Native road workers leveling concrete on Guatemalan bridge, part of Inter-American highway. Page 70

STEEL

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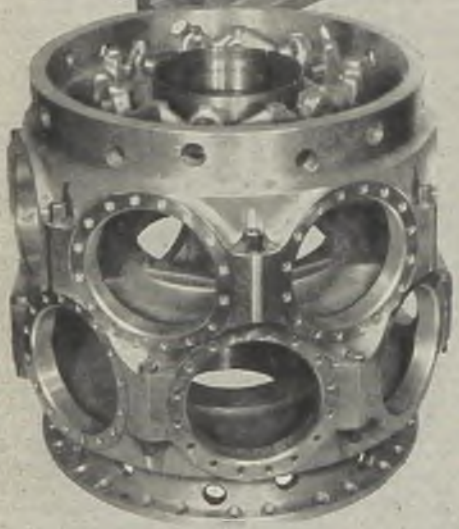

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EX-CELL-O *for* PRECISION

STEEL
February 21, 1944

The Road Is Hard and Long

To hundreds of manufacturers who have worked hard to explain industry's attitude in regard to profits on war contracts, the provisions in the revenue bill pertaining to renegotiation seem to fall far short of fairness and justice. No amount of argument will convince some of them that they have not been treated shabbily and that they have not been deprived of rights guaranteed under the constitution.

Unfortunately, those who feel aggrieved over renegotiation are not the only ones who are embittered by what they believe is discrimination, persecution or worse. There are thousands of others whose experience with government agencies on labor matters has left them with the firm conviction that they have been wronged and that they have no immediate recourse to justice. In addition, there are thousands of others whose dealings with the government on OPA prices, or the whim-by-whim rulings on wage and salary stabilization, or the intricate and imponderable interpretations of tax laws by the Treasury Department, or the erratic regulations of other agencies, have made them cynical and doubtful of the possibility of obtaining fair treatment at the hands of the present government.

To all who are embittered for these and other reasons there is one point well worth remembering. The road back to government by law is hard and long. Victory over any of the injustices which now seem important would not in itself insure justice in all things, which is the ultimate objective. Ahead lie problems of termination of contracts, orderly disposition of government-owned plant to private account and many other questions involved in the preservation of private enterprise.

The sensible solution of these problems will challenge the abilities and resources of industry to the utmost. If we had expended all of our ammunition of fact and argument on renegotiation and other current controversies, we would be left without adequate reserves for the issues which lie ahead.

Fortunately, the record of American industry in this war has been incredibly good. The public has been favorably impressed by it. Congress recognizes it, although sometimes its actions seem to belie the fact. Industry has everything to gain and little to lose by playing the long game.

This does not mean that we should be silent on current injustices. Calm, well advised protest always is in order. The thing to remember is that the road to justice is hard and long.

REVOLUTION BREWING? Apparently something of a revolution is brewing in the field of milling. Guy Hubbard is setting the stage for this impending drama in a series of articles in which he introduces the principal actors and outlines the plot.

In the first article of the series he points out that milling, as conceived by Eli Whitney in 1818, was really mechanized filing. This concept, with certain refinements, persisted until early in the present century when the advent of high speed tool steel and of coarse-tooth milling cutters contributed to a departure from the filing tradition and to the development of more rugged and powerful milling machines. The milling practice resulting from these developments and subsequent improvements has continued without basic change until the present time.

However, happenings of the last five years may precipitate a drastic shake-up. Cemented carbide cutting materials; climb milling; negative rake milling and super-speed, ultra-coarse cutters have gained

(OVER)

considerable acceptance. The experience with any or all of these developments may bring about revolutionary changes in the design of milling machines.

No overnight miracle is in prospect, but in due time we may witness milling machines with power, speed, rigidity and other qualities far beyond anything we have known in the past. This may prove to be one of the postwar answers to the prayer of the machine tool builders for newer and better machines with which to meet the challenge of peacetime competition. —pp. 54, 76

° ° °

WE NEED MORE FACTS: Insight into an important characteristic of mass production is furnished by achievements in the output of aircraft. Ford Motor says "the second thousand bombers has come along much faster than the first." Studebaker turned out four times as many aircraft engines in 1943 as in 1942. Of Buick's output of bomber engines, 75 per cent was completed in the past 12 months.

These records emphasize the slow-start, rapid-finish aspect of mass production. Tedious days are spent in tooling. Initial production is retarded while the "bugs" are eliminated. Finally the setup begins to function smoothly and production mounts—sometimes exceeding expert predictions.

This is gratifying. It is a big factor in victory. It has great postwar potentialities. But it also introduces unsolved social and economic problems. We need to know more about all of the effects of mass production. —p. 59

° ° °

LESSONS FROM 1918-19: A study by the Bureau of Labor Statistics of price policies affecting the sale of steel products during the months following the armistice in World War I is basis for the conclusion that conflict and uncertainty among government officials, steel producers, steel consumers and labor contributed to a postponement of buying, which had an adverse effect upon the nation's transition to a peacetime economy.

Somewhat similar problems will be confronted when the present wars are over. We will go into the transition period with prices much lower than they were in 1918 and 1919, but with wages much higher and with numerous controls which did not exist 25 years ago. If we can also enter the period of transition with predetermined sound policies as to prices, wages and other vital factors, we may be able to avoid some of the mistakes we made a quarter-century ago. —p. 46

FONTANA AND GENEVA: Carson City, capital of Nevada, on Feb. 11 and 12 was host to a western states conference on the postwar industrial development of the West. The general topic for discussion was decentralization of industry, with strong emphasis on the postwar status of the Kaiser steelworks at Fontana, Calif., and the Geneva Steel Co. at Geneva, Utah.

No one can doubt the sincerity of the people in the Pacific Coast area who desire to develop local industries to round out the rapid population and economic growth of their great empire. But one wonders whether grants or subsidies, if gained by political pressure and if they discount economic laws too flagrantly, will be best for the Pacific Coast in the long run.

The Far West has a golden opportunity to expand industrially. Everything points to a gradually increasing need for certain facilities which heretofore have been located in the East. It would be better to encourage a sound natural growth than to unduly force an artificial one. —p. 48

° ° °

INTERNATIONAL ROADS: Progress on the overland highway route from Texas to the Canal Zone may not loom important in comparison with the more immediate problems of war, but it is decidedly typical of the kind of project which will be pushed energetically in many parts of the world after the war.

This Pan-American road, construction of which has been accelerated by military considerations, is of interest to American industry for two reasons. It and similar highways yet to be proposed will entail numerous bridges, culverts and other construction requiring sizable tonnages of steel. Secondly, in addition to its military significance, it will provide a new link with Central and South America which is bound to enhance our trade position with the other American republics.

The world is keenly conscious of air transportation in the postwar scheme of things. This should not blind us to the opportunities for international transport on the ground. —p. 70

E. C. Shane

EDITOR-IN-CHIEF

"Flying" bulldozers and scrapers will quickly repair this bombed airfield.

"Come on—Back the Attack —Buy War Bonds!"

Bulldozers That Fly

An airfield is bombed, but within a few minutes after the "all clear" signal is given Yankee engineers are at work repairing the damage with sturdy bulldozer and scraper units that are small enough to be flown anywhere by transport plane or glider. But repairing airfields is not the only job performed by these husky units—they also help build new airfields and vital supply routes, prepare camp sites, and perform many other chores so important to Victory.

Much of the steel used in these "flying" earthmovers is furnished by Inland to the La Plant-Choate Manufacturing Co., Cedar Rapids, Iowa. Producing steel for tough construction equipment is an old assignment to Inland steelmakers and metallurgists. A large tonnage of the steel shipped for this purpose before the war was Inland Hi-Steel—the steel that builds stronger and saves weight—the steel that will again be used for peacetime machinery when released from the demands of war.

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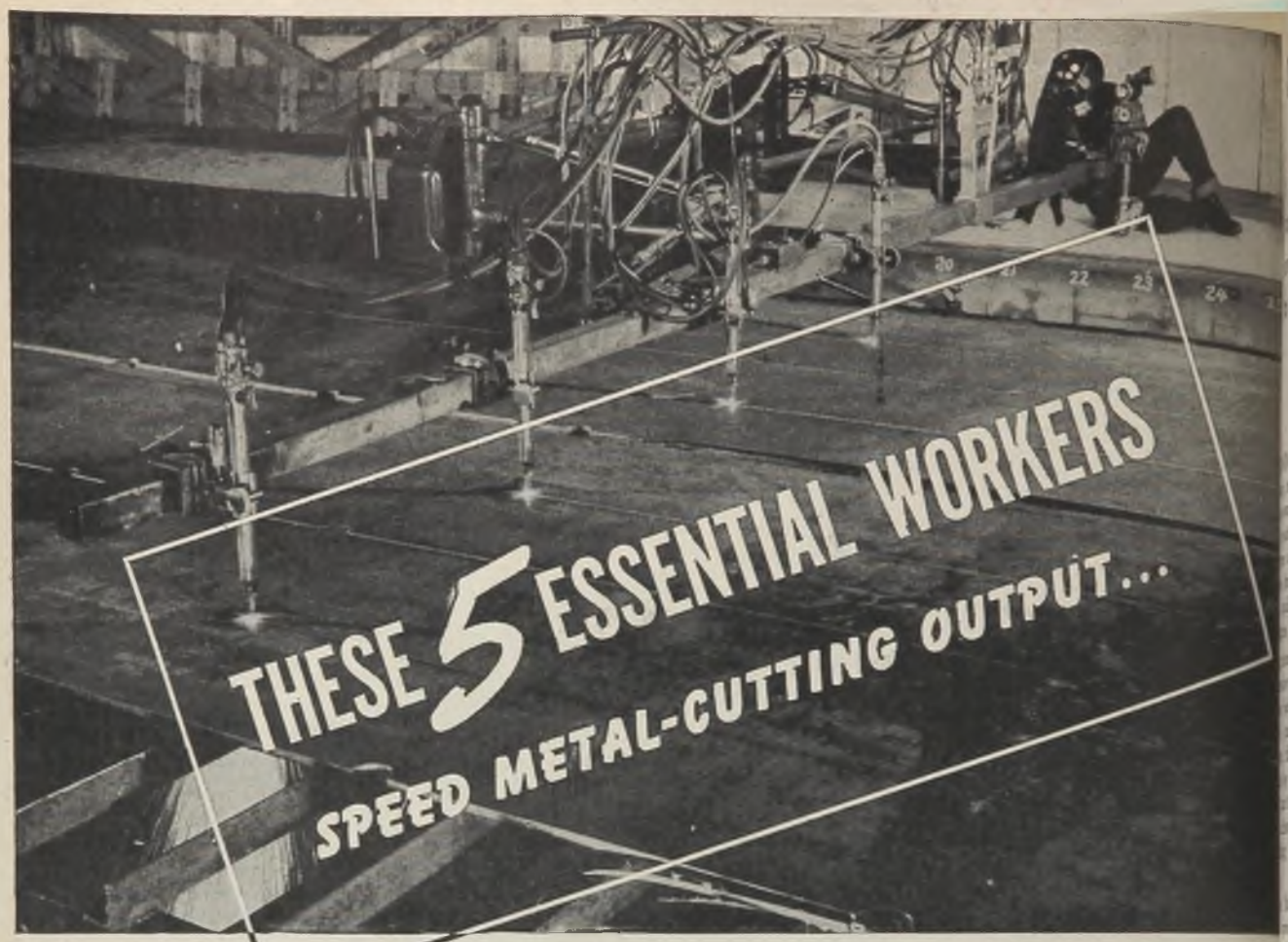

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Senators Offer Termination Measure

Murray and George press plan for settling war contracts and speeding changeover to peacetime production

Reconstruction Finance Corp. plans loans for reconversion. . . . New committee to be established within War Production Board

WASHINGTON

PLANNING for contract termination procedure, reconversion, disposal of government-owned surplus plants, equipment, inventories and products, loans to contractors and allied problems in the transition from a war to peace economy moves steadily but slowly forward in Washington.

Recognized as a problem second only to intensive prosecution of the war, observers believe two dangers lie in the path of a carefully formulated program. These are, first, that plans be influenced too much by political considerations; and, second, that the various planning agencies fail to achieve a singleness of purpose in drafting the overall transition program.

One of the latest moves in establishing the program was the introduction of an omnibus contract termination settlement bill, S. 1718, by Sen. Walter F. George (Dem., Ga.) and Sen. James E. Murray (Dem., Mont.). Incorporating many of the recommendations of the Senate Special Committee on Postwar Economic Policy and Planning (STEEL, Feb. 14, p. 72), the bill has strong support in the upper house.

The measure would establish an Office of Contract Termination Settlement, headed by a director, who would receive aid in settlement and interim financing problems from an advisory board consisting of the heads of the principal procurement agencies.

The policy of the government as defined by the bill would be to insure every war contractor fair compensation for the termination of any war contract. This compensation would include reasonable expenses incident to termination settlement, expenses of removing and storing materials and an allowance for profit on the work done on the uncompleted part of the contract, plus interest on the termination claim at a rate of 3 per cent.

Contracting agencies, functioning under regulations issued by the director, could settle termination claims by agreement which would be final except for instances of fraud. Such settlements, however, would be subject to renegotiation for recovery of excessive profits.

The bill provides for a court review for aggrieved contractors. It assures subcontractors of fair treatment. When prime contractors are paid after settlement, the contracting agencies would exercise control over such payments to insure that the subcontractors received their just share. Where a subcontractor fails to receive fair compensation because of insolvency or bankruptcy of the immediate contractor, the contracting agency would be permitted to make additional payments to protect the subcontractor.

The bill would establish a government policy to insure adequate interim financing within 30 days to every contractor pending settlement of not less than 90 per cent of the amount of his termination claim, after deducting liabilities to subcontractors and to advances, partial payments or loans.

SEN. WALTER F. GEORGE

SEN. JAMES E. MURRAY

Upper house leaders in postwar planning, Senators George and Murray joined forces in offering the omnibus contract termination settlement bill. Senator George is chairman of the Special Committee on Postwar Economic Policy and Planning. Senator Murray heads the War Contracts Subcommittee of the Military Affairs Committee.

In this connection the Reconstruction Finance Corp. has indicated it is ready to make or guarantee immediate loans to speed the transition. Charles B. Henderson, RFC chairman, addressed a letter to the 31 loan agencies of the organization in which he said the RFC must be "prepared to carry out our responsibility to the national economy in the exercise of our statutory lending powers for war demobilization, contract termination and reconversion to peacetime operations."

Mr. Henderson asked each of the managers of the various loan agencies to survey their territories and contact business enterprises and individuals interested in such financing to ascertain what may be expected of the RFC and how it can be most helpful.

"These activities should be carried on, wherever possible, in conjunction with banks or other financial institutions since now, as always, it is our desire that private financing be used, with or without participation by RFC."

Under the terms of the George-Murray bill, the general accounting office would be authorized to examine all records of the contracting agencies relating to the settlement to ascertain whether the settlement was induced by fraud. Where fraud was in evidence, reports would be made to the Congress, the director, and the Department of Justice. The comptroller general, however, would not be authorized to suspend or withhold payments.

Incidentally, the bill provides that the compensation of the director of the Office of Contract Termination Settlement, a man who would administer some $75 billion of contracts, would be $12,000 a year.

The measure reportedly was originally opposed by Bernard M. Baruch and John Hancock, postwar planners in the Office of War Mobilization, on the ground that they did not need any legislation to handle contract terminations. This opposition was withdrawn when they were overruled by James F. Byrnes, OWM director. The Baruch-Hancock unit already has established contract termination procedure to accord with the bill

and now is engaged in writing a standard subcontract clause.

Mr. Baruch last week also submitted to the President a complete plan for the reconversion of industry from war to peace, which is expected to be released soon.

Meanwhile, the War Production Board also is looking forward to the day when war demands decline and greater emphasis can be placed on civilian production. Chairman Donald M. Nelson last week assured business men that reconversion problems were receiving attention and that plans were afoot for a free and frank discussion with industry and labor of the problems involved.

It was reported at WPB that plans have been drafted for establishing a new reconversion committee.

1943 Railroad Construction Projects Totaled 3629

Nation's railroads received approval from the Office of Defense Transportation and the War Production Board for construction during 1943 of 3629 projects, costing a total of $134,968,171, ODT announced last week. Breakdown of projects by classes of work, number, and cost, respectively, was as follows: Signalling, 247, $24,259,835; bridges, trestles and culverts, 395, $16,298,255; main tracks, 54, $19,990,200; other tracks, 808, $37,891,628; mechanical facilities, 912, $19,180,187; station facilities, 228, $4,581,346; communications, $1,046,848; miscellaneous, $11,119,863.

East Central Region's Program Tied to General Industry Plans

With bulk of area's production absorbed in other manufactures plans for after the war period must be related to those of the consumers it serves. Surplus goods and plant, contract termination pose problems

POSTWAR planning by industry in the east central region, comprising Ohio, eastern Pennsylvania and eastern Kentucky, is dependent upon planning by industries in other parts of the country, states Robert L. Whaley, United States Department of Commerce Field Service, in the 1943 fourth quarterly report, "Postwar Planning in the East Central Region," recently issued.

Ideally situated to serve both eastern and midwestern industry, the bulk of the east central region's output (steel, machine tools, metal products) is absorbed in the manufacture of other products. This makes postwar planning in the area dependent upon planning in other areas, while also aggravating its situation is the problem of utilization of an additional $2 billion worth of war plant facilities, general uncertainty as to government policy on contract termination and disposition of surpluses, as well as the draining of reserve funds through taxes and renegotiation.

How much and what kind of steel is produced in the area depends, of course, upon what the automobile, railroad, and the other consuming industries do. New production facilities to be utilized are worth a billion dollars. One segment of the region's steel industry, alloy steel, faces greatly enhanced competition because of the newly built government-financed plant in South Chicago, Ill., which has expanded alloy-steel capacity about six or eight times above the prewar level.

Steel companies, however, are not worrying about competition from the light metals and plastics industries for they, too, have been making improvements.

Facing the certainty of greatly extended capacity and an over-saturated market when victory is won, the machine tool industry in the area is utilizing at present only about 92 per cent of its capacity because of loss of manpower and the falling off of production due to cutbacks and completion of contracts, and of this 92 per cent some utilization constitutes manufacture of war materials other than machine tools. Most seriously affected are the smaller machine tool builders.

Machine Tool Surplus

A critical postwar problem will be a surplus of machine tools. Postwar planners have two alternatives: Redesigning present machines to make them more efficient and to hasten obsolescence in existing equipment; or developing some type of product that can be made in a machine tool shop. A few of the larger and more aggressive plants in the region are reported to have well advanced plans for alternative postwar products and are even now working on other products, but the industry as a whole doubts that this is the answer. Although realizing that production of products other than tools would help fill peak postwar demand for consumer goods, the individual tool manufacturer is concerned about keeping his plant in operation producing machine tools because he feels his industry should continue in its highly competitive status, keeping up with the times and being prepared to make tools for national defense when necessary. To this end the preservation of special skills possessed by machine tool builders is vital.

In making plans for the future, the hundreds of screw machine products manufacturers in the region are con-

RESCUE SHIP: S. S. MONTEREY, which recently rescued 1675 of 1973 survivors of an Allied troop transport sunk in the Mediterranean, is being converted for war purposes in a Bethlehem Steel Co. ship repair yard. The War Shipping Administration praised the officers and crew of the MONTEREY for effecting the rescue while under German air attack

POSTWAR PREVIEWS

TERMINATION— Omnibus contract settlement bill introduced in Senate to speed changeover to peacetime production. Reconstruction Finance Corp. makes plans to aid financing of reconversion. See page 43.

DECENTRALIZATION—Geneva Steel Works seen as "guinea pig" in efforts of West and other sections to decentralize industry and hold industries necessitated by war after hostilities end. See page 48.

MACHINE TOOLS—Development of tools which will make present equipment obsolete one solution to postwar surplus problem. See page 54.

AIR TRANSPORT— Presents vast potential for future. Can make inland trade centers competitive with seaports. See page 62.

ENAMELING— Intensive research on manufacturing methods and processes launched to prepare for anticipated heavy demand for finishing household appliances after the war. See page 69.

INTER-AMERICAN HIGHWAY— Overland route from Texas to Panama holds vast implication for postwar trade among western hemisphere countries. See page 70.

MILLING REVOLUTION— Widespread acceptance of carbide cutting materials, climb and negative-rake milling and introduction of super-speed ultra-coarse cutters point toward gradual revolution in milling machine design. See page 76.

CROSSROLL FORGING— Experience of large producer with Assel crossrolling mill—higher accuracy, reduced forging weight, production of finished forged cavities without machining—gives it preferred position. Inroads of 50 per cent on total output of forgings once processed by "pierce-and-draw" now indicated for this and the "one-shot" techniques. See page 80.

BROKEN TOOL "DISINTEGRATOR"—New electrical oxidation method for removing broken taps, drills and reamers without damage to work promises to gain top rank as approved work salvage medium in machining operations. See page 92.

fronted by a number of pressing issues, including:

1. The problem of screw machines in the hands of former customers. While the number of automatic screw machines in use has doubled within the past four years, the number in the screw machine products industry itself has increased only 20 per cent. The reason is that, since these small firms could not get DPC equipment, they had to buy their machines outright. If the many former customers now having DPC machines and experienced workers to operate them are permitted to buy this equipment at 20 cents, or less, on the dollar, it is feared that they will keep on producing screw machine products in competition with their former suppliers. If, on the other hand, they have to pay the full price, many will be inclined to let this work go back to former channels.

2. How low will firms in the industry have to go in pricing to get business in competition with former customers? Will it be below cost?

3. What will be done with the increase from 300 to 800 firms in the industry; overexpanded machine capacity outside of the industry; and an estimated cut in volume to 25 per cent of its present load?

4. Termination of contracts.

To help solve some of these problems the National Screw Machine Products Association is issuing a series of booklets.

Plan To Produce Same Products

An increase in over-capacity beyond that already existing before the war, plus the problems of surplus stocks, contract cancellation and renegotiation, are giving bolt, nut and rivet manufacturers concern. The industry plans to make essentially the same products after the war. However, the National Association of Nut, Bolt and Rivet Manufacturers is urging industry members to investigate the possibility, uncovered by the war, of producing things other than bolts and nuts on heading equipment.

Commercial drop forgings, a small, low-yield, competitive industry, is faced with a lack of working capital to carry over excessively high inventories and to replace hard-used equipment.

For many small metalworking establishments production of new products will provide the only means of survival, particularly for those who went into business after Pearl Harbor.

War industries, such as tanks, jeeps, guns, explosives, and ammunition and vast expansion in aircraft and parts have created the postwar problems of utilizing the new facilities, valued at approximately $800 million, and of adjusting local employment. The Dayton area has doubled its industrial employment since July 1, 1941.

Aircraft and parts and allied activities account for almost three-fourths of the increase. These same activities represent nearly half of the 100 per cent gain in Akron's industry during the same period. The Columbus area presents a similar picture, and including ordnance, Toledo is in the same class. Substantial new aircraft facilities have been created in the Cleveland and Cincinnati areas. Pittsburgh is producing aircraft parts on a smaller scale, as is Erie, Pa., and the industry is also relatively important in the Sidney-Piqua-Troy (Ohio) area.

In summary, it is noted in the Department of Commerce report that reconversion of the older industries of the East Central region will be comparatively quick and simple, while the problem of utilization of the new war facilities is directing postwar planning toward a search for new products. Particularly important to this region is the question of prompt contract settlement.

Flat-Rolled Steel Makers Organize New Association

PITTSBURGH

Newly formed to serve the manufacturers of flat-rolled steel products the Steel Manufacturers Association will open offices in Pittsburgh this week.

The new association will perform many of the functions which were formerly carried on by the National Association of Flat Rolled Steel Manufacturers, and its secretary-treasurer will be Harry H. Burris, who was president of the latter organization.

Announced purposes of the new group include a co-ordination of activities of flat-rolled steel producers in establishing industry standards; simplification of practices within the industry; standardization of specifications, and similar activities.

Organizational work has not yet been completed, but the association will be governed by a board of trustees elected by the members, and a president and vice president will be elected from the board of trustees.

Mr. Burris, who will serve as operating head of the unit, has been active in the flat-rolled steel industry since 1916. He was connected with the NAFRSM for many years, succeeding to the presidency following the death of Neil D. Flora, long-time association president.

Postwar Policy Pattern Sought

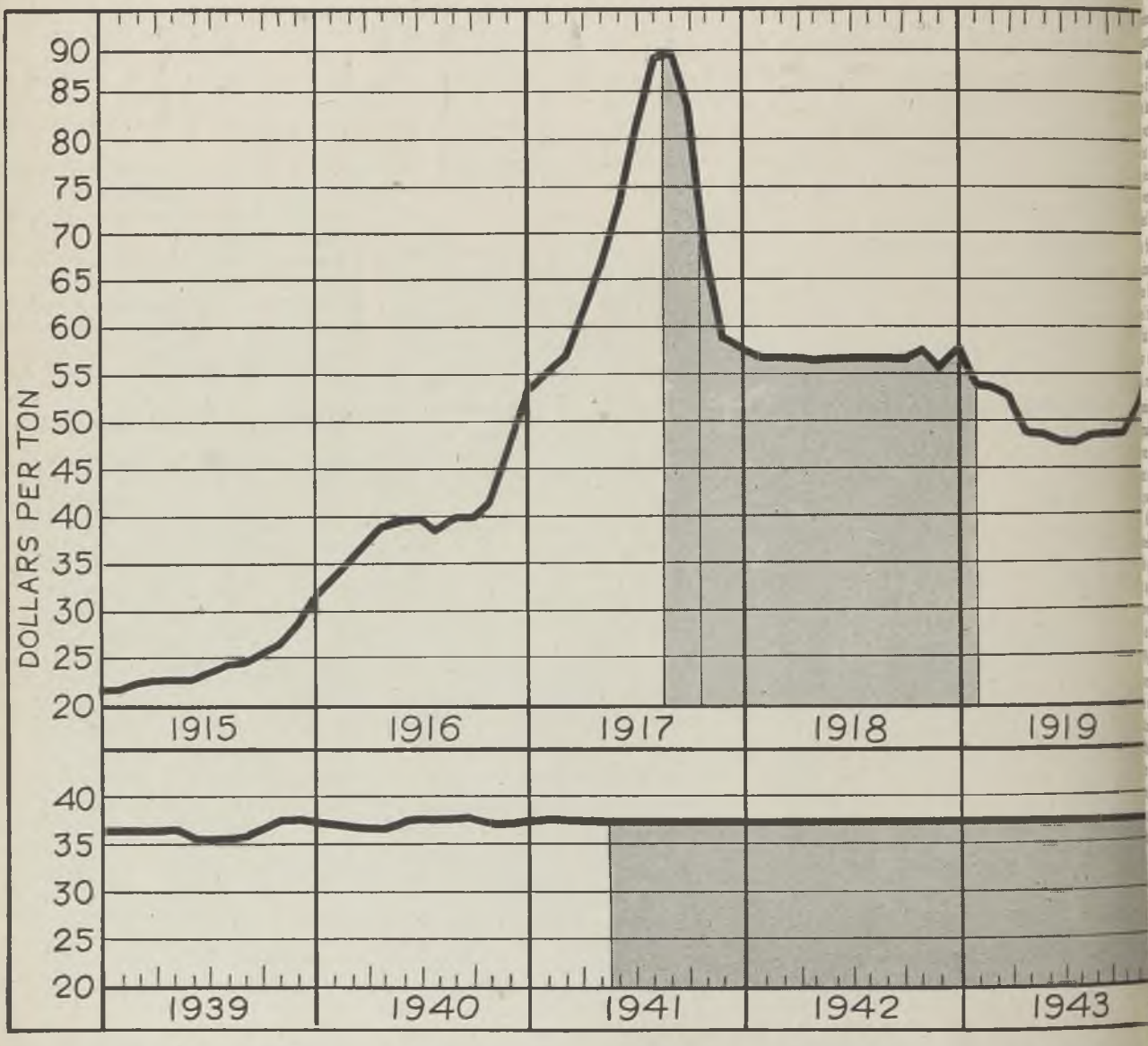
Critical analysis of situation after World War I made by Bureau of Labor Statistics. Conditions after World War II will not be wholly comparable

A CRITICAL analysis of the price policies of iron and steel producers in the six and a half months following the armistice in World War I and the effects of these policies upon production, employment and payrolls has just been released by the Department of Labor.

Prepared by Joan Stauffer Crane of the Bureau of Labor Statistics, the study covers two intervals—first, the seven weeks from the signing of the armistice to Jan. 1, 1919, during which government price controls initiated in July, 1917, were continued; second, the following five months when government price controls were lifted and the industry attempted with a large degree of success to stabilize steel prices.

The analysis is informative in that many of the problems which existed after the first World war will again be met when present hostilities cease. These include contract termination, the question of whether or not to continue price controls, the problems connected with reconverting steel consuming industries to civilian goods production, and a probable surplus of labor caused by the cessation of war production and the demobilization of men and women in the armed services.

An outstanding difference between th conditions prevailing after the last wa and those which probably will prevai after this one, however, should be noted During the first war, steel prices ros sharply, practically quadrupling from th



Iron and steel prices in World War 1 were much higher and fluctuated more widely than during the present conflict. The charts above show the course of prices as reflected in STEEL'S *composite price of a group of iron and steel products. During the first war, the composite reached a peak of* $89.69 *in August,* 1917, *and after imposition of government controls retreated to about* $57 *for the remainder of the war. Price ceilings were imposed before the United States entered the present war and there has been little variation from the present composite price of* $38.15. *Shaded portions in charts show periods when prices were under government control*

beginning of 1915 until July, 1917, when government price controls were initiated. The composite price of iron and steel products as compiled by STEEL (then *Iron Trade Review*) rose from $21.90 in January, 1915, to $89.69 in August, 1917 (see accompanying chart). Imposition of government controls forced the composite down to around $57 where it held with minor fluctuations until the armistice.

In contrast, steel prices for the present war were frozen in the spring of 1941, before this country entered the war, and have shown only minor changes since that time. The composite price for iron and steel products now, according to STEEL's compilation, is $38.15.

During the first seven weeks after the armistice, the Labor Department's survey points out, discussions were vigorous and controversial over the policy to be adopted when price controls were dropped. "It was apparent that the steel producers and the producers of steel consuming goods were in conflict over the subject of steel prices. The producers of steel consuming goods were anxious to have steel prices reduced from the high wartime level," says the report, adding that steel producers were emphatic in declaring that if any price reductions were made they would have to be preceded by reduction in wages.

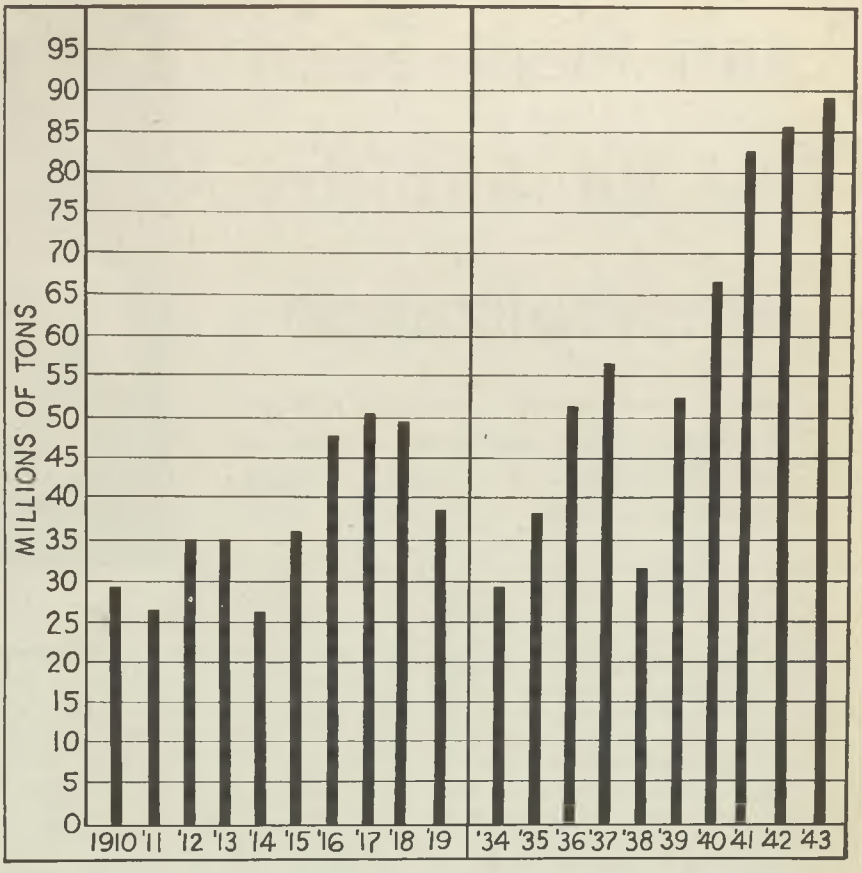
Despite the hopes of the steel consuming industries, the survey continues, steel prices held at a high level during the period from Jan. 1, 1919, through May of that year. "There is evidence that many steel purchases were postponed as a result."

The coming of the armistice and the sudden grinding to a stop of the gargantuan war machine jarred industry and government alike into a belated recognition that postwar policies were still embryonic. All parties interested in the level of steel prices—the producers, consumers, the government and labor—were uncertain as to what to do next.

