-carrying members should be chemically treated for additional resistance to fire and rot. This should include stair stringers and treads, framing and flooring. Wood should not be used around hot equipment where a leak might result in a flash.

—Design foundations, concrete slabs on the ground and toe walls to use mass concrete without reinforcement or with minimum reinforcement.

—Construct control houses with brick walls and timber beams or timber trusses and timber plank roof covered with built-up roofing, wood doors, frames and sash.

—Construct other buildings containing operating equipment such as compressor houses, pump houses, and the like, using brick walls with substantial buttresses supporting and providing anchorage for wood roof trusses, wood purlins and wood plank roof with built-up roofing. Use doors, frames, windows and louvres of wood. Keep all piping supports independent of the structure insofar as practical. Support mufflers from gas engines outside the structure.

—Provisions shall be made for handling equipment during maintenance by portable A-frames rather than by overhead trolley beams. For 2-story structures, utilize reinforced concrete on the lower story and heavy timber mill construction on the upper story if feasible.

—Support drums on reinforced concrete. Where temperature permits, construct all excess stairs, ladders, and platforms of treated wood. Buildings for offices, laboratories and change houses shall be wood throughout.

—To reduce valve requirements, use plug cocks in place of steel valves where feasible. Eliminate valves at towers which are installed solely for the testing of lines prior to starting up. Use only one valve between towers and pumps on short suction lines. Simplify manifold installations all possible. Eliminate all but one valve in branch steam lines. Simplify bypasses on exchangers as much as possible. Use salvaged valves from other equipment.

—Design low-pressure towers for the exact design pressure specified by the process engineers or for a static head when filled with water, whichever is the greater. Make no provision for hydrostatically testing towers after erection. Use cement asbestos sheet in place of galvanized or asphalt-coated iron.

—Omit the use of galvanized nails.

—Make sheet piling of wood where feasible and creosote it if for a permanent installation.

—Eliminate metal lath wherever possible.

—Restrict the use of fence to built-up areas and construct fence with wood posts, ungalvanized mesh or wire and without metal top rail.

—Flashing and downspouts shall be

of ferrous material, nonmetallic coated or tight zinc coated. Screening shall be of ferrous material painted for protection.

—Sewer pipe shall be terra cotta or concrete where practical, and only light-weight iron shall be used when iron pipe is required.

—Conduit shall be nonmetallic coated, except for extreme conditions, and light-weight conduit shall be used except in hazardous locations. Nonmetallic sheathed cable shall be substituted for conduit where practicable.

—Heating coils and convectors for heating enclosed areas shall be made without copper or copper-bearing alloys and with cast iron radiators.

—Use second-hand steel rails where ever possible.

—Office furniture, lockers, shower stalls and the like shall be of nonmetallic construction wherever possible. Plumbing and heating fixtures and hardware shall be of unplated ferrous material. Laboratory fixtures shall be of vitreous material. Switch and receptacle plates shall be of nonmetallic material.

—Employ steel tubes in place of Admiralty where fresh water is used.

—Use preloaded concrete tanks for oil and wood tanks where the contents permit. Use concrete, compressed asbestos or wood pipe for large water lines.

—Use spring-wound instead of motor-driven clocks.

—Use portland cement asbestos coverings in place of galvanized sheets for water-proofing insulation.

—For internal parts of high-temperature vessels where failure of such parts would not increase the stress in the vessel nor otherwise endanger the vessel, use the value of stress for rupture in 100,000 hours as the design stress in place of stress for 1 per cent creep in 100,000 hours or other approved code stresses. This applies particularly to internal piping open to the vessel but subject to severe expansion strain, to load-bearing grids for supporting catalyst or similar material.

—Use surplus and spare equipment wherever possible. Idle equipment should be dismantled as a source of additional material.

Designs Speed Conversion

(*Continued from page* 114)

sibly typical of the applications for the standard nuts is that shown in Fig. 6. Here two standard types—the flat and the U-type—are employed. Also, a special bracket-type nut is utilized to replace two nuts, two lockwashers and an ordinary bracket as is shown. The application for these nuts is in connection with new latching-type harness Speed clamps developed by Tinnerman engineers for faster attachment of wire "bundles" in aircraft.

These clamps are made in two types. No. 3043 series are used at intermediate locations and where a group of wires branch off from the main harness. No. 3044 are main supporting clamps that may be quickly snapped around the harness at the point of make-up so that no taping or "boggles" are required, and then serve as the mounting means for the attachment of the harness to the structure. This allows bench assembly of wiring harnesses and drastically reduces assembly time. Extruded plastic channels that cover the clamps to cushion the wires have stood up in abrasion tests ten times as long as other materials used for wire cushions. Ten different sizes of clamps accommodate bundles from ¼ to 1½ inches in diameter.

Fig. 4 shows details of another application that was worked out for standard Speed nuts of the self-locating J-type. When these nuts are snapped over an aluminum carrying ring, an assembly method is produced for attaching recognition lights, hand hole plates, access

doors and the like. It has proved both faster and lower in cost than previous methods.

One former method employed forged aluminum rings or channels with "lock" nuts attached. Another method was to rivet self-locking anchor nuts in place. These are replaced with the Speed nut carrier ring, which showed a net weight saving of over 60 per cent and eliminated 2/3 of the riveting operations. These carrying rings are also made in moisture resisting fibre which are still lighter in weight and conserve precious aluminum.

