Retirement age worker continues at vital war production task, p. 41

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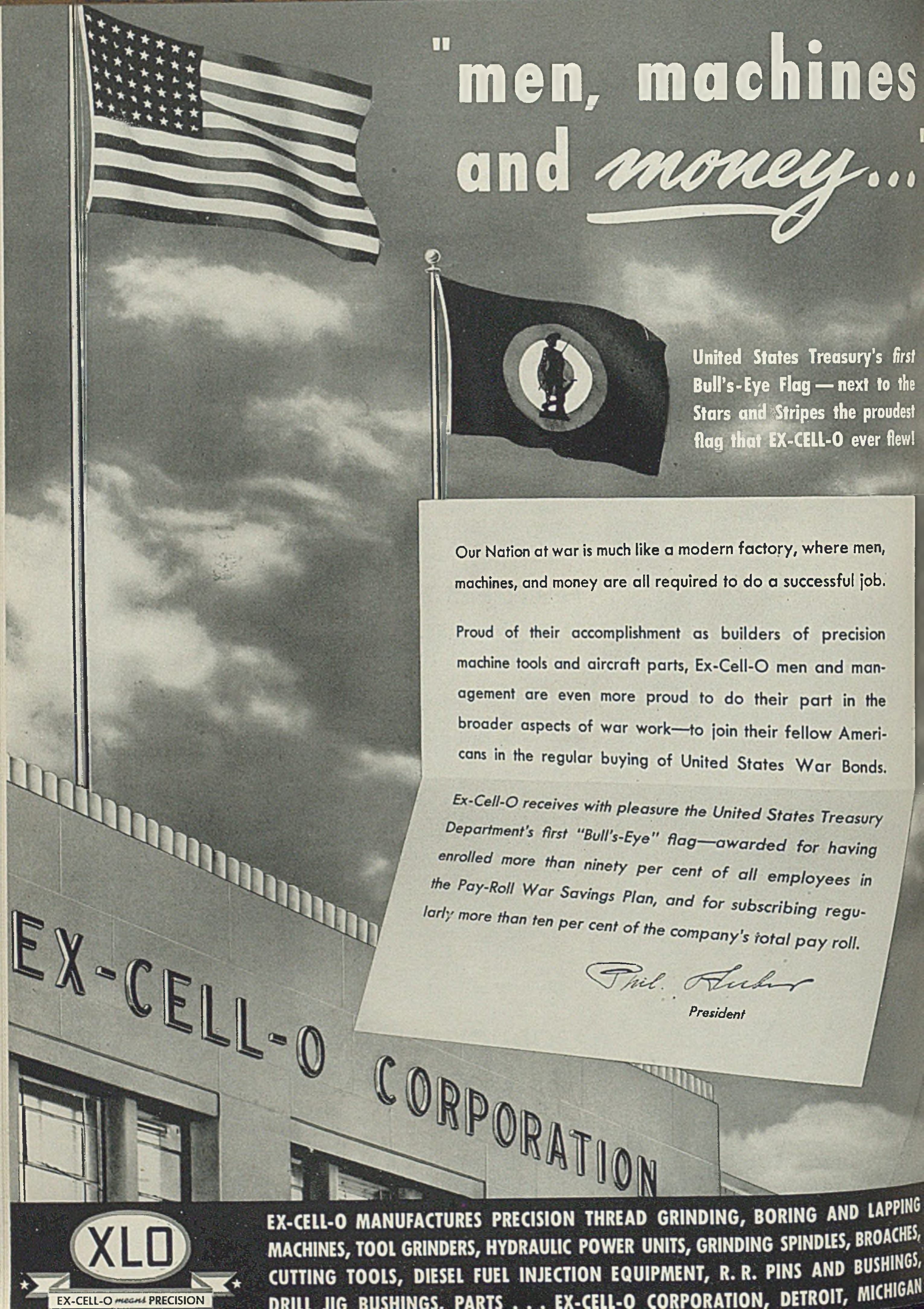

"men, machines and money..."
United States Treasury's *first* Bull's-Eye Flag — next to the Stars and Stripes the proudest flag that EX-CELL-O ever flew!
Our Nation at war is much like a modern factory, where men, machines, and money are all required to do a successful job.
Proud of their accomplishment as builders of precision machine tools and aircraft parts, Ex-Cell-O men and management are even more proud to do their part in the broader aspects of war work—to join their fellow Americans in the regular buying of United States War Bonds.
Ex-Cell-O receives with pleasure the United States Treasury Department's first "Bull's-Eye" flag—awarded for having enrolled more than ninety per cent of all employees in the Pay-Roll War Savings Plan, and for subscribing regularly more than ten per cent of the company's total pay roll.
President
EX-CELL-O CORPORATION
XLO
EX-CELL-O *means* PRECISION
EX-CELL-O MANUFACTURES PRECISION THREAD GRINDING, BORING AND LAPPING MACHINES, TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES, BROACHES, CUTTING TOOLS, DIESEL FUEL INJECTION EQUIPMENT, R. R. PINS AND BUSHINGS, DRILL JIG BUSHINGS, PARTS . . . EX-CELL-O CORPORATION, DETROIT, MICHIGAN

HIGHLIGHTING

this issue of STEEL

MANPOWER Industry hasn't seen anything as yet in the form of labor shortages. That is a safe conclusion to be reached as a result of findings to date by the War Manpower Commission and the Army's Selective Service system. To raise an army of 10,000,000 men the Army and Navy will cut deeply. Dependency and occupation are being given less consideration. The plan is to draft every able-bodied man including those in essential jobs. The situation will be aggravated further by a "draft labor" law now in preparation under which the voluntary system of employment will be replaced by a compulsory system under which the government plans to make maximum use of all employable men and women to the maximum possible extent (p. 50).

All employers should read the article by General Hershey in which he calls on them immediately to make inventories of their personnel and launch programs to train replacements for those workers to be absorbed in the military draft (p. 40). The importance of acting now on General Hershey's recommendations is stressed by STEEL's editor-in-chief, E. L. Shaner, who points out that each individual employer bears a direct responsibility in helping to solve the overall problem of fully mobilizing our manpower (p. 39).

LABOR Subsidiaries of the United States Steel Corp. have agreed under protest to abide by the War Labor Board's award of a retroactive wage increase and union security including the checkoff. They took this action because "the country is at war" (p. 42). Otherwise the labor situation in the main is stable but an increase in wild-cat strikes and slowdowns is noted. A. H. Allen, STEEL's Detroit editor, concludes there is something basically at fault in the minds of laboring men and union leaders (p. 58). Absenteeism is increasing. As one manufacturer puts it: "The boys are making a lot of money and need time off to spend it".

Effectiveness of the co-operative management-labor apprenticeship plan at Murray Corp. Detroit, is proven by the fact that more than 50 per cent of the graduates hold supervisory positions. Details of the plan should be studied by other manufacters (p. 74).

PRIORITIES Concentration of authority to issue priority ratings, under Donald M. Nelson's new order is expected to enable steel mills to schedule steel rollings with considerably less confusion than in recent months (p. 133).

Wilful violations of priorities orders for selfish reasons has about vanished, it is learned at Washington. But many violations continue due to misunderstandings. Priorities officials caution manufacturers to read and re-read carefully the pertinent priorities orders. In many cases violations have resulted from mistaken advice given by customers, even from Army and Navy procurement officers. Where manufacturers have any doubts or uncertainties about permissable procurement under the priorities orders, they should ask questions of the WPB Priorities Division (p. 51).

CONSERVATION Details about the new AMS (Aeronautical Materials Specifications) steels are presented (p. 78). These represent selections of a limited number of compositions to meet all requirements for aircraft steels.

C. L. Clark writes on conservation of alloy steels in petroleum processing equipment (p. 86).

PRODUCTION Many new iron and steel production records were established in August (p. 44). Numerous ingenious techniques are employed to keep tonnage figures up. Relining time on one blast furnace was reduced 15 days by tapping the salamander (p. 67). The scrap outlook continues grave; inventories were increased last week but only slightly so (p. 133) and unless an improvement takes place stocks will run short in the winter months. Twelve new mines will raise iron ore output this year by 1,634,000 tons (p. 61).

To help solve production problems more industry advisory committees have been appointed (p. 54). Another approach is through increased use of production illustrations to facilitate training of green hands (p. 55). Shippers are fearful of the effects of the new "capacity loading" order and point out it needs revision (p. 60). The water transportation order has been amended to make for smoother operation (p. 61).

TECHNICAL Control of nickel electrodeposits in war work is discussed by F. P. Romanoff who explains methods by which such deposits can be produced to have exactly the desired degree of ductility, hardness and other properties (p. 98).

A monorail handling system with drop sections speeds sheet metal fabricating operations (p. 89) . . . E. W. P. Smith describes some important uses of welding in gas plant maintenance (p. 92).

STEEL
September 7, 1942

Manpower Shortage Ahead!

Much confusion has developed in connection with mobilizing the nation's manpower for war effort. The draft status of hundreds of thousands of young men is uncertain because the selective service machinery has not been administered uniformly in all sections. Attempts to encourage workers in less essential occupations to shift to jobs in munitions plants have not proved satisfactory. The entire problem of distributing manpower needs clarification.

This situation has reached a point where better defined policies and more decisive action by the government may be expected soon. In the meantime, industrial executives should not permit the present stalemate to blind them to the real threat of labor shortage which lies ahead.