The government's war agencies were confused as to the extent of their powers.

"The War Industries Board was converted overnight from a powerful director of the war production machine to an organization uncertain of its powers, responsibilities, of its own wishes. Eight days after the armistice the chairman of the board, confronted with the request that he accept partial responsibility for cancellation of contracts and for price controls, exclaimed in confidential session with his division chiefs: 'What is the good of talking about something we cannot do in any way. The power of the War Industries Board is a dead cock in the pit. You might as well recognize it. As long as you had power to direct purchases and make prices you could maintain you had some power. But there are no more purchases, there is no shortage, and you cannot maintain prices made and the power is lost'."

The larger steel consuming industries also were confronted with uncertainties. The railroads were under government control and it was impossible to predict whether this control was to continue or whether they would be returned to private ownership. Extensive replacements and repairs were necessary because of the serious depreciation that had taken place during the war. During the last year of the war, the railroads had laid only 50 per cent of their usual tonnage of rails.



Steel ingot and castings production then and now. This chart illustrates the large gains in productive capacity made from the decade starting in 1910 and the ten years just ended. With prices and costs at present levels, any considerable decline in operations will place many mills below the "break even" point

A major problem disturbing the machine tool industry was uncertainty as to the eventual disposition of the large surplus of tools in the hands of the government.

Favor Speedy Contract Termination

The automobile industry, which during 1918 had been repeatedly urged by the War Industries Board to go on a 100 per cent war production basis, was chiefly concerned with the rate of government contract termination. Whether a manufacturer wished for speedy or deferred termination depended largely on the degree of conversion accomplished in his plants before the armistice. Those who had effected a relatively small amount of conversion were eager for quick contract termination. Others who had engaged in extensive retooling and plant alterations had to weigh the advantages of rapid reconversion and a return to normal production conditions against the costs of a period of disorganization and inefficiency involved in probable labor layoffs with subsequent responsibilities for rehiring.

The farm implement manufacturing industry had been the least affected of these four industries by wartime controls. Not until September, 1918, did the War Industries Board issue its first curtailment in the use of steel. This order came so close to the armistice that it had relatively little effect on the production of farm implements.

Naturally, these consuming industries were anxious to obtain lower steel prices. Reluctance on the part of producers to reduce prices were based largely on a desire to avoid the necessity of reducing wages. Neutral observers questioned the wisdom of immediate reduction in single industries, pointing out that it would be wiser to allow the readjustment to work itself out by law of supply and demand.

Leading newspapers pointed out that the reduction of prices in any single industry might work in an unexpected and unpleasant manner, since this would inevitably lead to a reduction in wages. Wage reductions in turn would be opposed, probably by strikes and stoppage of operation.

"Is it wise," said the *Washington Post*,

(*Please turn to Page* 148)

Utah Plant Seen Test for Industry Decentralization

Western states' postwar conference told area's future linked to new steel facilities. WPB policy attacked. Speaker holds Geneva can produce pig iron at low cost

SEN. PAT McCARRAN

"GUINEA PIG in the battle over decentralization of industry," was the way the government-owned steel plant at Geneva, Utah, was described at a western states conference to consider problems incident to postwar industrial development of the West held at Carson City, Nev., Feb. 11 and 12.

Delegates from the California, Utah, Nevada and Oregon Commissions on Interstate Co-operation attended.

That the West is intent on developing its steel industry which has been given a healthy upward shove by the expansion since the outbreak of the war was evident. Much of the discussion at the two-day conference concerned the future of the Geneva steel plant, which was erected for the government by the Columbia Steel Co., subsidiary of the United States Steel Corp., and now is being operated for the government by the Geneva Steel Co., newly formed subsidiary of the corporation.

That members of the War Production Board are trying to sabotage the decentralization of heavy industries to the disadvantage of the West was charged by Sen. Pat McCarran (Dem., Nev.) speaking at the closing session of the conference. The senator, who attended as an observer for congressional committees concerned with the decentralization of industry, told the conference that only pressure from the West and congressional action could "bring a change of policy in the WPB", declaring that federal officials had tried to take over hundreds of thousands of square miles of the public domain in the West through misuse of the National Public Monuments act in which President Roosevelt was guided by Secretary of the Interior Ickes.

Speaking on the Geneva steel plant, Chad Calhoun, vice president, Kaiser Co., asserted the United States Steel Corp. controlled the Geneva plant and that he was "apprehensive of the continued management" of it by the corporation's experts. He declared construction of the Geneva mills had bogged down some time ago whereas the Fontana, Calif., plant was speedily built under the management of the Kaiser interests.

With respect to the new steel properties in the West, Senator McCarran insisted that there was room for both the Fontana and Geneva plants but said that the WPB and the Defense Plant Corp., whose funds built the Geneva plant, had put in for men "whose hearts are in some other parts of the country." He further said that it was estimated that $20,000,000 in priority materials and machinery for the Geneva structural mill (work on which was stopped) were at the site but never had been unloaded.

Fairless Flatly Denies Charges

Benjamin F. Fairless, president, United States Steel Corp., in a telegram to the conference flatly denied the charges made at the meeting that the United States Steel Corp. had deliberately delayed construction and operation of the Geneva works. In his telegram Mr. Fairless not only denied the charges made on Feb. 11 by Mr. Calhoun but stated affirmatively the corporation had repeatedly urged higher priorities for the project.

Mr. Fairless' telegram was read shortly after Senator McCarran had voiced the opinion that the builders and operators of the Geneva plant, while among the ablest steel men in the world, were more interested in protecting the established steel industry than in promoting a western development. Mr. Fairless' telegram to the conference follows:

"A representative of the Kaiser Steel interests is reported to have stated that the Geneva project was deliberately delayed by U. S. Steel. This is absolutely without foundation. Construction of this plant has been controlled from the start by priorities and scheduling of the War Production Board and has been completed as expeditiously as government limitations would permit. I am forwarding to you copies of telegrams and correspondence with WPB and Defense Plant Corp. urging higher priorities and elimination of delays due to giving other projects priority over Geneva. In addition we have had representatives in Washington and at plants of manufacturers holding orders for Geneva equipment urging earlier deliveries. No such accusation has ever been made by WPB or DPC, the interested governmental agencies, who at all times have been fully advised of the construction progress of the plant. I ask that you make the telegrams and correspondence sent to you a part of the record of your hearing. Copies will also be sent to Senator McCarran."

Attorney General R. W. Kenny of California, who described the mill as a "guinea pig", said that WPB had stopped work, at least temporarily, on the structural steel unit of the plant, and the West was fearful that its postwar industrial development faces strangulation by eastern interests. He asserted that 2,000,000 newcomers into industry in western war plants will be forced into a deflationary period by the older sections of the United States if the West is asked to fold up its industries and find some other way of supporting itself in the postwar period.

Declaring that it would be unfortunate for the entire West if anything caused closing of the Geneva mill, Dr. J. H. Mahoney, director of the Bureau of Economics, University of Utah, told the conference that the Geneva plant can produce pig iron at a cost equal to that in Birmingham, Ala., and from $2 to $3 lower than Pittsburgh.

Discussing future possibilities for the continued operation of the plant, Dr. Mahoney said that the plant is the most modern of flat-roll continuous mills and can be converted to produce such items as tin plate for the canning industry of the western states, as well as tubular products including seamless tubing.

He said exploration and experimentation have disclosed additional raw material reserves, coking coal, iron ore and fluxes to be present in large quantities in

the western states to add to the reserves already in existence. The biggest problem, he added, is to bring together the coking coal and iron ore for successful operation, which can be done at Geneva.

The only chance for the western steel industry to develop will be through cooperation of all the western states, Dr. Mahoney declared, stating that it was his belief that the best plan for peacetime maturity of western industries would be in noncompetitive fields and that there will be no markets in the postwar period unless the Geneva and Fontana plants are converted. An adjustment in freight rates also would be necessary, he held.

Second Blast Furnace at Geneva Works Blown in

Another blast furnace will begin production of pig iron next week for the Defense Plant Corp.'s new steel plant at Geneva near Provo, Utah. This will be the second of three blast furnaces to be blown in at the Geneva Steel plant, which is being operated for the government by Geneva Steel Co., United States Steel Corp. subsidiary. The first blast furnace has been in operation since Jan. 3, 1944.

To obviate an anticipated shortage of scrap and pig iron in the Pacific Coast area, the government early in 1942 requested the Columbia Steel Co., subsidiary of the United States Steel Corp., to dismantle an idle blast furnace at Joliet, Ill., and re-erect it at Ironton, Utah. This blast furnace has been operated by Columbia Steel Co. since July, 1943.

Pig iron production from two blast furnaces at Geneva will be sufficient for a number of months ahead to supply the requirements of the steel producing facilities at Geneva. With this new source of supply from Geneva, and the iron supplied by other producers, the demands of the West Coast can be fulfilled at the present time. Thus, there being no need for its production, operations at the No. 2 blast furnace at Ironton will be suspended. This furnace, however, will be held in readiness for future operation in an emergency.

Grossman Discusses Effect Of Alloying Elements

Principal effects of alloying elements in steel were reviewed by Dr. M. A. Grossmann, Carnegie-Illinois Steel Corp., before the Detroit chapter, American Society for Metals, Feb. 14. He examined in some detail the relative effects of the various elements on such factors as hardenability, machinability, corrosion resistance, magnetic and electrical properties, etc.

Manganese appears to exert the greatest relative effect upon hardenability of any of the common alloying elements, although, unit for unit, boron is probably the most powerful additive yet used in steels as far as hardenability is concerned.

Economic Advantages Detailed

Information about natural resources and other economic factors of 11 far western states made available in newly compiled commercial encyclopedia

AFTER six years intensive effort investigating and collating information about natural resources and economic factors, the first comprehensive commercial encyclopedia of the eleven far western states has been assembled in printed form.

It includes 38 sections in some 2400 pages, the work of a large number of engineers, geologists, foresters, agricultural, fishery and other experts serving those states or members of the faculties of colleges and universities in those states.

The encyclopedia is sponsored by an organization known as the Industrial West Foundation, with offices in the National Press building, Washington; 111 Sutter street, San Francisco; and the Title Guarantee building, Reno, Nev.

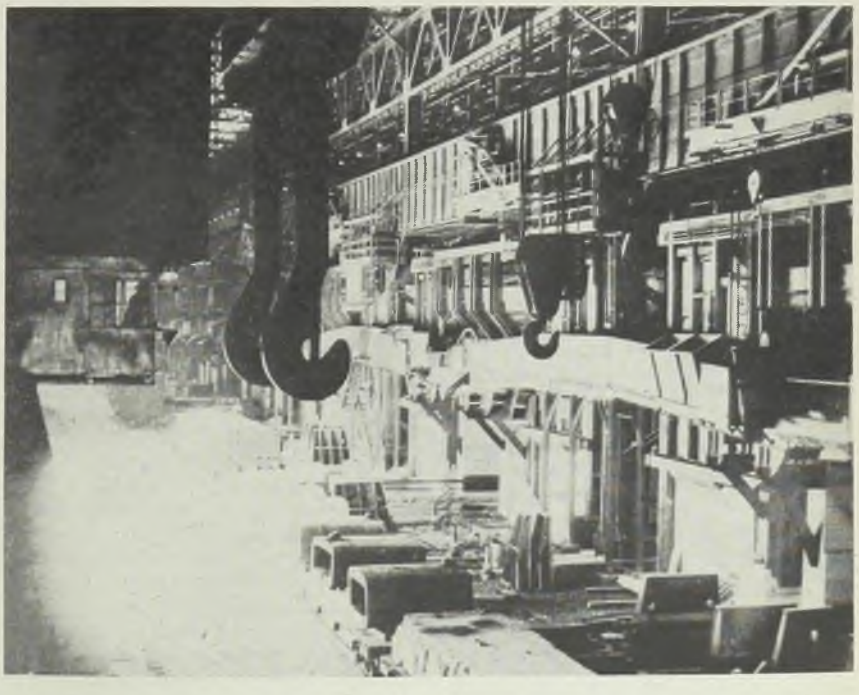
"Our eleven states have a population of some 14,000,000—about 10 or 11 per cent of the country's total," said Governor Sidney P. Osborn of Arizona, chairman of the Eleven Western States Governors Conference, in a Washington press conference, following a White House visit in which he presented the first copy of the new encyclopedia to the country's Chief Executive.

"We have land and resources that will support many more. We have every mineral known to man except tin. About 25 per cent of the entire area is potential oil or gas land.

"We are mining many different metals. We have coal. We have vast hydroelectric and irrigation capacity, both developed and potential. We have fisheries, forests and we raise important and diversified agricultural crops. We have a steel industry. We have the vast Pacific markets at our door.

The states covered by the encyclopedia are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming; in addition it covers Alaska, Hawaii and the Philippines.

"The encyclopedia is intended to serve as a source of factual information for those interested in studying the opportunities offered by the western states," according to George W. Malone, formerly Nevada state engineer, and managing director of Industrial West Foundation. "It will be kept up-to-date by monthly revisions and supplements."



The $180,000,000 government-owned Geneva Steel Works at Geneva, Utah, was the subject for much discussion at the recent postwar conference of western states at Carson City, Nev. Recent stopping of construction work on the plant's structural mill has caused western interests to view with alarm the postwar outlook for this plant. Above is shown one of the nine open-hearth furnaces at the works, which is being operated for the government by the Geneva Steel Co., subsidiary of U. S. Steel Corp. Acme photo

Production Pressure Unrelaxed, Steel Founders' Convention Told

War output record of the industry outstanding. Turns out 2,700,000 tons in 1943. Technical progress continues despite handicaps of plant facility and manpower shortages. Contract termination discussed

WHILE the steel foundry industry's war production job has been outstanding in expanding output of castings to more than 2,700,000 tons in 1943 and in developing improved products for war purposes, continued heavy demands of the armed forces and essential civilian needs permit no relaxation in the industry's efforts, it was indicated at the forty-second annual meeting of the Steel Founders' Society of America at the Edgewater Beach hotel, Chicago, recently.

Progress in technical development work, despite handicaps of plant facility and manpower shortages was reported by Charles W. Briggs, technical and research director of the society. Work was started on six projects proposed by the technical research committee. These include: 1—Determination of mechanical properties of the low-alloy NE steels as produced for castings. 2—Determination of critical dimensions of necked down risers. 3—Comparison of properties of core oils and binders, and the development of acceptance tests. 4—Determination of the relation of impact strength to hardness and ductility in cast steel. 5—Investigation of the value of low-temperature ceramic glazes as mold washes. 6—Preparation of "S" or time-temperature transformation curves for use in heat treatment of cast steel.

The technical session of the two-day meeting consisted of a symposium on "Water Quenching of Steel Castings," and included six papers. Lee C. Wilson, Reading Steel Casting Division of American Chain & Cable Co., Reading, Pa., was panel chairman.

Reports by various officers of the society were presented at the opening session at which Oliver E. Mount, American Steel Foundries, Chicago, and recently re-elected president of Steel Founders' Society of America, presided.

Chauncey Belknap, general counsel of the society, discussed the recent attempt of the War Labor Board to involve steel foundries in a consideration of a uniform procedure to be followed in settling wage contract negotiations of basic steel companies with the USA-CIO union.

Thornton Lewis, chief, Public Service Branch, Re-Adjustment division, Army Service Forces, Washington, spoke on "Termination of War Contracts" and explained that additional adjustments in the termination procedure are in prospect.

A forceful address entitled "Free Men on the March" was given by the Hon. Samuel B. Pettengill, general counsel, Transportation Association of America. One of the basic problems facing the nation, he stated, is to dispel the notion that government can create purchasing power.

Reports on the work of various committees of the Steel Founders' Society of America were presented by chairmen of the groups. These included: Clarence Tolan Jr., Dodge Steel Co., Philadelphia, for the Advertising Committee; A. H. Thomas, Buckeye Steel Castings Co., Columbus, O., for the Research Fund Committee, and Lee C. Wilson, Reading Steel Casting division, Reading, Pa., for the Technical and Operating Committee.

Representatives of government war agencies spoke on matters affecting the steel casting industry. Regulations and policies applicable to steel casting prices were discussed by Warren M. Huff, price executive, Iron and Steel Branch, OPA, and by Stephen Van R. Spitler, head, Castings Section, Iron and Steel Branch.

Changes in policies of the Selective Service System eventually will react to the benefit of industry from the standpoint of labor supply, according to H. S. Colby, consultant to deputy vice chairman for production, WPB.

General Cable Effects New Policy on Containers

General Cable Corp., New York, last week in a statement of trade policy announced that survey of the practices, conditions and procedures existent in the wire and cable industry over a period of years shows elimination of some of these policies will result in substantial benefits to all branches of the electrical industry, to all customers and the general public.

In line with its policy, the company plans to institute such changes as experience warrants. At present it feels it incumbent upon itself to assume "clearance of the decks" in respect to reels, spools and cases which are used for the shipment of products. Effective March 1, all General Cable Corp. containers will be shipped on a "no charge" basis and no payment or deposit will be required. The company requests that all of its returnable type containers be returned promptly, credit being allowed for all containers a customer has been billed as containers and which have been paid for provided they are returned in good condition on or before Feb. 28, 1945. After that date no credit will be allowed.

T. H. HARVEY

Feature of a luncheon meeting at the annual meeting of the Steel Founders' Society of America, in Chicago, was presentation of the Lorenz Medal to T. H. Harvey, vice president, Ohio Steel Foundry Co., Lima, O., and a past president of the society. Presentation of the medal was by Oliver E. Mount, president of the society. The Lorenz Medal, an annual award, is given in recognition of the most outstanding contribution to the advancement of the steel foundry industry during the past year.

Pittsburgh Coke & Iron Has 1943 Net of $750,390

Pittsburgh Coke & Iron Co., Pittsburgh, reports 1943 net income of $750,390, compared with $850,371 in the preceding year and $1,015,211 for 1941.

Continental Steel Reports Net Profit of $762,610

Net profit of Continental Steel Corp., Kokomo, Ind., totaled $762,610 in 1943, compared with $938,852 in the preceding year. Based on nine months and year end reports, the indicated net income for the fourth quarter amounted to $280,993, compared with $147,280 in the preceding quarter and $316,853 for the final 1942 period.

Acme Steel Has 1943 Net Profit of $1,999,667

Acme Steel Co., Chicago, reports 1943 net income of $1,999,667, equal to $6.09 a share on capital stock, compared with $1,709,625, or $5.21 a share, in the preceding year. December quarter profit was $583,894, against $458,202 in the like 1942 period and $483,902 in the September quarter last year.

Blast Furnace Group Discusses Preparation of Raw Materials

MEETING of the Eastern States Blast Furnace and Coke Oven Association, William Penn hotel, Pittsburgh, Feb. 11, was the largest in attendance ever held by the group with over 300 present.

At the joint morning session of blast furnace and coke oven operators, T. M. Hart, Kaiser Co. Inc., Fontana, Calif., discussing raw materials preparation, stated that western coals do not weather without serious depreciation from oxidation after 30 days and consequently stockpiles are held below 20,000 tons. Bunker oil is added to the coking coals at the rate of 1½ pints per ton with no increase in density. Coal is coked at an oven temperature of 2100 degrees Fahr. but he explained that 2150 degrees never was exceeded because of oven wall failure at this temperature. Slow coking speed is used as is obvious by current practice of 18 hours gross.

Ore mined by open-pit methods on 50-foot benches at Kelso, Calif., is hauled 174 miles to the plant at Fontana; about 2500 tons are mined daily.

For December, the coke practice at the blast furnace was 1865 pounds per ton of iron; the ratio is lower during certain periods, Mr. Hart stated. Ingots are bottom cast to assure high-quality steel for the plate mill which rolled 31,600 tons during January with four down turns and 20 hours accumulated delays.

B. W. Norton, Republic Steel Corp., Birmingham, Ala., in discussing raw materials preparation in the South presented a wealth of material on southern blast furnace practice. He pointed out that the ash content of coal runs as high as 9 per cent and that some companies are obliged to mine 2 tons to obtain 1 ton. In fact, at one mine the ash in the coal before washing is 19 per cent and after washing 8½ per cent. One of the most serious conditions with which southern operators are faced is the increasing larger amount of 'middle man' or rock being taken out with the coal at practically all southern mines.

Mr. Norton drew attention to the fact that while southern ores have an iron content of about 35 per cent they are equivalent to northern ores of 45 per cent iron because of their lime content. Another point of difference between southern and northern blast furnace practice is the pressure of the blast carried at southern stacks. Normal working pressures range from 27 to 29 pounds per square inch and as high as 34 to 35 pounds. Furnaces are checked regularly because of the high slag volume carried and the hard ores in the burden. Slag volumes of 2200 pounds per ton of iron are not unusua Coke per ton of iron is 2000 to 2500 pounds on basic and up to 3000 pounds on foundry grades of iron.

J. S. Ferguson, general superintendent, American Rolling Mill Co., Hamilton, O.,

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Present, Past and Pending

GAS SHORTAGE CLOSES 150 OHIO FACTORIES

CLEVELAND—One hundred and fifty Ohio factories were made idle last week when low temperatures and increased home consumption caused an acute gas shortage.

WAR EXPENDITURES INCREASE 6.7 PER CENT IN JANUARY

WASHINGTON—United States war expenditures increased $465 million, or 6.7 per cent, in January to a total of $7,416 million, compared with $6,951 million in December. They totaled $7,794 million in November and $7,105 million in October, 1943.

ENGLAND TO CLOSE MAGNESIUM PLANT

LONDON—England will close one of its magnesium plants, costing $3,500,000, because production in the United States and Great Britain is exceeding requirements.

STRIKE AGAINST WALKING 25 FEET

DETROIT—Thirty employes of the Chrysler tank arsenal went on a sitdown strike in protest against the corporation's method of distributing coveralls. The men demanded their coveralls be delivered at the bins where they pick up their tools rather than at a central distribution booth 25 feet away.

LABOR HIRING CONTROLS TO BE INSTITUTED

PITTSBURGH—War Manpower Commission is establishing "labor-budget" plans designed to curb the drain on the labor pool by nonessential employers. Labor hiring controls will be instituted in this area this month, with employers being grouped into three categories based on their importance to the war effort.

TIN CAN DETINNING PLANT IN OPERATION

BIRMINGHAM, ALA.—Operations have been started at the detinning plant of the Southern Detinning Co., built by Defense Plant Corp. Plant has capacity of 20,000 long tons annually.

GRANTED HAITIAN BAUXITE MINING CONCESSION

RICHMOND, VA.—Reynolds Mining Corp., subsidiary of Reynolds Metals Co., has been granted a 60-year concession by the government of Haiti to mine a large deposit of bauxite. Deposit is only three miles from the sea.

MOTOR REVOLVES 2000 TIMES A SECOND

SCHENECTADY, N. Y.—An electric motor, which operates at a speed of 120,000 revolution per minute, 65 times faster than the conventional motor used in home appliances, has been developed by General Electric Co.

SYNTHETIC GAS PILOT PLANTS APPROVED

WASHINGTON—The House has passed the Randolph bill providing for pilot plant production of synthetic gasoline by the Bureau of Mines to determine costs for commercial manufacture. Bill provides $30,000,000 for the experimental program.

STEEL WAREHOUSE PROBLEMS DISCUSSED

WASHINGTON—Possible relaxing of WPB warehouse orders and relief from ODT order on full carloads of steel were discussed here last week at a meeting of the Warehouse Advisory [illegible] WPB Steel Branch

MEETINGS CALENDAR

American Institute of Mining and Metallurgical Engineers: Annual meeting at the Waldorf-Astoria hotel, New York, Feb. 20-24.

American Hot Dip Galvanizers Association Inc.: Annual meeting, Blackstone hotel, Chicago, Feb. 24-25.

American Society for Testing Materials: Spring meeting and committee week, Netherland Plaza hotel, Cincinnati, Feb. 28 to March 3.

Great Lakes Regional Advisory Board: Twenty-first annual and fifty-eighth regular meeting, Commodore Perry hotel, Toledo, O., March 22.

American Society of Tool Engineers: Annual meeting at the Bellevue Stratford hotel, Philadelphia, March 26-28.

American Gas Association: War conference on industrial and commercial gas, Hotel Seneca, Rochester, N. Y., March 30-31.

American Ceramic Society Inc.: Annual meeting in Pittsburgh, April 2-5.

Electrochemical Society Inc.: Spring convention at the Pfister hotel, Milwaukee, April 12-15.

American Institute of Mining & Metallurgical Engineers: Twenty-seventh annual conference of the Open-Hearth Steel committee and Blast Furnace and Raw Materials committee, Iron and Steel Division, A.I.M.E., William Penn hotel, Pittsburgh, April 20-21.

American Foundrymen's Association: Third war production foundry congress at Buffalo, April 25-28.

American Iron and Steel Institute: Fifty-third general meeting, Waldorf-Astoria hotel, New York, May 25.

WINDOWS of WASHINGTON

Would Curb Army Dams

A BILL to prevent the Army from undertaking flood control projects without the consent and co-operation of the states involved has been introduced in the House by Rep. Charles A. Plumley (Rep., Vt.) as a result of Vermonters' protests against proposed construction of a dam at West Dummerston. Representative Plumley said his bill is aimed not merely at the local situation, but constitutes a step to recapture for the states "those rights which, in what they were induced to believe was an emergency, they sacrificed on the altar of bureaucrats, Fascists and New Dealers."

Equipment Not Available

Production of prewar type of all-metal domestic ice refrigerators will not be resumed in the near future, the WPB said recently. To meet wartime demands, it was necessary to enlist the facilities of 23 manufacturers in addition to some 10 manufacturers then established in the industry. Since the facilities of these new manufacturers were especially designed for woodworking, they were readily adaptable for production of the war model refrigerators, which consist almost entirely of hardboard and wood. It would be impossible for some of these 23 manufacturers to convert for the production of metal refrigerators without installing completely different equipment, suitable for steelworking.

New Malleable Patent

Method of producing malleable cast iron is covered in a patent assigned to the Crane Co., Chicago, according to the Official Gazette of the United States Patent Office.

The process involves casting a mixture containing 1.5 to 3.5 per cent carbon, 0.5 to 2.5 per cent silicon and not less than 94 per cent pure iron in the presence of a small amount of lead up to 1 per cent of the mixture. The lead is sufficient to obstruct the formation of carbon in flake form during solidification and thereby produces a white cast iron which is annealed under conditions that will cause separation of at least a portion of the carbon as temper carbon, it is said.

The malleable cast iron patent No. 2,340,854 was jointly received by Nicholas A. Ziegler of Chicago and Homer Northrup of Chattanooga, Tenn.

Hold Termination Classes

The first of a series of contract termination conferences in the Philadelphia Ordnance district between officials and ordnance contractors will be held in the armory in Allentown, Pa., Friday evening, Feb. 25. The program is designed to give contractors, bankers and accountants a general picture of termination procedure. Attendance at this meeting will be restricted to executives.

A few days later a meeting will be held for accountants, inventory checkers and others. Such meetings will also be held in York, Pa., Wilkes-Barre, Pa., Philadelphia, Richmond, Va., and Baltimore. The first meeting in Baltimore is scheduled for March 16, with dates for the remaining cities yet to be announced. Meanwhile, in Philadelphia, meetings are being held two evenings a week at the ordnance headquarters, 150 South Broad street.

SMALL BUSINESS FIRST

Small business must be given the first opportunity to reconvert to peacetime production in the postwar period, Donald M. Nelson, chairman, War Production Board, told regional directors of the Smaller War Plants Corp. at a recent meeting. Small business should be given top priority, he added, when surplus materials over and above the stockpile needed for war are released.

Asserting that small business is more important to this nation today than ever before in the country's history, he said that, in his opinion, "small business does not want, or need, a WPA organization. All that small businessmen want is an opportunity to use their own initiative and ingenuity."

Maury Maverick, director of the SWPC, promised that his agency would be conducted as a strictly nonpolitical organization. "We are not going to sell out to anyone," he said. "We are carrying out a vital program which must transcend all political lines."

New Loan Policy

To render greater financial assistance to small plants, the Smaller War Plants Corp. has amended its loan policy, increasing from $100,000 to $250,000 the amount that banks are permitted to carry under a deferred participation where the bank takes a direct participation in the loan of 10 per cent or more. Interest up to 6 per cent annually is allowed on that part of the loan which the bank carries at its own risk and on the balance, which is carried under a deferred participation, interest of 4 per cent is charged with the bank paying to SWPC a graduated fee of from one-half per cent to 1 per cent annually, depending on the percentage of the bank's participation. The new policy, says Maury Maverick, chairman, enables the small plant to deal with the local bank which, in turn, "will be able to service its customers on loans which otherwise may have been beyond its legal limits."

Caution Warranted

In connection with proposed reduction in Rhodesian copper production as a means of freeing part of the limited rail facilities in Rhodesia for the transportation of vitally needed coal and metallurgical chrome, members of the Combined Raw Materials Board said that "although the copper position has improved in recent months, the uncertainties of future production and military requirements are such that the United Nations should proceed cautiously with any program to reduce output or relax consumption."

Alien Property

The United States has seized more than $375 million worth of alien controlled property and 30,000 patents which have been made available to American industry, according to Leo T. Crowley, alien property custodian. Mr. Crowley reported to Congress he had seized 318 business enterprises of which more than 200 were in process of liquidation and another 100 were placed under American management.

Integrate Planning

The Economic Development Committee of Louisiana is busily at work on an attempt to integrate all planning, both public and private, with the objective of providing 300,000 new jobs in the immediate postwar era. This is twice as many as the carefully estimated postwar unemployment of the state when war jobs are ended. The objective is to expand industrial activities all over the state. Among numerous other features, the plan calls for construction of roads to make it profitable to work undeveloped mineral lands.

Helpful Survey

The Tennessee State Planning Commission has just completed an exhaustive county-by-county compilation of resources, and a preliminary analysis of industrial opportunities. It also has compiled a directory of the products of the state and the location of manufacturing plants. Other surveys aimed at assisting postwar developments are under way. The commission is working on plans for highway and other public improvements. It has organized a staff to furnish planning leadership and assistance to the counties and municipalities throughout Tennessee.

Not Much Chance

Members of the newly appointed WPB General Metal Office Furniture Industry Advisory committee are agreed production of metal desks, chairs, and file and storage cabinets for civilian use cannot be resumed until the industry is less heavily engaged in war work and continuing supply of steel is assured.

How can machine tools avenge this

Dunkerque in Arkansas?

This is no enemy propaganda. No "usually well-informed sources" or Berlin broadcasts tell this tale. This is real . . . this is here . . . and this is defeat.

Our own private *peacetime* Dunkerque — in Arkansas, in New York, in West Virginia or California — in countless American "homes" where millions of people are ill-housed, ill-clothed, and bodily and mentally ill-fed.

What part will machine tools play in turning this kind of defeat into victory? The *whole* part, if the men of industry have the vision and the freedom to plan ahead, and to carry out what they plan.

If you are a manufacturer, there is one thing you can do at once: Have your production men and planners consult now with the engineers of the leading basic machine tool producers. They can help you in planning today your part in the peace that must be won after the war is won.

One of these is a Bryant man. . . . We invite you to send for him.

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

New, Faster Units Held Primary Need

Gains made in centrifugal casting techniques, powder metallurgy, plastics and molding methods may have severe impact on postwar machining methods

Will the government retain on a "stand-by" basis machine tools such as this big lathe, shown operating on a large caliber gun at Washington navy yard? Or will this kind of equipment be released to private industry after the war, and if so, on what basis? These are a few of the "$2.7 billion questions", which now are being pondered by the government and industry as a vital phase of postwar planning. Official government photograph by Palmer.

STABILITY of the machine tool industry in the future will depend in large measure on its ability to develop new machines which will make many existing tools obsolete, in the opinion of many trade authorities.

To offset the huge accumulation of government-owned tools—now valued at $2.7 billion—built up during the war, and to meet the inroads of the rapid development of new plastic and molding techniques, centrifugal casting of steel and nonferrous metals, and powder metallurgy, the industry must develop super-speed tools for the machining of light metals and for meeting closer tolerances on materials of all kinds, it is maintained.

Various authorities advocate an active promotion program, perhaps under the auspices of the National Machine Tool Builders' Association, to induce manufacturers to replace older machines as rapidly as more efficient tools are developed; aggressive development of the export field; and intelligent handling by the government of the estimated 500,000 tools which it owns.

The fact must be faced that to meet war requirements the machine tool industry expansion has been more than six times that of World War I.

Recall what happened at the close of the last war?

In the period 1914-19, the industry had built such a surplus of machine tools that after the war one-third of the tool builders were forced out of business; some went bankrupt, others sold out their assets, and some merged with other companies.

At the beginning of 1920 more than half the machines then installed had been produced after 1915 and were in excellent condition. The great expansion in output of goods of all kinds was made possible by putting this great pool of machine tools to work on peacetime goods.

In spite of the revolutionary changes in design that trebled the productivity of machine tools, the number of new machines installed from 1921 through the early '30s was only a small fraction of the total number of tools in use. The steadily rising trend in the national income from 1921 to 1929 was the result of an expansion of industry made possible by the large pool of machine tools carried over from the war plus a relatively small number of new and more productive tools produced in the decade ended in 1929.

