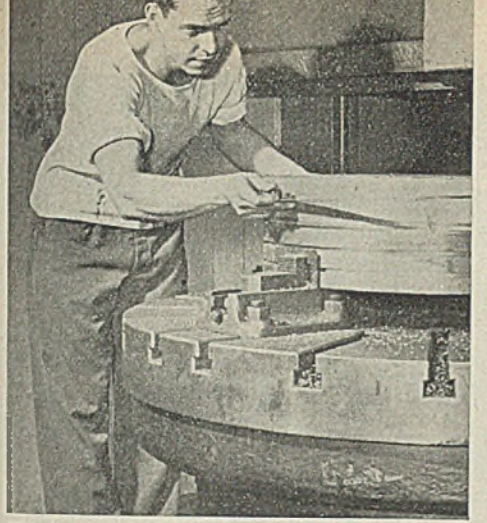

This boring-mill operator has resumed former job after year in Army combat service. Page 74

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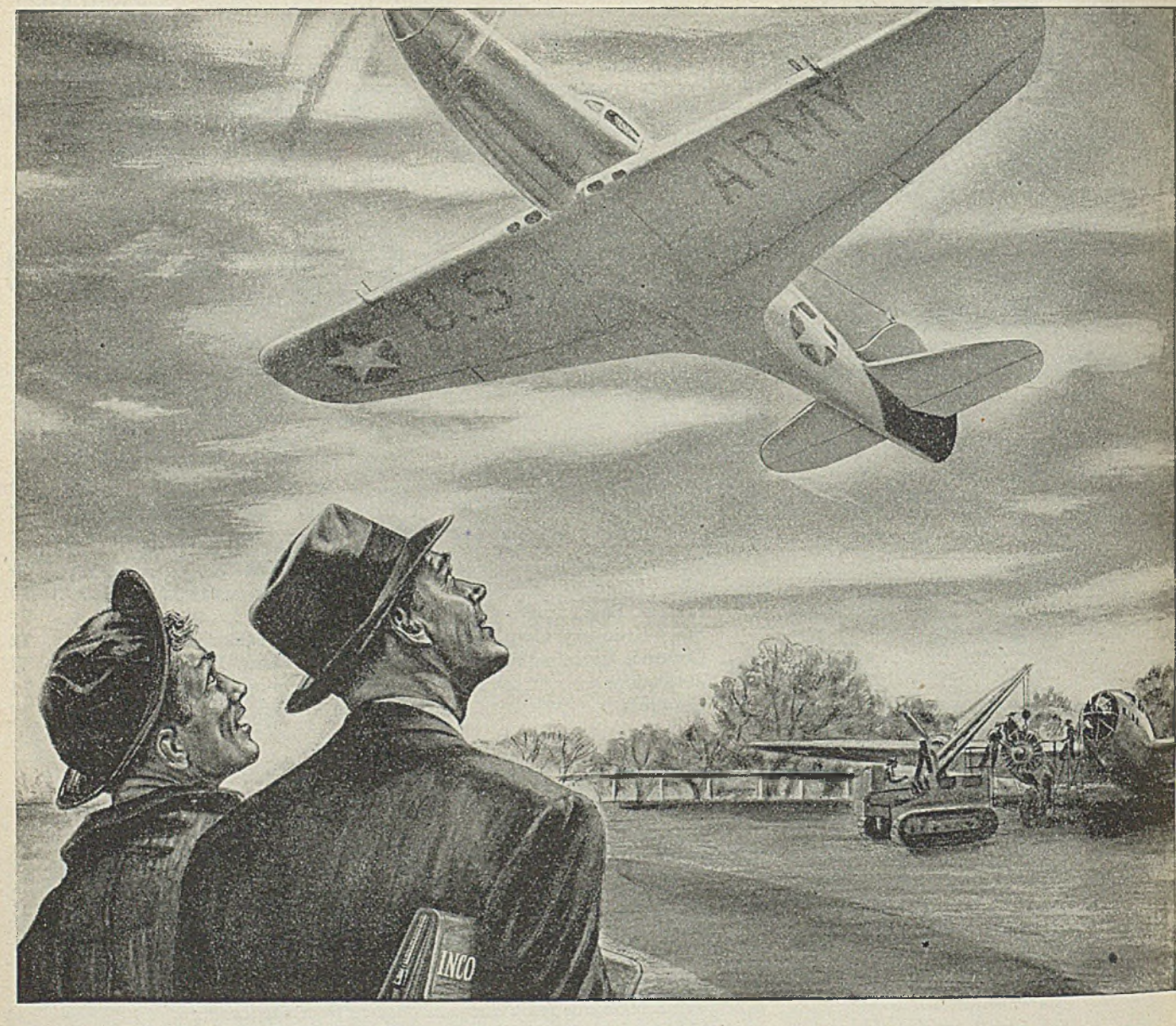

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to KEEP 'EM FLYING!

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The technical staff of International Nickel has been privileged to cooperate with the aeronautical engineers who have accomplished so much toward the improvement of aircraft. These engineers and metallurgists offer counsel and data to all who desire assistance in the selection, fabrication and heat treatment of ferrous and non-ferrous metals.

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THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York, N. Y.*

STEEL
December 20, 1943

The Penalty for Inefficiency

On the whole, industry's contribution to the war effort has been magnificent. Partly because of this fact, as the end of the year approaches, tens of thousands of industrialists will be looking back over their achievements in 1943 and most of them will be congratulating themselves on the fine records they have made.

But pride in wartime achievements, no matter how well founded it may be, should not be permitted to lull executives into a sense of complacency. Some who have done well in the war period should not be too ready to accept full credit for their apparent success. They should remember that in wartime business is conducted in an artificial atmosphere. The stern laws of "supply and demand" and of "survival of the fittest" are shelved for the duration. A substantial volume of "over-the-transom" business is dumped into the laps of most going concerns.

Brig. Gen. Leonard P. Ayres laid great emphasis upon this artificiality in his recent annual forecast of business for the new year. He pointed out that in the 90 years for which records of business failures are available, there are only three periods in which business insolvencies have almost disappeared. They declined almost to zero in the third and fourth years of the Civil war, they dropped even lower during World War I and now in 1943 they have dipped to an even lower level.

This means that war is staying the hand of fate which normally forces a considerable number of industrial concerns into insolvency. In this connection, General Ayres says that "there are records in Washington showing the numbers of man-hours required in different plants to produce the same sorts of ships, weapons, planes and engines. The differences in efficiency are almost incredible. Many plants produce several times as much per worker as do others making the same products. The government buys the outputs of the efficient makers and those of the inefficient ones alike because it has to have munitions."

Next year may witness a partial return to peacetime conditions. The shift from government to civilian orders will revive the factor of competition. Slowly but surely the manufacturer who is burdened with high costs and low efficiency will be forced out of the running. Indeed it is likely that the penalty for inefficiency will be greater after the war than it has been in any previous peacetime period.

Obviously, the first step in postwar planning for high-cost manufacturers is to develop efficiency in operations.

BOUQUETS FOR N.A.M.: Editorial comment on the recent annual meeting of the National Association of Manufacturers has been noticeably favorable. In fact, the affair elicited a better "press" than any of its predecessors in more than a decade.

We believe the reason for this is that the tone of the meeting came closer to reflecting the true attitude of N.A.M. members than has been the case in some past meetings. The association's members are not all cast in the same mold. They range from reactionaries to progressives, from rock-ribbed Republicans to ardent new dealers and from industrial pigmies to industrial giants.

Despite this wide variation in the make-up of its membership, N.A.M. sometimes has given the public the impression it is an organization of adamant reactionaries. This year, while "viewing with alarm" certain dangerous administration policies, the N.A.M. meeting also launched a number of constructive proposals. This well-balanced program, with a strong accent on constructive leadership, gave N.A.M. an

(OVER)

almost unanimous vote of confidence in the public prints.

Highly effective was retiring president Crawford's, "We know that America is not going to be run for the benefit of business. We intend to run business for the benefit of America." This may sound trite to industrialists, but it is a truism worthy of constant repetition. —p. 54

° ° °

REPORT ON METALLURGY: The report prepared by H. W. Gillett for the War Metallurgy Committee, now being published serially in STEEL for the first time, is being hailed as an outstanding contribution to modern metallurgy. Doctor Gillett, an outstanding authority in the field, in the preparation of this report enjoyed the assistance and criticism of a host of eminent experts, including Zay Jeffries, P. D. Merica, John Johnston, R. F. Mehl, J. H. Critchett, G. F. Jenks, V. N. Krivobok, J. B. Macauley, J. L. Gregg, S. Epstein, Val Cronstedt, and F. R. Shanley, as well as the staff of Battelle Memorial Institute, with its director, Clyde Williams.

In the report, Doctor Gillett takes "pot shots" at many time-worn precepts which will stimulate the thinking of engineers, metallurgists and designers. In the current installment, he presents data on the evaluation of materials for "guts" to withstand overloading. He suggests that an arbitrary schedule of overstressing could be used as a basis for determining propensity toward or relative freedom from damage. —p. 88

° ° °

NEARING THE CEILING: Some persons find it difficult to reconcile statements on war production. At the N.A.M. convention, Charles E. Wilson, executive vice chairman of WPB, stated that war demands in 1944 will be 20 per cent greater than in 1943. Last Tuesday Chairman Donald M. Nelson declared that the nation is approaching the "ceiling" in munitions output.

The two statements are not as contradictory as they appear to be. A glance at the charts on page 49 will show why. For instance, consider total munitions production. The 1944 program calls for production corresponding to an index of 236 per cent. Actual production in 1943 will be 185 per cent. The sharp increase is more than Mr. Wilson's 20 per cent. But the annual rate of production attained in the fourth quarter of 1943 will be at 224 per cent, which is not far from the 1944 goal of 236 per cent—confirming Mr. Nelson's statement we are nearing the ceiling. —pp 47, 49, 50

UNCLE SAM'S PLANTS: After analyzing the government's investment in wartime facilities, the National Industrial Conference Board concludes that the competitive importance of this investment to the postwar economy is being given "too great prominence" in current discussion. This conclusion is based upon the assumption that of a total of $27.5 billion invested by the government in wartime plant and equipment only $5.5 billion, or about a fifth, will be of substantial immediate postwar industrial significance.

From an overall standpoint this view is correct. However, it happens that the $5.5 billion in question is invested in facilities for producing synthetic rubber, aluminum and magnesium; in almost half of all machine tool manufacturing facilities; and in directly competitive facilities to the iron and steel; radio and electrical equipment, food, chemical and miscellaneous metal industries.

Absorbing this plant and equipment in an orderly manner into the industries affected will not be an easy undertaking. From the standpoint of these particular industries, the problem is not likely to be given too great prominence in current discussion. —p. 73

° ° °

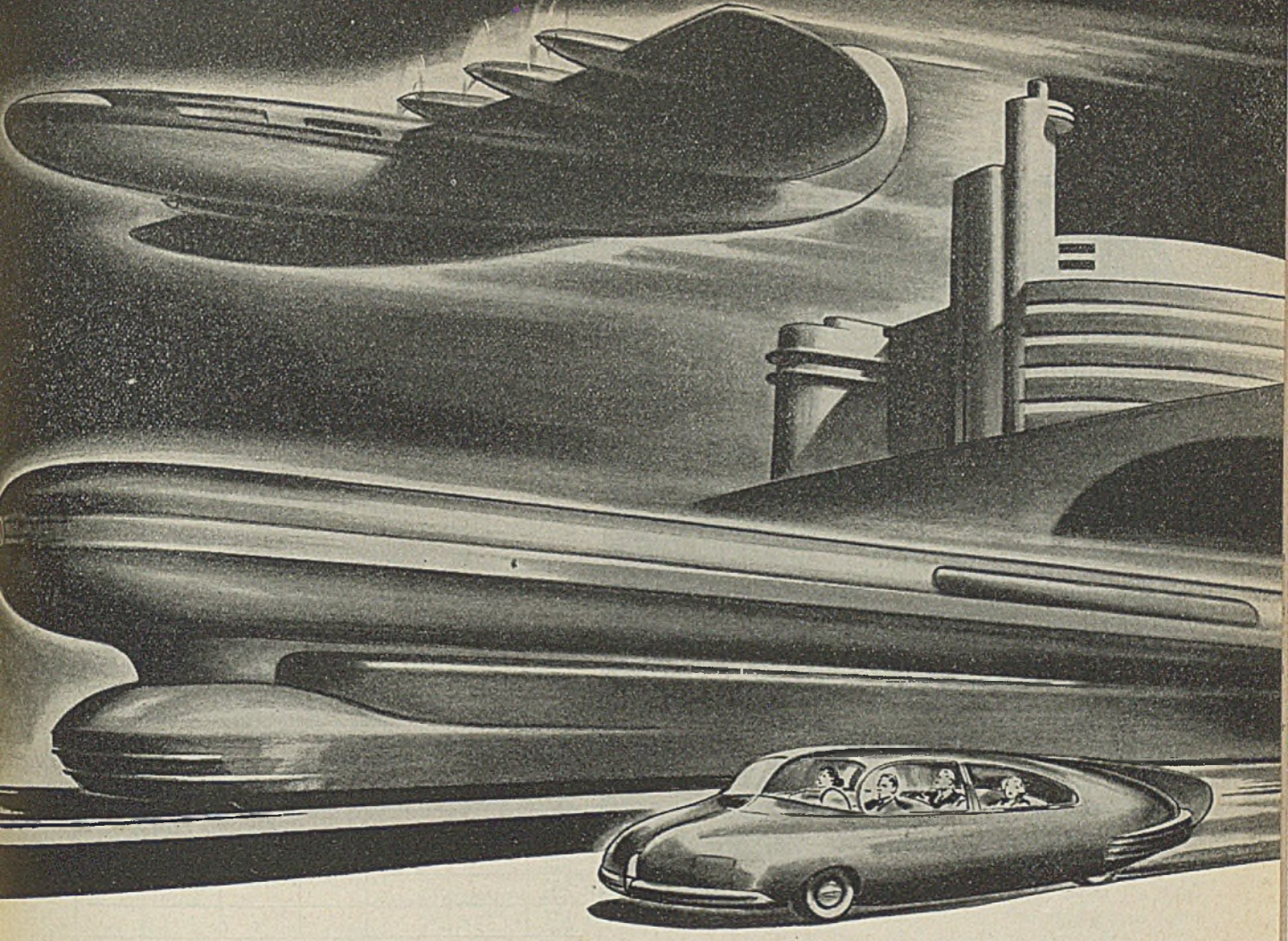
HONORABLE DISCHARGE: In a period when every week witnesses the birth of numerous government agencies, the announcement that a government-sponsored organization is about to close up shop is news. The Steel Recovery Corp., incorporated Aug. 6, 1942, as an agency of the RFC-owned Metals Reserve Co., is in the process of liquidation and will wind up its affairs Dec. 31.

Backed by the authority of WPB, Steel Recovery Corp. undertook to expedite the flow of idle and excess steel into war-useful channels. The corporation's personnel, which numbered 549 at the peak of activities, located 547,000 separate items of idle or excess steel in the possession of 47,000 different companies and marshalled this material into the service of the war. On numerous occasions the corporation was able to discover idle steel to meet acute emergencies. It effected savings on government purchases nearly equal to the entire cost of its operations.

The steel and warehouse men identified with SRC have a right to be proud of its record. —p. 52

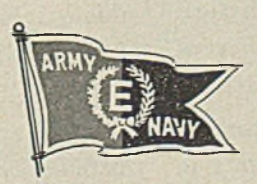
E. L. Shaner

EDITOR-IN-CHIEF



Better Steels are Coming— from the Tests of War

Hour after hour, month after month, Inland metallurgists study not only the needs for this war of steel, but also the requirements of a victorious America—the America that will turn again to peacetime developments in the crafts, and in the sciences—new developments that will prove again that free peoples set the pace for others to follow. Coming out of the tests of war are finer steels—steels that will set new standards of safety and speed in transportation. Steels that will help bring the newest advancements in swift communications into most homes in the land. Steels that will bring new conceptions of beauty, convenience, comfort, and utility—all at prices that can be afforded by the average American. Yes, you can look forward to the day when steel from Inland, now flowing 100 per cent into war products, will help build a greater America.



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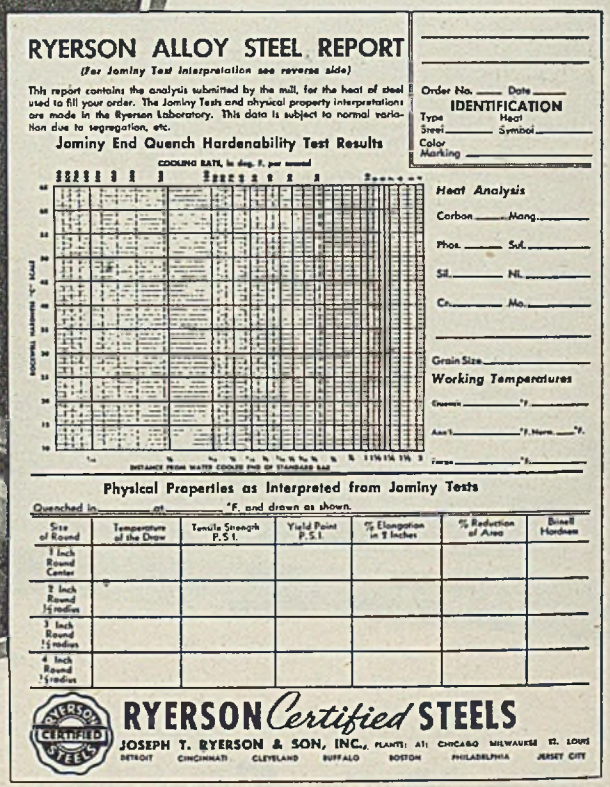

RYERSON ALLOY STEEL REPORT

(For Jominy Test interpretation see reverse side)

This report contains the analysis submitted by the mill, for the heat of steel used to fill your order. The Jominy Tests and physical property interpretations are made in the Ryerson Laboratory. This data is subject to normal variation due to segregation, etc.

Order No. ____ Date ____

IDENTIFICATION

Type ____ Heat ____

Steel ____ Symbol ____

Color ____

Marking ____

Jominy End Quench Hardenability Test Results

COOLING RATE, in deg. F. per second

Heat Analysis

Carbon ____ Mang. ____

Phos. ____ Sul. ____

Sil. ____ Ni. ____

Cr. ____ Mo. ____

Grain Size ____

Working Temperatures

Forging ____ °F.

Annl. ____ °F. Norm. ____ °F.

Temper ____ °F.

Physical Properties as Interpreted from Jominy Tests

Quenched in ____ at ____ °F. and drawn as shown.

Size of Round	Temperature of the Draw	Tensile Strength P.S.I.	Yield Point P.S.I.	% Elongation in 2 Inches	% Reduction of Area	Brinell Hardness
1 Inch Round Center						
2 Inch Round ½ radius						
3 Inch Round ½ radius						
4 Inch Round ½ radius						

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Ryerson furnishes hardenability interpretations with each alloy steel shipment

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All this information makes it easier for you to specify your alloy steel requirements in terms of *what the steel will do* . . . rather than on analysis alone. It further guides you in the proper heat treatment of your steel to obtain the best results.

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RYERSON STEEL-SERVICE

Higher Output Scheduled for Third Year of Hostilities Despite Cutbacks

Greater emphasis to be placed on invasion vessels, long range bombers and heavy trucks. . . Program for 1944 calls for overall production aggregating $72,000,000,000. . . Easier labor, materials situation anticipated

By J. C. SULLIVAN
Assistant Editor, STEEL

AMERICA entered its third year of war with materials supply in a comfortable position, its war plants largely complete, production "over-the-hump", and a critical manpower situation apparently near the turning point.

The favorable materials situation, especially the recent notable easing in steel and other metals considered critical only a few months ago, is leading to widespread expectations that limitations on the manufacture of essential civilian goods will be lifted.

The War Production Board already is developing a program to raise unnecessary restraints on the production of nonwar goods in a campaign preliminary to the reconversion of arms plants to peacetime manufacture.

Among recent moves in this direction have been: Easing of restriction on aluminum to permit its use in buses and in collapsible tubes; special allotment of controlled materials for manufacture of heating system controls; authorization of utilities to build short line extensions; removal of controls over used locomotives and industrial cars.

Another significant move was the WPB action to move into regular distribution channels inventories of fabricated articles or components made idle by contract modifications or terminations. See page 61.

Organized labor is becoming uneasy as steel production exceeds demand for uses now permitted, resulting in the dropping of a number of open hearths and an excess supply of ingots. In a letter to WPB Chairman Donald M. Nelson, CIO President Philip Murray proposed that WPB "remove all restrictions upon the use of steel for civilian purposes. Such action seems urgent and necessary for the support of the home front."

Mr. Murray estimated steel operations in the early months of next year will fall from 5 to 10 per cent below capacity levels of this year.

The steady upward trend in order cutbacks and cancellations, totaling close to 2100 prime and subcontracts with value of about $2 billion during October and November, have led some observers to feel that demand and supply of labor may balance out within the next few months. The War Department alone is reported scheduling contract cutbacks valued around $3 billion for over the next few months.

Record-breaking production of war materiel for the ground forces and to a lesser extent design changes have forced a backing up in output of certain items such as small arms, antiaircraft guns, bombs, tanks, shells, escort vessels, and even output of some aircraft parts is ahead of schedule and must be trimmed. The Maritime Commission has ordered all shipyards to close down every Sunday starting Jan. 1.

Some War Programs Increased

However, renewed emphasis is being placed on production of landing craft, heavy trucks, certain type tanks, super long-range bombers, radios and radar equipment, and larger aircraft engines. Continental Motors Corp. is scheduled to soon start mass production of large Rolls Royce engines for the bomber program.

Overall production schedules in 1944 call for a performance of about 4 per cent above the pace established during the current quarter, or a total valuation of about $72 billion. These schedules are constantly under review, but subsequent revisions will not be upward in the view of Charles E. Wilson, executive vice chairman, War Production Board. Production for munitions alone next year is seen climbing 5.4 per cent above the present quarter level.

CHARLES E. WILSON

Compared with the rate of output this quarter the 1944 production of aircraft will be up 26 per cent; Navy ships off 10.6; Maritime Commission vessels up 6.5; ground army ordnance and signal equipment off 9.2; construction off 28; tanks off 9.6 and trucks up 44 per cent. Accompanying charts, see page 49, presented by Mr. Wilson at the second War Congress of American Industry held in connection with the forty-eighth annual conference of the National Association of Manufacturers in New York recently, shows the 1944 projected war production schedules in their relation to 1942 output on a percentage basis.

The trend in awards of prime war supply contracts (over $50,000) on a nationwide basis turned sharply upward from about $1.5 billion in November, 1941, to a shade higher than $3 billion in December that year and reached a monthly peak of $10 billion in January, 1942. In February they eased to $8 billion and by March had dropped to about the $6 billion level. From this point they edged upward to around $7.5 billion in August, but then declined to a low since Pearl Harbor of slightly more than $3 billion in January 1943. The trend was upward during the first half this year, climbing to nearly $7 billion in June. Latest official figures show a downward tendency during July.

A breakdown of monthly awards of prime war supply contracts (over $50,000) as reported to the WPB fifth regional statistical division, in the period July 1, 1942, to Oct. 31, 1943, is presented in the table below.

1943	Contract Awards
October	$315,321,000
September	731,795,000
August	637,523,000
July	421,795,000
June	382,797,000
May	502,911,000
April	612,246,000
March	583,504,000
February	439,525,000
January	449,942,000
1942	
December	345,866,000
November	309,287,000
October	841,225,000
September	346,509,000
August	404,374,000
July	1,041,965,000
Period total	$8,366,585,000

Indicative of the current wave of order cut-backs and cancellations is the

recent steady increase in idle and excess steel inventories. In the year of its operation through to Oct. 1 last, the Steel Recovery Corp. tabulated slightly over one million tons of idle steel, and moved about 649,000 tons into consuming channels. Most of the steel not moved was unusable in war production, some could be used for civilian goods production, while a small portion will have to be scrapped. Demand for steel for civilian output is helping WPB's redistribution program.

Excess Steel Stocks Increasing

T. S. Fitch, special assistant on redistribution problems for WPB Steel Division, estimates that 1.5 million tons of steel are now available for redistribution. This figure is expected to be substantially increased over the coming months. Between 75,000 and 100,000 tons of excess steel are estimated to be located in the Pacific Southwest area.

The WPB fifth regional redistribution office moved 6688 tons of idle steel stocks during November into the following states and countries: Ohio, Pennsylvania, Massachusetts, New York, New Jersey, Connecticut, Rhode Island, Maryland, Georgia, Michigan, Illinois, Indiana, Iowa, Minnesota, Kansas, Nebraska, Utah, Missouri, Mississippi, California, Texas, Washington, Mexico, Venezuela, Brazil and Cuba.

Idle steel inventories tabulated by the fifth regional redistribution branch on Nov. 30 amounted to about 200,000 tons; of which 70 per cent was alloy steel and balance carbon.

The kind of war we are now fighting and plan to fight in the Pacific is entirely different than the one with Germany, and requires different types of equipment. Many dislocations in production schedules are expected over the coming months, with unemployment possibly developing in some areas, but it does not indicate any overall letdown in war production.

With cutbacks and cancellations in certain types of war equipment continuing and possibility of gaining momentum, many war workers envisioning an unheralded end to war production are acquiring mental jitters. This has caused grave concern among those responsible for war production, for there has occurred a slowing up in the completion of war contracts in a few instances. Favorable results from this situation include a decline in absenteeism and labor turnover reported at a number of plants.

WPB officials aim to get as many plants into essential civilian goods production next year as materials and manpower will permit. Detailed information is being obtained on smaller plants in less critical labor areas which are ready to resume production. Already plans are being prepared for output of 300,000 electric refrigerators, 2,000,000 household electric irons, and an unstated number of electric ranges, pails, wash tubs, etc. while WPB production approval for vacuum cleaners and washing machines are due before mid-year 1944. Carbon steel inner liners are now permitted for new furnaces in new buildings.

Farm Implement Program Stepped Up

The farm implement and heavy construction machinery programs have been stepped up sharply. Another indication of the easier steel supply situation is the recent WPB approval for the construction of 30,000 all-steel freight cars in 1944, requiring an estimated additional 52,000 tons of plates and shapes over the composite type cars.

Quality and price restrictions on civilian goods items are expected to play an important role in the transition from an all-out war effort to that of gradually stepping up essential civilian goods production.

Appeals by concerns requesting permission to get into production of essential civilian goods, or the lifting of quota limitations on output of those items now being produced, have increased about 25 per cent in the past two months, records of the fifth WPB regional office show. An increasing number of appeals have been granted recently. Some of the items include: Fire screens, stainless steel edging and binding, corrugated culverts, metal factory stools, metal screen frames, insect screens, warm air registers, steel fence posts and metal jackets for hot water heaters.

Those concerns which were granted their appeals already had the necessary inventory or could obtain it from frozen stocks, the product to be produced was essential, and the labor was available without restricting war output in the community.

In lifting the limitations on output of certain essential civilian goods there arises the problem of the advisability of permitting new interests to enter industrial fields, while the logical manufacturers are either on war work or happen to be in a critical labor area, with the consequent disruption to the economic status of these concerns now on war work in the early postwar period. One alternative suggested is to have the original manufacturer subcontract production of the item under its own trade mark.

Recent order cutbacks and cancellations have given rise to a delicate problem as to what should be done with raw materials in various stages of processing. A manufacturer may not want to accept material for inventory if it will make his stocks exceed the 60-day inventory regulation under CMP. The steel producer, if he cannot readily find another customer, is not in a position to stock it and is therefore inclined to ship the material, claiming his commercial rights under the contract with the customer.

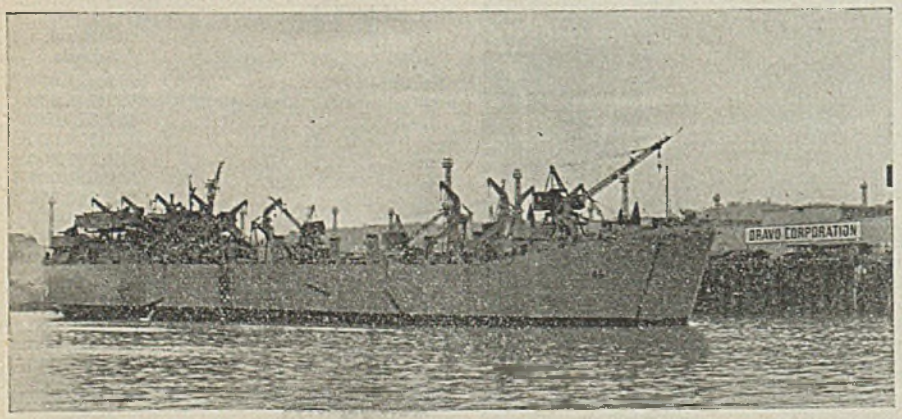
Must Get WPB Approval

Even though under the commercial contract the customer is obligated to take delivery of the material, he should not accept it, from standpoint of CMP Reg. 2, if the shipment will raise his inventories above the 60-day level, until he has filed an appeal from the restrictions under the regulation with the WPB redistribution branch and permission is granted.

If the cancellation has to do with a special item and the steel mill has already started production and has advised the consumer that he has started and the minimum quantity he will have to complete, the consumer may accept delivery of the minimum quantity. However, this provision applies only in those cases where the consumer may ultimately have use for the material.

In instances where consumer and producer can not reach an agreement as to what should be done with the material affected by the order cutback or cancellation, CMP officials state prompt response to an appeal from the CMP regulation can be obtained from the WPB redistribution branch.

Another indication of the extent of order cutbacks and cancellations is that of idle critical machine tool hours. In the WPB fifth region, plants reported such idleness rose 20,000 hours to 269,-



Contract for 44 additional LSTs (landing ships tanks) has been awarded to the Dravo Corp., Neville Island, Pittsburgh. Building of the invasion craft will keep the company's yards busy well into 1945

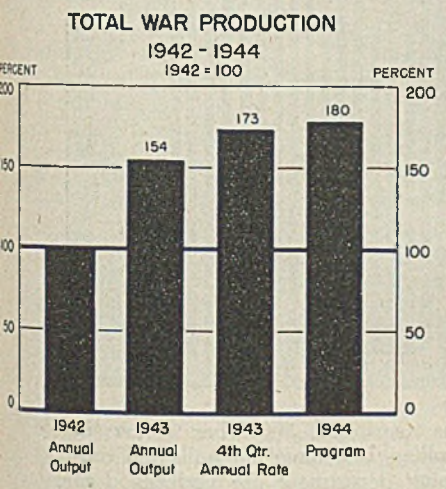
000 hours within the work week since July last. Most of the increase occurred in the Pittsburgh and Erie, Pa., areas. These two districts accounted for 16,000 hours of the total increase.

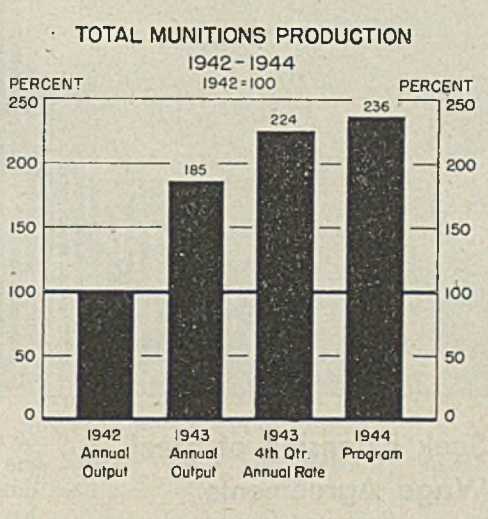
The Smaller War Plants Corp. reports 1021 distressed plants (those operating under 66 2/3 per cent of capacity) in the SWPC fifth region on Nov. 1, compared with 963 plants Sept. 1. During this period 152 companies were taken from the list through their own initiative in obtaining contracts or through SWPC assistance. Additions to the list totaled 210 companies.

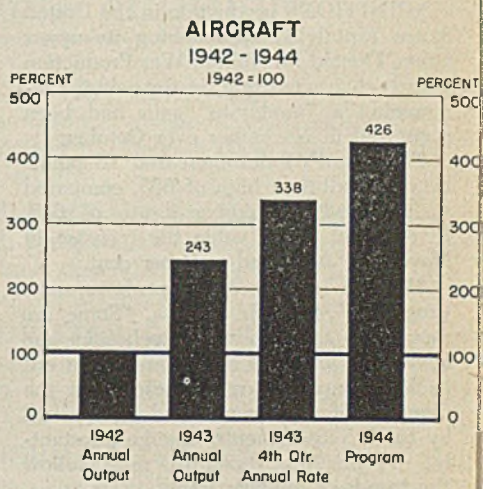
From July 1 to Dec. 4, SWPC placed 1094 subcontracts valued at $25,177,372 in the fifth region, and 528 prime contracts valued at $61,653,327. Majority of these contracts were placed with companies operating over 66 2/3 per cent of capacity but were in need of work, for they had the necessary equipment, "know-how", and other factors.

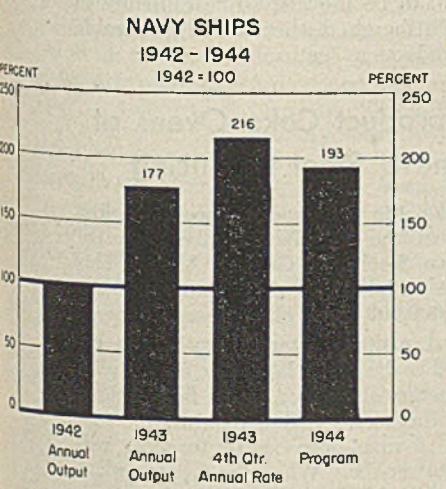
Latest order backlog figures available for companies in the WPB fifth region are for September, and show that out of the 980 reporting concerns 419 had backlogs of less than six months' output, 401 from 6 to 12 months, 122 from 12 to 24 months and 38 in excess of 24 months. Of the group those behind in war production schedules totaled 298.

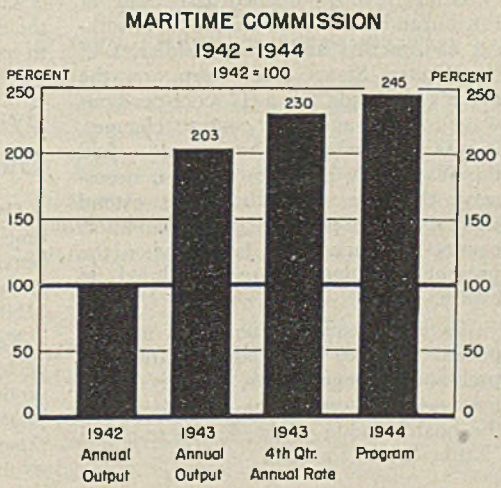
WPB Estimate of 1944 War Materiel Production Trends

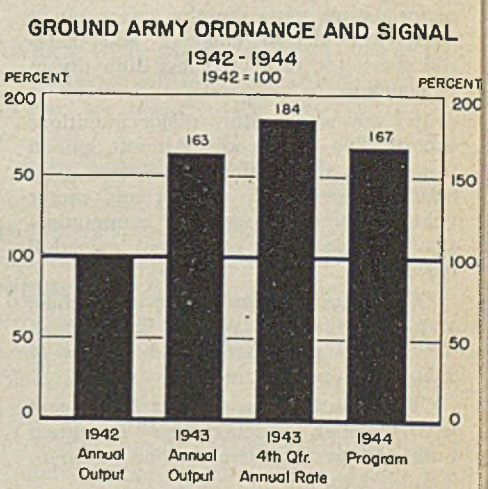


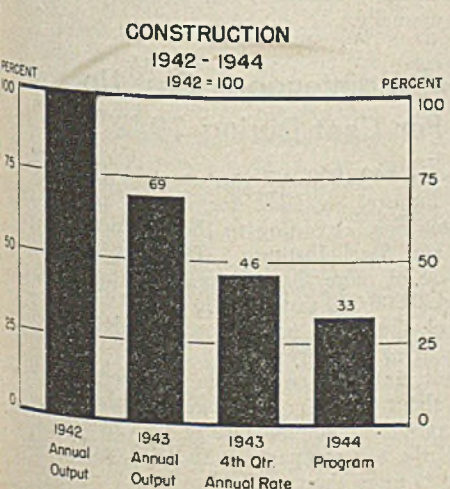


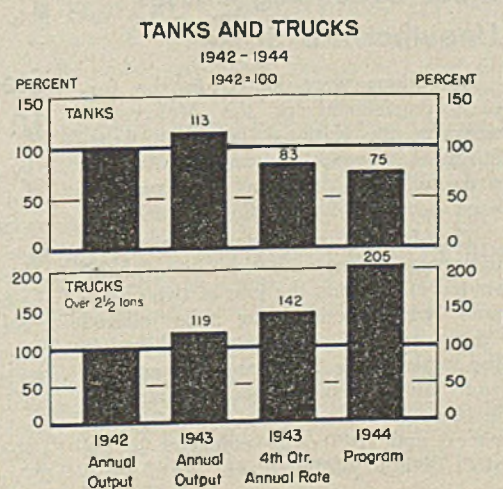


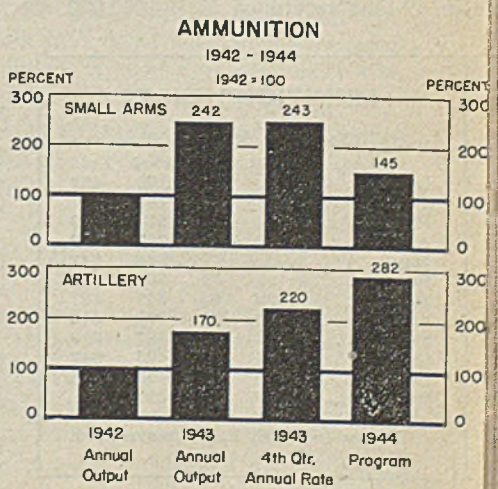












November Arms Gain Modestly, Approach Peak

Manpower, materials shortages offering less difficulty. . . Five of six major munitions programs register advances

MUNITIONS production in the United States rapidly is approaching its upper limits, Donald M. Nelson, War Production Board chairman, said last week in announcing a "moderate" gain had been registered in November over October.

The board's index increased 18 points to a new all-time high of 665, compared with a revised October figure of 647. In terms of dollar value the increase in November amounted to 3 per cent.

"We have reached the peak in some programs," said Mr. Nelson. "Some are moving at about an even keel; some are advancing and still others are being cut back. It must be remembered that the demands of war, as reflected and proved by battle requirements, change constantly. Production, therefore, must follow the trends of military action.

"In general, problems which were of a major nature some months ago, such as manpower, design changes, and material shortages, presented less difficulty in November.

"Of our six monthly major munitions groups, five advanced. Aircraft gained 6 per cent; ships gained 4 per cent; guns gained 3 per cent; combat and motor vehicles gained 1 per cent; communication and electronic equipment gained 6 per cent.

"Only one program showed a decline, ammunition, which was off 2 per cent. This program has been cut back due to changes in requirements.

"War construction was off 8 per cent from October, as scheduled. The great bulk of our war construction program is behind us."

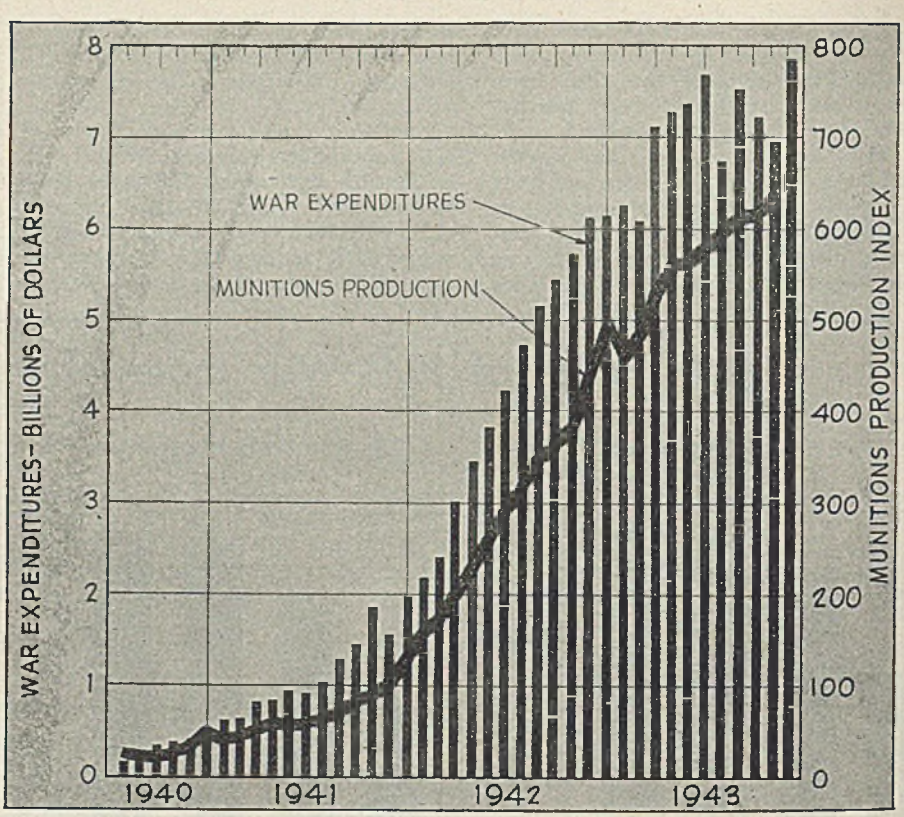
War expenditures in November reached an all-time record of $7,794,000,000.

MUNITIONS INDEX

(November 1941 = 100)

	1940	1941	1942	1943
Jan.	..	41	166	452
Feb.	..	45	182	477
Mar.	..	52	213	519
Apr.	..	60	247	549
May	..	57	276	547
June	..	59	309	560
July	23	64	339	587
Aug.	22	72	372	610
Sept.	22	83	387	619
Oct.	27	91	403	647
Nov.	34	100	448	665
Dec.	50	133	497	...

Figures for 1943 have been revised.



Seek Extension of Steel Wage Agreements

As negotiations opened last week at Pittsburgh between the United Steelworkers of America and five subsidiaries of the United States Steel Corp., on the union's demands for a 17 cent-per-hour wage increase and other contract changes, it was announced the union had asked the War Labor Board to direct, if necessary, that the steel companies extend their union agreements, if new contracts cannot be reached by Jan. 3 when the present agreements are scheduled to expire.

Wage demands of the union are expected to go to War Labor Board after preliminary negotiations, as any wage increase made would be in violation of the board's wage yardstick, the so-called "Little Steel" formula.

Steel Order Lag Causes Unauthorized Strike

Operations were halted in the furnace department of the McKeesport works of the National Tube Co., Pittsburgh, last week by an unauthorized strike following the taking off of one furnace because of a decline in orders.

The furnace suspension, carried out under agreement with the union, necessitated eliminating the jobs of two cranemen who declined to take offered "downgraded" positions elsewhere in the works. The two cranemen quit and were joined by seven pouring cranemen assigned to three other operating furnaces, and sixty other employes in the steel division of the plant. As a result of the suspension, 560 other workers in the rolling, blooming, bar mills and conditioning department are understood to have been thrown out of work. This is said to be the first strike difficulty in the Pittsburgh district directly traceable to production "cutbacks".

By-product Coke Ovens at Geneva Steel Producing

Coke was produced last week the first time in the by-product coke ovens of Geneva Steel Co., Geneva, Utah. This is the initial phase of operations at the $180,000,000 steel plant near Provo.

Next major step in operations is expected to be taken later this month with production of pig iron in the first of three blast furnaces. Following this, the first three of nine open-hearth furnaces will go into service. When the Geneva plant swings into full operation it will produce approximately 1,200,000 tons of steel ingots annually.

Steel Maintenance Cost Up 10 Per Cent During 1942

Nearly $465,000,000 was spent by the steel industry in 1942 for repairs and maintenance, according to the American Iron and Steel Institute. This was an increase of more than 10 per cent over the $420,000,000 expended in 1941.

Steel operations in 1942 averaged 97 per cent of capacity.

Plant maintenance costs in 1942 averaged about $7.45 for each ton of finished steel produced, an increase of well over a dollar a ton compared with 1940, and 65 cents more than in 1941.

Outright Sale On Exclusive Basis Proposed

House bill, if enacted, would reverse present practice of granting nonexclusive, royalty-free licenses

BILL introduced by Rep. Bertrand W. Gearhart (Dem., Calif.), identified as H. R. 3672, proposes to direct the alien property custodian "to offer for sale, and to sell, with all convenient speed, all enemy patents, trademarks, and copyrights vested in him" except such patents, trademarks and copyrights belonging to persons whose funds are exempt from seizure. Exempt persons include "bona fide residents of the United States or of one of the United Nations, or of a country invaded by an enemy nation, or who prove to the satisfaction of the alien property custodian that they have fled from an enemy or occupied country on account of persecution by the government or ruling power of such enemy or occupied country."

The bill stipulates "the alien property custodian shall not offer for sale or dispose of such patents, trademarks, or copyrights as the President, by executive order, shall exempt from sale on account of the fact that such exemption is necessary to the prosecution of the war." It provides that "as to other than such patents, trademarks, and copyrights, the alien property custodian is directed not to grant any further license or licenses for the use thereof except upon payment of fees commensurate with the reasonable value of such licenses, such as fees to be transmitted by him forthwith to the Secretary of the Treasury."

It provides further that "no such fee to be agreed upon shall be deemed commensurate with the reasonable value thereof, unless the Secretary of Commerce, upon due investigation, has certified that he considers the fee to be paid as a reasonable compensation for such license agreement."

If enacted, the bill would sharply reverse the present practice of the alien property custodian which is to grant nonexclusive, royalty-free licenses. Instead, a manufacturer would be permitted to buy a patent right and own it exclusively. This would overcome an objection on the part of many manufacturers who have protested against licenses being issued nonexclusively, and also with a clause permitting revocation.

Lawyers generally believe the clause calling for revocation probably never would be acted upon by the alien property custodian. Over the past 50 to 60 years, opinions of the Supreme Court and the attorney general have held that, in the absence of express congressional authority, a federal agency does not have the power to dispose of property on royalty-free terms except upon the understanding that such property may be recaptured in the event the government determines that other disposition must necessarily be made in the public interest. But there has been general agreement that the right to revoke must not be exercised.

The fact that licenses to seized patents, trademarks and copyrights at the present time are granted nonexclusively and with the revocation clause is known to have prevented some companies from making applications for licenses. Chief objection has been to the nonexclusive feature. At the same time a large number of applications have been made to the alien property custodian. Some 400 licenses, covering some 2600 patents, already have been granted. Some 700 applications, covering some 12,000 patents, are pending, and the number of applications received is increasing.

Present, Past and Pending

EDGAR THOMSON BLOWS IN 1330-TON FURNACE

BRADDOCK, PA.—B furnace of Edgar Thomson Works, Carnegie-Illinois Steel Corp., was blown in last Thursday. This is the second of the Defense Plant Corp.'s 227-foot stacks built here. It will produce 1330 tons daily.

SHEET METAL WELL CASINGS PLACED UNDER RATIONING

WASHINGTON—Sheet metal well casing now is being rationed. Persons wishing to use a quantity of this type of casing, costing more than $100 (retail value) for any one well will be required to obtain a purchase certificate.

OPA ACTION EXPECTED SOON ON STEEL CASTING PRICES

WASHINGTON—Office of Price Administration will decide before Jan. 15 on proposed increases in maximum prices for steel castings and railroad specialties. Meantime, adjustable pricing will be permitted.

SCRAP AND SECONDARY ALUMINUM PRICES CUT

WASHINGTON—Ceiling prices on aluminum scrap and secondary aluminum ingot at the producer level have been reduced generally 1½ cents a pound by the Office of Price Administration, effective Dec. 23.

OXY-ACETYLENE EQUIPMENT MAKERS GET MORE BRASS

WASHINGTON—Manufacturers of oxy-acetylene equipment will be granted additional quotas of brass, totaling about 50 tons a quarter, to replace a like quantity of critical malleable iron, castings, and cold-rolled steel.

ABRASIVE GRAIN SMALL ORDER EXEMPTIONS RAISED

WASHINGTON—Size of the exemption from authorization for small orders of abrasive grain, with the exception of optical finishing powders, has been increased to 20,000 pounds in each two-month authorization period, beginning Jan. 1, 1944.

RESTRICTIONS EASED ON ELECTROPLATING EQUIPMENT

WASHINGTON—War Production Board eased restrictions last week on acquisition of electroplating and anodizing equipment to allow users to obtain needed spare or repair parts without the necessity of filing a PD-1a application.

25,000,000-TON BITUMINOUS COAL SHORTAGE SEEN

WASHINGTON—United States will enter 1944 with a bituminous coal shortage of about 25,000,000 tons, according to the Solid Fuels Administration for War. By Jan. 1, consumer and dealer stockpiles will have been reduced to about 60,000,000 tons.