Regardless of the confusion, a few facts stand out in clear relief. As Major General Lewis B. Hershey has pointed out significantly, "there are not more than sixty million people in this country who are capable of effective productive effort." This pool of manpower will not be sufficient for our needs unless we employ it wisely.

Men are being inducted into military service more rapidly than was scheduled. The need for more workers in war industries is developing faster than had been anticipated. As a result, industry will be forced to yield more men between 20 and 45 years of age to the armed services earlier than had been contemplated.

This means that management should consider manpower one of its most pressing problems. Every employer should inventory or reinventory his employes, determine anew how many are likely to be called to arms and intensify his efforts to find and train replacements.

He can suspend the automatic age retirement plan, if one is in force. He can place women in some jobs which men have held. He can be less exacting in qualifications for employment. Above all, he can rely more upon in-plant training.

All of these precautions are "musts," for the employers, for employes and the nation.

E. L. Shaner
Editor-in-Chief

Analyze Manpower, Train Replacements, Says Hershey

"Don't ask deferments for men who can be replaced"—General Hershey

Selective Service director warns fewer occupational deferments will be granted. Dependency no longer prime consideration. Women and partially handicapped persons must fill gap

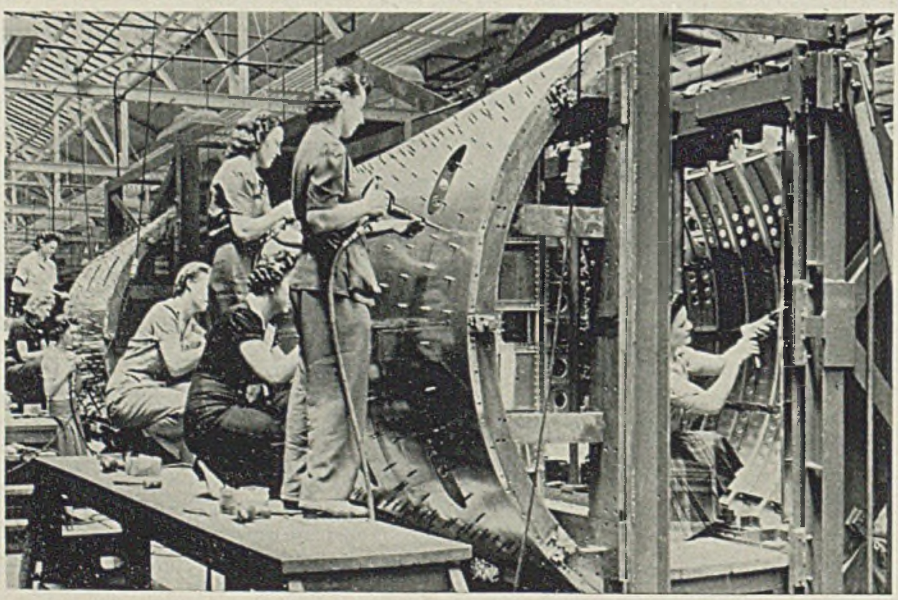
By MAJ. GEN. LEWIS B. HERSHEY
Director of Selective Service

MANPOWER is a most important strategic material of today. Every employer should make a prompt inventory, appraisal and analysis of the manpower in his own plant as he would inventory his stockpile. In order to keep production going and at the same time furnish men for the armed forces, industry should now establish an orderly replacement program.

In order to obtain temporary deferments for essential men while he is training women, young men, older men, men physically handicapped or those with a high degree of dependency, the employer should know the fundamental principles in the operation of his local Selective Service board. Certain steps should now be taken by each employer. He should know how many men on his pay roll are between the ages of 20 and 45. He should investigate the classification of every one of those men. On the basis of such an inventory he should prepare to plan ahead and train men for replacement of those who must necessarily enter the armed forces if we are to have the sort of army which can win the war.

Deferments, granted so that employers may train women or men not liable to early induction, are temporary deferments; they cannot exceed six months and in many cases may be for only 30, 60 or 90 days. The Army today has to train a bomber pilot within a period of eight months to operate a very technical machine with an instrument board which puzzles an expert. Why, therefore, should industry insist that it assume that it can take two or three years to train men for industrial tasks not nearly so complicated?

The fundamental purpose of every deferment of a registrant is to allow an employer to train a replacement. Only in a few rare instances can an employer expect to have these temporary deferments continued for more than the six months period. These are only in cases where an abnormally long period of training is required for a replacement and the eight months needed in which a bomber pilot can be turned out now is something to remember in this connection.



Women are being trained in the De Soto bomber plant to do some of the operations on fuselage assembly work. Here is shown the outer shell of a bomb-bay section being riveted

Employers may seek the deferment of their necessary men with or without their consent.

Here is how they go about it.

On page 3 of the Selective Service Questionnaire (Form 40) which is sent to each registrant before he is classified is the following:

Instructions—If your employer believes that you are a necessary man in a necessary occupation, it is his duty to fill out Form 42A requesting your deferment. You may also attach to this page any further statement by yourself which you think the local board should consider in determining your classification. Such statement will then become a part of the questionnaire.

This is on all the questionnaires distributed during the past six months. The fact that the Selective Service system now specifically mentions the filing of Form 42A as the manufacturers' duty is a clear indication of the Selective Service system view on the responsibility of each employer in this matter.

The employer can obtain Form 42A at the local board and the local board will consider the employer's request when the form is properly filled out and signed.

If such request should be denied because the man, after consideration of the claims offered for him, is not considered to be indispensable to the company's operation, and is needed more in the armed services, the local board will advise the employer of its refusal of such an occupational deferment.

The local board does this by sending to the employer, at the same time it notifies the registrant of his classification, a Form 59.

There are 10 days after Form 59 is mailed by the local board to the employer during which the employer can appeal the registrant's case.

The registrant will not be ordered to report for induction during this period.

In order to make an appeal the employer simply has to sign his name to Form 59 which he has received, and return it to the local board; or in case the Form 59 is not received from the local board, any written request will have full value to make such an appeal effective.

When Form 59 is returned by the employer the appeal procedure becomes automatic.

All necessary forms are available at the local board in the employer's immediate vicinity or at the office of the State Director of Selective Service.

If the local board and the appeal board deny the appeal for the occupational deferment of a key man, the employer may then bring the matter to the attention of the State Director at the State Selective Service Headquarters, with the request that the case be reopened or appealed by him to the President.

A double duty rests upon the employer. He should personally know what his manpower situation is. He should not leave the job to a minor employe to decide who is necessary. The employer who delegates the task of filing a request for deferment to a clerk, the executive who does not make a complete inventory of his whole plant today, is negligent.

A good rule to follow: Don't ask deferments for any men who can be replaced by training another individual not likely to be eligible soon for service.

Make an inventory, request deferment for any man whose immediate going into the armed services would retard production of vital war material or other services essential to the war effort, or who is needed to maintain national health, safety and interest.

Only when an employe is working in a critical occupation within an essential industry should a Form 42A be filed for his temporary occupational deferment.

Yes, an inventory within a man's own plant is called for; also an appraisal and analysis of the manpower in the community. There is many a man over 45, or a man physically handicapped, or a woman who can do that job that the 23-year-old boy is doing who took a 12-weeks course at a learn-quick school.

There are not more than 60,000,000 people in this country who are capable of effective production effort. These men and women represent our total manpower available to win the war. They must do everything that must be done in a total war; maintain transportation, communications and utility systems, maintain public services, grow food for ourselves and our allies, mine the metals and produce the raw materials, fabricate and produce the amount of consumers goods necessary to maintain even a restricted national life and the supplies, weapons and munitions of war; also most of all they must provide the men who land on strange shores in far places, the men who carry the fight to the enemy on a multitude of far-flung frontiers. The rest of the population who mine raw materials and produce the weapons with which these men fight must be a self-disciplined team working in unity. The individual personal convenience, comfort or pleasure, or the convenience and ordinary leisurely replacement programs of the employer, will have to be given progressively less consideration as the war gets tougher and the casualty lists grow.

When we hear of the big armies we are going to raise, we must all remember that it takes at least five men or women to produce what they eat, use, fight with and wear. With less than sixty million availables in this country, those figures are worth deep consideration.

Although Harry L. McKinney, who has been assembling power line switches at Westinghouse Electric Mfg. Co. for 41 years, reached the retirement mark in May, he has been granted an extension to continue an important production job, thus helping to ease a tight skilled labor situation. NEA photo

U. S. Steel Subsidiaries Bow to NWLB Directive "Under Protest"

CARNEGIE-ILLINOIS STEEL CORP., Pittsburgh, and four other operating subsidiaries of United States Steel Corp., last week accepted under protest directives of the National War Labor Board ordering installation of maintenance of membership, dues checkoff, a wage advance of 5½ cents per hour retroactive to Feb. 15, and minimum daily guarantee.

In similar letters to the board, executives of the affected companies flatly asserted that the acceptance of the board's ruling was predicated on the premise that the country is at war, that the decision was formed on the basis of hearings conducted six months earlier with only a small portion of the steel industry represented, and that the directives are unnecessary and undesirable.

J. Lester Perry, president, Carnegie-Illinois Steel Corp., warned that compliance with the union security and retroactive wage directives is not to be construed, in any sense, as an acceptance by the company of the fairness or propriety of the directives or of the underlying philosophy which led to their formulation or the reasons advanced to support them. "The acceptance is predicated on one premise only," he said. "That the country is at war and that your board, created by the President of the United States of America, has ordered this company to do certain things embodied in your directives.

"For the period of the contract now under negotiation, the company bows to your decision and accepts that which it considers unnecessary, undesirable, and subversive of the workers' individual freedom.