The production of new machines was not sufficient to keep pace with the obsolescence of existing equipment throughout the '20s yet the excess volume of machine tools made in the first world war was sufficient to produce a rising national income. It is estimated that the depreciated value of existing machine tools in 1949, if output of new tools were to cease completely now, would nearly equal that of 1941; and this would be sufficient to support a peacetime national income of more than $150 billion—an unprecedented amount.

Value in 1943, $4 Billion

Taking only machine tools up to 13 years old as a basis for determining the supply of efficient machines remaining after the present war, the tool industry states that the value of these machines at the close of 1943 totaled $4 billion, of which three-fourths were built in the last three years. In 1929, the previous all-time peak in the volume of machines in use, only one-quarter of the tools in use were three years old or less.

Industry officials reason that insofar as present production has displaced the output of new machine tools for many years to come, the expenses incident t the continued existence of the industr such as development engineering, d preciation and other overhead cost must be provided out of income fro present production.

A substantial portion of the estimate 500,000 government-owned tools in w plants could, it is believed, be absorbe by a combination of the following ste outlined by Tel Berna, general manage National Machine Tool Builders' Ass ciation:

1. Have the government secure early decision from contractors regardin the machines which they have optio to buy.

2. Earmark those machines the go ernment wishes to retain for variou services.

3. Have machines for trade schoo promptly set aside.

4. Have machines for export prompt segregated.

5. Have as many as possible of the re maining machines sold to the companie who built them. However, it is real ized that the redistribution of the bul of these government-owned machine of necessity must be left up to the pres ent users, and to that end should b promptly revalued, even at a heav "markdown", so that decisions ca speedily be made respecting them.

Private industry will undoubtedly hav many replacements to make in connec tion with the retooling program whic may get under way before the com plete cessation of hostilities. But eve

if this demand arising from the retooling program should be so great as to use up most of the surplus tools, the long term outlook for the machine tool industry still will remain grim.

Plants which are soundly equipped will naturally do less buying for a number of years. However, few concerns appreciate the character of depreciation reserves, and there is still a lack of long term planning in the purchasing of capital equipment for manufacturing operations. The tendency is to put off buying new machinery until the old is about ready to fall apart. All of which indicates the reluctance of manufacturers, under normal conditions, to recognize the real contributions which technically up-to-date equipment can make to profits.

Another uncertainty the machine tool industry faces in the postwar period is the impact of new developments upon its business. Some observers believe powder metallurgy, rapid development of new plastics and molding techniques, and the centrifugal casting of steel and nonferrous alloys to close limits of accuracy may to some extent displace machining operations.

Little Known About New Developments

Not too much is known of the developments now being made in plastic molding techniques, or of the nature and physical properties of the plastics themselves. Some feel, however, that their application to many parts formerly made of metal may displace millions of tool hours.

In the production of units of large size, it appears unlikely that machining practice will be displaced by new techniques in the foreseeable future. It is probable, however, that there will be a change of emphasis in many manufacturing fields. Along this line it is probable, for example, that there will be a broad development in super-speed machines for machining of lighter metals, also in machines for meeting closer tolerances on materials of all kinds.

Grinding machines and other tools built to perform precision work will represent an increasing proportion of total machine tool output. There is expected to be a widespread adoption of more exacting surface finishes and consequent activity in the field of those machines which contribute to them. One observer thinks that screw threads and gear teeth will be ground to an increasing extent, even when the parts are components of relatively commonplace products; and it may be less exacting parts will be made more and more by the casting and molding processes, leaving only the finishing operations to machine tools.

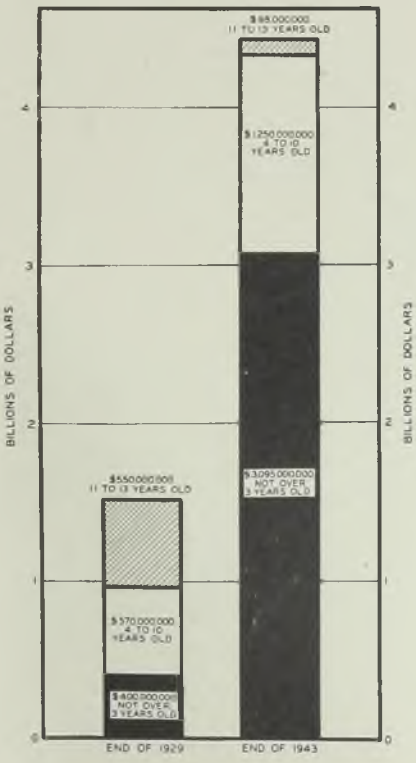
The problem of postwar export markets deserves some special attention, F. S. Blackall Jr., president and treasurer, Taft-Peirce Mfg. Co., Woonsocket, R. I., believes. He says that by no means can we take it for granted that our machine tool surplus can be dumped into the European market, for our allies, and perhaps even our enemies, will be factors in the postwar economy and will have something to say about this. England, for example, shop for shop, is just as well tooled up as we are and has expanded its machine tool industry percentagewise nearly as much. Furthermore, English machine tool designers have done an outstanding job. The export minded Briton will no longer be satisfied to consider his products second rate in comparison with those of American machine tool builders. American machine tool designers and builders must not be complacent, but must face the new competition realistically. The export market will be far more competitive than it has in times past; nor can we disregard our present enemies altogether in this particular, Mr. Blackall states.

Despite the knotty postwar problems which face the machine tool industry the outlook is not without promise. At no time in history has there been such a concerted determination on the part of employers to put into action measures designed to counteract future sharp swings in the business cycle, or at least to cushion their effect to some extent.

New markets in other parts of the world may be opened up by the prospective industrial awakening of such areas as China and South America, the reconstruction of bombed and war-torn nations, such as industrial Russia, Germany and occupied countries, and the probability of increased development of India.

The moratorium on the manufacture of consumer goods in this country and abroad has built up a tremendous potential demand, which is expected to make itself felt for a substantial period in the postwar era.

VOLUME OF MACHINE TOOLS IN USE AT END OF 1943
NOT OVER 13 YEARS OLD



Competition will be keen after the war with wage levels high. These factors will necessitate more efficient industrial installations than ever have existed in the past. One observer thinks it unlikely that manufacturers will be able to survive with 40 per cent of their machine tool equipment of ancient vintage. A high rate of industrial activity is always coupled with an active demand for more efficient machine tools. It is quite possible that the government surplus machine pool will be assimilated, and that new product developments, new industries, and replacements of outworn equipment may insure the tool industry a protracted period of sound business, this observer thinks. Therefore, contrary to widespread belief, future prosperity of machine tool builders may not—after all—hinge on their ability to swing into lines other than machine tools.

Cites Responsibilities of Postwar Private Enterprise

It is the responsibility of private enterprise to take the initiative in endeavoring to produce conditions which will provide all those who are able and willing to work with adequate employment and with an ever-increasing production of goods for their consumption and use at lower prices, H. C. Welsford, vice president, Dominion Engineering Works Ltd., Montreal, Canada, declared recently.

He said that consumer expenditure alone cannot provide full employment and that capital expenditures are necessary to maintain or increase production in the postwar period. Production can be expanded and total employment increased by replacing obsolete equipment, and this production must be expanded from the earnings of industry. He pointed out that the government must help industry to save for expanded production after hostilities cease.

Mr. Welsford urged that house building and home ownership be encouraged. Government expenditures are not considered by him as a good substitute for individual initiative and enterprise. Timing of expenditures will be important in the postwar period.

International trade directly affects employment, Mr. Welsford contends. Basis of prosperity is production and prosperity for all but if the government continues to tax surplus earnings to the point where no funds are left to provide for depreciation and obsolescence, then expanded production cannot be expected when peace arrives, he said.

He sees private enterprise as the foundation of vast employment and declares that management and labor must agree on wage and price policies in order to maintain a high level of peacetime employment.

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

ALLOTMENTS: Manufacturers of one product, part of the output of which consists of class B products and the rest of which are unclassified products, now may file a single Controlled Materials Plan 4B application to cover the entire production of the item, under a simplified procedure outlined in direction 1 to priorities regulation No. 11B. If the manufacturer elects to file the single CMP-4B application for his entire production, he must explain in a letter accompanying it that the products covered include both class B and unclassified products. Preference ratings assigned to production schedules as a result of CMP-4B applications may be used in ordering production materials for products covered by the application. Allotment number identifying the class B product schedule must be used to identify the ratings when applied to orders for production materials, regardless of whether the orders are for materials with which to make the class B products or the unclassified products.

ELECTRICAL DEVICES: Distributors' purchase orders for electrical wiring devices and electric fuses that bear preference ratings assigned on WPB-547 (formerly PD-1X) must be filed after Feb. 12 by manufacturers as though they were rated AA-2X. However, they may not be scheduled for delivery ahead of other purchase orders with AA-2X or better ratings placed before Dec. 30, 1943. This action was taken by direction 1 to orders L-161 and L-277.

HOUSING: Rules issued under CMP regulation No. 6 which previously governed housing construction no longer apply inasmuch as limited preference order P-55-c now governs.

L ORDERS

PLUMBING FIXTURES: Any copper-base alloy used in production of bodies for radiator supply valves shall be made without the use of any primary copper or tin and shall be of no higher grade than a maximum of 86 per cent copper and 6 per cent tin. No packless radiator supply valve may be produced with metallic bellows or diaphragms but such valves may be made in any type or pattern; and there are no restrictions as to size.

Former restrictions as to sizes, designs, patterns and types of low pressure thermostatic radiator and drip traps, combination float and thermostatic traps and boiler return traps have been removed, except that bodies of these items are still required to be made of cast iron.

Restrictions still in force under the revised schedule VIII of order L-42 do not apply to the production of articles or parts not available in the producer's inventory for use in ships, boats, or planes when required by the Army, Navy, Maritime Commission, War Shipping Administration, or Coast Guard, or for use in chemical plants, research laboratories and hospitals. (L-42)

AUTOMOTIVE PARTS: WPB has revoked order L-106 which had prohibited the use of copper and copper-base alloys in the production for civilian use of automobile radiators, gaskets, fuel and oil lines, brake and clutch lining rivets, and other essential parts. This action does not permit the manufacture of any products with copper other than those specifically enumerated in order L-158 which remains in force. Use of these metals is prohibited also under terms of M-9-c whenever substitution of a more plentiful material is practicable. (L-106)

COMMERCIAL SCALES: Permission to produce commercial scales for use in retail trade at a rate not to exceed 40 per cent of 1941 production has been granted. Production of these scales was banned previously. Each manufacturer may produce commercial scales at a rate not to exceed two-fifths of the total dollar value of commercial scales billed to customers during 1941. (L-190)

CONVEYING MACHINERY: Producers of conveying machinery and mechanical power transmission equipment now are permitted to use alloy steel or iron in chains and sprockets or conveyors and elevators. (L-193)

RAILROAD GAGES: Standardization and simplification of gages which are specially designed and manufactured for use on locomotives and railway rolling stock have been provided. (L-272)

FOOD PROCESSING MACHINERY: Percentages have been established covering the gross tonnages of controlled materials which manufacturers may use in the production of meat canning, processing and packing machinery and equipment; quota percentages have been set covering the production of flour, grain, and feed milling and processing machinery and equipment. Both schedules are based upon the average annual tonnage of controlled materials used by these manufacturers during the calendar years of 1939, 1940 and 1941. Production period covered by the schedule runs from Oct. 1, 1943, to Sept. 30, 1944.

For the production of meat processing machinery and equipment, manufacturers may use up to 125 per cent of the average annual tonnages of controlled materials they used during their base period. Flour and milling machinery manufacturers may produce equipment under the following quota percentages: General reduction, 100 per cent; grinders, 140 per cent; mixing and feeding machines, 90 per cent; sifting and screening, 110 per cent; cleaning and grading, 100 per cent; general conditioning equipment, 90 per cent; filter and press, 90 per cent; and all other types of machinery and equipment, 85 per cent. (L-292)

SCREEN CLOTH: Preference ratings of AA-3 or less on civilian purchase orders for steel insect screen cloth are to be disregarded by producers who are required to supply civilian needs without regard to the customer's size, location, or affiliated outlets. (L-303)

MOTORCYCLES: Motorcycle producers have been authorized to make 1400 units for domestic use, 80 for Canada, and 650 for export, all to be distributed to public and private protection or police agencies and for essential civilian use. In addition, they have contracts to deliver some 50,000 units for military requirements during 1944. (L-331)

INDEX OF ORDER REVISIONS

M ORDERS

NICKEL: Nickel anodes, nickel salts and plating solutions in platers' inventories, which have been frozen since Jan. 20, 1942, have been made available for all uses permitted by existing regulations of the use of nickel.

Stocks acquired in the future or prior to March 30, 1942, may be used for any purpose, if no nickel anodes (scrap or other) are used in the plating process; and no additional nickel salts are added. If nickel anodes are used or salts are added to the solution, the solution may be used in any manner not forbidden by M-6-b or any other restriction that may be placed on their use at time of allocation. M-6-b provides that none of its restrictions apply to nickel going into "implements of war" which are produced for government war agencies.

Use of nickel in the following items and in all component parts thereof is prohibited, except to extent permitted by M-6-b, or as specified in this list: Transportation equipment (except where necessary for operational purposes); building supplies, hardware, and ornamental metal work; plumbing, heating and air conditioning supplies, and domestic and institutional appliances and equipment (excluding valve seats, pressure, thermostatic and vacuum controls and safety devices, and further excluding domestic and commercial electrical appliances and domestic ranges and parts therefor, to the extent of resistance material allocated on form PD-556 from reserves held under the provisions of order L-65); clothing accessories; furnishings and furniture; commercial and industrial appliances and equipment (except where necessary for operational purposes); jewelry, toilet articles, accessories, souvenirs, novelties, games, toys, art objects, and musical instruments; platings, containers of all types, fire-fighting apparatus and equipment, and lighting equipment (except where necessary for operational purposes); branding, marking and labeling devices; nonoperating or decorative uses or parts of installations and mechanical equipment, including frames, bases, standards and supports; photographic and art equipment and supplies; sporting goods and pleasure boat fittings and hardware; saddlery and harness hardware and fittings. (M-6-b)

NICKEL SCRAP: Generators of nickel scrap and secondary nickel have been relieved of the necessity of filing report forms. Revocation of order M-6-c does not relax control on or segregation of nickel bearing ferrous scrap which still is covered by order M-24-c; or the use of nickel, including scrap and secondary nickel, which still is covered by order M-6-b. (M-6-c)

ANTIFRICTION BEARINGS: Users of antifriction bearings may not accept deliveries in excess of specified amounts during any one month of the second and third calendar quarters of 1944 without specific approval. These limits are: 1500 bearings of any one size where they are being purchased for incorporation in an endproduct or for reshipment with the endproduct as concurrent spare bearings; 500 bearings of any one size where they are being purchased for reshipment to the Army, Navy, Maritime Commission, or the War Shipping Administration subsequent to delivery of the endproduct.

These restrictions on acceptance of bearings apply on a plant basis. Approval to purchase antifriction bearings may be obtained by filing form WPB-3333 before March 1, indicating bearing requirements for the two succeeding calendar quarters. (M-293)

CHEMICALS: A uniform, general allocations order covering chemicals has been issued. A special feature of the order is the appendix which provides a ready-reference summary of requirements for each allocated material. (M-300)

TUNGSTEN AND MOLYBDENUM: Each person seeking to acquire tungsten, molybde-

num or their alloys must make written application to WPB not later than the "first day of the second month preceding the month in which delivery is desired." (M-369)

TRICHLORETHYLENE: Allocations have been established for all trichlorethylene (used in degreasing metals) producers and distributors, except distributors who sell only in quantities of a 52-gallon drum (700 pounds) or less per customer per month. Customers are required to file certified statements of end use with purchase orders when ordering 700 pounds or more for delivery by all suppliers in any month. After March 1, no supplier will be permitted to make deliveries except to persons specifically authorized in writing by WPB. (M-371)

P ORDERS

HOUSING: Under a simplified procedure, holders of approved residential housing applications are given blanket authority to construct.

Order P-55-c provides that approved applications constitute authority to begin construction, and approvals carry an allotment symbol for controlled materials. It assigns a preference rating of AA-3 for all other materials and products permitted by schedulel (war housing critical list) which imposes material limitations. Schedule II (war housing construction standards) impose limitations on building sizes as well as other restrictions.

Applications for authority to construct and for materials with which to carry on housing construction will continue to be filed on WPB-2896. Controlled materials will be obtainable through the use of allotment symbols H-1 and S-2.

The approving agency is authorized to cancel priorities on any project not begun within 60 days after approval of the application. The order makes possible the cancellation of any part of a project which has not been started by the date authorized in the application.

The order removes the general restriction in structural steel framing and the use of reinforcing steel for concrete and masonry. It also permits the use of metal gutters and down-spouts for all types of dwellings. Permission is granted for additional electrical outlets; for the use of hot water and steam heating systems for less than four dwelling units; use of warm air furnaces in smaller dwellings; use of sheet metal ducts within six feet of furnaces; use of zinc or steel weather stripping. (P-55-c)

PRIORITIES: Rules governing replacement of defective material or material which has been lost, stolen, destroyed or damaged in transit when rated orders where placed for it have been established in priorities regulation No. 3. A supplier must schedule replacement delivery of material on basis of original date of the order as follows: If, in the case of defective material, he is notified within 15 days after the material was delivered, by the person who placed the rated order; if, in the case of material lost, stolen, or destroyed in transit, he is notified by the person who placed the rated order within 45 days of the date the material was shipped. If the notice is received after the 15 or 45-day periods, the supplier must schedule the replacement delivery as if he received a separate order on the date the material was shipped.

PRICE REGULATIONS

IRON AND STEEL SCRAP: Specific dollars-and-cents differentials, which may be applied to the maximum price for No. 1 railroad heavy melting steel scrap by railroads, car manufacturing companies and switching companies to determine their ceilings for 35 listed grades of railroad steel scrap, have been established. Specific maximum prices for seven listed grades of cast iron scrap by railroads also have been established. Dealer's fee for preparing heavy breakable cast iron scrap into foundry sizes has been increased to $3.50 from $2.50 per gross ton. See page 148 for additional details. (No. 4)

Second Quarter Requests for Carbon Steel Cut One Million Tons

Military claimants to receive slightly less than stated needs but allotment will cover actual production and construction planned for the period. . . Civilian claimant agency to get larger allotment but 7 per cent under amount requested

ALLOTMENT of carbon steel will fall short about one million tons of the amount requested by military and civilian claimant agencies for the second quarter. Military claimants will receive slightly less than their stated requirements while the civilian claimant agency will receive around 7 per cent less than the amount requested.

The quantities allotted are believed sufficient, however, for all military production and construction now planned for that period. Supply of and demand for basic metals are virtually in balance for all essential programs, J. A. Krug, chairman of the War Production Board's Requirements committee, said last week, following action on allotments of steel, copper and aluminum for the second period.

"In making second quarter allotments, we had to scale down the stated carbon steel requirements of the fourteen military and civilian claimant agencies by approximately 1,000,000 tons," Mr. Krug said. "The military claimants—Army, Navy and Maritime Commission—received slightly less than their stated requirements, but in the judgment of the committee the quantities allotted are sufficient for all military production and construction now planned for the second quarter. It was necessary to reduce the requests of the various civilian agencies by slightly more than 7 per cent. The allocations of copper and aluminum to the respective agencies were balanced off with allotments of carbon steel."

Mr. Krug said that the Office of Civilian Requirements had been allotted 210,000 tons of steel for the second quarter, as against 155,000 for the first three months of the year. He emphasized, however, that this increased allotment does not reflect any change in WPB's policy of restricting the production of civilian goods to the basic essentials, pending clarification of military trends and requirements in Europe. The increased allocation for the second quarter will go for the production of those civilian items already authorized by the board as essential to workers on the home front. The 1944 civilian truck production program, for instance, has been increased four-fold and has been given priority ratings equal to aircraft.

While the supply of steel, copper and aluminum is adequate to meet all authorized programs, Mr. Krug cautioned that other materials needed in the war effort and for civilian use are becoming even more critical because of the increased seriousness of the labor situation.

Lack of an adequate labor supply is still delaying some military production schedules. With sufficient metals available for the necessary programs, the WPB is intensifying its efforts to achieve the necessary military production, despite the short labor supply.

The action of the Requirements committee with respect to civilian programs for the second quarter definitely postpones consideration of any further resumption of civilian production until the last half of the year.

Stainless Steel Producers Must File WPB-2933 Monthly

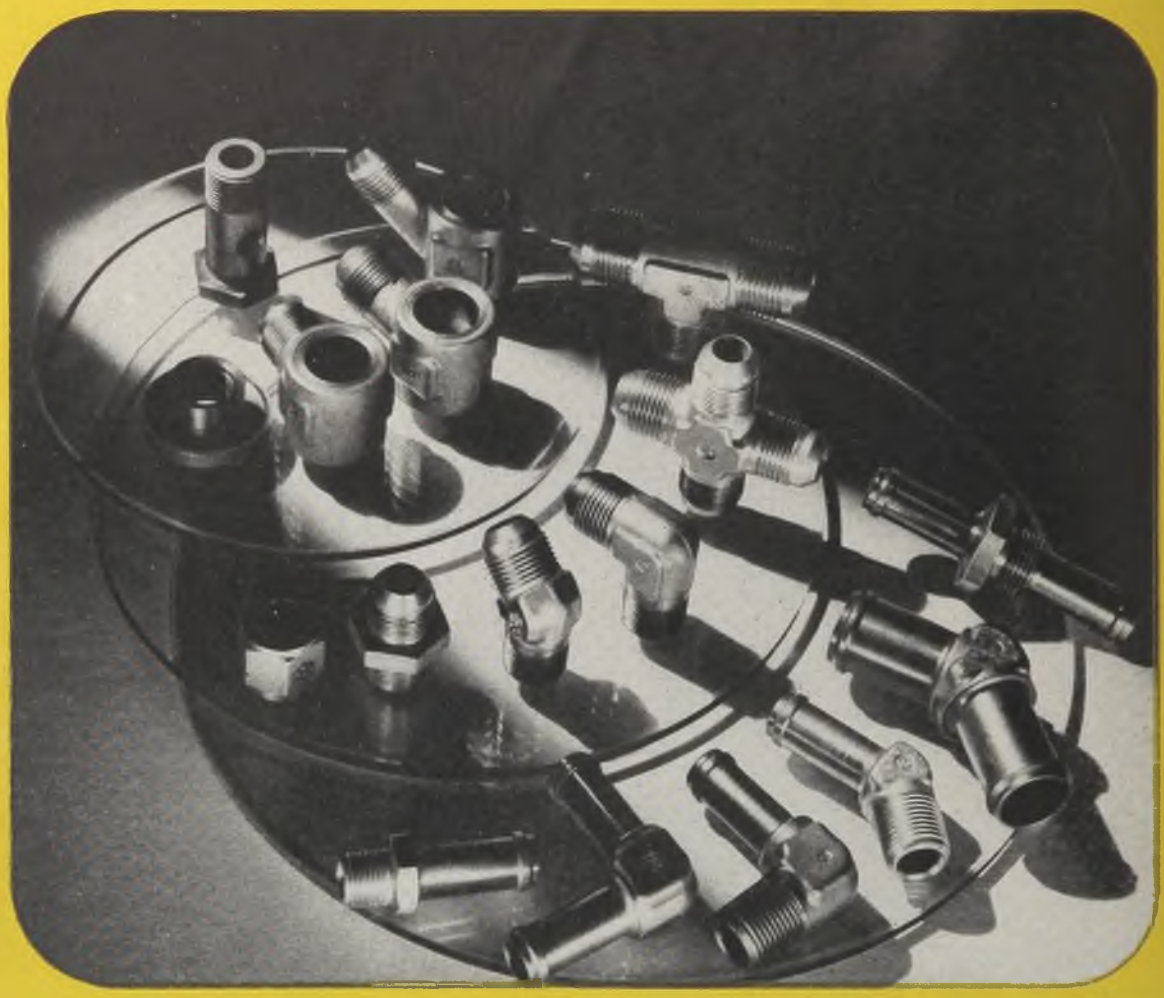
Stainless steel melters must continue to report on form WPB-2933 as instructed in CMPL-558, dated Jan. 10, 1944. It was erroneously reported in STEEL, Feb. 7th issue, that this report had been eliminated.

Direction 1 to order M-21-a was revoked as of Feb. 1, 1944, relieving stainless steel manufacturers of the necessity of reporting to WPB "any such steel which cannot be applied to an order previously approved for melting on form WPB-2933, due to deviation from specifications or for any other reason, with a statement explaining why such steel cannot be applied to such an order." The revoked direction also had provided that a producer must not apply such steel to any order not approved for melting on form WPB-2933, except when specifically authorized in writing by the WPB; and a producer must not melt a replacement heat of any such steel except when specifically authorized in writing by the WPB.

Deliveries of rejected corrosion and heat resistant alloy steels, to which direction 1 to order M-21-a applied, remain subject to all other applicable WPB regulations and orders.

Adams Named Director, WPB Durable Goods Division

Stanley Adams has been appointed director of the Consumers Durable Goods Division, War Production Board. He has been associated with WPB and its predecessor agency, OPM, since May 19, 1941. He was successively assistant chief, Iron and Steel Branch; special assistant to the director of materials; and special assistant to the director of priorities.



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By A. H. ALLEN Detroit Editor, STEEL

MIRRORS of MOTORDOM

Crucial period of mass production job is always at start when new tooling comes into action and production "bugs" are uncovered. Efficiency more than compensates for preliminary expense and time

IT IS an old axiom in the motor plants that more employes are needed at the start of a new model run than are required in later months when production may have risen to four or five times the level at the first few weeks of a run. The crucial period of any mass production job is always at the start when new tooling comes into action and production "bugs" are numerous.

The identical situation is prevailing on war production. Thus, Ford reports, "The second thousand bombers has come along much faster than the first—and a third thousand is on the way." Doubtless by the yearend the seventh thousand will be in the air. Likewise, Studebaker reports production of 22,295 aircraft engines in 1943—four times the output of the previous year. And Buick puts in the record its 33,000 engines for B-24 bombers, three-fourths of them built in the past 12 months.

Basically, mass output springs from adequate tooling which is both costly and time-consuming but productive of output and efficiency which more than make up for the preliminary expense.

Value of tooling for mass production is shown in the case of a crankcase for one company's aircraft engine, on which the production schedule was revised upward three times. Original small daily output was met with a minimum of tooling, each crankcase requiring 230 direct labor hours and spoilage averaging 47.6 per cent. With the first increase in production, tripling daily output up to this time, the operation was further mechanized. Thirty-two new machines were purchased along with their specialized jigs and fixtures. The 230 hours manufacturing time dropped to 125; scrap dropped to less than 7 per cent.

Refinements in tooling and extension of mechanization kept pace as schedules were doubled, and doubled again. Labor on the crankcase dropped to 40 hours and finally to 32 hours, while scrap dwindled to less than 4 per cent.

Similarly, changes were made throughout the engine plant. Two specially designed boring mills were installed to perform simultaneously 18 operations formerly done separately. Production was increased 92 per cent, and nine regular boring mills were released for other work along with seven skilled operators. Total production man-hours per engine were cut in half and scrap reduced by 80 per cent.

One of the show pieces at the Ford Willow Run plant is a special fixture for assembling the huge center wing section of the B-24. It replaces a knockdown fixture which had to be set up for each new job and then dismantled so the part could be removed, requiring a mere 13 days in all. Now, the permanent fixture permits the wing to be lifted out the top by crane and carried to the next operation. Time required for just setting up the fixture has been reduced from 250 man-hours to 60 man-minutes. For actual construction of the entire wing, man-hours have been reduced 94 per cent.

At the Murray Corp. plant, the addition of 16 conveyor lines for production of wings for P-47s and B-17s saved 185,660 man-hours per month, and released 796 workers for other assignments.

These accomplishments make dramatic reading and reflect well-deserved credit on the automotive plants realizing them. Actually, however, the credit rests not so much with the auto industry as with the tool shops, the machine tool industry, the materials handling engineers and all the others who for years have catered to production requirements of the motor industry. From their years of association with equipment and supply interests, the motor company engineers know just where to go when a problem presents itself, and they are unique in knowing how to apply just the right amount of pressure to get the job done quickly and efficiently.

In this respect, the original airplane manufacturers and the airplane engine builders, long accustomed to building their product by the handfuls, were at a disadvantage, for they had no contact with mass production engineering services. They are now acquiring these contacts, and if they can outgrow their innate fussiness over nonessentials and train themselves to build to a price, they will be able to compete with the automotive plants. However, this maturity still is some distance away.

Just two years ago production of automobiles ground to a stop, and over the intervening 24 months the industry's 1038 principal plants have delivered

ELECTRIC BIKE: Clarence H. Price, employe of Bendix Aviation Corp., South Bend, Ind., has solved the gas rationing problem by building his own electric bicycle, using two automobile batteries to operate a specially constructed motor generator. Materials cost $200; the labor was his own. Weekly operating expenses run about $1 for 75 miles of travel, and the batteries will run about 75 miles before recharging is necessary. Top speed is 20 miles an hour

$14.2 billion dollars worth of war materials. Current rate of production is in excess of $10.5 billions annually. Nearly half of the two-year total comprises aircraft, aircraft engines and parts. Second in volume are military vehicles and spares, totaling $4.2 billions. Third place goes to tanks at $1.9 billions; then guns, $1.15 billions; marine equipment $1.02 billions; ammunition $500 millions; and other products $400 millions.

Reduction of war schedules, particularly in respect to ammunition, has posed the problem of assisting laid-off employes to find other jobs. The Chrysler Evansville, Ind., ordnance plant, producing 0.45 and 0.30-caliber ammunition by the hundreds of millions of rounds a month, is a case in point, since personnel has been reduced by several thousand over the past three months, total force being cut over 50 per cent.

Each of the workers thus disemployed received a personal letter from C. L. Jacobson, general manager, explaining the necessity for reducing production schedules resulting from War Department instructions that "ample stocks of ammunition (are) now available." Further, the laid-off individuals were called into their respective department supervisor's office and advised at greater length as to reasons why the plant was forced to reduce operations.

Then, to help these people find new work, other industries in the area were advised of the layoffs and invited to come to the Chrysler personnel office and set up interviewing and hiring facilities. While it is not known how many discharged employes were able to arrange jobs in this way, reports do show that 5785 interviews were given, many of which doubtless resulted in hirings.

Tool and Die Commission of the regional War Labor Board in its first annual report notes labor pirating among the tool and die shops is "virtually extinct" and wage stabilization is "practically complete." At the incidence of the war program, the tool and die industry's jobbing shops were unable to cope with the enormous volume of orders primarily because of the lack of a sufficient number of skilled workers, so wages soared and labor pirating became commonplace. Workers quit captive tool rooms to take advantage of the boom in the job shop. Many went into business for themselves, inevitably attracting old associates from the established shops. To combat the chaotic situation the WLB in December, 1942, set specific maximum wage rates of $1.75 per hour for key classifications of toolmaker and diemaker in job shops and $1.60 in the captive shops, at the same time creating the Tool and Die Commission to enforce its directives and rulings.

Processes 1981 Cases

As of Jan. 1, this year, the commission had processed 1981 cases of all types, including 987 applications for approval of voluntary wage adjustments affecting 45,909. The 462 applications approved included only three general increases. Some 112 companies were found in violation of WLB orders and 783 individual excess rates were ordered reduced to legal ceilings. In wilful violations, the commission has recommended to the Internal Revenue Bureau the imposition of sanctions running into thousands of dollars, in one case $60,000 being set as the amount the bureau should disallow as income tax deduction.

Largest number of the 544 violation cases closed by the commission up to Jan. 1 were committed by small operators in unlisted old garages and similar places.

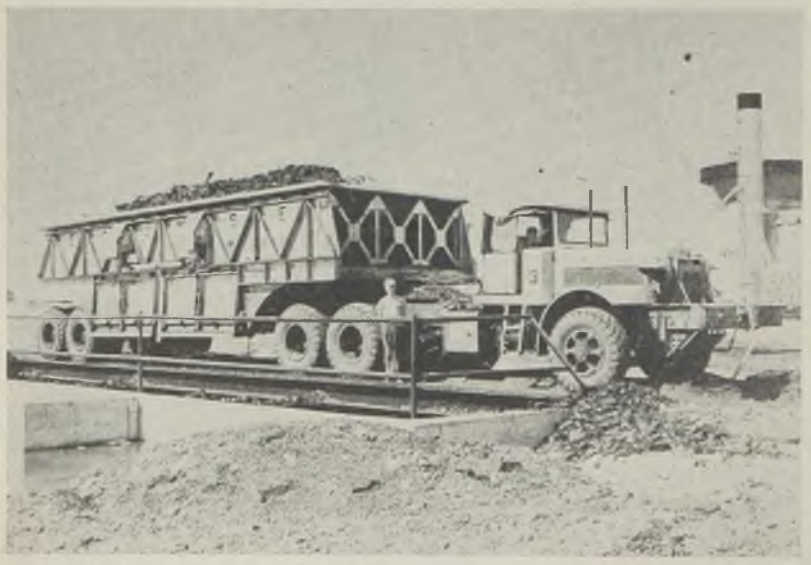
In this connection, it might be pointed out that one of the current methods adopted by prospective employes to circumvent wage ceilings is to ask employers to furnish rent and board in addition to furnishing wages.