FEDERAL SHIPBUILDING TO BOOST OUTPUT 20 PER CENT

KEARNY, N. J.—Federal Shipbuilding & Drydock Co.'s dollar volume of construction is "to be boosted 20 per cent in 1944, and additional types of ship construction have been scheduled," Lynn H. Korndorff, president, revealed last week.

SPONGE IRON EXPERIMENTAL PLANT COMPLETED IN WYOMING

LARAMIE, WYO.—Sponge iron experimental plant here of the Bureau of Mines has been completed. Equipped with a rotary kiln, it is expected to turn out about 50 tons of sponge iron daily. Wyoming ores will be used at first.

ILLINOIS INSTITUTE STARTS BUILDING SECOND UNIT

CHICAGO—Illinois Institute of Technology has started construction of the second permanent unit of its $3,100,000 campus development program. The new building will house the automotive research laboratory of the Armour Research Foundation.

COLONIAL BLAST FURNACE OFFERED FOR SALE

RIDDLESBURG, PA.—Colonial blast furnace here, operated by the U. S. Pipe & Foundry Co. until early this year under contract with Defense Plant Corp., is being offered for sale. The offering includes 200 coke ovens, mines and all equipment.

Federal Agency Disbanded After Idle Stocks Are Redistributed

Savings on government purchases nearly equalled cost of operation. . . Total of 547,000 items, aggregating millions of tons of steel, redirected into war effort. . . Less than one tenth required remelting

CHARLES F. CRUCIGER

THE federally sponsored Steel Recovery Corp., now in liquidation in Pittsburgh, is winding up its affairs with a record of having effected savings on government purchases of supplies nearly equal to the entire cost of its operation, it is announced by Charles F. Cruciger, president. This record is unique, in the opinion of the steel men who directed the emergency program for moving many tons of idle and excess steel into war-useful channels.

Release of personnel, which reached a total of 549 at the peak of operations, has been in progress since Sept. 30, and the corporation will close its doors Dec. 31.

Presently outstanding contracts and obligations will be completed. These were undertaken by the corporation as an agent of the RFC-owned Metals Reserve Corp. under the salvage program of the War Production Bo: redistribution of idle and excess steel will be carried on by WPB regional offices.

Steel was handled by the corporation in an almost endless variety of types and shapes, and with savings not only of irreplaceable production time but, in many cases, of cost to the government.

"In one transaction alone," said Mr. Cruciger, "we were able to save the government the equivalent of a very substantial portion of the total cost of our operations. In connection with the manufacture of service men's identification tags and chains, we located and purchased idle stainless steel, formerly used for ice pans in refrigerators, making possible the substitution of this material for silver. In this single deal a unit cost saving of over 30 cents was effected on government orders totaling more than seven million units."

The activities now being brought to a conclusion have been accompanied by reduction and redistribution to comparatively modest and manageable proportions of steel inventories rendered idle and excessive by war emergency freezing orders and variously estimated before the agency was formed in the summer of 1942 at from 12,000,000 to 15,000,000 tons. A total of some 547,000 separate items were located in the possession of 47,000 different holders.

Functioned as a Clearing House

The steel recovery program functioned principally as a clearing house where buyer and seller were brought together promptly. The Steel Recovery Corp. purchased materials for reprocessing for vital armed service needs and, where occasion warranted, for remelting. According to officials of the corporation, the entire program was accomplished at a per ton cost of less than normal brokerage fee, and only a small percentage of the funds available for the program was used.

At the outset, estimates were made that an outlay of $300,000,000 might be required to maintain capacity production in the nation's steel mills by assuring an uninterrupted flow of scrap. The corporation is completing its work with a total expenditure of approximately 1 per cent of this amount.

The story of the Steel Recovery Corp.'s program, undertaken at the request of WPB, covers a period of less than a year and a half. It is essentially that of a group of practical steel men who met on government call, organized and directed a rush compilation of information on idle and excess steel on a scale never before attempted, acted vigorously to move the steel into vital war production, and then, the corporation's mission accomplished, voted to disband.

Huge steel inventories, lying idle at a time when expanding war industries were demanding more and more steel, constituted a grave problem in the summer of 1942. To deal with it, the Steel Recovery Corp. was incorporated in Delaware on Aug. 6 as an agency of the RFC-owned Metals Reserve Co. to which the WPB had assigned the salvage program in which copper, aluminum and other basic materials were also included.

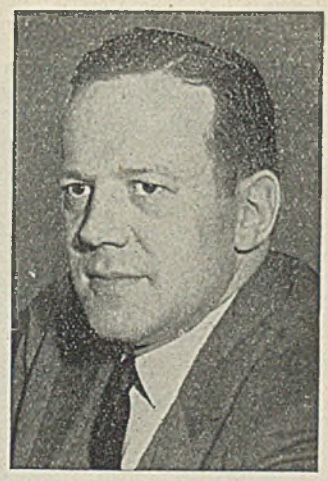
Backed by the authority of the WPB, notices went to a list of nearly a quarter of a million possible holders of steel in all forms, urging the reporting of all steel in the idle or excess categories. Holders were offered help in finding buyers; and where private sales could not be effected, and government purchase was warranted, the corporation offered to buy direct at established prices ranging up to 85 per cent of material cost. Finally, holders were warned of the

LESTER BRION

RICHMOND LEWIS

B. E. KIBBEE

EVERETT D. GRAFF



GEORGE L. STEWART

WPB's power to requisition in cases where the voluntary method failed.

"It is an open secret in the steel industry," said Mr. Cruciger "that some millions of tons of steel moved into legitimate trade channels from idle and excess stockpiles in anticipation of the required reporting."

Reports began to flow in shortly in such volume that an average of nearly 10,000 items per day was recorded during the peak period. To maintain an up-to-date inventory record, a system was established for classifying, tabulating and machine-selecting the data reported.

"During the course of the program," said Mr. Cruciger, "it was found possible to modify in very large measure the original and drastic concept of our job, which was that of purchase and remelting of steel in volume, a method admittedly uneconomic and justified only by the wartime urgency of demand for steel. Less than one tenth of the steel we located was sent through for remelt.

"We discovered before we had gone very far that a high percentage of inventories could be matched with demands for finished and even fabricated items. In all such cases, the buyer and seller were brought together and told, within the limits of prevailing restrictions, to go ahead and do business. In other words, we put the idle steel right to work. About 5000 inquiries were received per month from prospective purchasers.

"We also found that in many cases remelting could be avoided by processing from nonusable to needed forms. Here also we were able to effect a prompt movement into production, through purchase at approximately material cost prices, of a very appreciable tonnage. Rerolling, shearing, cutting, slitting and other methods were used."

Material for Wide Range of Uses

The program located, and made available to war manufacturers, materials for a wide range of uses, among which were farm equipment, gasoline drums, galley gear, identification tags and bead chains, ship structural steel and plates, vacuum bottles, mess trays, meat cans, license plates, and many other uses. One of the presently unfinished programs of Steel Recovery Corp. is the furnishing of steel for the zipper industry. Many of these items could not have been manufactured without the materials purchased and reprocessed by Steel Recovery Corp., which afforded many manufacturers the only relief available from prevailing restrictions.

During a period of approximately a month in the spring of 1943, there was maintained, at the corporation's office in Pittsburgh, what amounted to a resident buyers' meeting representing the farm implement industry, badly hit by limitation orders. From this came numerous materials enabling the industry to furnish otherwise unavailable farm equipment. Thus, the Steel Recovery Corp. made very appreciable contributions to the harvest of the past season.

One day an urgent phone call came from Dayton, where 3500 tons of steel for the manufacture of the special drums used for shipping high-octane gasoline were needed to complete a rush order. Within an hour and a half, the necessary inventory information had been assembled and sent to Dayton by airplane.

One phase of the operations consisted of taking over the uncompleted projects of War Materials Inc., in connection with salvage operations.

Much of the corporation's activity was directed by its first president, George L. Stewart, who resigned to return to his duties as vice president of Edgar T. Ward's Sons Co., Pittsburgh. He was succeeded by Mr. Cruciger, who was formerly vice president of Spang Chalfant Inc. Vice president is Donald C. Hamilton, formerly of Northwestern Mutual Life Insurance Co. Treasurer and assistant secretary is George M. Durschinger, formerly assistant treasurer and secretary of Pittsburgh Coke & Iron Co. Frederick E. Milligan of the law firm of Reed, Smith, Shaw & McClay, is secretary and general counsel.

Directors are: Lester Brion, president, Peter A. Frasse & Co. Inc.; Norris Jay Clarke, vice president, Republic Steel Corp.; Henry Cornell, assistant vice president, Metals Reserve Co., who has recently succeeded Charles W. Nichols, chairman of the board of Nichols Engineering & Research Corp., and a former vice president of Metals Reserve Co.; Walter S. Doxsey, president, American Steel Warehouse Association; Everett D. Graff, president, Joseph T. Ryerson & Son Inc.; B. E. Kibbee, vice president, Sharon Steel Corp.; Richmond Lewis, president, Charles C. Lewis Co.; John May, vice president, American Steel & Wire Co.; Walter S. Tower, president, American Iron and Steel Institute; and Mr. Stewart, who continued as a director after resigning as president.

Senator Hawkes Addresses Illinois Manufacturers

Congress is showing evidence of a determination to recover its constitutional powers, many of which were unnecessarily voted away for the conduct of the war, Sen. Albert W. Hawkes (Rep., N. J.) said addressing 2000 midwestern business executives attending the Fiftieth Anniversary annual dinner of the Illinois Manufacturers' Association at the Stevens hotel, Chicago, Dec. 14.

JOHN MAY

WALTER S. DOXSEY

WALTER S. TOWER

NORRIS J. CLARKE

Industry Urged To Get House in Order To Expedite Procedure

Manufacturers told they should set up termination committees, check inventories, review costs, and be prepared to co-operate with government agencies now working out cancellation and surplus property disposal policies

NEW YORK

ASSURING manufacturers that federal buying agencies were hard at work on problems and policies relating to the termination of war contracts and the disposition of surplus plants, government procurement officials urged these interests in New York recently to get their own houses in order, by setting up contract termination committees, carefully checking inventories, reviewing cost data and otherwise laying plans to expedite procedure whenever the time becomes necessary.

Before a gathering that filled the main ballroom of the Waldorf Astoria, these officials spoke at a panel session on the closing day of the second Congress of War Industry, held in connection with the forty-eighth conference of the National Association of Manufacturers.

Speakers were members of the panel which included, J. H. Marks, vice president, Packard Motor Car Co., Detroit; Col. David N. Hauseman, director of readjustment of Army Air Forces and Air Corps; Brig. Gen. Albert J. Browning, director, purchase division, War Department; H. C. Beaver, president, Worthington Pump & Machinery Corp., Harrison, N. J.; Raymond S. Smethurst, counsel of the association; Commander H. F. Linder, administrator of contract termination, Navy Department; and A. G. Drefs, vice president, McQuay-Norris Co., St. Louis; with Malcolm Muir, president, *Newsweek*, and chairman of the association's War Committee, serving as moderator.

Formulating Uniform Policy

Pointing to work being done in Washington, Gen. Browning declared that a uniform clause would likely be announced within two weeks by the Joint Contract Termination Board, organization of which had only been announced by James F. Byrnes, director, Office of War Mobilization, a few days previously.

The new board, he declared, is also working on plans for a uniform policy for prompt partial payment and loans to contractors and subcontractors after war contracts are settled and during the settlement period; prompt disposal of inventory and equipment in contractors hands when contracts are terminated; and a uniform method of quick handling of the claims of subcontractors.

He revealed that the war department had created a new staff division that would devote itself exclusively to the problems of contract settlements and disposal of excess materials and equipment, with jurisdiction over all terminated contracts, both for the technical services and the Army Air Forces.

Emphasizing that war contractors could not begin too soon in preparing themselves for handling termination problems, Mr. Drefs pointed out that, as of the end of last August, 8520 contracts had been terminated with a value of $5,800,000,000, and that since then the figure has been raised to approximately $8,000,000,000 for the Army alone. He said that the total amount at the end of the last war was only $5,000,000,000, so that already, if the Army and Navy be taken together, it is probable that the current value is twice what it was at the end of World War I.

Disposition of Government Property

Commander Linder said he understood that a subcommittee under Bernard M. Baruch was considering the establishment of a 60-day limit on the time companies will be obliged to keep government property in their plants after contracts are terminated.

He pointed out that certain navy facilities will have to be retained and not sold or dismantled.

Passing of legislation setting up a Surplus War Property Commission, independent of existing agencies, was urged by Mr. Beaver. Such a commission, he said, should be given authority and direction to dispose, subject to existing contractual relationships, of all property and financial interests acquired by any federal government agency for use in the war effort that are not needed for purposes of national defense after the war is over.

In alluding to the new Joint Contract Termination Board, General Browning said that the armed forces would retain control over decisions as to what contracts are to be terminated and when, but the board would develop uniform policies and procedures after the Army and Navy had made their decisions.

He said the War Department regarded negotiated settlements as preferable to those made by detailed audits.

In response to a question as to what factors are considered by the War Department in selecting contracts to be terminated, General Browning suggested the present policy be considered as applying only during the war, because "a lot of people are going to settle it afterward."

ROBERT M. GAYLORD

Newly elected president of the National Association of Manufacturers, Mr. Gaylord is also president of the Ingersoll Milling Machine Co., Rockford, Ill. He was president of the National Machine Tool Builders Association in 1932, has been a member of the executive committee of the Machinery and Allied Products Institute since 1934 and a vice president of the institute since 1937, and has been a director and officer of the Illinois Manufacturers Association since 1938.

Mr. Gaylord joined Ingersoll in 1917 as a vice president, after being associated with Minneapolis Steel & Machine Co., Minneapolis, Emerson Brantingham Co., Rockville, Ill., and Gray Tractor Co., Minneapolis. He has been president of Ingersoll since 1928.

Because of the fact that right now the most critical shortage is that of manpower in certain areas, the location of a plant in most cases will be the determining factor. Another which is going to receive a great deal of consideration, he said, is the cost within the plant.

Another factor will be the amount of business within the contractors' plants.

He added, too, that there were questions of cross-haul, quality of product and the desire of the contractors themselves as to whether they wish to go on or end their work so that they can get started in some peacetime pursuit.

Commander Linder also suggested that a factor seriously considered by the Navy, and probably by the Army also, has to do with extent to which a contract has been completed.

Mr. Marks said that the Packard company has something like 8000 government tools and that it would require about 1,000,000 square feet of floor space to store it. He thought the government should adopt a policy now for the disposal of such equipment in various plants.

Output Seen on Rise Until War Ends in Europe

Economist says steel production will be sustained for several years. 1944 national income seen little changed

VOLUME of industrial production is near its ceiling, but will continue to rise slowly until the war in Europe ends next year, Brig. Gen. Leonard P. Ayres, vice president, Cleveland Trust Co., and nationally known economist, said last week in his annual address before the Cleveland Chamber of Commerce.

General Ayres' predictions for the coming year follow:

Steel production will be well sustained in 1944, and for several years to come, although output will likely be slightly less than the current record year.

Production of bituminous coal will be not less than 2 per cent nor larger than 7 per cent greater next year than in 1943.

A gain of not less than 10 per cent or more than 20 per cent is predicted for electric power consumption in 1944.

Labor shortages will probably continue to be serious until Germany is defeated, but will decrease rapidly in importance after that.

Rising trend in average weekly earnings of factory workers may be expected to continue until the war in Europe is ended. Overtime payments of factory workers and other employes will decrease rapidly after Germany is defeated.

Transportation problems next year are expected to become more acute.

Cost of living will be higher next year, and it is not likely that the average in 1944 will be less than 5 per cent or more than 15 per cent above the 1943 average. Wholesale prices will advance not more than 10 per cent above 1943. Average price of coal will be higher, but the increase will benefit the miners rather than 9 per cent.

National income in 1944 will not differ much from that of 1943. Probably the increase or decrease will not be more than nine per cent.

New Legislation Replaces Scrugham Stockpiling Bill

Original Scrugham stockpiling bill, S. 1160, has been withdrawn and replaced by a new bill, S. 1582, containing extensive changes. It provides "preferential treatment to domestic ore producers, and only if the purposes specified cannot be fulfilled from domestic sources could new foreign purchases be made."

For a year following the termination of hostilities it is proposed to continue paying premium prices to those mines "in which the governmental assistance or investment or private investment is shown to have been made with the intent and purpose of augmenting war or essential civilian production."

The Metals Reserve Co. would do the stockpiling, under policies to be established by a Mineral Stockpile Control Board composed of "five outstanding members of the mining industry, appointed by the President with the advice and consent of the Senate." All stockpiles would be frozen until Congress deemed the utilization of them necessary for a future national emergency."

POSTWAR PREVIEWS

ALIEN PATENTS— Congress to consider bill directing outright sale of seized patents on exclusive basis, reversing present practice of granting nonexclusive, royalty-free licenses. See page 51.

CONTRACT TERMINATIONS—Manufacturers warned to place houses in order, set up termination committees, check inventories, review costs and be prepared to co-operate with government agencies. See page 54.

AYRES' PREDICTION—Steel operations will be well sustained in 1944 and for several years to come, although slightly less than current record year. See page 55.

TAXES—Industrialists demand enough latitude under new revenue law to permit accumulation of reserves to finance postwar rehabilitation of machinery and equipment. See page 58.

TRUCKS—Increase in 1944 program for heavy units may leave 10 to 15 years' supply of trucks to threaten normal postwar market. See page 63.

RECONVERSION—General Motors raises ante for postwar conversion to half billion dollars. See page 64.

WAR PLANTS—Competitive importance of government-owned facilities overemphasized, National Industrial Conference Board survey indicates. Only one-fifth of $27.5 billion of war facilities will be of substantial importance in peacetime economy. See page 73.

ELECTRICAL INDUSTRY—Specific postwar plan already formulated by contractors and labor. Calls for stabilization of wages and employment on an annual basis. See page 73.

EMPLOYMENT—Widespread unemployment in demobilization period not anticipated in report of Falk Foundation survey. See page 73.

RE-EMPLOYING VETERANS—Agencies now being established to channel discharged servicemen back into industry and to train them for effective production. See page 75.

PEACETIME PLANS—International Harvester Co. buys 375-acre site for new farm machinery plant to be constructed after war ends. See page 77.

ELECTRONIC TESTING—Multitude of quantitative and qualitative tests can be made by use of newly developed electronic techniques. Process already commands attention for work it is doing in checking, evaluating and sorting both magnetic and nonmagnetic metallic materials in form of stock or finished pieces. Important postwar applications forecast. See page 82.

NEW FABRICATION TECHNIQUES—Swaging of steel tubing and use of pressed sheet steel parts assembled by arc and resistance welding cut costs and save much copper, tin, aluminum. Method has wide possible range of application in postwar work. See page 84.

BETTER HEAT TREATING—Many new developments in heat-treating cycles have been made but comparatively few possible users are aware of them, states one authority in the industry. He points out some of the important advantages accruing from use of improved processes, indicates significant future. See page 106.

DEEP DRAWING— Details of the improved deep-drawing techniques developed in the successful production of steel cartridge cases are revealed. Lessons can be applied to manufacture of many articles from steel heretofore considered impossible. See page 110.

WINDOWS of WASHINGTON

Hearings Interrupted

ACTIVITIES of the Senate Special Committee on Postwar Economic Policy and Planning were interrupted recently when the Senate Finance Committee took up the House revenue bill; all the important members of the former committee are members of the later, and the problem of the tax bill was given precedence. With the tax bill out of the way, the postwar committee will resume its studies of postwar reconversion legislation. While the agenda has not yet been formulated, it is expected that Bernard M. Baruch, postwar planner, will be invited to give his views to the committee.

Baruch To Advise Only

Bernard M. Baruch's conception of his job seems to be pretty well indicated by his new official government letter-head which reads:

OFFICE OF WAR MOBILIZATION
Advisory Unit for War and Post-War Adjustment Policies

Three names are printed on it. James M. Byrnes is identified by the title as director of the OWM. Mr. Baruch and John M. Hancock appear without identification as to titles. This specific wording appears to warrant a prevailing impression that Mr. Baruch will serve in an advisory capacity only and that he does not intend to actually implement the execution of the policies he will help establish.

Rail Mill for Russia

With approval by the Foreign Economic Administration, the Treasury Procurement Division is preparing to place a contract with United Engineering & Foundry Co., Pittsburgh, for production of what is said to be the largest rail mill in the world. It will be shipped to Russia and will be rushed so as to permit delivery within 10 months. The order includes a 46-inch blooming mill and a combination rail and structural mill.

Jap Arms Inferior

Capture of enemy ordnance to obtain accurate knowledge of the adversary weapons is an important wartime function. The Japanese are not in a good position to do this as they are on the defensive, and when they do capture any of our equipment they find difficulty in getting it to a place where they can analyze it. They are particularly keen on getting their hands on our equipment—because American battle tools are superior to theirs.

Tests disclose that the latest Japanese rifle, a manually operated bolt-action weapon with bore of 0.303 caliber, is inaccurate at ranges of more than 350 yards, while the American M1 rifle, the Garand, is accurate at greater distances. The Japanese light machine gun fires 30 rounds in three seconds, but since it has only a 30-round magazine, its effective rate of fire is reduced to 200 to 300 rounds per minute. It is accurate at short distances but at 500 yards it does not compare with the 0.30 caliber Browning, which fires 500 to 600 rounds per minute.

Blames Embargo for HCL

One reason why there is discontent in many areas because of food shortages and rising food prices is the embargo of last April on shipments of food to the United States, Alfred H. Benjamin, president, Anglo-American Trading Corp., New York, told the Senate Finance Committee. As a result, he said, meat, butter and other foods are clogging the refrigerated warehouses of Argentina, Uruguay, Canada, New Zealand and Australia.

"Our firm alone has 1500 tons of meat in New Zealand. Owing to the embargo," he said, "we cannot load it on War Shipping Administration vessels even though they now are returning to United States ports with empty refrigerated chambers. What has happened is that we now have complete British domination of all foreign food commodities which enter into the cost of living in the United States."

CENSORSHIP RELAXED

Office of Censorship spokesmen in announcing a relaxation of censorship rules made it clear that that office alone has the authority to make censorship decisions, and the Army and Navy have no power to censor.

This is important not only to editors and writers but also to war contractors. In many instances, Army Public Relations officers have ruled manufacturers with an iron hand on the publicity they are allowed to release.

The revised censorship code removes restrictions on nationwide summaries of war production, progress of production, plant details and capacity, and lend-lease shipments.

Stringent Regulations

The fact that considerable sentiment has built up in favor of relaxing the stringent regulations governing charge accounts and installment buying since August, 1941, is not to be taken as any indication that there is likely to be any such relaxation. There is no intention on the part of the Federal Reserve Board to make any change under present conditions. Incidentally, as many affected merchants throughout the country favor as are opposed to a continuation of the present restrictions.

Tokens Packaged in Steel

Osborne Register Co., Cincinnati, under contract with OPA, will manufacture 8,000,000 steel containers in which the new ration tokens will be delivered to some 17,000 banks all over the country for distribution to the public. Contract was placed after WPB had located and made available some 800 tons of sheet steel in surplus inventories. Osborne also has the contract for manufacturing 2,000,000,000 ration tokens. The tokens will be stamped out of vulcanized fiber sheets. A number of companies have submitted for OPA approval models of proposed instruments on the order of simplified cash registers which are aimed at making it more convenient for merchants to handle the tokens.

Batteryless Telephone

A sound-powered telephone operated without cumbersome batteries proved one of the most useful pieces of equipment on Guadalcanal, according to Lt. Col. R. B. H. Rockwell, Signal Corps, back from the South Pacific island where he served as a division signal officer. Power in the telephone is generated by the human voice; signaling is accomplished merely by whistling into the transmitter. In size and appearance it is similar to the handset in use in American homes and offices. In addition to being lighter, smaller and more durable than battery-powered telephones, it also licked the problem which arose from rapid deterioration of batteries because of the damp climate.

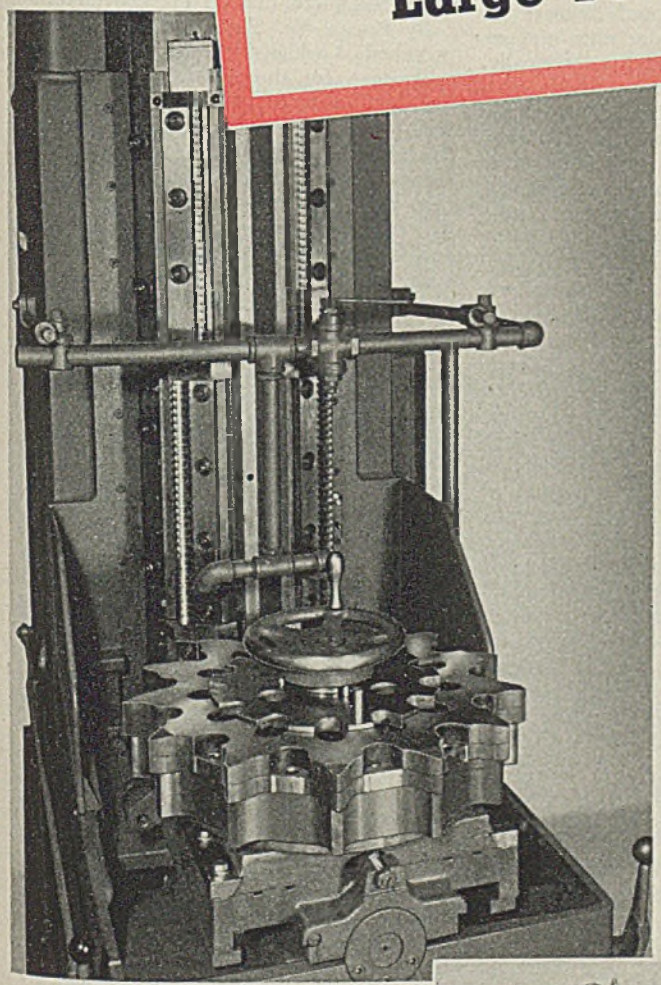
Jeeps Pull Freight Cars

This Army news brief is worthy of some thought in connection with postwar development of railroad transportation: "Jeeps are now used as switch engines in Australia. Fitted with flanged steel wheels, a jeep can move loaded freight cars."

Army Offers New Film

American war workers will be shown a new sound film, entitled "War Department Report", beginning Dec. 26. As seen in a pre-view by members of the National Press club, it shows how strong our enemies are, and proves beyond any shadow of doubt that there is substantial ground for continued emphasis on increased production of war *materiel*. Scenes from combat films—the invasion of Italy, the invasion of Sicily and the capture of Rendova—show the tremendous volume of weapons and other equipment which is destroyed in even our most successful battles. Incorporated are portions of film captured from the Germans and the Japanese that leave nothing to the imagination as to what they are doing to increase production. The film will be distributed by Industrial Services Division, Bureau of Public Relations, War Department, Washington.

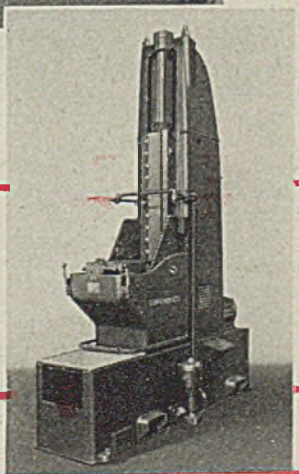
New and More Economical Way of Finishing Large Tooth *Profiles*



The teeth of large sprockets, especially those which are comparatively thin, present several problems in machining. Not the least of them is how to obtain the correct profile and a good smooth finish, while maintaining a satisfactory rate of production. After analyzing the various requirements, CINCINNATI Service Engineers decided that a job of this type could be done more economically by the *broaching process.* The illustration at left shows how the part was tooled up on a CINCINNATI No. 10-66 Single Ram Hydro-Broach Machine with receding table.

The secret to the success of this equipment lies in the arrangement of broach inserts. *They are made in three sections, each having a simple curvature. Inserts are mounted on sub-plates, and each section may be independently adjusted.* The opposite faces of two different teeth are broached in one pass of the ram. A hand indexing fixture, operated during the return stroke of the ram (and while the table has receded), holds one sprocket.

CINCINNATI Service Engineers have many years of experience in solving unusual machining problems by the economical surface broaching process. They will be glad to study your production methods for possible improvements.



● CINCINNATI No. 10-66 Single Ram Hydro-Broach Machine. Complete engineering specifications may be obtained by writing for catalog M-886. For a quick picture of these machines, look in Sweet's catalog file for Mechanical Industries.

CINCINNATI

THE CINCINNATI MILLING MACHINE CO. CINCINNATI, 9 OHIO, U.S.A.

TOOL ROOM AND MANUFACTURING MILLING MACHINES... SURFACE BROACHING MACHINES... CUTTER SHARPENING MACHINES

Senate Finance Committee Gives House Tax Bill Close Going-Over

Legislators impressed by widespread demand for enough latitude under revenue law to permit accumulation of reserves to finance postwar rehabilitation of machinery and equipment. Manufacturers cite handicaps

WASHINGTON

DESPITE early indications, the Senate Finance Committee now has much more than a perfunctory attitude on the subject of the House-passed 1943 revenue bill. When word got around that Chairman Walter F. George (Dem., Ga.) frequently was the only member in attendance at the hearings, practically all of the missing senators showed up—for the members of Congress do not like to get a reputation for slacking on their jobs.

As a result, Vice Chairman David I. Walsh (Dem., Mass.), during the illness of Chairman George, broadcast over the radio recently that the House bill was full of bugs and that the Senate Finance Committee proposed to tear it apart. Later in the week the committee went into executive session and since then the process of revision has been under way. Chances are the revised bill will be reported out the latter part of this week.

First off-key note was encountered when representatives of some 16,000,000 bowlers in the United States complained about the proposal to change the tax from $10 per bowling alley to one of 20 per cent of the charge for each individual game. It was pointed out that this would break a precedent and for the first time tax participants in a sport rather than spectators. It further was pointed out that 70 per cent of bowling is the recreation of people in the white collar class whose incomes have not kept pace with the generally rising trend of wages. Bowling was shown to be the leading sport participated in by $50 a month soldiers and sailors.

Postage Increase Protested

Another thing that impressed senators was the widespread demand for enough latitude under the revenue law to permit accumulation of money for the repair or replacement of equipment wearing away at a rapid rate under wartime pressures. These demands came from the railroads, truckers, hotel operators and many similar services which do not have the time, labor or the materials with which to make replacements or with which to maintain adequate maintenance.

The committee was impressed when shown that the House-approved whiskey tax increase of $3 per gallon would tax the poor man's drink double that of the tax on the rich man. For the man who can pay only $3 a bottle this is a hidden sales tax of 20 per cent, whereas for the man who buys a $6 bottle the tax comes to only 10 per cent.

Also developed at the hearings was the fact that the proposed increase in postage rates, money order rates and so on was not carefully and scientifically worked out. The point was made that the proposed rates would hurt manufacturers and merchants who rely largely on third-class postage in sending out letters, literature and other matter necessary, particularly in a mail order business.

Penalizes Incentive Wages

Here are some of the criticisms and suggestions made to the committee:

By James F. Lincoln, president, The Lincoln Electric Co., Cleveland—"There are two things wrong, from the point of view of the industrialist, with the present proposed tax law as we see it. The first is that it eliminates or penalizes incentive payment of wages. Incentive payment of wages of itself is a tremendously helpful thing in the production of war products. The second thing, by renegotiation it penalizes the efficiency of the operation."

Mr. Lincoln said that these factors combined to raise the cost of war production and to lengthen deliveries and create a manpower shortage. He thought one of the things of even greater importance was the fact that "the postwar condition of industry in which they have to meet world competition is tremendously handicapped because inefficient methods are being developed during the present time which will stand us in bad stead at the end of the war."

Senator George, in commenting on testimony of Col. Willard F. Rockwell, chairman, Timken-Detroit Axle Co., Detroit—"Arbitrary power ruins even good men like Under Secretary Patterson and Under Secretary Forrestal. They want to be good and just, but arbitrary power will ruin them and ruin the citizen in the process. I agree with you fully on this Renegotiation act. If I had it in my power I would throw it out entirely and rely absolutely on the taxing laws. In the beginning there was some excuse and reason for it, because excess-profits taxes were not so high, and the government was engaging in new businesses or engaging in a volume of old business in which it had had no previous comparable experience. But that time certainly is past."

By M. D. Harbaugh, Cleveland—"Depletion was never intended to cover expenditures for facilities for mining, and expenditures which are simply advance costs of mining. Such items should be considered as allowable deductions, separate and apart from depletion; either through depreciation (to the extent appropriately allowable as depreciations of improvements), or as mining costs to be charged off either when incurred, or as deferred costs when the mineral benefitted is recovered. Section 114 (b) (4) of the bill should be amended by adding the following sentence:

" 'Such depletion allowance shall be exclusive of and in addition to the return of costs of development (incurred subsequent to exploration resulting in the initial discovery), whether such costs be charged to expense in the taxable year or deferred subject to extinguishment when the mineral benefited is recovered.' "

By Lucien W. Shaw, assistant to the president, Lockheed Aircraft Corp., and spokesman for the Aeronautical Chamber of Commerce of the United States Inc.—"The demand for planes has forced the aircraft companies to expand their volume way beyond what sound business management would have dictated. The only protection which they can have against these forced risks is sufficient profit or reserve which can be set aside to provide for contingencies when they arise. The figures show that the tax structure and renegotiation have not made a sufficient allowance for this purpose. The aircraft industry should be permitted to deduct 20 per cent of net income for a postwar reserve . . . . As to renegotiation, we cannot understand the logic of a system which allows the Boeing Aircraft Co. a profit after taxes and renegotiation of 2.1 per cent on sales and allows DuPont 13.8 per cent, General Motors 8.3 per cent."

Wants Machine Tools Exempted

By Tell Berna, National Machine Tool Builders Association—"This nation had, in 1938, about 900,000 machine tools. By the end of 1943 it will be around 1,800,000. About 200,000 machine tools have been shipped abroad through 1939-1943, thereby greatly reducing the hope of the industry for export markets after the war. To survive the period during which the nation will absorb the machines already built, to redesign their product and make it even better than it is now, machine tool builders must have reserves. The effect of draining large sums in cash from practically every machine tool company by renegotiation is to guarantee the extinction of most of the industry soon after the war. The bill under consideration gives the proposed War Contracts Price Adjustment Board the right to exempt standard commercial articles such as machine tools; this provision should be made mandatory.

"The bill says: 'Under the new definition of subcontract, factory supplies such as tools, equipment, typewriters, business machines, etc., are exempt from renegotiation.' I do not believe the proposed amendment will have that effect. In 1942 about half of the orders received by machine tool builders were from contractors acting for and on behalf of the Defense Plant Corp. Legally speaking, these are prime contracts. The new definition of subcontracting will not affect this very large portion of the orders for manufacturing equipment. Purchases for

foreign nations are handled through lend-lease and contracts are placed by the Ordnance Department. These, too, are prime contracts and are not affected by the proposed amendment. Sales of manufacturing equipment to the Defense Plant Corp. agencies and to the Ordnance Department of lend-lease should be made exempt in specific terms.

"According to the amendments, annual business of $500,000 or less is exempt. As we understand it, a contractor whose total 1943 sales are $501,000 will be renegotiated, while his neighbor, doing $500,000 will be immune. It would seem more equitable to make exempt the first $500,000 of business of every contractor.

"Renegotiation should be defined as a recovery of those profits which are found to be excessive after the payment of taxes. To report that a company has been allowed to retain 10 per cent on 1942 sales certainly sounds as if the board had allowed a very generous profit. As a matter of fact, that might mean the retention of only 2.7 per cent after taxes, and that residue is the only amount the machine tool builder may consider his profit.

"The bill provides that when the board has made a decision it will notify the contractor or subcontractor in writing and he will have had a determination of the board. This applies to 1943 and later years. With reference to business done in 1942 the amendment provides for an appeal by any contractor or subcontractor aggrieved by a determination of the Secretary made prior to the date of enactment of the Revenue act of 1943 whether or not such determination is embodied in an agreement with the contractor or subcontractor.

"Voluntary Acknowledgment of Guilt"

"May I draw your attention to the plight of the company that signs a so-called agreement before the enactment of this act but does not get it back signed by the government until after the act becomes law. It has not been the custom of price adjustment boards to put their demands in writing; legally speaking he does not have a determination of the Secretary made prior to the date of the enactment of the Revenue act of 1943. He may not be able to prove the verbal demand. The wording of the agreement he has signed, perhaps under duress, is in the form of a voluntary acknowledgment of guilt and restitution of excessive profits.

"The paragraph further provides that if he is aggrieved by a determination of the Secretary made after enactment of the act, he may appeal, but only if the determination is not embodied in an agreement. The Secretary need only sign the incomplete agreement, and the contractor or subcontractor has no right to appeal.

"May I suggest that the right of appeal be extended to contractors under these circumstances?"

By Pearce F. Boyer, vice president and comptroller, Republic Steel Corp., Cleveland—"Republic Steel is on the invested capital basis for excess-profits taxes. It has capital invested in its business of approximately $300,000,000 and, therefore, falls in the class of corporations which will be adversely affected by the proposal contained in the House bill to lower the invested capital credit before excess profits taxes from 6 to 5 per cent, and from 5 to 4 per cent on substantial parts of its capital. I am here to protest this proposal as well as the proposal to increase the excess-profits tax rate from 90 to 95 per cent. If these proposals are adopted it will mean that Republic can earn only $2.84 net on each $100 of invested capital before the balance of its earnings, if any, are classed as excess profits and taxed at 95 per cent.

Declares Return Inadequate

"This return is inadequate and will embarrass the company seriously in its financial and dividend policies; will seriously interfere with essential provision for postwar conversion and rehabilitation of its facilities and, above all, will cripple it in its hopes and plans to give back jobs to the 17,000 of its employes who are now in the armed forces, not to mention jeopardizing the interests of 65,000 present employes and over 60,000 stockholders and bondholders."

Alben W. Barkley, left, of Kentucky, majority leader of the Senate, confers with Sen. Walter F. George, Georgia, chairman of the Senate Finance Committee, which now is holding hearings on the 1943 revenue bill. NEA photo

Lincoln Electric Co. Pays Year-End Bonus To Workers

Government restriction prevented larger "incentive payments" to employes of Lincoln Electric Co., Cleveland, President J. F. Lincoln said recently in distributing year-end pay checks aggregating $2,920,000, or an average of $2250 for each of the 1300 employes.

The checks ranged from $25 in the case of a new employe, to $50,000 for an engineer, who developed a new type welder which cut the production cost nearly 50 per cent. Ninety per cent of the distribution went to factory and office workers.

Since the bonus incentive system was inaugurated in 1934, the company has distributed $12 million.

PRIORITIES–ALLOCATIONS–PRICES

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

INSTRUCTIONS

MRO RATINGS: Blanket MRO ratings of AA-1 and AA-2 may not be used, according to direction No. 5 to priorities regulation No. 3, to purchase chemicals or other materials included in the list attached to the order. The direction does not affect use of the AA-5 blanket MRO rating for purchase of the specified chemicals.

The following ratings may be used for the materials contained in the list: AA-2X by persons eligible to use an AA-1 preference rating; AA-3 by persons eligible to use an AA-2 rating; ratings for production materials to be physically incorporated in a product or construction project may be used to get the materials in the list for MRO for use in the production of that product or construction project. (Any materials so purchased must be deducted from the MRO quota under CMP regulation No. 5 or any other regulation or order which placed a quota limit on MRO purchases.); any rating assigned by a preference rating certificate which specifically names the kinds and quantities of the items rated may be used.

Orders scheduled for delivery before Jan. 1, 1944, of chemicals or other materials included in the list need not be rerated, but orders for later delivery must be reported in accordance with provisions of the direction. Persons unable to obtain material or MRO supplies with their assigned ratings may apply on form WPB-541 to the nearest local WPB office for a higher rating.

CANS: Substitution of tinplate waste-waste for frozen tinplate has been authorized in cases where frozen tinplate is specified as a can material for packing a product under order M-81.

TRUCK TRANSFERS: All holders of certificates of transfers or government exemption permits have been directed to exercise their permission to acquire new trucks under the provision of these documents by Dec. 31, or return them to the WPB for cancellation or revalidation. Those permits which have been issued under order M-100 but not exercised prior to Dec. 31 may be revalidated by the WPB for use within a maximum period of 60 days after Jan. 1.

HAND-BRAKE WHEELS: Railroads can obtain malleable hand-brake wheels for freight cars only for maintenance and repair of their rolling stock. They cannot be used in converting from the old non-geared type of brake to the modern geared type. This was provided in direction 1 to preference rating order P-142. Action was taken because of a critical shortage in the supply of malleable iron castings and a mounting backlog of manufacturers' orders for this material.

PROCESSING MACHINERY: Permission to install processing machinery or equipment or to relocate all kinds of machinery or equipment has been granted to factories, plants and other industrial units having a productive floor area of 10,000 square feet or more which do not make products listed on schedule A of L-41. The amount spent in construction is not limited to, and need not be deducted from, the amount allowed for construction under paragraph C of L-41.

MRO ratings and allotments may be used by persons on schedule 1 and 2 of CMP regulation No. 5 to get the installation materials required for these jobs.

CONSTRUCTION EQUIPMENT: Automatic AA-1 preference ratings are assigned to the Foreign Economic Administration for repair parts needed to rebuild and recondition used construction equipment to be shipped overseas for use in strip coal mining. The same ratings are assigned for spare parts that are shipped with the equipment. This action was taken by direction 1 to order L-192. Repair and spare parts purchased under the direction are exempted from restrictions on sale and delivery established by L-192.

CMP PRODUCTS: "Official CMP Class B Product List and Class A Civilian Type End Product List," issued May 15, 1943, no longer will be used. Its place will be taken by publication in "Products and Priorities" of the "Official CMP Product List," brought up to date monthly.

L ORDERS

OFFICE FURNITURE: Order L-13-a has been amended to assure continued control over production and distribution of all restricted types of metal office furniture and equipment, regardless of whether such furniture is used in an office or elsewhere. Metal tool cases continue to be excepted from prohibitions of the order, but they now will be interpreted as including tool room shelving inserts, used to protect edged tools and to store critical machine shop items. Metal time card racks have been omitted from order L-13-a since they are under jurisdiction of order L-54-c. Inventory reports henceforth are to be filed quarterly on form WPB-1600 (L-13-a)

INDEX OF ORDER REVISIONS

FURNACES: Carbon steel inner liners for new furnaces installed in new buildings or additions to old buildings are now permitted. Manufacture of feed door smoke curtains, feed door inner liners, hot blast lift doors and upright shaker handles from cast iron is now permitted. Furnace manufacturers must file a monthly report on form WPB-3316, containing information concerning production, shipments, unfilled orders and estimated future production. (L-22)

LIGHTING FIXTURES: New fluorescent lighting fixtures now may be bought under blanket MRO ratings, including ratings extended under CMP regulation No. 5, only if purchase orders carry ratings of AA-1 or AA-2. (L-78)

NATIONAL EMERGENCY STEEL PRODUCTS: Schedule 12 of order L-211 provides that all steel heat exchanger, condenser, evaporator and similar tubes be hydrostatically or non-destructive tested hereafter. (L-211)

INDUSTRIAL BRUSHES: Size and other markings may be stamped on brush ferrules so long as no special or additional manufacturing operation is required. Minor changes have been made in manufacturing specifications for ferrules; and the type of brushes on which they may be used is stipulated. Maximum variation in the permitted width and thickness of ferrules has been reduced from 1/64-inch to 1/32-inch. (L-251)

FARM MACHINERY: Total permitted tonnage of farm machinery for export to Canada during the current year has been increased slightly. Certain items have been added to the export list in accordance with requests from the Canadian administration. (L-257-a)

WELDING EQUIPMENT: Regulations requiring all owners of idle used resistance welding equipment to register such equipment with WPB have been relaxed. Hereafter, owners need register such equipment only on specific requests from WPB on form WPB-4732. (L-298)

INSECT SCREEN CLOTH: Manufacture of steel insect screen cloth has been limited to the width, meshes, etc. set forth in schedule I of order L-303. Producers may not discriminate in accepting orders from persons who meet their regularly established prices and terms of sale. Producers must supply customers needs periodically without regard to the customer's size, location, or affiliated outlets. They must file quarterly summaries of proposed shipping schedules by letters, showing total quantities scheduled for shipment to dealers and to screen manufacturers. First reports are due Dec. 28 and subsequent reports are due 15 days prior to the beginning of each calendar quarter. Effective date for simplification and stadardization of production is Dec. 28. (L-303)

M ORDERS

ZINC DUST: Number of applications that will be required hereafter for zinc dust has been reduced. The volume of the product which may be purchased without authorization has been increased by about 50 per cent. Requirement that consumers forward allocation certificates to the supplier for endorsement has been eliminated. (M-11-L)

BALE TIE SCRAP: Supplementary order M-24-d which channeled all cotton bale tie scrap to the reworkers has been revoked. This action was taken because of the heavy carryover of reworked ties, the short cotton crop, and the need for scrap by steel producers. (M-24-d)

TINNED AND DETINNED SCRAP: Methods of collecting and utilizing tin cans in a group of counties in Kansas, Missouri and Texas have been changed. Henceforth, tin cans from the specified counties will be used for recovery of their tin coating and carbon steel base, rather than being collected, shredded and shipped to copper mines. Shredding plants in Kansas City, Houston and Dallas will close down. (M-325)

U ORDERS

UTILITY EXTENSIONS: Electric and gas utilities have been authorized to build short line extensions to serve a substantial number of consumers who have been unable previously to obtain service. The restriction has been removed from U-1-f which had prohibited extensions to persons living outside critical housing areas, except when built as a part of a war housing project. Many types and sizes of wire from excess inventories which were previously frozen have been made available for use by utilities. Steel wire primaries no longer are required in rural construction and, in addition, construction standards for all types of utility construction have been altered to permit more extensive use of now idle material of other kinds.

Supplementary order U-1-b has been revoked and is superseded by U-1-d and U-1-f which retain the substance of the revoked order. Minor changes have been made in orders U-1-a, U-1-c, and U-1-d. (U-1-a, -c, -d, -f)

PRICE REGULATIONS

CAST IRON SCRAP: Scrap dealers no longer

are required to absorb inbound rail transportation charges on heavy breakable cast scrap which has been allocated or which they have purchased in behalf of a foundry consumer. He may pass on to the buyer the rail transportation charges accruing for moving the material from its point of origin to his yard for preparation into No. 1 cupola cast scrap.

The intransit preparation provisions may be applied on purchases of heavy breakable cast scrap originating in the states of Montana, Idaho, Wyoming, Nevada, Utah, Arizona, New Mexico, North Dakota, South Dakota, Nebraska, Colorado, Kansas, Oklahoma, Texas and Florida, even though the material is unallocated. (No. 4)

HINGES and BUTT HINGES: A 5 per cent upward adjustment of maximum prices for sales of hinges and butt hinges by manufacturers and resales by jobbers has been made. Terminal discounts have been reduced 5 per cent on manufacturers' sales to jobbers while discounts to contract distributors have been frozen at levels at least as favorable as those prevailing on Oct. 1, 1941. (No. 413)

Rules on Freight Factor In Warehouse Steel Prices

Warehousemen and other resellers of iron and steel products have been provided by the Office of Price Administration with an interpretation concerning the freight factor used in computing ceiling prices. "Rail rate of freight" was given definition by OPA on Nov. 1, 1943, but some uncertainty had arisen as a part of their dollar-and-cents maximum delivered prices.

The interpretation said in part:

The "rail rate of freight" defined as the lowest filed or published rail tariff rate, affects the pricing of all products covered by price schedule No. 49 (Resale of Iron or Steel Products) with the exception of oil country tubular goods. The filings or publications of rates and rules of rail carriers include a statement to the effect that the charge for a less-than-carload shipment must not exceed the charge for a minimum carload of the same freight at carload rates.

The rail tariffs speak of the lowest charge for the shipment; that is, for the total quantity. The ceilings provided in the OPA schedule are generally per 100 pounds. It is necessary, therefore, after determining the total charge for freight under the rail tariffs to divide such charge by the actual quantity involved to determine the applicable rate per 100 pounds in computing maximum prices.

Flow Meter and Combustion Control Output To Be Cut

Production program in 1944 for the differential type flow meter and combustion control industry will be somewhat less than half of the 1943 production program, it is indicated by data submitted to the industry advisory committee by E. A. Capelle, chief, Industrial Instrument Section, Radio and Radar Division, WPB. Since productive capacity in this field now exceeds visible requirements, discontinuance of scheduling for the production of these products has been recommended.

Restrictions Eased on Transfer Of Certain Fabricated Articles

Inventories made idle by contract modifications or terminations may be sold, if WPB regional directors grant approval, to distributors or wholesalers who submit specified certifications. . . . Inventory restrictions under L-63 also waived

ACTION to move into regular distribution channels inventories of fabricated articles or components made idle by contract modifications or terminations has been taken by the War Production Board. This program, initiated by Col. C. R. Baxter, director, Redistribution Division, has been approved by the WPB operations council.