In addition, any degree of "float" may be obtained in the assembly by varying the hole size in the retainer ring over which the Speed nuts fit. Fig. 4 shows details of the method as utilized in mounting the "Grimes" B-2115 recognition light.

Another variation of the Speed nut principle is a self-retaining Speed nut snapped over the upper or lower leg of 755 type conduit clamps. This type Speed nut is also available for use over cushion bonded clamps.

Simplifies Assembly

This arrangement greatly simplifies assembly work, for much handling of parts is eliminated. Now the assembler need handle only the clamp, screw and screwdriver where formerly he had to handle the clamp, the screw, the locknut, a screwdriver and a wrench to keep the locknut from turning while tightening up the screw. The saving in time is obvious.

In addition to this advantage, the saving in weight is important because the Speed nut weighs less than half as much as the standard hex locknut formerly used. Being manufactured from special aircraft spring steel, the nut fastens the assembly with a double spring lock that conquers vibration loosening.

Typical of the special fastening devices developed is the junction box clip shown in Fig. 5. Many of the electrical connections in the wiring systems on aircraft require junction boxes and terminal boxes. This device shown permits the attachment or removal of covers to these boxes without the use of screws or special fasteners and no tools are required for their attachment. These are already being used by many manufacturers of army and navy aircraft.

The clip is so constructed that the one size can be used universally on boxes with wall thickness from 0.025 to 0.064-inch. Both sections of the clip are made from heat-treated high-carbon spring steel. One part is inserted through a hole in the side of the box and clipped over a cut-out section at the top edge of the box. The other part of the unit hinges on the first and has an integrally

formed dimple on the end which snaps into a hole or mated dimple in the box cover.

With these devices, the cover is locked to the box with a firm spring tension, yet the cover can be readily removed and reattached at any time without requiring tools. Junction boxes now in use can easily be adapted to use these fasteners by merely drilling and notching as needed.

Besides the important speed and weight advantages of this fastening method, it is reported as saving more than 80 per cent of the cost of any former method.

Fig. 7 pictures another development that has proved extremely useful. It is a method designed to speed up the attachment of nameplates of all types by eliminating riveting operations entirely. It permits fastening the nameplate from one side of the structure only, thus doing away with difficulties in riveting plates where the back side of the structure was hard to get at for bucking up the rivet during its application.

With this method, the assembler need merely line up holes in the plate to be attached with holes already punched or drilled in the structure; then with the simple hand tool illustrated the tubular clip is driven home from the outside or front of the nameplate.

Nameplate Rejects Reduced

For attaching light fibre plates, rivets are unnecessary as the split clip provides sufficient tension to grip securely the inside edges of the hole; holding the nameplate in place by friction. For attaching metal nameplates and thick fibre plates, a rivet is driven into the clip after the clip has been driven home. This causes the clip to expand, providing yet a stronger frictional hold on the structure. At the same time, the hardened tips of the clip press tightly against the body of the rivet, holding it securely in place.

The use of this fastening method has been found to reduce greatly the number of dented or cracked nameplates since very little pressure is put on the face of the plate. Also it makes the application a one-man job, since the second man required on the former method is no longer needed.

Weighing but 0.14-pound per thousand, these clips fit into 0.086-inch diameter holes in metal of any thickness from 0.025 to 0.125-inch.

The Speed clip for junction box terminal strips shown in Fig. 1 is also a timesaver for it permits bench assembly of terminals outside the box, where the work can be done conveniently and swiftly. After all wires have been assembled to the terminal block, the entire assembly is easily snapped into place in the junction box by means of the

two clips illustrated. This eliminates squeezing hands within the small confines of the box while trying to make connections.

The clip is applied to the box either by riveting or by spot welding. It is made in various widths to accommodate terminal blocks of different sizes.

Another special clip that has attracted much attention is the unit designed to hold insulation to the wings of aircraft in connection with the installation of bullet-proof gasoline tanks. Douglas Aircraft Co. utilizes the clips shown in Fig. 2 to hold such insulation in place in Douglas attack bombers. Formerly the job was done by means of a special cement or mastic coating, but the company finds that the use of the clips saves many man-hours of assembly time per plane and that they hold the insulation in place indefinitely. No corrosion occurs because the clips are made of 24ST aluminum coated with a zinc chromate primer.

All of these developments are possible only through the exercise of considerable ingenuity on the part of the designers. Possibly the most intriguing of all the special designs is that shown in Fig. 3. As noted in the illustration, this device employs a tricky 3-part plastic guide rotatable between a special Speed nut and an aluminum base so that it is "universal" to any angle of cable, to act as a cable guide or "fairlead guide block." Note that through an ingenious design of the 3-part plastic guide, it can be assembled over a cable without threading the cable through it. This permits the plastic parts to be replaced easily without unthreading the cable.

Output Entirely for War

This guide and its mounting are an important development because they allow prepunching or drilling of fairlead holes in the structure, make drilling of angular holes in fairlead blocks unnecessary and speed up assembly of cables and their required fairleads.

It will be noticed that where it is practical to make a hole of the required diameter (29/32-inch), the plastic guide and upper section of the clamp can be used alone as in Fig. 9 to eliminate the use of the base piece. This is typical of hundreds of Speed nut fastenings.

This conversion of the Tinnerman plants to war production was made by redirecting all the resources of the development engineering department. That redirection was primarily into aircraft. At the beginning of the year only about 25 per cent of the plant's production was in war work. Within six months it was over 80 per cent and *now the entire output is war work.* Now these fastenings are going into aircraft, jeeps, gas masks, and many other ordnance items.