Dr. E. E. Witte, chairman of the Detroit regional WLB, and a former economist from the University of Wisconsin, has resigned to accept appointment to the national WLB, being named as one of four alternate public members. His Detroit staff now numbers 140, supplemented by some 400 public, industry and labor panel members. Dr. Witte will be succeeded by Louis C. Miriani, chief counsel for the Detroit Legal-Aid Bureau.

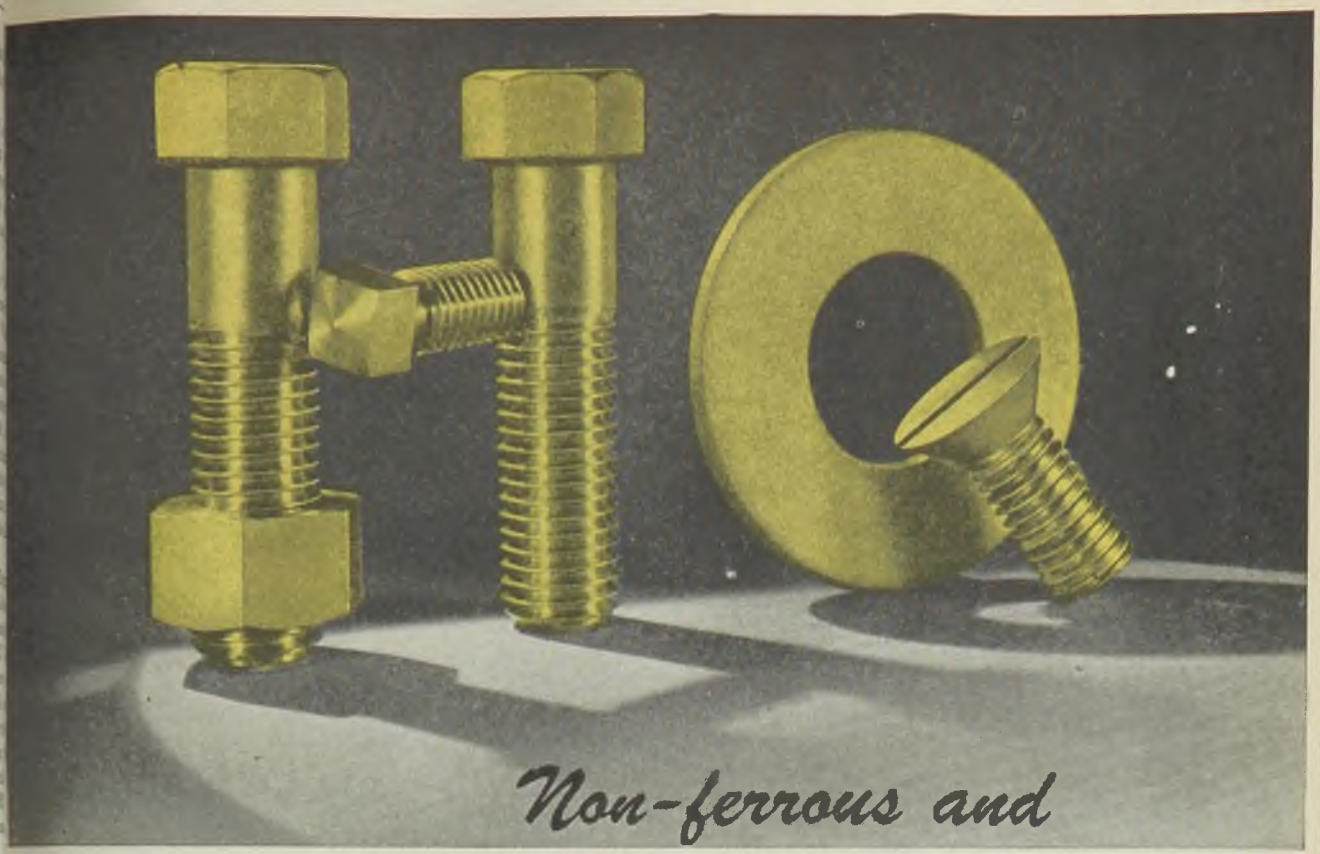
Automotive Parts and Equipment Manufacturers Association, old-line trade group of motor parts companies and headed for many years by C. C. Carlton of Motor Wheel Corp., has been reconstituted as the Automotive and Aviation Parts Manufacturers Inc. The new combine held its first annual meeting Feb. 9, and heard general manager Frank Rising enumerate a survey of the 392 member plants now doing overall business of better than $3 billions annually. Broken down into groups, business of these companies in 1943 was 29.3 per cent aircraft, 13.7 ammunition, 28.7 vehicles and parts for military and civilian use, 15.8 tanks and parts therefor, 3.6 artillery, small arms and parts, 3.4 marine equipment, 0.6 machine, tools, dies, jigs, fixtures, etc., and all other 4.9 per cent. It should be noted that the entire output of this group of companies is included in the total mentioned earlier for the "automotive industry" as compiled by the Automotive Council for War Production.

Eight Fisher Body plants in Michigan and Ohio are now producing parts and assemblies for the three assembly plants currently engaged in building the Boeing B-29 Superfortress, several score of which have been delivered to the Air Forces. Fisher plants are now supplying elements for four combat planes—the B-29, the B-17, the B-25 and the P-75, the latter being assembled by Fisher as well.

Ford schedules for the remainder of the year have been drawn up, but because of the nature of the production little can be disclosed as to their extent. They include, of course, the B-24 bomber in assembled and knockdown form, the Pratt & Whitney aircraft engine, the tank engine, two types of armored cars, a gun carrier, tractor trucks, stake trucks, cargo trucks, jeeps, two types of gliders, superchargers, generators, bomb service trucks—all for the military services, and tractors, moto-tugs, two types of buses and V-8 trucks for civilian purposes. Scheduled output of the Ferguson tractor for the year is in excess of 45,000 units, and assemblies will be at the rate of around 5000 monthly.



BEHEMOTH: Tecumseh Coal Corp. of southern Indiana takes a 50-ton payload of coal from its open pit mines every time this Mack tractor-trailer combination loads. The combination empty weighs 40 tons, for a total of 90 tons when loaded



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Stainless FASTENING

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To serve fastening users, Harper stocks over 4280 different items . . . employs a large staff of engineers and field service men . . . and offers a vast fund of practical non-ferrous and stainless fastening "Know how." Sample this "Know how" by writing (on your letterhead) for a 4-color, 84 page catalog.

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EVERLASTING FASTENINGS

Air transport presents vast potential for the future, with inland trade centers as much ports of the world trade lanes as are seaports today. Air cargo will not necessarily be developed at expense of existing surface transport

THE FUTURE of air transport stands as a vast, immeasurable potential. The speed of the airplane, flying great-circle courses and shrinking the world in size to a matter of hours, will enable us for the first time to show with competitive promptness the merits of our products in the most remote markets in the world, Thomas E. Lyons, executive secretary, Foreign-Trade Zones Board, told a joint meeting of the Miami Propeller Club and the Greater Miami Port Authority recently.

Until 1939, when the trans-Atlantic clipper service was inaugurated, only 11 out of 88 attempts to cross the Atlantic had succeeded. Since Jan. 1, 1943, American transport planes have maintained an average of 500 trans-Atlantic flights per week. Land-fall to land-fall time for such flights has been reduced to just over 6 hours.

But even on the basis of present achievements it is possible to think of all of Europe, Africa, North and South America and parts of Asia as being within 24 hours flying distance of the United States, he said. Not only does the airplane travel faster, it travels the shortest distance between two points on the earth's surface. For example, the straightest route from the Panama Canal to Tokyo is not directly across the Pacific. Roughly it passes over the Gulf of Mexico, Houston, Denver, Seattle and the Aleutians.

The sea route from Seattle to Calcutta is 12,000 miles; air distance is only 7225 miles. From Chicago to Murmansk is 6150 miles by the shortest surface route, 3500 miles by air. In terms of elapsed time, of course the difference is even more striking. A cargo plane can make 25 trips while a freighter is making one.

Plane Knows No Boundaries

Commercial relationships in the world at large have been maintained, heretofore, through ports with access to the seas and oceans. But in the air-ocean of the future, inland trade centers will be as much ports of the world trade lanes as seaports are today. It is neither visionary nor impractical to foresee the day when ice-free harbors will no longer be the exclusive lifeline of a nation's sea commerce, Mr. Lyons said. The airplane knows no boundaries, being able to traverse sea, desert, and mountain without interruption. Thus, the port of tomorrow can be located just as easily 1000 or 2000 miles inland, depending upon the industry and economic importance of the region surrounding it.

Undoubtedly, development of air cargo will make inland points important foreign trade centers. Cities and towns such as Chicago, Cincinnati, Detroit, Wichita, St. Louis, and Fairbanks, Alaska, can become foreign-trade centers as vital as seaports are today.

Nor need air cargo be developed solely at the expense of existing surface facilities, Mr. Lyons said. While some classes of cargo now carried by other forms of transportation will be a source of business for air cargo, we should not concern ourselves too much with this diversion. First, it will extend over a period of time sufficient for adjustments to be made. Second, long years ahead of what would have been possible otherwise, air transportation and air cargo will bring into the channels of trade many of the products and the resources of the hitherto undeveloped regions of the earth.

Too often we have considered the airplane merely as a unit capable of carrying a small group of passengers and a few hundred pounds of mail and express. But cargo planes now rolling off the production lines for military purposes and the commercial planes planned for the postwar era are a different story. For example, one of the largest railroads owns 80,000 freight cars. On the basis of actual ton-miles carried in a recent year, only 1150 airplanes of the type being built today could carry an equivalent amount of freight in one year.

Present air-cargo rates are between 80 and 90 cents a ton-mile—several times rail express rates, which are next above those of less-than-carload freight. Although air-cargo rates, and passenger rates, too, will in time be substantially reduced, relative cost factors will favor surface forms of transport. However, speed of air transport will reduce the necessity for maintaining large inventories of expensive goods.

Just as air transport is playing a vital role in this war so can it play an important part in securing unity and lasting peace. The future of the world—politically, economically, and socially—is inseparably bound up with that of aviation, said Mr. Lyons.

WOMEN SET THE PACE: Georgia women are playing an increasingly important part in bomber production at Bell Aircraft Corp.'s new plant near Marietta, Ga., as demonstrated by this working team in the fuselage assembly department

Reduce Production Time For Fighter Planes 95%

Production time for manufacturing a typical fighter plane for the armed forces has been reduced by 95 per cent and a tremendous reduction in time required to produce a four-engine bomber is also reported by the West Coast Aircraft War Production Council Inc., San Francisco.

Council members pointed out that the first fighter craft to come off the production line took 157,000 man-hours to build. The tenth required 59,000 man-hours, the thirteenth, a revised model, still required 59,000 man-hours, but the one hundredth plane, in spite of design and model changes and changes in specifications, required only 26,500 man-hours. And by the one thousandth fighter craft, production time had been reduced to 7800 man-hours.

The first bomber to roll off the assembly

YOU CAN GET MORE "STAINLESS" *Delivered Faster Now*

Pasteurizing tanks made of stainless

Oxygen tanks for sky-fighters

For a warplane's collector system

Stainless steel has been one of the "tightest" of all scarce metals. Now it is more readily available for W.P.B.-approved war and civilian uses, and delivery can be made faster.

Greater production of ARMCO Stainless Steels is made possible by more plentiful raw materials. Most of the alloying elements used in stainless—including chromium, nickel and molybdenum—are again fairly abundant.

For war uses it is not necessary to look for substitute materials. In fact, removal of restrictions is being considered for applications where it has been difficult to convert to other materials.

Resists Heat and Corrosion

ARMCO Stainless has many advantages, in war as well as in peace. Its hard, smooth surface withstands wear and tear; its high strength/weight ratio helps you design with lighter sections. Stainless defies heat and staunchly resists many forms of corrosion. It forms easily and can be readily welded.

If you make war equipment you'll find an ARMCO Stainless grade for every requirement. Just write to The American Rolling Mill Company, 821 Curtis Street, Middletown, Ohio.

STAINLESS ARMCO STEEL

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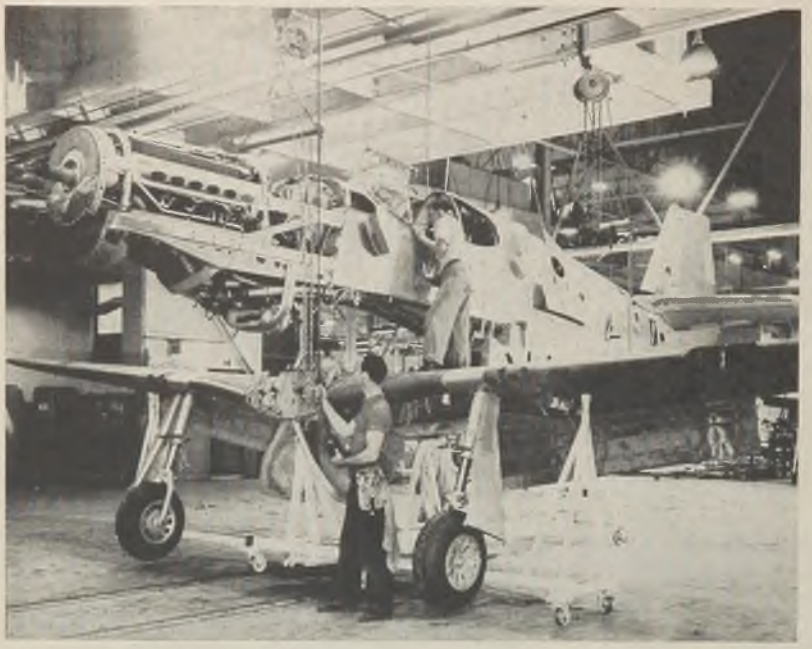

ASSEMBLING FIGHTER: Fuselage, with Packard-built Rolls-Royce engine mounted in position, is lowered onto the wing and landing gear section of a P-51 fighter at plant of North American Aviation Inc., Inglewood, Calif. The P-51 is reported to be one of the "hottest" fighter ships now serving at the battlefronts

line required about 200,000 man-hours to build. Time requirements dropped rapidly to 187,500 man-hours for the tenth, 137,500 man-hours for the twentieth, 87,500 man-hours for the one hundredth, 50,500 man-hours for the three hundredth, 22,500 man-hours for the one thousandth and only 13,000 man-hours for the two thousandth.

The council explained that these figures were offered to show that although aircraft plants on the West Coast were expected to construct 50 per cent more planes, in terms of weight, than in 1943, it would be done with relatively minor increases in manpower. The armed forces are drafting a large number of aircraft workers every month.

Bell Aircraft Will Need 2000 Additional Employes

L. L. Benson, works manager, Bell Aircraft Corp., Buffalo, recently told the Buffalo-Niagara War Manpower Committee the company shortly would need 2000 more employes—1500 in Buffalo and 500 in Niagara Falls—because of forthcoming concentration on production of two new models. He did not indicate what types of planes the new models were, although it has been revealed Bell is building a number of the revolutionary "jet propulsion" fighters and for sometime has been preparing to build a new P-63 fighter, details of which are restricted.

Contract for P-39 Airacobras has not been completely produced, although it is in its last stages. Approach of termination of this contract may have resulted in some layoffs at Bell plants in recent months; this was not covered in news dispatches of Mr. Benson's comment. He did say that 60 per cent of the new employes to be needed could be women.

Sketchy details of the jet-propelled fighter indicate its engines, two of which are mounted in the ship, were originally of British design. For more than 14 years, Group Captain Frank Whittle, RAF, worked on this new type of engine, completing his first successful tests in April, 1937. The British Air Ministry awarded the first contract for a jet-propelled plane to Gloucester Aircraft Co. Ltd., and the plane had its first successful flight in May, 1941.

In July, 1941, full information on the project was disclosed to the U. S. Air Forces, and almost immediately the engine which had made the first flight was sent to the General Electric Co. which in co-operation with air forces personnel of both countries, built a number of the power plants, the first being ready for tests in less than six months.

Simultaneously with the shipment of the first engine, Bell was given an order to design and build an aircraft suitable to accommodate two of the engines. In something under 12 months the first flight was made, on Oct. 1, 1942, with Bell's chief test pilot, Robert M. Stanley, at the controls.

The designing task was headed by Harland M. Poyer, director of engineering; Herbert L. Bowers, chief development engineer; Robert A. Wolf, chief research engineer; James S. Limage, chief structural engineer; Edgar P. Rhodes, chief project engineer.

New Laboratory Built To Test Propellers of Future

A proving ground for aircraft propellers was opened recently at Caldwell, N. J. by the propeller division of the Curtiss-Wright Corp., constructed by the company at a cost of $550,000 without the aid of government funds.

The new test unit has been built to meet aviation needs of the future when it may be called upon to test propellers up to 30 feet in diameter on engines ranging as high as 5,000 horsepower. At a recent inspection, tests were conducted with the world's largest four blade, hollow steel electric propeller some 16 feet and 8 inches in diameter, powered by a Wright Cyclone engine of 2200 horsepower.

Within three or four weeks the laboratory will be on three shifts, operated by a staff of about 24 men. Four or more engines can be used interchangeably in order to conduct endurance tests which may run into several hundred hours. Test cells are 30 feet square, with 31-foot orifices. The unit, which contains observation windows and intricate instrument panels, duplicates actual flight conditions. It is regarded as one of the most modern aircraft propeller laboratories in the world.

"In opening these new test cells," Robert L. Earle, vice president and general manager, propeller division, Curtiss-Wright, said, "we are stepping far ahead of current engine and aircraft requirements. They have been built for the purpose of developing the huge propellers of the future. This twin cell ground laboratory is another tool in the hands of our engineers for accelerating development of propeller designs to help provide American and Allied aircraft with every performance advantage."

Anodic Coating for Magnesium Developed

Anodic-type protective coating for magnesium alloys in aircraft has been developed by Consolidated Vultee Aircraft Corp. at its Fort Worth, Tex., division.

Weight increase in 0.040-inch magnesium sheet treated on both sides by the process is only 0.8 per cent, or one-seventh the weight of a prime coat of paint and two coats of lacquer. The new film is described as extremely tight and resistant to electrical current and abrasion. It readily withstands potential of 110 volts.

A further factor is the high degree of smoothness of the finish and the possibility that dyes can be introduced into the anodic solution with subsequent production of a wide variety of colors.

"Turning Points" to Victory

Official Signal Corps photo

HUB-DEEP in war

Bad roads to the battle-front can obstruct advance as effectively as exploding enemy shells. Yet, these sturdy wheels gain their objectives because they turn on ball bearings — trouble sealed out — friction-free power sealed in.

News readers thrill to accounts of bombs blasting and machine gun bullets spattering — but a commanding general's ear is tuned to the music of motors, to powerful wheels churning through sand or mud, in cold or heat, to bring more and more men, ammunition and supplies to move the tide of battle ever forward.

Friction, ignored, can bring a whole war machine to a grinding, smoking stop. But it can't happen to our side because ball bearings have been placed at every "turning point". They are pre-designed to keep at bay every hazard of terrain, temperature, speed or load — and they're making good along with the fighting men who operate them.

Some day, the smooth, full-powered punches delivered by Fafnirs in ships, planes, guns, trucks and tanks will lead to the final Axis-knockout. And from this tough testing ground will emerge the Fafnir Ball Bearings on which peacetime machines and vehicles will turn. They will serve you as dependably then. The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR BALL BEARINGS

Buy War Bonds and Stamps

MEN OF INDUSTRY

GEORGE W. HINDS

RUSSELL M. ALLEN

HARRY K. WERST

HERSCHEL J. WOOD

George W. Hinds has been named director of purchases, Lamson & Sessions Co., Cleveland, and **Frank DeCrane** has been appointed to succeed him as purchasing agent. Mr. Hinds and Mr. DeCrane have worked together in the Lamson organization's purchasing department for 18 years.

—o—

Selwyn G. Blaylock, president and managing director, Consolidated Mining & Smelting Co. of Canada Ltd., Trail, B. C., has been elected an honorary member of the American Institute of Mining and Metallurgical Engineers. Mr. Blaylock will receive this award, which is the highest honor conferred by the institute, at the banquet Feb. 23 during the annual meeting of the institute in New York.

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John M. Simpson, vice president since 1938, A. M. Castle & Co., Chicago, has been elected president to succeed **Alfred C. Castle.** The latter will retain his interest in the company and will serve as vice chairman and a director. All other officers were re-elected. Mr. Castle, president since 1930, has been connected with the company 35 years.

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Karl L. Konnerth has been appointed assistant to the president in charge of engineering for H. C. Frick Coke Co., United States Coal & Coke Co., and associated companies. **George M. Thursby** has been named director of industrial relations for these subsidiary companies of United States Steel Corp., continuing as assistant secretary of H. C. Frick Coke Co. **August J. Breitenstein** succeeds Mr. Konnerth as chief engineer of H. C. Frick Coke Co.

—o—

B. A. Graham, vice president and assistant general manager, Chicago Flexible Shaft Co., Chicago, has been elected president and general manager, to succeed **H. C. Wright,** who becomes chairman of the board and of the executive committee. **C. E. Timson** resigned as board chairman and treasurer, and was made chairman of the finance committee. Other new officers named are **J. W. Lynch,** former second vice president, as senior vice president and general plant manager; **E. K. Ploner, W. E. Cornelius** and **J. J. Dahm,** vice presidents, and **H. C. Gwinn,** treasurer.

Mr. Graham joined the company's sales division in 1924, three years later became sales manager, and was advanced to the vice presidency in 1935. Mr. Wright has been associated with the organization 31 years and had been president and general manager since 1935.

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Russell M. Allen, since 1940 general manager of sales, Allegheny Ludlum Steel Corp., Brackenridge, Pa., has been elected vice president in charge of sales. **P. E. Floyd,** formerly sales manager of the Chicago district, has been appointed assistant general sales manager for the corporation. Mr. Floyd returned recently from Washington where he served as chief of the Stainless Section of the Steel Division, WPB.

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Harry K. Werst, partner in Booz, Allen & Hamilton, management engineers of Chicago, has been appointed vice president in charge of manufacturing for Elastic Stop Nut Corp. of America, Union, N. J. and Lincoln, Neb. Mr. Werst's experience includes several years with Baldwin Locomotive Works, Philadelphia, and seven years with Edward G. Budd Mfg. Co., Philadelphia, where he served during part of that time as superintendent of the stainless steel fabricating department.

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Harold A. Wright, for the past 20 years associated with the industrial department, Hawthorne Works, Western Electric Co., Chicago, has become affiliated with McKinsey, Kearney & Co., Chicago, management consultants, as consultant on industrial relations and personnel management problems.

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Richard J. Golden has been appointed assistant to vice president, Pullman-Standard Car Mfg. Co., Chicago.

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Jack E. Allen has been appointed district sales representative in Buffalo and surrounding territory for Wyckoff Drawn Steel Co., Pittsburgh, and will make his headquartetrs at 525 Liberty Bank building, Buffalo. **W. A. Bolton** continues as metallurgical consultant in the company's Syracuse office.

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Herschel J. Wood has been appointed southwestern representative in charge of the new Houston office, Lebanon Steel Foundry, Lebanon, Pa. Mr. Wood, who formerly was associated with Elastic Stop Nut Corp. of America, Union, N. J., will make his headquarters at 1505 Commerce building, Houston, Tex.

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James Y. Murdock has been elected president, Canada Wire & Cable Co. Ltd., Toronto, to succeed **H. H. Horsfall,** who resigned owing to ill health. Mr. Horsfall will remain chairman of the board. **W. C. Bennet,** president, Phelps Dodge Refining Corp., New York, was elected a director.

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R. W. Owens, previously manager of the Motor division, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has joined Elliott Co., Jeannette, Pa., as assistant to the president.

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William Miller, Detroit district sales manager since 1938 for Jones & Laughlin Steel Corp., Pittsburgh, has been appointed assistant general sales manager. **Charles M. Merritt** succeeds Mr. Miller as district sales manager in Detroit.

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Robert K. Burns, Chicago regional chairman, WLB, has resigned to become director of the division of board agencies, WLB, Washington. **Theodore Kheel,** executive director of the national board, Washington, will serve in Mr. Burns' former post until a successor is named.

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Courtney Johnson has been named assistant to the chairman of Studebaker Corp., South Bend, Ind.

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E. S. Moreland has been appointed assistant sales manager, Pesco Products Co., Cleveland, a division of Borg-Warner Corp. Other personnel changes at Pesco Products Co. include the nam-

ing of **E. M. Whalley** as works manager, **Louis Matthews** as general superintendent, **Jay M. Roth** as director of engineering for pump and automotive developments, and **John A. Lauck** as chief engineer, pump department.

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Harold Metzendorf, formerly promotion and research manager of *Factory Management & Maintenance,* has joined Southern States Iron Roofing Co., Savannah, Ga., as advertising manager.

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John H. Bemis, chief of the Pig Iron Section, Steel Division, WPB, has resigned to return to Pickands Mather & Co., Cleveland.

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A. B. Agnew has been appointed sales agent for "SP" ingot mold insulation, Steel Ingot Production Inc., New York. Mr. Agnew's headquarters are at 4 Smithfield street, Pittsburgh.

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J. A. Martino, assistant comptroller, National Lead Co., Maurer, N. J., has been elected a director of the company.

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O. J. Klein has been appointed purchasing agent, Anthony Co. Inc., Streator, Ill., succeeding **L. E. Walker,** who is now plant manager.

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W. P. Hilliard has been appointed general manager of the Radio division of Bendix Aviation Corp. at Baltimore and Red Bank, N. J. Mr. Hilliard, director of sales and engineering of the division since its inception in 1936, succeeds **Hugh Benet** who assumes responsibilities of a special assignment nature.

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W. S. Long, formerly operations manager of United States Rubber Co.'s Los Angeles plant, has been appointed Pacific Coast sales manager, mechanical goods. Mr. Long will continue in charge of the company's war products activities on the Pacific Coast.

—o—

C. B. Allen, who recently completed an assignment with the Bureau of Ships, Navy Department, Washington, has returned to Reliance Electric & Engineering Co., Cleveland, and has been assigned to the Detroit district as an application engineer.

ELMER B. DUNKAK

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Harry A. Rowbottom, purchasing agent, Belmont Iron Works, Eddystone, Pa., has been elected a director of the company, succeeding **C. L. Huston,** retired.

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Harris B. Carlock, 1329 North Highland avenue, N. E., Atlanta, Ga., has been appointed to represent H. M. Harper Co., Chicago, in Tennessee, Mississippi, Alabama, Georgia, North Carolina and South Carolina.

—o—

Elmer B. Dunkak, former vice president and general manager of C. M. Kemp Mfg. Co., Baltimore, and originator of many widely used improvements in process heating and controls, has been appointed manager of the newly-organized Process division, Davison Chemical Corp., Baltimore. Mr. Dunkak was associated for many years with Public Service Electric & Gas Co., Newark, N. J., and in addition has had many contacts with the industrial life of Great Britain and France, where he spent considerable time arranging for the manufacture under license of American products.

W. H. HOLCOMB

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W. H. Holcomb, assistant to the president, Baldwin Locomotive Works, Philadelphia, has been appointed vice president in charge of industrial relations, a newly-created office. **James J. Nelson,** who recently was named general manager of the company's Cramp Brass & Iron Foundries division, has been made vice president of the division. **C. D. Williams,** since 1938 a member of the law firm of Maclay, Lyeth & Williams, New York, has been appointed vice president and general counsel in charge of the corporate and legal affairs of American Locomotive Co. **Carl A. Sundberg,** former assistant treasurer of the company, has been appointed secretary, and **C. E. Kraehn** has been appointed assistant to **V. H. Peterson,** who is in charge of all sales activities of the company. **A. J. Tigges,** who has been associated with the engineering firm of Jackson and Moreland, Boston, since 1923, has joined Baldwin Locomotive Works as manager of consulting engineering for all divisions and subsidiaries.

—o—

J. S. F. Carter has been appointed engineer in charge of design and engineering service, Process division, S. D. Hicks & Son Co. Inc., Boston. Previously Mr. Carter was chief design engineer of the Cherokee Ordnance Works built by Heyden Chemical Corp. at Danville, Pa.

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William O. Wilson, since 1937 manager, the Midwest district, Worthington Pump & Machinery Corp., Harrison, N. J., has been appointed commercial vice president responsible for direction of all Worthington's commercial activities in the Midwest district.

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Lucien E. Kinn has been elected president, Floor Surfacing Machine Co., Toledo, O. Other newly-elected company officers are: **Thomas J. Dolan,** first vice president; **Herman J. Blaser,** second vice president; **William D. Crew,** treasurer

WILLIAM E. HARRISON

Who has been made assistant fuel engineer, Lukens Steel Co. and subsidiaries, Coatesville, Pa., noted in STEEL, Feb. 14, p. 93.

ADAM J. HAZLETT

Who has been appointed general sales manager, Jones & Laughlin Steel Corp., Pittsburgh, reported in STEEL, Feb. 14, p. 93.

and general manager; **Frank D. Dolan,** secretary and assistant general manager, and **J. W. Bower,** assistant secretary and assistant treasurer.

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Burt W. Wetherbee, formerly manager of research for Globe Woven Belting Co., Buffalo, has been appointed manager of technical service, American Resinous Chemicals Corp., Peabody, Mass.

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Kreston T. Sorensen, who for many years has been associated with Baldwin Locomotive Works, Philadelphia, supervising installation of rolling mill equipment by the company in Russia and also supervising installation of special aircraft equipment for Baldwin Locomotive Works in France, and more recently in charge of heavy tank design for Baldwin, has joined the staff of William Sellers & Co. Inc., Philadelphia, as assistant to the president.

—o—

Herbert A. Reece, manager of Meehanite Metal Corp., Pittsburgh, has been elected first vice president in charge of operations. Mr. Reece, who is the inventor of the Equalized-Velocity process of cupola melting, as well as inventor of many methods of manufacture of specific property irons, will continue to make his headquarters in Cleveland.

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Preston B. Porter, vice president, Remington-Rand Inc., Buffalo, has been appointed director of public relations for the company and its affiliated enterprises. **Arthur R. Rumbles,** vice president and general manager of the System Products division, has also been made general manager of the Photographic Records division, formerly headed by Mr. Porter.

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Robert Steel, formerly superintendent of the Buffalo yards, American Ship Building Co., Cleveland, has been named assistant general superintendent in Chicago.

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Gordon G. Johnson has been named head of the Lycoming division, Aviation Corp., to succeed **P. E. Garlent. Raymond K. Cowden** has been appointed sales manager of the Lycoming division, succeeding **C. O. Samuelson. Earl L. Wilkinson** is new production manager of the division, succeeding **L. C. Senart.**

OBITUARIES . . .

Benjamin F. Affleck, 74, retired president of Universal Atlas Cement Co., New York, United States Steel Corp. subsidiary, died Feb. 13 in Winnetka, Ill. In 1896 Mr. Affleck joined the St. Louis offices of Illinois Steel Co., now Carnegie-Illinois Steel Corp. He was branch manager in St. Louis for the company's cement department when in 1906 Universal Portland Cement Co. became a separate subsidiary of United States Steel Corp. As general sales manager of the new subsidiary, Mr. Affleck developed an outstanding sales organization, and in 1915 he was elected president of the company. When Atlas Portland Cement Co. joined with his company in 1930 to form Universal Atlas Cement Co., he continued as president until his retirement in 1936 and remained a director until his death. During his service with the cement company its business grew from 30,000 barrels to 30,000,000 barrels.

Mr. Affleck was a member of the American Iron and Steel Institute, American Society for Testing Materials, American Road Builders Association, United States Chamber of Commerce, and was an honorary member of Western Society of Engineers, American Concrete Institute, and Portland Cement Association, of which he was president for five years.

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John C. Hipp, 84, president, Cleveland Steel Products Corp., Cleveland, died Feb. 15 in Hinckley, O. He also was president of the Pennsylvania Rubber & Supply Co., Cleveland.

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Melvin Pattison, chairman of the board, Industrial Brownhoist Corp., Bay City, Mich., and formerly president or the corporation, died in Bay City, Feb. 11.

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Frederick A. Prahl, 62, who had been associated with the tin can industry from 1906, when he joined American Can Co., New York, as an engineer, until 1940 when he retired as president of Owens Illinois Can Co., Toledo, O., and who had been affiliated with the Weirton Steel Co., Weirton, W. Va., for the past three years as research engineer, died Feb. 9 in Morristown, N. J. From 1927 to 1936 Mr. Prahl had been vice president in charge of manufacturing, Continental Can Co., New York.

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Guy E. Swartz, 61, president, Swartz Tool Products Co., Detroit, died Feb. 8 in St. Petersburg, Fla. Mr. Swartz had established his own business in 1918.

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Andrew J. Dietrich, president of Dietrich Bros. Inc., Baltimore, fabricator of structural steel and ornamental iron, died recently.

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William O'Day, retired foundry executive, died recently in Buffalo. Mr. O'Day had been with J. B. Pierce Foundry Co., Buffalo, for 40 years and later had been manager of the Buffalo branch of American Radiator & Standard Sanitary Corp., New York.

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James A. Parks, 64, vice president, Thomas W. Kiley & Co., Brooklyn, dealers in iron and steel, died there Feb. 9.

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Thomas B. Payne Jr., 47, sales representative for Chapman Valve Mfg. Co., New York, died Feb. 9 in Manhasset, N. Y.