Under a delegation of authority, signed by J. A. Krug, program vice chairman, each of the WPB regional directors has been authorized to waive restrictions which have limited transfers of such articles and components.

Approval will be granted by the regional directors for transfers of idle material reported to WPB. Sales may be made only to a distributor or wholesaler who certifies that he is regularly engaged in the business of selling the material in the form in which it is being acquired. The authority covers materials other than "industrial materials" as defined in priorities regulation No. 13.

The items affected, therefore, are fabricated articles or components rather than raw materials. Each regional director may act only with respect to material physically located within his region.

The transfers permitted are limited also as follows:

The material must have been listed, including an adequate description, with the regional office; material subject to the control of directive 16 (pertaining to aircraft inventory transfers) is not covered by the delegation, until the sale has been approved by the aircraft resources control office or the aircraft scheduling unit; material rejected by any of the services is not included.

It is not intended that the materials acquired by distributors as a result of such special transactions will be deducted in processing PD-1X applications for similar materials from normal sources of supply.

The restrictions which are waived are contained in priorities regulation No. 1, which requires holders to use or dispose of materials obtained with priorities assistance on a preference rating of AA-5 or higher, or a rating equivalent to that originally used to acquire materials. Under these conditions, and particularly in view of changed contracts resulting from shifting war demands, holders of materials often have experienced great difficulty in finding allowable interested buyers.

The delegation of authority also waives restrictions imposed by order L-63, which normally limits inventories, so as to permit distributors and wholesalers to accept material purchased under the program.

Priorities regulation No. 1 already provides for the re-delivery of materials to the persons from whom obtained.

New Standards Approved for Jacks and Pipe Fittings

A new American Standard has just been approved which brings together in one document the various standards covering pipe plugs, pipe bushings, pipe caps, and locknuts. The combined standard is known as "American Standard for Ferrous Plugs, Bushings, Locknuts, and Caps with Pipe Threads (B16.14-1943)."

Sections which cover pipe plugs were published originally as American Standard B16e-1936. Dimensions of the square heads and the sockets of the plugs are made to conform to the sizes of standard open-end wrenches and to maximum dimensions of standard hot-rolled steel bars, respectively.

American Standard dimensions for bushings and locknuts were included originally in the "American Standard for 150-pound Malleable-Iron Screwed Fittings (B16c-1939)."

American Standards Association also has announced approval of a new standard, "Safety Code for Jacks (B30.1-1943)." It applies to the construction and use of all portable, manually operated jacks, except those which are supplied with automobiles as part of standard equipment; it covers lever and ratchet, screw and hydraulic jacks.

Employment in Construction Industry Continues To Drop

Current decline in construction will have released an additional half a million men for other employment by next midyear, the War Manpower Commission predicts. Construction employment has fallen steadily from its wartime peak of 2,190,000 men in the fall of 1942 to about 1,066,000 in the same period of this year. Indications now are that the decline will continue to about 600,000 or 700,000 in January, 1944, and to 500,000 or 600,000 in July, 1944. Between July and November of this year, more than half of 267,000 construction workers released were in areas of acute labor shortages.

THESE FELLOWS ARE ALWAYS LOOKING FOR TROUBLE

—so they can prevent it! They're the "watch dogs" of our Heat Treating Processes, where good bearings get off to a good start. Theirs is a roving commission, *re*-checking the checking done by the regular inspectors—to make doubly sure each step of the Heat Treatment of Hyatt Roller Bearings produces perfect results.

'Round the clock, 'round the year, they're on the job, looking for trouble—to save *you* trouble. They've worked out a series of continuing tests covering every phase of Heat Treatment. Some are repeated every 15 minutes, others several times an hour—some take only several seconds, others several hours. All are important... as is every test in precision bearing manufacture.

So important, in fact, that one out of every 6 Hyatt employes devotes his time to testing and inspection in various stages of manufacture.

Sound like a lot of work? It is—but worth it when you remember that more than 90% of all Hyatt Roller Bearings made today go directly into fighting equipment or the machinery that helps build it.

That's why we've *got* to make 'em good. Because Victory is our Business.

Hyatt Bearings Division of GENERAL MOTORS CORPORATION, Harrison, N. J.

Pave the Road to Victory with War Bonds

HYATT BEARINGS DIVISION OF **GENERAL MOTORS**

By A. H. ALLEN Detroit Editor, STEEL

MIRRORS of MOTORDOM

Heavy truck program toughest job for motor industry in 1944. Principal bottlenecks are in foundry, forge shop and machining facilities. . . General Motors doubles ante for postwar conversion of facilities to a total of $500,000,000

TOUGHEST job ahead of the motor industry at the moment is the 1944 truck program, involving unprecedented numbers of outsize heavy-duty units for military purposes. Engineers are working overtime on new designs, suppliers are being combed for essential components and facilities in general reshuffled to make way for putting what were formerly custom-built vehicles into mass production.

Six, eight and ten-ton trucks, while nothing new to the industry, have never been required in any great numbers, but with the Army's realization that the self-sufficiency of its field divisions would be considerably enhanced with a fleet of a few-score heavy-duty bruisers, instead of the hundreds of ½ to 1½-ton transports, truck builders have had their work cut out for them.

Principal bottlenecks are in respect to foundry, forge shop and machining facilities. Malleable castings have been given top priority for trucks and numerous other uses restricted in the interests of expediting truck castings. New facilities are under way, such as the foundry to be operated by Saginaw Malleable at Danville, Ill., for supplying castings to the nearby Standard Steel Spring Co. plant which will build new heavy axle units.

Plan Construction of More Buildings

Additional contracts for axle forgings for heavy trucks are requiring the immediate construction of three buildings adjacent to the Oldsmobile forge shop in Lansing, Mich., at a cost of several million dollars. Expansion will include a heavy forging unit, a heat-treat unit and a two-story building to be used for die shop, personnel office, cafeteria and locker facilities. Including a steel storage yard, the addition will extend the present plant area by 165 per cent on the north and west sides of the present forge shop, itself built within the last few years. The plant originally was destined to produce automobile crankshafts by hot pressing instead of the usual impact forging, but never got under way on this project because of the incidence of war and the demands of the combat tank program.

Scheduled for completion some time this spring, the expanded Olds forge plant will rank as one of the most modern in the country and an estimated 500 more employes will be needed.

Another new forge shop, still not 100 per cent completed, is that of Timken-Detroit Axle Co., on which construction started early in 1942. Delays on materials and equipment have held back both this $4,000,000 forge shop and a $6,400,000 axle plant far beyond the originally scheduled completion date of November, 1942.

Total number of units involved in the huge Army program was at one time estimated to be nearly three-quarters of a million, not a particularly large number of trucks as far as previous production of such vehicles is concerned, but almost an impossible number when the preponderance of heavy-duty units is considered. Recently reports have indicated the total has now been scaled back to under half a million.

Axles and transmissions were recognized at once as the critical components in the heavy truck schedule, with engines nearly as bad. Since the heavy trucks are all six-wheel types with all wheels driven, the axle requirements loomed even more of a hurdle. Timken-Detroit and Chevrolet, principal producers, set about, with the assistance of the Detroit ordnance office and the Tank-Automotive Center, to reinforce supply sources drawing in Eaton, Columbia Axle, Hupp, Reo and others. Subcontracting was fanned out widely. The same procedure was worked out on transmissions to ease the load on Spicer, Clark Equipment, Fuller, Borg-Warner and others. Kearney & Trecker, milling machine builders in Milwaukee, were called in to assist on transmission construction.

Difficulties are by no means entirely worked out of the truck production plan, but it is still a No. 1 "must" as far as the Army is concerned. Sudden fly in the ointment was the appearance of Maj. Gen. Lucius D. Clay, director of materiel for the War Department, before the Senate Finance Committee with charges that an $89,000,000 contract with Timken-Detroit for axles, approved by the Detroit ordnance district, was being held up because of "entirely unreasonable" profits involved. He said the profits accruing to Timken-Detroit on the contract would have amounted to $4,368,000, with an additional $6,336,000 to Standard Steel Spring, operating as subcontractor for Timken-Detroit.

As in so many cases of government or Army officials appearing before congressional committees with apparently incriminating charges against industry, the whole story was not told. Timken-Detroit officials point out that the contract was set up on the basis of "target" prices subject to readjustment after 40 per cent of the contract had been filled; further, that these preliminary prices necessarily were higher than those which might be quoted in a regular axle production contract, because of the risks involved and lack of sufficient data to determine what actual costs would be.

Contract Subject to Renegotiation

In addition, the axle builder notes that the contract is subject to normal renegotiation procedure as are all other war contracts. When originally drawn up and approved by the Detroit ordnance district, it was understood that the contract would permit profit of around 5 per cent for Timken when true costs had been established. General Clay's charges may prove to be just a red herring drawn across the business, because the contract had already been signed Oct. 28 and the government has made advance payments of $750,000, apparently indicating approval by the fiscal division.

Corollary to the charges by General Clay, which were re-echoed for popular consumption by Under Secretary of War Patterson, Timken-Detroit claims that if the War Department had acted on its advice early in 1942 there would have been no shortage of heavy-duty axle manufacturing facilities and no need for the present "involved" contract. It was at this time that the Detroit company recommended construction of additional plant capacity, and a letter of intent was received from the government approving the axle plant and forge plant previously mentioned. However, various delaying actions have resulted in these plants still being incomplete.

In respect to Secretary Patterson's charge that Timken-Detroit under the contract is producing nearly its standard product, Timken adds that the secretary "fails to appreciate that this very fact entitles us to a larger margin of profit than war manufacturers who started in business in 1940. It is possible that before the war ends there

CAN'T CUT WAGES

The wage stabilization program is not a one-way street. Wage decreases are just as illegal without War Labor Board approval as are certain wage increases, employers were reminded when the Fifth Regional War Labor Board cited the Dixie Sales Co., Cleveland, for allegedly reducing some commissions, and eliminating others paid to three driver-salesmen.

Philip Fusco, regional WLB attorney, said executive order 9250 clearly states wage rates may be neither increased nor decreased without War Labor Board approval.

"Of course, under the board's general orders issued from time to time," he said, "automatic approval has been given to certain type of wage adjustments."

will be 10 to 15 years' supply of trucks from 2½ to 10-ton capacity which will hang as a threat over the commercial market. Even now the government is selling obsolete trucks to the public. Our postwar business is being jeopardized by every effort we make to increase the output of these units."

On top of the military truck program is an ambitious civilian truck schedule or authorization, totaling approximately 123,000 units. Final allocations are as follows, after revision of preliminary breakdowns: Autocar, 2727; Brockway, 1237; Chevrolet, 33,122; Corbitt, 200; Dart, 179; Diamond T, 2997; Dodge, 10,387; Duplex, 10; Euclid, 522; Federal, 2034; Ford, 28,149; General Motors, 9851; International Harvester, 19,683; Kenworthy, 291; Koehring, 59; Linn, 20; Mack, 4505; Oshkosh, 252; Peterbilt, 317; Reo, 1594; Sterling, 510; and White, 4442.

Bus Construction Authorized

Authorizations for bus construction also have been made, totaling around 7000 for the full year of 1944. They break down to: Beaver, 200; Beck, 200; Brill, 4; Crown Body, 60; Fitzjohn, 200; Flexible, 415; General Aero, 400; General Motors, 1500; Gillig, 4; Kalamazoo, 100; Kenworthy, 40; Mack, 4; Reo, 400; Southern, 60; Superior, 400; Transit Buses, 8; Ford, 1920; Twin Coach, 6; and White, 800.

However, there is going to be considerable carryover of 1943 bus authorizations into next year, because only about one-third of those authorized for this year will have been completed. And, with 2000 more carried over into 1944, there may be some of the 1944 authorizations slopping over to 1945.

General Motors has upped its projected ante for postwar plant conversion expenditures from an originally reported $250,000,000 to an aggregate of $500,000,000, according to a recent address by GM's chairman, Alfred P. Sloan, in New York. Analyzing the corporation's sizeup of the postwar market, he said: "Let us assume, as a prewar base, a national income of 65-70 billion dollars. Under the postwar circumstances, a new base of 100 billions of the same dollars should be a reasonable objective. We then determine the potential volume of each of our products or services, both old and new, and on the basis of the expanded production opportunity, recognizing that each item of necessity has a different elasticity of demand. The result is a measure of the new operating base and determines the needed economic resources of production, such as manpower, organization, plant and machinery."

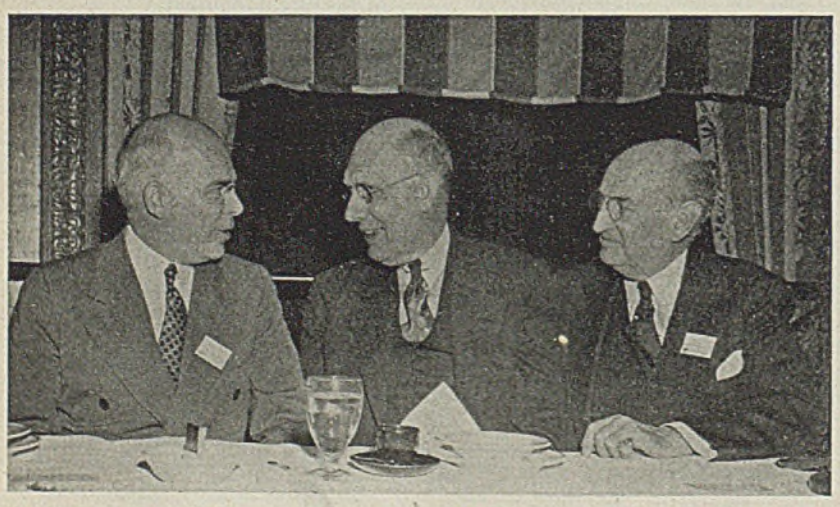
Likening the proposed half-billion expenditure to the "contribution we are prepared to make to help preserve the free competitive enterprise system as the keystone of the American economy", Mr. Sloan further observed: "The responsibility of management of private enterprise from the standpoint of its longer pull position must involve, as its most fundamental concept, technological progress. That is the great instrumentality that enables real gains to be made throughout the system as a whole. That point can never be overemphasized.

"Therefore, research and engineering developments must be encouraged. There is no limit. Research should not be confined to the physical sciences. It must be applied, and aggressively, to all functional activities of enterprise.

"The wage rate must be recognized and dealt with, not as the predominating issue between two groups, but as one of the most important economic problems involved in the whole economy because of its dominating influence on costs and selling prices. It must be dealt with from the point of view of a proper economic balance between all groups.

"An incentive should apply not only to capital in the form of a profit, but likewise to management and workers. All should have an opportunity to progress directly according to their individual ability and their willingness to contribute."

Field engineers of United States Rubber Co., after extensive tests, report passenger car tires of synthetic rubber, when driven at wartime speeds, showed 90 per cent or better of the tread wear obtained from first-line natural rubber tires.



ENGINEERING LEADERS: Robert M. Gates, left, president of the Air Preheater Corp., New York, is the new president of the American Society of Mechanical Engineers, succeeding Harold V. Coes, vice president of Ford, Bacon & Davis Inc., New York, right. In center is Charles F. Kettering, vice president and director of research for General Motors Corp. Photograph was taken at the association's recent convention in New York

Automotive Engineers To Discuss Postwar Problems

The Society of Automotive Engineers plans to make its annual meeting, scheduled for Jan. 10-14, 1944, in the Book-Cadillac hotel, Detroit, a practical wartime engineering conference including discussion of postwar potentialities of wartime developments.

Featured will be both wartime and peacetime engineering uses of aluminum, magnesium, synthetic rubber, plastics, and steel.

Use of Steel Transmission Wire Saving Vital Copper

Vital stores of copper are being conserved by the production of transmission wire for electric power being made entirely from steel at plants of the American Steel & Wire Co., Cleveland.

Especial care is necessary in selecting raw materials for production of the wire and extremely high control is maintained in making it, rolling the rod and drawing of the wire. A heavy coating of zinc is applied for corrosion resistance.

SAE Reorganizing Iron and Steel Group To Speed Work

Reorganization of the Iron and Steel division of the Society of Automotive Engineers' Standards Committee, New York, is being made to speed up action on wartime and postwar problems of standardization through quick decisions by a wider representation of producers and users.

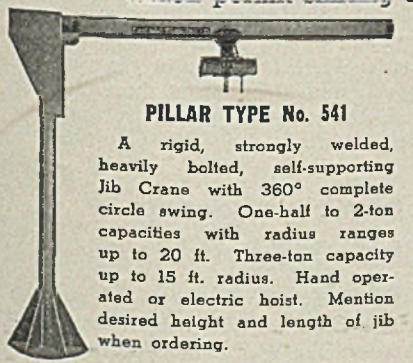
Start will be made, effective next year, with ten product panels representing steel producers, iron and steel castings, aircraft, tractor, agricultural and earth moving equipment, automotive vehicles, power plants, gears and power trains, springs, and antifriction bearings, and general users.

Steel Plant MANAGERS:

YOUR FOUNDRY AND STEEL STORAGE ROOM OPERATE AT TOP EFFICIENCY WITH OVERHEAD CRANES SERVING THE ENTIRE WORKING AREA!

Photo Courtesy Weidenmiller Foundry Corp., Chicago, Ill.

★ Above illustration of overhead transfer cranes is typical of the manner in which loads may be transferred from one or more points to *any* point-of-operation in the foundry . . . from furnaces to pouring. Note how the runways extend the full length of the building with various transfer points which permit shifting of hoists from one crane to another. Likewise, Chicago Tramrail Overhead Cranes may serve any number of building bays in steel plants, in steel storage rooms, resulting in a speedy lift in production with a sharp let-down in handling costs. Such an installation is your best answer to more efficient crew operations, reduced worker fatigue, more production in the face of labor shortages.



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WING TIPS

More than 70 basic types of aircraft instruments and engine components in straight line mass production at rate of 375,000 units monthly achieved by Bendix Aviation and its subcontractors since Pearl Harbor

STRAIGHT line mass production of more than 70 basic types of aircraft instruments and engine components at a current rate of more than 375,000 units per month—has been achieved since Pearl Harbor by the Eclipse-Pioneer division, Bendix Aviation Corp., and its subcontractors, Raymond P. Lansing, vice president, revealed last week.

The division, he stated, now is a center for engineering, development and volume manufacture of the greatest variety and volume of precision aircraft equipment produced in world history.

Measured by dollar volume, the division's total monthly deliveries to the armed forces have increased more than 7 times pre-Pearl Harbor levels, while unit deliveries have in many instances exceeded 1941 levels as much as 200 times, it was disclosed by Kenneth MacGrath, general manager.

Pursuing the corporation's nation-wide policy of passing on the benefits of reduced costs resulting from increased and more efficient production, the Eclipse-Pioneer has effected price reductions to the government totaling $18,000,000 since Pearl Harbor, Mr. MacGrath said.

Stemming from predecessor companies established as early as 1912, the division is one of the largest units of the Bendix corporation, which operates 30 plants from coast to coast.

In two years of war, Mr. MacGrath said, the division has doubled its operating floor space and total number of employes in its own New Jersey plants and has added 35 subcontractors to meet demands of the air forces for such vital equipment as aircraft engine starters, generators, air and hydraulic pumps, auxiliary power units and a complete line of flight and remote indicating instruments.

Five new plant structures, in addition to nine already in operation before America's entry into the war, have been purchased, built or rented in nearby New Jersey communities to accommodate expanded production, foundry and other activities.

Since Pearl Harbor, Bendix engineers have concentrated on developing special production equipment designed to make possible efficient performance by newly trained workers and by subcontractors whose previous manufacturing was far removed from aircraft products.

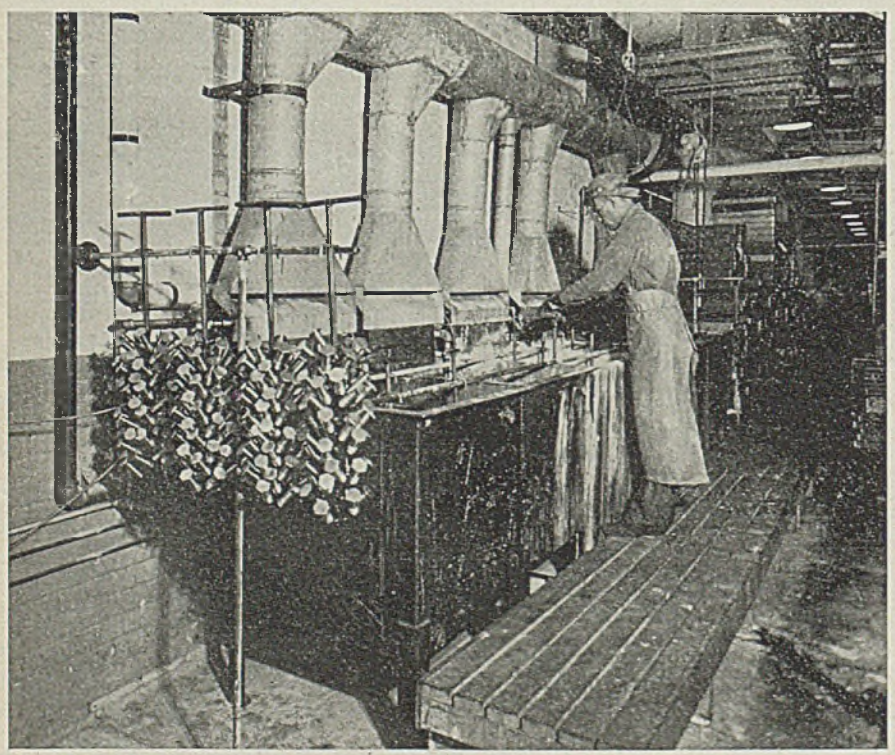
As a result, he said, more than 40 per cent of production operations formerly done by hand by skilled workers now are automatic or semiautomatic and more than 30 per cent of the division's total employes are women, hundreds of them trained since Pearl Harbor.

To break bottlenecks in its portion of the nation's vastly stepped-up aircraft production program, Mr. MacGrath said, the division's methods experts and "machine wise" shop workers since Pearl Harbor have:

(1) Designed or specially built 476 machines to simplify manufacturing processes.

(2) Created approximately 30,000 special tools or modifications of tools to lessen production problems.

(3) Provided approximately 20,000 tools and as many as 40 "model" machines to subcontracting firms.



Small aircraft engine parts like these at Republic Aircraft division, Aviation Corp., Detroit, are suspended from racks at the head end of the process tanks before they are "penetrated". Penetrating is a salt-mixture controlled oxidization process applied to ferrous metals, giving a lustrous black finish which adds to the durability of the metal surface and has marked antifriction and antirust qualities

Aircraft Engine Parts Treated by "Penetration"

Six-tank production line now applies the "penetrating" process to small aircraft engine parts at Republic Aircraft Products division, Aviation Corp., Detroit. Penetrating is a salt-mixture controlled oxidization process applied to ferrous metals, giving a lustrous black finish which adds to the durability of the metal surface and has marked antifriction and antirust qualities.

First step in the treatment is immersion of the parts in a mixture of alkali cleaner and water at a temperature of approximately 180 degrees Fahr. From 15 to 25 minutes' exposure removes all oil and grease. Tank No. 2 is a hot water rinse into which the racked parts are dipped twice by hand to wash away traces of the cleaner. The third tank contains the penetrate solution, heated to a temperature of from 285-290 degrees. The parts are given their first exposure to the salt mixture in this tank for 25 minutes. They are then transferred to tank No. 4 containing a second batch of penetrate solution at from 302-304 degrees.

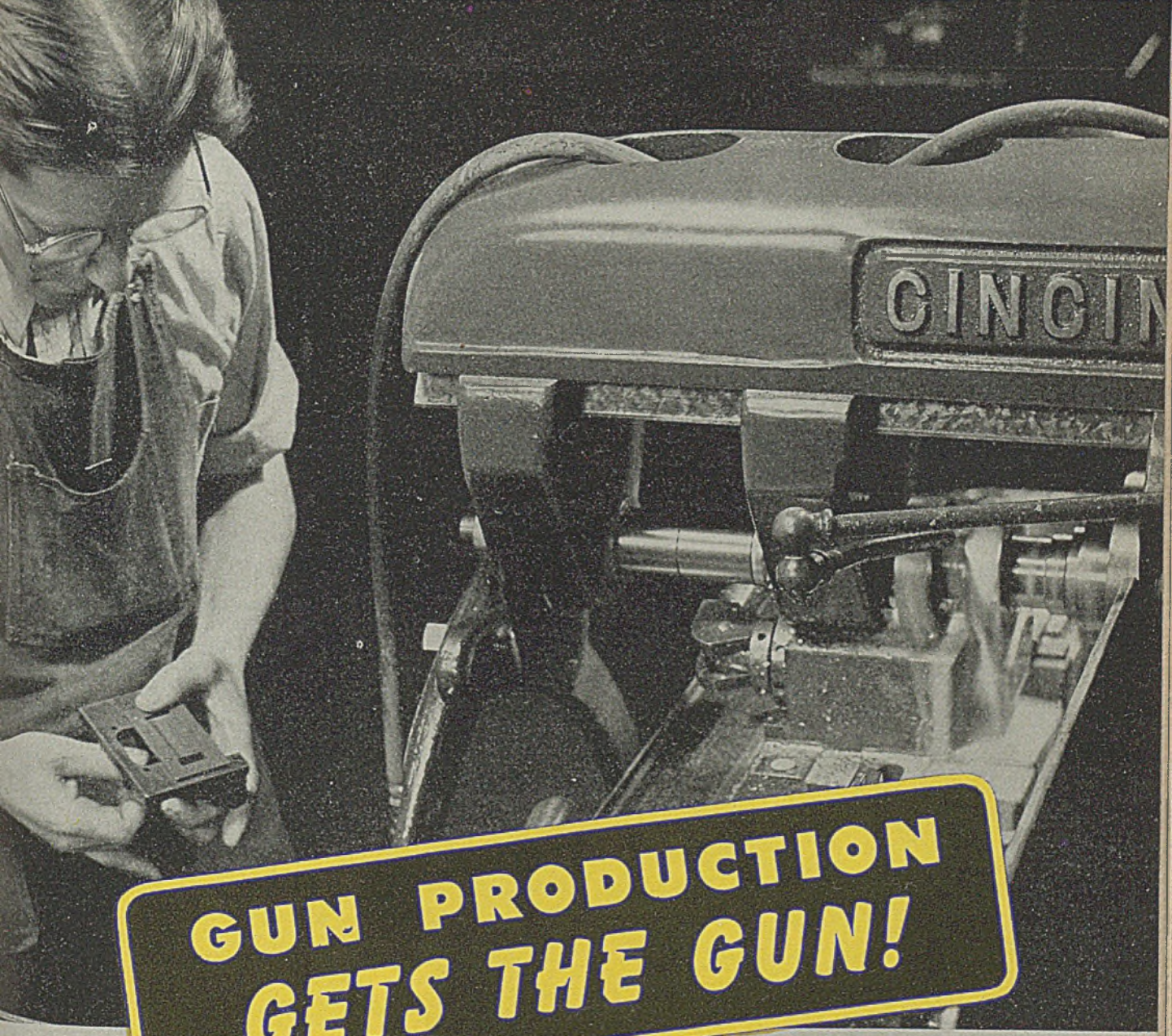
A cold water rinse in tank No. 5, to which the parts are next exposed for another 25 minutes, is agitated by air to remove all traces of free penetrate deposit.

The sixth tank contains a mixture of soluble oil and hot water at a temperature of 180 degrees. A final 25-minute exposure to this mixture provides an oil coating for the surface of the part. Removed from this tank at the end of the line, the treated pieces are hung on racks to drain and cool.

Columbium-Bearing Steel Use Restricted

Operating Committee on Aircraft Materials Conservation, Aircraft Production Board of the War Production Board, has issued directives restricting the use of columbium-bearing corrosion-resisting steel, limiting the use of precision antifriction bearings, and liberalizing restrictions on use of corrosion-resisting steel in aircraft firewalls.

Due to the critical nature of the sup-



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increases cutter life . . . improves finish . . . cuts costs

The accuracy and speed with which American manufacturers are turning out vital parts for automatic guns for our armed forces is a production marvel . . . and Sun Oil Engineers and Sunoco Emulsifying Cutting Oil have a part in it!

One large plant, recently awarded the Army-Navy "E" for outstanding achievement in the production of automatic guns, had been having trouble on an important milling operation. Production was not up to rated capacity and the entire schedule was threatened by this bottleneck.

On the recommendation of a Sun Cutting Oil Engineer — a Doctor of Industry — they changed from the competitive product they were using to Sunoco Emulsifying Cutting Oil. Sunoco solved their problem! It was stable in emulsion . . . increased cutter life . . . produced a better finish . . . and in addition there was a saving of 25% in cutting oil costs and operators' complaints about skin irritation ended.

In this way — in hundreds of other ways — Sun Doctors of Industry and Sun Cutting Oils are contributing to the production miracle that is winning the war. Let them help you in your plant . . . write . . .

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SUNOCO

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ply of columbium, the use of columbium-bearing corrosion-resisting steel is restricted to applications in aircraft construction where experience has indicated its use essential. These restrictions apply to material conforming to AN-QQ-S-757 columbium type only, and are not effective if titanium is used.

Use is restricted to, but not mandatory for, the following applications: All parts of the exhaust system which come into contact with exhaust gases and which are exposed to high temperatures; supercharger systems; vital engine or engine accessory parts exposed to temperatures in excess of 800 degrees Fahr., during fabrication or service, which during service are subject to severely corrosive conditions or to conditions likely to result in fatigue failures; welding rod and electrodes used in welding the above material.

The corrosion-resisting steel situation in general has improved sufficiently to possibly warrant removal of restrictions on its use in certain applications where difficulty has been experienced in converting to available alternative materials, or where continuation or resumption to the use of corrosion-resisting steel would beneficially affect service characteristics, man-hours required in manufacture, or cost.

An investigation is being conducted by WPB to determine if available supplies of alloying elements and producing facilities are adequate to warrant the removal of current restrictions on its use in aircraft firewalls. Where use of corrosion-resisting steel for firewalls would expedite production or improve service performance, and its use is not permitted under order M-126, an appeal may be made through the usual channels on WPB form 1477.

Need More Antifriction Bearings

The quantity of precision antifriction bearings produced is inadequate to meet the demand. The Operating Committee reports, therefore, it is necessary that plain sleeve type bearings or commercial type ground or unground antifriction bearings be used instead of precision antifriction bearings in all authorized applications.

Precision antifriction bearings conforming to Army-Navy aeronautical specification AN-B-4 shall be used, however, in the surface control systems of all combat airplanes and large transport airplanes as well as in other applications where control forces, accuracy requirements or the necessity for minimum friction indicate their use.

The greatest opportunity for the use of alternate bearings will be in gliders, training airplanes, utility airplanes and in various locations in combat aircraft other than in the primary control system. The use of alternate bearing products must, however, be considered separately for each airplane and each application, and the decision based on the net effect of the bearing on the handling and operation of the mechanism.

Plain bearings may be used for the surface controls and surface control systems of gliders, training and utility airplanes in applications where the added friction will not adversely affect the operation of the control involved. Plain bearings may be used for secondary controls where friction and sensitivity of control considerations permit. Some of the possible applications consistent with the above requirements are: Landing gear door mechanisms, bomb bay door mechanisms, cowl flaps, shutters, selector valves, switches, etc.

Commercial type ground or unground antifriction bearings may be used as an alternate for precision antifriction bearings where low friction properties are necessary, or where lower capacities than those prescribed for precision ball bearings can be accepted. Some of the possible applications consistent with these conditions are sliding hatches, seat roller, ammunition box roller, etc.

YULE GIFTS FOR AIR FORCES: Aircraft engine starters roll off a conveyor line at the Eclipse-Pioneer division of Bendix Aviation Corp., East Orange, N. J., at a rate sufficient to equip thousands of warplanes a month

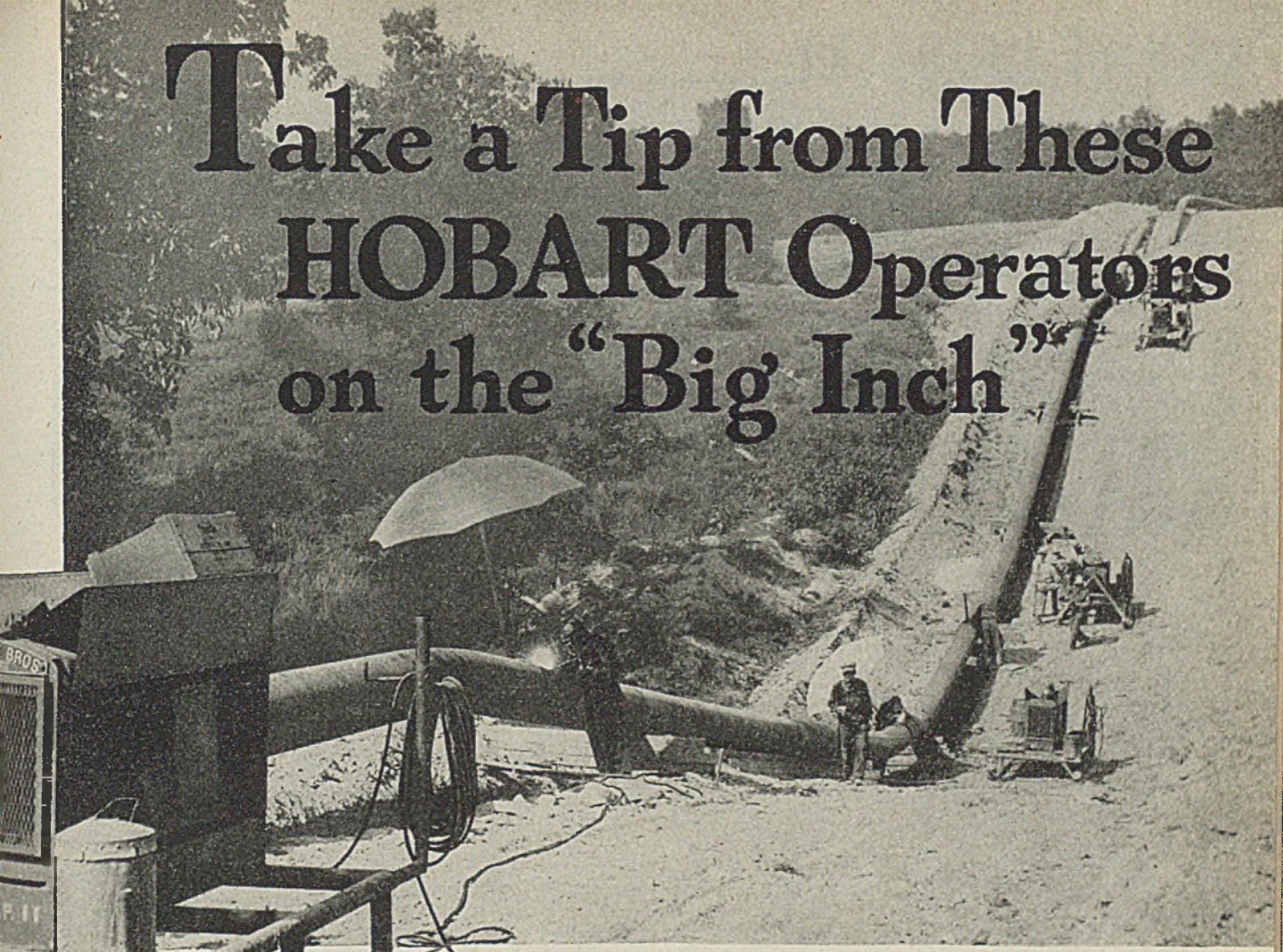
Boeing Sets Record in Flying Fortress Output

Production of B-17 Flying Fortresses at the Boeing Seattle plant for October set a new all-time record, climaxing the company's struggle throughout the summer and fall to meet the Army's continually increasing schedule in the face of a grave manpower shortage.

From May, 1942, to May, 1943, increasing production schedules were met by continually increasing production efficiency, despite the fact additional manpower was not available. During that period, production of Fortresses was doubled while total employment remained almost level, and while nearly half the male employes were being replaced with completely inexperienced women.

Output in pounds of completed airplanes per square foot of plant area became the highest of any aircraft plant in the country. Output in pounds per employe became the second highest in the country, first place being held by the Boeing trainer plant in Wichita, Kans.

Take a Tip from These HOBART Operators on the "Big Inch"



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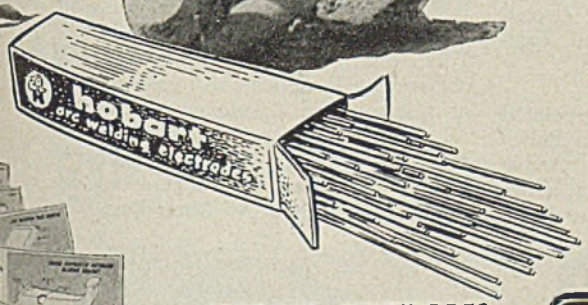

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MEN of INDUSTRY

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L. E. MacFADYEN

E. O. SWEARINGEN

WILLIAM BUTLER III

Dudley L. O'Brien, former sales agent at the Cleveland office for the American Car & Foundry Co., New York, has been appointed district manager of the Cleveland office, succeeding **R. A. Williams** who has been transferred to the New York general offices.

—o—

Robert T. Dunlap, recently appointed assistant to the president, Wickwire Spencer Steel Co., New York, has been named general superintendent of the company's Buffalo works, succeeding **William A. Steele,** resigned.

—o—

Frank W. Warner has been named successor to **Henry M. Richardson** as chief engineer, Plastics divisions, General Electric Co., Bridgeport, Conn.

—o—

William H. Lang and **Wallace Diffenderfer** have been appointed assistant credit managers for the Eastern and Central areas for the Carnegie-Illinois Steel Corp., U. S. Steel Corp. subsidiary.

—o—

Elmer F. Richter has been named vice president and general manager, Addressograph-Multigraph Corp., Cleveland. **A. P. Tyler** has been made secretary of the corporation, and **Donald C. Adams** succeeds him as assistant secretary.

—o—

Walter S. McLucas, chairman of the board, National Bank of Detroit, has been elected a director of Bendix Aviation Corp., South Bend, Ind.

—o—

Edwin E. Davis has been appointed assistant manager of orders, Jones & Laughlin Steel Corp., Pittsburgh.

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Henri B. Vidal, area manager in Buffalo for Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been elected president of the Buffalo Sales Executives Association, and **William A. Meiter,** sales manager, Worthington Pump & Machinery Corp., Harrison, N. J., has been elected secretary.

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E. W. Brock has been named manager of the Cincinnati office of Detroit Tap & Tool Co., Detroit. **T. S. Mellen** is district manager, South Bend, Ind.; **J. R. Armstrong,** Indianapolis; and **A. Olson,** Pittsburgh. These are new branch offices.

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L. E. MacFadyen, superintendent of the High Bridge, N. J., plant of the Taylor-Wharton Iron & Steel Co. since 1940, has been transferred to the same position at the company's plant at Easton, Pa. He assumed his new duties on Dec. 6.

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E. O. Swearingen, former superintendent of the fettling shop of the Taylor-Wharton Iron & Steel Co., has been promoted to plant superintendent of the High Bridge, N. J., plant, succeeding **L. E. MacFayden.**

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William A. Blume, president, American Brakeblok division, American Brake Shoe Co., New York, has been elected a vice president of the parent company.

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Frank E. Brown has been appointed general sales manager, American Pulley Co., Philadelphia, succeeding **Archie Chandler,** who is retiring from active sales management of the company. Mr. Chandler will continue as vice president and will direct the company's sales and service on the West Coast.

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William Butler III, a member of the sales promotion department of Lukens Steel Co., Coatesville, Pa., since 1938, has been promoted to advertising manager. Mr. Butler succeeds **George M. Gillen,** recently named assistant manager of combined sales for the company and its subsidiaries.

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Stuart H. Betsinger has been appointed sales manager, Kinney Aluminum Co., Los Angeles.

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Jack Manildi has been appointed manager of sales, Pacific Tube Co., East Los Angeles, Calif.

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Victor R. Willoughby, vice president, American Car & Foundry Co., New York, who formerly was in charge of engineering, has been assigned director of research and development. **Edmund D. Campbell,** recently named a vice president, succeeds Mr. Willoughby as head of the company's engineering activities, and **Alvin A. Borgading,** also

F. J. LUPKE JR.

Who has been placed in charge of the newly-opened Detroit branch office of Ross Heater & Mfg. Co. Inc., Buffalo, reported in STEEL, Dec. 13, p. 100.

W. C. PALMER

Who has been named manager of sales, Round, Flat Wire and Specialties division, John A. Roebling's Sons Co., Trenton, N. J., noted in STEEL, Dec. 13, p. 100.

J. A. PROVEN

a newly-elected vice president, takes charge of all company purchases. **A. G. Wood** has been appointed district sales manager for American Car & Foundry in Washington.

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J. A. Proven, formerly with the Victor Adding Machine Co., has been appointed general sales manager of the Sterling Tool Products Co., Chicago.

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August H. Henrich has become associated with Auto-Diesel Piston Ring Co., Cleveland, as assistant to the vice president and the general manager. Mr. Henrich was formerly in the experimental department of Thompson Products Inc., Cleveland.

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R. W. Piper, formerly associated with Sun Oil Co. of Philadelphia, has joined the Hodson Corp., Chicago, as technical adviser to the industrial trade, Pittsburgh area.

Charles M. Lemperly was elected vice president and director of sales of the Sherwin-Williams Co., Cleveland. Last April he was made director of sales, and prior to that time he had served for a number of years as director of advertising and publicity.

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Frank H. Fisher has been appointed manager of the Welding and Cutting division, Bastian-Blessing Co., Chicago. Previously Mr. Fisher was associated with American Steel Foundries, Chicago.

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Donald S. Klippert has been appointed assistant general manager of sales, Timken Steel & Tube division, Timken Roller Bearing Co., Canton, O., and is succeeded as Cleveland district manager of the Timken Steel & Tube division by **Robert P. Donnell.**

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W. E. Tootill has been appointed district manager in Pittsburgh for Bristol Brass Corp., Bristol, Conn. This newly-opened office is located at 438 Oliver building.

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Frank S. MacGregor has been appointed general manager, Electrochemicals department, E. I. du Pont de Nemours & Co. Inc., Wilmington, Del. Mr. MacGregor, whose appointment is effective Jan. 1, succeeds **Dr. E. A. Rykenboer,** who is retiring because of ill health.

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H. W. Lange has been appointed sales manager, Fire division, Cardox Corp., Chicago. **H. R. Harper** succeeds Mr. Lange as chief engineer of the Fire division.

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Thomas Colclough, technical advisor, Steel Controller of the United Kingdom, has arrived in the United States to inspect blast furnace plants, steelworks and rolling mills for the purpose of obtaining technical information that may be applied in British practice. A distinguished British metallurgist, Mr. Colclough formerly was connected with Brassert & Co. Ltd., and was active in the design and construction of iron and steel plants in Great Britain, China and Turkey.

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Thomas A. Cleary, superintendent, Youngstown Sheet Tube Co.'s Brier Hill open hearth plant, has been appointed superintendent of open hearths at the Campbell plant, replacing **A. E. Reinhard,** who resigned to become superintendent of steel production at Great Lakes Steel Corp., Ecorse, Mich. Mr. Cleary is replaced at Brier Hill by **William J. Reilly,** assistant superintendent of open hearths at Campbell.

R. G. CAULLEY

Who has been appointed director of purchases, Fruehauf Trailer Co., Detroit, as announced in STEEL, Dec. 13, p. 101.

OBITUARIES . . .

Erle F. Whitney, 58, assistant district manager in Cleveland for General Electric Co., Schenectady, N. Y., died in Cleveland Dec. 12.

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George E. Harris, for many years field representative in Buffalo for Firth-Sterling Steel Co., McKeesport, Pa., died Dec. 6 in Buffalo.

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James L. Mead, 80, founder and president, Mead Cycle Co., Chicago, died Dec. 7 in Evanston, Ill.

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George R. Carroll, 52, assistant superintendent of maintenance, Jones & Laughlin Steel Corp., Aliquippa, Pa., died Dec. 7 in that city.

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Harold K. Ferguson, 60, founder and president of the H. K. Ferguson Co., Cleveland, died there Dec. 9.

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David M. Hammett, 59, vice president, Axelson Mfg. Co., Los Angeles, died recently.

Thomas J. O'Regan, 80, retired traffic manager, Brooklyn Steel Co., died Dec. 9 in Jersey City, N. J.

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G. D. Dorsey, 83, a former director and member of the executive committee, National Lead Co., New York, died Dec. 8.

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Frank A. Vockrodt, 58, secretary, Carborundum Co., Niagara Falls, N. Y., died Dec. 8.

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Clifford Chester Smith, 79, a construction engineer who at one time had been associated with the old Wellman-Seaver-Morgan Co., Cleveland, died Dec. 12 in Cleveland.

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George Atwater, 48, assistant comptroller, Continental Can Co. Inc., New York, died Dec. 9 in New Rochelle, N. Y.

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Robert Munroe Jr., president, R. Munroe & Sons Mfg. Corp., Pittsburgh, died Dec. 7 in that city.

John M. Gillespie, president and vice chairman of the board, Lockhart Iron & Steel Co., Pittsburgh, died Dec. 6 in Newark, N. J.

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John G. Schoener, 63, retired research engineer who had been associated with International Nickel Co. Inc., New York, for 43 years, died Dec. 5 in Cranford, N. J.

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Joseph G. Kenan, 61, who operated the Joseph G. Kenan Co., Cleveland, until his retirement 8 years ago, died recently in Upper Sandusky, O.

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John H. Vought, 73, president, Cyclone Grate Bar Co., Inc., Buffalo, died there recently.

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Urban J. Krupp, 52, general superintendent, Loomis Machine Co., Tiffin, O., died recently in that city.

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Ralph K. Rex, chairman of the board, Diebold Safe & Lock Co., Canton, O., died at his home in Cleveland, Dec. 13.

Army's Excess Supplies Largely Diverted to Other War Uses

Less than 14 per cent of approximately $74 million of serviceable War Department property redistributed between July 1 and Sept. 30 found its way into non-governmental channels. Majority purchased by manufacturers of military materiel

LESS than 14 per cent of approximately $74,000,000 worth of serviceable surplus property redistributed by the War Department between July 1 and Sept. 30 found its way into non-governmental channels, and of that, the major portion was bought by manufacturers working on contracts for the armed services, the War Department announced last week.

Property sold or otherwise disposed of by the War Department consists of materials and equipment which, because of changing war requirements, are found to be no longer of service. The accumulation and disposal of such surplus property has no direct relation to the progress of hostilities, and does not mean that there is any slowing down in war activity. Large amounts of property are diverted from one technical service within the War Department to another, from the War Department to other government agencies and to war contractors without reaching consumer channels at all. Thus, the War Department has been able, by a careful redistribution of materials on hand, to avoid the scrapping of such materials, or the need for purchasing their equivalent.

Of the approximately $74,000,000 in surplus serviceable property of all types disposed of during the quarter, $43,000,000, or nearly 58 per cent, was transferred to other technical services of the War Department and never left military control. The Navy and other federal agencies acquired property valued at about $21,000,000, or nearly 29 per cent. The remainder, estimated $10,000,000, was sold outside the government.

The dollar amount of overall war Department transfers and sales during the quarter ended Sept. 30 ($74,000,000) does not include transfers within the individual technical services. For example, a transfer from one installation of the Ordnance Department to another would not appear in the total. While the amount of such intra-service transfers cannot be definitely stated, it probably equals or exceeds the amount of redistribution ($43,000,000) among the services.

Neither is there included in the total the disposition of property by War Department contractors whose contracts have been terminated. Although the War Department is interested in the disposition of such property because it affects the amount payable to the contractor, the interest is only indirect, and the property is owned by the contractor, and not by the government.

Unserviceable property disposed of for salvage amounted to $73,092,000 during the fiscal year ended last June 30, the latest period for which accurate figures are available. About $55,000,000 of this was disposed of under allocations by, or through channels approved by, the War Production Board at OPA ceiling prices. Virtually all the rest was sold after competitive bidding.

War Department salvage activity during the 1943 fiscal year is analyzed in the following statement:

	Net Tons	Amount
Ferrous metal	598,100	$ 8,199,000
Nonferrous metal	299,280	49,386,000
Wool rags and clippings	9,530	3,148,000
Cotton rags, clippings	13,920	892,000
Waste paper	56,800	369,000
Tin cans	23,500	259,000
Scrap rubber	12,300	318,000
Fats, grease, bones, etc.	33,600	1,448,000
Kitchen waste	.....	1,383,000
Miscellaneous	.....	7,690,000
TOTAL	.....	$73,092,000

The procedure for disposing of serviceable property is laid down in War Department procurement regulation 7, the operation of which has resulted in the retention within the government of millions of dollars worth of property that otherwise would have had to be bought or would not have been available for government use.