"You have said that each case before you would be decided on its own merits. Yet now, to the contrary, you advise 'that collective bargaining agreements in the basic steel producing industry are impliedly subject to whatever changes may be required to preserve the policy of wage uniformity, even though such changes are necessitated during the life of some agreements'; and you now decide that hearings conducted six months ago were industry hearings, although by far the larger part of the industry was not represented or given an opportunity to be heard.

"As the minority opinion of your board pointed out, you have ignored a solemn contract entered into by the employer in a good faith effort to comply with the statute providing for collective bargaining. Your apparent motive is the fear that the observance of the contract will cause the members of the other party to the contract to endanger maximum production."

"We do not share your fear that continued observance of the contract would have endangered maximum production."

LABOR LEADER PROTESTS DOUBLE TIME PAY

R. J. THOMAS, president, UAW-CIO, told President Roosevelt that the practice in some plants of paying double wages for weekends and holidays was a "threat to continuous wartime production." He was one of the labor leaders, pictured above, in a group which visited the White House recently. Left to right: Richard Frankensteen, Walter P. Reuther, Mr. Thomas and George F. Addes

Steel Payrolls Establish New Record During July

Total payrolls of the steel industry established a new peak in July of $120,671,000, nearly $2,000,000 above the previous peak, according to the American Iron and Steel Institute.

In June, steel payrolls totaled $118,067,000 while in July a year ago, $114,059,000 was distributed in payrolls by the industry.

Average number of employes during July was 655,000, compared with 659,000 in June and 648,000 in July, 1941.

Wage-earning employes of the industry earned an average of 102.7 cents per hour in July, a new peak, which compares with 102.0 cents per hour in June and 99.1 cents per hour in July of last year.

Wage earners worked an average of 38.4 hours per week in July, as against 38.7 hours per week in June and 37.8 hours per week in July, 1941.

Seven Months of Strikes Cost War Plants 1,130,678 Man-Days

War industries in the first seven months of this year lost 1,130,678 man-days of work because workers ignored the pledge of labor and industry leaders and went on strike. In the period an average of 8000 out of each 10,000 workers were idle because of strikes, while a total of 295,734 participated in action which tied up production at war plants.

A compilation including these figures was issued last week by the War Labor Board after a survey had been taken of war plants exclusively. United States Conciliation Service reports indicated that there are three or four times as many non-defense as defense strikes.

The Board reported that man-days lost by strikes in war industries increased from

46,000 in January to a peak for the seven months of 255,000 in June. The July total was 234,000. In January 13,000 workers lost 46,000 man-days of work; in February 27,000 workers lost 119,000 man-hours; in March 39,000 strikers lost 167,000 man-days; in April the totals were 43,000 and 170,000, respectively; in May, 48,000 and 137,000; June, 85,000 and 255,000; and in July, 81,000 strikers and 234,000 man-days lost.

There were 728 strikes called during the seven months, involving less than 3 per cent of the total number of war workers, the Board said. On Sept. 1 there were seven strikes affecting war industries in progress, but the disputes involved fewer than 1500 workers.

Contrasting with the Board's statement that there had been no "notable increase" recently in either strikes or other disputes, the office of the Secretary of Labor last week certified eight disputes involving 35,675 workers to the board, an amount described as one of the largest "batches" submitted in a single day recently.

Industrial Health Meeting To Study War Workers' Needs

How to reduce manpower wastage in the face of a threatened labor shortage will be discussed at the seventh annual meeting of the Industrial Hygiene Foundation to be held at Mellon Institute of Industrial Research, Nov. 10-11. Theme of the meeting will be "Health Arms the War Workers."

The program will be under direction of industrial health specialists who are striving to reduce the approximately 2½ million working days lost weekly by war workers through illness and non-industrial injuries.

Attributing the growth of health problems in industry to the intensified war effort, the hygiene foundation has discovered that increased use of chemicals, some of them possessing little known toxic effects, longer work periods with prolonged exposure to toxic materials and the increased employment of women, youths and older men who lack "normal" resistance are principal causes of lost time.

Wildcat Strikes in Pittsburgh District Continue Unchecked

PITTSBURGH

Labor troubles are creating more dissatisfaction and dissension in this district than any other problem, including the war itself. It is becoming more evident that national labor leaders have little if any control over the locals. Wildcat strikes are multiplying and jurisdictional quarrels between labor leaders are common.

Last week an alleged "strike vote" was taken in plants of the Aluminum Co. of America and the president of the union departed for Washington to enforce his demands for higher wages by threatening a nation-wide strike. Opposed to this, the leader of the union's largest local issued a statement that nobody had authority to call a strike vote; that an aluminum strike at this time would be unpatriotic.

Absenteeism Higher in War Plants Employing Women

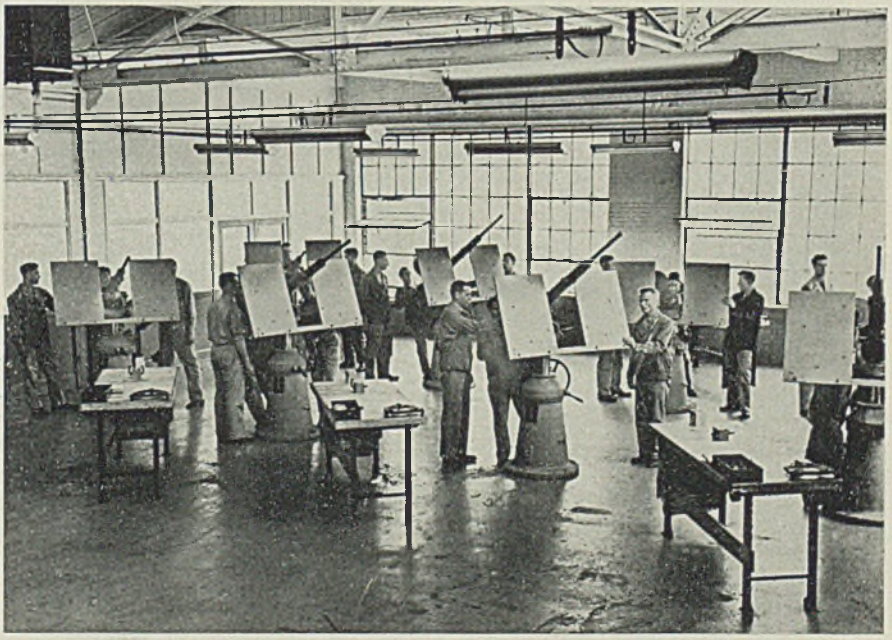
Repeated absences of employes from their work in war materiel plants is causing mounting concern among officials responsible for uninterrupted production of war goods. A recent canvass of personnel departments of a number of representative firms, many of them with above-average wage scales, disclosed that the best efforts of the War Production Board, of management and labor unions have been ineffectual in controlling absenteeism.

The majority of companies surveyed reported the greatest defection among women employes. Strong moral persuasion exerted by campaign posters and literature appealing to patriotism and common sense, which have been fairly effective in holding men on their jobs, appear to leave the women cold. One employer interprets this apparent indifference on the part of women workers who continue to stay away from work one or two days a week as a distressing result of wartime conditions—of the disrupted personal lives of married women employes who have relatively no time for buying food and other family essentials.

Some attempt has been made toward adjustment of working hours, to assign the women employes to shifts better suited to their personal requirements, but the increasing number of female workers on war plant payrolls and longer hours and other conditions necessitated by wartime schedules of operation, prevent any sweeping change of work assignments. Several companies have surmounted the problem of shopping time for both men and women employes by opening food stores and barber and beauty shops on plant premises.

Voluntary absenteeism has been reduced in some instances, the canvass found, by pressure from labor leaders who reason that unnecessary absence from war work constitutes an offense against co-workers.

ARMY MEN STUDY MECHANISM OF ANTIAIRCRAFT GUN



FIRST class of enlisted men and noncommissioned officers studying mechanism of the 20-millimeter Oerlikon antiaircraft cannon at the plant of Pontiac Motor Division, Pontiac, Mich. The company has been building these guns for the navy for more than a year. Verne L. Murray, assistant sales manager, is director of the training school which provides service men a 4-week course of study on this gun, as well as on the 40-millimeter antiaircraft gun, also built by Pontiac

Steel Plants, Blast Furnaces Establish New Records in August

FOURTH monthly world record in pig iron production made in 1942 by a single blast furnace stack is claimed by Bethlehem Steel Co. Its "H" stack at Lackawanna Works, Buffalo, poured 44,659 net tons of iron in August.

The previous record was set by Lorain No. 3 stack of National Tube Co. in May, with 43,866 tons. Until this year No. 10 stack of Carnegie-Illinois Steel Corp. at its Gary works held the record at 41,701 tons, established in July, 1931. The first mark above this tonnage was made in January, 1942, by Carrie No. 3 stack of Carnegie-Illinois at Rankin, Pa., with 41,782 tons. This was followed in March by a new mark of 43,478 tons, made by Zug Island furnace of Great Lakes Steel Corp., at Detroit.

The new record holder was completed in November, 1941. It has hearth diameter of 27 feet. It consumes 3000 tons of iron ore and 2800 tons of coke per day. It is tapped five times per day and gives an average daily output of 1440 tons of pig iron.

Republic Steel Reaches New Peaks in Ingot, Iron Output

All-time records for the production of steel ingots and pig iron for an eight-month period were broken by Republic Steel Corp., Cleveland, during the first eight months of 1942.