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Robert S. McConnell, 73, who retired in 1939 as assistant mechanical engineer in charge of production in the engineering department, Baldwin Locomotive Works, Philadelphia, died there Feb. 9. Mr. McConnell had been associated with the company since 1896.

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Second Lieut. Paul M. Fletcher, 25, bombardier on a B-24 Liberator, and formerly assistant production manager, International Machine Tool Corp., Indianapolis, was killed Jan. 25 in a crash in the Asiatic area, according to word received from the War Department.

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C. Connor Cowpland, 65, assistant superintendent of the Kenvil, N. J. plant, Hercules Powder Co., Wilmington, Del. died Feb. 13. Mr. Cowpland had been manager of the company's Pluto, Mich. plant for 25 years until he retired several years ago. He was recalled to service shortly after this country went to war.

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Gus Anderson, 70, for more than 20 years superintendent of the die shop, Louis Marx Co. Inc. of Penna., Erie, Pa., died Jan. 30.

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Morton McNeil, 73, who retired in December, 1941, as mechanical engineer and technical sales specialist, Union Special Machine Co., Chicago, died Feb. 7 in that city. He had been associated with the company 51 years.

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James J. Shanahan, 61, for 16 years special representative in Chicago for American Tool Works Co., Cincinnati, died Feb. 8 in Chicago.

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Weldon O. Hampton, 41, chief design engineer, Delta-Star Electric Co., Chicago, died Feb. 9 in that city. Mr. Hampton had been active in the affairs of the American Institute of Electrical Engineers.

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David L. See, 57, manager of the Fabricating division of the Ambridge, Pa., plant of American Bridge Co., Pittsburgh, died Feb. 10 in Sewickley, Pa.

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Robert J. Delehanty, Boston sales representative for the Multigraph division, Addressograph-Multigraph Corp., Cleveland, and former assistant sales manager of the corporation, died Feb. 13 in Wellesley Mills, Mass.

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Aulden D. Snyder, 39, sales engineer with Addressograph-Multigraph Corp., Cleveland, died Feb. 12 in that city. Mr. Snyder, who had been associated with the corporation ten years, was formerly affiliated with Bailey Meter Co., Cleveland, and B. F. Goodrich Co., Akron.

—o—

Charles T. Gerding, 60, superintendent, Allyne-Ryan Foundry Co., Cleveland, and also a partner in Gerding & Sweeney Trucking Co., died in Cleveland Feb. 10.

New Processes Being Studied By Committee

Institute looks forward to heavy demand for finishing when manufacture of household appliances is resumed

NEW manufacturing methods and processes in porcelain enameling are being studied by a committee recently established by the Porcelain Enamel Institute, Washington.

The committee at its first meeting, held in Cincinnati, laid out a specific program of inquiry and assigned one new process to each member for intensive study. At subsequent meetings, a final report to the industry of the adaptability of these processes will be formulated.

Committee members believe the processes of applying porcelain enamel are in need of critical examination at this time. Engineering advances in the finishing field have been rapid, they point out, and processes not subject to continuous research will be superseded.

The tremendous tonnage of iron and steel sheets to be finished with porcelain enamel for domestic appliances during the postwar period will tax the manufacturing capacity of the industry, the institute states. Improvements in manufacturing processes will make possible the rapid production of material for the peacetime market without extensive installations of new equipment.

"Di-electric heating and induction heating for drying and fusing porcelain enamel are two suggested changes in processing," the institute says.

Revolutionary Effects Anticipated

"These methods of heating may have revolutionary effects upon the application of porcelain finishes. Although such work has not been done previously, the importance in other fields indicates that such methods may be possible.

"The use of multiple or repeat tanks in cleaning operations and electrolytic cleaning has been suggested. The technicians in this industry agree that better cleaning is important and point to the results which have been secured for other coating processes such as plating. The possibility of producing perfectly clean working surfaces on iron or steel sheets has been a matter of long development in the porcelain enamel industry.

"Atmospheric control of furnaces is progressing with great rapidity, especially when the protective nature of the porcelain enamel coating is important. The manufacture of water tanks and other containers has been the proving ground for this important method of application. The surface produced seems to be completely free of the usual irregularities."

Members of the process development committee of the Porcelain Enamel Institute at its initial meeting, left to right: H. D. Carter, research engineer, the Harshaw Chemical Co., Cleveland (immediate foreground); R. M. King, associate professor, ceramic engineering, Ohio State University; C. S. Pearce, managing director, Porcelain Enamel Institute; Edward Mackasek, development engineer for the institute; A. I. Andrews, head of the department of ceramic engineering, University of Illinois; J. W. Hoehl, vice president, Wolverine Porcelain Enameling Co., Detroit; G. W. Dykstra, engineer, Great Lakes Steel Corp., Detroit; R. E. Taylor, general superintendent, Enamel Products Co., Cleveland; F. R. Porter, engineer, Inland Steel Co., Chicago. L. E. Nordholt, vice president, Tennessee Enamel Mfg. Co., Nashville, Tenn., and chairman of the committee, was not present when photograph was taken

War Plants Granted Awards

ARMY-NAVY production awards were presented to the following companies for outstanding achievement in the production of war materials:

Great Lakes Steel Corp., Stran-Steel division, Mansfield, O.

Griffin & Co., Jeffersonville, Ind.

Jeffersonville Boat & Machine Co., Jeffersonville, Ind.

Houdaille-Hershey Corp., Decatur, Ill.

Kane Mfg. Corp., Kane, Pa.

Edward Katzinger Co., Chicago.

James A. Kiley Co., Somerville, Mass.

McDonough Steel Co., Oakland, Calif.

Nachman Motor Corp., Long Island, N. Y.

Nashua Mfg. Co., Lewistown, Me.

Norfolk Iron Co., North Quincy, Mass.

Frank D. Palmer Inc., Chicago.

Shell Oil Co. Inc., Martinez, Calif.

Southern Welding & Machine Co., Charlottesville, Va.

E. C. Taylor Engineering Co., Tuckahoe, N. Y.

Wollensak Optical Co., Rochester, N. Y.

Square D. Co., Milwaukee.

Cooper-Bessemer Corp., Mt. Vernon, O., second gold star.

Edwards & Co. Inc., Norwalk, Conn., third award.

Babcock & Wilcox Co., Augusta, Ga., second star.

Western Pipe & Steel Co., Los Angeles.

Borg-Warner Corp., Mechanics Universal Joint division, Chicago.

Mall Tool Co., Chicago, adds star.

L. F. Grammes & Sons Inc., Allentown, Pa.

J. G. Brill Co., Philadelphia.

Air-Maze Corp., Cleveland.

Edlund Machinery Co. Inc., Cortland, N. Y.

Hacker Boat Co., Mt. Clemens, Mich.

Kewanee Machinery & Conveyor Co., Kewanee, Ill.

National Lead Co., Luckey, O.

Magnesium Reduction Co., Luckey, O.

Rock Bit Sales & Service Co., Philadelphia.

Underwood Elliott Fisher Co., Bridgeport, Conn.

Worth Steel Co., Claymont, Del.

Aluminum Co. of America, Trentwood, Wash

American Electrical Heater Co., Detroit.

Arcrods Corp., Cleveland.

Arvey Corp., Jersey City, N. J.

Atlas Elevator Co., San Francisco.

Cochrane Corp., Philadelphia.

Columbia Electric & Mfg. Co., Spokane.

Columbus Foundry Corp., Brooklyn, N. Y

Continental Can Co. Inc., Chicago.

L. A. Darling Co., Bronson, Mich.

Erco Radio Laboratories Inc., Hempstead, N. Y.

Florence Stove Co., Kankakee, Ill.

Food Machinery Corp., Riverside, Calif

Frisch & Co., New York.

Balch Mfg. Co., Kalamazoo, Mich.

Butler Mfg. Co., Galesburg, Ill.

Carlton Lamp Corp., Newark, N. J.

E. I. du Pont de Nemours & Co. Inc., Wyandotte, Mich.

Manco Mfg. Co., Bradley, Ill.

Osborn Mfg. Co., Cleveland.

Pittsburgh Piping & Equipment Co., Pittsburgh.

Roth Mfg. Co., Chicago.

Symington-Gould Corp., Depew, N. Y.

A. F. Holden Co., New Haven, Conn., first star at two plants.

De Laval Steam Turbine Co., Trenton, N. J., receives third star.

Worthington Pump & Machinery Corp., Harrison, N. J., receives thirteenth production award.

Cochrane Corp., Philadelphia.

Consolidated Steel Corp., adds eagle to Maritime "M" burgee.

John Nooter Boiler Works Co., St. Louis.

Sylvania Electric Products Inc., plants at Salem and Danvers, Mass.

Ace Mfg. Corp., Philadelphia, receives second award.

Alloy Steel Products Co. Inc., Linden, N. J., awarded star.

Ilg Electric Ventilating Co., Chicago, awarded star.

Work Is Progressing on Overland Route From Texas to Panama

Geographical unity and solidarity of all the Americas brought nearer realization by road under construction. Interruptions in seaborne traffic to Central and South America emphasize need for project

By EDWIN WARLEY JAMES
Chief, Inter-American Regional Office,
United States Public Roads Administration

"America occupies, in solitary grandeur, the entire Western Hemisphere. ° ° ° Stately, powerful, unique; such is physical America, discovered by accident, named by mistake. Columbus discovered America in 1492. *Americans waited until* 1942."—*So speaks Luis Quintanilla in his recent book, "A Latin American Speaks".*

DR. QUINTANILLA'S statement may be emphasized by adding that it has required the repercussions of two global wars to awaken the people of the United States to the facts as they are slowly and somewhat onerously developing. Pearl Harbor changed the face of things as they were. The United States government suddenly realized that at Panama in the Canal Zone and its surroundings it had not only a huge investment in money but a profoundly vital interest.

Simultaneously, all the Americas realized their geographical unity and solidarity. The western continent--the American continent--was isolated by war. Exports to Europe vanished; exports even to the northern half of the continent dwindled.

Steps were at once taken to open a through overland route between the United States and Panama. Funds were made available, surveys of the incomplete were started and plans made to construct a pioneer road across all the gaps lacking all-weather surfaces.

These gaps aggregated 1060 kilometers and occurred in every country south of Guatemala. The surveys required stretched to more than 790 kilometers.

The amount of heavy construction and the unusual number of bridges led at once to an adjustment which would provide the most convenient and practicable rail and highway combination from the United States to Panama. This arrangement contemplated the use of the standard gage railroads in Mexico to the southern frontier at Tapachula or Suchiate and a pioneer road from either or both of those points to Panama. Such a combination would make through traffic possible with a single transfer from rail to truck.

Road Authorized in June, 1942

The pioneer road project was authorized in June, 1942, by two directives from military authorities, one providing for immediate surveys and the other for construction of a surfaced road on the location of the proposed Inter-American highway, over all sections which did not at the time have all-weather surfaces. The pioneer road surface was to have a minimum width of ten feet, and a thickness of 8 inches of compacted gravel or crushed stone without artifical binder. A maximum controlling grade was set at 10 per cent with a tolerance up to 12 per cent for short distances. No maximum curvature was set as it was expected that the construction would follow the alignment standards of the Inter-American highway. Advantage was to be taken of the fact that where alignment is fixed a variety of profiles can be laid. With the low standards of the pioneer road and the higher standards of the ultimate Inter-American highway this process, if carried through, would assure that only a small fraction of the work on the pioneer road would be discarded in final construction.

An adjustment had to be made also with respect to bridges and culverts. The total number of bridges over twenty feet in length remaining to be built between the southern Mexican frontier and the Panama Canal Zone was 97, and the very large footage of box and pipe culverts needed could be determined only after completion of surveys. It was obviously impossible with restrictions that affected steel to fabricate all the needed bridges, or provide reinforcement for so large an amount of concrete as would be required for culverts. It was stipulated therefore that certain hazardous bridges should, if possible, be completed according to final standards adopted for the Inter-American highway and that other bridges should be made temporary structures, of wood, steel or masonry, built somewhat down stream and off line, if possible. Culverts were treated the same way. Certain ones that could be built exactly in line and at grade of finally anticipated profile could be made permanent, others should be temporary. It was expected that even some log culverts might be built in the temporary class.

Construction was to be handled joint-

Construction view of the Tamasulpa river bridge in Guatemala, part of the Inter-American highway. Above, workmen are shown leveling concrete ahead of screed

EDITOR'S NOTE

Despite difficulties, work is progressing on construction of an overland route linking the United States with Panama. The Inter-American highway was first launched in June, 1942, but owing to a slow start and continuing difficulties of transportation of equipment, supplies and materials, the original program will not be possible. However, the road will be constructed either as a pioneer or standard highway across Guatemala, Salvador, Honduras, Nicaragua and Panama by July 1, 1944, and Costa Rica should be through by July of 1945.

Thousands of tons of steel for road construction and bridges are being consumed, and additional thousands of tons of steel are required for the roadbuilding equipment necessary for the project. Of even vaster implication is the potentialities for postwar export trade.

ly by the Public Roads Administration and the U. S. Engineer Corps and because of the conditions existing it was decided to do the entire job so far as possible by contract. The Engineer Corps was responsible for the pioneer road work and Public Administration for the standard work on roads, bridges and culverts regardless of whether the drainage structures were on pioneer or standard sections of the road. In all, nine contracts were let for roads and bridges covering a total of 1405 kilometers of highway and some eighteen bridges.

Three of the republics having highway organizations partly or wholly equipped took contracts to construct the sections of pioneer road included within their limits. Guatemala undertook to reconstruct an existing dirt wagon road from Malacatan via Ayutla, Retalhuleu, to Esquintla. El Salvador contracted to reconstruct and extend a road from San Miguel via Santa Rosa to the Goascoran river, and Nicaragua agreed to build a new road from the vicinity of Jinotepe via Nandaime, Rivas and La Virgen to the Costa Rica frontier. It was necessary to provide Guatemala and El Salvador with some additional equipment to that available to the highway departments. Such equipment was furnished on a rental basis.

Private contracts were made with the Foundation Co., New York, Martin Wunderlich Co., Jefferson City, Mo., with Swinnerton, McClure & Vinnell, San Francisco, and with Ralph E. Mills Co., Frankfort, Ky., for road construction; and with the Frederick Snare Co. for bridge substructures and steel erection. Bridge steel was fabricated by contract by the United States Steel Export Co. The Swinnerton contract covers the section of pioneer road in Honduras from the Goascoran river at the Salvador border to El Espino on the Nicaragua line, via Nacaome, Choluteca and San Marcos, following throughout the location proposed for the final standard construction on the Inter-American highway. The total length in Honduras is 164 kilometers. In addition, the Swinnerton associates have the northern section in Nicaragua from the Honduras line via Somoto, Condega and Esteli, to Sebaco, where present standard construction is picked up

and continues to Jinotepe. The Foundation Co. undertook to construct the section in northwestern Costa Rica from the Nicaragua line, practically at the shore of Lake Nicaragua to Naranjo, via La Cruz, Liberia, Canas and San Ramon. Difficulties, later referred to, in securing equipment and supplies led to the termination of the contract with the Foundation Co. and at this time the work is being carried on by force account.

The Ralph E. Mills Co. has a very difficult section in Central Costa Rica from Cartago to San Isidro del General, about 94 kilometers long, that crosses the continental divide at an elevation of 10,931 feet in extremely rough terrain. Wunderlich continues the work in Southern Costa Rica down El General valley via Buenos Aires and Paso Real to the Panama frontier at the crest of the Santa Clara range, then across the Chiriqui Plateau, and down the mountain to Concepcion and David at which latter place terminates the construction of the Central highway in Panama from the Canal Zone, 493 kilometers to the east.

The Frederick Snare Corp. was awarded a contract to construct six bridges: One at the Gascoran river, on the Honduras-El Salvador line; two in Honduras at the Cuacirope and the Rio Grande near Nacaome; one at the Ochomogo north of Rivas, Nicaragua; and one each at El General and Brus rivers in southern Costa Rica. This contract has been augmented by additional bridges as steel has been made available. Three additional structures in Nicaragua at the Rio Grande, Aguacatasta and Calabazas, for which substructures are already complete were first added and later nine structures in Costa Rica were included. These latter with one exception lie in El General valley between the General and Brus bridges originally provided for.

As should be expected, under the circumstances coincident with the development of this construction program, the difficulties of organization have been exceptional. Although the project was not undertaken solely as a war measure, because the co-operative construction and the greater part of the necessary funds were provided before the forced entrance of the United States into the war, nevertheless, the addition of the pioneer section and the expedited program were obviously incident to defense activities from the point of view of transportation insurance. This original plan called for the completion of all surveys, the letting of all contracts, the assembling of all required equipment at convenient points in Central America, the construction of camps and the accumulation of supplies by Nov. 15, 1942, so that with the opening of the dry season construction could be started simultaneously at all possible points. Contracts were let in August less than a month after final instructions to proceed. But the difficulties in securing equipment and forwarding it to points in Central America were such as to seriously retard the initial organization and preparation. Even today not all needed equipment has arrived on the respective sections.

Transportation Failure Hampers Plan

The original program called for completion of the pioneer road by May 15, 1943, at which time the rainy season might be expected to open. This provided for about six months of construction season for 1637 kilometers of road under eight contractors or roughly 35 kilometers per month per outfit. As some sections of the route could be approached at numerous points besides the ends it was expected that enough construction gangs would be put to work to complete such a program with relative ease.

The almost complete failure of transportation by water to Central America from ports of the United States on both coasts not only quite destroyed the possibility of carrying out the original program, but emphasized as almost nothing else could the necessity for the very project that was being prevented by the inevitable course of events. Indeed, so keen became the pressure to secure some outlet from Central America that plans were successfully carried forward to construct a railroad bridge at the Suchiate river between the towns of Mariscal and Ayutla at the head of rails respectively in Mexico and Guatemala. But the building of the bridge and the creation of a freight transfer station at Ayutla, Guatemala, did not come in time to relieve the need and so difficult became shipping conditions that one contractor was entirely unable to equip his job and the contract was canceled.

Other difficulties have been encountered that were not to be expected. The rainy season that normally would have tapered off to three or four inches for December with most of that before the fifteenth of the month carried on almost unabated in the upper elevations and often in the lower into January, February and even into March in some places. As the job was in large part one of making the dirt fly, the continued rains rather effectively interfered.

The completion of the instrument survey over the hitherto unsurveyed section of the continental divide in Costa Rica revealed an exaggerated series of conditions, expected in lesser degree but occurring far beyond anything previously contemplated. It was known from reconnaissance surveys carried out over wide areas in southern Costa Rica that the construction there would probably be the most difficult between Mexico and the Canal Zone. It was thought that the elevations already reached in Mexico and Guatemala would exceed anything required to get over the continental divide in Costa Rica. But the section between Cartago and San Isidro del General in Costa Rica is far the most diffi-

(*Please turn to Page* 148)

They Say:

"After the war is won and industry has been fully readjusted to a peacetime basis, American enterprise will meet its greatest challenge, namely, to provide peacetime production commensurate with the enormous ability to produce which our economy has demonstrated during the war years. . . To meet this challenge, we must realize that a high level of employment requires a high level of expenditures, private or public. . . Greatly reducing everybody's taxes, however, is not the way to maintain a balanced budget."—**Marriner S. Eccles**, chairman, Federal Reserve Board.

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"When we re-establish ourselves after this war, we must get the idea that we cannot have a continuity of sameness, that we are going to have a continuity of change. We need to go into the new era convinced that if there is one thing eternal, it is change."—**Charles F. Kettering**, vice president and director of research, General Motors Corp., Detroit.

"In order to successfully convert to peacetime operations, there should be set up a demobilization office such as that proposed by the Senate Committee on Postwar Economic Policy and Planning, which will operate under specific policies laid down by Congress and will be composed of three groups to handle the complex problems of contract termination claims, surplus war materials, and disposal of government-owned plants."—**Ernest R. Breech**, president, Bendix Aviation Corp.

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"No procedure in modern government has greater potentialities for destroying the democratic process than the creation during the last decade of a fourth branch of government, consisting of commissions and agencies. There is a concentration of legislative, executive and judicial power in a single body, against which there is little or no right of appeal except to the Congress."—**A. L. M. Wiggins**, president, American Bankers' Association.

Republic's Book Promotes Steel Export Market

Manual being distributed to buyers and users of steel in many parts of world, particularly Latin America

INDICATIVE of the growing interest in export trade possibilities after the war is a 98-page book just published by Republic Steel Corp., Cleveland. The book is being distributed to buyers and sellers of iron and steel products in many parts of the world and is available in English, Spanish and Portuguese editions.

Believed to be the first work of its type ever published specifically for steel export markets, this new, profusely-illustrated book tells the story of how steel is made and offers much technical information on many different types of steel, steel products and steel applications for the guidance of purchasers and fabricators outside the United States.

The manual opens with a description of the organization and the services offered by the export department of the present day steel producer. Following a pictorial trip through Republic's mines, mills and manufacturing divisions, it describes each of the many kinds of steel now produced and the many forms in which they can be supplied, under normal conditions, to steel users.

Another chapter deals with the forms, finishes and sizes of well-known specialty products in steel. A section which should prove of unusual interest in Latin America illustrates and describes accepted as well as many new applications of steel in such activities as agriculture, food processing, transportation and communications, mining, drainage and irrigation work, construction, etc.

Definitions of iron and steel terms are collected for Latin Americans for the first time in a single source in a special concluding section, which is followed by helpful gage and conversion tables.

Representatives of Latin American governments in the United States, who received advance copies of the comprehensive manual, have predicted it will prove extremely useful to their countrymen.

Plan To Expand Activity In the Electronics Field

Expanding its activities in the electronics field, the North American Philips Co. Inc., 100 East Forty-second street, New York, will establish laboratories in the old "Richmond Hill" mansion, Irvington, N. Y., which will be directed by Dr. Ora Stanley Duffendack, professor of physics, University of Michigan. The laboratories will be opened March 1.

Dr. Duffendack has been a director of research with the National Defense Research Committee and is serving as chief of one of the sections. He is known in the scientific world for his work in the field of electrical conduction through gases. He will continue his affiliation with the government.

North American Philips Co. Inc. was chartered in January, 1942, and all of its stock is held by Hartford National Bank and Trust Co., Hartford, Conn., as trustee for Philips Incandescent Lamp Works Co., formerly Eindhoven, Holland. Prior to the German invasion, headquarters were transferred to Willemstad, Curacao, Netherland West Indies.

SILVER ANNIVERSARY: Centered at the speakers table at the twenty-fifth anniversary of the Cleveland chapter of the American Society for Metals, Feb. 7, are, left to right: L. V. Emmons, Cleveland Twist Drill Co., Cleveland, who gave a history of the organization; Dr. Marcus A. Grossman, Carnegie-Illinois Steel Corp., Chicago, and president of the national society; Dr. Gerald Cover, Case School of Applied Science and Cleveland chapter chairman; William H. Eisenman, national secretary

BRIEFS . . .

Brown Instrument Co., Philadelphia, recently started a new industrial instrument maintenance and repair course under the supervision of its Training School division.

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Eversafe Insulator Co., New York, has purchased the Texal Corp.'s plant in Plainfield, N. J., consisting of an acre of land and several buildings.

—o—

Securities Exchange Commission has approved an application by Atlas Corp., Rotary Electric Steel Co., and Bonwit Teller Inc., exempting certain shares from provisions of the Investment Co. act.

—o—

Davison Chemical Corp., Baltimore, has formed a Process Division with E. B. Dunkak as manager. It offers the chemical, petroleum, steel and allied industries a complete design and equipment service implemented by research and experienced personnel.

—o—

American Steel Warehouse Association Inc., Cleveland, has approved establishment of a Colorado chapter. The territory of the new chapter includes the state of Colorado and parts of New Mexico and Wyoming.

—o—

Ransome Machinery Co., Dunellen, N. J., announces its welding positioning equipment is being handled exclusively through Worthington Pump & Machinery Corp.'s district offices in 36 cities.

—o—

Ruthman Machinery Co., Cincinnati, has published a 60-page catalog containing information on its coolant pumps.

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U. S. Machine Corp., Lebanon, Ind., reports that its monthly employe magazine has won first prize for internal magazine style in a contest conducted by the Industrial Editors Association, Chicago.

—o—

Gray-Mills Co., Chicago, has moved from its previous quarters at 215 W. Ontario street, Chicago, to a new plant at Ridge avenue, Evanston, Ill.

—o—

Symington-Gould Corp., Depew, N. Y., announces its Gould Coupler plant has a backlog of orders to keep the plant busy at least until August.

Production Pace Holds Steady at High Levels

WHAT may well be termed "war-winning stability" continues to be demonstrated by industry, with some output indexes recording moderate gains. Strikes still take their toll in various localities, but this unwarranted man-hour loss has not been sufficient to nullify the dominant strength of overall production figures.

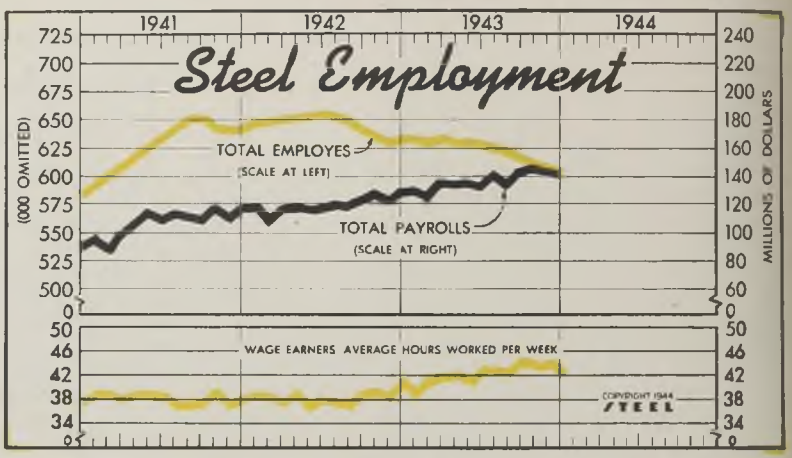
Although possible prolonging of the German war may increase reconversion difficulties by shortening the interval between Germany's defeat and the crushing of Japan, developments affecting the postwar period are favorable. War Manpower Commission's executive director reports civilian goods output has declined only 8 per cent since 1939, and says industry must simply carry on from that point. Committee for Economic Development, sponsored by Studebaker's President Hoffman and other leading industrialists, has already succeeded in initiating its program with companies representing a total of 73 per cent of the nation's 1939 factory output.

TRANSPORTATION—Emergency meeting of the Association of American Railroads at Chicago strongly emphasized the narrow margin by which a transportation collapse is being averted. Railroad employment suffered a decline of 37,000 workers for the six months ending with December, and lines executives foresee a loss of over 50,000 to the armed services during the first half of 1944. Freight and passenger traffic has been maintained at capacity levels in spite of manpower shortage and overworked equipment.

Railroads are trying to handle such a volume of freight that a freight priorities program will not be needed. Car builders will manufacture 65,000 freight cars this year, and the railroads are buying the entire quantity and hoping they can locate enough help to keep the freight rolling on adequate schedules.

ENGINEERING CONSTRUCTION — January volume of civil engineering construction in continental United States totaled $156,518,000, an average of $39,130,000 for the four weeks. This average volume was 11 per cent above December's five-week average, but 31 per cent under the weekly average for January, 1943. Types of construction showing gains in January over the preceding month were public buildings, up 42 per cent, and commercial building and large-scale private housing, with a 21 per cent increase.

INDUSTRIAL PRODUCTION — Output practices are tending to increase employment in larger plants and reduce volume of orders handled by smaller companies. As worker-hour output increases through heightened skill and improved processes, large prime contractors have been able to withdraw subcontracted work to keep their own employes busy when cancellations or revisions cut into their orders. Thus each cancellation means less business for the small subcontractor. With critical materials still under such tight War Production Board control that manufacture of essential civilian goods on a large scale is not possible nor permissible for small plants, the situation may influence 1944 unemployment figures.



Steel Employment

	Employee—Number (000 omitted)				Total Payrolls (Unit—$1,000,000)			
	1943	1942	1941	1940	1943	1942	1941	1940
Jan.	637	651	598	556	129.7	118.8	96.2	82.8
Feb.	635	651	603	538	122.8	108.5	89.6	70.8
March	637	653	613	514	136.8	117.0	98.0	68.8
April	634	654	621	503	133.3	118.5	108.6	67.7
May	632	656	632	510	137.4	117.4	115.3	75.2
June	631	659	638	535	136.2	118.0	110.5	77.4
July	627	655	648	549	142.8	120.7	114.1	82.2
Aug.	625	647	654	560	139.9	118.7	112.8	83.8
Sept.	620	641	652	565	143.8	124.8	110.4	82.1
Oct.	615	635	646	568	144.9	126.6	118.9	90.8
Nov.	611	632	645	577	141.5	122.8	109.9	87.9
Dec.	605	633	646	585	140.2	129.3	117.2	91.2

FIGURES THIS WEEK

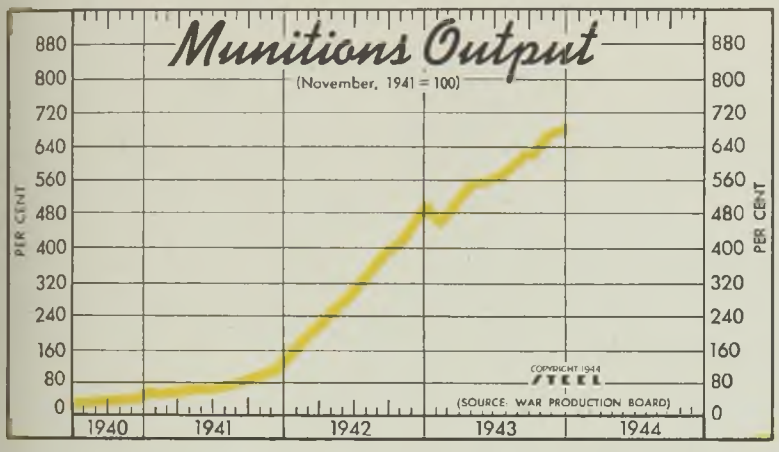
INDUSTRY	Latest Period*	Prior Week	Month Ago	Year Ago
Steel Ingot Output (per cent of capacity)	100.0	100.0	99.0	97.0
Electric Power Distributed (million kilowatt hours)	4,533	4,524	4,539	3,940
Bituminous Coal Production (daily av.—1000 tons)	2,130	2,133	2,062	1,980
Petroleum Production (daily av.—1000 bbls.)	4,413	4,396	4,375	3,857
Construction Volume (ENR—unit $1,000,000)	$23.2	$35.5	$98.7	$70.9
Automobile and Truck Output (Ward's—number units)	17,595	17,745	17,770	17,830
*Dates on request.				
TRADE				
Freight Carloadings (unit—1000 cars)	787†	806	780	752
Business Failures (Dun & Bradstreet, number)	22	33	39	84
Money in Circulation (in millions of dollars)‡	$20,586	$20,534	$20,404	$15,798
Department Store Sales (change from like week a year ago)‡	+8%	+15%	−6%	None
†Preliminary. ‡Federal Reserve Board.				

Steel Shipments†—Plate Production‡

(Net tons; 000 omitted)

	—Shipments—		Plate Output	
	1944	1943	1944	1943
Jan.	1,731	1,686	1,173	1,135
Feb.		1,692		1,072
Mar.		1,772		1,168
Apr.		1,631		1,122
May		1,707		1,115
June		1,553		1,056
July		1,661		1,090
Aug.		1,705		1,061
Sept.		1,665		1,106
Oct.		1,795		1,147
Nov.		1,661		1,142
Dec.		1,720		1,169
Total		20,245		13,382

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



Munitions Index

(November 1941 = 100)

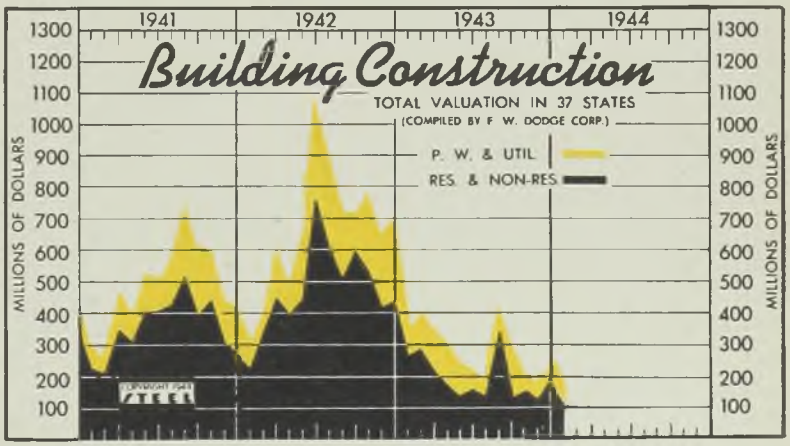
	1940	1941	1942	1943
Jan.		41	166	453
Feb.		45	182	476
Mar.		52	213	518
Apr.		60	247	547
May		57	276	548
June		59	309	560
July	23	64	339	587
Aug.	22	72	372	609
Sept.	22	83	387	611
Oct.	27	91	403	644
Nov.	34	100	448	661
Dec.	50	133	497	662

Figures for 1943 have been revised.