Under the terms of this regulation, each technical service periodically re-

INVISIBLE AIRPORT: Walter E. Irving, president of the Irving Subway Grating Co., Long Island City, N. Y., points out a bar in an "invisible" airport runway on the company's proving grounds. Illustrating the natural camouflage quality of the steel mats is the grass that has sprouted through the mesh. Installations in the war zones screen the landing mats from the eyes of enemy airmen

views property on hand and in the possession of manufacturers and lists all items not required for an immediate or definitely foreseeable need. The lists are circularized to about 100 procurement offices within the War Department, and are also made available to a large number of other government agencies, including the War Production Board, the Navy Department, the Treasury Department Procurement division and the Petroleum Administrator for War

The War Department maintains close liaison with all these agencies, and in some cases receives from them lists of their requirements. They are then promptly notified when any required item appears on a War Department excess property list. The Petroleum Administrator for War alone purchased, through the Defense Plant Corp., in the neighborhood of $464,000 worth of War Department surplus property between Aug. 1 and Oct. 31, 1943.

Property not absorbed within the War Department or by other government agencies becomes available for general sale. Military property, comprising generally finished end products and supplies of all descriptions, is sold at public sale by the regional offices of the Treasury Procurement division, if no use can be found for it within the government.

Nonmilitary property, which embraces largely production equipment and raw materials, is fed back into industry as rapidly as possible through listing with the regional offices of the War Production Board. For a period of twenty days after listing, only military agencies or their contractors may buy. After twenty days anyone may buy, but first preference is still given to war contractors.

Scrap and salvage sale is conducted by salvage officers at posts, camps, stations and industrial installations operated by the War Department.

Shipping Steel Plates Unsheared Raises Cost

Thousands of dollars will be added monthly to the cost of steel plates made in the Cleveland strip mill of Republic Steel Corp. because of the necessity of shipping plates unsheared to shipyards.

Departure from regular manufacturing process has been ordered by the Maritime Commission and is due to the slowdown on the plate shearing line which has been in effect since Oct. 9 and which followed a two-day strike. The slowdown has resulted in loss of ship plate amounting to approximately 20,000 tons a month.

Cost of shipping unsheared material to shipyards will be increased by as much as $2.89 per ton in the case of that going to the Pacific Coast. Increased costs are due to increased freight charges and the difference in scrap price ceilings at shipbuilding centers as compared with scrap prices in Cleveland.

Postwar Importance Overstressed

Conference Board study shows not more than one-fifth of some $27.5 billion of war facilities will be of substantial industrial significance in the peace economy

COMPETITIVE importance of publicly owned war plant and facilities to the postwar economy is given too great prominence in current discussion, according to an analysis by the National Industrial Conference Board.

Examination of the industrial composition of the facilities created during the war at a war-inflated cost to the public of some $27.5 billion "suggests the possibility" that not more than one-fifth of them will be of substantial immediate postwar industrial significance, the board says.

Of the $27.5 billion public investment in facilities, fully $12 billion have been expended for facilities completely non-industrial in character, of which at least one-fourth has been placed off the continent, or remains otherwise unassigned. Military camps, barracks, depots, and related items which have virtually no industrial postwar significance constitute the bulk of these facilities, according to the board's analysis.

While the remaining $15.5 billion have been expended for industrial plant and equipment, over $10 billion of this amount have been committed specifically for production of military items with little or no immediate civilian market or conversion possibilities, or to expand capacities already far in excess of any possible peacetime needs, the board points out. Roughly one-third of all publicly owned industrial facilities is concentrated in the fields of ammunition, explosives, shell loading and guns. Such plants, the board says, are generally unsuited for the production of civilian items.

Another third of public plant is centered about the production of aircraft, engines and parts, and ships. This plant, the board finds, has potentials far beyond any possible civilian demand in the immediate postwar years, and presents peculiar and expensive conversion problems if they are to be shifted to other channels of civilian production.

This leaves, according to the board's study, little more than $5 billion of public plant representing facility readily adaptable to supplying major peacetime wants.

Electrical Industry Formulates Postwar Plans

A four-point postwar program for the electrical construction industry has been formulated by the National Electrical Contractors Association and the International Brotherhood of Electrical Workers.

The program includes:

1. Immediate assignment of electrical contractors and their skilled working staffs to do repair, installation and maintenance work in shipyards and war plants.
2. Survey of the possibilities of the future expansion of the industry.
3. Application of many new discoveries of increasing efficiency of operations, which will lower costs to the public and result in wider utilization and enjoyment of electrical installations.
4. Trial of a "revolutionary experiment" involving the stabilization of wages and employment on an annual basis, as a supplement to the present hourly basis of pay.

Robert W. McChesney, president of the contractors' association, said the electrical contracting industry is ahead of other industries in its postwar planning because it already faces postwar conditions. Cutbacks in war construction have reduced building activity to a rate of $2 billion annually, compared with a rate of $13½ billion last year.

Vast Unemployment Not Anticipated in Postwar Era

Large scale unemployment in the demobilization period is not anticipated for demobilization will be gradual and probably will extend over a period of from two to three years, depending upon the time required to defeat Japan after the victory over Germany, according to a study by Karl T. Schlotterbeck, financed by the Falk Foundation, Pittsburgh.

Mr. Schlotterbeck believes between 6,000,000 and 7,000,000 servicemen and war workers may be demobilized before the Asiatic war ends. For the purpose of study, it is assumed that Germany will be defeated by the end of 1944 and Japan a year later. It is estimated that approximately 17,800,000 persons may face demobilization during the first two and one-half years after the end of the European war. Of these, 9,500,000 would be from the armed forces, 1,400,000 from war agencies and 6,900,000 from munitions industries.

Gulf Chapter of Scrap Institute Elects Officers

Max Clairfield, Sampson Machinery & Supply Co. Inc., Houston, Tex., was re-elected president of the Gulf Coast chapter of the Institute of Scrap Iron and Steel Inc. at a recent meeting.

James Novy, Austin Metal & Iron Co., Austin, Tex., was re-elected vice president and Cyril M. Coguenhem, Luria Bros. & Co. Inc., Houston, was re-elected secretary-treasurer.

Discharged Servicemen Channeled

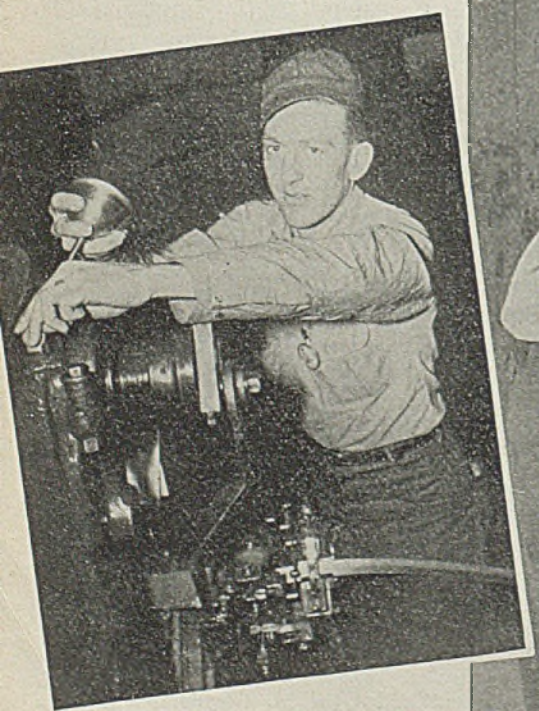
DURING the last war returning soldiers searching for employment shifted for themselves because of the lack of any definite program or plan by either industry or the government. Today thousands of honorably discharged servicemen are being reabsorbed each month on important war jobs through the medium of specially organized industrial personnel departments and government bureaus.

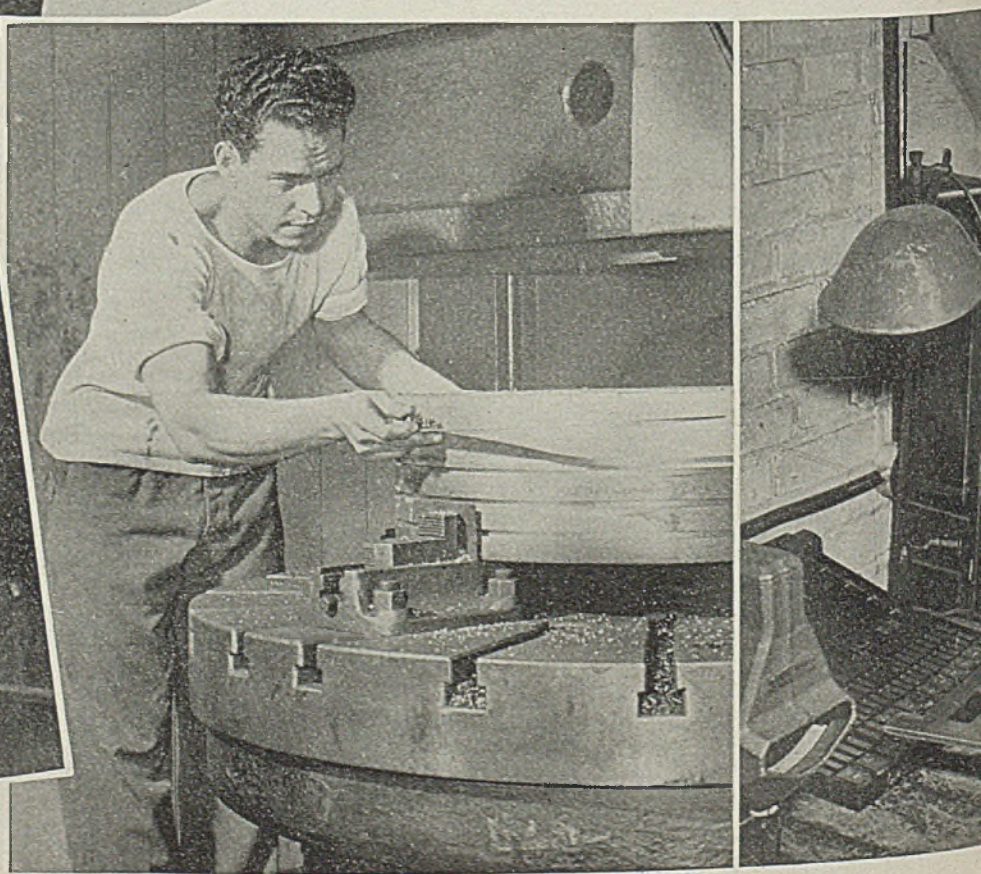
Although the entire plan for returning servicemen on industrial jobs still remains in the early stages of development, it is working effectively to meet present needs and is rapidly being perfected to operate efficiently in preparation for the millions who will return to civilian life when the great demobilization day arrives.

Dr. William Haber, assistant deputy

This soldier, left, above, awarded the Purple Heart in the North African invasion, is recovering full use of his wounded arm through physical therapy at Walter Reed hospital. NEA photo

Oiling a punch press which he operates at the Acme Steel Co., Chicago, is this veteran of Guadalcanal, below, left, who was discharged from service after being wounded and stricken with malaria





nto Industry

Armed forces releasing 70,000 monthly, many of whom are placed in war jobs. . . Special industrial personnel departments and government bureaus assist in placing veterans in work for which they are best fitted

By J. M. KURTZ
Assistant Editor, STEEL

director for program development of the War Manpower Commission, recently revealed that the armed forces are discharging about 70,000 persons monthly, including 35,000 a month released from service hospitals throughout the nation. These men were not all battle casualties for many have been discharged because they were unfit for military life for various reasons. More than 7000 men have been released to fill the manpower shortage in copper mining, the only industry so favored.

Office of War Information revealed that 800,000 servicemen have already been discharged from active service and the majority of them channeled into war production jobs with such rapidity that "they are becoming a real factor in relieving the manpower shortage." The Army has released 585,000 veterans, the Navy 133,155 and the Marine Corps about 34,759.

General Motors Corp., Detroit, was among the first of the large companies in the country to take definite steps to re-employ discharged servicemen. In a letter to general managers and personnel managers of divisions, H. W. Anderson, vice president in charge of personnel, stressed the necessity for placing in suitable jobs all former employes who have returned from military service. He also pointed out the necessity for giving these men all possible assistance and training to fit them for normal employment.

"More than 82,000 GM employes are in military service, and more are going every day," Mr. Anderson pointed out. "Already some of these men are returning to work in the plants after recovering from injuries received while in active service. The problem of placing the disabled veterans will become increasingly serious and important throughout the period of the war and afterwards. We feel that it is not too early to make preparations to meet this situation.

Placement on Sound Basis

"As a general policy we should make every effort to place these handicapped veterans on jobs which they can perform without harm to themselves or others. To be successful the placement of handicapped veterans must be on a sound basis both from the standpoint of productivity and economic return to the worker."

The GM plan calls for co-ordination of the activities of the plant medical departments, employment departments, training facilities, supervision and others concerned with the rehabilitation of disabled veterans. It calls also for a survey of jobs in the plants from the standpoint of physical requirements to determine the suitability for placement of veterans with various types of physical handicaps.

Plant doctors will give returned veterans complete physical examinations and on the basis of these examinations will recommend the type of work to which they can be assigned. Each man will be followed up to see that he becomes acclimated to his work and is able to carry the job. In event it is found that a man is not suited to the work to which he is first assigned, transfers will be arranged. Training facilities will be made available for veterans who must learn types of work in which they are inexperienced. When necessary every help will be given discharged veterans in taking advantage of the facilities of the Veterans' Administration.

The corporation recently revealed that about 1000 of the 10,268 men inducted into the armed forces from 16 Fisher Body plants have been placed on essential war jobs. In the Detroit area alone, some 470 workers discharged from military service have returned up to Nov. 1. Besides this, about 300 others not previously employed with GM had been hired and placed on vital war jobs.

Establish Military Service Department

Early this month Thompson Products Inc., Cleveland, and its subsidiary, Thompson Aircraft Products Co., Euclid, O., set up separate Military Service Departments as branches of the personnel division. These departments are shouldered with the responsibility of preparing for the postwar rehabilitation of returned veterans. It will keep records, conduct interviews of employes leaving for the armed services and veterans returning for re-employment, and also will disseminate any information considered important to relatives as well as to the servicemen themselves.

The Oliver Iron & Steel Corp., Pittsburgh, is an excellent example of a company which has taken steps to meet the problem of re-employing discharged servicemen. The company for more than 18 months has kept contact with all of its employes in uniform. A personal letter from the company's president, Theodore F. Smith, is followed by mailing the servicemen a carton of cigarets. The company sends the servicemen photos of their families taken by a company photographer. Copies of the

After serving more than a year in the Army, and a veteran of the North African campaign, this 24-year-old man, left, center, is back on his job as a boring mill operator at the Aluminum Co. of America, Cleveland

This discharged veteran, left, of the Navy is now checking gages at the Ohio Crankshaft Co., Cleveland. Prior to his induction he was an inspector in the diesel crankshaft division

company paper also are mailed to them regularly.

The personnel department then assembles information on each employe in uniform regarding his training and experience. In such a way the personnel department hopes to fully utilize any specialized training of value which the former employe might have obtained while in uniform. All postwar plans of the company are being carried out with the idea of finding suitable jobs for returning soldiers.

Ohio Crankshaft Co., Cleveland, reports that it hires between five and ten discharged servicemen each week. These men are interviewed by the personnel department in order to determine what jobs would be most suitable. A form is sent to foremen of the re-employed servicemen every four weeks to keep a record of their progress. Thus, if the serviceman is dissatisfied with the job or is not performing satisfactorily, he is shifted to a department where he believes he would like to work.

A number of companies, particularly airplane manufacturers, have placed standing orders with the Veterans' Employment Service for discharged servicemen. These returned veterans are helping to relieve the manpower shortage and contribute to the morale of workers for greater production.

"Nothing so lifts the morale of a discharged veteran as to find that, despite his disabilities, he is still able to hold down a good job," Hugh A. Kerwin, assistant director of the Veterans' Employment Service, said. "He is particularly pleased that the job he is able to perform contributes to the winning of the war."

The personnel manager of the Douglas Aircraft plant at El Segundo, Calif., reports that at present some 400 veterans of the present war are working at the plant. One of them is a former Marine flight sergeant who was shot down at Guadalcanal with the loss of one eye and a shattered face. He is now flight testing radios in the dive bombers manufactured at the plant. Another, a former pilot shot down over the English Channel, is doing excellent work in the plant's planning department. These are only a few of the examples of thousands of similar cases throughout the country in every phase of industrial production.

The Texas division of North American Aviation Inc. reports that at its Dallas plants, where it manufactures trainers, Mustang P-51 fighters, and B-24 Liberator bombers, about 700 honorably discharged veterans are on its payroll. The company conducted a national advertising campaign recently to inform veterans that jobs are awaiting them at the North American plants upon their discharge. North American's efforts to employ veterans has a three-fold purpose. It is attempting first of all to provide a method of rehabilitation of disabled war veterans in order to help them find a place in civilian life. Secondly, the company believes it can utilize the knowledge and technical training many of these men have gained in combat. And lastly, the placement of veterans in production departments boosts the morale of other workers.

Companies To Provide Training

Many legless and armless men are returning from this war because of the use of a destructive weapon called the anti-personnel mine. The federal government is endorsing the aid of private, state and industrial companies for aid in rehabilitating such casualty cases. The Veterans' Administration is contracting with companies like Ford, Chrysler and General Motors to train the returning servicemen in virtually any occupation they desire.

Several thousand applications have been filed with the VA by soldiers no longer able to fight or able to earn their living on their old jobs. Since the first of July, a number of men have been receiving special attention under the rehabilitation program. These men are paid a pension while learning. Eventually they are returned to civilian jobs for they must complete their training within four years.

Veterans must prove at least a 10 per cent disability and also show that injuries prevent them from returning to their old jobs in order to qualify under the VA program. In some cases the VA is financing college careers. The program is being financed this year from a general fund of $600,000,000. Eventually the cost will climb to around $1,500,000,000 a year and handle training of 400,000 men, winding up in six years.

Re-employment of disabled servicemen is within the jurisdiction of the Veterans' Bureau. War Manpower Commission offices nearest the Army, Navy and Marine hospitals register the disabled and question them regarding employment. Applications then are forwarded to veterans' employment representatives, there being one located in virtually every state. Probably of greatest importance are the volunteer re-employment committeemen attached to local selective service boards. At present there are from two to 20 volunteer re-employment committeemen in each board. Eventually there will be one committeeman for every 25 veterans. They will provide a personalized service unheard of in the last war. Acting as a friend and agent of veterans, the committeeman will handle the records and return him to his old job or find him a new one. Staffs of local agencies of the Veterans' Administration and representatives of the Veterans' Employment Service, full time specialists, also will aid the returning servicemen. All of these branches are adjuncts of the War Manpower Commission.

Various local and state rehabilitation

(*Please turn to Page* 150)

They Say:

"At the close of the war, our productive resources will be greater than ever before. One can hardly doubt that without increasing the prewar ratio of women at work, our productive system is incapable of producing an abundance of everything we need or want."—**Ruth Leach,** vice president, International Business Machines Corp.

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"Some people are worried about the national debt which now exceeds $1000 per capita. This debt has been largely incurred because of war and depressions. If after the last war we had invested 10 cents per person per year in research and planning, and had worked with the same energy as researchers in the physical sciences and in medicine, we might have prevented the panics and this war."—**William L. Batt,** vice chairman, War Production Board, and president, SKF Industries.

"Behind the problem of employment and production lies the much deeper problem of human relations."—**Charles E. Wilson,** executive vice chairman, War Production Board.

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"No one government agency, no one company, and no one union, can possibly meet the situation alone. They must see their functions and responsibilities in relation with each other. The task ahead will test the intelligence and quality of government, management and labor leadership."—**Clinton S. Golden,** vice chairman, War Manpower Commission and vice president, United Steelworkers of America.

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"Labor, management, agriculture and government must work together for an abundant and prosperous America."—**T. M. Girdler,** chairman, Republic Steel Corp., and chairman, Consolidated-Vultee Aircraft Corp.

International To Build New Farm Machinery Plant

Purchases 375 acres at Alton and Wood River, Ill., for modern implement plant which will employ 3500 workers

INTERNATIONAL Harvester Co., Chicago, has purchased 375 acres of land on the east bank of the Mississippi river between Alton and Wood River, Ill., for construction of a postwar farm machinery manufacturing plant. Construction will not begin until after the war.

The design calls for a thoroughly modern industrial plant of one-story construction with a foundry, forge shop, machine shop, warehouse and a central heating plant. About 3500 workmen will be employed there.

Excellent rail, water and highway transportation are available to the company at the Alton-Wood location. Mississippi river shipping will be possible through construction of a dock on the plant property. The Illinois Terminal railway line runs just north of the tract and a new highway is to be built just east of the property.

More War Plants Cited With Army-Navy "E" Awards

A number of additional war plants were awarded recently Army-Navy "E" emblems for outstanding achievement in production of war materials. The companies are:

American Cystoscope Makers Inc., American Catheter Corp., Port Chester, N. Y.
Bradford Kennedy Co., Omaha, Nebr.
Electrolux Corp., Old Greenwich, Conn.
Elgin National Watch Co., Aurora, Ill.
General Motors Corp., Delco Radio division, Kokomo, Ind.
Globe Union Inc., Milwaukee.
Kennedy Van-Saum Mfg. & Engineering Co., Danville, Pa.
Liggett Spring & Axle Co., Monongahela, Pa.
A. R. Maas Chemical Co., South Gate, Calif.
Minnesota Fire Equipment Co., Lindstrom, Minn.
United States Rubber Co., Naugatuck, Conn.
Albert Wright, Oakland, Calif.
Phelps Dodge Copper Corp., New York, second renewal.
Candler-Hill Corp., Detroit.
Baldwin Locomotive Works, Standard Steel Works division, Philadelphia, adds fourth star to pennant.

BRIEFS . . .

Pioneer Engineering & Mfg. Co., Detroit, recently released a very attractive brochure titled, "Solutions to Some Executive Problems."

—o—

Brush Development Co., Cleveland, has issued a new pamphlet containing the latest technical information on its series of industrial instruments.

—o—

Castaloy Corp., Detroit, has published a four page equipment list which enumerates the extensive facilities of the corporation.

—o—

Interchemical Corp., New York, announces that effective Jan. 1, 1944, the trade sales division will be the official outlet for all its consumer products and those of its subsidiaries, with home offices and factory at Paterson, N. J.

—o—

Planett Welding Electrode Co., Los Angeles, now is producing coated extruded welding electrodes.

—o—

General Excavator Co., Marion, O., reports that "General Ironguts", first shovel ever built by the company, is still in service after marking its seventeenth birthday.

—o—

Gerrard Co. Inc., Chicago, has changed its name to Gerrard Steel Strapping Co. to better identify the organization with the product it manufactures and distributes.

—o—

General Electric Co., Schenectady, N. Y., now is producing a small quantity of simplified electron microscopes which will be shipped on high priority orders to industrial laboratories and colleges.

—o—

Hudson Motor Car Co., Detroit, has set up the first child day care center in Michigan by a major manufacturer. The nursery admits children from 2 to 5 years old of mothers working in the Hudson plants.

—o—

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., delivered $63,113,578 of equipment for the armed forces during October, a 3 per cent increase over last August, the previous high month.

—o—

Jefferson Machine Tool Co., Cincinnati, recently published an eight page catalog listing some of its equipment.

—o—

Brown Instrument Co., Philadelphia, has applied for a patent for a new type of thermocouple for cyanide carburizing in the heat treating and allied industries.

—o—

Association of American Railroads, Washington, reports there were 133,537 cars of export freight, excluding coal and grain, handled through United States ports in November, compared with 75,767 in November last year, an increase of 76 per cent.

—o—

Steep Rock Iron Mines Ltd., Toronto, Ont., announces that delivery of power by the Hydro Electric Power Commission of Ontario on Nov. 28 ushered in the second and final stage in the preproduction development of the dewatering of Steep Rock Lake to permit open pit mining of ore in 1944.

—o—

International Machine Tool Corp., Elkhart, Ind., reports stockholders have approved a proposal to merge the Detrola Corp., Detroit, under the name of International Detrola Corp., effective Dec. 31.

—o—

American Can Co., New York, mailed a 48-page report to approximately 34,000 shareholders and also to customers revealing the outcome of renegotiation proceedings.

—o—

Phoenix Iron Co., Phoenixville, Pa., which for many years has sold fabricated steel under the name of a subsidary, Phoenix Bridge Co., will, in the near future, sell the product under the name of Phoenix Iron Co. to do away with duplication.

—o—

Mack International Motor Truck Corp., New York, reveals that the nation's 5,000,000 trucks are averaging 10,000 miles annually for a grand total of 50 billion miles yearly. In rolling distance in 1942, the trucks hauled 60 billion ton-miles of freight and have exceeded that figure this year.

—o—

Minneapolis-Honeywell Regulator Co., Minneapolis, awarded first prize for a system of steam heating to Clyde H. Baker, Detroit architect, and first prize for hot water heating system to Leonard Weger, Philadelphia architect. Each received a $2000 prize in the $10,000 heating contest.

—o—

American Car & Foundry Co., New York, announces that its Berwick, Pa., plant won the Frederick A. Stevenson safety trophy in a contest among its 12 plants for a record of no lost time accident during November. The Wilmington., Del., shipyard was runnerup.

—o—

Sterling Tool Products Co., Chicago, has moved its general office from 363 East Ohio street to 155 East Ohio street.

—o—

Hydro-Arc Furnace Corp., La Grange, Ill., which has been associated with the Whiting Corp., Harvey, Ill., over a period of years, has now been acquired by the Whiting Corp. W. Harvey Payne, president and founder of the former, will continue in the capacity of consulting engineer.

—o—

Blaw-Knox Co., Pittsburgh, was honored recently for its participation in the creation of the American synthetic rubber industry by the 1943 Committee of Award for Chemical Achievement.

—o—

Kelsey-Hayes Wheel Co., Detroit, reports it has taken steps to acquire the stock of French & Hecht Inc., Davenport, Iowa.

—o—

Bituminous Coal Institute, New York, has published a reference booklet titled, "Coal Facts" which shows why coal is the backbone of the war effort.

THE BUSINESS TREND

Production Pace Holds But Uncertainty Mounts

WITH the War Production Board calling for increased war goods output during 1944, but cutbacks and cancellations suggesting an early increase in production of some civilian goods, industry stands confused among the contradictions as it performs its dual task of maintaining high output of war items and laying plans for the postwar era. Disposal of war plants and machines; disposition of surpluses; settlement of canceled contracts—these are among the dangerous question marks which should be settled by firm federal policies widely publicized.

In spite of the uncertainty, current production of war goods sustains its rapid pace as changing military needs shift emphasis from ordnance and ammunition to planes, ships, landing barges, and trucks.

MANPOWER—With factory employment continuing at levels below its mid-1943 ceiling, and the armed forces anticipating 11,300,000 in service by July of 1944, clearly the manpower problem has not been solved. However, incentive programs, federal controls, and more effective production methods have lowered the shortage estimates, and cutbacks and cancellations have released enough labor to improve the situation in many local areas.

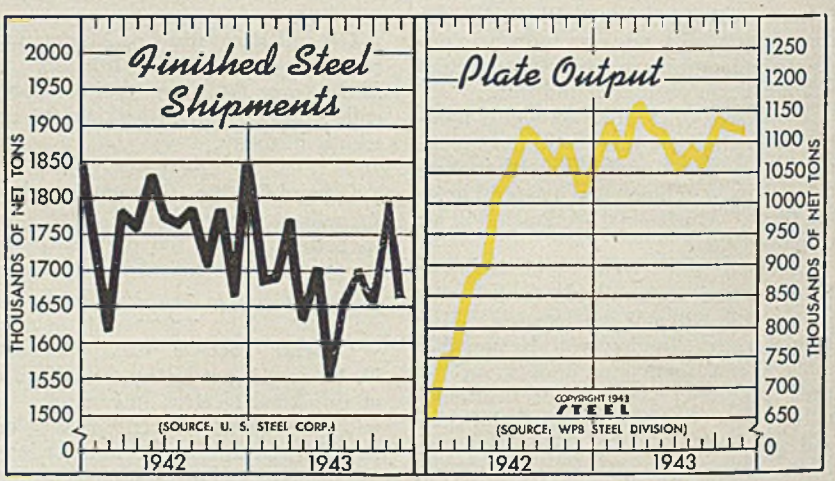
If Germany does not crack before March, that may be the crucial period for manpower, for it is then that seasonal workers leave the factories for the farms, and the armed services must fill their ranks to attain the total set up for July.

RE-EMPLOYED SERVICEMEN—How many men and women now with the armed forces will return to positions with the same companies they left to enlist? World War I experience on the subject would be helpful, but a recent survey reveals that those records are not to be found. Executives who were interviewed expressed the opinion such re-employment would be high after this war, and their estimates ranged from 70 to 80 per cent.

INVENTORIES, ORDERS, SHIPMENTS—Inventories of durable goods manufacturers registered a small gain in October, according to the Conference Board's seasonally adjusted index. New orders showed a 6 per cent advance over the September figure.

For the third consecutive month manufacturers' unfilled orders dropped to a new 1943 low in October. Producers of railroad equipment and miscellaneous durable goods reported an increase, largest declines being in non-durable items. Shipments dropped below the September figure, with losses in both durable and non-durable industries.

As recorded by U. S. Steel Corp., finished steel shipments for November show the third lowest monthly figure for 1943 to date, June and April being lower. Plate production declined moderately.



Steel Shipments†—Plate Production‡

(Unit 1000 Net Tons)

	Shipments		Plate Output	
	1943	1942	1943	1942
Jan.	1685.9	1738.9	1135.4	754.5
Feb.	1691.6	1616.6	1072.0	758.7
Mar.	1772.4	1780.9	1167.7	878.7
Apr.	1630.8	1758.9	1121.0	895.9
May	1706.5	1834.1	1114.9	1012.2
June	1552.7	1774.1	1059.3	1050.9
July	1661.0	1765.7	1089.0	1124.1
Aug.	1704.5	1788.6	1061.0	1097.9
Sept.	1664.6	1703.6	1161.0	1061.8
Oct.	1794.9	1787.5	1147.1	1101.4
Nov.	1660.5	1665.5	1141.1	1013.6
Dec.	.....	1849.6	.....	1060.0
Total	.....	21,064.2	.....	11,809.7

†U. S. Steel Corp. ‡War Production Board.

FIGURES THIS WEEK

INDUSTRY	Latest Period*	Prior Week	Month Ago	Year Ago
Steel Ingot Output (per cent of capacity)	98.0	98.5	99.0	99.0
Electric Power Distributed (million kilowatt hours)	4,567	4,560	4,483	3,938
Bituminous Coal Production (daily av.—1000 tons)	2,100	2,075	465	1,889
Petroleum Production (daily av.—1000 bbls.)	4,377	4,384	4,436	3,771
Construction Volume (ENR—unit $1,000,000)	$34.7	$52.2	$63.0	$85.3
Automobile and Truck Output (Ward's—number units)	18,730	17,880	19,300	17,835

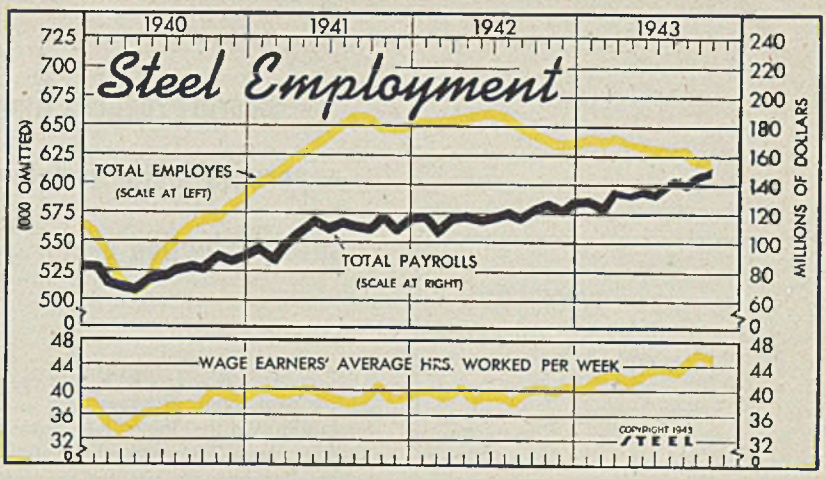
*Dates on request.

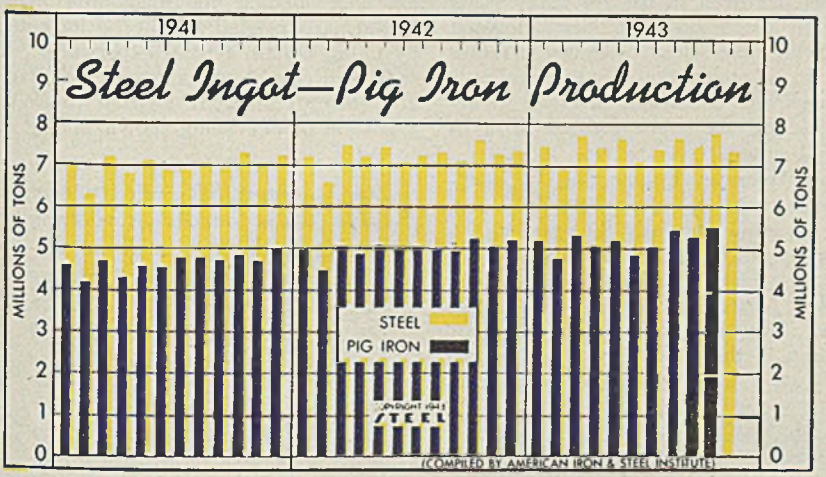
TRADE				
Freight Carloadings (unit—1000 cars)	848†	863	845	759
Business Failures (Dun & Bradstreet, number)	40	35	30	132
Money in Circulation (in millions of dollars)‡	$20,135	$19,940	$19,514	$14,986
Department Store Sales (change from like week a year ago)‡	+13%	+21%	+10%	−1%

†Preliminary. ‡Federal Reserve Board.

Steel Employment

	Employes—Number (000 omitted)		Total Payrolls (Unit—$1,000,000)	
	1943	1942	1943	1942
Jan.	637	651	129.7	118.8
Feb.	635	651	122.8	108.5
Mar.	637	653	136.8	117.0
Apr.	634	654	136.3	118.5
May	632	656	137.4	117.4
June	631	659	136.2	118.0
July	627	655	142.8	120.7
Aug.	625	647	139.9	118.7
Sept.	620	641	143.8	124.8
Oct.	615	635	144.9	126.6
Nov.	...	632	.....	122.8
Dec.	...	633	.....	129.3





Iron, Steel Production

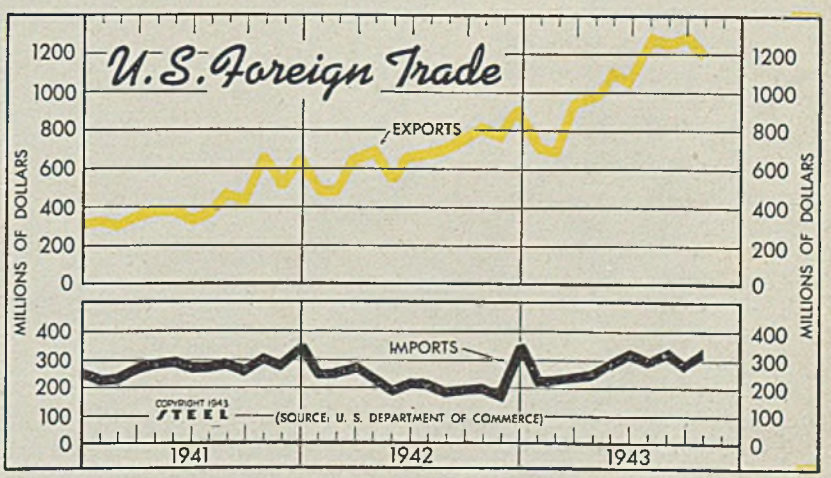
(Net tons—000 omitted)

	Steel Ingots		Pig Iron	
	1943	1942	1943	1942
Jan.	7,424	7,112	5,194	4,983
Feb.	6,826	6,513	4,766	4,500
Mar.	7,670	7,392	5,314	5,055
Apr.	7,374	7,121	5,035	4,896
May	7,545	7,383	5,173	5,073
June	7,027	7,015	4,836	4,935
July	7,376	7,145	5,023	5,051
Aug.	7,562	7,228	5,316	5,009
Sept.	7,489	7,058	5,226	4,937
Oct.	7,786	7,580	5,324	5,236
Nov.	7,357	7,180	....	5,083
Dec.	.....	7,305	.....	5,201
Total	....	86,030	....	59,959

Foreign Trade
Bureau of Foreign and Domestic Commerce

(Unit Value—$1,000,000)

	Exports			Imports		
	1943	1942	1941	1943	1942	1941
Jan.	751	479	325	228	253	229
Feb.	732	478	303	234	253	234
Mar.	984	611	357	248	272	268
Apr.	963	695	385	257	234	287
May	1,069	525	385	281	191	297
June	1,004	618	330	302	215	279
July	1,251	627	359	300	214	278
Aug.	1,205	694	455	315	184	282
Sept.	1,233	718	417	280	196	263
Oct.	1,185	776	666	329	199	304
Nov.		750	492		174	280
Dec.	...	853	651	...	356	344
Total	....	7826	5128	....	2743	3345



FINANCE

	Latest Period*	Prior Week	Month Ago	Year Ago
Bank Clearings (Dun & Bradstreet—millions)	$8,886	$7,668	$8,762	$7,314
Federal Gross Debt (billions)	$166.1	$170.1	$169.5	$104.1
Bond Volume, NYSE (millions)	$53.8	$48.6	$51.7	$39.3
Stocks Sales, NYSE (thousands)	5,174	3,701	5,884	3,285
Loans and Investments (millions)†	$51,166	$51,462	$52,642	$38,387
United States Government Obligations Held (millions)†	$37,341	$37,377	$38,071	$24,808

†Member banks, Federal Reserve System.

PRICES

STEEL's composite finished steel price average	$56.73	$56.73	$56.73	$56.73
Spot Commodity Index (Moody's, 15 items)†	246.5	244.8	243.2	234.3
Industrial Raw Materials (Bureau of Labor index)‡	111.7	111.1	112.1	103.7
Manufactured Products (Bureau of Labor index)‡	100.4	100.3	100.3	99.7

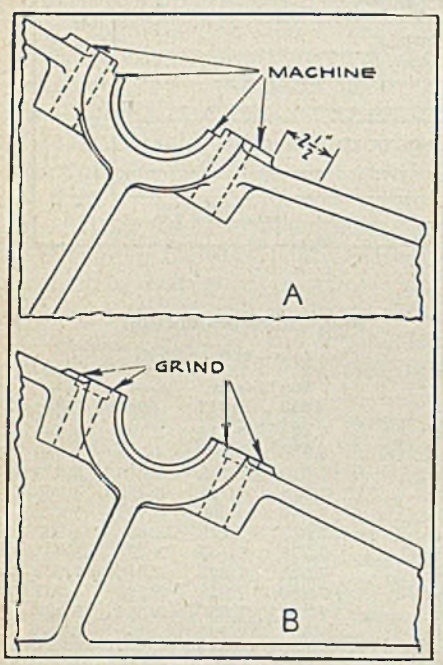
†1931 = 100; Friday series. ‡1926 = 100.

Face Grinding

—sharply reduces time required for finishing machine parts

—permits faster training of operators

—cuts production costs



NEW APPRECIATION of the advantages of face grinding and an understanding of its limits has grown out of the war. The procedure itself, of course, has been in use for many years but too much time has been devoted to trying for close tolerances rather than to a recognition of the real advantages and economies involved in accomplishing the work for which it is so well suited.

The American Engineering Co.'s experience with face grinding has covered a period of nearly 25 years in the manufacture of heavy machinery, notably Hele-Shaw pumps, Taylor stokers, Lo-Hed hoists and marine deck auxiliaries. The quantities of any one part required in this type of work ordinarily are not large, so elaborate fixtures and jigs are not justified from the standpoint of economy.

Face grinding has proved to be an excellent method for machining many of the parts needed as may be indicated by citing certain typical experiences.

In one case it was desired to surface 100 stoker crankshaft bearing brackets, a portion of one being shown in Fig. 1.

Fig. 1 (Upper left)—Redesign of this stoker crankshaft bearing bracket made it possible to employ face grinding in finishing the piece. Above (A) is shown bracket as originally designed and below (B) as redesigned for face grinding

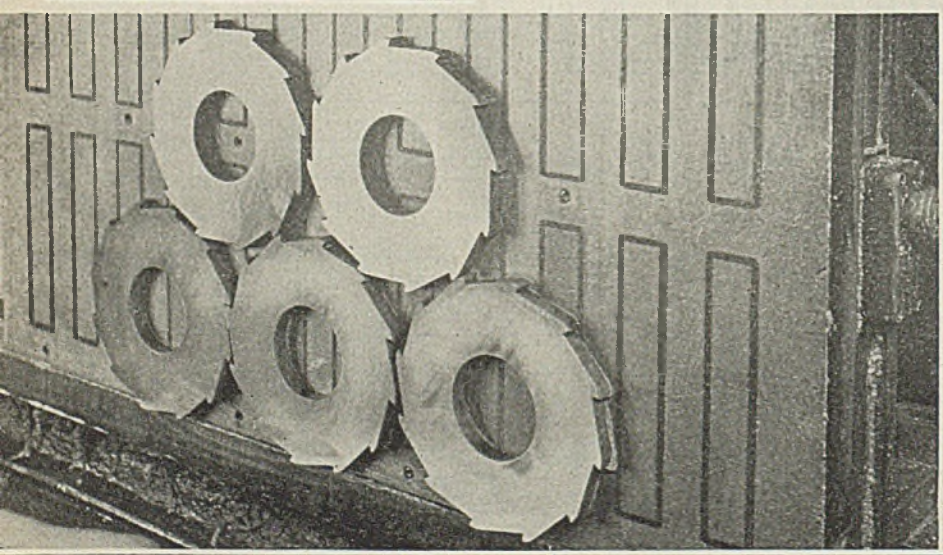


Fig. 2 (Immediate left)—Here five forged rachets are ganged up on a magnetic chuck and are face ground simultaneously to required thickness

Fig. 3 (Left below)—Two sides of this casting, 17 x 19½ inches, were faced parallel in 25 minutes with face grinding. Other methods required up to 125 minutes

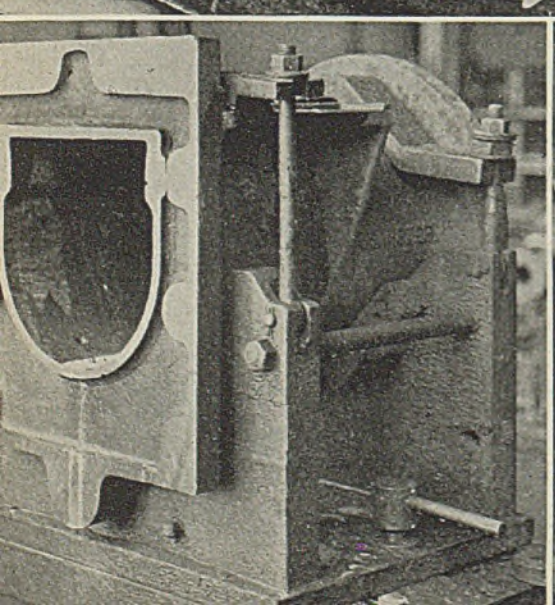
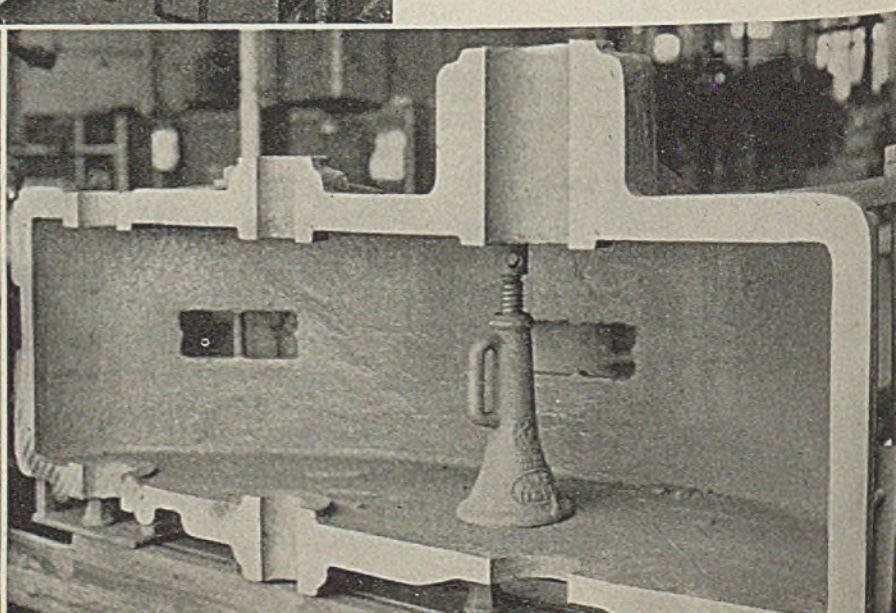


Fig. 4 (Below)—This gear housing, measuring 28⅛ x 68½ inches overall, was face ground in 78 minutes floor-to-floor or in approximately one-third the time required by other methods



By J. S. BENNETT
American Engineering Co.
Philadelphia

As originally designed, however, the job was impractical for face grinding as will be noted by referring to the upper drawing A, Fig. 1. Therefore, at the insistence of the manufacturing department, the bracket was redesigned as shown at B so as to permit the face grinding wheel to pass across the surface without any fouling of the bracket.

Provides Substantial Economies

The obvious lesson learned from this experience was that it often pays to redesign a part in order to take advantage of the substantial economies provided by face grinding. In fact, the entire crankshaft bearing bracket is an excellent example of a job suitable for face grinding since it was designed so that a number of surfaces are flat and thus may be ground readily. Tolerances for these surfaces need not be held closer than 0.010-inch thus permitting faster grinding.

A recessed end of this bracket emphasizes another point in favor of face grinding. Recessing in itself saves metal, usually without sacrificing strength, and such recessed surfaces are particularly suited to face grinding. A cutting tool travels at a metal cutting speed whether it cuts metal or passes over a recess. With a face grinder, however, grinding time is proportioned to the amount of material to be removed. Recessing, therefore, actually results in a reduction of finishing time when a face grinder is employed. Recessing also is apt to be harder on cutting tools since they slam into the work after passing each recess.

Face grinding also provides several other advantages which should not be overlooked. Among these are savings in material other than that provided by recessing for it is practical to reduce the allowance for finishing over that required by other methods of facing. This is for the reason that face grinding produces the first flat surface regardless of scale. Further, no roughing cuts are needed to get through the tough skin of castings. Too, lumps and hard spots do not slow up grinding.

The most important advantage of face grinding is reduced cost of production through a saving in machining time. It may be profitable to examine a few case examples:

Fig. 3 shows a casting 17 by 19½ inches, two sides of which were faced parallel. Face grinding required a total of 25 minutes compared with as much as 125 minutes by other machining methods. A rotating fixture with a quick-acting clamp was used on this job, necessitating only one setup.

Machining Time Reduced

In facing a gear housing joint (Fig. 4) measuring 28⅛ x 68½ inches overall, the time for face grinding was 78 minutes floor-to-floor or one-third of the time needed when employing other machining methods. Nothing was required for setting up other than a jack and a simple shop made fixture.

Incidentally, in citing both of the above cases there is no intention to deprecate other methods of surface finishing. The obvious implication is that these two jobs are better adapted to face grinding than to any other method which could be employed.

In another case (Fig. 5) it was found advantageous to face three sides of a pump case 90 degrees apart by the grinding method. The actual time for all three operations was only 35 minutes floor-to-floor. By revolving the pieces around a centering plate, only one setup was required for completing this particular job.

Another excellent example of face grinding is shown in Fig. 2 where five forged ratchet wheels are ganged up on a magnetic chuck and faced to their required width. This setup is particularly well adapted for this type of work. In another case, two surfaces of a stoker power box casting were ground in a floor-to-floor elapsed time of only 28 minutes.

There are many instances where it is necessary to control the dimensions of parts within fairly close limits, yet where the character of the finished surface is not so important. Typical instances of this are the width of sheared plates, forgings, castings and the like. By employing a face grinder operation, the part may be made close to size by shearing, forging or casting, and the final sizing obtained by grinding. This removes the excess metal where necessary, but leaves unground those surfaces where excess metal does not exist.

An advantage of the face grinder now of particular interest because of the present manpower shortage is its ease of operation. Any intelligent man without previous mechanical training can be taught to operate a face grinder in an extremely short period. Also, production per man is much greater than when using other types of machines. Newer types of face grinding machines, such as illustrated in Fig. 5, permit even greater output per man.

Fundamental Rules Evolved

From the experience of this company, a few fundamental rules have been evolved which will facilitate obtaining best results with face grinding:

—The designer of machine parts must understand the face grinding operation thoroughly.

—Jogs must be avoided, such as shown at A, Fig. 1.

—Surfaces to be finished should be "relieved" as much as possible to speed up the operation.