Steel ingot tonnages exceeded those of a similar period in 1941 by several per cent.

This increase in steel ingot output reflected a rise in pig iron production of more than 200,000 tons. The August pig iron record exceeded the previous top established in July. During the same month the Cleveland district established a new record in both iron and coke, and Youngstown in open-hearth steel.

Record production was also established in two of Republic's iron mines—one in northern New York and one in Minnesota.

American Steel & Wire Sets 520 Records Since Pearl Harbor

Production of materials of war continued at a high rate in plants of American Steel & Wire Co., United States Steel subsidiary, during July with a total of 71 new production records being established during the period. This brings to 520 the number of records broken since Pearl Harbor.

During July the Donora, Pa., Steel & Wire Works broke a total of 20 records. The Worcester, Mass., plants of the company were next in line, North Works breaking 12 former records and South Works establishing 11 new highs. The Consolidated Works in Cleveland set seven new high marks, while at Joliet, Ill., five records were established. Waukegan, Ill., and Trenton, N. J., plants each broke three former records, while the New Haven, Conn., and Duluth operations, in addition to Cuyahoga Works and Central Furnaces in Cleveland, exceeded previous records on two occasions. Newburgh Works and American Works, both in Cleveland each established one new high for the month.

Blast Furnace Production Up 78% in Seven Months

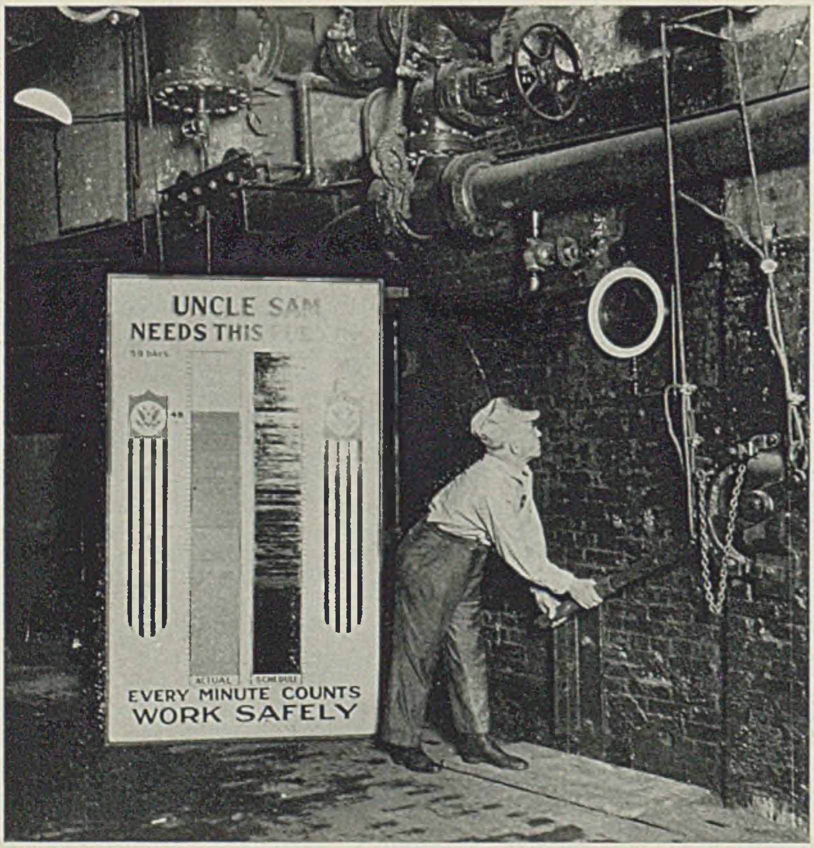
Production of the blast furnaces of the Wickwire Spencer Steel Co. during the first seven months this year increased 78 per cent, as compared with corresponding period of 1941, and has set a new all high record in the company's history, according to E. C. Bowers, president. Larger production was announced also for the company's open-hearth furnaces, bloom and rod mills and its wire rope, mesh and spiral wire fabric departments.

Machine Tool Output Now at Rate of $1,360,000,000 Yearly

Value of 28,300 new machine tool units shipped during July was $113,600,000. During June 26,600 units, valued at $111,100,000, were shipped.

Production of machine tools has reached a rate of more than $1,360,000,000 a year. Last year the value of machine

BLAST FURNACE RELINING COMPLETED AHEAD OF SCHEDULE



TURNING the hot blast into No. 3 furnace at National Works of National Tube Co., McKeesport, Pa., after a record relining job completed 11 days ahead of schedule, is Marko Blazik, oldest employe of the United States Steel Corp. subsubsidiary's blast furnace department. Stack was relined from the hearth up, including the salamander tools was about $771,400,000 and the present going rate represents an increase of more than 76 per cent.

Compared with the same month of last year, the July value of machine tools is an increase of 96 per cent.

Cooper-Bessemer Opens Foundry Addition

A foundry addition built by Defense Plant Corp. at a cost of $300,000 for Cooper-Bessemer Corp., Mt. Vernon, O., was dedicated last week by the company in a ceremony jointly celebrating opening of the new building and award of a U. S. Treasury Minute-Man flag.

The addition will house all core shop operations, with seven new core drying ovens large enough to hold cores for castings going into the most massive engines built by the firm. Bulk handling of foundry sand is an additional feature, a new spur track adjoining the structure making possible delivery by carload. Sand dumped in pits below ground level will be hoisted into a muller and from there distributed through the core shop.

Sponge Iron Pilot Plant To Be Built at Laramie, Wyo.

A commercial-size pilot plant for production of sponge iron will be built by the Bureau of Mines at Laramie, Wyo., it was announced last week. Proximity to available sources of iron ore, natural gas and coal was given as the reason for selection of the site.

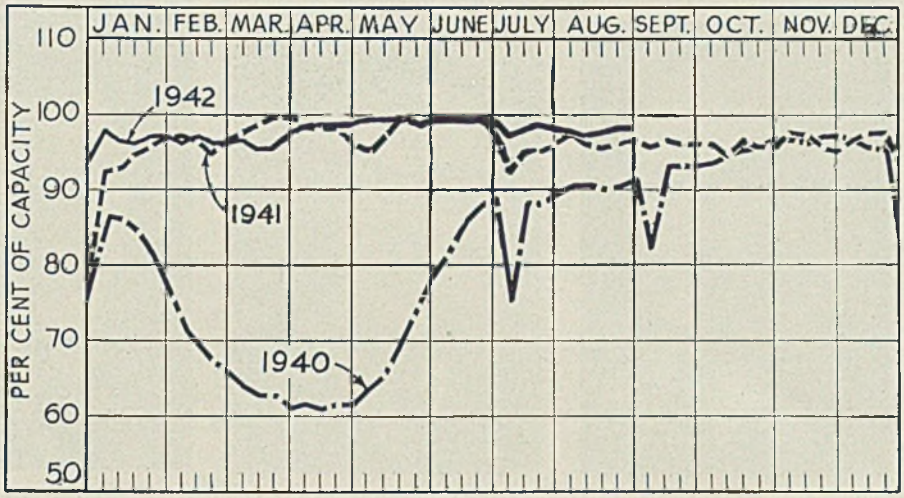
During construction of the pilot plant, the Bureau of Mines will investigate various processes for making sponge iron in small-scale pilot plants owned by private companies.

Bicycle Production Reduced To 10,000 Units Per Month

Manufacture of bicycles is cut to 10,000 a month and the entire production has been concentrated in two plants so that the remainder of the industry will be free to produce war weapons

The Army, Navy, Maritime Commission, War Shipping Administration and lend-lease will have first call on the bicycle production permitted under the amendment. If these requirements do not amount to 10,000 a month, the remainder will be available to civilians under OPA's rationing regulations

Under the amendment, the Westfield Mfg. Co., Westfield, Mass., may produce 6000 bicycles a month. The Huffman Mfg. Co., Dayton, O., may produce 4000 a month.



PRODUCTION . . . . *STEADY*

PRODUCTION of open-hearth, bessemer and electric furnace ingots last week remained unchanged at 98 per cent of capacity. Three districts made slight gains, four declined and five were unchanged. A year ago the rate was 95½ per cent; two years ago it was 82 per cent, both computed on the basis of capacity as of those dates.

Central eastern seaboard—Maintained 95 per cent production in face of scant scrap supply.

St. Louis—With 26 of 28 open hearths active production continued at 95½ per cent. An additional furnace may be lighted this week.

Detroit—Necessity for repairing another open hearth dropped the rate 3 points to 86 per cent.

Cincinnati—With only one open hearth out for repairs the rate was 95 per cent, a gain of 4 points. Careful planning is keeping down idle time for repairing.

Birmingham, Ala.—Continued at 95 per cent of capacity, with 23 open hearths melting.

Pittsburgh—Unchanged at 94 per cent for the third week.

Wheeling—Gained 5 points to 83 per cent as additional furnaces were put in service.

District Steel Rates

Percentage of Ingot Capacity Engaged in Leading Districts

	Week ended Sept. 5	Change	Same week 1941	1940
Pittsburgh	94	None	98	72
Chicago	101.5	— 1.5	101	84.5
Eastern Pa.	95	None	95	79
Youngstown	97	+ 1	96	75
Wheeling	83	+ 5	94	80
Cleveland	96.5	— 2.5	95	81
Buffalo	90.5	— 2.5	90.5	90.5
Birmingham	95	None	95	88
New England	92	None	90	85
Cincinnati	95	+ 4	89	68
St. Louis	95.5	None	98	80
Detroit	86	— 3	86	94
Average	98	None	*95.5	*82

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

Cleveland—Declined 2½ points to 96½ per cent, two interests curtailing production while one added a furnace.