Construction Valuation In 37 States

(Unit—$1,000,000)

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



FINANCE

	Latest Period*	Prior Week	Month Ago	Year Ago
Bank Clearings (Dun & Bradstreet—millions)	$9,636	$10,830	$8,963	$7,366
Federal Gross Debt (billions)	$182.1	$178.7	$170.6	$116.5
Bond Volume, NYSE (millions)	$87.7	$94.2	$97.2	$46.6
Stocks Sales, NYSE (thousands)	3,512	4,263	4,698	5,349
Loans and Investments (millions)†	$52,177	$50,827	$49,527	$41,708
United States Government Obligations Held (millions)†	$37,930	$36,575	$36,033	$28,648

†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)†	249.0	248.9	247.3	244.3
Industrial Raw Materials (Bureau of Labor index)‡	112.4	112.7	112.1	108.6
Manufactured Products (Bureau of Labor index)‡	100.5	100.4	100.4	100.4

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

Is Milling Being Revolutionized?

In the light of past history, current events in tool engineering indicate that next move will be up to machine tool builders. This article is first of a series on significant developments in metalworking

THE Newcomen Society, dedicated to study of the history of engineering and technology, has a Latin motto which translates something like this: "While going ahead, look behind occasionally." Despite the fact that Lot's wife came to a bad end doing that, it is not a bad idea in the machine tool business to look back occasionally along the rocky road so that prior mis-steps will not be repeated, thus enabling a quickening of the pace of progress along the equally difficult road ahead—the general direction of which then will be much more clearly understood.

The only way that a machine tool builder can come to grief through looking back, is by doing it superciliously from what he assumes to be the end of the path of progress. Then it will be the end as far as he is concerned, because his competitors will pass him by on their way to higher achievements, leaving him behind like the Biblical pillar of salt.

Things are happening now in the field of milling which seem to justify a sharp glance back along the road to get some kind of a bearing on the direction in which we are headed. If we look back to the beginning, we see that milling originally was mechanized filing. When Eli Whitney built the forerunner of all American milling machines in 1818 (see Fig. 1), it was designed to replace hand filing of interchangeable gun parts in "filing jigs", by power rotary filing of parts held on the work table of this little bench machine.

A clear idea of the nature of the early milling cutters is given by the photograph (Fig. 3) of one made by the noted French mechanic Jacques de Vaucanson in Paris about 1780. This rare specimen, preserved by Brown & Sharpe Mfg. Co., was designed to cut gears. It is in fact a rotary file, its fine teeth having been swaged up with a chisel, in the same manner that the teeth of a hand-cut file are formed. This is typical of milling cutters used by Eli Whitney and for many years after his time.

Even after the technique of milling the teeth in cutters was developed, the rotary file tradition hung on and relatively fine teeth continued to be the rule for many years. As long as that tradition persisted, structurally frail milling machines of low power—fundamentally representing no great improvement over Whitney's very sensible basic design—"got by."

Not until early in the present century was there a major shake-up in milling practice. Two main factors then contributed to it. One was the introduction of practical high speed steel by Frederick Winslow Taylor and his contemporaries. The other was the final break with "filing traditions" when A. L. de Leeuw and his contemporaries introduced what were called "coarse tooth milling cutters". Few if any standard milling machines of 19th century design were capable of handling these high speed, coarse tooth cutters with maximum efficiency. Therefore, much more rugged and powerful machines—essentially as we know them today—had to be developed. That is about where things stood when I prepared an article for Sept. 11, 1939, issue of STEEL, entitled, "Take a Look at Milling." In the meantime a number of things have happened which indicate another major upset in milling practice.

Contributing factors to the current situation are: Widespread acceptance of cemented carbide cutting materials; climb milling and negative rake milling; and still more recently, the introduction of the super-speed, ultra-coarse cutters. While these various developments have come along at different times and from entirely different directions, their combined impact will be the determining factor in the forthcoming shakeup in milling machine design.

That such a shakeup is due—at least in heavy duty, high production milling machines—there hardly can be any question. Eventually it may affect all classes of milling machines. That this shakeup will involve greatly increased power; added rigidity and elimination of vibration and chatter; tremendously increased ranges of spindle speed and work feed; provisions for continuous removal of correspondingly increased volume of chips; and possibly a thorough revision in methods of using coolant, seems equally certain. There are signs that there may be radical departures from now accepted basic principles in milling machine design—which when all is said and done—still rest to a surprising extent on the foundation laid by Eli Whitney more than a century and a quarter ago. Take another look at his machine and see if that is not true.

The design developments just mentioned are not going to burst on a startled world overnight when the war ends or at any other time (except, perhaps, to a certain degree at the next national machine tool show—if and when held), nor will any one machine embody all of them. So-called "revolutions in machine shop practice" don't happen overnight. As a matter of fact they take place so gradually that in many cases they are not recognized as revolutions until someone looks back to Eli Whitney as we have just been doing, or until several years of slow, steady progress are "telescoped", as far as the

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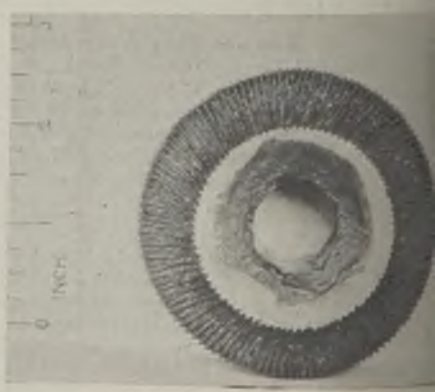


By Guy Hubbard

Machine Tool Editor, STEEL

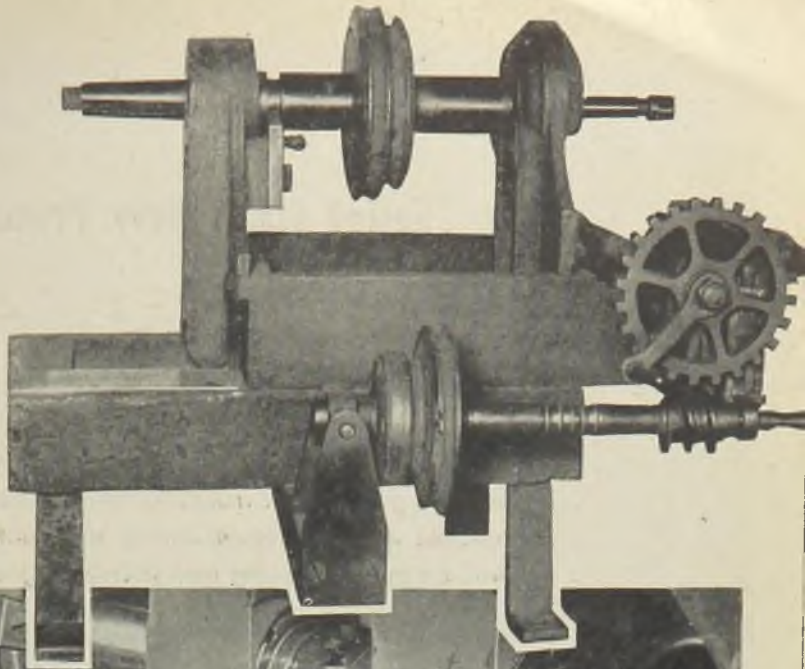


Fig. 1 (Right)—The ancestor of all American milling machines. This small bench miller with power feed was designed and built by the eminent inventor Eli Whitney about 1818. Work table, gibbed behind worn wheel, and drive pulley, keyed to tapered left end of spindle, are missing. Photo courtesy Museum of Science and Industry

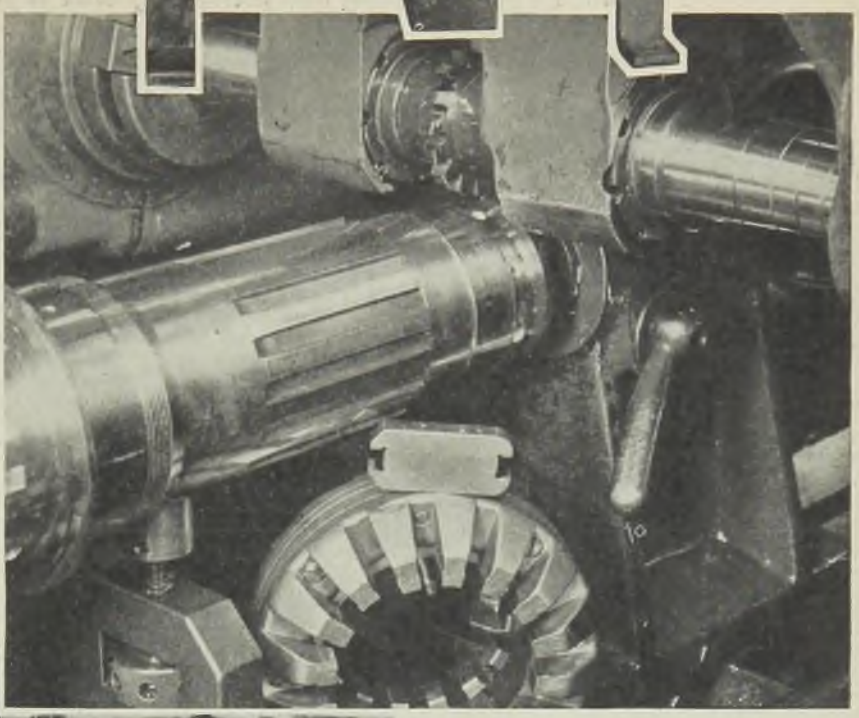


Fig. 2 (Right)—Setup for precision spline milling of this airplane propeller shaft demonstrates factors necessary for successful "climb milling" of a tough alloy steel part. Note rigid support of cutter arbor, rugged fixture, and built-in jackscrew supporting work from below. Photo courtesy Pratt & Whitney division of United Aircraft Corp.

Fig. 3 (Left, opposite page)—Early milling cutters were "rotary files", as indicated by this one made by Jacques de Vaucanson of Paris about 1780 for cutting gear teeth. Photo courtesy Brown & Sharpe Mfg. Co.

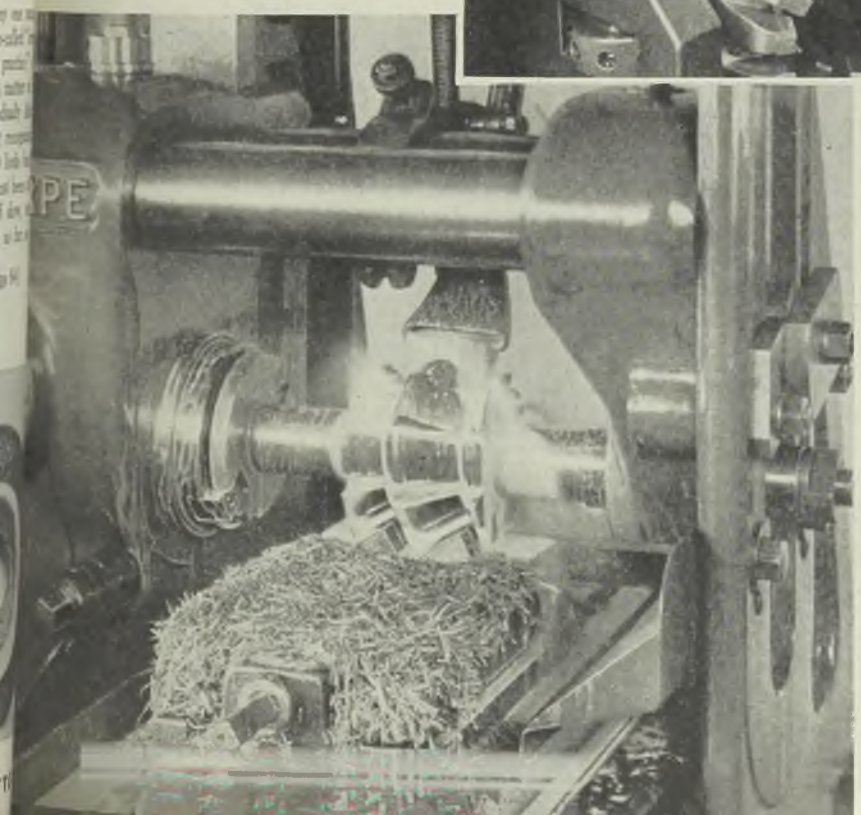
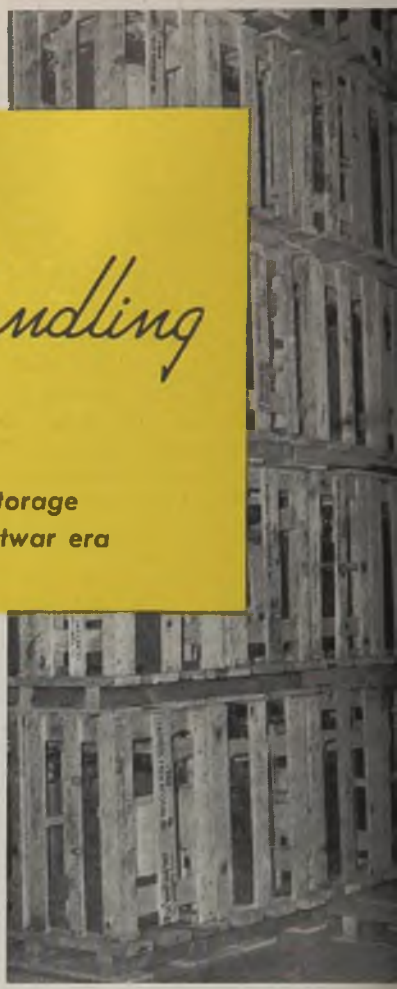


Fig. 4 (Left)—This bed-type machine, has independent separate, direct-connected motor drives for spindle, table and coolant pump, and complete electrical control for all table and spindle power movements. On setup like one shown, it will climb mill in one direction, reverse the table then finish mill conventionally during high speed return travel. Photo courtesy Brown & Sharpe Mfg. Co.

United States Navy Promotes

Standardized Pallet Handling

. . . . for it increases moving and storing efficiency
. . . . enables power fork trucks to lift and carry loads
. . . . reduces damage losses during shipment and in storage
. . . . will cut manufacturing and distributing costs in postwar era



By C. H. BARKER JR.
Technical Director
Field Operations Branch
Bureau of Supplies and Accounts
Navy Department
And
G. W. BIRDSALL
Associate Editor, STEEL

RIGID SPECIFICATIONS for packaging and shipping of goods set up by the armed forces have done more to increase the efficiency of materials handling than any other factor to date, some authorities feel. Long used by certain large industrial plants to increase materials handling efficiency, shipping and storing goods on standardized pallets has been greatly extended by the Navy's packaging and materials handling program now in full operation.

The necessity for some standardized method of handling with power trucks was recognized as essential for moving and taking care of the large shipments at Navy depots, Navy yards, ship docks, warehouses and other points of assembly of war material. The fork-truck-pallet system has proven highly efficient for moving and storing finished materials at such places. The advantages of this system are so numerous that packaging on standardized pallets has been developed by Navy's Bureau of Supplies and Accounts to a point where it now speeds shipment of goods in an undamaged condition along all Navy supply lines from subcontractors to prime contractors to depots to shipping points and even overseas right up to the battle line.

The significance of this program is that the required palletized shipments of various products by the Navy has resulted in thousands upon thousands of manufacturing plants becoming acquainted with efficient handling and shipping methods. This "education" appears to be something that will extend far into the postwar period to cut handling and shipping expense, thereby lowering manufacturing and distribution costs.

By having all incoming shipments from plants arrive on standardized pallets, speedy unloading, storage and reshipment is assured, for power fork trucks can thus be utilized effectively to move tremendous tonnages.

The Navy's packaging and materials handling program is a four way development to expedite handling of greater quantities of materials in less time with less manpower by making the best use of modern facilities and equipment. Specific functions are (1) to set up specifications for materials handling equipment for all activities, to establish equipment requirements, to pool excess equipment and to replace parts where needed; (2) education and instruction — establish courses of instruction, including lectures, motion pictures, slide films and manuals for supervisory materials handling personnel as well as to select and train supervisors; (3) unit load—develop the unit load idea by designing unit loads for Naval activities, as well as for vendors; (4) air borne cargo—develop proper handling equipment, establish correct loading methods, set up proper stowing practices.

Of most significance to industry is the great amount of development work that has gone into designing unit loads which could be handled on pallets by fork trucks for most efficient movement and most effective utilization of storage facilities.

There are many factors which determine the dimensions of pallets, such as size of the items to be packed, center of gravity of the load, weight of the material, transportation media involved in movement, and the like.

Experience at Naval depots demonstrates that pallets 48 inches by 48 inches are satisfactory for most handling operations. This size enables maximum loading with minimum loss of space between the average carton, box, bag or part which generally has at least one dimen-

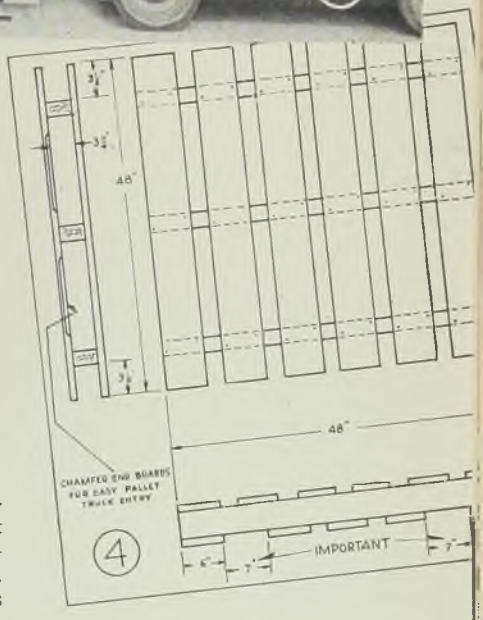


Fig. 1—Part view of oil drum stock, Naval Supply Depot, Oakland, Calif., showing tremendous volume of stores easily and quickly handled by modern fork-truck-and-pallet methods

Fig. 2—Good example of efficient use of overhead space is this stacking five tiers high of crates of chemical fire extinguishers, four crates to a pallet. Official U. S. Navy photos

Fig. 3—Fork truck handles two tiers of oil drums at a time. Accurate placing of such loads as represented by these eight drums is only possible where firm level support is available for truck operation

Fig. 4—Standardized pallet recommended by Navy. See Table 1 for specifications

sion of either 12, 18 or 24 inches. Too, pallets 48 x 48 inches are of a size which conforms with the inside dimensions of railroad freight cars.

By having the runners set in from the edge of the deck, sling bars may be inserted under the top deck for loading aboard ship as well as crane handling.

Therefore, the Navy has standardized on the pallets shown in Fig. 4. Standard length is 48 inches and standard width is also 48 inches, although some variation is allowed in the width. The length of 48 inches is a practical limit, for a longer length would result in the center of gravity of the pallet being too far out on the forks of the truck, on which the material is handled in all cases, as shown in accompanying illustrations.

Use of pallets emphasizes the importance of proper piling to assure firm tiering of pallet loads to maximum height of the storage space available or a maximum height that the truck can handle. Improper piling of cartons, boxes, cases and like items may easily cause stacks to tumble over and result not only in loss of storage space but also in damage to materials being handled and stored.

It is profitable to take the time to teach car gangs the correct methods of loading all different types of materials on pallets. Fork truck operators also should be trained in the correct methods of placing pallet loads when carrying loads in storage.

All bags, bales and boxes not having square dimensions should be cross hatched in piling. This type of piling helps to lock the materials in place and also increases the stability of the load.

Yankee ingenuity admits no limit to the size or shape or type of load that can be palletized for unit load handling and shipment.

Yes, almost any commodity can be palletized. Lumber, pipe and other lengthy material that is awkward to handle can be put up in unit loads readily for quick, easy handling with fork trucks. Where long bulky items are to be handled, such

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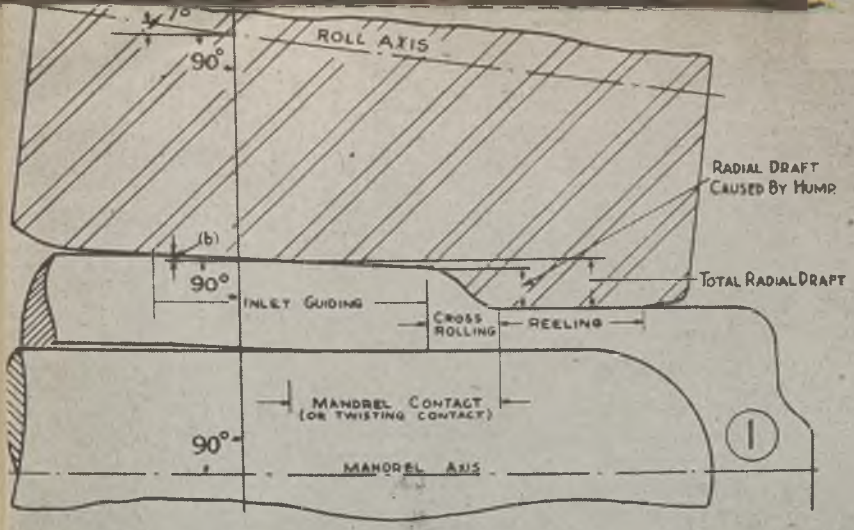


Fig. 1—Diagrammatic representation showing relation of various zones in crossrolling

CROSSROLL FORGING

At Christy Park

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

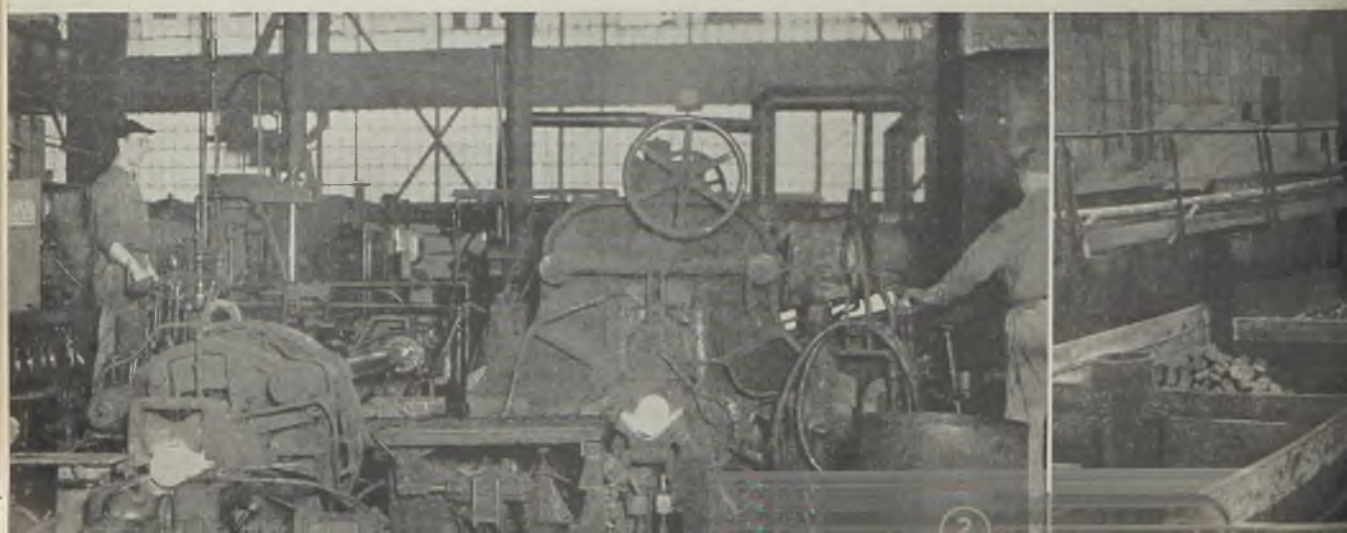
ACCUSTOMED to the concept of forming seamless tubes in Mannesmann type rolls, the adoption of the Assel crossrolling mill as a preferred method of forging high-explosive shell at Christy Park works of National Tube Co. was a natural result of the experience of that company in this field. If it were possible to open up a cylindrical billet into a tube by skew rolling, the feasibility of producing a short closed tube by similar means appeared reasonable enough; and although this, and other comparatively recent developments in the art, including the application of the upsetter and the "one-shot" process have not succeeded in displacing the older and well established "pierce and draw," *inroads to the extent of some 50 per cent of the total output have been made by the newer methods.*

Forging Weight Reduced: What are the principal objectives in crossrolling and other departures from earlier practice, apart from the production of finished forged cavities requiring no machine work—a characteristic distinguishing all World War II methods? If shell forging were as easy as it looks, the chances are that fewer avenues would have been explored in the search for improved methods; but the effort to punch a round, concentric hole in a blank at forging heat has been the occasion of much "sweat and toil".

In the last war relatively little attention appears to have been given to forging weight. This war, however, has placed a premium upon accuracy. Obviously if a certain eccentricity must be tolerated, all shell forging must have sufficient weight in excess in order that those forgings of maximum eccentricity may clean up in the lathe.

Redistribution of Forging Work: A rather obvious first step away from the simple expedient of finishing the job in a die with one or more piercing and forming punches was the elimination of necessary draft and reduction in the depth of penetration by the addition of a subsequent drawing operation through a series of ring dies or roller assemblies of diminishing aperture. Thus arose the "pierce and draw".

But there is a practical limit to the amount of forging work which may be relegated to the drawing operation with such arrangements designed to mitigate the severity of the pierce. If a much greater proportion of the forging work were applied to the extending operation, the depth of the pierce may be further reduced and the action confined to the production of a relatively short, stubby cup, in which the proportionate eccentricity, for any given eccentricity, is reduced as compared with a blank having thinner walls. Further, if means were adopted to maintain this proportionate eccentricity, instead of increasing it in



the subsequent extending operation (if not, indeed, partially correcting it) a reduction in the losses from carcasses which failed to clean up could then be expected; or as an alternative, with a given loss from this cause, a reduction in the weight of the forged blank could be obtained.

Capacity To Absorb Power Speeds Production: Unquestionably the process of crossrolling offers an opportunity to deliver large amounts of power. Amid the maze of factors affecting production rates, the crossroll mill is conservatively capable of the 240 *seventy-five millimeter shell blanks per hour in production.* This mill is successfully employed on all sizes from 3-inch to 155 millimeters without changing the rolls.

Round Slugs Are Used: In any appraisal of the efficacy of a given method of forging the carcass of a high-explosive shell, the process should be considered as a whole. While it is practicable to open up a cylindrical billet into an open ended tube by rolling alone, if the end is closed (as in a shell) the action must be initiated by piercing the blank. But this pierce need not be deep, since the Assel (pronounced "Ossel") mill takes a short, thick cup, thereby minimizing some of the problems which beset the ordinary piercing operation.

Partly as a matter of convenience, but also because round slugs are more stable on the hearth, absorb heat more uniformly and cause more uniform wear on the piercing die, the slugs are cut from the heavy round bars ordinarily employed in the manufacture of seamless tubes and readily procurable from the National Tube Co.'s own mills. The 3-inch anti-aircraft and the 75-millimeter take a 4¼-inch diameter slug; the 90-millimeter, a 4¾-inch; the 105-millimeter, 5½-inch; and the 155-millimeter, an 8-inch slug.

Flame Cutting and Sawing Favored: Following a check of the chemical analysis (made at the steel works) the bars are first pickled in dilute sulphuric acid to reveal surface flaws and blemishes, which are then removed by flame scarfing or chipping with the air hammer. Sawing with a circular saw and flame cutting with triple torches are both employed, but the latter is preferred because of greater output.

Regardless of how cut, a section at or near the end of such bar is etched with a 10 per cent solution of sulphuric acid in water, at a temperature of 160 to 170 degrees Fahr.

Slug Diameter: Size of the billet from which the slug is cut at Christy Park is determined by necessity of maintaining a constant difference between the outside diameter of the finished forging and the outside diameter of the pierced blank. In the small units on which the 3-inch, 75-millimeter, 90-millimeter and 105-millimeter forgings are produced, the difference between the outside diameter of the pierced and the finished forging is 1 inch. On the large unit on which the 155-millimeter forgings are made, this difference is 1.4 inches.

All billets are weight checked on their way to the bin via the roller conveyor, and each heat of steel is kept separate.

Rotary Hearth Furnaces Preferred: There are five rotary hearth furnaces, three supplying forging units 1, 2 and 3, the other two feeding unit 4. Although considerably higher in first cost than more primitive types, rotary hearth furnaces are well liked by makers of shell forgings. Apparently the additional cost is justified by the uniformity of heating and the steadiness of forging temperatures which they provide.

Attaining a uniform temperature prior to forging is very important, since the resistance of steel to deformation varies sharply with temperature in the forging range, being about twice as great at 1800 as it is at 2300 degrees. Thus, not only should there be no important difference in temperature between one side of the slug and the other, but the core should be as hot as the periphery, if eccentricity is to be avoided. Rotary hearth units not only expose the upended slug to heat from every side, but facilitate the exercise of positive control over the duration of the heating cycle.

Heating rate is around 17 or 18 minutes per inch of slug diameter. This rate has generally been considered safe in the case of shell steel; but there is a certain tendency in some quarters toward the employment of much higher rates through the use of induction and radiant heat, and by the simple device of raising the temperature quickly to some 100 degrees above forging heat and allowing to cool to the temperature desired, in air or in a soaking zone. Surprisingly enough, rates as high as 1¼ minutes per inch of diameter have been attained with induction heating, without apparent injury to shell steel.

Furnaces 1 and 2 have hearths 20 feet 5 inches in diameter and a central

Valuable assistance in preparation of this article was given by Mr. C. R. Cox, president, National Tube Co., and his colleagues; and by Professor W. Trinks, Projects Director, Shell Forging Research Committee, American Society of Mechanical Engineers, and his field staff.

Fig. 2—From pierce, gravity conveyor takes cup to Assel mill charger, extreme right, who inserts mandrel in cavity. Center operator controls Assel mill. From Assel mill, rolled forging with mandrel still inside rolls across inclined table to sizing mill, left. Man extreme left stamps heat code number on forging as it goes to cooling conveyor

Fig. 3—After cutting from bar stock, slugs pass on chain conveyor to outdoor bin storage setup shown here. Both line at left and above as well as near line are separated into bins according to type of steel, size, heat code. Overhead crane with magnet takes slugs from bins to conveyor leading to rotary-hearth heating furnaces

Fig. 4—Near operator is checking forgings for concentricity. Other inspectors on line will also check for inside and outside diameter, base thickness, boss length, cavity length, scabs, seams, and other defects

flue post 10 feet in diameter, giving a hearth area of 248 square feet. Furnaces 3, 4 and 5 are somewhat larger, with hearths of 331 square feet.

All burners are mounted 2 feet above the hearth to avoid direct flame impingement, and are inclined (with some exceptions) at 30 degrees to the radius to promote a flow counter to the direction of hearth rotation. There are three zones. The preheat is held at 2150 degrees Fahr.; heating, 2300; and soaking, 2400. Actual temperature of the steel runs around 2220 in the furnace, 2160 in the descaler, 2035 on the outside after crossrolling, and just over 2000 in the cavity after the draw.

Fuel is natural gas with a calorific value of 1140 B.t.u. per cubic foot. Furnaces 1 and 2 consume about 10,000 cubic feet of gas per hour. Larger units consume about 14,000 cubic feet per hour. Scale is removed from the furnaces once a week. Chrome was formerly used as a hearth material but has been replaced by a proprietary material called Corindon.

Descaling of the slug is done with water jets at a pressure of 2500 pounds per square inch. Enroute from the furnace to the piercing press on the chain conveyor, the slug enters the descaling tunnel, turning on the water as it enters and turning it off as it leaves.

For piercing, 250-ton presses are used on the two small units, and 400-ton presses on the two large units. On arrival at the press, the slug drops into a basket, where it is held vertically and thus may easily be lifted on to the press chair with a pair of tongs. Now the die pot comes down, enveloping the slug, which is forced into the die under a pressure of 50 to 80 tons, depending on the size of the press. Piercing supervenes on exposure of the punch as the downward stroke continues under the full ram pressure of 2500 pounds per square inch.

On completion of the pierce, main ram and die pot return to the upper end of the stroke, the cushion force meantime stripping the blank from the punch, and the ejector knocking the cup from the die. After each stroke the die pot and punch are sprayed with paraffin base oil and graphite. A gravity conveyor now carries the blank to the Assel mill.

Crossrolling: While the art of crossrolling has evolved from the familiar process of manufacturing seamless tube, this important distinction has to be noted: Whereas extension takes place in both a circumferential and axial direction in tube rolling, the former must be avoided in the crossrolling of a shell blank, if ballooning is to be prevented.

The cup, having already been pierced, merely requires elongation. To attain this end, a roll of the form shown in Fig. 1 is employed, its most important characteristic being the "hump" which may perform up to perhaps 85 per cent of the actual reduction in wall thickness. The profile of this hump is quite critical.

To understand more fully the action of the rolls in the Assel mill, which in addition to the cone angle setting of 7 degrees are cocked or "skewed" 3 degrees from the axial plane, it may be assumed that in general the friction between the blank and the rolls is sufficient to produce forward feed of the blank through the rolls, as in making seamless tubes. However, under these circumstances there is a pronounced tendency on the part of the blank to "run ahead" of the mandrel.