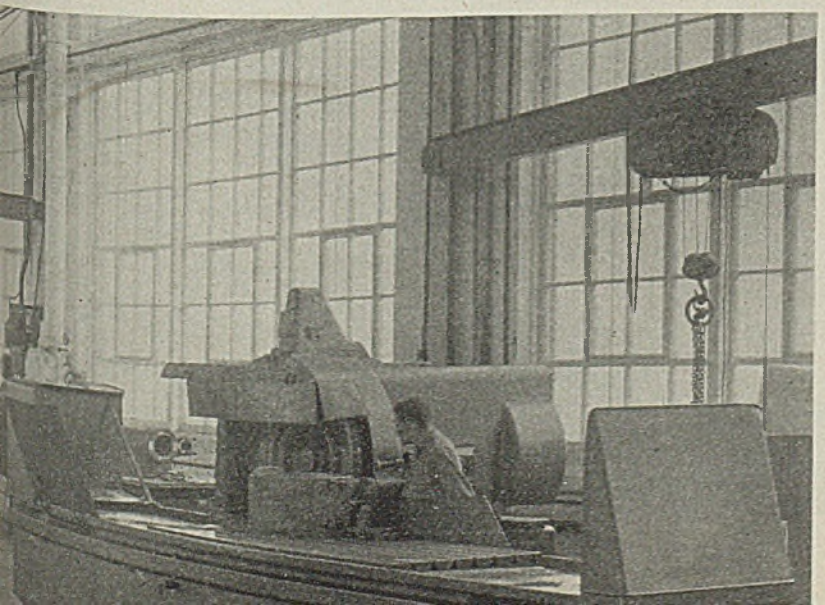
—Where control of dimensions rather than finished surfaces is the object, partly unfinished surfaces shoud be accepted.

—Castings must be poured close to size to avoid unnecessary removal of metal. This, of course, is not practicable in ordinary machine tool operations as the presence of scale in or close to the finished surface would dull the cutting tools too quickly.

—One complete operation also is eliminated by face grinding because no preliminary operation (rough machining to get through tough skin of castings) need be employed.

Anyone unfamiliar with face grinding should consult a maker of face grinding equipment before attempting to use the process. A study of various types of work—made from prints or actual pieces —enables the grinder maker to determine quickly whether or not face grinding will save time, material and money, and whether the work in question is suitable or can be redesigned for face grinding. Some grinder manufacturers will grind samples of work to determine actual grinding time and costs.

Fig. 5—In this operation on face grinder of latest design, three sides of a pump case at a 90-degree angle are ground in 35 minutes. By revolving the piece about a centering plate only one setup is required. Largest of the three surfaces ground measures 10 x 22½ inches, the other two, 8¼ x 9¼ inches



ELECTRONIC TESTING

. . . . finds important applications in qualitative and quantitative metallurgical tests on either ferrous or nonferrous materials; commands attention for its work in checking, evaluating and sorting such materials in the form of stock or finished pieces

POSSIBLY the newest application of electronics in metal producing and metalworking fields comes under the general heading of magnetic testing methods. It represents an advance in the science of nondestructive metal testing through the medium of high frequency vacuum tube oscillators and cathode-ray tubes. It is reported to be conspicuously successful in tests for case depth, core hardness, plating or cladding thickness, carbon content, brittleness, variations in heat treatment and even tests of machinability.

The method finds its commercial use in the form of the Cyclograph, Fig. 3, developed by the Allen B. Du Mont Laboratories Inc., Passaic, N. J. The piece of metal to be tested is inserted in a coil which is part of the instrument and also part of a tuned circuit. The test piece thus constitutes the core of the coil, producing measurable power losses in the tuned circuit which are used in various ways to give indications on the cathode-ray tubes.

These core losses are a function of the numerous different frequencies of oscillations being used in testing for different properties. They are interpreted by a study of patterns on the screens of the cathode-ray tubes. As pieces are inserted one after another into the coil fixture, the "cyclogram" or cathode-ray trace pattern instantly varies in height to indicate metallurgical differences.

Such measurements as case depth, core hardness, carbon content, etc., require that all properties except the one under observation remain reasonably constant from sample to sample. The multiple frequency characteristic of the Cyclograph makes possible preliminary selection or "standardizing" tests to insure that all properties of the test samples in a given lot remain constant except for the property under investigation. This standardizing test would correspond to a chemical determination of manganese, chromium, nickel, etc., taken to fix these elements quantitatively so that variations caused by their presence as alloys and indicated on the instrument may be given no undue significance if the test, for example, were concerned solely with carbon content and tensile strength.

Practical applications of this electronic test method to simple sorting problems include:

—Sorting SAE and NE steels according to chemical analyses.

—Classifying pieces of steel of the same analysis according to heat treatment.

—Sorting nonferrous metals according to structure.

—Separating case-hardened from non-case-hardened pieces.

—Separating decarburized pieces from satisfactory pieces of steel.

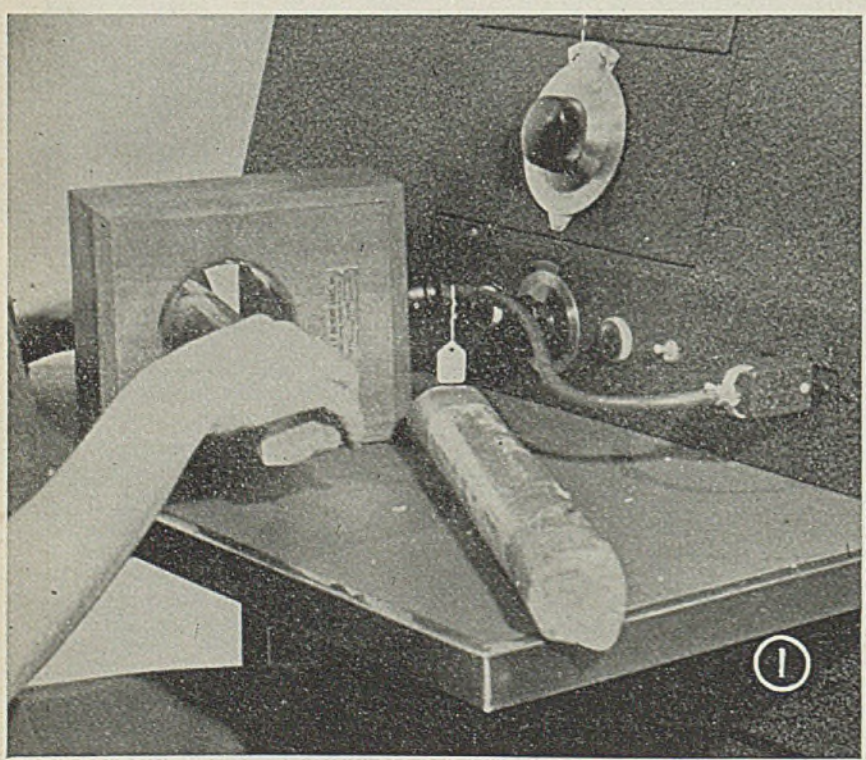
—Sorting pieces of metal in which the internal stresses are excessively high, from others in which internal stresses are normal.

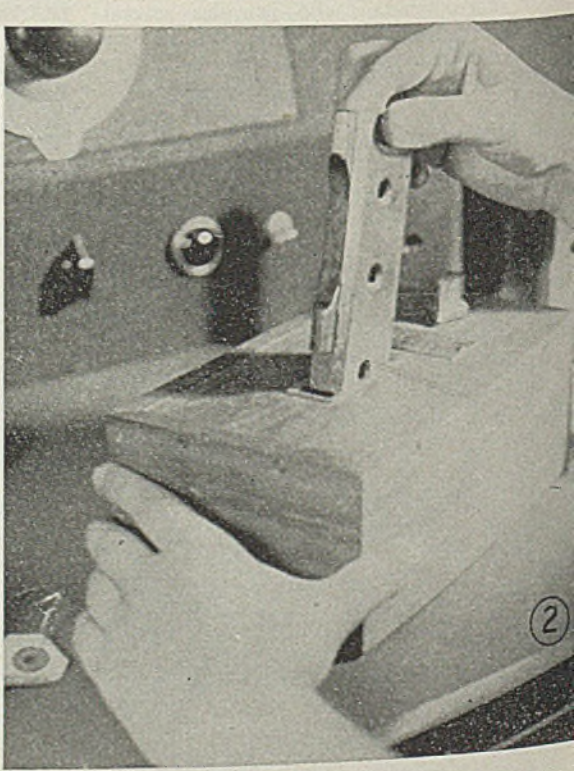
The procedure followed in sorting common grades of SAE and NE steels in all stages of heat treatment has been to select two or more frequencies which give a correlation between the instrument readings and the characteristic of the metal to be identified. A graph is plotted which shows the relative instrument readings as a function of the frequency, and proper test frequencies are chosen from this graph. Representative curves in Figs. 4A, 4B and 4C demonstrate that steel bars may be sorted according to analysis or heat treatment.

It may be seen that measurments at three frequencies, say, of 3, 10 and 50 kilocycles, are sufficient to establish definitely the curve upon which any

Fig. 1—Checking the packaging of welding rods to make certain that each bundle of 50 electrodes is of the same metallurgical composition

Fig. 2—Cyclographic test for case hardening of gun breech blocks





METHOD

By DAVID GROSS
Allen B. Du Mont Laboratories Inc.
Passaic, N. J.

particular steel lies, as shown by the graphs.

If an attempt were made to separate any two of a number of different steels such as those shown in Fig. 4A at any one frequency, confusion would result, for ultimately two steels giving the same reading would be encountered. To make a practical separation of the two, a sample of each steel is obtained. A composite indication at two frequencies other than the measuring frequency furnishes a reading typical of each grade. This is the standardizing reading. If the standardizing reading is one of the two values expected, the measuring indication shows which one of the two steels is the particular piece. If it is not one of the two expected readings, the piece under test then patently does not belong to either of the two grades the instrument is supposed to be sorting, or else it is not in the expected state of heat treatment.

A representative example of the adaptability of this system as an aid in sorting is its employment by a welding electrode manufacturer to check the packaging of welding rods. Fig. 1 shows packages each of which contain 50 rods. Inserted in the test coil one package at a time, it is possible to make certain prior to shipment that all rods in any one package are of the same kind or metallurgical composition. The cathode-ray pattern tells at a glance whether rods of the wrong type have been included.

Of course, an application like this is handled with comparatively low frequencies in order to get an indication (of core loss) through the entire cross section. This contrasts with surface measurements such as those for case depth, and decarburization which are done with high frequencies in order to confine the indication to the outside portion of the cross section.

Other instances where the system is used successfully for sorting are:

—The effective separation into three groups present of several million aircraft bolts. Analyses were SAE-1020, 1065 and 4130.

—Sorting of 300 tons of 1 21/32-inch billets into two analyses present in 8 hours. Instrument was placed near the mixed billets and one end of each billet, carried in a sling, was inserted in the coils to make the test.

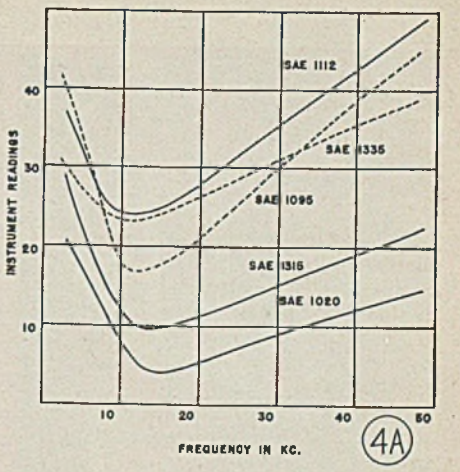
—Sorting of 8000 cylinder head bolts

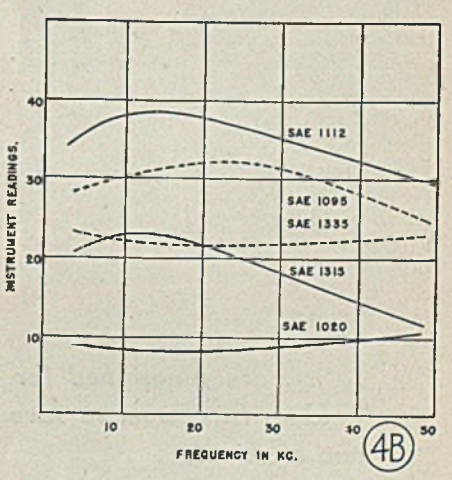
(*Please turn to Page 127*)

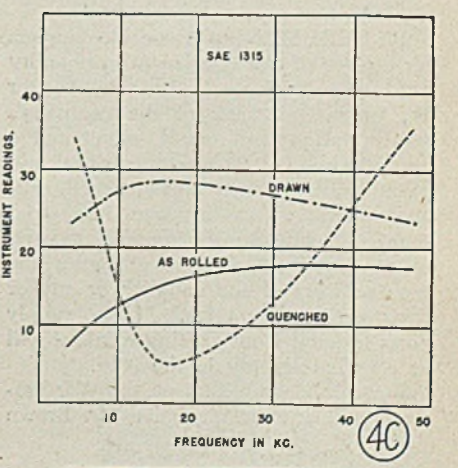
Fig. 3—Cyclograph checks the hardness of armor-piercing shot against a given standard

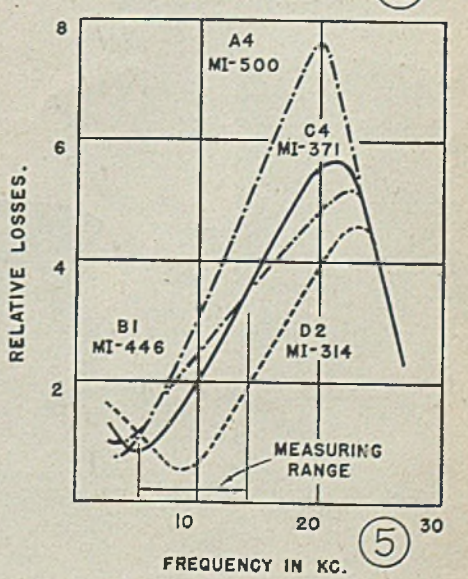
Fig. 4—(A) Curves for SAE steels as rolled; (B) SAE steels quenched and drawn; (C) Curves for SAE-1315 in various stages

Fig. 5—Loss-frequency curves recorded by the Cyclograph compare favorably with the machinability index for bullet core steels

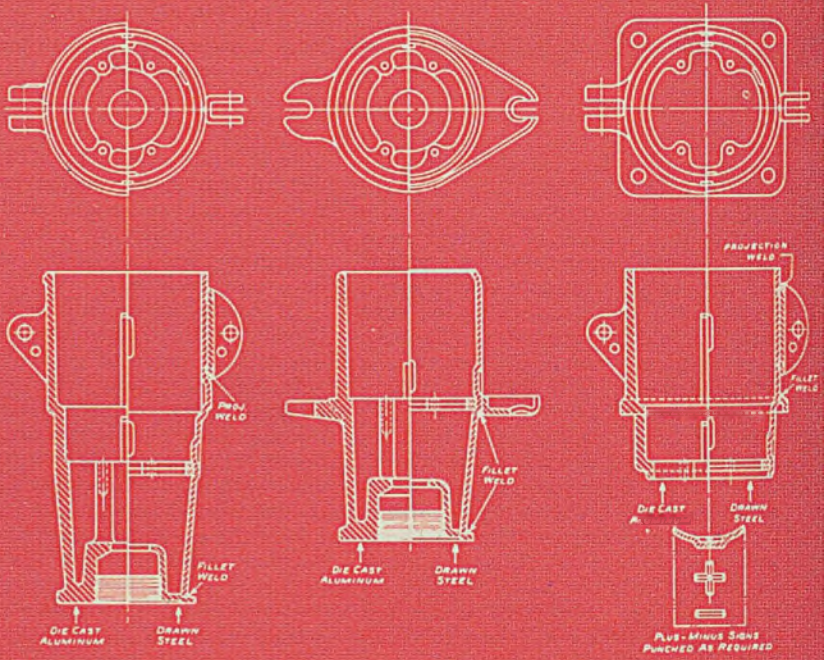








Cable Couplers



. . . . are redesigned for production by arc and resistance welding from steel to save important amounts of copper, tin and aluminum

By W. H. COCHRAN
Works Laboratory
General Electric Co.
Erie, Pa.

BY REDESIGNING the cable couplers for a piece of war equipment in quantity production at General Electric, Walter W. Brown, engineer of the company's transportation department, eliminated a bottleneck in the machine shop and paved the way for savings of tons of critical materials. At the same time, strict interchangeability of component parts was maintained without changing the type or form of the couplers or any of their catalog numbers. Thus, supply parts ordered from existing catalogs will fit couplers already in the field.

For this accomplishment, the War Production Board recently gave Mr. Brown a citation of Individual Production Merit —the highest honor that can come to any individual war worker. Mr. Brown was the seventh man ever to receive this honor.

On the basis of current orders, the saving of material amounts to 8900 pounds of brass rod; 21,500 pounds of phosphor bronze (containing 18 to 20 per cent tin); and 120,000 pounds of aluminum—remarkable totals since only one of the coupler parts redesigned weighs more than a few ounces. The savings in brass and bronze resulted largely from use of swaging to produce the desired shapes rather than by machining from solid bar stock. The saving of brass amounted to approximately 35 per cent for each redesigned part while the saving in phosphor bronze ranged from 30 to 60 per cent.

The saving in aluminum, amounting to 100 per cent, resulted from changing the coupler case from a diecasting to fabricated steel as illustrated in Fig. 1. An increase of 50 per cent in production was also obtained. Whereas the aluminum casting required machining, an operation which was fast becoming a bottleneck, the fabricated steel coupler cases require no machining and no finishing work other than punch press operations where capacity was ample. New dies had to be developed, however, in order to form the steel tube stock into the particular shape required for the casing. Also, a special fixture had to be built in order to hold and slowly revolve each casing to permit automatic arc welding of the several circular seams required, as illustrated in Fig. 2.

A special fixture for resistance welding, Fig. 3, also was required for attaching "ears", Fig. 4, for the fastening bolts.

How the Fabrication Processes Were Selected: The principal requirements of joints between component parts of the coupler cases were that they be leakproof, watertight and of good appearance. No great strength was required of any joint except the one which held the ears for the fastening bolts. A number of fabrication processes capable of meeting these requirements were available including copper brazing, silver soldering, resistance welding and arc welding.

Brazing or soldering were not used because of their tendency to soften the

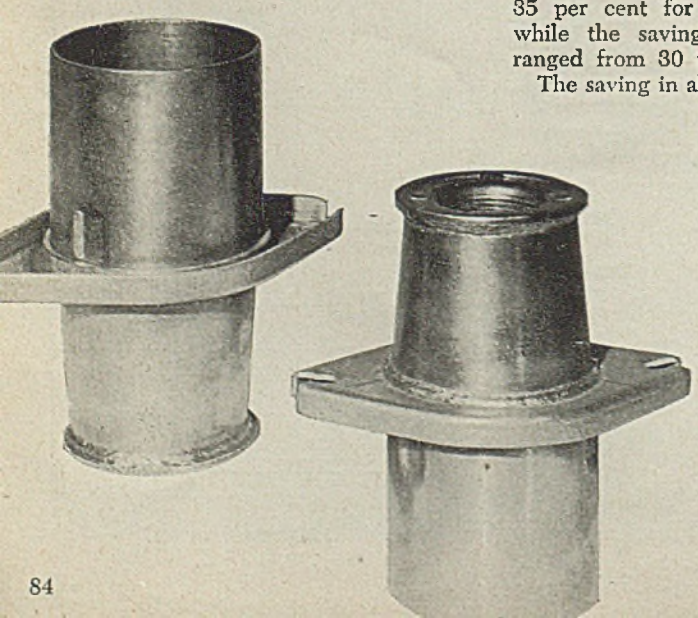


Fig. 2 — Flanges and glands are arc welded automatically to drawn steel tubing in making the new steel coupler cases

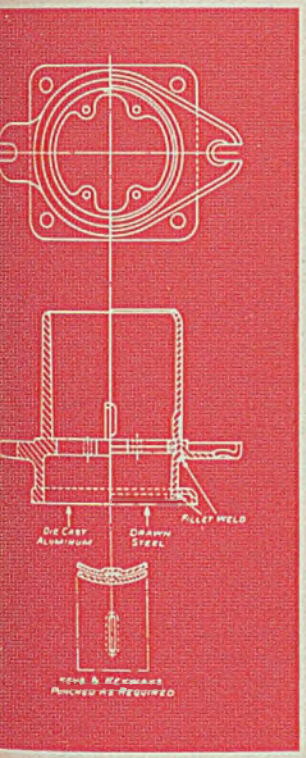
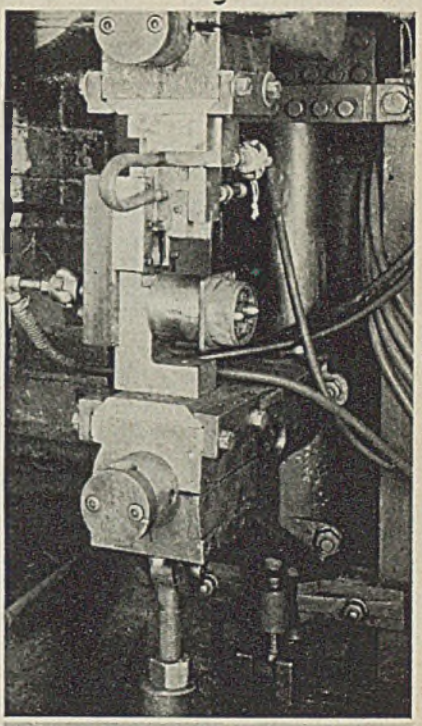


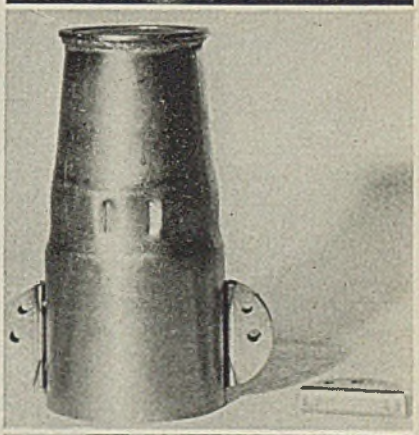
Fig. 1 (Left)—These four examples show how cases of cable couplers formerly of diecast aluminum were redesigned for fabrication from steel. Left half of each drawing shows former design, right half as made of steel

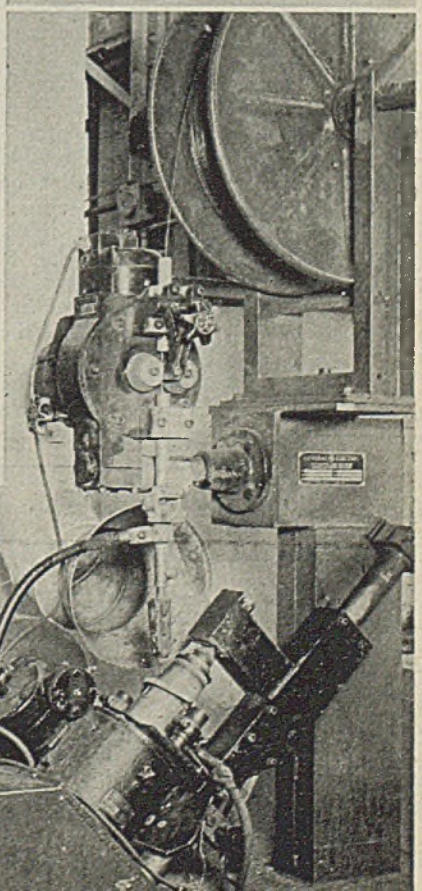
Fig. 3 (Top, right)—Closeup of die and fixture setup for resistance welding ears to body, see Fig. 4

Fig. 4 (Center, right)—Ears are fitted with elongated projections for projection resistance welding them to the tube body as shown in Fig. 3

Fig. 5 (Bottom, right)—Automatic arc welder uses Thyratron controlled head to feed bare electrode from overhead reel. Operator establishes desired welding conditions by means of control panel at left







tubing and injure its ability to withstand rough handling. While resistance welding was ideally suited to fastening the ears and similar parts, it could not be applied to the circular seams without unwarranted expense. Arc welding was the ideal means of joining the flanges and glands to the tubular element since it permitted the use of punched parts which are relatively inexpensive.

Also, since the seams were perfectly uniform and circular in shape, and since the volume of production warranted the initial investment, the automatic process of arc welding was selected to obtain best speed and economy.

Selection of Electrodes: Two general classes of electrodes were available for automatic operation to suit a job of this character:

—Heavily coated electrodes in cut lengths applied with an automatic stick feeder;

—Bare or lightly coated electrode applied with continuous automatic feed from a reel.

The strength requirements of the joint did not warrant the use of heavily coated electrodes; hence, the second method was selected because electrodes of this kind are more readily available, there is no loss from stub ends or coating, and the welded joint is watertight and of good appearance.

Since the size of the fillet weld for the circular seams is relatively small, as illustrated by Fig. 2, an electrode diameter of only 3/32-inch is required.

Bare electrodes conforming to both class E-4510 and E-4520 AWS filler metal specifications were considered. While the melting rate of the latter class is faster, results were not acceptable because the required arc voltage was so high that the arc had a tendency to spread out over more area and it was difficult to make a small fillet weld.

The class E-4510 electrode gives the best results of any electrode tried because the arc is more concentrated and the required arc voltage is low enough to prevent burning off the edges of the parts. The electrode is operated at a current of 130 to 140 amperes, with an arc potential of 16 volts. The resulting welding speed is 13 to 14 inches per minute. The electrode is purchased in 150-pound coils which are mounted on a reel having a demountable flange for use with the automatic welding head.

Standard Thyratron Controlled Arc Welding Head: To feed the electrode into the arc at a constantly controlled rate, a welding head of standard G-E manufacture is used as illustrated in Fig. 5. The electronic (thyratron) control for this head responds instantly whenever the arc voltage tends to change and the response operates to maintain the arc voltage constant for uniform welding.

The operator's station, or means by which the operator establishes the welding conditions which are to be maintained automatically, is mounted within easy reach. This station provides for ad-

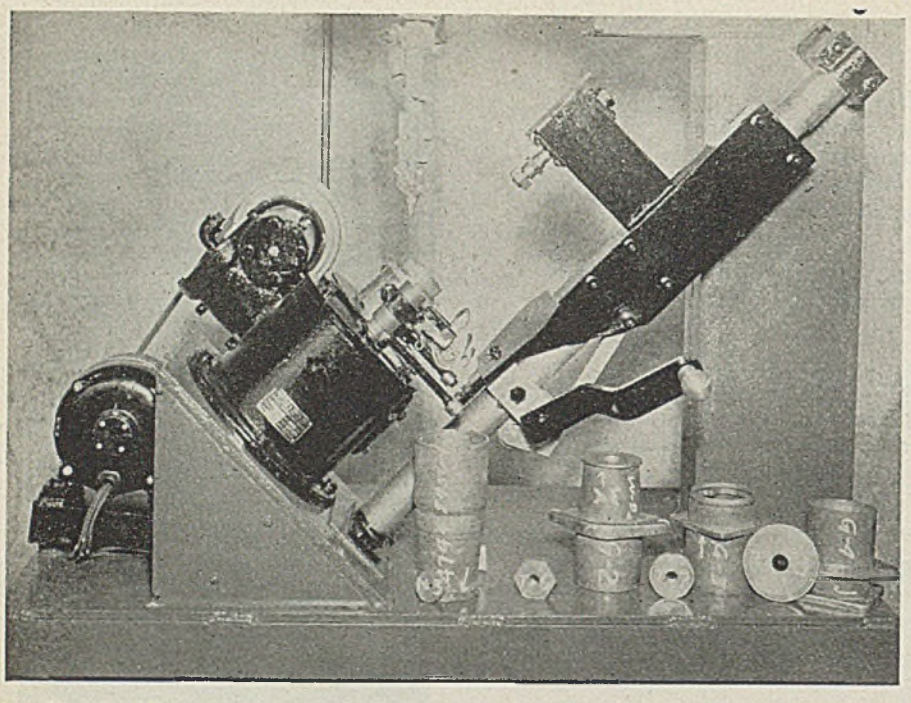


Fig. 6—Closeup of custom-built fixture and drive for holding and rotating work during welding in machine, Fig. 5. Adapters for movable tail fixture (top right) are shown on base. These permit various types of work to be held and rotated in same fixture. Note handle operating cams controlling brush movement

justment of arc voltage, control of welding speed, as well as starting and stopping. It also indicates welding current and arc voltage.

Custom-Built Work-Holding Fixture: Since the seams to be welded are perfectly circular, traverse motion between the work and the welding head is obtained by simply rotating the work. To permit welding to be done in the flat position, the axis of the work is tipped to 45 degrees as illustrated in Figs. 5 and 6. This position is maintained by clamping the work between the head stock and the tail stock as illustrated in Fig. 5.

The work is revolved by means of the head stock which is driven by a direct-current motor providing an adjustable speed range of 2:1. Speed reduction is obtained by means of a double-reduction gear driven by a 4-step pulley V-belted to the drive motor. See Fig. 6. Limits of motion are established by switches which in turn are operated automatically by the spur gears beneath the head stock, Fig. 6.

To save time in loading and unloading, the sliding tail stock is operated by a crank and toggle linkage as shown in Fig. 6. The tail stock is locked in the open or closed position by turning the handle through approximately 180 degrees. Location of the tail stock is adjustable by means of a threaded pin which engages one of a series of holes. This flexibility of adjustment permits coupler cases of various lengths to be accommodated as shown by Fig. 6.

The tail stock spindle is mounted on ball bearings and backed by a preloaded spring which further secures the work by additional compression when the tail stock is locked in the welding position. Both the head stock and the tail stock are provided with adapters as illustrated in Fig. 6 for holding the various pieces of work in the fixture.

To assure good electrical connections for introducing welding current to the work, two Metite brushes are mounted in insulated holders which are pivoted to permit loading and unloading the work. The pivot is operated by levers having rollers which engage the cam plate attached to the tail stock frame.

When the tail stock is in the unloading position, the brushes are held in the clear as shown by Fig. 6. When it is in the welding position, the cam clears the rollers and allows the brushes to bear on the outside of the work piece. For cases which do not fit over the hub of the head stock, the cam plate is relocated so that the brushes transmit current through the hub of the head stock.

Resistance Welding Used for Joining Some Parts: As mentioned before, resistance welding is also used for joining some of the parts of the coupler cases, such as the welding nut (projection welded to a case for the purpose of attaching a cap chain) and the ears used for holding the fastening bolts.

Fig. 4 shows one of the coupler cases with ears projection welded in place, and also shows the ears with projections embossed on the surface. The projections are of the elongated type, as it was found that this shape of projection gives the best results when the flat surface of the ears is welded to the radius of the tube. When tested to destruction, these welds will tear out metal but will not break.

Fig. 3 shows the fixture used for projection welding the ears to the tube body with the coupler case in place ready for welding. The tube body is slid over the spud on the fixture and is positioned correctly by means of pins protruding from the ends of the spud. An ear is held on the upper or traveling head of the fixture by means of spring clips fastened to the top die, as shown in Fig. 3.

The top and lower half of the fixture are built as a unit for ease in setting up the job in the machine. Thus the fixture is always in line when it is placed on the projection welder, and no unnecessary time is spent in lining up the job. As the ears must be positioned with relation to other parts of the coupler, this is an important feature.

The top head also has a self-aligning feature which equalizes the welding pressure on both projections.

The projection welding of the ears of the coupler cases is done on a 200 kilowatt-ampere projection welder controlled by a thyratron resistance welding control panel and a sequence panel.

Welded Cases Satisfactory: The applications of welding to the fabricating of the coupler cases has been very successful and the product has been accepted as an improvement over the cast case.

Thousands of these cases are now being made with an average of 14 inches of arc weld on each part and four projection welds on approximately half of the parts. The welding operations are reliable and there have been few if any rejects due to faulty welds.

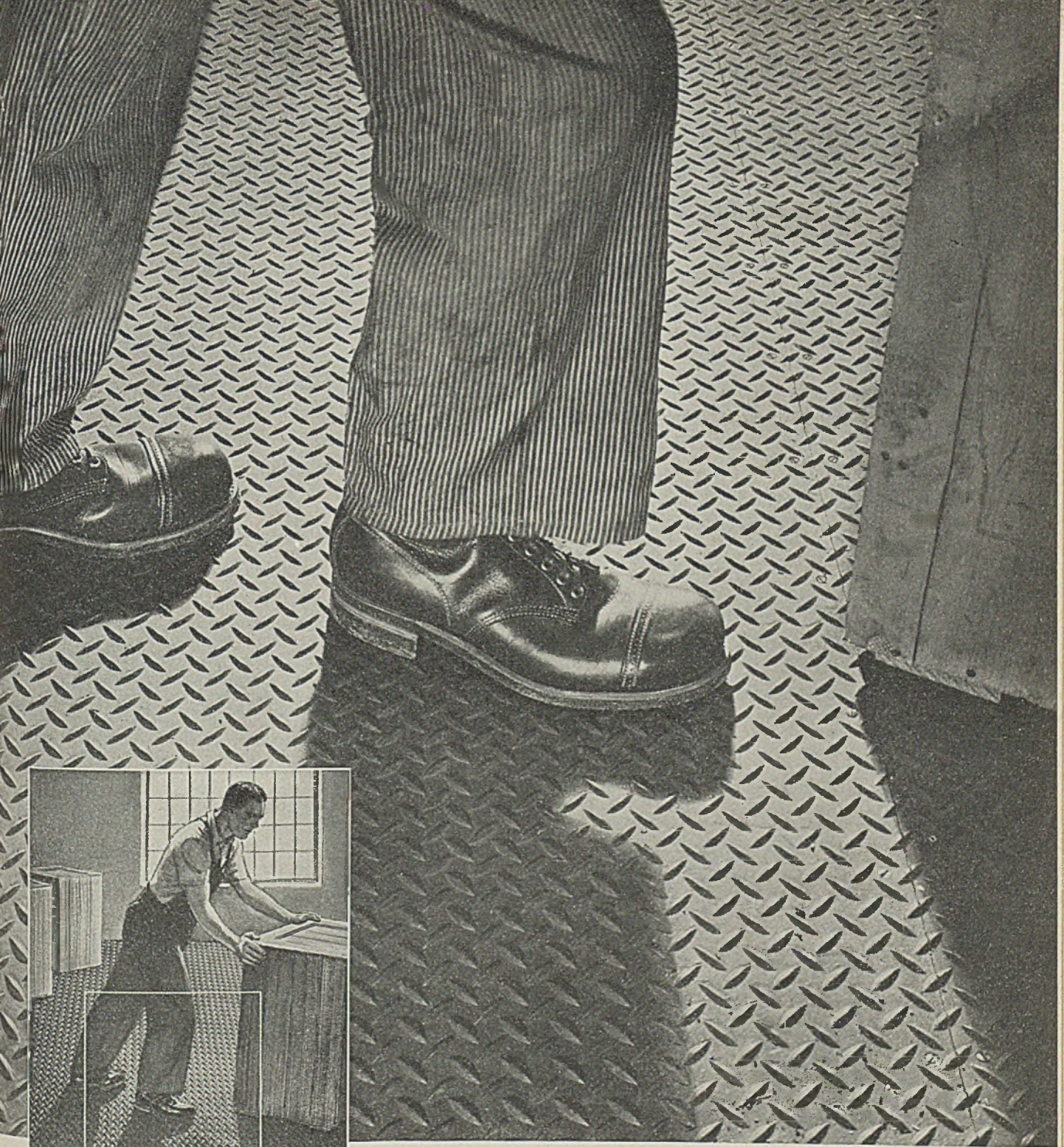
Grease-Dirt Solvent Aids Maintenance of Machinery

Many metal cleaning applications which do not respond to alkaline cleaning are being successfully handled by Running Gear, an emulsifiable-type cleaner produced by the Technical Processes Division, Colonial Alloys Co., Philadelphia 34. It is said to be harmless to metals in quickly removing oils and solid particle dirts and greases from road and mining machinery, tractors, tank chassis, gun mounts, parts and assemblies prior to repairs or refinishing.

The preparation has effectively cleaned smut on steels, polishing, buffing, drawing, stamping compounds and slushing oils, all quite difficult for other known methods such as solvents and alkalies.

For the mixture, there is added to 1 part of Running Gear from 3 to 10 parts of kerosene or common mineral spirits. It is used at room temperature and is either sprayed on or made up into a solution for a tank into which the work is dipped. Soaking period varies from ½ minute to 30 minutes, depending upon the extent and nature of the dirt.

A three-bath vapor-solvent degreaser may be converted to the use of this cleaner by a few simple changes—removal of the vapor condenser, insertion of a splash baffle between the first and second baths, and steam coils cut off in the first partition.



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AN ENGINEERING APPROACH TO THE SELECTION, EVALUATION AND SPECIFICATION OF

METALLIC MATERIALS

Publication of Doctor Gillett's report prepared for the War Metallurgy Committee began with the Nov. 22, 1943 issue of STEEL and will continue for several more weeks—In Chapter I he discussed "The Need for Interpretation of Test Data," in Chapter II "Chemical Composition an Insufficient Criterion" and in Chapter III "Pounds Per Square Inch"—In Chapter IV, part of which already has appeared, he comments on "The Meanings of Conventional Tests"—In this issue, he presents data on evaluation of materials for "guts" to withstand overloading, saying arbitrary schedule of overstressing could be used as basis for determining propensity toward or relative freedom from damage

By H. W. GILLETT

Damage

IF WE KNOW that the repeatedly applied stresses are at a definite level, the endurance and the notched-endurance limits have a "lbs/sq./in." meaning. If stresses above those limits are to be applied, but the engineer cannot state their intensity or number, but nevertheless demands evalution of a material for "guts" to stand undefined overload punishment, the testing engineer is in a quandary.

Most engineering metals will stand quite a number of quite high overloads without distortion or damage, that is, if the repeated stress is thereafter lowered to that of the endurance limit, the not-too-greatly-abused specimen will last indefinitely, in spite of having been overloaded. The part would fail if the overloads were indefinitely repeated, yet it will not even distort in one such overload below the yield strength. Somewhere between the one, harmless, and the finite number, fatal, overloads comes a dividing line between a nondamaging and a damaging number. No crack develops during the nondamaging period, nor does it develop visibly, if it is there at all, in the first part of the damaging period. A crack does develop toward the end of the damaging period; after the crack starts, failure is certainly inevitable at the stress level of the endurance limit, where material undamaged by repeated overload would not fail.

Reasonable basis for evaluation of the propensity toward or relative freedom from damage might be had through an arbitrary schedule of overstressing. A specimen could be run for some definite fraction of the life it has shown at some definite overstress as a virgin bar, then be run at a lower stress, i.e., at the endurance limit or only at slightly above the endurance limit. The behavior at this lower stress, compared with the behavior of a virgin specimen, will show whether the specimen was or was not damaged. Some such damage data exist, and are collected in Reference 5 but few have been obtained on such a schedule as to be thoroughly comparable with each other.

The behavior of the annealed carbon steel whose virgin S-N curve is shown in Fig. 23b, when overstressed between the endurance limit and the yield strength is shown in Fig. 24. In the polished bar this steel is very readily damaged. The notched bar probably develops more effective cold-working at the base of the notch and has some resistance to damage in the notched condition.

Moore's data for two steels are shown in Fig. 25. Johnson and Oberg's data for aluminum propellers are shown in Fig. 26. Data for malleable iron appear in Fig. 27.

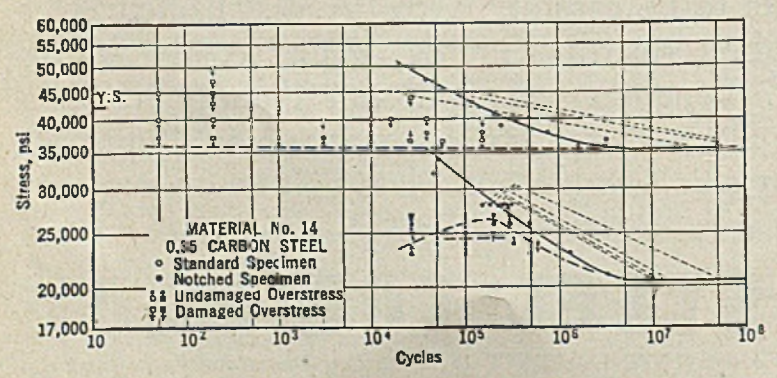
Far too few data exist on different classes of steel, different structures resulting from heat treatment and different heats of ostensibly similar steels, to allow generalizations about damage.

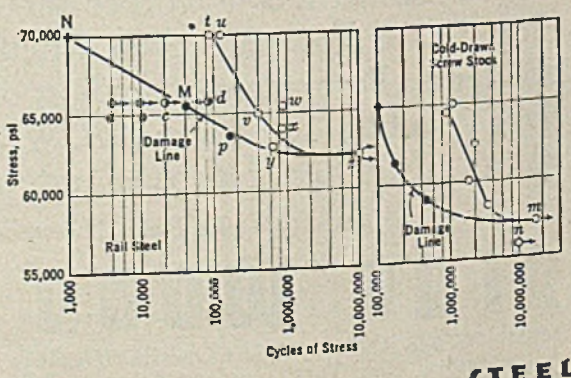
It is, however, certain that steels, structures, and probably heats, do vary in resistance to damage. It is also certain that no way of revealing fatigue damage is known save the very tedious method of overstressing and then running fatigue tests on the overstressed specimens.

The scatter among duplicate tests of virgin bars, resulting in a S-N band, means that very many damage tests are

Fig. 24 (Left below)—Damage lines for smooth and notched annealed 0.35% carbon steel. Overstressed at the stresses, and for the number of cycles indicated, then run at the endurance limit. If any overstressed specimen ran 10 millon cycles at the endurance limit, it was considered undamaged. Russell and Welcker[49]

Fig. 25 (Right below)—Damage lines for rail steel and cold-drawn screw-stock. Moore[49a]





STEEL

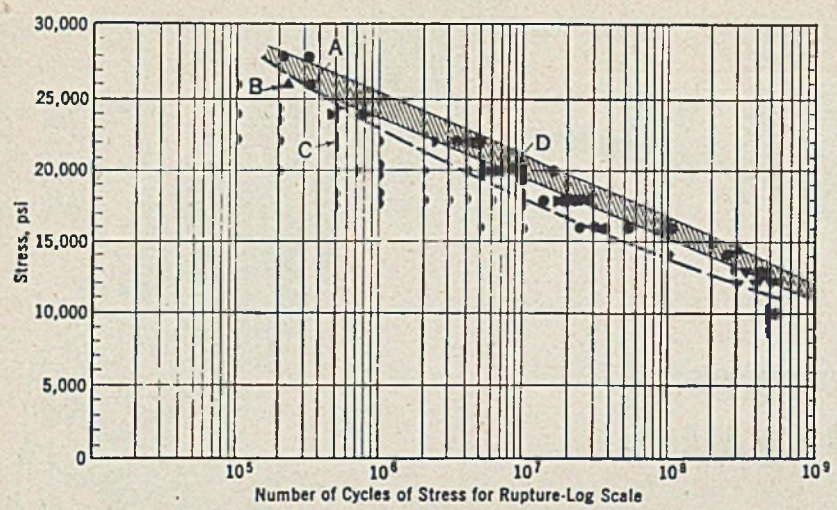


Fig. 26 (Left)—Scatter band and damage line for specimens from forged aluminum alloy propellers. Johnson and Oberg. Half circles indicate undamaged specimens

necessary in order to establish the trend of behavior. Attention to the elimination of scatter will have to precede accurate knowledge of damage behavior.

An important clue to one cause of scatter on polished-bar endurance tests seems to be emerging from current investigations. The importance of the surface cold-working that occurs in mechanical polishing has evidently been greatly underestimated. In supposedly "duplicate" specimens, various amounts of final polishing may be required to remove scratches left from earlier operations and these variations in cold-work are reflected in variations in life, i.e., scatter is produced. Without some such cause the distribution curve of Fig. 29 should have equal deviations from the mean, whereas the deviation is markedly on the side of increased life, presumably representing those specimens that received more cold work. The true base-line may perhaps be obtained and scatter reduced, by electropolishing deeply enough to remove all vestiges of cold-work.

The data of Fig. 29 were obtained as a prelude to damage studies. A specimen from each bar of the low carbon steel used was tested at 45,500 lbs. per sq. inch and unless it broke at close to 30,000 cycles, that bar was discarded. The bars that passed were made into polished fatigue specimens, overstressed as indicated in Fig. 30, then S-N curves determined to give the new endurance limits, after overstressing. The tendency toward increased lowering of the new endurance limits with increasing number of cycles of overstress is clear, but the scatter in individual sets was large.

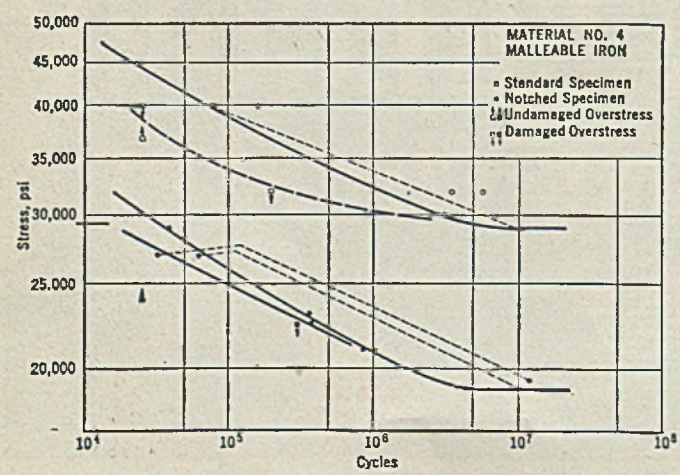
Conclusions drawn from a few specimens in the study of damage on a given heat may not be sound, because of uncertainty due to scatter, and since it is all too probable that, were sufficient data at hand, it would turn out propensity toward damage might be one of those features in which what has been done to an individual heat of steel, rather than the composition of the steel, is the ruling variable; an exhaustive study of many supposedly duplicate heats would have to be carried out before the damage problem can be truly clarified.

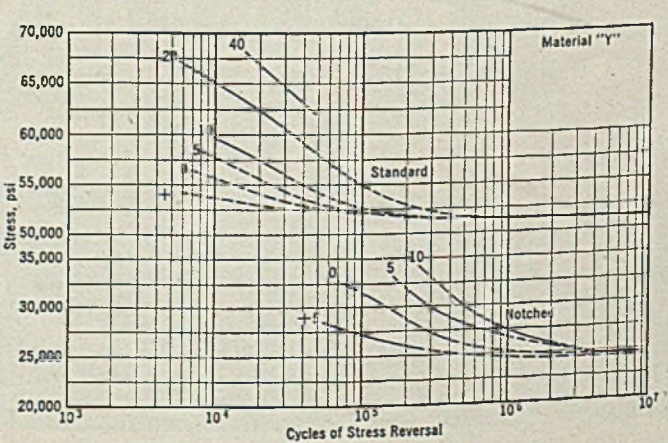
Uncertainty of the true behavior due to different composition, different finishing practices, and different heat treatments, could be resolved if enough tests were made in exhaustive researches, but, for the engineer to apply the results of such investigations, he must be able to estimate the degree of overstressing to which the material will be subjected in service.