Buffalo—Receded 2½ points to 90½ per cent as one producer withdrew an open hearth for repair.

Youngstown, O.—Steel production last week gained 1 point to 97 per cent, the highest rate in nearly a year. Three bessemers and 77 of the 83 open hearths were in operation. Republic Steel Corp. at one time last week had all its 23 open hearths, its five blast furnaces and bessemer plant in operation, the first time in years.

Chicago—Down 1½ points to 101½ per cent because of furnace repairs. One interest had only two days scrap supply and was threatened with curtailment.

New England—Production was unchanged at 92 per cent last week. One open hearth which has been operating for many months on acid went into basic production.

Basic Magnesium Plant in Nevada Starts Production

Plant of Basic Magnesium Inc., Las Vegas, Nev., with a rated capacity of 3½ times total magnesium production of the United States last year, has started production according to WPB. It is the latest of five important plants that have entered production within recent weeks. Others are the Texas plant of Dow Chemical Co., Michigan plant of Ford Motor Co., California plant of Permanent Metals Corp., and Connecticut plant of England Lime Co.

MEN of INDUSTRY


Wallace T. Montague


George T. Jones


John W. Price Jr.


Carl J. Kennedy

WALLACE T. MONTAGUE has been elected a vice president, Norton Co., Worcester, Mass., in charge of sales planning and development. Heretofore assistant vice president, Mr. Montague joined Norton in 1912, devoting his talents chiefly to research and sales. He is chairman, Grinding Wheel Manufacturers Association, and vice president, Special Refractories Association.

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George T. Jones has been appointed chief metallurgist at the Homestead steelworks of Carnegie-Illinois Steel Corp. **John W. Price Jr.** has been named assistant chief metallurgist at that plant. Mr. Jones began his employment at the Homestead works as a metallurgist in March, 1937, prior to which he was associated with Allegheny Steel Co. Mr. Price joined the Homestead works as an observer in June, 1937; in December of that year was promoted to metallurgist, and in January, 1940, was assigned as metallurgist in charge of development.

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Charles S. Duvall, former vice president, Maryland Bolt & Nut Co., Baltimore, Md., has been elected president. Associated with the company since 1920, Mr. Duvall succeeds the late S. Forry Laucks.

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Rudolph B. Flershem, formerly vice president, American Radiator Co., has been appointed general manager, Buffalo Bolt Co., North Tonawanda, N. Y.

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Frank A. Sharpe, veteran automotive sales and engineering executive, now with Mid-West Abrasive Co., Detroit, has been promoted to sales manager. He joined the Mid-West company about a year ago.

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George B. Waterhouse, heretofore associated with the War Production Board, Washington, has been transferred to the Office of Lend-Lease Administration, 515 Twenty-second street Northwest, Washington, where he will serve as special consultant on iron and steel and other metals to the administration.

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F. D. Wild, formerly vice president and treasurer, Warman Steel Casting Co., Los Angeles, has been elected president and treasurer. **William P. McGervey Jr.**, secretary, has been named vice president in charge of production, and **H. T. Adams** succeeds Mr. McGervey as secretary.

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Cantwell Clark has been named manager of the Buffalo plants of **E. I. du Pont de Nemours & Co.**, succeeding **Richard T. Cann**, who has been transferred to Wilmington, Del.

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Ralph M. Kelly has been appointed zone manager in charge of the recently combined Nash Motors and Kelvinator factory branch operations for the Buffalo territory. He formerly headed Nash Motors' Buffalo branch.

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N. W. Willard, since 1918 assistant to the president, Atchison, Topeka & Santa Fe railroad, Chicago, has been appointed to the newly created position of executive assistant to the president. **R. G. Rydin**, chief clerk to the president since 1937, succeeds Mr. Willard as assistant to the president.

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Ernest L. McClure, representative in Malaya, Indo-China and Thailand for the International Harvester Co., Chicago, arrived home Aug. 28 following passage on the Swedish diplomatic exchange ship Gripsholm. He was interned by the Japs in Bankok, Thailand, last November.

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Major John Slezak, head of the tank branch and acting chief of the industrial division, Chicago Ordnance District, United States Army, has been promoted to the rank of lieutenant colonel. He was president, Turner Brass works, Sycamore, Ill., when called to active duty last January.

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Carl J. Kennedy has been appointed sales manager, assistant secretary and assistant treasurer, Hydraulic Machinery Inc., Detroit. Until recently Mr. Kennedy was sales manager, McAleer Mfg. Co., Detroit.

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T. L. Kishbaugh, vice president, Earle M. Jorgensen Co., Los Angeles, has accepted an appointment as a dollar-a-year man with the War Production Board, Washington, where he will serve in an advisory capacity as an alloy steel specialist to **J. R. Stuart**, head of the Warehouse Unit, Iron and Steel Branch.

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J. F. Van Nort, heretofore western division sales manager for Duff-Norton Mfg. Co., with headquarters in Chicago, has been promoted to general sales manager and transferred to the company's general offices at Pittsburgh. Before his affiliation with Duff-Norton, Mr. Van Nort was sales manager, eastern division, Oil Well Supply Co., a subsidiary of United States Steel Corp.

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William B. Prosser, heretofore equipment sales manager, Perfect Circle Co., Hagerstown, Ind., has been named manager of the new defense plant to be operated by Perfect Circle at Richmond, Ind. Others to be transferred to the new plant include **W. J. Cramer**, plant engineer, who will become factory manager; **K. J. Stahr**, until recently manager of the warehouse, shipping and billing department, will be personnel manager; **E. H. Fosnight**, formerly chief inspector, will be production superintendent; **A. H. Webber**, a former regional manager of the replacement division, has been named office manager; and **W. H. Skinner** will be purchasing agent.

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Roy M. Smith has joined Roller-Smith Co., Bethlehem, Pa., as assistant chief engineer. He formerly was engineering manager for the wiring device division, Bryant Electric Co., Bridgeport, Conn., and before that was associated with Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., as section engineer on relay design and application.

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J. T. Callahan, associated with B. F. Goodrich Co., Akron, O., since 1928, has been named western district manager of the company's national sales and service division, with headquarters in Chicago. He succeeds **Walter W. Thomen**, who has been called to active duty as a major in the office of the chief of ordnance, War Department.

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William H. Casson, since 1936 general superintendent of the Cleveland plants of Addressograph-Multigraph Corp., has been named works manager in charge of all plants, including those in London, England, and Toronto, Canada. **Howard J. Warwick**, formerly assistant to Mr. Casson, has been made works manager at Cleveland. **William F. Daniels** has been named assistant supervisor of Cleveland factories, while **Charles Jensen** has become supervisor of all fabricating departments.

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W. J. Laidlaw has been appointed manager of the Cleveland district office, Worthington Pump & Machinery Corp., Harrison, N. J. He succeeds **A. J. Klug**, who will now devote his time to special work with certain important industries in the Cleveland district. Mr. Laidlaw has been associated with Worthington in various capacities since his return from overseas in 1919.

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William R. Robbins has been promoted to division accountant and **James R. Seaman** to assistant treasurer and assistant secretary, Pratt & Whitney Aircraft Division of United Aircraft Corp., East Hartford, Conn. Mr. Robbins was formerly assistant treasurer and assistant secretary, while Mr. Seaman was heretofore assistant treasurer, which position he retains.

Frederick Detweiler, factory accountant at Pratt & Whitney Aircraft, has been named division accountant and assistant secretary of the new plant at Kansas City, Mo. **George Knaus**, facility accountant, has been made assistant treasurer and assistant secretary of the western organization.

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D. J. Hutchins, acting head of the Detroit region, War Production Board, since transfer of **E. C. Kanzler** to Washington, has been named director of the region. Associated with Ford Motor Co. 25 years in various production, materials, purchasing and sales capacities, he later became associated with Firestone Tire & Rubber Co., and is now on leave of absence from that company, joining the WPB in January.

R. L. Vaniman now heads the automotive branch of the WPB, a post also held formerly by Mr. Kanzler, with Mr. Vaniman then his deputy. He was until recently associated with Chrysler Corp.

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Sherrod E. Skinner, vice president, General Motors Corp., and general manager of the Oldsmobile division, has been appointed director, Production Division, Services of Supply, War Department. Mr. Skinner will be charged with developing and initiating policies and procedures to expedite production for the Army's Services of Supply.

OBITUARIES . . .

Harry T. Thompson, 53, Pittsburgh district manager, Metal & Thermit Corp., New York, died recently at his home in Mt. Lebanon, Pa. Mr. Thompson served in France as captain in the field artillery in the first World war and after return to civilian life, became associated with Differential Steel Car Co., Findlay, O. He was later made a vice president and director of the company, an association which continued until his death. He joined the sales organization of Metal & Thermit Corp. in 1931, and shortly thereafter was placed in charge at Pittsburgh. He was a member, American Welding Society.

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Norton A. Mears, vice president in charge of purchases, R.C.A. Mfg. Co. Inc., died Aug. 19 in Philadelphia. Mr. Mears, at one time, was identified with Amalgamated Machinery Corp. as assistant manager at Chicago and manager of the open-hearth steel plant at New Cumberland, W. Va., following which he was engaged in consulting industrial engineering practice for several years; organized and was the first president of Alaskan Steel Co., and was vice president and general manager, Chicago Forging & Mfg. Co. for nearly ten years before becoming associated in 1934 with R.C.A.