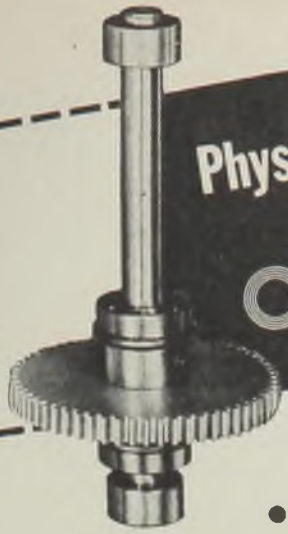
Since the cavity must conform to a

(*Please turn to Page* 112)

Fig. 5—*Heated and descaled steel slug is placed in* 320/400- *ton piercing press. Outside of pierced cup is formed in die contained in press directly under crosshead. Cavity is formed by punch resting on bottom platen of press. Length of stroke controls thickness of base of pierced cup. U. S. Steel Subsidiaries photos*

Fig. 6—"*Porcupine*" *cooling conveyor, unloading end. Work is still at temperature of* 200 *to* 350 *degrees Fahr. Another conveyor takes work from here to water sprays, then to inspection*

CORROSION is ONLY the HALF OF IT



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Is the Stainless you are using inadequate to exacting requirements and conditions? Are you production economies of Carpenter Free-Machin or soft and ductile Carpenter Stainless Strip in operations? Talk it over with your Carpenter r He is trained to help you select the right Stainles solve Stainless fabricating problems.

Complicated forming and bending operations can be done more *easily* and more *accurately* with uniform Carpenter Stainless Strip. And this Stainless will help you reduce costs on today's and tomorrow's jobs.

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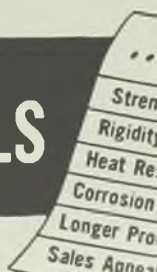

(Concluded from Page 76)

Is Milling Being Revolutionized?

public is concerned, into the single week of the occasional national exhibition.

What is happening and will happen in the meantime is that advantage will be taken of the new techniques in the best of the existing machines, just as limited advantage was taken of smokeless powder in the best firearms of the black powder era, and just as limited advantage may be taken of high-octane gasoline in engines not primarily designed for it. Such limited use of "strong medicine" demands ingenuity in strengthening up the physique of the older mechanism to stand the gaff.

Some breakdowns and considerably increased wear and tear on the mechanism can be expected. However, increased production will in many cases justify such encroachments on factors of safety. Then too, by the time the machines are worn out—even though prematurely in terms of old fashioned machine shop thinking—the new designs already hinted at in this article will have materialized and the older models will have been outmoded whether worn out or not.

Rather than attempting to go right on up into the rather misty heights where somewhat controversial experiments in superspeed milling with ultra-coarse tooth cutters just now are going on, let's work along in that general direction by way of some of the intermediate developments already mentioned. Generally speaking, these things involve primarily what we now think of as standard equipment.

Take the setup illustrated by Fig. 2, for example. This is a successful application of what is known as climb milling. The part is a propeller shaft of exacting specifications as spline-milled by the Pratt & Whitney aircraft engine plant in East Hartford, Conn. Note that the cutter teeth sweep down on the work—not up as in conventional practice. This has definite advantages as regards speed and finish, but unless every precaution is taken to eliminate back lash, deflection and chatter, the cutter—of which each tooth takes a substantial initial bite into solid metal—will stall, or will "climb" and wreck the part or the setup.

Observe the heavy arbor, the dual and close-up support of the cutter, the strong fixture employed and the fact that a jackscrew is built into this fixture to give the work added support from below. This machine is heavily powered and all adjustments such as gibs, feed nuts, etc., have been set up snug to eliminate back lash.

Incidentally, there already are a number of bed-type production milling machines on the market which have been designed to meet the stiff requirements imposed by climb milling. One of these —the No. 12 Brown & Sharpe electrically controlled milling machine—is shown in action in Fig. 4.

This machine is so arranged that a climb milling roughing cut can be taken in one direction followed by automatic reversal of the feed and a finishing cut at double the roughing feed during the return stroke of the table—the cutter then operating in the conventional manner in relation to the work. The table of this machine has fast and slow feeds in both directions and a solenoid controlled back lash takeup on the table feed screw.

One of the many advantages of climb milling is that instead of tending to lift the work, the downward sweep of the cutter presses the work toward the table. The advantage of this in the present instance, where a stack of plates is gripped in a milling vise, is self-evident. This characteristic will assume increased importance as heavier cuts with coarser tooth cutters become more and more common practice. It is logical to assume that most of the postwar vintage milling machines will be engineered to perform climb milling.

This article—as already hinted—is intended to lead up to, rather than to deal directly with, the rather "hot" subject of superspeed milling. That I plan to tackle in subsequent stories. What I am trying to do here is to touch upon some significant performance in existing machines—machines with which all of us are more or less familiar.

In this spirit let's take a glance at the possibilities of end mills as efficient metal removing tools. There lately have been great improvements in the design of single and double lipped end mills patterned more or less after the routing cutters used in woodworking. As a matter of fact in the aircraft industry surprising results have been achieved on light metals, using these end cutters in high speed machines originally designed for woodworking. As a result a number of high speed end milling attachments have been developed for use on standard milling machines, and there is a tendency to step up the speed of the latest vertical milling machines. This technique now is assuming importance in milling iron and steel as well as aluminum and magnesium and their alloys.

New Uses for Spline Millers

A practical example of what can be done in this direction came to my attention recently in one of the large arms plants. This was a setup for mortising pistol frames. The job was being done at extremely high speed in a battery of machines originally designed for an entirely different purpose. The equipment to which I refer is a group of standard Taylor & Fenn duplex spline milling machines.

The working section of one of these semiautomatic machines is shown in Fig. 5. With the parts held in quick-acting fixtures and with the high speed spindles driving the cutters in from both sides simultaneously, short work is made of recessing the tough steel forgings. Performance in this case demonstrates advantages of rigid spindle mountings, minimum overhang of tools, close proximity between work table and cutters, as well as advisability of using "balanced cuts" wherever possible.

Use of high speed end mills for surfacing as well as slotting was emphasized at the Machine and Tool Progress exhibition of ASTE in March, 1943.

In the current excitement over the startling performance of large diameter "superspeed" mills there may be some danger that equally startling possibilities of small, high speed end-working cutters are being overlooked. If this article helps to stir up some active interest in that direction, one of its main purposes will have been accomplished.

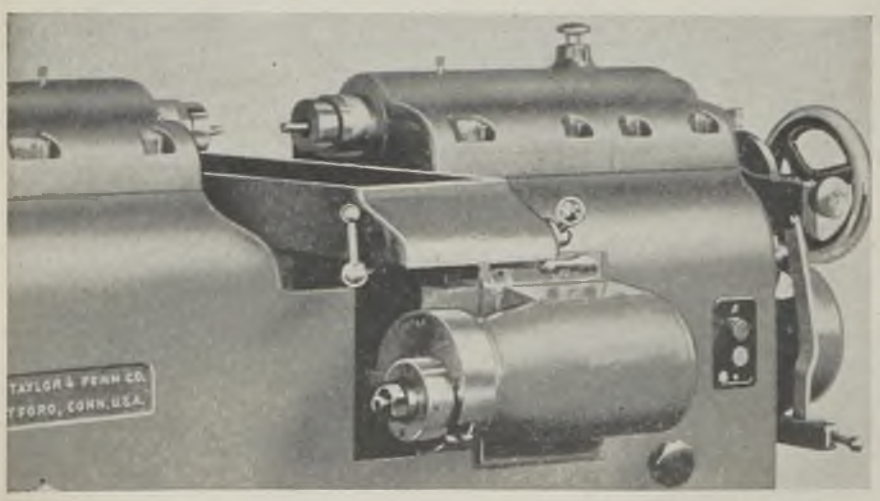

Fig. 5—Designed primarily for spline milling, this high speed duplex spindle machine, using latest types of single or double lipped cutters of small diameter, can be applied effectively on pistol frames and similar work requiring mortising, slotting and internal milling operations. Photo courtesy Taylor & Fenn Co.

PORTER 35 TON DIESEL-ELECTRIC

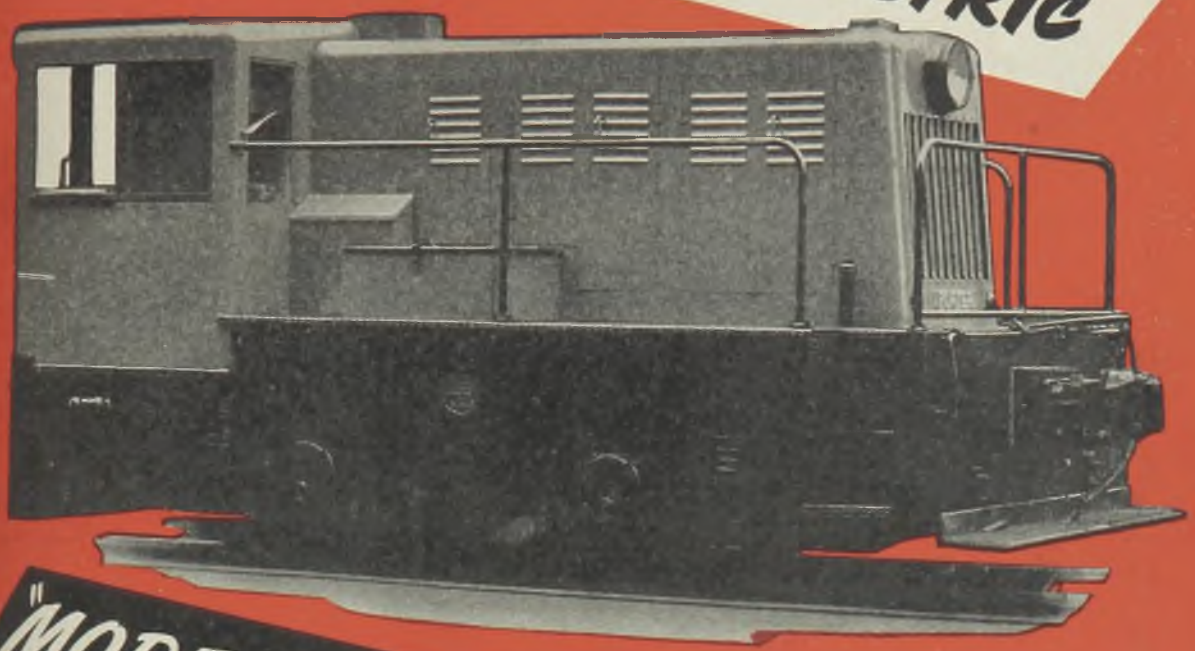

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Fig. 5—Girl operator easily moves and stacks 15 cylinders of compressed carbon-dioxide gas at a time. Note each successive line is stacked facing opposite direction. Valves and cylinder numbers can then be checked easily from walking aisle between lines

Standardized Pallets

(*Concluded from Page 79*)

extra items may be maneuvered by two or more fork trucks working together as a team.

Shovels and picks are regarded ordinarily as being exceptionally hard to pack and handle. However, no difficulty is encountered when they are tied into bundles and bundles interlocked on pallets, the whole being steel strapped to the pallet. It is possible to stack shovels, picks and other awkward items in layers four high per pallet by this method.

Compressed gases in steel containers are typical examples of high handling efficiency provided by the method. Fig. 5 shows how 15 cylinders are handled on a single pallet in three rows of five each. These cylinders contain carbon dioxide gas for fire extinguishing systems. Note how each successive line of pallets is stacked in opposite direction on the floor from the previous line so that valves are facing each other. This leaves a walking aisle between the rows of stacked cylinders for the purpose of checking cylinder numbers and valves.

The big advantage of pallet handling is that there is no need for handling the individual items piece by piece. This is true regardless of how many handlings occur between the manufacturing plant and the eventual point of use. Thus in this instance, 15 cylinders are handled as a unit by means of one operator and a fork truck. If the same number of cylinders were handled individually, an exceptionally large crew would be necessary, tiering would be difficult, and there might be some question as to the safety of the whole operation.

Fig. 2 affords an idea of how efficient palletized handling can be in storage operations. Here crated chemical fire extinguishers are stowed on pallets which are stacked in five tiers. This most effectively utilizes the cubical contents of storage warehouses, not limiting the capacity to the floor area alone, for materials can be stacked clear to the roof (provided permissible floor loadings are not exceeded).

In some warehouses and plant buildings, low roof height may limit the storage by this method, whereas, if outside storage facilities are utilized, the material can be piled to a height limited only by the tiering ability of the truck. Fig. 3 indicates what can be done outside where there is no limit on height. Here oil drums are tiered six high, as the tiering fork truck places the last two tiers simultaneously, as shown in this illustration.

Of course, such heavy unit loadings of floor areas as result in this application require excellent floors to provide a firm steady foundation for the fork truck during the high lift and also to prevent toppling of the piles from uneven settling.

However, an outside storage area provided with a good reinforced concrete surface can easily withstand the heaviest loading practicable to place upon it with fork trucks. Undoubtedly now that many manufacturers are becoming more familiar with fork truck and pallet handling and storage methods, it is expected that they will find greatly increased application in postwar production work.

TABLE I—STANDARDIZED NAVY PALLET SPECIFICATIONS (SEE FIG. 1)

Lumber: Oak, maple, hickory, birch, beech, ash, elm, cherry and pecan; sound, square edge, any stage of seasoning.

Top Deck: Two end boards 1 x 6" or wider and surfaced on one side to ⅞". Other boards 1 x 4" and wider, surfaced one side to ⅞". Spacing between boards must not exceed 1½". Surfaced sides of boards must be up.

Bottom Deck: Two end boards 1 x 6" surfaced one side to ⅞". Other boards 1 x 4" and wider, surfaced on one side to ⅞". Space between outside boards and next inner boards to be 7". Surfaced side of boards to be down.

Stringers: Three 2 x 4 x 48", surfaced two edges to not less than 3¾". Stringers to be set in 3½" from side.

Nails: No. 6—2½" cement-coated drive screw nails only to be used in holes drilled in boards with proper size bit. Drilling is not necessarily required but splits because of nailing will not be acceptable. Two nails to be used in 4 to 6" boards. In wider boards space nails at 2" intervals.

Note: Stagger nails off center line to avoid splitting stringers. Chamfer outside top edge on both outside bottom boards for easy entry of truck forks.

—o—

A new insulating varnish, formulated without the use of critical materials yet said to be equal to prewar varnishes, is announced by Watson-Standard Co. Pittsburgh. A highly technical specialty insulating varnish must have many important properties such as heat endurance, resistance to fresh water, sea water, acids and alkali, as well as high dielectric strength. The new product designated by the manufacturer as "W 2315", makes use of available materials without sacrifice of any of the requirements of good insulating varnish.

Announcement

NORTON GRINDING WHEELS OF #57 ALUNDUM ABRASIVE now available to everybody

DEVELOPED by Norton research several years ago, 57 Alundum abrasive was an immediate and outstanding success in wheels for cylindrical, centerless and internal grinding. Limited production facilities, however, made it necessary to restrict the use of the new wheels to those critical war jobs for which their characteristics were most needed.

Now increased production capacity makes it possible to offer Norton grinding wheels of 57 Alundum abrasive for all jobs.

57 Alundum abrasive combines the fast, cool cutting action typical of 38 Alundum abrasive with the durability and toughness of regular Alundum. Thus these new Norton wheels stay sharp longer and hold their shape better. Dressings are few and heavy cuts without burning are possible.

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NORTON ABRASIVES

Successful procedure worked out for using more alloy scrap in

MAKING ELECTRIC FURNACE STEEL

By VICTOR E. ZANG
Unitcast Corp.
Toledo, O.

A PROCEDURE has been developed for handling larger percentages of alloy steel scrap in electric furnaces as a means of relieving the pressure on carbon steel scrap and will be outlined here for the benefit of other companies in the same field.

Back in October, the scrap representative of the Ferrous Foundry Advisory Committee of the War Production Board pointed out that a surplus of alloy scrap existed. Foundries with smaller electric melting units being faced with the problem of using their own remelt, plus 8 per cent alloy turnings in alloy melts under WPB Order M-21-a, frowned on using additional alloy scrap. The melting of these turnings imposed considerable hardship and chance, due to bulk (low poundage per cubic foot), erratic analysis, and retained cutting oils.

Bulk (Low poundage per cubic foot of charged material) caused back charging with loss of time and hazards from flying molten metal.

Erratic Analysis gave difficulty in figuring analysis, and thereby limited the amounts of alloy steels that could be used in conjunction with them.

Oils, unless degreased or burned off, caused increased carbon with increased melting and refining time, as well as possibilities of sulphur pick-up.

Late in November we received a 90-day relief from M-21-a to experiment on making alloy steels with the maximum alloy steel scrap charges. A resume of 100 such heats melted in a period of 17 days is shown in Table I.

TABLE I

Scrap Charge	Pounds	Percentage
Foundry remelt alloy	490,500	41.9
Foundry remelt carbon	24,500	2.1
Purchased alloy	544,900	46.5
Purchased carbon	112,000	9.5
Total scrap	1,171,900	100.0

Use of some carbon steel scrap is necessary to adjust chemical compositions, as these heats are melted without the use of any additions of virgin alloy.

When first starting this procedure, considerable difficulty was encountered in adjusting charges to maintain a desired composition. However, we feel that this is now well overcome, and charging instructions are given so as to maintain a specific range that meets all physical requirements.

The chemical range is listed in Table II with the percentage of "withins", for each major element.

It will be noted that nickel is the hardest element to control, the reason being a variation of as much as 0.30 per cent of this element in scrap steels when purchased under the same specifications, while other elements maintain a much narrower range. To show chemical variation, typical average analyses of 11 cars of scrap received during this trial are given in Table III.

Sampling procedure has been found important in the maintaining of proper scrap piles and charges. When cars contain only one type of scrap, two samples are selected and analyses run in duplicate on each sample. When several types of scrap are received in one car, two samples of each type are analyzed in duplicate and the entire lot averaged.

Scrap is then grouped according to the average analysis. For example, in the preceding analyses we have used three groups.

Scrap is charged by magnet into charge buckets, in accordance with instructions issued by the laboratory. Charging instructions vary according to analysis of scrap, and the quantity of foundry alloy remelt to be consumed. A typical charge is given:

	Pounds
Foundry alloy remelt scrap	4,000
Moly Plate (purchased) scrap	1,000
SAE 4340 (purchased) scrap	4,000
NE 8600 (purchased) scrap	1,000
Carbon (purchased) scrap	2,000
Total	12,000

This type of melting has produced a steel that meets all QQS-681-B, 4B series and 4C series up to 4C3, consistently and regularly, by variation of heat treatment according to the physical properties desired. Since using this practice we have been placed on a quality control basis for 4C2 steels by the Ordnance Department after testing 20 consecutive heats. A fairly close control of physical properties can be obtained by controlling the brinell hard-

(*Please turn to Page* 110)

TABLE II

Element:	Carbon	Manganese	Nickel	Chromium	Molybdenum
Range:	0.27-0.37	0.75-0.85	0.60-0.90	0.40-0.60	0.17-0.27
Withins:	93%	92%	67%	98%	95%

TABLE III

Car	Specifications	Nickel	Chromium	Molybdenum
A	SAE 4340	1.62	0.62	0.29
B	SAE 4340	1.84	0.66	0.24
C	SAE 4340	1.86	0.68	0.25
D	SAE 4340	1.68	0.60	0.19
E	SAE 4340	1.56	0.58	0.35
F	NE 8600	0.42	0.32	0.32
G	NE 8600	0.50	0.36	0.33
H	NE 8600	0.38	0.33	0.20
I	Moly Plate	.	.	0.29
J	Moly Plate	.	.	0.30
K	Moly Plate	.	.	0.21

TABLE IV

Brinell Hardness	Tensile	Yield	Per Cent Elongation	Per Cent Reduction of Area
207	100,000	75,000	25	45
217	105,000	77,000	23	45
228	110,000	85,000	19	45
241	115,000	90,000	19	42
255	120,000	95,000-100,000	17	40
269	125,000-130,000	105,000	17	35

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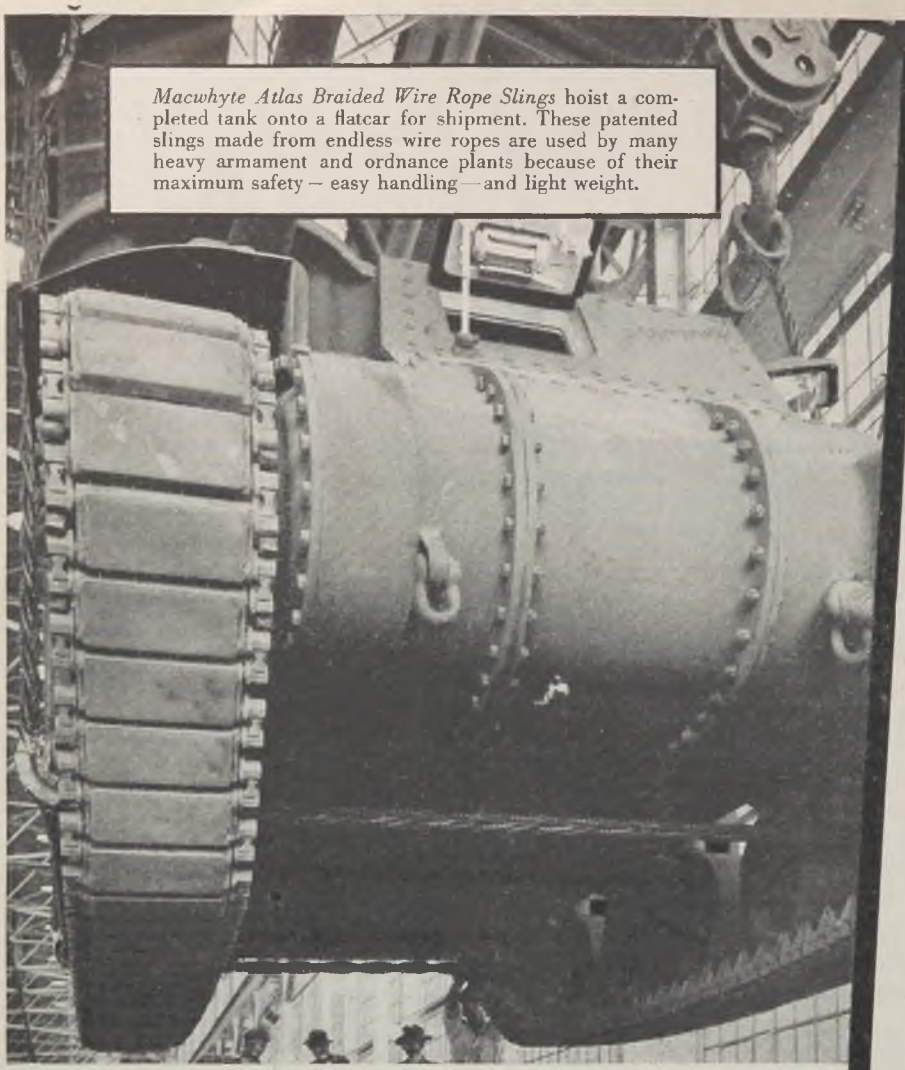

Macwhyte Atlas Braided Wire Rope Slings hoist a completed tank onto a flatcar for shipment. These patented slings made from endless wire ropes are used by many heavy armament and ordnance plants because of their maximum safety – easy handling – and light weight.

A Pair of Macwhyte Y-Guard Slings handle oil field casing quickly and easily. Notice no seizing is necessary in the eyes of this type of sling—no splices to become dangerous jaggers and injure workmen's hands.

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A Fixture for Contour Machining

By ROBERT MAWSON

CONTOUR MACHINING is now considered almost standard practice in modern machine shops. With the type of machine tool fixture illustrated, intricate shapes can be produced at low cost with minimum waste of material. This fixture, designed to make concave and convex shapes, is believed to be capable of meeting such requirements.

The device consists of a base "F" which is slid over the machine table and locked in position with two thumb screws "G". The position lengthwise on the table is determined by the length of the piece to be machined.

The stud "H" in one end of the long lever "K" is set to suit the radius of the machined part it is desired to obtain. Graduations are marked on the face of the base as shown, to agree with the radius from the edge of the cutting saw to the center of the stud in "H". An index line on the boss, also at "H", assists the operator in making the desired setting.

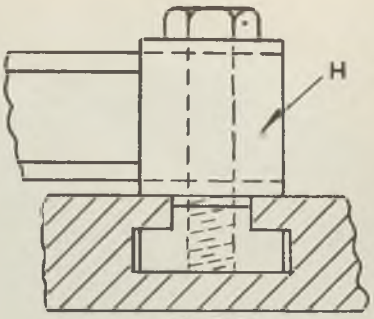
The part to be machined is held by two clamps "E", one type being illustrated.

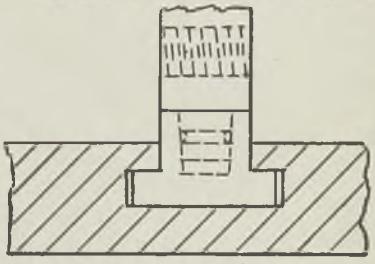
The machine then is started in operation and the operator feeds the piece against the saw by means of the screw and handle "J". The pressure of this screw forces the lever "K" to fulcrum on the stud, and as the piece being machined is attached to this lever, a contour surface is machined with the same radius at which the stud is located from the edge of the cutting saw.

It might be added that the clamps do not need to be heavy in construction, as they act more in the capacity of locating mediums. The reason for this is that the cutting pressure is downward. Because it has been found that these saws do only a small surface cutting, light clamps are just as satisfactory as the heavier and rugged design. To prevent the saw from binding in an advanced stage of cutting a narrow section similar to the one shown, a small steel wedge may be tapped lightly into the mouth of the kerf. This is usually unnecessary with a wider work piece, for the weight of the two pieces made by the cut prevents them from springing toward the saw. The wedge also comes into play in cutting a narrow section to facilitate clearing the path of the saw near the end of a cut. When 90 per cent of the cut has been completed, one clamp is loosened and cleared away (from left side of piece) and the wedge is placed under the piece. This prevents the saw from striking the clamp or from coming in contact with the table of the fixture.

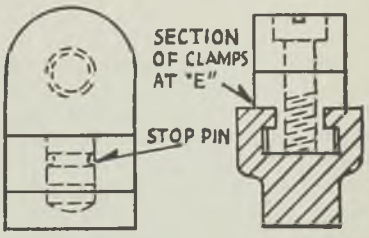
Accompanying diagrams detail the different parts of the fixture, which should present no difficulty to any shop desiring to make and use it. By careful manipulation and a little practice, it is possible to produce concave and convex surfaces blending into each other and to make other simple and inexpensive clamps to suit the particular part.

Before this fixture was made and placed in service, the operator used the method of laying out the various shapes either by marking off the shape on the part or by means of a template. This method, it may be seen readily, was both slow and costly.

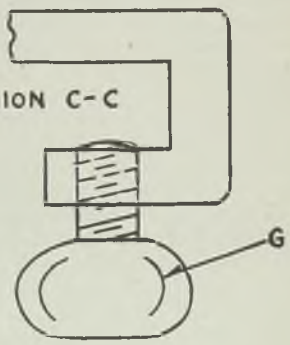


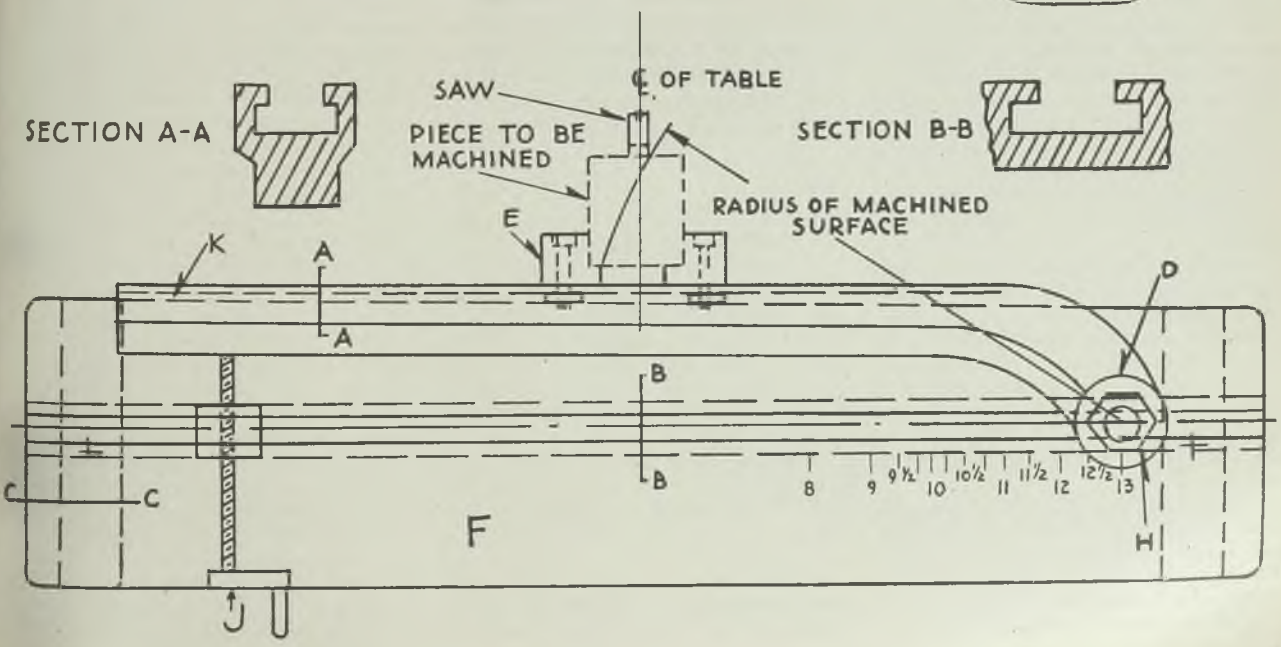


SECTION AT "D"



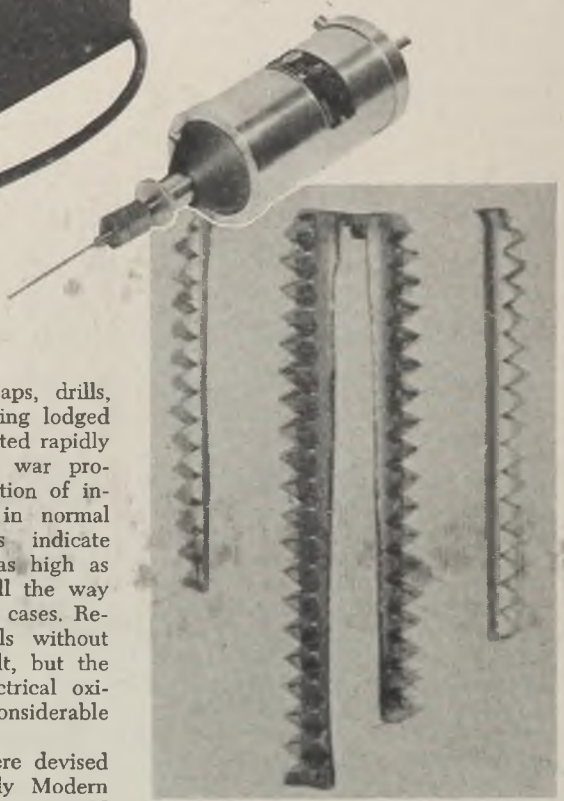
MAKE SHANK TURN IN HOLE. THIS WILL ALLOW SCREEN TO ADJUST ITSELF AS THE LEVER "K" IS FED IN.





"Disintegrator" Drilling

. . . . . removes broken drills, taps, reamers without damaging work piece



INSTANCES of broken taps, drills, reamers, and the like becoming lodged in machined parts have mounted rapidly because of the pressure of war production and the high proportion of inexperienced workers. Even in normal production times, estimates indicate broken taps and drills ran as high as 1 per cent; now they run all the way up to 70 per cent in extreme cases. Removal of these broken tools without damaging the part is difficult, but the development of a new "electrical oxidation" technique holds considerable promise.

Method and equipment were devised by the Elox Corp., (formerly Modern Methods Experimental Co.) Detroit, and involve essentially the electrical "disintegration" of an annular ring of metal squarely in the center of the tap or drill lodged in a hole, permitting the center core to be removed, the sides collapsed and picked out.

The process likewise is adaptable to "electric boring" of holes in hardened pieces without disturbing the structure of the metal. Because the burning or disintegrating process proceeds slowly and is continuously quenched in a flow of water, there is no heating or annealing effect from the action.

Equipment, which is readily portable, comprises the following essential elements:

—Disintegrator head, carrying the electrode and a backing solenoid device for regulating the contact of the electrode with the piece being treated. This unit is mounted on any standard type of drill press or other machine shop tool with a throat deep enough to accommodate the part and with means to feed the head into the broken tap or drill.

—Transformer, which is plugged into 110/115-volt, 50-60 cycle alternating-current power line, stepping down this current to either 4 or 7 volts to supply the disintegrator head.

—Cooling system, with hose lines, to supply water at 30 to 40 pounds pressure to the hollow electrode.

—Various sizes of disintegrating electrodes to handle different sizes of taps and drills. Each is hollow to permit a stream of water to flow out the end and also to allow the center core of the tap or drill to pass up into the electrode as it feeds down through the jammed tool.