If the engineer does know the stresses, both as to stress level and number of repetitions and the order in which they occur, and the severity of the notches and stress-raisers he has to allow, a notched-damage test could be evolved to appraise the behavior of materials and of different heats of the same material under that service. Lacking such knowledge, even simulated service tests can hardly be devised that reasonably reproduce the unknown conditions of service. A material may have better "guts" than another, yet neither of the two have enough to withstand the conditions that actually occur in service. In one use one may be as bad as the other, yet under less strenuous conditions one may be de-

Fig. 27 (Left Below)—Damage lines for malleable iron. Russell and Welcker. See footnote, Fig. 24

Fig. 28 (Right below) — Curves for degree of damage, in region between the damage line and the S-N curve. Sanford, from Kommer's data.[50] Shows not only the ordinary damage line, but curves for degree of damage, and a curve showing improvement through limited overstressing. After overstressing a set of bars of an as-rolled 0.45 per cent carbon steel, for numbers of cycles, at various stresses (10, 20, and 30 per cent) above the endurance limit for polished or for notched bars, each set was tested for the endurance limit of that set. The new endurance limits are not shown by plotting, but are indicated by the numerals at the left of each curve. The new endurance limit for the bars overstressed along the curve marked "+5" for notched bars, was 5 per cent higher than the virgin endurance limit. The new endurance limit for the curve marked "O" was the same as the virgin endurance limit, i.e. this is the ordinary damage line. Curves bearing numerals 5, 10, etc., indicate that the prestressed bars had lower than the virgin endurance limits, by 5 per cent 10 per cent, etc. Such testing is illuminating but tedious in the extreme, as so many specimens are required





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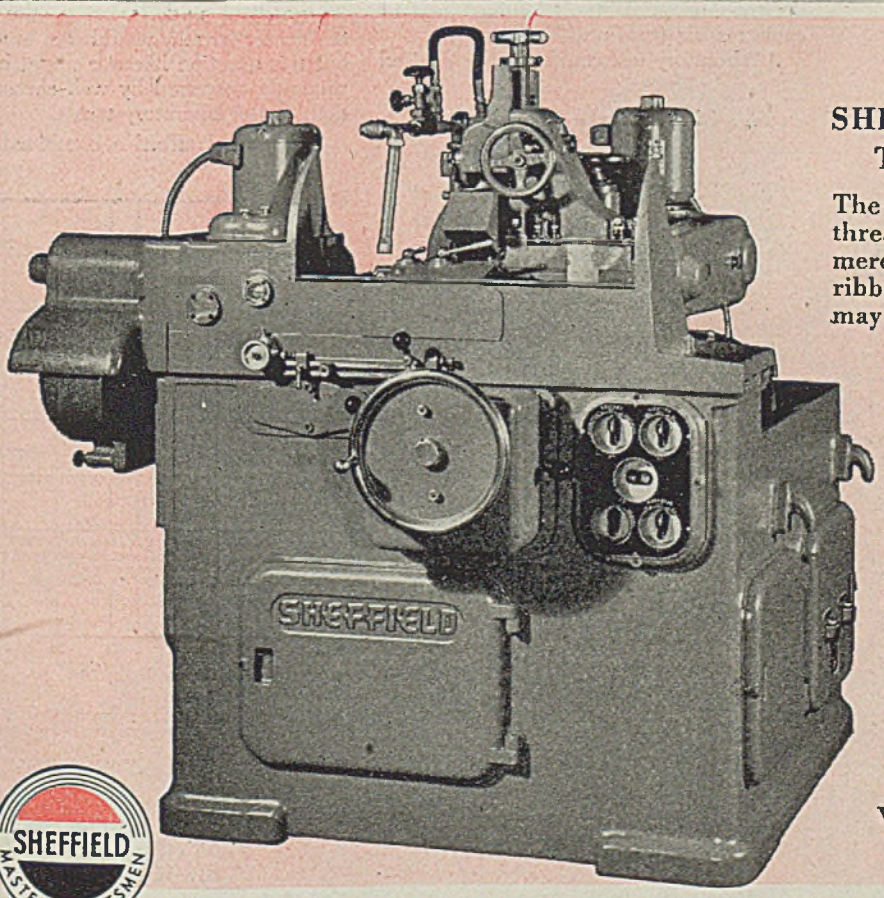

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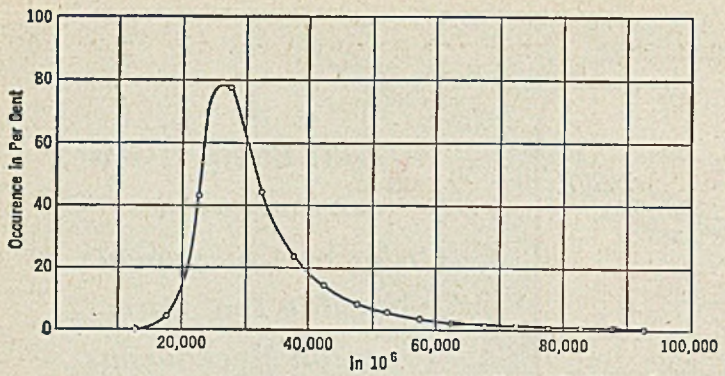


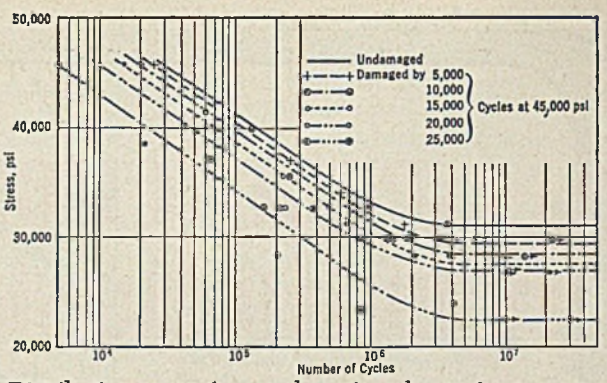
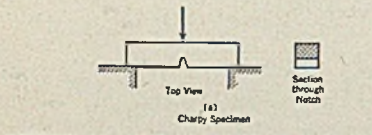
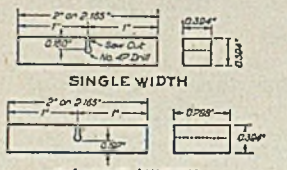


Fig. 29 (Top left) — Distribution curve for number of cycles to fracture at 45,500 p.s.i. The carbon steel ranged between 50,000 and 57,500 p.s.i. tensile, and had an endurance limit of 31,000 p.s.i. Muller-Stock[51]

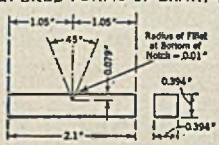
Fig 30 (Top right)



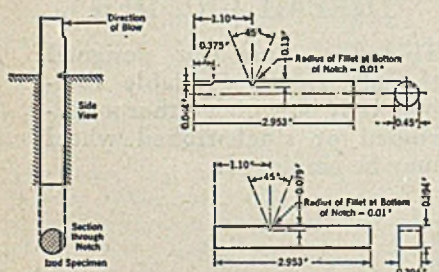
METHOD OF LOADING CHARPY TYPE BAR



PREFERED FORMS OF CHARPY BARS



ALTERNATE CHARPY TYPE BAR WITH V NOTCH



METHOD OF LOADING IZOD BAR

ROUNDS AND SQUARE IZOD BARS

Fig. 31 (Above)—Method of loading Charpy type bar. Preferred forms of Charpy bar, (a) and (b). Alternative Charpy type bar with V notch. Method of loading Izod bar. Round and square Izod bars

cidedly superior to the other material.

The increasing use of recording strain gages in aircraft flight testing suggests that there are now available, or may readily be made available, data showing with a reasonable degree of reliability the relative intensities of the succession of repeated stresses to which any part of an aircraft is expected to be subjected in service, provided that a suitable strain gage may be applied to that part. That is, the frequency of occurence of low and of high stresses could be plotted in a curve representing both the periods of understressing (and strengthening) and of overstressing (and possible damage).

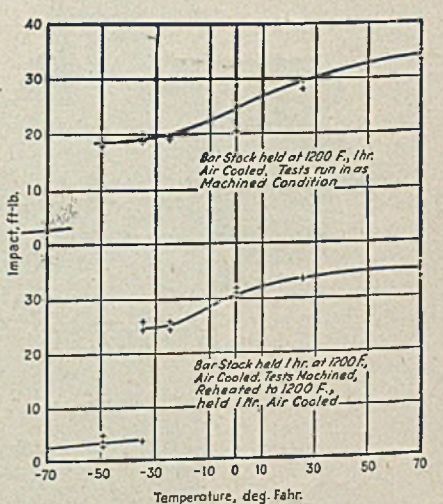
A laboratory test could then be devised to apply a sequence of repeated stresses correctly representing these periods and could be continuously applied to an actual, full-sized, aircraft part (with all its stress-raisers), divorced from the rest of the plane, thus allowing a test to be carried out in a few weeks that might correspond to the expected years of actual service.

The question would arise as to the effect of the sequence of stresses, for if the total number of peak stresses expected in the life of the plane were crowded closely together without long periods of intermediate understressing, the opportunity for repair would be minimized, but this question likewise might be fairly promptly answered by well-chosen variations in the laboratory test.

This would afford a combined test of

Fig. 32 (Below) — Toughness of malleable iron

Fig. 33 (Right)—Charpy data at low temperatures on the 0.35 per cent carbon steel whose fatigue and damage curves are shown in Figs. 23b and 24. Sergeson and Poole[68]*. Note particularly, at the lower left of the figure, that three tests at −35 degrees gave 26, 24, and 4 foot pound illustrating a border-line condition. If only two tests had been made, showing 26 and 24 foot pound, the steel would be considered, by the ordinary observer, as thoroughly tough, whereas a slight increase in the size of the specimen or a slight decrease in temperature, would make it act brittle*



Single blow notched Charpy value, ft. lb.	3.5-4	5	5.5-6	8-8.2
No. of 70 ft. lb. blows on wedge	14-22	22-24	27	30-30

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materials and structural design in relation to repeated stress, and might well be a short cut to a better understanding of both. However, this would supplement, rather than replace, tests in which materials were tested primarily, and design only secondarily, by damage studies along more conventional lines.

Development of damage-testing and the accumulation of data on different heats of different kinds of alloys and of supposedly duplicate heats under an arbitrarily-chosen set of conditions is much needed to dispel some of the present obscurity about damage-resistance, even though tests for exact appraisal may be in the far distant future. Development of tests along these various lines may be classified as the most pressing need in the evaluation of engineering materials.

Bland and Sandorff[53] discuss the importance to the aircraft industry of such developments, commenting that when damage curves can be expressed on a summation basis to give the summation of all combinations of overstress and number of cycles under the curve, the evaluation of life expectancy *would be exact.*

In spite of the importance of finding out how different steels and different heats respond to notches and overloads, and of improving behavior in these respects, avoidance of fatigue failures in improved materials, as in the everyday materials of engineering now available, will still require the engineering expedients of avoiding notches and utilizing controlled cold-working of the surface. A fine example of this is the work of Wood and Sanders previously cited. (p. 51)

One engineer 53 discusses this as follows:

"Fully 90 percent of all fatigue failures occurring in service or during laboratory and road tests are traceable to design and production defects and only the remaining 10 percent are primarily the responsibility of the metallurgist as defects in material, material specification, or heat treatment.

"Study of fatigue of materials is the joint duty, of the metallurgical, engineering, production department. There is no definite line between mechanical and metallurgical factors that contribute to fatigue. This overlapping of responsibility is not sufficiently understood.

"Hence the engineers are constantly demanding new metallurgical miracles instead of correcting their own faults. Until metallurgists are less willing to look for metallurgical causes of fatigue and insist that equally competent examination for mechanical causes be made, we cannot hope to make full use of our engineering material."

Materials that we ordinarily appraise as tough, sometimes fracture in brittle fashion under a single blow. Our first impulse is to blame the material and try to set up a test to evaluate its propensity toward brittle behavior. On the assumption that the test tells all, we are then prone to draw unwarranted conclusions from the test figures.

Notched-Bar Impact Testing

The test consists in measuring the foot-pounds of energy absorbed in fracturing a bar carrying a notch (Fig. 31) of such severity that any engineer would do his best to avoid it if he can possibly find a way to do so. Results are reproducible *only* for a given size bar and given notch. While they are sometimes reported in ft. lb./sq. in. or kgm/cm.^{2} of area back of the notch, this is a fiction, for there are no reliable conversion factors. Scale models do not tell consistent stories. This should at once make us suspicious of data given by a tiny specimen. Use of larger specimens, especially a comparison of the results shown by single, double, and triple width specimens (Fig. 31b),. tends to imitate the behavior of a large notched part a trace more closely, but there is still no assurance that service behavior is truly reflected.

The whole thing boils down to the fact that notch brittleness depends as much on the geometry of the piece, the restraint this geometry of size and shape imposes upon plastic deformation, as upon the ability of the material to deform in plastic fashion.

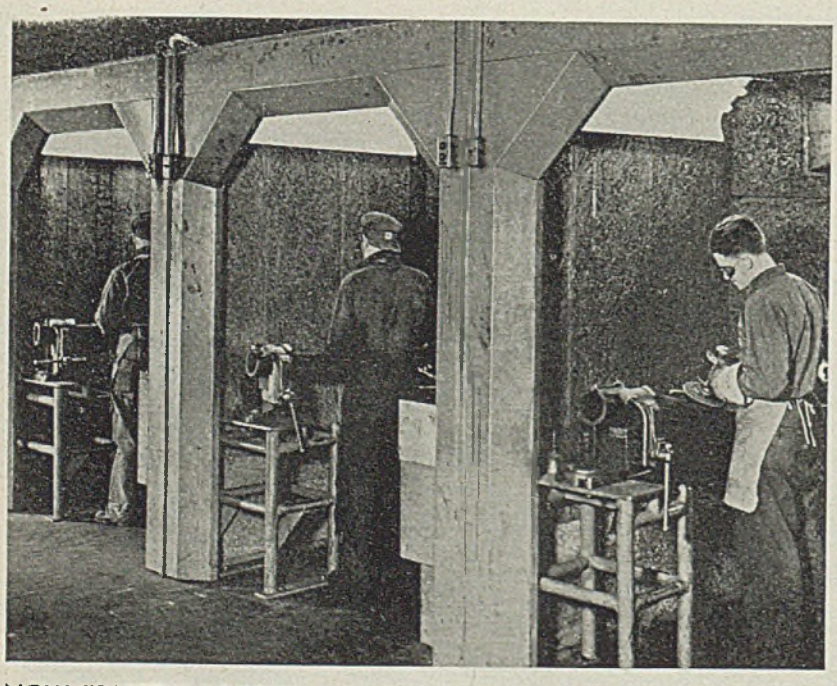
According to theory, brittle behavior depends on the ratio of shear *strength* to "cohesive *strength*", and on the ratio of applied shear and tensile *stresses.* Unfortunately, no one knows, or at least has been able clearly to describe, how to measure "cohesive strength" with a useful degree of accuracy.

According to theory [54], a material is ductile in the tension test when the cohesive strength is twice, or more than twice, the shear strength. A notch increases the ratio of tensile to shear *stress.*

When a material is without ductility in the tension test, and gives a flat break, without necking, the notched-bar test likewise shows it brittle. This is the case with cast iron. The reverse is not necessarily true. When a material does have ductility in the tension test, and thus can deform when conditions of constraint allow it to deform, and it starts to deform, it cold-works. The cold-work may alter the ratio of shear to cohesive strength and the ratio may also be altered by temperature.

A given notch in a given-sized bar thus selects one particular ratio of tensile to shear *stress,* and the material behaves according to the ratio of shear and cohesive *strengths* developed by the permitted deformation and the temperature. The test is accurate for that particular set of conditions, but does not allow extrapolation to any other set of conditions. For this reason, the foot-pound figure of a notched-bar impact test has value *only* in checking on whether two supposedly like materials are alike.

Service brittleness may be met, even



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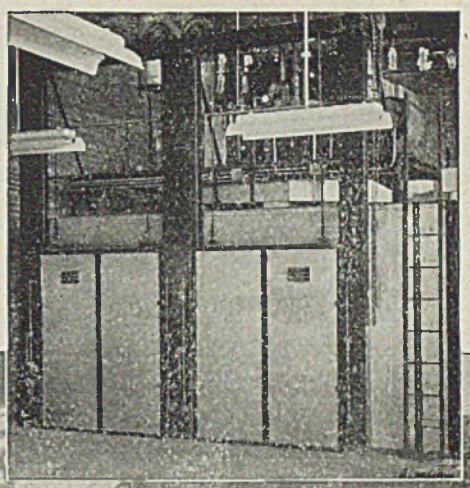

Right: Typical Maehler 2 compartment magnesium aging furnace.

Above: 8 of the many Maehler core ovens at Howard magnesium, aluminum and bronze foundries.

Above: Maehler Furnaces for normalizing brass rods and extruded aluminum shapes, Bohn Aluminum & Brass Corp.

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in materials ordinarily considered highly ductile if applied stresses throw "triaxial" tensions on the part.

Notches produce triaxial tension stresses, and the adoption of a "standard" notched bar represents a groping toward the end of subjecting materials to controllable triaxial tension. There is no practical method of either measuring or computing the magnitude of triaxial tension induced by a notch in a crystalline material, and there is no general agreement as to what constitutes similarity between notches in small test bars and those in large parts. This lack of agreement originates from observations that notches which are supposed to be "geometrically" similar do not produce the same results on large parts as they do on small test pieces. This means that there is a "scale" effect in the geometry that is not completely understood. The only way in the present state of engineering development by which the true behavior of a material under the unmeasurable triaxial tension of service can be ascertained is by testing full-sized parts stressed as they will be stressed in service. The "standard" notch test thus has no design value.

A material of 20 foot-pound in the "standard" test is not "twice as strong", as one of 10 foot-pound, and, for two different materials, like figures of 10 foot-pound each do not necessarily connote likeness in any other set of conditions. Their response to temperature, to different sizes of specimens, and to different notches, may be quite different.

Cast Iron Insensitive to Notches

Nor may brittleness or toughness in the notched-bar impact test be taken as an indicator of notched-fatigue behavior. Cast iron, very brittle in the single blow notched-bar test, is very insensitive to notches in fatigue. A striking case of lack of correlation is reported by Inglis[55] for a certain lot of constructional nickel-chromium steel which, in elevated temperature service at 750 degrees Fahr. for several years, dropped in room temperature notched-impact from 38 foot pound to 4 foot pound, but endurance tests on threaded specimens of the steel in the two conditions gave exactly the same, 23,500 pounds per square inch notched endurance limit.

If we are not going to subject the material to stress conditions conducive to brittle behavior, low notched-bar impact figures are not a detriment. The Ford crankshaft, Fig. 15, with around 1 foot pound, yet serving in millions of cars, is an excellent example.

In World War I, aircraft engine crankshafts were evaluated with great attention to securing high notched-bar values. At present, nitrided crankshafts for the Rolls Royce aircraft engine are specified at 55 foot pound Izod minimum in the core. In an early type of the German Jumo 211 engine for some of the Junkers planes, specimens of crankshafts from captured engines showed some 70 foot pound impact, but in a latter type the crankshaft (though not of a regular nitriding steel) was nitrided for better wear resistance and the impact figure was reduced to some 10 foot pound[56]. We haven't heard that the German designers have died from worry over possible failures.

Benson[57] comments, "For ordinary engineering purposes, a high impact figure obtained on a small test piece has no real significance and is not essential for satisfactory service. * * * In ordinary work actual engineering requirements would be met by an Izod test in the region of five to ten foot-pound."

"Shock resistant" phenolic molding materials made from chopped paper or fabric fillers bonded together with synthetic resins show, at room temperature, "0.46 to 5.4-foot pounds per inch of (Izod) notch", while all-plastic, unfilled, Lucite shows 0.4 to 0.6 per inch of (Charpy) notch. The "per inch" means length of notched face. Since the standard bars for metals have about 0.4-inch face of notch, this means that these plastics, including "shock resistant" ones, show around 0.15 to 2.2 foot pounds, when tested by the regular bars used for metals. But these materials have their uses.

Heron, Harder and Nestor[58] comment on the satisfactory application in aircraft engine exhaust valves of hard steels with Izod notched-bar impact values of less than 2 foot pounds at room temperature, in spite of an earlier statement by Aitchison[59] that high impact resistance is needed, but they draw an interesting distinction between material with around 0.5 foot pounds and that which is "glass brittle". They bar "exceedingly brittle" materials but do not attempt to pick any specific impact figure as a dividing line.

It would be unfair to class cast iron a glass-brittle material, for it has a kind of toughness, and various cast irons have various degrees of toughness, indicated by deflection in the transverse test, and by impact tests on unnotched bars. When shock is not involved in service, cast iron is not handicapped, but when it is involved, as in the case of a "near miss" of a bomb falling near a ship with cast iron valves and fittings in its piping, the cast iron parts may shatter and a tougher material has to be used.

Malleable cast iron is a material in which single blow notched-bar impact tests give figures that do not indicate much toughness. Yet malleable is used in tank track guides and in brackets for 3-inch guns, among many other applications where toughness appears important. Frye[60] illustrates the battering that malleable endures in some ordnance applications. The malleable producers evalute their product by repeatedly dropping a 21 lb. tup falling 3-1/3 ft., thus producing 70 ft. lb. at each blow, on a wedge 1 inch wide, ½-inch thick at the butt, 1/16-inch thick at the tip, curling it up into shape reminiscent of the dandelion curls the kids make. The test is carried to 30 blows if no crack results, or stopped at the first crack.

A comparison of results from this test and from the regular Charpy notched-bar single blow impact test is shown in Fig. 32 for a regular malleable iron, as received. It's the notch, rather than the impact that is to be avoided.

In spite of having only a fraction of a foot-pound notched bar resistance, zinc-base die castings are used in shock absorbers on Army jeeps.

Chase[61] gives the following for *un*notched specimens. For information on toughness, impact tests on zinc-base die castings are made and reported on ¼ x ¼-inch *un*notched specimens. See Table D.

If engineers had insisted on high ductility and high resistance to impact on a notched-bar and, hence, had disregarded the possibilities of zinc-base die castings, they would have cut themselves off from great savings in production, obtained through the ability of the alloys to be die-cast with very small dimensional tolerance, so small that no machining at all is required on many parts. Aluminum piston alloys and cast iron used for pistons are extremely low in notched impact resistance, yet serve their purpose.

These materials of low notched-bar resistance do not worry the engineer, he knows that they serve excellently when the applied stresses are of the type they will withstand.

Various types of ductile material also cause no worry because their ratio of shear strength to cohesive strength is such that, though they could theoretically be made to act brittle under triaxial stress, the engineer knows that under no conditions he needs to impose, do they act in brittle fashion. One of these materials is the austenitic type of stainless and of high-manganese steel.

Annealed stainless steel of the 18:8 type is not injured by low temperature.

(*Please turn to Page* 120)

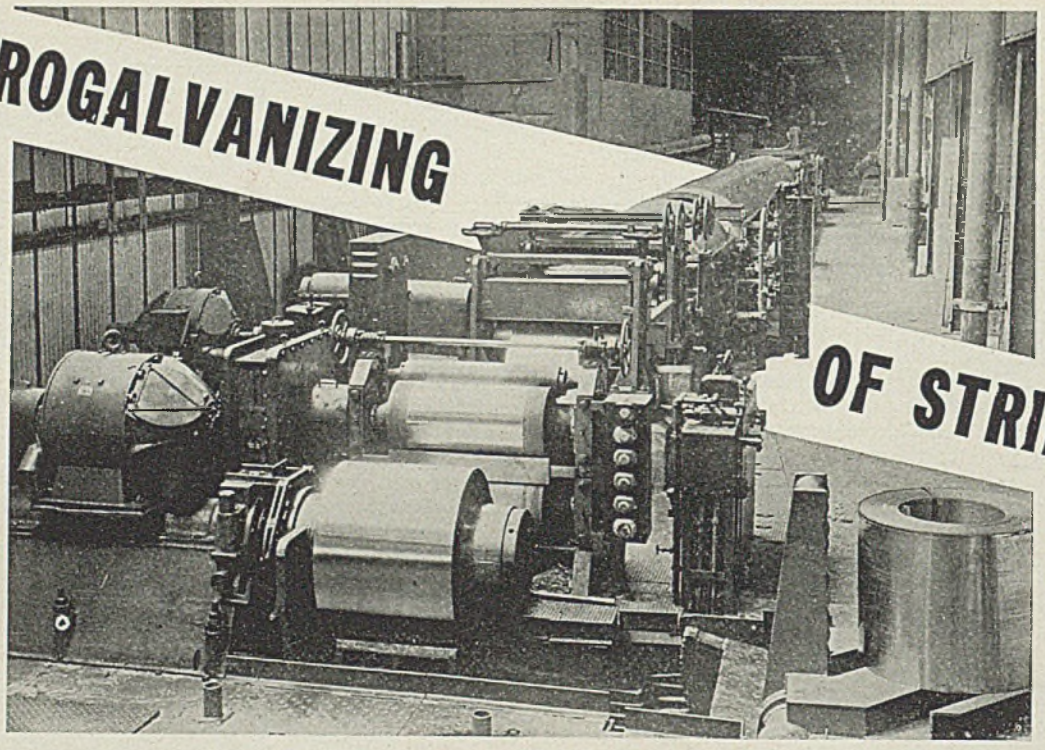
TABLE D

	Tensile p.s.i.	Elong. % on 2 inches	Ft. lb. impact to break ¼-inch square bar at room temper.
Sand Cast Malleable Iron	56,000-56,000	12-22	8-12
Sand Cast Brass	25,000-35,000	10-28	7-20
Cast Iron	25,000-35 000	.....	0-2
Die Cast Aluminum Alloys	25,000-35,000	1-5	2-5
Die Cast Zinc Alloys	35,000-55,000	4-10	15-20

TABLE D1

		Tensile	Yield	Elong.	R.A.	Impact ft. lb.
A	Room Temp.	99,000	35,000	56	78	150-166
	—105° Fahr.	179,000	50,500	36	70	117-135
B	Room Temp.	102,000	52,000	42	72	67-73
	—105° Fahr.	153,000	73,000	51	68	69-90

ELECTROGALVANIZING OF STRIP STEEL



Exit end of electrolytic strip cleaning line. Delivery pinch rolls, 3-roll drag tension device and winding reel shown in foreground

Cleaning of steel for coating is accomplished by water sprays, brushes and acid and alkaline solutions. Zinc coated steel, bonderized and lacquered, is especially resistant to corrosion. Ratio of edge-deposit to average thickness governed by certain factors

By ERNEST H. LYONS JR.
Chemist
Meaker Co.
Chicago

EARLY electrogalvanizing installations were made to coat hot rolled steel strip. Heavy scale is removed from such strip by hot sulphuric acid, usually around 10 per cent in strength, operated at 160 to 185 degrees Fahr. Traces of oil are carried off with the scale. Black smut, largely cementite and iron, is removed by sprays of water and brushes. As it enters the plating tank, the steel is rough and etched in appearance.

Much cold rolled steel is annealed by passing it through a bath of molten lead, at about 1000 degrees Fahr. which burns off the rolling oils fairly completely, often with a visible flame. To avoid adherence of lead to the strip, the bath is kept free from foreign metals and oxides and is covered with coke breeze, expanded mica, or silica powder. The hot steel accumulates a light scale (often blue) which is removed by pickling it briefly in sulphuric or hydrochloric acid. Furnace annealing in reducing atmospheres does not remove rolling oils, and may produce residues difficult to clean. Annealing usually is carried out in the galvanizing line.

If annealing is not practiced, oil must be removed by electrolytic cleaning in hot alkaline solution.

Hydrogen embrittlement, which is sometimes troublesome, results from pickling rather than from electroplating, since absorbed hydrogen is sealed in by the relatively impermeable zinc coating, while hydrogen produced in plating is sealed out. The coating generally is so heavy and nonporous that the embrittlement cannot be relieved by baking as often recommended. If steel subject to hydrogen embrittlement is to be galvanized, hydrochloric acid is preferred to sulphuric for pickling; the acid should be dilute, the temperature low, and the time of treatment as short as possible. Inhibitors are helpful if they are removed before plating so as not to cause peeling of the zinc; generally special treatments are required.

The last step before plating is invariably a rinsing and scrubbing operation.

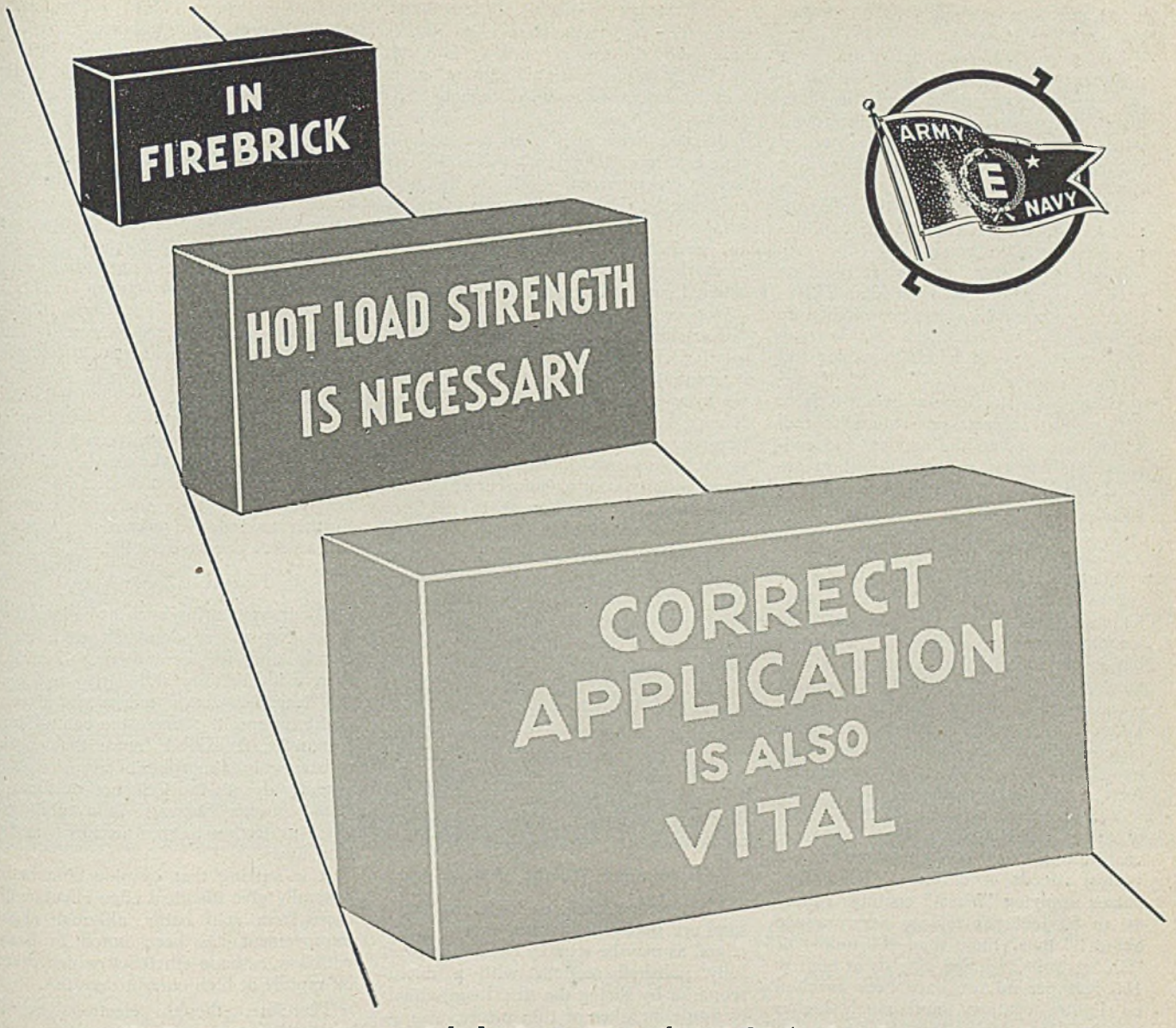
Acid baths, generally proprietary, are employed because higher current densities may be used, which with cathode efficiencies, afford much faster p'ating, while the cost of maintenance is much lower, than with cyanide baths.

Strip may be carried horizontally through the bath, with anodes below and sometimes above the strip; or it may pass through several vertical U-shaped loops, with vertical anodes. The horizontal plan usually has been preferred, although it requires greater space; for it affords easier threading and servicing, and simp'er control of solution flow, temperature and composition, while reducing the bending of the strip and the drag on it.

Usually only one side of the strip is plated at a time, and the strip, if narrow, is twisted 180 degrees in the center of the tank so as to coat the other side. Anodes used over the strip interfere with accessibility and ease of threading, and unless they are pure and the bath is filtered, they may drop particles which produce pits in the coating; but upper anodes have been used successfully with certain baths. In some installations, the strip after being plated on one side is inverted to travel in the opposite direction through a second plating tank above the first, to coat the second side.

Many products, such as box strapping, bar hooping, and strip for "BX" cable are galvanized in the widths to be used. For other material, such as stitching wire and Venetian blind slat stock, a wide strip is galvanized and slit longitudinally into the desired widths after plating. A single strip may be slit into as many as 18 narrow strips. On account of the virtue of the zinc in extending e'ectrolytic protection to contiguous bare areas of steel, the cut edges are often no less resistant to ordinary corrosion than the coated faces, as many tests have shown. Galvanizing before s'itting reduces handling and equipment costs. Nevertheless, most strip is coated in the widths to be

From a paper presented at the eighty-fourth general meeting of the Electrochemical Society, New York.



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used; sometimes as many as 38 strands are plated in one tank.

The pH is held, within 0.3 unit, at a point between 2.0 and 4.5. The operation and maintenance of the baths differ little from standard practice. Like round wire, sheet steel is also being galvanized with insoluble anodes and a strong acid electrolyte.

The solution is circulated through suitable cooling and settling tanks; continuous filtering is customary.

When worn thin, anodes are piled on each other, or "double-decked," and completely consumed, or else are recast into full size anodes. The bath drag-out may be kept to a small figure by wipes and wringer rolls.

Current density usually averages from 110 to 150 amperes per square foot of surface exposed to the anodes, and considerably higher current densities are used with suitable electrolytes and proper circulation.

Contacts Are Shielded

Contact to the strip is made by copper rollers or bars, carefully "blanketed off," i.e., shielded from the anodes. The weight of the strip sliding over a contact bar is not sufficient to secure good contact; some form of "hold-down" roll or other positive contact device is necessary. Periodically, contacts are removed, cleaned in acid and brushed. Finger type contacts are emp'oyed advantageously for the narrower strips.

Because of wide variations in the sizes of tanks and strips and the weights of coating applied, it is not possible to give typical speeds or currents. Some machines applying "2 test" coatings run at 40 to 80 feet per minute and produce about 35 tons (more than 400 miles) of "BX" strip in 24 hours. Speeds as high as 150 feet per minute have been reached on lighter coatings, and much higher speeds are feasible. It is customary to provide ½ to 1 gallon of electrolyte for each ampere of plating current to minimize composition changes and facilitate cooling.

After electrogalvanizing, the strip is carefully rinsed, dried, and coiled for shipment. In some instances, a slow scratch-brushing lends more luster to the coating. Strip to be lacquered, enameled, or painted, as for Venetian blind slats is bonderized in the galvanizing line immediately after plating; without some such treatment, adhesion of organic coatings is often poor.

Recently wide strip with a very light zinc coating (0.00002 to 0.00004-inch) has been bonderized. While, for its thickness, such a coating has a surprising resistance to corrosion, primarily it affords an excellent bond for paint or lacquer to steel. It may be formed and, it is claimed, welded without serious damage to the coating.

The electrogalvanizing-bonderizing-lacquering of steel offers a corrosion-resisting coating which has possibilities, which, we believe, have often been overlooked. It may well substitute for much more expensive and more critical materials in severely corrosive exposures as in tropic, strong industrial, or chemical atmospheres. The three coatings appear to reinforce each other admirably.

Properly electrodeposited zinc is far more ductile than the steel base and cannot be separated or "peeled" from it. Proprietary cleaning methods are sometimes helpful in obtaining maximum adhesion.

The weight of the electrogalvanized coating may be made any desired value. Often, as for box strapping and Venetian blind stock, light coatings, as thin as 0.0001-inch are satisfactory, and offer substantial savings. Extremely heavy coatings have been electrodeposited experimentally.

Determining Weight of Coating

Electrogalvanized coatings on strip steel are perfectly uniform except at the edges, as may be seen by examining carefully polished sections with a microscope; or by slicing the strip longitudinally into a number of thin pieces, averaging 0.03 to 0.05-inch wide; the coating on each slice may be determined by stripping in hydrochloric acid containing antimony chloride, and the average width of each slice may be computed from its stripped weight. Either method, with proper precautions, is reliable to about 10 per cent.

The factors governing the ratio of the edge-deposit to the average thickness are; dimensions of the strip, space between the strips during plating, distance from anodes, distance from surface of the solution, and polarization and conductivity of the electrolyte. The two outermost strips may receive a heavier coating than inner strips in the plating tank.

On commercial strip steel, the heavy coating at the edge sometimes extends as far in as 0.19-inch. The comparatively heavy ridge along the edge rapidly falls off to the uniform thickness of the central area of the strip.

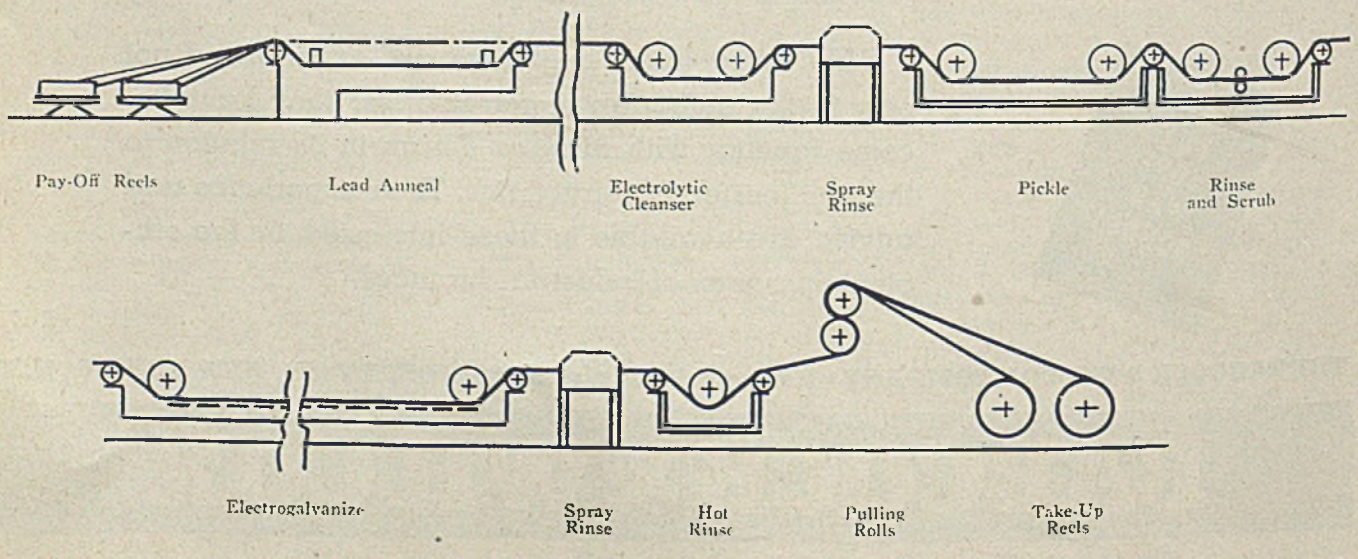
The heavy ridge is less than 0.05-inch wide, and averages up to 2.5 times heavier than the uniform central coating. The "transition zone" may be as wide as 0.14-inch, and averages about 1.25 times heavier than the uniform coating. Further towards the center of the strip, no variation can be detected.

Transition Zones Vary

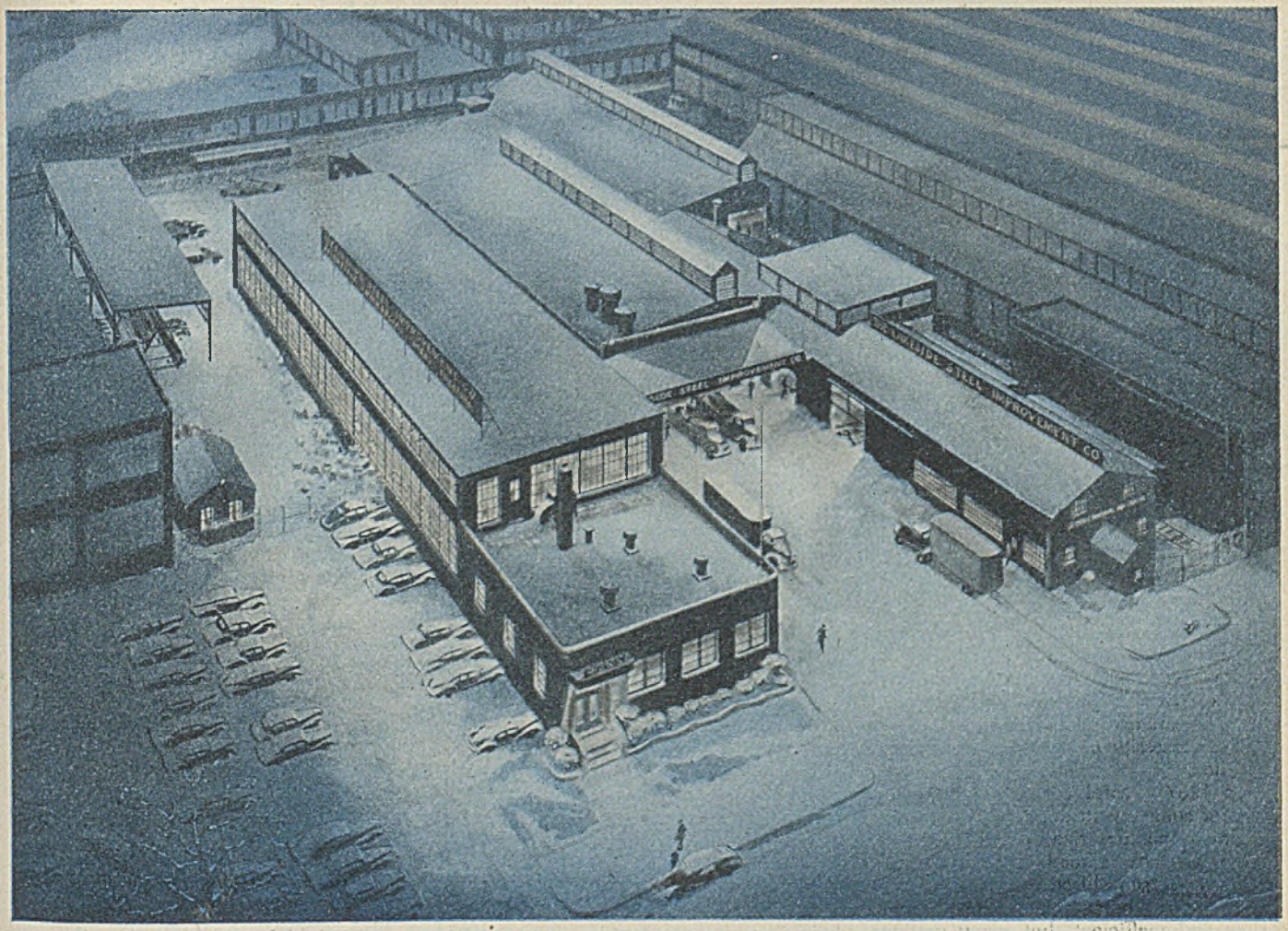
For narrow strips, such as ⅜-inch, the "transition zones" approach each other closely and the central area becomes narrow indeed. For still narrower strips, the "transition zones" merge into a more uniform deposit. Where the central area is narrow, it exhibits more than usual resistance in atmospheric corrosion, apparently due to the influence of the adjacent heavier deposits. Zinc often extends protection to steel as much as ⅛-inch away.

It is striking that cyanide zinc baths generally give identical edge effects with those from acid baths, although slight improvement has been noted in baths with low cathode efficiency which drops off rapidly at high current densities.

Therefore, though electrogalvanized coatings on strip steel are not entire'y uniform, the nonuniformity is not significant. On the average strip 6 inches wide, the excess coating carried on the edges is less than 1 per cent of the total weight of zinc. Moreover, along the length of the strip, as well as between the narrow bands along the edges, the electrogalvanized coating is perfectly uniform.



Diagrammatic view of the various steps involved in the electro-galvanizing of strip steel



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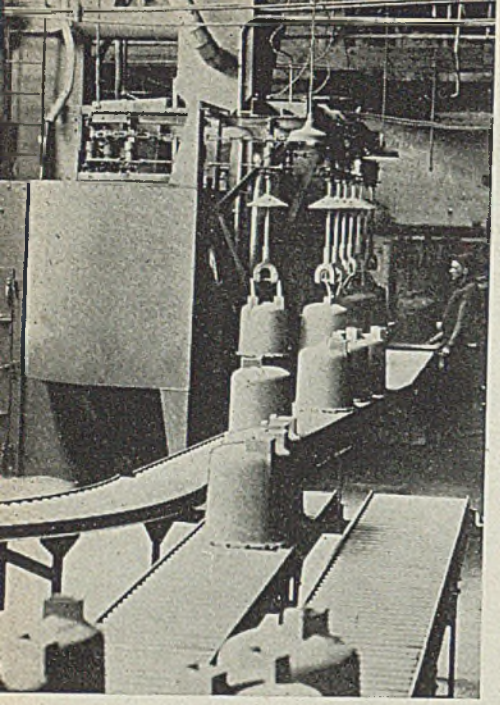


CLEANING COSTS CUT 60%

. . . . by continuous automatic blast-cleaning equipment and mechanical handling aids

By D. C. TURNBULL
Chief Engineer
American Foundry Equipment Co.
Mishawaka, Ind.

MODERNIZATION of the cleaning department at New York Air Brake Co., Watertown, N. Y., resulted in cost savings of over 60 per cent and improved the appearance of finished castings—a virtual necessity on the war work being handled.

In 1937 a careful analysis was made by the company to determine its cost of cleaning medium size, 10 to 70-pound, miscellaneous railroad castings. Compressed air sand-blast barrels then used for cleaning operations, were not only slow and inefficient, but many castings had to be spot blasted after milling. Cleaning costs, including labor, power, air supply and maintenance, were found to be $3.96 per ton of castings.

Realizing that this figure was excessive, investigations of different cleaning equipment were made and a Wheelabrator Tumblast, a 11½-cubic-foot-capacity barrel employing centrifugal force for propelling abrasive upon the castings to be cleaned, was installed by American Foundry Equipment Co., Mishawaka, Ind., for cleaning these production castings. Actual operating cleaning costs per ton of castings dropped to $1.56—a saving of $2.40 per ton.

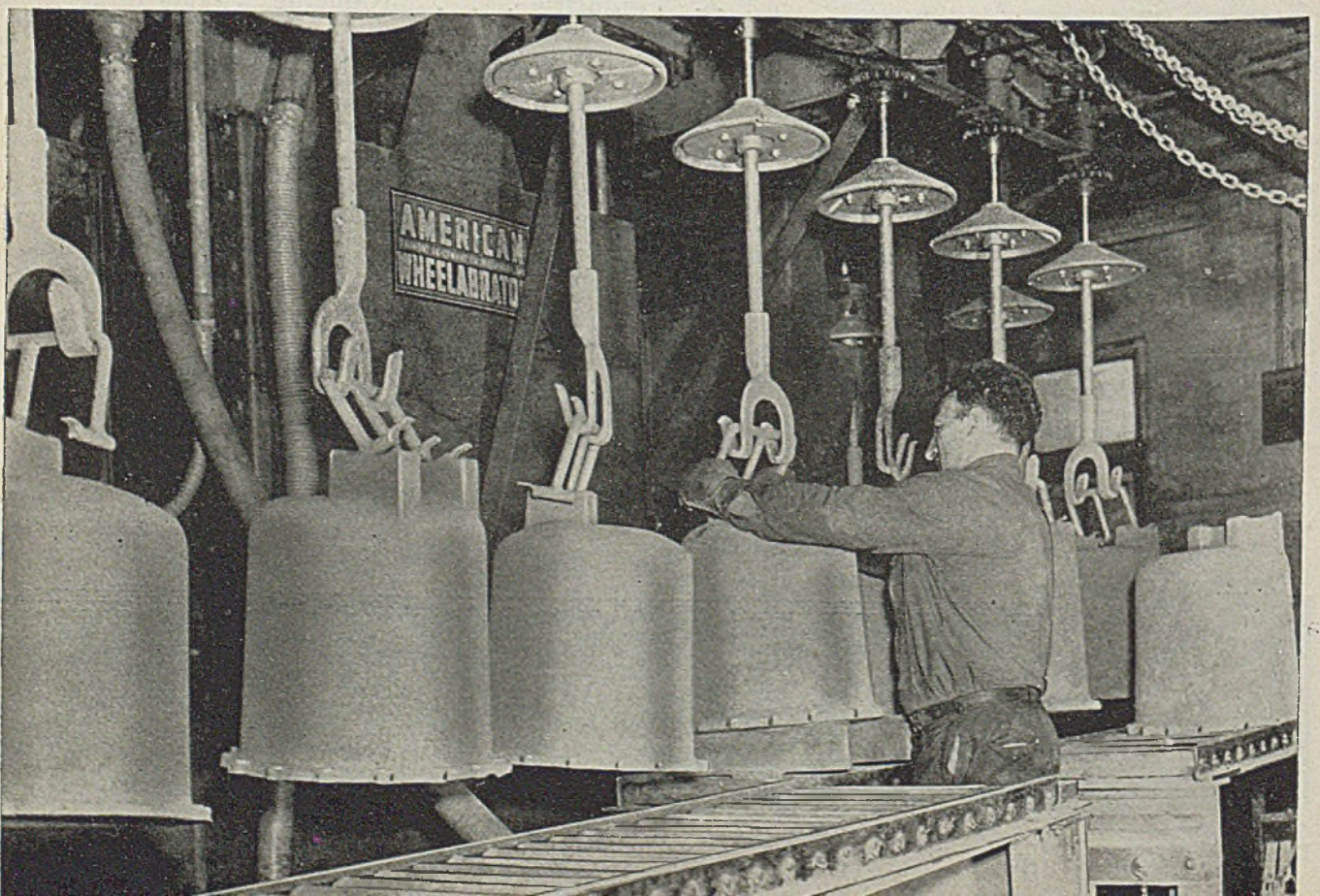
With wartime demands for greatly increased production, another Wheelabrator Tumblast with larger capacity and the special cleaning cabinet were installed in early 1942 primarily to clean air-reservoir castings. Used on railroad cars, these castings measure 19 inches high by 19 inches diameter, and have a side-wall thickness of about 5/16-inch, weighing 120 pounds. After being cleaned in a sand blast room, they subsequently were cleaned in tumbling mills with small logs packed in with them to reduce breakage.