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Kenneth W. Bair, 46, the past 13 years chief inspector, Briggs & Stratton Co., Milwaukee, died in that city, Aug. 19.

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William C. Canann, head of the materials control division of Bendix-Westinghouse Air Brake Co., Elyria, O., died in that city, Aug. 22.

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Edwin L. Smalley, 65, president, Hevi Duty Electric Co., Milwaukee, died in that city, Aug. 29. A pioneer in the electric heat treating furnace industry, he held a number of furnace patents.

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Frank C. Lindgren, 57, vice president, Quality Hardware & Machine Corp., Chicago, died in that city, Aug. 25.

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Prof. Raymond H. Danforth, 64, since 1914 head of the department of mechanics and materials, Case School of Applied Science, Cleveland, died in that city, Aug. 30. He was a member, American Society of Mechanical Engineers and American Society for Testing Materials.

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Harold C. Ryder, 49, advertising and sales promotion manager, Hayward Co., New York, died Aug. 15 at his home in Hollis, Long Island. He had been associated with the company 35 years.

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Russell B. Wilfong, vice president in charge of sales and a member of the board of directors, Pittsburgh Tube Co., Pittsburgh, died in that city, Aug. 20.

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Edward H. Younglove, 62, staff manager of the steel industries division, Johns-Manville Sales Corp., Chicago, died in that city, Aug. 30. He had been associated with the company 46 years.

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Charles C. Younggreen, 52, executive vice president, Reincke-Ellis-Younggreen & Finn., Chicago advertising agency, died in that city, Aug. 19.

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Frank A. Skelton, 72, former secretary-treasurer and vice president, Canadian Car & Foundry Co., Montreal, and a former vice president, National Steel Car Co., Hamilton, Ont., died Aug. 14, in Montreal, Canada. He retired in 1924.

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Thomas S. Grasselli, 67, president, Grasselli Chemical Co., Cleveland, until it became a wholly-owned subsidiary of E. I. du Pont de Nemours & Co. in 1936, and then a vice president of that organization until his retirement in 1939, died Aug. 22, at his home in Cleveland.

Reese H. Taylor

Amory Houghton

R. C. Allen

Iron and Steel Branch of WPB Undergoes Broad Reorganization

MAJOR reorganization of the Iron and Steel Branch of the War Production Board was inaugurated last week when Reese H. Taylor resigned as branch chief. No permanent successor to Mr. Taylor has been appointed.

Mr. Taylor succeeded C. E. Adams as chief of the branch in May this year.

Mr. Taylor is expected to return to his position as president of the Union Oil Co. of California, Los Angeles, a job which he has held since 1938. Previously he was president, Consolidated Steel Corp., Los Angeles.

David F. Austin, until recently head of the Products Division of the Iron and Steel Branch, WPB, has been appointed deputy chief of the branch and will serve temporarily as acting chief. Mr. Austin, in private life, is vice president in charge of sales, Carnegie-Illinois Steel Corp.

R. C. Allen, deputy chief of the Iron and Steel Branch, also has resigned from the War Production Board. He will return to his position as executive vice president, Oglebay, Norton & Co., Cleveland.

Kanzler Succeeds Houghton

Ernest C. Kanzler has been appointed Director General for Operations. Mr. Kanzler succeeds Amory Houghton. Mr. Houghton resigned, effective Sept. 15, to save Donald M. Nelson and the WPB "any possible embarrassment" resulting from the United States district court opinion handed down recently in Toledo, O., which held that Mr. Houghton and his company, the Corning Glass Works, had violated antitrust laws.

Mr. Kanzler, the new Director General for Operations, has been serving as deputy chairman of the WPB in charge of program progress. He won widespread acclaim as chief of the Automotive Branch and was largely instrumental in the successful conversion of the automotive industry to war production.

A resident of Detroit, Mr. Kanzler was founder of the Universal Credit Corp. and served as its president from 1928 until he joined the staff of WPB. Before establishing the Universal Credit Corp. Mr. Kanzler had served as vice president in charge of production for the Ford Motor Co.

WPB officials last week indicated that W. A. Hauck, head of the Planning Unit of the Plant Facilities Section of the WPB, had submitted his resignation. Mr. Hauck, formerly associated with Lukens Steel Co., Coatesville, Pa., and the American Iron and Steel Institute, New York, had made two exhaustive surveys of the necessity for expansion of steel and pig iron producing facilities. These surveys, to a large extent, have determined the iron and steel expansion program financed by the government.

P. M. Reinartz, formerly technical director of the Armco International Corp., and managing director of a German subsidiary, has been appointed acting chief of the planning unit. Mr. Reinartz has been associated with American Rolling Mill Co., Middletown, O., in its di-

David F. Austin

vision for 31 years. Until the outbreak of the war he was associated with Armco International and maintained contacts with continuous mill licensees in Germany, France, Poland, England and Italy. While in Europe Mr. Reinartz had opportunity to observe what could be done in producing steel with limited facilities.

Raymond Hart, New York, has been appointed administrator of the Production Requirements Plan on the staff of A. I. Henderson, deputy director general for industry operations. Mr. Hart will be in charge of PRP operations within the industrial and commodity branches of WPB and will maintain liaison between the branches and the office of the Deputy Director General for Priorities Control.

PRIORITIES – ALLOCATIONS – PRICES

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

L ORDERS

L-41 (Revision): **Construction**, effective Sept. 2. Cuts all civilian construction further by reclassifying types, making distinctions within residential and non-residential categories, and reducing amount for which no authorization is necessary.

L-52 (Amendment): **Bicycles and Parts**, effective Sept. 2. Cuts output of bicycles to 10,000 a month of which Westfield Mfg. Co., Westfield, Mass., may produce 6000 and Huffman Mfg. Co., Dayton, O., 4000, all of the victory model.

L-78 (Extension): **Fluorescent Lighting Fixtures**, effective Sept. 2. Extends expiration date from Sept. 1 to Oct. 1. The order prohibits sale or manufacture of fluorescent lighting fixtures using tubes rated at more than 30 watts, with certain listed exceptions.

L-91 (Amendment): **Laundry Equipment**, effective Sept. 1. Lifts prohibition on manufacture of parts to rebuild, recondition, and maintain existing equipment. Brings used equipment having a value in excess of $100 under restrictions on distribution contained in the order.

L-180: **Replacement Storage Batteries**, effective Aug. 29. Limits production from July 1 to Dec. 31, 1942, to 90% of number sold during like 1941 period, and to one-half of this allowed number before Sept. 30. Establishes production standards based on ampere hour capacity and container sizes. Limits producers' inventories to a 60-day supply. Consumers must turn in used battery when purchasing a new one.

M ORDERS

M-81-b (Revoked): **Tin Plate and Terne Plate**, effective Sept. 2. Revocation of this order prohibits further manufacture or use of terne plate oil cans except for sale to government agencies.

E ORDERS

E-2-b: **Cutting Tools**, effective Sept. 2. Requires producers to schedule monthly output of each type according to instructions of the order beginning with October production. Revokes E-2-a.

P ORDERS

P-95 (Revoked): **Farm Machinery and Parts**, effective Sept. 2. Revocation of this order, which had granted A-3 ratings to farm machinery and equipment manufacturers, was ordered because the assigned rating is no longer useful and most manufacturers are operating under P-90.

PRICE REGULATIONS

General Maximum Price Regulation (Amendment): Effective Sept. 3, Suppliers of semi-fabricated silver products may add 36.125c per fine ounce of domestic silver contained in the article to the maximum prices provided under the General Maximum Price Regulation for identical articles made of foreign silver.

No. 49 (Amendment)—**Resale of Iron and Steel Products**, effective Sept. 4, 1942. Establishes maximum delivered prices for less-than-carload sales of NE emergency steels by warehouses, jobbers and other resellers.

Basing point cities are: For hot rolled alloy steel, Bethlehem, Pa., Buffalo, Canton, O., Chicago, Massillon, O., and Pittsburgh; for cold finished, Buffalo, Chicago, Cleveland, Gary, and Pittsburgh. Maximum base price per 100 lbs. within free delivery area of basing point cities is aggregate of the following adjusted to the nearest 5 cents: (1) the mill alloy base price as established in Schedule No. 6, (2) mill analysis extras, (3) a mark-up of 66⅔ per cent of the aggregate of mill alloy base price and mill analysis extras. Maximum for delivery to any other destination is combination of base prices for basing point cities plus less-than-carload freight rates, for delivery at any other destination it is combination of base prices for basing point cities plus less-than-carload freight to destination.

Item quantity extras for orders placed in one day, shipped at one time, to one destination, are $1.25 per 100 lbs. on an order for less than 300 lbs., 75 cents per 100 lbs. for 300 to 499 lbs., 50 cents per 100 lbs. for 500 to 999 lbs., and no item quantity on an order of 1000 to 39,999 lbs. Order extra of $3 per 100 lbs. may be charged on orders for less than 300 lbs., but cannot be charged if item extra is charged.

Hot rolled alloys and cold finished alloys need not be combined to determine total weight. Charge of $2.50 per 100 lbs. may be made for heat treatment or double treatment (both annealing and normalizing or spheroidized annealing). Charge of $1 per 100 lbs. may be made when either annealing or normalizing is performed. No charge can be made for straightening. Size extras may be added but shall not exceed mill size extras.

No. 198 (Amendment)—**Silver Bullion**, effective Aug. 31. Increases maximum price at which silver may be imported into this country to 45.00c a troy ounce.