Here, briefly, is how the equipment is operated: The work is placed on the table of the machine on which the disintegrator head is mounted. The broken tool is aligned and centered under the suspended electrode tip. Power and water are turned on, and the tip lowered sufficiently to make contact with the work, whereupon the disintegrating action starts, with small arcs observable at the start around the point of the electrode. When the center or core of the tool has been removed, after the electrode has been fed completely through, the strips of thread of the tap or spiral cutting edge of the drill are picked away from the wall of the hole, collapsing easily if the proper size electrode has been used and the axis of the tool aligned with that of the electrode.

The operation can be performed wherever it is possible to reach the work with an ordinary drill. Any casting or machined part containing broken tools can be reclaimed, regardless of the material in the part. The harder the material of the broken tool, the better the disintegration seems to be. Working temperature never rises much over 130 degrees, so there is no problem of distortion of the part.

As to the mechanics of the disintegration process, when the electrode makes contact with the tap or drill lodged in a hole, the electrical circuit is completed, permitting passage of a high-amperage low-voltage current, short circuiting being avoided by the proper balance of resistance, reactance and impedance of the electrical circuit. The heavy current creates a small hot spot on the metal at the point the electrode touches. The solenoid acts to raise the electrode at this stage, thus striking small arcs which may break down some of the water flowing out the electrode to form hydrogen and oxygen, the latter speeding up the oxidation of the steel being penetrated. At the same time the expansion and contraction of the steel resulting from the heating by the current and immediate water quenching, a cycle repeated at a rate of something like 120 times a second, tends to break off particles of the steel which are flushed out by the water stream.

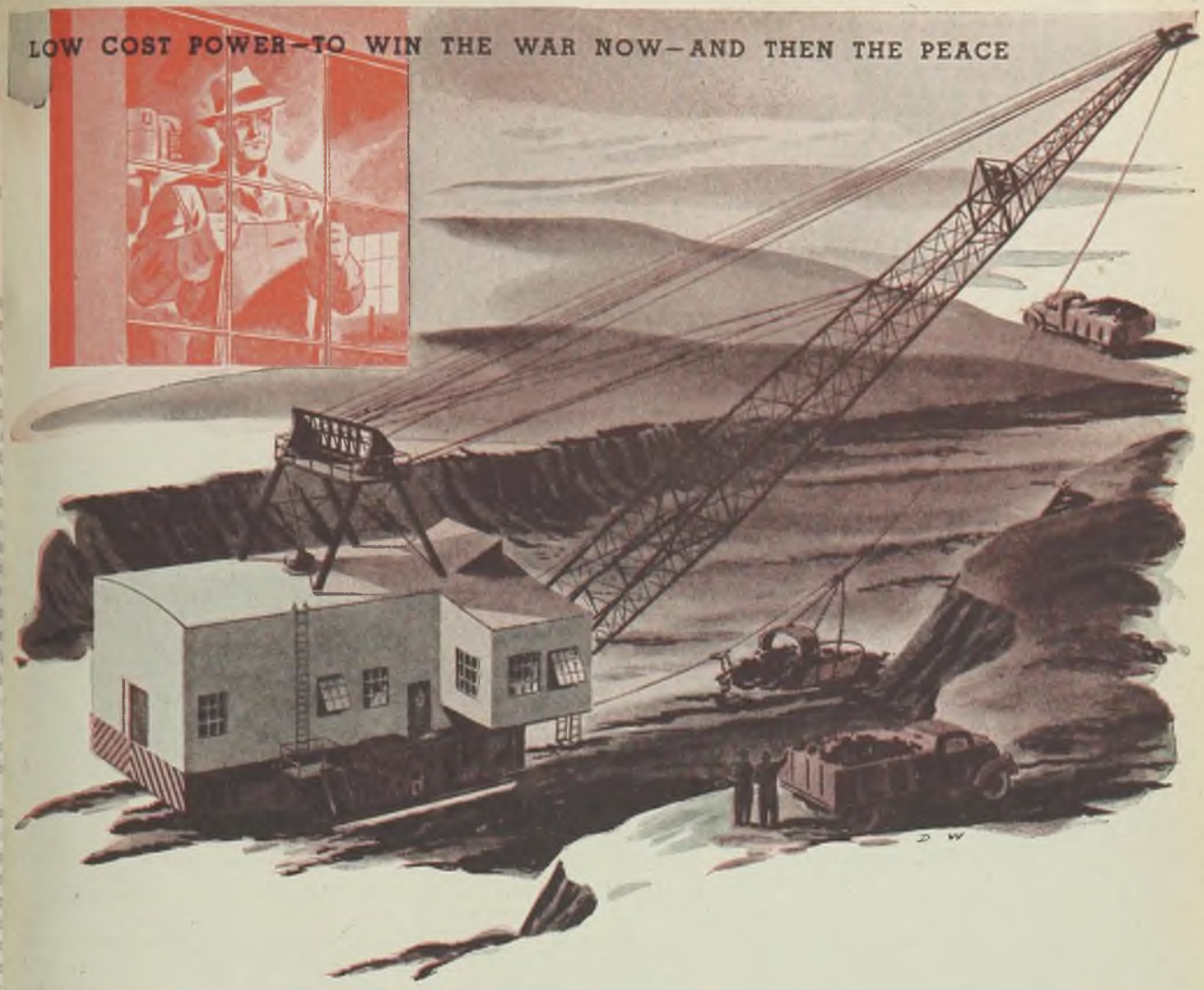
No particular pressure is required back of the electrode, and it feeds down through the tap or drill at a rate of approximately 1/32-inch per minute.

The equipment may be put to a number of uses other than removing broken taps or drills. As mentioned before, it can be used to drill holes in hardened steel parts where such holes may have been forgotten in original machining operations. Or it may be used to remove broken studs, though in this case it is, of course, not possible to collapse the threaded portion of the stud. Practice here is to insert an expander in the disintegrated hole in the center of the stud and back it out.

Fig. 1 (Above)—Illustrated are these four cutting edges of a broken tap after center has been "disintegrated" by electrical oxidation

Fig. 2 (Above left)—Disintegrator head, right, with electrode chucked in position is mounted vertically on any standard drill press. Low-voltage high-amperage current is fed from transformer at left to work point

LOW COST POWER—TO WIN THE WAR NOW—AND THEN THE PEACE



Paul Bunyan's Coal Shovel

THIS 350-ton giant could easily qualify as Paul Bunyan's coal shovel. Forty-five feet high, with a 160-foot reach and a 6-cubic-yard bite, it scrapes up as much as 1000 tons a day.

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Drawbenches . . .

Their Operation, Uses and Drives

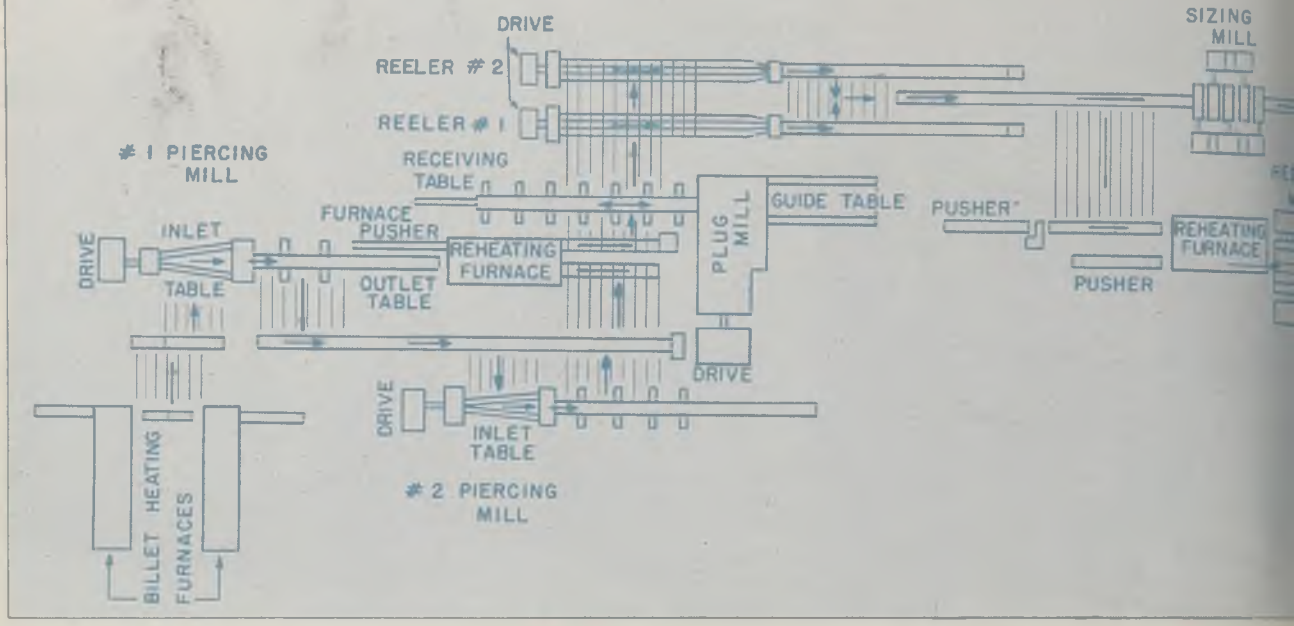

Fig. 11—Layout of seamless tube mill showing application of drawbenches

Part II

Drawing Ferrous Material: In working steel tubing, bars or rod, common practice is to hot work the material to near the required dimensions. The drawbench then cold works the material to the finished dimensions. To obtain the required properties in some tubing, however, it is necessary to make much of the reduction by cold drawing. As in any cold working process, there is a limit to the amount of work which can be done on the material without annealing, and it is therefore necessary to work the material to its limit, anneal it and then work it again. This process is followed until the desired finished dimensions and metallurgical properties are obtained.

A larger percentage of the steel tubing worked by drawbenches is produced in the seamless tube mill. To show how the drawbench is used in the production of finished tubing, Fig. 11 shows part of the layout of a seamless mill. This sketch is not intended to imply that all mill output goes through the drawbench; a large portion of the output from such a mill may be finished by other methods.

From one of the billet heating furnaces the billet is conveyed to No. 1 piercing mill. In going through this mill the work done on the billet raises its temperature making it unnecessary to reheat for No. 2 piercing mill. This mill lengthens the pierced billet, after which it is conveyed to the reheating furnace. From here the tube is worked first by the plug mill, and then by the reelers. Depending upon the desired finished diameter the tube then is directed through the sizing mill or the tube reducing mill. Tubing above about 3 inches diameter is worked by the sizing mill, while the reducing mill brings the tubing down to diameters as low as 1½ inches.

Transferred to Cooling Rack

From either of these mills the tubing is conveyed across the cooling rack to the first storage cradle. Tubes to be drawn then are pointed, pickled and washed. Some processes require dipping the tube into a lubricant before it is taken to the first drawbench; with other methods the lubricant is applied when the tubing starts through the die.

The first bench will make one or more draws after which the tubing usually will be annealed and sent to a smaller bench.

Welded tube mills also furnish a large amount of the steel tubing used in our war machines. When special dimensions or shapes are required the drawbench can profitably be used to finish the welded tubing to specifications.

Drawing Nonferrous Material: Since there is a practical minimum diameter at which tubing can be pierced or extruded, and since the most uses for this type of tubing are in the smaller diameters, the copper and brass industry uses a large number of drawbenches for reducing the tubing from the pierced or extruded diameter to its finished dimensions. Thus, a common copper and brass tube mill might have a 200,000-pound drawbench, one 100,000-pound, one 75,000-pound, three 50,000-pound, four 30,000-pound, five 20,000-pound, and five 10,000-pound benches, as well as possibly a number of smaller units. The tubing is drawn successively smaller through this series of benches. During the process the material must be repeatedly drawn and annealed, and, depending upon the finished length and diameter reduction, the original pierced billet may finish as two or more tubes on the final drawbench.

Aluminum and magnesium tubing is produced almost exclusively by extrusion. To obtain finished diameters and desired metallurgical properties, tubing then may be worked by drawbenches or tube reducing machines (The Rockrite process), and annealed. Most plants use both methods of reduction, since the two frequently are used in combination. A typical extrusion plant will have about the same type and number of drawbenches as a copper and brass tube mill of the same output, but the annealing and aging processes differ.

A majority of the tube benches put into service since the start of the war

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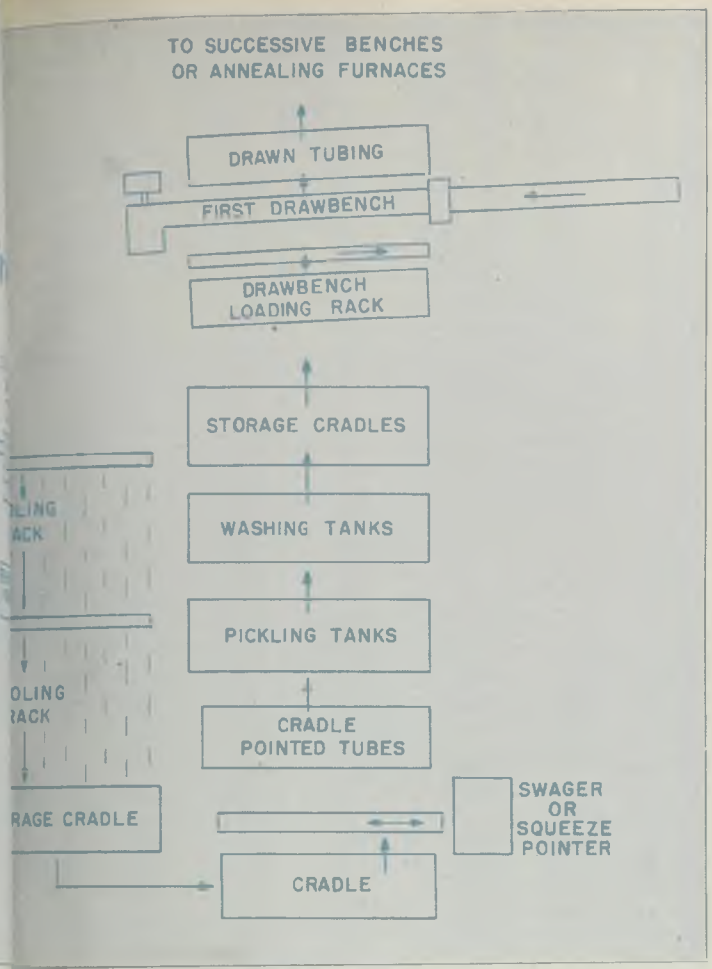
In this article, the second in a series of three, the author draws attention to seamless tubes cold finished on drawbenches, the nonferrous industry's use of tube benches and the newly developed continuous drawbench which finishes two tubes at once though it works four tubes most of the time. Last week's installment dealt with twin-mandrel and bar type benches, their ratings and component parts



are installed in extrusion plants. Bar-benches are also widely used in the nonferrous metalworking industry.

A Continuous Drawbench: A unit of this type has recently been developed which eliminates the usual carriage return motion. Fig. 12 illustrates the operation of this bench. None has been installed to date, although a working model has been built.

On this machine a four-hole die is used; each carriage draws two tubes or bars at any one draw. Tong positions are staggered as indicated in Fig. 12. Carriages A and B are each drawing two tubes, carriage A from the upper two dies and carriage B from the lower two. At the end of the draw, the tubes will be released from carriage B and will fall into the cradle below. From this point carriage B is conveyed to the elevator which lifts it to the return track where it will in turn be brought to the opposite end of the bench for lowering to the drawing level. At about the time carriage B completes its draw, carriage D will be in position to start the next draw. Thus four tubes are being drawn most of the time, with a minimum of two tubes at any time.

This bench will have simplified electric equipment since no carriage drive is required and since the chain operates at a constant speed. However, two elevators are required, one for raising, the other for lowering the various carriages. And, of course, automatic control will be required.

Electric Equipment: Drawbench electric equipment consists essentially of the main drive, carriage return, and other auxiliaries. Main drives may be broken up roughly into the following different types: (1) Single speed alternating-current drive; (2) two, three, and four-speed nonaccelerating alternating-current drives; (3) two and four-speed accelerating type alternating-current drives; (4) wound-rotor accelerating type alternating-current drives; (5) alternating-current motor with eddy-current clutch for acceleration; (6) alternating-current motor with hydraulic unit for acceleration; (7) constant potential direct-current accelerating drive; and (8) adjustable voltage direct-current drive.

Single-Speed A-C Drive: This single-speed squirrel cage induction motor drive has the advantage of simplicity and minimum cost, but the necessity for hooking and drawing at the same speed cuts down the possible drawing speed and therefore the rate of production. For certain types of benches, such as for instance those used for some copper and aluminum tubing, it is possible to hook at speeds of from 100 to 150 feet per minute, which is a reasonably high drawing speed. An average hooking speed is about 50 feet per minute.

In selecting the horsepower rating for a single-speed drive, the motor does not have to furnish the power required for acceleration and on a duty cycle basis, can draw loads considerably in excess of its normal rating. For instance, if the bench requires about 100 horsepower at rated drawing load, the duty cycle will probably be such that a 75-horsepower motor can adequately meet the normal operating conditions. Before this selection is made, however, it is well to refer the worst possible operating duty cycle of the drive to the electrical manufacturer for his recommendations.

With the single-speed drive some additional flexibility often is built into the drive mechanically by furnishing a gear change to provide two operating speeds. All drawing would still be at the hooking speed in either case.

Multispeed A-C Motor Drive: This type of drive has the same disadvantages that the single-speed drive has, except that greater flexibility is obtainable. It usually will be found that a

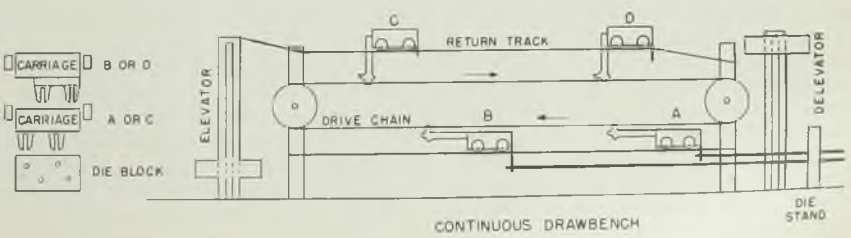


Fig. 12—Recently developed continuous drawbench equipped with a 4-hole die. Each carriage draws two pieces at one draw

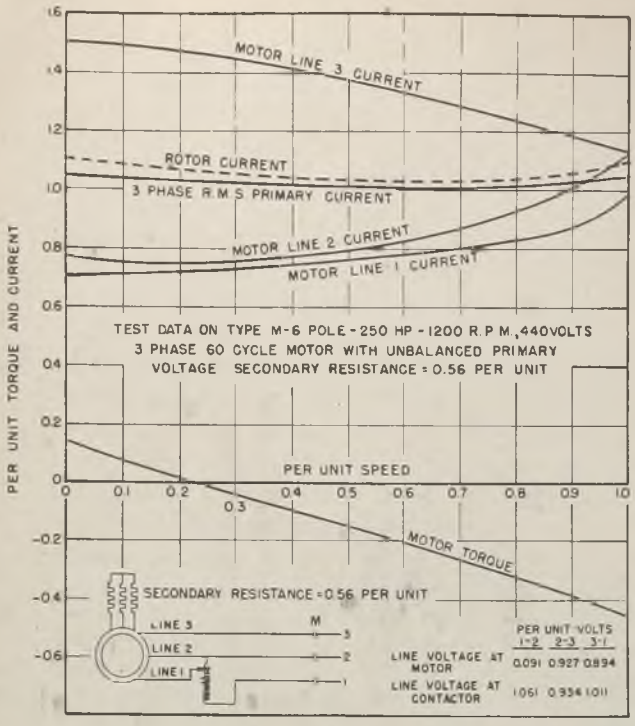


Fig. 13 — Speed torque and speed current curves for unbalanced voltage condition

multispeed motor can be provided at a lower cost than the cost of providing a mechanical gear change.

Depending upon the type of work to be done, the drive may be either constant torque or constant horsepower, and for larger size benches where heavy tubing is to be drawn at the slowest speed, it is sometimes advantageous to choose a constant horsepower motor. If this choice is made and the horsepower rating at base speed corresponds to rated pull on the bench, lighter tubing must be drawn at higher speeds. This method of selection does not take advantage of the full capacity of the bench, but may prove to be the most satisfactory from an operating standpoint.

Another method of selection is to choose a multispeed motor which will be oversize at the lower drawing speeds, but will be at about the proper rating for some higher operating speed. This has the disadvantage in that the mechanical equipment may be greatly overloaded at some low drawing speed when an oversize tube should happen to be drawn. In the case of the constant torque motor, however, if the proper rating is selected for any given speed, the same pull can be made on all speeds.

Two or Four-Speed A-C Accelerating Drive: On some sizes of drawbenches, multispeed alternating-current squirrel-cage induction motors have been used successfully for accelerating service, but this type of drive has disadvantages and limitations. Thus, some care must be used in choosing an alternating-current accelerating drive, and in the study of this problem, many interesting motor characteristics and capabilities can be developed.

Before applying a multispeed squirrel-cage induction motor for accelerating service, the worst possible operating duty cycle should be checked against the capability of the motor. The motor rotor must absorb and dissipate all slip losses and is therefore a possible source of trouble. Operating conditions have been encountered, however, where the rotor is able to dissipate its heat, but where stator overheating has resulted. This can occur if a motor is not designed for the application, or it can occur on small motors drawing light loads with frequently repeated acceleration. Where this operating condition can be predicted, however, the motor can be bettered by improved design and by furnishing Class B insulation for the stator. Sooner or later with this type of operation, however, trouble usually does occur with the motor rotor, since under such conditions it is probably operating at the limit of its thermal rating.

The inertia of the motor and its connected load must be carefully checked against the requirement for acceleration under load, which in turn affects the frequency of acceleration, or in terms of production, the number of tubes per hour which can be drawn.

Because of the frequent accelerating duty a specially designed motor with higher-than-normal slip should be furnished. In the smaller ratings, the cast aluminum rotor will usually meet operating requirements, but for the larger sizes the brazed brass rotor is used. The brass rotor has a greater thermal capacity which may save a rotor burnout during, say, a short period of extreme overload, or possibly a stalled condition.

Where difficulty is experienced with multispeed motors for accelerating service, the usual circumstances are: (1) That the motor has been greatly overloaded during brief periods of operation; or, (2) that the frequency of acceleration has been greater than recommended for the motor; or, (3) that the motor has been operated for too great a length of time under stalled conditions. Although any one of these conditions may last for only a short period, it may cause damage which does not appear at first, such as a partial rotor failure but which leads eventually to trouble and finally to complete rotor failure. In drawbench operation, it is not difficult for the operator to encounter such overloading conditions, and it is therefore important that operators be well educated as to the limitations of this type of motor, and the precautions which must be taken for its protection. Production schedules should be checked to make certain that the tubing to be handled by any particular bench is not too large, and that the tubing is long enough to limit the frequency of acceleration to a reasonable maximum.

In the operation of this multispeed motor, there are a number of ways in which it can be controlled. The drive can be provided with torque continuity by leaving the low-speed contactor energized a short interval of time after the high-speed contactor has picked-up. Under some conditions of tube drawing, some operators feel that if torque continuity is not provided, the tube may be "necked" at the instant the high-speed contactor is energized because of the change from zero applied torque to maximum torque. In most cases, the inertia of the drive is sufficient to carry over the speed change smoothly from low to high without damaging the tube.

Inrush Is High

The current inrush during the interval both contactors are energized is high, since both windings are working against each other in attempting to establish the two synchronous speeds, in addition to carrying the normal accelerating load. This is a disadvantage, both because of the additional loss and motor heating involved, and also because of the resulting slower motor acceleration.

The need of torque continuity requires a two-winding design for two-speed motors; this usually will result in a larger frame size because space must be provided for two separate windings. Providing torque continuity also results in increased motor losses and should, if possible, be eliminated.

In comparing the single-winding and two-winding two-speed designs, the two-winding motor is superior in performance for straight accelerating service; thus if it is known that it will never be necessary to draw continuously at low speed above motor rated torque, this design will be superior. Under this condition an intermittent rating will be assigned the motor at low speed. Class B insulation can be used to good advantage, or forced ventilation may be used if the motor is operated continuously on low speed.

With the normal drawbench, heavier tubing is drawn at base speed without accelerating the chain, and the root-mean-square load on the motor can be expected at least to equal the low-speed horsepower rating. Thus, since the single wind-

(*Please turn to page* 116)

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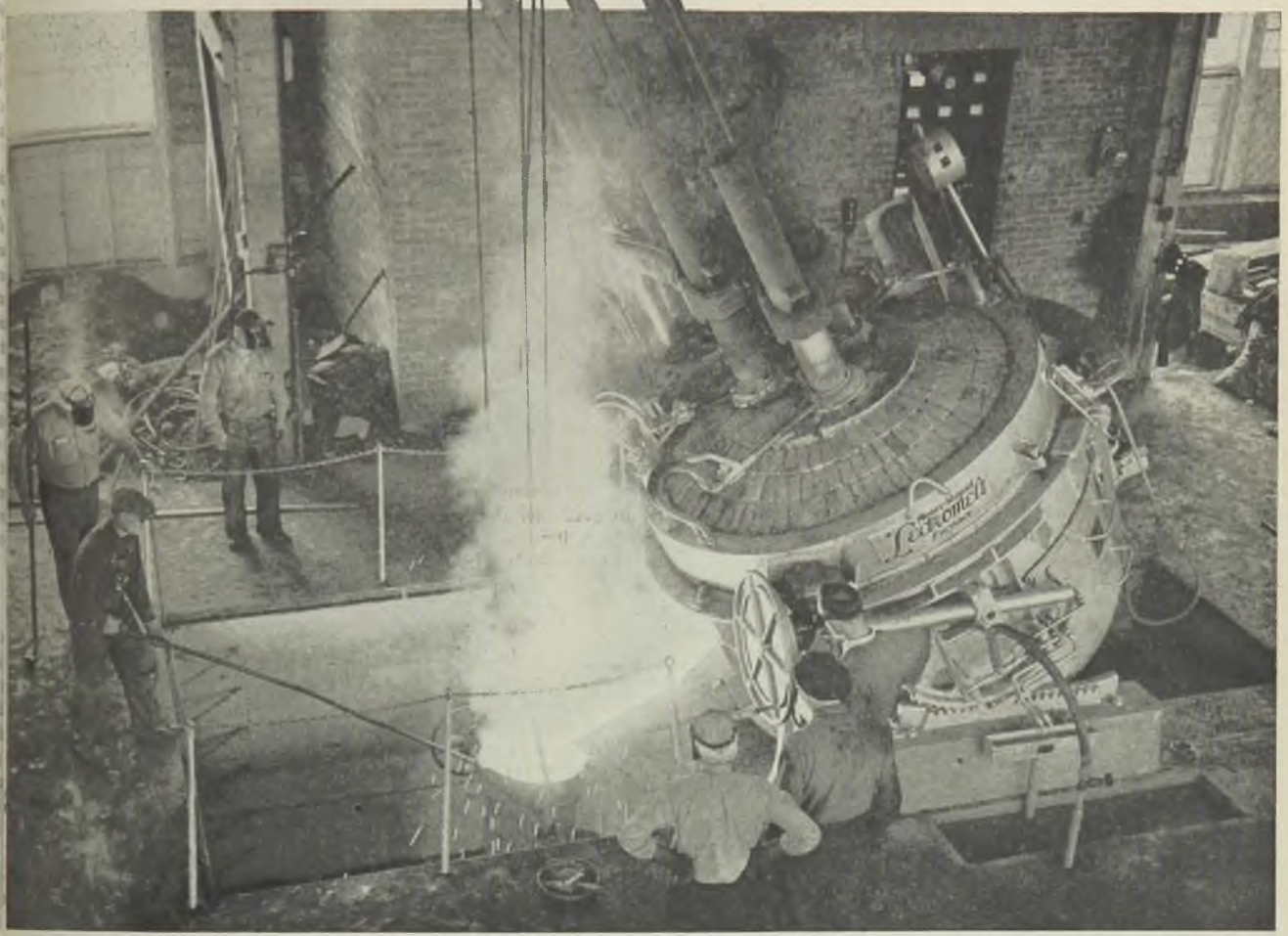

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Electric Resistance Brazing

Because they are typical of the electric resistance brazing of many types of joints, improved practices developed for making electrical connections to commutators of motors and generators are detailed here. Good joints are made without expensive solders, yet provide stronger and better connections

By C. LYNN
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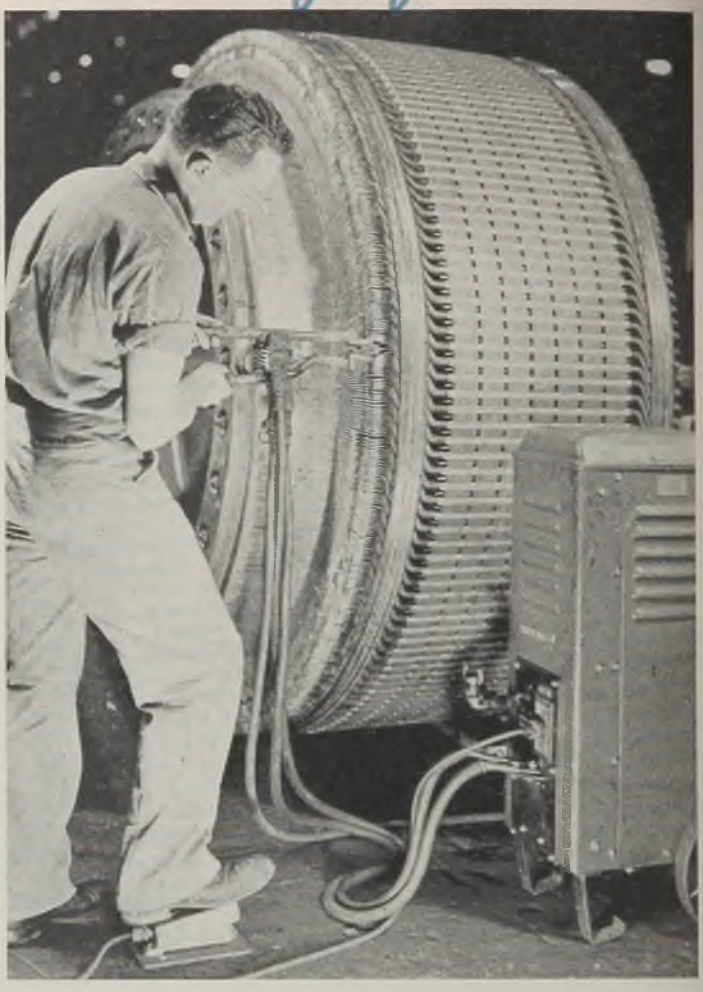

Fig. 1—Portable hand-operated tong brazing outfit being used to join armature coils to necks

SOLDER has been used universally for making the connections between armature coils and commutator necks, and between armature cross connections and armature coils on direct-current motors and generators ever since their development. Solder has been used because solder joints are easily made and provide good contact when correctly made. Until very recently, no other commercially satisfactory means was available.

Soldered joints, however, have three fundamental imperfections: The joint is relatively weak mechanically, the strength decreasing rapidly with increasing temperature due to the nature of the material; joints will not stand high temperature since ordinary 50-50 solder melts at approximately 183 degrees Cent.; and, there is no known way of telling whether a good soldered joint has been made.

On some machines and on practically all machines with class "B" insulation, which includes all railway equipment, these joints have been made with pure tin instead of solder on account of the higher temperatures at which these machines operate. Since tin melts at 232 degrees Cent., higher operating temperatures can be employed when it is used alone.

To conserve tin, Westinghouse started developing a brazed type of joint for these connections. Similar efforts made in years past were never successful. Brazing with a flame is impractical on account of the spread of heat and accompanying damage to insulation and adjacent parts.

Figs. 2, 3, 4, 5 and 6 show various types of commutator necks. Figs. 2 and 3 are standard types of construction used on soldered joints. Fig. 2, the most common, employs a neck made of a double thickness of copper with the outer periphery opened to form a space for the insertion of the armature coil ends. This neck may be of two pieces, riveted or spot welded together, or may be of one piece folded to give two thicknesses. The second type, Fig. 3, used when the commutator bar pitch is very thin, employs only a single thickness of neck material with an additional piece riveted on to form an opening for the armature coil ends. Filler pieces of copper of the same thickness as the armature coil ends are used as indicated.

In Fig. 4, armature coil ends are simply brazed to the standard type of neck. Copper filler pieces have been omitted. In brazing this type of joint, thin strips of Phos-copper, a phosphor copper brazing alloy, approximately 0.015-inch thick with a width equal to approximately half the width of the neck in a direction parallel to the shaft are inserted between each side of the armature coil ends and the neck. Current from a low-voltage transformer is then applied with pressure to the joint by means of carbon-tipped brazing tongs. After the brazing alloy has melted, at 815 degrees Cent., and flowed over the surface to be brazed, the current is stopped but the pressure is maintained till the joint cools. In normal production, a blast of compressed air is applied directly to the joint whenever current is not flowing. Thus, when the circuit is interrupted at the end of the melting period, this air rapidly cools the brazed joint.

An improvement consists of blowing a small stream of air in a radially inward direction against and between the armature conductors just back of the commutator necks. This keeps the conductor cool; eliminates damage to insulation. In making a joint in this manner, it is possible to braze armature coils with class "A" insulation without damage to the insulation. Since the armature conductors are brazed solidly to the commutator necks, no spacers are necessary between conductors or below the bottom.

It should be pointed out that electrical resistance of a brazed joint is somewhat