Cost of cleaning these castings in the tumbling mills was 17.1 cents per casting. Direct labor costs accounted for 5.5 cents of the total, shot cost was 0.7-cent, power 3.5 cents, belt and maintenance cost 3.2 cents, and mill breakage loss (approximately 1 per cent of castings tumbled) was 4.2 cents.

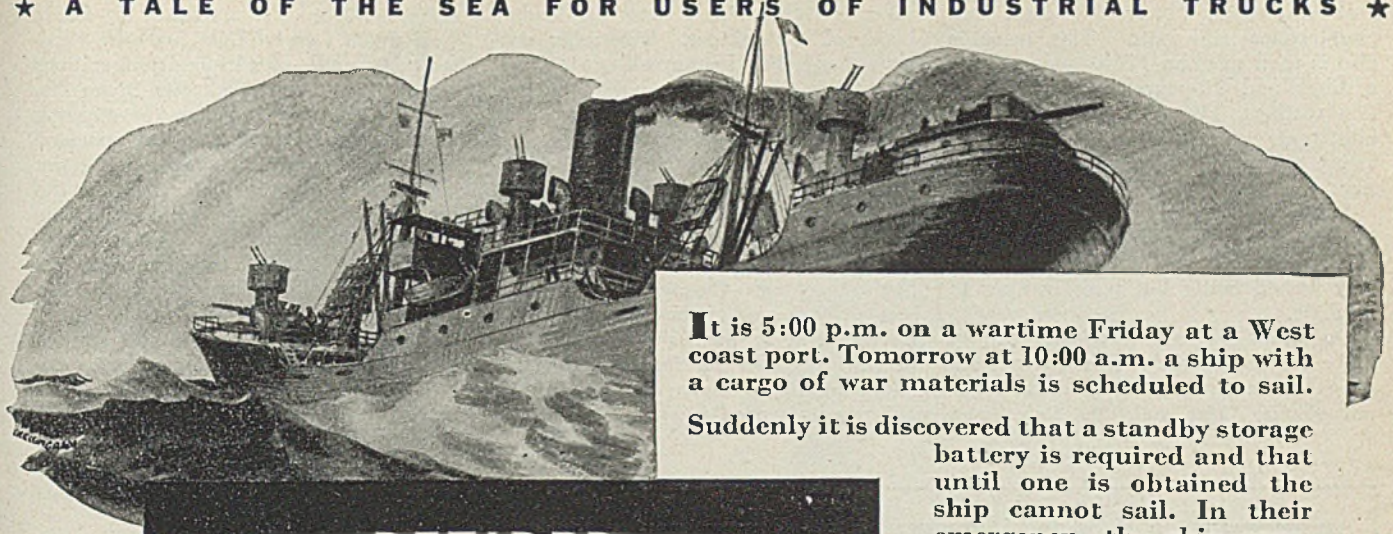
This cost was halved, to 8.4 cents per casting, when the airless blast cabinet was installed. Labor cost with this type cleaning is 1.8 cents per casting, abrasive

Fig. 1 (Left, above)—Overall view of cleaning section showing conveyor lines to and from Wheelabrator cabinet. After cleaning, castings are sent down one or another of the three conveyor lines in foreground for inspection, gaging and chipping. Monorail electric hoist with lifting fixture loads five castings at once on the roller conveyor

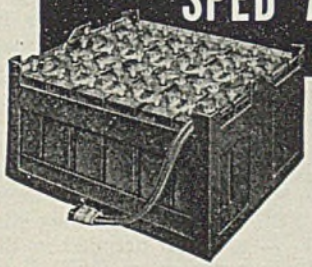
Fig. 2 (Below)—Closeup of loading station of Wheelabrator showing section of roller conveyor which slides underneath the loading hooks of the cleaning machine. An air hoist lifts the conveyor section so casting can be hooked to overhead chain conveyor carrying it through the blast-cleaning cabinet



★ A TALE OF THE SEA FOR USERS OF INDUSTRIAL TRUCKS ★



HOW A RETIRED BATTERY SPED A SHIP TO WAR



It is 5:00 p.m. on a wartime Friday at a West coast port. Tomorrow at 10:00 a.m. a ship with a cargo of war materials is scheduled to sail.

Suddenly it is discovered that a standby storage battery is required and that until one is obtained the ship cannot sail. In their emergency, the ship operators phoned a local Edison engineer. Could a new alkaline battery be supplied from local stock? It could not. Then what could be done? "Perhaps," the Edison Engineer suggested, "our marine distributor could lend you a battery made up of used cells, until the new one can be shipped from our factory."

"See if they can," was the reply.

They could. They rounded up old but still serviceable cells; charged them during the night, and by 5:00 a.m. had assembled them into a battery and installed the battery on the ship. At 8:00 a.m. the official inspectors tested it and pronounced it satisfactory in every way. At 10:00 a.m. the ship sailed—on schedule. In normal times, this would not be considered good battery engineering. But that is not the moral of the narrative. The moral is that Edison Alkaline Batteries, even after they are old and perhaps no longer capable of delivering full rated capacity, nevertheless provide highly dependable service.

This quality, always available, is proving especially valuable in wartime . . . in the locomotives that are hauling coal and ore from the working places of American mines . . . in the industrial trucks that are handling materials in the war industries and the distribution depots of our armed forces . . . in the carlighting and signal systems of American railroads . . . in military uses where battery failure would be intolerable.

Some of the characteristics which account for this extra reserve of dependability in an Edison Alkaline Battery are cited in the column at left.

ADVANTAGES OF THE EDISON ALKALINE BATTERY IN INDUSTRIAL TRUCKS AND TRACTORS

★ It is durable mechanically. High strength steel construction is used in the container, grids, pole pieces, etc. The electrolyte is a preservative of steel.

★ It is foolproof electrically. It may be short-circuited, over-charged, over-discharged, or even accidentally charged in the reverse direction without injury.

★ It can be charged rapidly. It may be charged at full normal rate throughout the entire length of charge and is not subject to finish rate limitations. It requires no equalizing.

★ It withstands temperature extremes. It is not damaged by freezing. Free air spaces on all sides of all cells provide ventilation for rapid cooling under high temperature conditions.

★ It is free from ordinary battery troubles. It is not subject to sulphation, shedding of active material, buckling of plates, jar breakage or other common causes of battery failure.

★ It is simple to maintain. Merely charge adequately, add pure water, keep clean and dry.

★ Its tray assembly and cell connections are extremely simple.

★ Its life is so long that its annual depreciation cost is lower than that of any other type of storage battery.

EDISON STORAGE BATTERY DIVISION, THOMAS A. EDISON, INCORPORATED, WEST ORANGE, NEW JERSEY

Edison

ALKALINE BATTERIES

cost 4.5 cents, power 0.6 cent, and maintenance 1.5 cents. This machine also is used to clean 110-pound cylinder castings and 40-pound reservoir partition castings. Two Wheelabrator airless blast units are utilized in the cabinet to assure thorough cleaning of the various sizes and shapes of castings handled.

Besides providing appreciable savings in cleaning costs, New York Air Brake Co., found castings were cleaner and not only looked better but were cheaper to machine.

Operation of Special Cabinet: Castings to be cleaned in the special cabinet are picked up in groups of five with a monorail electric hoist and deposited on a roller conveyor which feeds the loading hooks of the cabinet. The roller conveyor has a short section with an air hoist that raises the castings up into hooking position, see Fig. 2.

After the casting is hooked to the overhead chain conveyor of the cleaning machine, the conveyor moves one position, carrying the dirty castings toward the cabinet entrance and bringing a cleaned casting over the roller conveyor section for unhooking. Cleaned castings are moved down a roller conveyor which may be switched to feed any one of three processing tracks for inspection, gaging and chipping as shown in Fig. 1. Only one man is needed to operate this entire cleaning setup, from start to finish.

Maintain Careful Cost Records: Careful cost records of a'l foundry operations are kept by New York Air Brake Co. When a load is brought to the cleaning machines, the operator of the machine enters each load on a daily report form. The entry for each load includes the piece number, the scale weight, the time elapsed in cleaning the load and the actual wheel time, or time the work was under the abrasive blast. A p'ace is also provided on the operator's daily report form to enter the amount and size of abrasive added to the machine during the day.

From these records, plus a time and material-cost record for maintenance, the company conveniently keeps track of all cleaning costs by machine and by class of work.

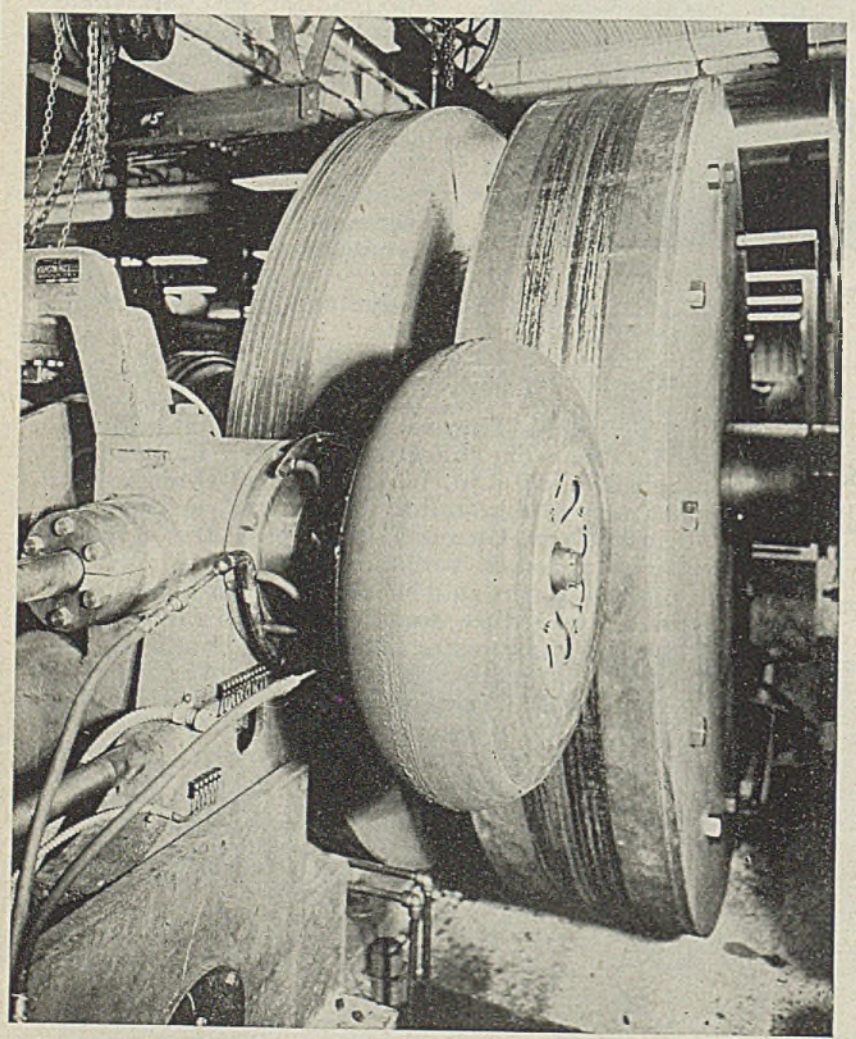
An analysis of this company's cost records not only proves the economy of this type cleaning over the method formerly used, but provides interesting comparisons over costs during different months of operation. Costs dropped, for example, as operators became familiar with the equipment and were materially lower when production was high, as would be expected.

During the initial five months of the first Wheelabrator Tumblast's operation, for example, cleaning costs dropped from $2.22 a ton to $1.04 a ton, mostly due to a steady improved operating efficiency factor. Labor costs dropped in the fifth month to less than one-half of the cost during the first month.

A further reflection of increased efficiency as operators became familiar with the equipment is the improved operating efficiency factor during this same period. This figure is determined by dividing wheel time (taken from a Servis recorder which shows actual machine operating time) by the number of labor hours chargeable to the machine during the same period. Operating efficiency increased month by month from 25.5 per cent in May to 43.5 per cent in September.

An analysis of cleaning costs during the first five months the three machines have been in operation revealed a saving of $8,298.74 over the costs that would have prevailed for cleaning the same amount of castings under old methods.

Because the Wheelabrator removes sand and scale right down to the virgin metal, which was impossib'e with the former air blast and tumbling methods, much longer tool life in the machine division has also resulted.



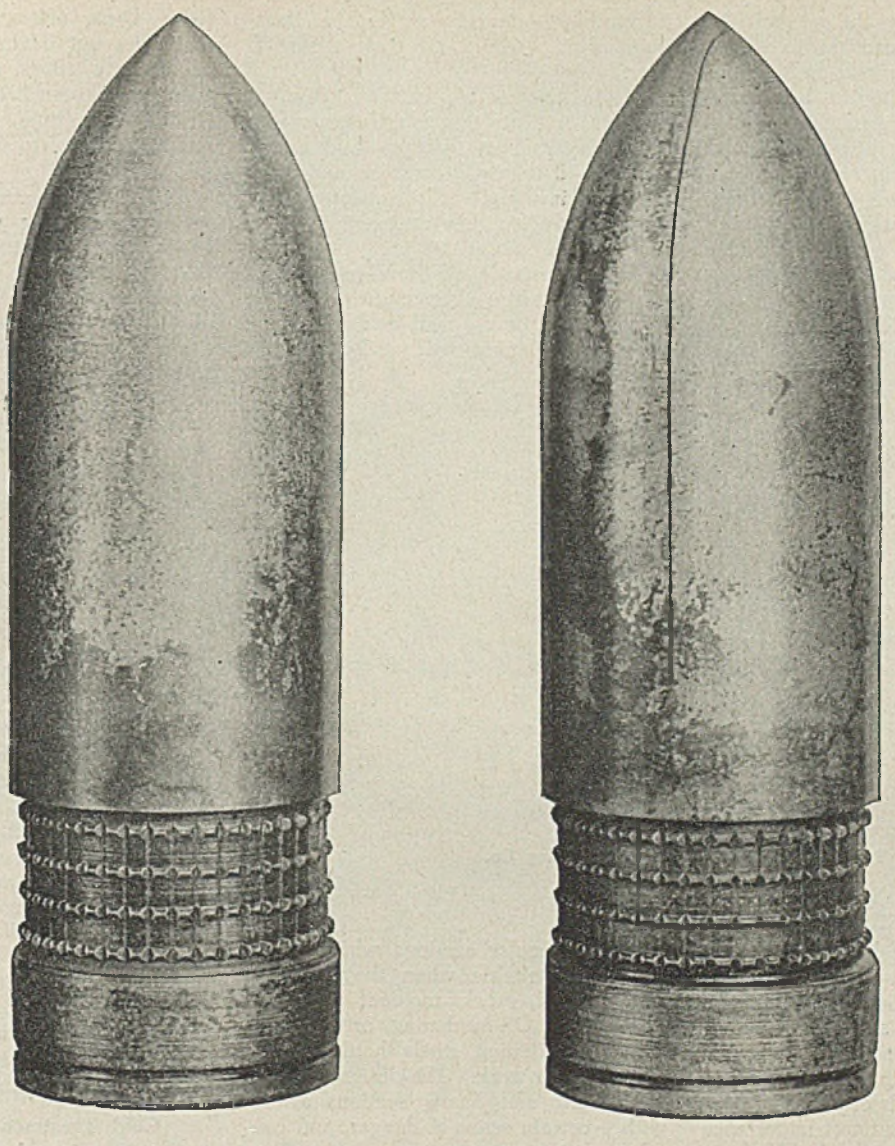
LANDING-WHEEL NEMESIS: Simulating landing conditions for aircraft wheels and tires at speeds up to 200 miles per hour, this 75-ton testing machine built for an Akron, O., plant of Goodyear Tire & Rubber Co. gives them a terrific preflight "beating" to ascertain how much they can stand. By means of 21 plates distributed on both sides of the 10-foot-diameter flywheel, landing loads up to 40,000 pounds per wheel, tire or brake can be tested. This is the equivalent of a 40-ton airplane. The main testing wheel, powered by a 150-horsepower motor with Goodyear-developed steel V-belts, weighs over 16,000 pounds and requires 168 revolutions to equal a mile's travel after an airplane tire "lands" against it. A brake of sufficient size to stop a 70,000-pound load is tested by harnessing it directly to the flywheel axle. The machine develops energy equivalent to 50,500,000 foot pounds, or enough to lift a Liberty Ship 2½ feet

—o—

A technical film describing processing methods for magnesium alloys has recently been prepared and released by the Dow Chemical Co.

The film deals with the machining, welding, forming, riveting, and surface treating of magnesium. It is available for showing before engineering, industrial and technical society groups.

Requests for the film or for information regarding it should be directed to the company at Midland, Mich.



One died from SHELL SHOCK!

THESE two armor piercing shells *looked* perfect . . . until they were shock tested in three successive water baths . . . cold . . . boiling . . . cold. One *was* perfect. The other cracked . . . was rejected as unfit to fight.

Heating and cooling these baths is just one of countless ways in which General Electric heating, refrigeration and air conditioning are serving war industries.

In recent months, industrial refrigeration and air conditioning have made great strides. Equipment is more compact, more flexible. Temperature and humidity are controlled more exactly. Result: more and better fighting equipment...in shorter time.

After the war, improved process refrigeration should help to make many peace-time products better . . . at lower cost. And vastly improved air conditioning will provide greater comfort in more and more hotels, offices, stores, theatres, homes . . . even in cars, boats and planes.

The wide experience that General Electric engineers are gaining in war work today is your assurance that they will be ready with finer and more efficient refrigeration and air conditioning equipment for the needs of post-war America.

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How To Get Longer Life from Tools, Dies and the Like by . . . .

Better Heat Treating

By A. S. EVES
Chief Field Engineer
Perfection Tool & Metal Heat Treating Co.
Chicago

THERE ARE many things that the tool and die maker can do to assure better results from the heat-treating operation. At one time the man who made the tools or dies was the same man who hardened them. Now, however, due to mass production and increased specialization, the heat treater and tool designer are usually two different persons . . . and frequently neither has a full knowledge of the other's problems. The result is an ever increasing gap between these two men—a gap responsible for reduction in quality of the heat treating and much inefficiency and short life in the tools themselves.

FIRST in importance is to inform the heat treater fully, precisely and accurately as to the kind of steel in each tool or die. Obviously with thousands of alloy steels and hundreds of different heat treatments, it is of the utmost importance to know the material to be handled.

Yet from 10 to 15 per cent of all work coming into heat-treating plants arrives without proper indication being given. Some jobs even come in bearing the wrong brand or analysis. It is not feasible to spark-test every piece; and even if it were, this is not a fool-proof method of determination, for certain oil-hardening steels throw a spark which exactly duplicates that from a straight carbon steel.

Loss of time alone in heat-treating plants, while waiting for the customer to supply proper information as to the kind of steel, is considerable. Wrong identifications given the heat treater may result in spoiling costly tools and dies. Different steels also require different heat treatment. That the latter is not always fully appreciated was demonstrated when a forming die made by welding together four pieces of steel was submitted for treatment. When spark-tested, one of these sections was found to be a low-carbon steel which ordinarily would involve case hardening; the second was a high-speed steel usually hardened by quenching in oil from 2250 degrees Fahr.; the remaining two sections were water-hardening steel, normally water quenched from 1550 degrees Fahr. Since all were firmly welded together, it obviously was impossible to devise a single heat treatment which would be correct for all four.

While this is an extreme case, it serves to indicate that tool designers can assure better heat treating—and longer tool life—if they will consider more fully what is involved in the heat-treating operations when they are designing the tool or die.

As an instance of how proper design can insure better heat-treating, often a tool or die will come in made of water-hardening steel yet having delicate or irregular sections which surely will cause trouble when they undergo the thermal shock incident to water quenching. Oil-hardening, or even perhaps air-hardening, steels should be utilized for such work. The designer should view light and heavy sections always with a certain sense of danger, and consider what is going to happen when they are heated and cooled. Light sections, of course, expand and contract much faster than heavy sections.

Another example having to do directly with design is the frequent receipt of tools, jigs, etc. to be carburized, which crack or break upon being given that heat treatment, or soon afterward. The cause is excessive carbon content. Broadly speaking, any steel with more than about 0.25 per cent carbon is in danger of fracturing if carburized.

Moreover, in mild steels there is need for giving careful regard to light and heavy sections. The general rule is that for work to be carburized, the thinnest section must govern the depth of case which can be applied with safety. The core should be at least twice as thick as the case. Thus if work is to be carburized 1/16-inch deep, an ear or flange which is ⅛-inch thick will be cased clear through. Since there is practically no tensile strength in a case, such an ear or flange will undoubtedly break off easily. Proper support to the case results only when the core is at least twice the case thickness.

This brings up another point that can help to prolong the life of tools and dies, if given proper consideration. It has to do mainly with the matter of carbon content. Quite often a steel is specified that does not contain sufficient carbon or assisting alloys to enable the heat treater to harden it to the value desired. At the same time, it may contain too much carbon to permit carburizing safely.

SECOND important suggestion that will assure longer tool and die life by better heat treatment is to make certain that the best heat treatment has been specified. In this connection, it is well always to provide information about the job a tool or die will be called upon to perform—unless of course its purpose is obvious. When it is known what work the tool or die is to do, the tool may be heat treated by the best method.

The designer usually will find it advisable to ask his heat treater if there is a better way to heat treat the tool or die than the way the designer specifies. For advances in heat-treating practice today are rapid, and heat-treating processes have extended to the point where they are so complex it is almost impossible for the designer to be fully informed on all of them, unless he keeps posted from day to day.

A typical example is the new treatment at sub-zero temperatures. Metallographic examination indicates that the primary result of reducing hardened steel to *minus* 120 degrees Fahr. is the elimination of retained austenite and its conversion into martensite. Theoretically, this makes the steel harder and stronger; and in most cases such results can be proven by work done. Again, some tools although testing high in hardness, cut poorly. These same tools often are found to give improved service after being subjected to sub-zero temperatures.

Cold Treatment for Hardness

Another example of what refrigeration sometimes can do is the case of a quantity of carburized gears which were desired to have a hardness of 60 rockwell C. Ordinarily such hardness would not be difficult of accomplishment; but in this instance they refused to come up to more than 57 rockwell C. However, when they were refrigerated and returned to room temperature, it was possible to obtain a value of 64 rockwell C.

So far, there is every indication that chilling does not harm the work, and it quite often provides important improvements.

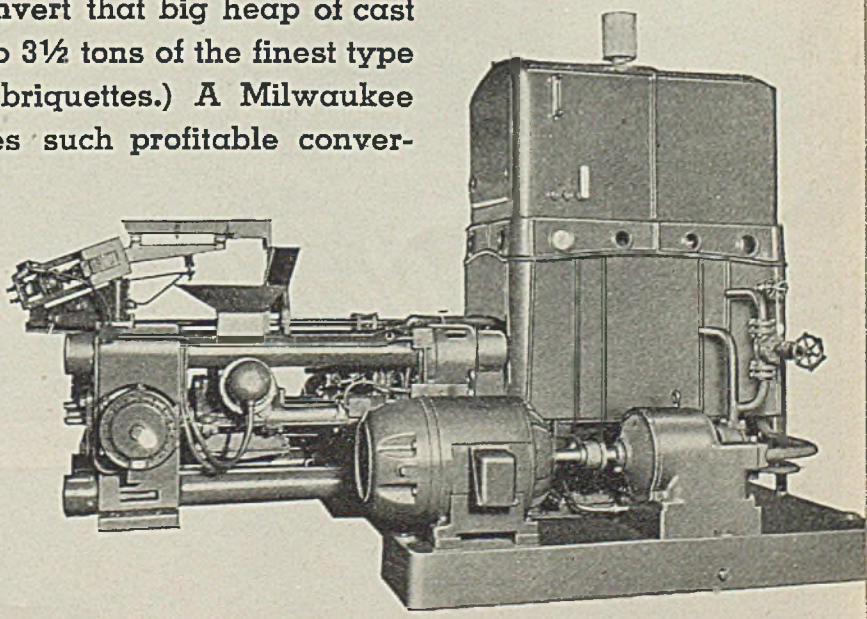
There also is the growing complexity of what at first glance appear to be similar treatments. For example, in our plant will be found six different ways of treating high-speed steel. Of these, the process known as "Nusite" is the most outstanding. With this process it is possible to guarantee a hardness of 65 to 67 rockwell C which hardness completely penetrates the tools. Yet the toughness measures almost twice that obtained by conventional hardening.

A test of the results by an independent laboratory showed an impact strength of 6.1 foot-pounds Charpy with a hardness of 67 rockwell C and a hot brinell at 700 degrees Cent. at 537. Given the

700 Cast Iron Briquettes Produced in ONE Hour...

In just 60 minutes, you can convert that big heap of cast iron borings and steel turnings into 3½ tons of the finest type of cupola scrap. (700 individual briquettes.) A Milwaukee Hydraulic Briquetting Press makes such profitable conversion possible. It reclaims the highest percentage of materials... affords better metal control... effects substantial savings in melting costs. Used by practically ALL automotive manufacturers and other large industrial plants. Plan *now* for your post-war needs. Write for further particulars.

Illustration shows large Milwaukee Hydraulic Briquetting Press with 3½ ton-per-hour capacity. Four other sizes available.



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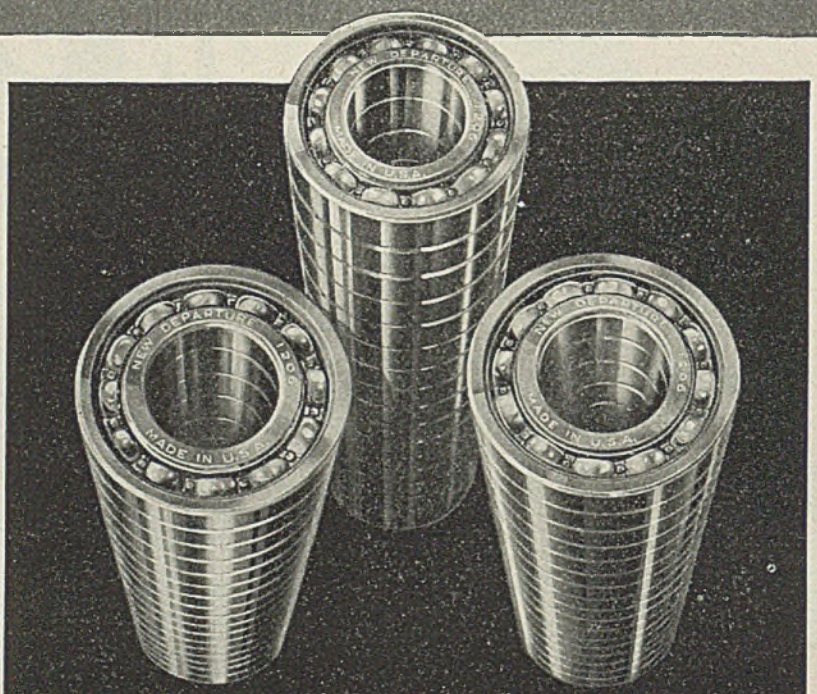


As Potent As Big Guns

Ball Bearings by New Departure have developed into star performers on every front—and behind the lines as well. Wherever a shaft turns—wherever motion must be friction-free—there "nothing rolls like a ball" in this highly mechanized war . . . And in recognition of the "yeoman service" these fine ball bearings are rendering — they again will be first choice for peacetime products.

New Departure Division of General Motors, Bristol, Conn.

New Departure

NOTHING ROLLS LIKE A BALL

ordinary heat treatment, the same material had a hardness of 67 rockwell C but the hot brinell changed to 541 and the impact strength was down to 3.4 foot-pounds Charpy.

Typical of the performance of tools so processed is 50 to 100 per cent longer life obtained on milling cutter blades. A life of three or four times the normal often is obtained on tool bits so hardened. In addition, they produce a cleaner cut and are less likely to chip and break.

An example of a cut with such a tool bit was on a job using 0.017-inch feed and cutting ⅜ to ½-inch depth of cut at 100 feet per minute in SAE-1035 material. When Nusite processed, 168 linear inches of cut were obtained between grinds, compared to 77 inches averaged for tools formerly employed. Lubricant was a soluble oil. In reaming shell bodies, the process increased the tool life 100 per cent. Instead of 3000 shell, now 6000 are worked per reamer. In addition, a smoother finish is obtained. In another instance, where ⅜ to ¾-inch tool bits were being used, it was found possible to employ heavier cuts with more speed and still extend tool life. The general superintendent reported an increase in production of 20 per cent here.

Prolongs Cutter Tooth Life

In an aircraft plant, tubular milling cutters are used on a machine to hollow-cut tube ends to fit one tube onto another. The usual experience was that if the cutters were made sufficiently hard by the conventional heat treatment, the teeth of the cutters fell off. When Nusite hardened, the cutters actually tested two to three points harder, yet the teeth remained firmly on the tools throughout their life. Also, less frequent sharpenings were needed. The process appears well suited for any type of high-speed steel used for cutting, including the molybdenum type.

Incidentally, it is our belief that molybdenum high-speed steels are here to stay—that they will become the principal standard after the war. They possess a certain heat dissipating quality that other types do not have; they are lower in cost and have been found to have other advantages on many jobs. As with any tool steel, much of the success or failure marked up for or against it depends upon how it is heat treated.

Five other methods are used, including the old-fashioned open-fire heat treatment now used only for selective hardening the "business" end of certain kinds of cutting tools. It consists of preheating in two furnaces, heating the end to a hardening temperature in a third, followed by quenching and then drawing in a fourth and perhaps a fifth furnace.

A third method is the conventional overall hardening which employs five furnaces; two for preheating, one for the hardening heat, and two more for drawing. These are atmosphere controlled furnaces and are used for all such work except molybdenum high-speed steels.

The fourth process is used almost exclusively for "moly" high speed tools. It requires use of a series of salt baths: Two for preheating, one for the hardening heat, followed by one for a salt quench. Finally two electric draw furnaces are used.

The fifth process is used for heat treating very large high-speed tools. It readily accommodated a broach about 8 feet long and 3½ inches in diameter; also an enormous high-speed tap, 7 inches in diameter by 9½ inches long, weighing 88 pounds. In this method the work first is packed, then hardened in a heat-treating furnace.

The sixth and last process applies a case, about 0.001 to 0.002-inch in depth, to hardened and finished high-speed cutting tools of most every variety. A very hard skin is produced at the low temperature of 1050 degrees Fahr., which improves the cutting edges.

These different processes for treating high-speed steels are mentioned here merely to indicate the wide variety of methods and cycles possible, and to emphasize the importance of choosing the correct one.

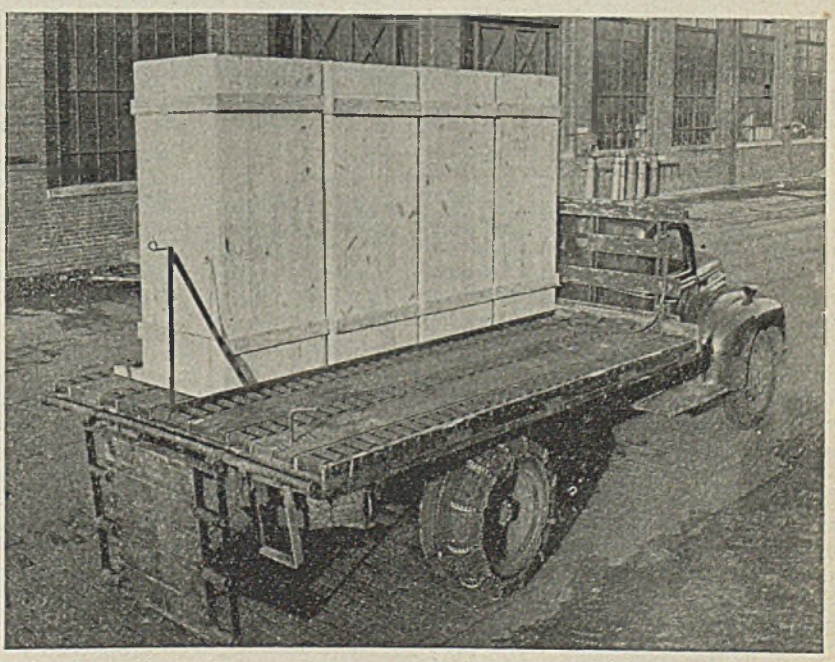
Still another comparatively new heat-treating process is called "Silver Finish" hardening. This is a nonoxidizing process, applicable to any steel which can be heat treated at temperatures below 1900 degrees Fahr. It has two principal advantages. It saves considerable grinding and polishing after heat treatment, since no scale or discoloration can occur on the work. Die casting die blocks, and certain ordnance parts, airplane gears and shafts, and the like, when so hardened, go out of the heat-treat shop retaining their original high polish. No cleanup work is required.

The second benefit lies in the possibility of "rescue" work. For example, more than 100 gears, 5 inches in diameter, all hardened and ground to size, were discovered to be too soft. They all were rehardened by this process, and then passed Navy inspection.

There are a number of other significant factors which can lengthen tool life, when fully appreciated by the tool engineer. One of these is extremely simple, yet frequently overlooked. We refer to avoiding the effects of mill decarburization which is found on bar stock. For example, a part made from 3-inch diameter bar stock, but reduced to three different diameters at different locations on the piece, produced three different hardness values when heat treated. The reason such hardness variation was found is because different amounts of stock had been removed, thus varying the amount of mill decarburization present on the steel as it went through heat treatment. Properly cleaning up such stock before hardening avoids trouble.

Often it becomes necessary to scrap a tool which represents a large investment of time and material because of excessive distortion caused by not re-

(*Please turn to Page* 118)

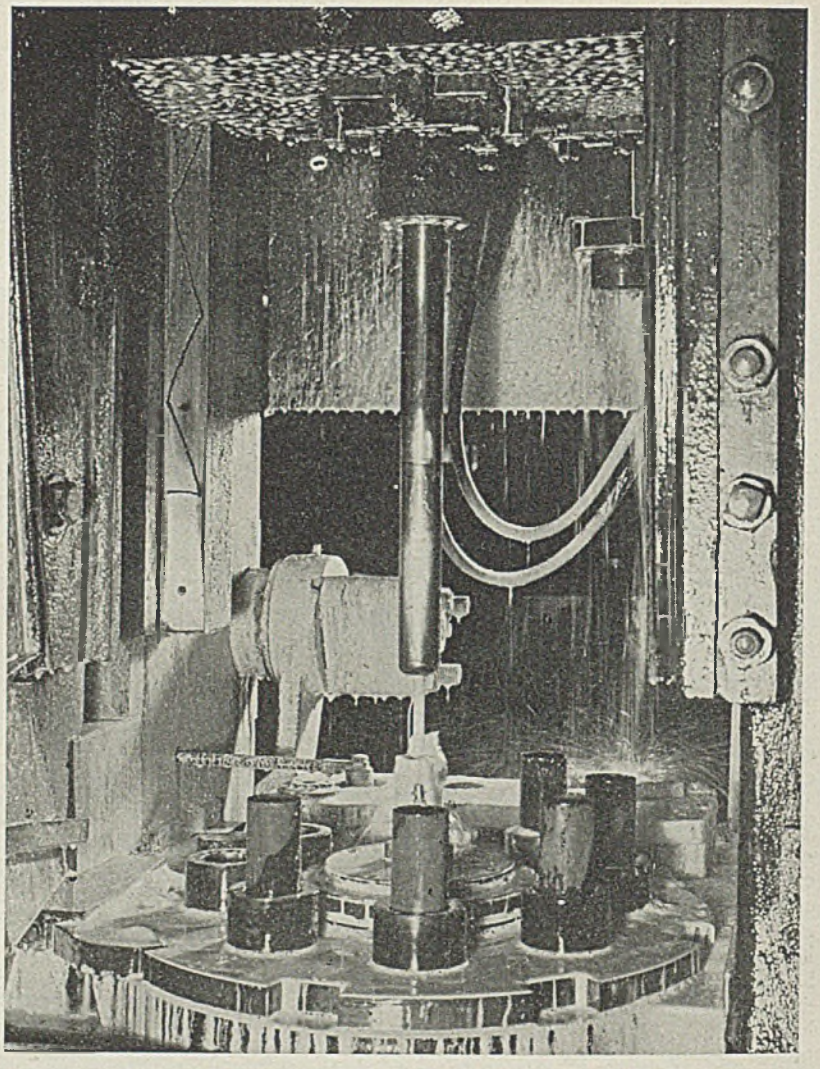


CONVEYORIZED TRUCK: Trucks fitted with roller platforms like the one shown above reduce the time and number of trips needed to move materials at General Electric Co.'s Schenectady Works. The rollers assist in positioning the load. Previously, only three standard size shipping pallets could be accommodated on the truck. But with its platform widened to 8 feet and five rows of old 2¾ x 6-inch conveyor rolls built into its bed, as many as six pallets can now be carried. To prevent movement of the load enroute, a hydraulic jack arrangement raises strips run lengthwise between the rows of rollers

By G. ELDRIDGE STEDMAN

IMPROVED *Deep Drawing* PROCESS

First disclosure of complete processing details in production of 37-millimeter cartridge cases in steel, with heat-treating cycles, metallurgical and procedure data



Fifth draw operation is typical of drawing operations. Here a dial feed with a hydraulic knock-out is used. Solid stream of drawing compound emerges from end of punch

OF ALL the deep-drawing jobs thrown at American industry, perhaps none has been more difficult than making steel cartridge cases, for here it is not only necessary to form an exceptionally difficult shape but special physical characteristics must be produced in the finished case.

One of the most successful processes yet developed for this work is found at Servel Inc., Evansville, Ind. The low scrap loss of 8 per cent has been achieved and is being lowered further. Principal problem in deep drawing 37-millimeter cartridges cases in steel was to develop proper balance between reductions in the various draws and to determine heat-treating (annealing) technique to use between draws to produce a case that would meet ballistic requirements.

To begin with, no one knew what physical properties were required to assure proper firing and ejection from the gun. Once gained, this knowledge had to be translated into processing specifications with working limits for each operation.

Tools have been another major problem. The contour and diameter of the dies, the nose radius and taper of the punches have a delicately balanced relationship that must be maintained in the face of severe steel drawing operations. Carbide drawing dies and hardened steel punches, super finished and chromium plated, along with an intensive study of lubrication are solving this problem.

The steel used for these cartridge cases is aluminum killed and approximately SAE-1025 analysis. It is received by Servel in the form of unannealed, cold coined cups which have been made from spheroidize-annealed blanks. The cups are first given a thorough alkali cleaning in one of three Alvey Ferguson washing machines followed by a water rinse.

They are then bright annealed in one of two General Electric controlled-atmosphere continuous furnaces operating at 1650 degrees Fahr. on 82-minute cycles. This treatment completely recrystallizes the cold worked structure of the cup and pearlitizes most of the carbides. This same annealing cycle is used between each draw, and full pearlitic development of the originally speroidized carbides is finally accomplished in the anneal after the fourth draw.

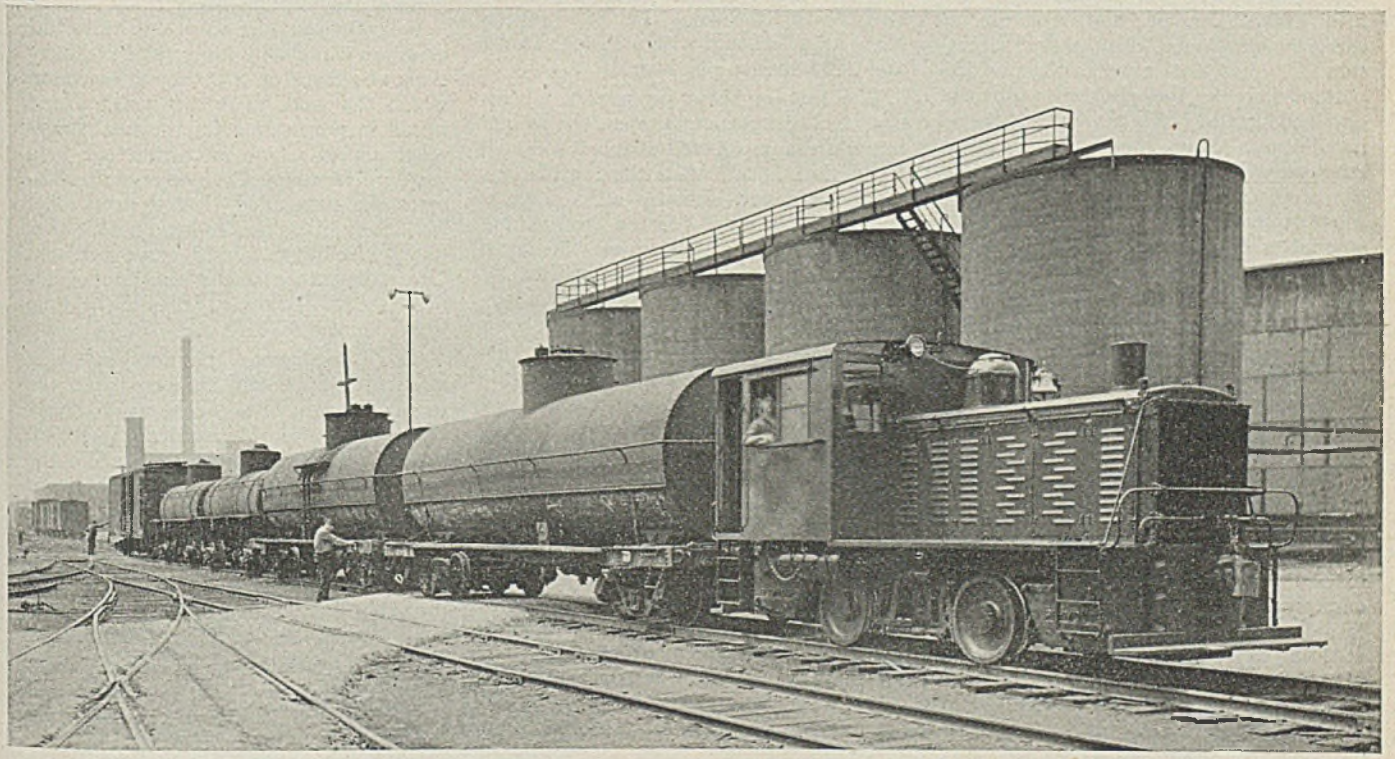
The annealed cups are etched for 15 minutes in a 3 per cent sulphuric acid, 5 per cent ferric sulphate solution operated at 160 degrees Fahr. and are rinsed in cold water followed by two hot water rinses. This etching treatment is used between each draw except that the time of immersion is reduced to 10 minutes between the fourth and fifth draws. Purpose is to produce a controlled roughening of the steel surface to assist in holding the lubricant on the case during the drawing operation; the lubricant is carried down through the die on the surface of the case.

The cups are now subjected to the first drawing operation. Servel was able to utilize all of the presses employed in brass shell case production on the steel case job, but a few new presses had to be added. Most shop experts believed that press tonnage would have to be two to three times greater for steel cases than for brass. This did not prove true. Actually only about a 15 per cent increase was necessary. However, the steel cases do require a slower stroke.

Servel uses a water soluble drawing compound in a flood lubrication system for all draws. This compound is washed from the cases in one of the Alvey Ferguson washing machines before each anneal.

The first draw is accomplished on a 150-ton Cleveland press with a 14-inch stroke operating at 1163 strokes per hour. The second draw is on a 180-ton Cleveland, 18-inch stroke, 990 strokes per hour. The third draw on a 150-ton Cleveland, 22-inch stroke, 1195 strokes per hour. The fourth draw on a 180-ton Cleveland, 18-inch stroke, 980 strokes per hour. Between the fourth and the fifth draw, the cases are trimmed on V & O trimming ma-

WHAT IT TAKES TO PERFORM CONSISTENTLY...



PLYMOUTH *has a plenty!*

War-time emergencies are proving, beyond the shadow of a doubt, the all-out dependability of Plymouth Locomotives. Owners of Plymouth's everywhere are praising the excellent performance records these locomotives continue to make in the face of greatly increased haulage requirements.

Recently a large oil company (name on request) had this to say about their Plymouth: "... doing a *very* satisfactory job and we like it... handles plant switching of all loaded and empty cars ... it's economical to operate."

Plymouth Gasoline and Diesel Locomotives have solved haulage problems in hundreds of industrial plants, shipyards, docks, mills, government bases and depots. They range in size from 2½ to 70 tons and are available in accordance with government rulings. If you have a haulage problem and you want the *economical* answer—write today for complete information about Plymouth!

PLYMOUTH GASOLINE and DIESEL LOCOMOTIVES

PLYMOUTH LOCOMOTIVE WORKS

Division of The Fate-Root-Heath Co. PLYMOUTH, OHIO, U. S. A.

chines. The final draw, the fifth, is on a 180-ton Cleveland, 32-inch stroke, 865 strokes per hour.

The fourth and the fifth draws and the anneal between are the most critical of all. The final physical properties of the case are absolutely dependent upon the microstructure and the amount of cold work in the fifth draw. The anneal between the fourth and fifth draws offers the final control over the microstructure. As the fifth draw product must be rigidly held as to diameter and wall thickness, the product of the fourth draw governs the amount of cold work possible in the fifth draw. The pearlitic structure so carefully developed during the succession of intermediate anneals plays an important part in the physical properties obtained in the fifth draw, for Servel metallurgists have found that such a structure will finally develop a higher tensile strength than can be gained with a spheroidized structure for the same amount of cold work.

The case is again trimmed after the fifth draw and is then headed and indented on a 600-ton Cleveland press with a 4-inch stroke operating at 1270 strokes per hour. Immediately following this, the primer hole is pierced on an 80-ton Cleveland, 6-inch stroke, 1500 strokes per hour.

The cases are now washed and rinsed in preparation for the taper anneal. This anneal is accomplished by suspending the cases, mouth down, from a circular fixture and immersing them to an accurately controlled depth in molten salt in a Lindberg salt pot. The salt is held at 1190 degrees Fahr. and the time of immersion is 2 minutes. This treatment produces a sub-critically annealed area of sufficient ductility to permit proper tapering. The cases are then given a 1-minute pickle in 5 per cent sulphuric acid at 140 to 160 degrees Fahr., and rinsed in cold water. Then they are immersed in a bonderite solution, which produces a phosphate coating on the cases that carries the lubricant through the dies in the tapering operation.

The tapering operation which follows is most critical. Here the cases are given a slight taper from head to shoulder and the mouth is tapered and formed. Servel performs this operation in three progressive dies on the same dial fed press, a No. 1107 Cleveland with a 12-inch stroke and 1365 strokes per hour.

The first of these progressive operations is a straight angle taper, the second forms the true tapered shape 0.050-inch larger than finish, while the third brings the tapered end to finish size. There is no internal support for the case during these operations so the anneal, the depth of softening and the dies must be exactly right. This tapering technique is a development of Servel.

After the tapering operation, the cartridge case heads are machined and the primer holes bored on a battery of 14 Midland turret lathes. The cases are then trimmed on a setup of three Coulter lathes after which they are washed and rinsed in preparation for the final mouth anneal which is accomplished in another Lindberg salt pot much as was the taper anneal, except that the molten salt temperature is held at 1250 degrees Fahr. and the depth of immersion is less. This final mouth anneal produces sufficient softening to a depth just greater than one caliber to permit entry and beading-in of the shot with sufficient ductility in excess to prevent splitting of the mouth on firing and to effect proper obturation.

The cases are again pickled and rinsed after the final mouth anneal and the mouth is then accurately sized, another delicate operation for which Servel has developed special tooling. The main feature is a floating, self-centering ring above the sizing punch that irons out the burr on the mouth edge.

The primer hole and countersink are now brought to exact finish size by a drifting and coining operation.

Following another wash and rinse, the cases are completely inspected for dimensions and finish on a conveyor line, after which the work is further washed and rinsed in preparation for the final stress-relief anneal which is carried out in a gas-fired Lindberg Cyclone furnace. The cases are suspended in the stress-relief furnace from a circular fixture, four tiers high, which carries 128 cases per tier. The temperature of the stress relief anneal is 650 degrees Fahr. and the time is 1 hour and 15 minutes.

This treatment, besides relieving stresses, brings about an increase in the tensile strength of the cold worked portions of the case of approximately 10,000 pounds per square inch. Here again the carefully developed pearlitic structure comes into play, because Servel metallurgists have found that stress-relief annealing enhances the tensile properties of a cold worked pearlitic structure appreciably more than can be gained on a cold worked spheroidized structure.

After the stress-relief anneal, the cases are given a flash pickle, are rinsed and are then neutralized for varnishing by immersion in a hot solution of Diamond Alkali inhibitor. Immediately prior to final coating, each case is printed with its identifying marking. The cases are varnished outside and inside in a Schweitzer automatic machine sprayer and the coating is immediately baked in a bank of infra-red lamps.