Baltimore Manufacturers Converted to War Work

BALTIMORE

With the Baltimore industrial area fairly overflowing with war work, plant conversions are proceeding rapidly. Approximately 9 per cent of the industries in Maryland are engaged in war work and the volume is being stepped up to a point where relatively few plants, and certainly few metalworking plants, have not sufficient business to provide for economical operation.

The Baltimore area has lent itself particularly well to conversion, for the principal reason that her industries are diversified.

The district's position has been greatly helped by the rapid expansion of merchant shipbuilding and ship repair, which has provided considerable miscellaneous work for small metalworking shops and foundries.

This district also has been fortunate in being able to draw heavily on airplane work, having already had an important nucleus at the start in the Glenn L. Martin Co., which has undergone heavy expansion in the last year and a half, with employment being stepped up from around 15,000 to 45,000. More than 9000 of these employes are women.

In certain branches of the metalworking industry, concern has been expressed over ability to convert to war work. Sanitary ware manufacturers and soil pipe producers have been hurt by restrictions in their normal output. However, they have been driving hard for emergency work and one large sanitary ware manufacturer is now converting production from iron to steel castings, for which there is a large demand. It is understood this interest will engage in the manufacture of tractor shoes to a considerable extent.

Most jobbing foundries are averaging fairly well, with contracts for machinery castings and for miscellaneous items of marine hardware helping out considerably, and also more recently, sizable orders for cast iron test shells. Some very small shops throughout the state, each employing only a relatively few men, have suspended, however.

Steel Carrier Sinks In Lake Superior

The motor ship STEELVENDOR, operated by the American Steel & Wire Co., Cleveland, sank in Lake Superior near Manitou Island, Sept. 3.

The vessel which was 250 feet long, with a beam of 43 feet, was carrying steel billets from Duluth to Waukegan, Ill. Launched in 1923, the carrier encountered a heavy sea and was abandoned by its crew of 23 men and two coast guards.

No more new metal office furniture not already in the hands of dealers will be purchased by the Army, the Services of Supply of the War Department announced.

This action is taken to conserve metals for vital war purposes. The Army's stop-order cancels all contracts not three-fourths fabricated.

WINDOWS of WASHINGTON

Industry warned fewer draft deferments will be granted. Replacements should be trained at once to offset drain on skilled workers. Army of 10,000,000 envisaged by Selective Service officials

ALL industrial managements should consider the article by General Hershey, appearing on Pages 40-41 of this issue, as one of the most important utterances addressed to them since Pearl Harbor. They should heed his warning about the need for training replacements for many of their skilled workers. It is advisable to lose no time in making personnel inventories and to follow the course of action outlined.

In order that the full import of General Hershey's words may be better understood, some background information may be summarized here, as follows:

Now in the making is a bill soon to be introduced in Congress. Closely following the British law, with some modification to suit our overall economic picture, it will replace our voluntary employment system with a compulsory system.

Under this bill, no man would any longer have anything to say about what employment he would have. The government would tell him what to do—and he would be obliged to follow orders.

The bill, of course, is based on current indications that this is to be a long, hard, tough war, and that we will have to throw in all our strength if we are to win it. All of our citizens, men and women alike, are to be used to the maximum degree to win the war.

All previous ideas about occupational deferment are out the window. Men who are operating turret lathes or other essential machines will be drafted right and left. Hence will arise the necessity for training replacement workers on a scale not heretofore conceived. To the maximum extent possible, all able-bodied men are to go into our armed forces.

It currently is estimated that about 10,000,000 able-bodied men are available for the armed forces. To get this number the Army and Navy will have to dig deep, and dependency will not mean a thing, while occupation will not mean what it did.

It is not yet known whether the 10,000,000 men in sight constitute the maximum available supply. The War Manpower Commission and the Army Selective Service system have been studying this question and now have about come to the conclusion that we will not know until after the fighting is over just how many workers at home will be required to supply a man at the front. Government economists have estimated that in this war 18 workers are needed behind the lines for each fighting man. However, the Army and the manpower commission have been unable to get any satisfactory proof that this estimate is correct. Hence about all they can say now is that they are going to go the limit—whatever that will prove to be.

Discovery and utilization in the war program of men with early experience in skilled machine trades is a project of the United States Employment Service. Seen here at the Cleveland center are registrants who were summoned to discuss with employment experts their qualifications for jobs urgently needing candidates in machine tool, aircraft parts, and heavy war industries. Although their present occupations include such far removed pursuits as sales of baked goods, furniture refinishing and washing machine repairs, every man in this group has had experience in the past on engines, lathe, drill press or screw machine operations

Voluntary Method Fails

That the voluntary method of seeking employment has proved a failure is a conclusion from experience so far obtained by the United States Employment Service in seeking to persuade men to leave positions of lesser importance in the wartime economy in order to take other more essential ones.

Samples taken so far in Cleveland and certain other communities have been highly unsatisfactory from the standpoint of the Army and the manpower commission. Out of some 200,000 men so far interviewed 80 per cent have rejected invitations to take other jobs because of three reasons. First, they fear the loss of their seniority status in their present employment. Second, they are uncertain about security in the new job. Third, they do not like to move or travel extra distances to reach the war plants where they are wanted.

Of the 20 per cent who said they would be willing to shift, nearly all

Chief craftsman for 23 years in a jewelry manufacturing shop specializing in wedding rings, the man at right above is believed by the interviewers to have adequate knowledge of threading and hobbing machine operation because of his experience during World War I in a screw products plant want to wait until the government will pay expenses that would be involved.

Drafting of men from jobs requiring skill will be conducted with great care so as to prevent any serious disturbance to production. In order that it might plan on a sound basis, the Army Selective Service system for some time has been making sample studies at different plants as to the length of time required to train men for various key industrial jobs.

In the steel industry, for example, it normally takes two years as a rule to train a rougher. It takes about an equal period to train a strander or a manipulator. Some eight or nine jobs in the steel industry take more than five years of training. It takes 10 to 15 years to train a man to become a department superintendent in the steel industry. On the other hand, it has been learned that under the emergency conditions the training periods can be shortened materially.

In preparing the labor draft bill it has been necessary to devote a great deal of thought as to what occupations are essential. This is a difficult matter inasmuch as opinions vary. Too, war plant managements have brought a great deal of pressure to bear in order not to lose employes through the military draft. Some managements have asked deferment for men serving in such capacities as sweepers, watchmen, guards and so on, and have given the length of their service as the periods required to train them for these jobs.

Official thinking about the urgency rating of different occupations appears to be sound. A bread baker, for instance, rates ahead of a pastry baker. A bread baker rates ahead of a truck driver who delivers bread on a residential route. By the same token a milk pasteurizer or bottler rates ahead of a driver who distributes milk on a residential route. Many types of repair and maintenance jobs are considered as essential, particularly because the ranks of men so employed are being depleted by absorption in similar work for the Army and Navy.

Another important feature of the bill now in preparation is a provision to prevent labor "piracy". There is to be a penalty on hiring workers away from their present employers. Labor "hoarding" also is to be prevented. Instances have been encountered where companies were keeping idle men on the payrolls in order to be assured of a labor supply for the future.

The War Manpower Commission may request the Army to cease voluntary recruiting. The commission's management-labor policy committee has asked for such action, declaring that Army absorption of technically trained men now has reached a point that threatens maintenance of war production.

This former sheet metal fitter at a Douglas Aircraft plant in California will soon be back at work in a war plant where his skill is critically needed. He was a bench hand in the airplane shops, forming sheet metal for fuselages and fabricating stringers for wings and braces for doors and bulkheads. Five years ago he returned to the East and has been employed until recently as traffic manager for a lithograph company. He is now ready to use his experience in any war plant the employment specialist, seen with him, may suggest

Violations of Priority Regulations on the Wane

Violations of priority regulations caused by the desire to help out old customers and by other unselfish reasons have about disappeared, it is learned from a competent source in the War Production Board. At least 95 per cent of current violations result from honest misunderstanding. But warning is given that even violations through misunderstandings will not be tolerated.

"This is no time for manufacturers to put legalistic interpretations on priority rulings and see how much they can get away with under the law," says this authority. "The War Production Board has had to promulgate a lot of new laws. It is dealing with a situation such as this country never before has experienced. Orders are written hastily and announced.

"While many of the priority orders are hard to read, they must be read and re-read by every manufacturer. Then, if every manufacturer will consider himself to be on honor, if he at all times will govern every action with the basic desire to contribute to the war effort, we will have little trouble in getting compliance."

Many cases have arisen where noncompliance has resulted from advice obtained by a manufacturer from his customer, even when that customer is the Army or the Navy.

One recent case involved a particular item for a steel plant. The manufacturer of this item rerated this particular order from A-1-a to AA-2 whereas the item was one that falls into the classification of equipment rather than something needed in the actual maintenance of steel production.