Following this, the cases are given a thorough final inspection, the primer holes are brush lacquered and the now completely finished cases are packed into cartons for shipment. Servel production of steel cartridge cases has now been stepped up to a figure that is a triumph for American engineering.

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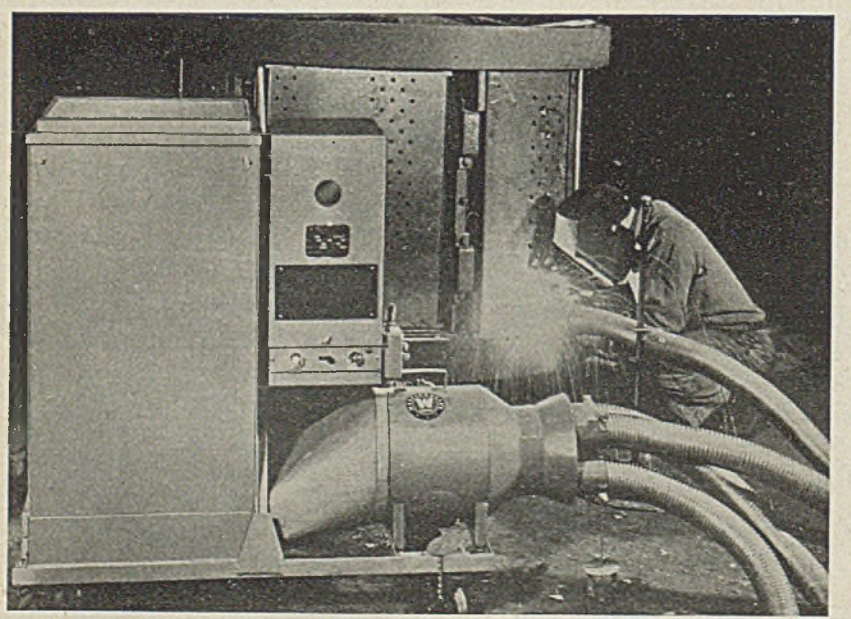
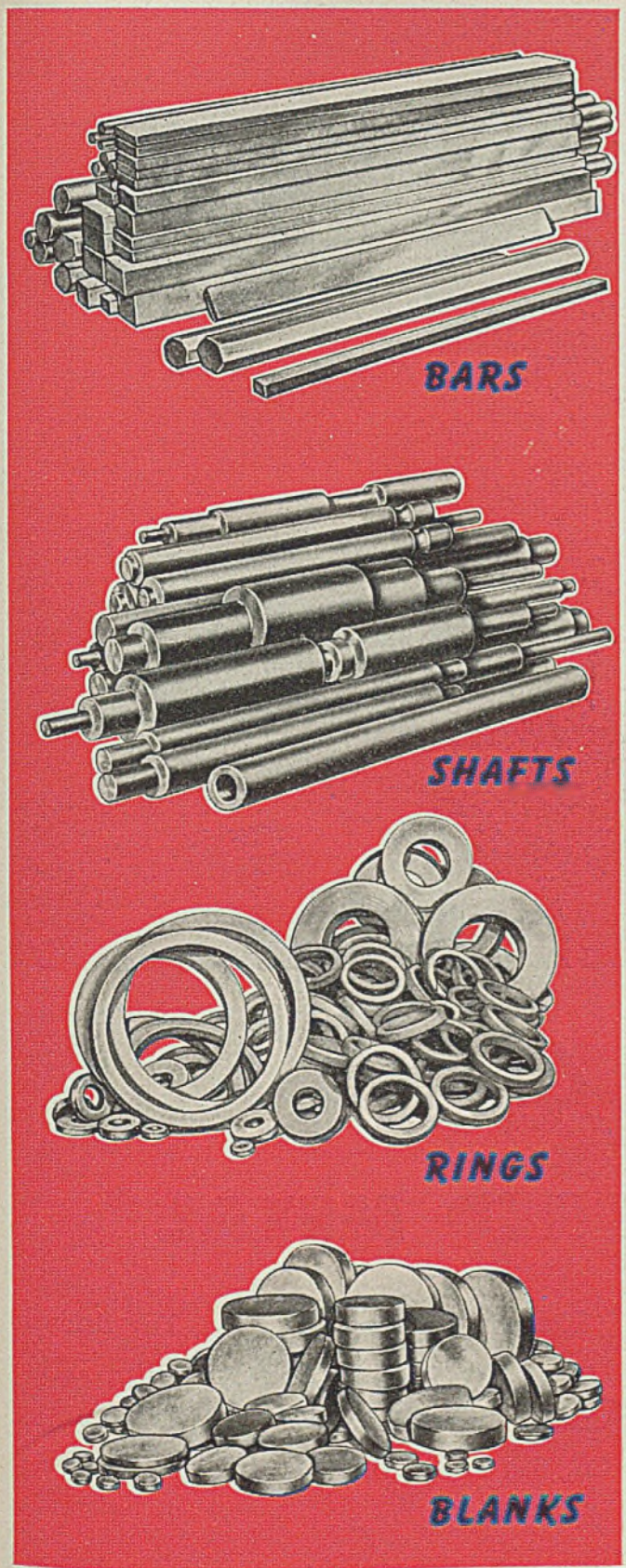
Because of the extraordinary cost of many gaging operations due to wear affecting accuracy of the close tolerances, a new idea in protective and wear-resistant treatments was evolved for precision surfaces. Known as Micronil, it is a liquid that lubricates *in* the surface rather than *on* it. It is applied by brushing a small amount to the leading edge. "Freezing" of gages is prevented, even with tolerances in the millionths.

It is said to be ideal for treating precision dies, punches, also for tapping and lapping operations. It is applicable to all metals, including chromium-plated and Carboloy cutters.



ELECTRONIC FUME REMOVER: Arranged for portable use, this Westinghouse Precipitron electrostatic cleaner is designed to remove welding fumes directly from the scene of welding activity. It employs three metal hoses, and the welding fumes drawn through them go directly through the cleaner which removes 90 per cent of the foreign material. Cleaned air is then returned to the room



Forging Production AVAILABLE NOW!

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Call your nearest Kropp engineering representative or send your blue prints direct for immediate quotation. *Production can be started in ten days or less, depending on size of parts needed, and availability of materials.*

To avoid any misunderstanding — we do not have drop forge capacity available and are booked for many months on essential war orders.

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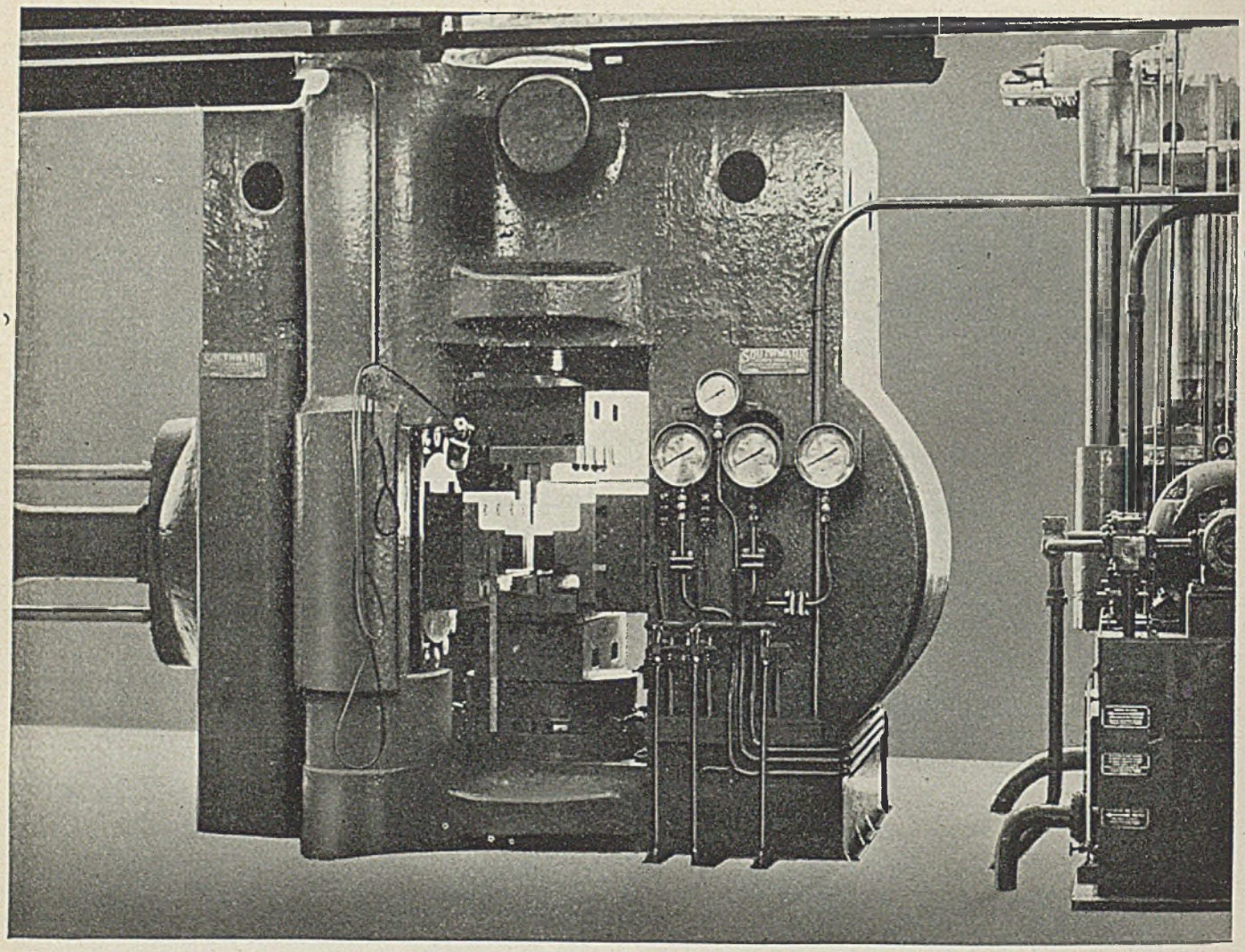

It's U.D. for POWDERED METAL

Here is a powdered metal press especially constructed by Southwark for the purpose of insuring the U. D. (uniform density) of a compressed object. This is accomplished by compelling the upper and lower rams — each of 3000 tons capacity—to oppose one another and allow the powdered metal to be compressed from both the upper and lower dies.

Just another example of Special Machinery designed and constructed by Southwark engineers.

Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia, Pa.; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco, Calif.

BLW THE BALDWIN GROUP

BALDWIN
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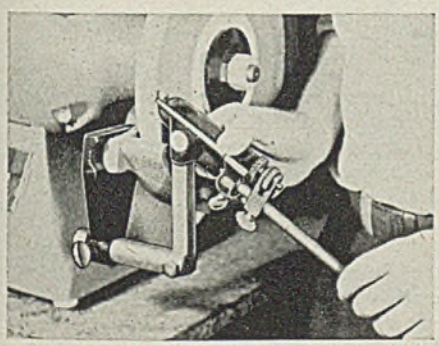
HYDRAULIC PRESSES

Grinding Fixture

Adjustable fixture in which any angle can be ground from 30 to 90 degrees, a new line of Ind-L-Way twist drill grinding fixtures is now being offered by Industrial Engineering Co. Inc., 141 West Jackson boulevard, Chicago. Precision built and unconditionally guaranteed, these fixtures assure perfect grinding of all drills from ¼ to 2⅞ inches. Ind-L-Way fixture No. 3, is for grinding drills from ¾ to 2⅞ inches, and fixture No. 1, illustrated, is for grinding drills from ¼ to ¾-inch. These fixtures prevent oversize or off-center holes, eliminate costly risks, improve work quality, increase twist drill life and assure top production.

When grinding twist drills for the first time with the Ind-L-Way grinding fixture, many various angles are found on drill points as a result of conventional hand grinding methods and it is necessary to remove a little more material from the drill point to bring it up to the uniform standard for drilling of different metals. The second grinding with the fixture, however, will usually require removal of only 0.002 or 0.003-inch. In many cases these fixtures will increase the service life of twist drills by 50 per cent.



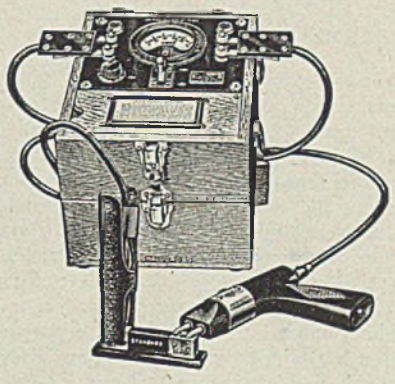
Brackets of this fixture are designed for Black & Decker, Van Dorn, bench or pedestal type grinders.

Low-Resistance Test Sets

Two new low-resistance test sets, type 645 (Army range) and type 653 (Navy range), manufactured by Shallcross Mfg. Co., Collingdale, Pa., contain the meter, batteries, switches, control, etc. supported comfortably and conveniently in front of the operator by means of adjustable straps which fit over the shoulders.

Both hands are free at all times to adjust and operate the instrument. The weight of the pistol grip exploring probe is reduced to a minimum by incorporating the meters, batteries, etc. in the cabinet suspended from the operator's shoulders.

Bond or contact resistance measurements as low as 0.0001-ohm can be made by simply attaching the fixed clamp to one side of the bonded surface and then touching the hardened points of the pistol grip exploring probe to the other side. Type 645 (Army range) is 0.005 and 0.5-ohm full scale. Type

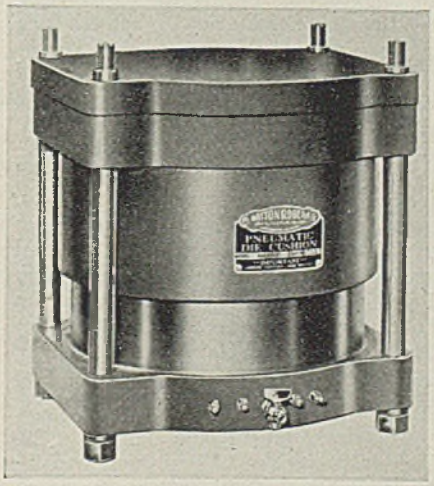


653 (Navy range) is 0.003 and 0.3-ohm full scale.

In addition to being used in testing aircraft bonding, these sets can be used for testing railroad bonds, radio equipment, contact resistance of relays, circuit breakers and so on. They also make bar-to-bar resistance measurements on commutators a simple task.

Die Cushion

A new model CB pneumatic die cushion that is completely self-contained and may be quickly and easily mounted directly to the bolster plate of practically any power punch press is announced by Dayton Rogers Mfg. Co., Minneapolis, Minn. This new design includes an all-hardened and ground pin pressure pad that can be machined and fitted to the



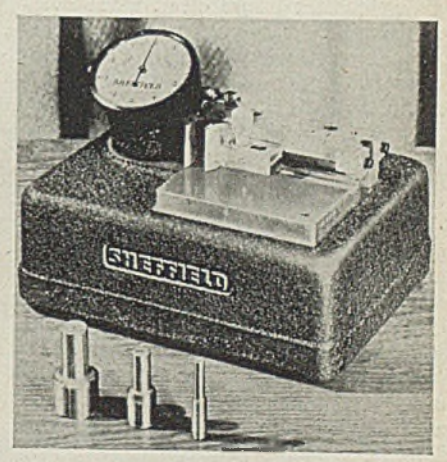
press bed openings of the individual presses used, thus increasing the pin pressure area to the maximum capacity of the press bed opening.

These pneumatic die cushions can replace the springs and rubbers on dies already in use, and are not only limited to the controlling of the draw ring on all deep drawing operations but may be used to an advantage to control the pressure pad on a large percentage of forming dies. They are now built in sizes from 6 to 24 inches; have a drawing capacity from 2 to 15 inches and will develop ring holding pressures from 1½ to 23 tons on 100-pound air line pressure. Each cushion is supplied with a combination reducing regulator valve and pressure gage together with high pressure hose fittings that facilitate quick and easy installation as standard equipment.

Checking Instrument

Designed for rapid and accurate checking quantities of threaded parts such as aircraft components, studs, and small shafts, a new production type Leadchek is announced by Sheffield Corp., Dayton, O. It also may be used to advantage in the receiving room or gage inspection department where quantities of identical threaded parts require checking.

Thread lead can be checked on this



Leadchek to an accuracy of 0.001-inch more rapidly than by any other method. It will handle threaded length up to a maximum of 2 inches. Threads as fine as 40 pitch or as coarse as 2¼ threads per inch may be checked. It will check parts having diameters ranging from 0.125 to 2 inches. The gage may be obtained with a dial indicator, Electrichek or Electrigage head.

The dial indicator has a range of 0.010-inch on the dial face and is graduated in units of 0.0001-inch. The gage is of extremely simple and rugged construction with sufficient capacity for a wide range of uses in production thread checking.

Continuous Printers

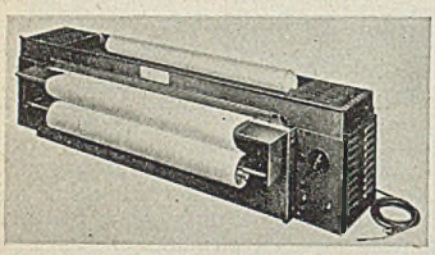
Two table-type continuous printers have been developed by Peck & Harvey, Chicago. These B-1 and B-2 models produce clear, sharp blueprints or direct process black and white prints up to 44 inches wide at a speed up to 42 inches per minute—at a cost of 1 to 1½ cents per square foot (including labor). Either cut sheets or continuous rolls may be used. Any drawing or tracing, or printed matter or any combination (as many as five 8½ x 11-inch sheets) may be fed

(All claims are those of the manufacturer of the equipment being described.)

into the machine at one time. Any length may be printed continuously, without side travel, blurring, or wrinkling.

The printers are compact, portable, simple and easy to operate and maintain, sturdy and highly efficient. No special wiring is required.

Use of Cooper-Hewitt mercury vapor lamps mounted horizontally gives



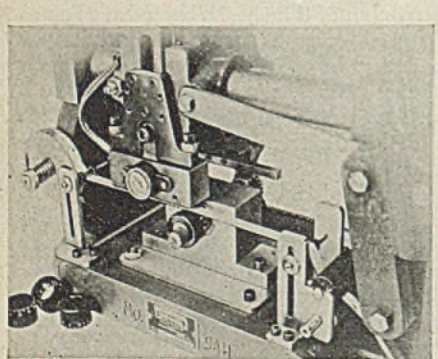
uniform light intensity overall. Superclear, hand polished contact glass and sliding contact insure clear, clean overall exposure. Efficient, quiet, ball-bearing equipped variable-speed drive provides wide range of speeds. No lubrication is required.

Marking Machine

A new marking machine that takes the place of engraving and filling by marking and applying pigment or metallic color by means of an electric heating element is offered by Acromark Co., 398 Morrell street, Elizabeth 4, N. J.

Speed of at least 20:1 is claimed by users of this new machine as compared with former methods of production. Filling of the marking with white, silver or other color is accomplished at one time.

The flat marking assembly incorporates the use of a roller die that rolls the mark into the flat part held in position by a



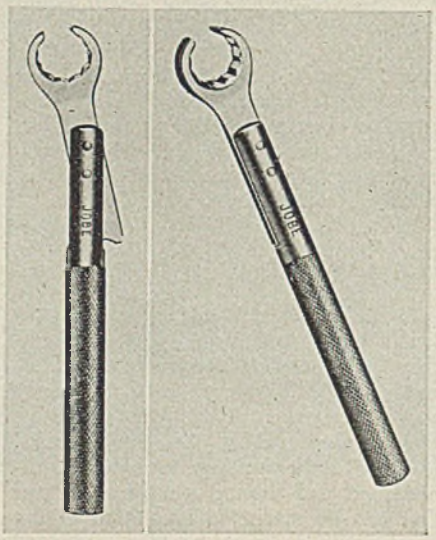
special form fixture as the die rolls over it. A ratchet feed advances the transfer tape at each stroke of the machine placing a full transfer filling into each mark. A specially engraved steel marking die sinks the marking and the color transfer at the same time. The die is heated by an electrical heating element, and on the front of the die holder is a thermometer for heat regulation.

It also can be used for marking graduations and numbers of binocular adjustment sleeve and for marking numbers, names and other data on other black or otherwise finished metal parts. The machine can be adapted readily to the marking of innumerable instrument and aircraft parts that have heretofore been marked by a slow engraving process followed by hand filling.

Tension Wrench

A new type tension wrench is now available for production lines where uniform torque tightening of nuts, bolts and tubing fittings is required. These new Jobe tension wrenches were designed to meet the need for a tension wrench where repeated torquing at the same torque load is required. Each wrench is set at a given torque, which cannot be changed except by the tool crib man.

The wrench indicates when the proper torque is attained by snapping open, thus giving immediate notice to the mechanic



to discontinue tightening. When the load is released, wrench snaps to neutral.

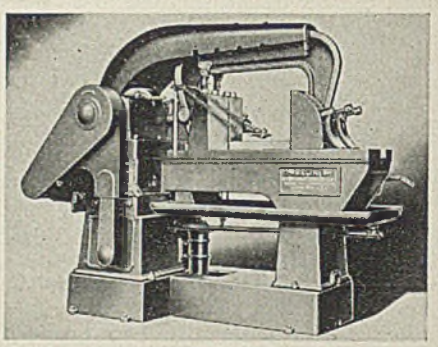
Designed with a broached wrench head to permit passage over tubing when used on hydraulic, oil and fuel line fittings, it can also be used for nuts and bolts.

A special adaptor can also be used for tightening wing nuts on hose clamps. These wrenches are made in various sizes with torque settings as required by the customer and are available through Joyce & Associates, 819 Washington building, Los Angeles 13.

Metal Cutting Machine

The development of a new 20 x 20-inch capacity metal cutting machine known as model No. 36C has been announced by Racine Tool & Machine Co., Racine, Wis. This machine was designed primarily to provide low cost cutting with a thin cutting tool in large size materials and it is particularly adaptable to use on die block steel and other costly materials. The comparatively lightweight blade used removes only a small amount of metal in the form of chips, and where multiple cuts are made, a substantial saving results from this feature alone.

The machine is hydraulically operated, full control being placed on a single lever. A special dual type feed is used which provides a fast cutting speed in light materials and yet is arranged for a

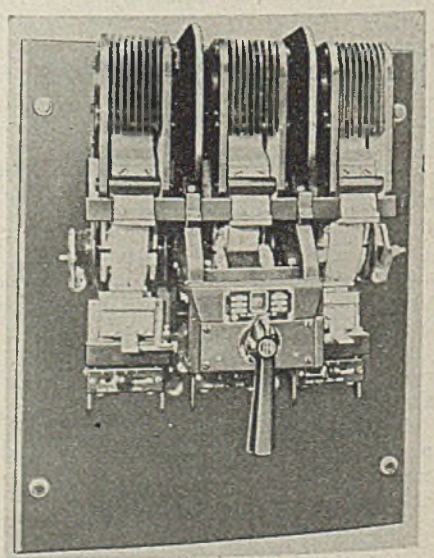


positive predetermined rate of cutting in die blocks, alloys and tool steel. A 3-speed transmission provides cutting speeds of 55-85 and 115 strokes per minute. A 3-horsepower motor drive through V-belts is connected to the 3-speed transmission by a twin disk clutch.

Air Circuit Breaker

A new trip-free air circuit breaker, known as type KC, with an interrupting rating of 50,000 root-mean-square amperes, is offered by the I-T-E Circuit Breaker Co., Nineteenth and Hamilton streets, Philadelphia 30. Ratings are 600 volts alternating current, 250 volts direct current, 100 to 1600 amperes. Operation may be either manual (illustrated) or electric; 1, 2 and 3-pole styles. Mounting may be on open type (live-front) or dead-front switchboards or in individual steel enclosures of general purpose or weatherproof construction.

Features include silver-alloy main contacts brazed to solid-copper contact blocks, auxiliary and arcing contacts which are also made of silver alloy and magnetic arc are chutes without blowout coils and iron vanes. Manual operation makes use of a large pistol-grip handle which requires turning only 90 degrees to open or close the breaker. Electrically operated breakers are provided with a unit-type solenoid mechanism and a trip-free closing relay.



Official U. S. Army Signal Corps Photograph

POWER TO ATTACK
relies on power to *produce*. For stepped-up production from *STEEL* mill equipment use...

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Better Heat Treating

(*Concluded from Page* 109)

moving stock equally from all sides of the work. At least 1/16-inch should be removed all over, if excessive distortion and unequal hardness are to be avoided. Much waste and spoilage comes from not heeding this point, since in quenching from the hardening heat, the cleanest and smoothest portions cool more rapidly.

A modern heat-treating plant has a great variety of equipment available. In our plant, for instance, 70 furnaces are "at heat" 24 hours a day. Many of these are of special design and have controlled atmosphere. About one-third of them are electrically heated, the others are gas-fired. All have automatic time and temperature controls. In size they range from tiny laboratory type furnaces up to the largest which measures 12 x 5 x 3½ feet.

Some 18 straightening presses are also required, ranging from small bench types to a 200-ton hydraulic unit. Degreasers, sand and shot blasting machines, special machines for die-quenching gears, cranes and hoists, and many other items are in constant use. There are six different case-hardening baths, with large quenching tanks near by that automatically remove the work from the quench.

In addition, facilities are found here for three kinds of carburizing—compound, liquid and gas. There is a rotary carburizing furnace, as well as plating and copper painting used in selectively case hardening.

Two continuous chain-belt furnaces, each equipped with automatic 5-degree controls, have 12-inch wide belts, are 22 feet and 31 feet long respectively. These belts are made up of flat-surfaced interlocking high-alloy castings, which travel smoothly with no vibration or chatter. Through these each day go many tons of parts for heat treating, from delicate springs and aircraft parts to tank track pins. Finally, a complete laboratory is maintained for analyzing, microphotography and research.

But all the equipment, experience, skill and special processes are of little avail unless full co-operation is extended by those who make the tools, dies and parts in the way of careful selection of steels, designs consistent with the rigors of heat treatment, correct machining—and above all, precise and complete information as to the kind of steel and the purpose of each job.

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Lifting of restrictions on its Vulcalock cement, so that anyone who can qualify under Rubber Restriction Order R-1 can purchase and use the product is announced by B. F. Goodrich Co., Akron, O. Vulcalock cement, developed in the company's laboratories, has been a most important contribution to the art of bonding rubber to metals, and has wide application in that field, in tank cars, pickling, plating, and other tanks where rubber lining is essential to operation.

STREAMLINED HEAT-TREATING...

War's impact has evolved new techniques which will be valued post-war procedures

To "get thar fustest with the mostest men" means getting there "fustest" with machines of war as well—tanks, planes, ships, bombs, torpedoes, and a thousand other essentials. To do that, American industry has had to perfect new ways of turning out war materials—better, faster.

Because heat-treating enters so largely into the making of most war materials, Gas has played a vital part in this rapid evolution of techniques. One aspect has been the creation of a new technique by which heat-treating with Gas has been integrated with production so that each operation, whether heating or quenching, is not a separate task but an integrated part of the whole operation.

All this new development will be available to industry after the war and will unquestionably help to produce peacetime goods faster and better and at immensely lower cost. Ask your Gas company for help in fitting Gas to your post-war needs.

AMERICAN GAS ASSOCIATION
INDUSTRIAL AND COMMERCIAL GAS SECTION
420 LEXINGTON AVENUE, NEW YORK

Metallic Materials

(*Continued from Page* 97)

An 18:8 steel gave[63] the following results under A for a water quenched ("quench annealed") low carbon 18:8, and under B for an annealed 18:8 with molybdenum. See Table DI.

Wiester[64] states that the chromium-manganese and high manganese types of austenitic steel are as impact resistant at liquid air temperature as the nickel-chromium type.

The increase in tensile and yield strengths at low temperature is characteristic of metals and alloys in general. Copper-base, nickel-base, and aluminum-base alloys retain much or all of their tensile ductility at low temperatures, in spite of the increase in strength. Their notched-bar impact resistance also tends to remain close to the room temperature level. They appear even better materials of construction at low than at normal temperature. Magnesium-base and zinc-base alloys may decrease somewhat in tensile ductility and the already low notched-bar values may also decrease, as the temperature is lowered.

The nonferrous materials, as a class, appear capable of considerable cold-working without becoming temperature-sensitive in ductility or notched impact.

Structural, Heat-Treated Types

It is the ordinary structural and, to a smaller degree, the heat-treated steels whose response to the type of applied stress, and whose alteration in the ratio of shear strength to cohesive strength through cold-work or through lowering of temperature, results in brittle behavior. The original room temperature ductility and notched-bar impact figures of the ordinary steels are decreased by factors that increase hardness, such as high-carbon content, cold-work, low tempering temperature after quenching, etc. But the tensile ductility and the notched-bar behavior do not necessarily go down hand in hand as the temperature is lowered. Indeed, the tensile test usually shows almost as much tensile ductility at —240 degrees Fahr. as at room temperature, though at —320 degrees Fahr. it may fall to under 5 per cent elongation or reduction of area, or may remain nearly as high as room temperature.

A sharp drop in the value returned by the conventional notched-bar test may, however, occur in ordinary steel, not quenched and tempered, at only moderately low temperature, as is shown in Fig. 33. The sharp drop is accompanied by a change in the appearance of the fracture, on the upper branch of the curve the fracture is a fibrous, tearing one, on the lower, a shiny, brittle one.

The brittle type of fracture may occur in actual *parts* despite a high notched-bar figure for the *material*, tested in the conventional fashion. This is a size effect. The effect of size is indirectly brought out in the work of Epstein.[65] When holes are punched in structural steel angles, made from unkilled, non-heat-treated steel, a ring around the

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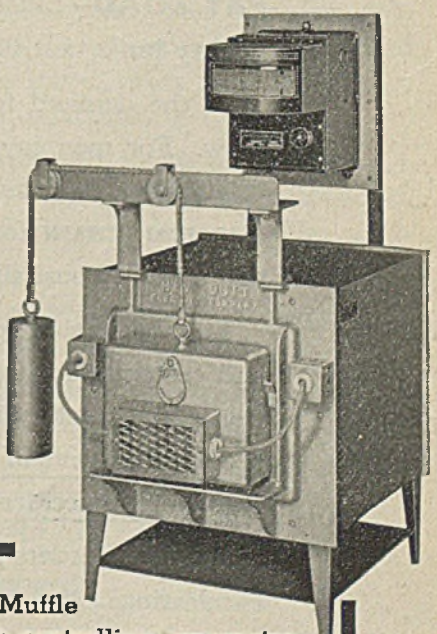

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punched hole is hardened by cold-work and its surface is torn and jagged on a microscopic scale. In a bend test of the whole angle, fracture may be tough or brittle. In angles of thicknesses of ¾ to 1 inch, such punched holes make ductile steel act brittle at ordinary temperature, whereas sub-punching and reaming to remove the torn surface and the cold-worked layer allows it to act tough. Small punched angles, ⅛ to 5/16-inch thick, however, acted tough, even at —40 degrees Fahr. Punched angles ½-inch thick may behave either tough or brittle. The degree of cold-working in punching is, of course, greater in the heavy angles, but the data indicate that the restraint upon deformation, imposed by mere size in the thick angles, is a major factor in governing whether the piece will act brittle or tough.

The lack of agreement between behavior of punched ½-inch angles, with impact results of standard specimens cut from the angles and representing the same steel without cold-work, is shown by the following, all on as-rolled steel at room temperature.

Steel	Fracture in Angle Bend Test	Charpy Impact, Ft. Lbs.
A	Brittle	27
B	Ductile	27
C	Brittle	31½
D	Ductile	25½
E	Ductile	31½

The "standard" impact test told exactly nothing about the behavior of the full-sized angles, carrying punched holes. Figures of more than 25 foot pounds in the standard test would lead the engineer to believe, incorrectly, that all these angles should act tough.

The effect of size has been commented on by many engineers. Haigh is approvingly quoted by de Forest.[67] "Large notched bars are necessarily brittle, even at ordinary temperature, no matter how ductile the metal may appear when tested in small sizes." Schuster[68] remarks that we ought to use very large specimens, more comparable with service conditions of large parts. Bailey[68] says that brittle fracture is a consequence of size and form; hence, the usual notch-bar test does not measure resistance to the spread of a crack as it would occur in practice, "fails in its own objective, and has no great practical value as a specification test."

That stress concentration produced by a given notch in a bar of one size differs from that in a bar of another size, being more severe in the larger bar, is brought out by Spraragen[69].

In this connection the converse of the size effect should be recalled, i.e., that as restraint upon deformation at the base of the notch is *decreased*, the piece *acts tougher*. The sharp drop in low temperature impact resistance of ordinary steels is absent or dropped to a much lower temperature is subsize specimens. Thin sheet is much tougher in low temperature notched impact behavior than massive stock. This raises an interesting question in respect to some equipment for low temperature chemical processes, where the wound-layer construction, as

used[70] by the A. O. Smith Corp. for pressure vessels and like, might be applied. The laminated structure might be less notch sensitive in impact than a massive construction, and a further step might be taken for protection of the exterior against nicking by dropped wrenches, or other accidents, by making the outer couple of layers of 18:8, with its high notch-resistance, just as the inside layers may be so made to combat internal corrosion. No evidence is at hand on which to evaluate the possibilities.

In any given state of heat-treatment, increasing the carbon decreases the impact figure, and if we demand high impact values at very low temperatures, such as that of liquid air, we must keep the carbon low. If we want great strength as well, we have to use alloying elements, and those that, like nickel, affect the matrix rather than the carbide, are most effective. As nickel has a large solubility in the matrix, it is the element usually used, and in very generous amounts.

High-Nickel "Not a Cure-All"

However, a series of tests[71] on low-carbon, high-nickel steels showed them to be very sensitive to finishing practice and that the high-nickel content was not a cure-all. With all the steel normalized and tempered, a 0.04 per cent Carbon, 2.12 per cent Nickel, and a 0.04 per cent Carbon, 3.07 per cent Nickel steel both gave Charpy values as low as 8 and 8.5 foot-pounds at 0 degrees Fahr., whereas an 0.03 per cent Carbon, 2.94 per cent Nickel steel that had been made with proper deoxidation practice showed a minimum of 18.5 foot-pounds at —100 degrees Fahr. In quenched and tempered steels, of carbon content usual in constructional steel, all properly finished, surprisingly little difference, considering that nickel has been so uniformly held to be a panacea, is shown in notched-bar impact figures at extremely low temperatures, between high-nickel and no-nickel steels.

A properly finished heat-treatable steel that hardens throughout on quenching, properly quenched, and well tempered back, say, to easy machinability, is, in general, well able to withstand even the lowest atmospheric temperatures met in aircraft operation, pretty much irrespective of its chemical composition. In such steels, proper heat treatment may even swamp out the effect of poor finishing practice. It is in non-heat-treated, as-rolled, or normalized steels that the effect of finishing practice becomes notably paramount.

This dependence on finishing practice is characteristic of constructional steels. At the same composition, grain size and heat-treatment, individual heats vary in impact behavior, particularly at low temperature, so that there is no way of *indirectly* specifying the low temperature impact behavior of ordinary steels. *Each heat is a law unto itself.* Rosenberg[72] of the Bureau of Standards, expresses this, in agreement with many other observers, as follows:

"Impact tests secured on a single heat

of steel are more or less peculiar to that individual heat, and will not necessarily be duplicated by another heat of the same type of steel. Individual heats apparently have what may be termed an "inherent" resistance to impact within certain limits, and this is dependent upon factors not at present recognized. . . . The practice of evaluating the impact resistance of any material, particularly at low temperature, from the results of even a comprehensive series of tests upon an individual heat of that material may lead to erroneous conclusions."

The strong effect of the practice used in finishing an individual heat of steel has been forcefully brought out by Sims and Dahle[73].

The proper role of the conventional impact test is in producing hints for the metallurgist to follow up in more direct fashion. Differences in cleanliness of different heats of steel, directional differences due to lack of cross-rolling, etc. may be brought to the metallurgist's attention by routine notched-bar tests that are cheaply made. Some metallurgists rely quite heavily on routine impact testing, usually of double-width or larger specimens, for hints on differences in different heats of supposedly like steels. Riegel[74] has expressed the point of view of this group of metallurgists.

Reduces Temper Brittleness

Notched-bar impact figures often reflect some precipitation phenomena in steel that are not shown by hardness or change in tensile strength or ductility. So-called "temper brittleness" in some heats of the more highly alloyed steels, notably the nickel-chromium steels, occurs when the steel is slow cooled from the tempering temperature, the notched-bar impact figures being decidedly lower than when pieces, small enough to be rapidly cooled at the center by quenching, are quenched from the draw temperature. Long sojourn at around 800 degrees Fahr. may induce a similar phenomenon. Addition of molybdenum is known to be effective in eliminating or greatly reducing the tendency toward temper brittleness. The cause, and the mechanism by which molybdenum serves to counteract it, are not clear. It is clear that the behavior is not due to the ordinary chemical composition, for some heats of steels of compositions often susceptible to it, are immune, without molybdenum addition.

Thus the results of the conventional impact test may steer the thought of the metallurgist into productive channels. For the designer, however, impact test figures have little meaning. The feeling of assurance he is likely to have when the fracture of a notched-bar impact specimen, more severely notched than his design calls for, is of the tough, tearing type, and shows some figure that pleases him, whether that figure is ten foot-pounds or 40, may be only an illusion, for the precipitous drop of Fig. 33 may be about to appear at a slightly lower temperautre, or, in a larger piece, i.e., with more restraint upon deformation, a

shattering failure might occur in spite of what the test bar says. Conversely, if the engineer sets an arbitrary 10 foot-pound "standard test" figure for material that, in the size and shape and at the temperature at which he will use it, is going to *act* tough even though it may show, say, only 3 foot-pounds in the test, his specification will exclude plenty of good material.

Shanley[78] remarks, "Impact resistance is an important research subject. The low temperatures encountered by aircraft at high altitudes have caused an increased amount of investigation in this field. Perhaps too much emphasis has been placed on the properties of the materials, however, and not enough on the design of the parts. The effects of 'triple-tension' or triaxial-tension loading are likely to be much more important that the selection of special materials. Such effects are usually combined also with stress-concentration, 'stress raisers'. The net result is that the material tends to behave like glass, even though the nominal impact characteristics may be good.

"The full-scale testing of actual parts under impact loads appears to be the best way to obtain useful impact data."

Perhaps the most important type of impact-resistant service today is that of armor plate. Here actual ballistic testing is required, and is used, the conventional "impact test" is no reliable criterion.

The conventional notched-bar impact does not tell the engineer what will happen in the actual use of a material.

However, if an impact test simulating service conditions is made on an actual part, just as it will be used, not on a "standard specimen", it does tell what happens, and that's just what the engineer wants to know.

BIBLIOGRAPHY

[49] Russell, H. W. & W. A. Welcker, Jr.,—Damage and Overstress in the Fatigue of Ferrous Materials.—*Proc. A.S.T.M.*, Vol. 36, Part 2, 1936, pp. 118-138. (see also Reference 5.)

[49] Moore, H. F.—How and When Does a Fatigue Crack Start? *Metals and Alloys*, Vol. 7, 1936, pp. 297-299.

[50] Kommers, J. B.—The Effect of Overstressing and Understressing in Fatigue, *Proc. A.S.T.M.*, Vol. 38, Part 2, 1938, pp. 249-268.

[51] Muller-Stock, H.—Mitt. Kohle und Eisenforschung, Vol. 2, No. 2, 1938, pp. 83-107 and Archiv fuer Eisenhuettenwesen, Vol. 12, 1938, pp. 141-148.

[52] Bland, R. B. and P. E. Sandorff, "The Control of Life Expectancy in Airplane Structures", *Aero. Eng. Review*, Vol. 2, Aug. 1943, pp. 7-21.

[53] Almen, J. O.—Probe Failures by Fatigue to Unmask Mechanical Causes, *SAE Journal*, Vol. 51, May, 1943, pp. 28-29.

[54] Hoyt, S. L.—Notched-Bar Testing, *Metals and Alloys*, Vol. 7, 1936, pp. 5-7, 39-43, 102-106, 140-142. Notched-Bar Testing and Impact Testing—*Proc. A.S.T.M.*, Vol. 38, Part 2, 1938, p. 141. See also Reference 18, p. 554. McAdam, D. J., Jr. and R. W. Clyne—The Theory of Impact Testing—*Proc. A.S.T.M.*, Vol. 38, Part 2, 1938, p. 113. A Symposium on Cohesive Strength was held at the Oct., 1942, meeting of A.I.M.E. and A.S.M.

[55] Inglis, N. P.—Relationship Between Mechanical Tests of Materials and Their Suitability for Specific Working Conditions—Trans. N.E. Coast Ind. Engineers and Shipbuilders, Vol. 53, pp. 101-136, 1936-37.

[56] Aero Components Sub-committee. A metallurgical study of German and Italian Aircraft Engine and Airframe parts. *Metallurgia*, Vol. 26, Aug., 1942, pp. 129-136.

[57] Benson, L. E., "The Quenching of Steel After Tempering and the Impact Test", *Engineering*, Aug. 14, 1942, pp. 134-175.

[58] Heron, S. D., O. E. Harder and M. R. Nestor—Exhaust Valve Materials for Internal-Combustion Engines. Symposium on New Materials of Transportation. A.S.T.M., Vol. 40, 1940, pp. 1-26.

[59] Aitchison, L.—Valve Failures and Valve Steels in Internal Combustion Engines. *Proc. Inst. Auto. Eng.* (London), Vol. 14, 1919-1920, pp. 31-72.

[60] Frye, J. H.—Malleable Iron Castings in Ordnance. *The Foundry*, Vol. 71, Sept., 1943, pp. 102-104, 162-163.

[61] Chase, H.—Die Castings, 1934, 264 pages, published by John Wiley & Sons, New York.

[62] Simmons, O. W., P. C. Rosenthal and C. H. Lorig—Study Malleable Casting Properties for Military Applications. *The Foundry*, Vol. 71, Oct., Nov., Dec., 1943.

[63] Reference 18.

[64] Wiester, H. J.—Application and Testing of Steels for Use at Low Temperatures, *Stahl und Eisen*, Vol. 63, Jan., 21, 1943, pp. 41-47—Through Bulletin, *Iron and Steel Inst.*, March, 1943, p. 180a.

[65] Epstein, S.—A study of the Embrittlement of Hot-Galvanized Structural Steel, *Proc. A.S.T.M.*, Vol. 32, Part 2, 1932, p. 293.

[66] Sergeson, R. and S. W. Poole—Low Temperature Impact Testing of a 0.35 per cent Carbon Steel. *Proc. A.S.T.M.*, Vol. 36, Part 1, 1936, pp. 132-142.

[67] de Forest, A. V.—Some Complexities of Impact Strength, *Trans. A.I.M.E.*, Vol. 145, 1941, pp. 13-29.

[68] Schuster, L. W. and R. W. Bailey—Discussions at Symposium on Notched-Bar Testing, N.E. Coast Inst. of Engineers and Shipbuilders, 1939, *Engineering*, Vol. 144, 1937, pp. 519-521, 537-538.

[69] Spraragen, W., "Ductility Under Polydimensional Stress", *Welding Journal*, Vol. 22, July, 1943, Welding Research Supplement, pp. 325s-328s.

[70] Jasper, T. M.—Multi-layer Construction of Thick-Wall Pressure Vessels—*Proceedings of American Petroleum Institute*, Vol. 20, 1939, pp. 7-16.

[71] Compare pages 74-87 of Reference 16.

[72] Rosenberg, S. J.—Discussion. *Trans. Am. Soc. for Metals*, Vol. 28, 1940, p. 20.

[73] Sims, C. E. and F. B. Dahle—Comparative Quality of Converter Cast Steel, *Proc. Am. Soc. for Testing Materials*, Vol. 42, 1942, p. 532.

[74] Riegel, G. C. and L. L. Vaughn—Practical Application of the Notched-Bar Impact Test. *Proc. A.S.T.M.*, Vol. 38, Part 2, 1938, pp. 60-70. See also discussion—Reference 18.

[75] Shanley, F. R.—Problems in Aircraft Structural Research, *Mech. Eng.*, March, 1943, pp. 169-178.

(To be continued next week)

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An even, black, corrosion-resistant finish, necessary for most wartime products of the type, can be produced on zinc or zinc alloy surfaces, including die cast metal, with the Alronox process, according to the Alrose Chemical Co., Providence, R. I., developers of the method. The finish is applied easily and economically by immersion. No elaborate equipment or controls are necessary for its application, which is nonelectrolytic and covers a 7-minute cycle. Alronox has a salt spray rating of 200 to 300 hours on 0.0002-inch zinc plate over steel without aftercoating, and is considered an excellent base for organic coatings. It has high weather and humidity resistance and will not chip or peel.

Electronic Testing

(*Continued from Page 83*)

into two analyses in a day. Bolt analyses were SAE-1035 and 1335.

—Differentiating between machine gun bullets containing 1.5 per cent nickel and those containing no nickel. Several thousand units were subjected to tests.

—Automatic sorting in a few hours of 10,000 small bolts using an automatic relay control. Bolts were of the same analysis, but some had been quenched and drawn, while the balance had only been quenched.

—Sorting according to case depth of a large number of roller bearings. Those with too thin a case were separated from the others and rejected.

—Rating cups of copper-clad steel according to thickness of cladding.

—Separation of decarburized forgings from satisfactory forgings.

The system is especially dramatic when automatic sorting is required. Those electronic differences which have been applied to the cathode-ray tubes are here transferred to suitable relay circuits and mechanical sorting devices. In cases where large quantities are to be sorted, an automatic solenoid-operated sorting mechanism can be used in conjunction with the instrument. Thus, small items such as bullets, ball bearings or screws can be dumped into a hopper from which they are passed one by one through a coil and sorted into one compartment or another according to their metallurgical classification. Speed of such sorting can be as high as five pieces per second. Larger pieces are handled on a moving belt, with relay-operated hinged gate or trap door rejecting or accepting the pieces as provided.

Cyclogram for Each Standard

In evaluating physical properties of metals, quantitative values are always obtained by comparison with a standard of known physical composition. Thus, the system supplies a true comparison that can be calibrated for each application by establishing a cyclogram for the given standard.

Thus, in order to measure case depth, one or more standard samples with known case depth must be obtained from the manufacturer of the part. All other properties, including chemical analysis, heat treatment, physical dimensions, stress gradients and temperature, must be reasonably constant. A simple acceptance test is readily set up to reject cases which are not within specified limits of case depth for the particular metal under test. Extremely thin pieces cannot be tested by this method; nor can case depth at a local area be measured.

In practice, as illustrated in Fig. 2 showing gun breech blocks being tested for case hardening, core characteristics are inspected first. Difference in analysis, heat treatment and internal stresses are indicated; the parts are divided into groups showing the same magnetic properties. Each group is then tested separately for case depth. In both preliminary

selection and final evaluation, operation of the equipment is simple enough that tests can be carried out by the average plant worker, with no more technical training than is required for rockwell hardness tests. Production rates are between 20 and 30 pieces a minute.

Since the characteristics which control the core losses at high frequencies are not magnetic phenomena—being based on eddy current losses rather than hysteresis losses, nonferrous metals can also be inspected. Thickness of plating or cladding may be compared on any shape which can be inserted in a coil. The extent of cold working on surface layers of cold-drawn steel or nonferrous wire or rods may be evaluated. Conditions of unusually high stress near the surface may be detected in both ferrous and nonferrous metals. Whether the application of all these tests will be useful is of course determined by the limits of accuracy desired.

Testing Armor-Piercing Shot

One project, shown in Fig. 3, has been to distinguish tough shot (armor-piercing) from brittle shot having the same surface hardness. In a suitable armor-piercing shot, a balance of internal stresses is reached, although hardness and stresses are not uniform throughout. If a medium test frequency is chosen, a tough shot in which the hardness gradient and distribution of internal stresses are as desired gives a definite reading. If the hardness is higher or lower than desired, the reading will change because the relative values of core losses change. Similarly, increased internal stresses in any one area, such as are caused by having a surface layer under extreme stress, will greatly increase the high frequency losses which are only affected by changes in surface layers. If the high frequency used is such that the field of flux penetration approximately coincides with the hardened zone of the shot, a very sensitive measure of stress distribution can be obtained.

Low frequency measurements are used to identify pearlitic and spheroidized structures in bar stock, again by the process of separating the two groups by means of a preliminary selective test. After the pearlitic bars are segregated, the spheroidized bars are graded according to per cent spheroidization. This test is not meant to give a quantitative determination, but from it may come the assurance that all of one lot will have similar machining properties and behave identically in hardening. The instrument gives an average reading for the bar which may not coincide with the structure exposed by sectioning by the usual laboratory technique.

Still another example of the correlation of core losses for a single physical property is the sampling at various frequencies for machinability of a number of different bullet core steels. Four sets of samples, taken from four different manufacturers and representative of a wide range of conditions in this type of material, were given routine tests by N. Meagley for chemistry, green hardness,