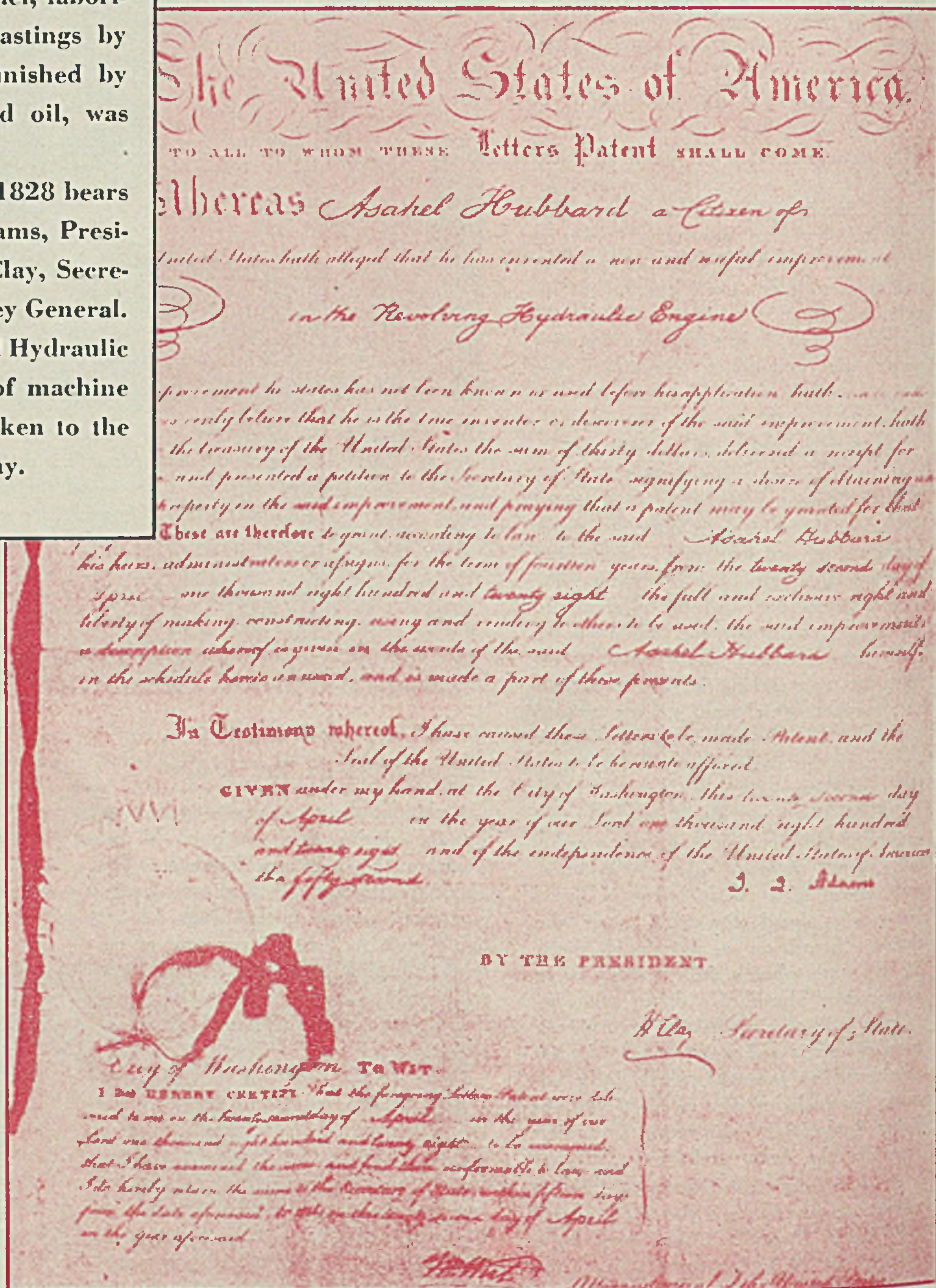
Such violations of Priorities Regulation No. 12 are regarded as a serious matter, particularly because the Army and Navy Munitions Board has been very careful to rerate only where maintenance items are involved. Due to misunderstandings, unwarranted reratings have enabled subcontractors frequently to get in ahead of allowable reratings. For example, an order involving turret lathes for a subcontracting plant was rerated to AA-3, thus superseding A-1-a items the Army and Navy had not rerated but which should come ahead of the turret lathes.

The point is stressed that PD-4X, on which form Army and Navy reratings are made, is secret so that manufacturers have no way of checking to determine whether they can rely on the advice of individual procurement officers as to the legal status of reratings. Their only recourse is to study Priorities Regulation No. 12 carefully so that they can understand fully how to comply with it. They

At his watermill in the West Parish, Asahel Hubbard experimented with his "Revolving Hydraulic Engine." Models made of wood were tested, rejected, modified and refined. At last a working model, laboriously formed from rough iron castings by the lost art of "chipping" and finished by grinding with powdered glass and oil, was assembled and found successful.

The patent granted April 22, 1828 bears the signatures of John Quincy Adams, President of the United States, Henry Clay, Secretary of State, William Wirt, Attorney General. This marks the birth of the National Hydraulic Company beginning a long chain of machine industries that comes down unbroken to the Jones & Lamson Machine Company.

JOHN QUINCY ADAMS



The United States of America.

TO ALL TO WHOM THESE Letters Patent SHALL COME.

Whereas Asahel Hubbard a Citizen of

United States hath alleged that he has invented a new and useful improvement

in the Revolving Hydraulic Engine

provement he states has not been known or used before his application hath ... does verily believe that he is the true inventor or discoverer of the said improvement, hath ... the treasury of the United States the sum of thirty dollars, delivered a receipt for ... and presented a petition to the Secretary of State signifying a desire of obtaining ... property in the said improvement and praying that a patent may be granted for that ... These are therefore to grant according to law to the said Asahel Hubbard his heirs, administrators or assigns for the term of fourteen years from the twenty second day of April one thousand eight hundred and twenty eight the full and exclusive right and liberty of making, constructing, using and vending to others to be used, the said improvement a description whereof is given in the words of the said Asahel Hubbard himself in the schedule hereto annexed, and is made a part of these presents.

In Testimony whereof, I have caused these Letters to be made Patent, and the Seal of the United States to be hereunto affixed.

GIVEN under my hand at the City of Washington this twenty second day of April in the year of our Lord one thousand eight hundred and twenty eight and of the independence of the United States of America the fifty second.

J. Q. Adams

BY THE PRESIDENT

H Clay Secretary of State.

City of Washington TO WIT:

I DO HEREBY CERTIFY that the foregoing Letters Patent were delivered to me on the twenty second day of April in the year of our Lord one thousand eight hundred and twenty eight to be examined; that I have examined the same and find them conformable to law; and I do hereby return the same to the Secretary of State within fifteen days from the date aforesaid, to wit: on this twenty second day of April in the year aforesaid.

Wm Wirt

Attorney General of the United States

Signed our BIRTH CERTIFICATE

OUR determination to test, reject, modify and refine, links us with the past and points ahead into the future. Whenever invention born of necessity in a time of emergency has developed new materials or new methods, we at Jones & Lamson have been ready with advanced machine tool technique, and those who have depended on us have not been let down.

No matter how preoccupied with today's production problems, you cannot fail to benefit by contacting a company that has so consistently maintained leadership. Whether your organization is large or small your inquiry will receive the careful, detailed study of our engineers.

Send your questions today and ask for our illustrated catalogs.

JONES & LAMSON
MACHINE COMPANY

Manufacturers of Ram & Saddle Type Universal Turret Lathes . . . Fay Automatic Lathes . . . Automatic Thread Grinding Machines . . . Comparators . . . Automatic Opening Threading Dies and Chasers

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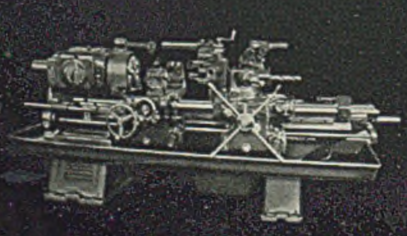


SADDLE TYPE
UNIVERSAL TURRET LATHE

PROFIT PRODUCING
MACHINE TOOLS

RAM TYPE
UNIVERSAL TURRET LATHE

should read with special care that portion of the order from 944.33 to Paragraph 3. Prevailing attitude is that ignorance is no excuse under the law.

Emphasizing this attitude, one compliance officer advances this reason for being hard-boiled: "It is not at all strange that whenever a manufacturer violates the priority system the mistake always is to his advantage. It is like getting short-changed in a restaurant; the mistake always is at the cost of the customer. This is a very human trait—and we must guard against it.

"The basic objective behind Priorities Regulation No. 12," he concluded, "is to give right-of-way to anything that is shot at the enemy, giving secondary consideration to facilities that are to be used in making such goods."

Copper Allocation To Be Controlled More Closely

Copper Branch of WPB is effecting closer control over allocation of metal to consumers through Form PD-59-d which lists the individual orders on the books of each fabricator.

The new system eliminates the blind allocation setup previously based on preference ratings. The Production Requirements Plan does not supply sufficiently accurate information on which to base allocations, according to a branch official, since it is impossible for anyone to guess what production will be for fourth quarter, as an example.

The Copper Branch has complete data on the airplane, tank, ship, gun, ammunition and other programs which is checked against the detailed information derived from the PD-59-d forms. As a result, the Army and Navy are able to schedule shipments more accurately.

September authorizations already have been sent back to fabricators in most instances. Fabricators are reported pleased with the new setup. As expressed here, the Production Requirements Plan has academic but not practical merit—at least as far as distributing copper is concerned.

Post-War Reconversion of Industry Being Surveyed

More than 8000 manufacturers are cooperating in a survey now under way to determine post-war employment and reconversion prospects.

Survey is a part of a research project undertaken by the Chamber of Commerce of the United States to develop facts as to consumer demands, and the means of industry to fill them when full peacetime production is resumed.

"The project," a chamber announcement said, "is designed to assist management, labor, agriculture and the government in planning for quick reconversion and quick employment after the war."

The broad national canvass of the post-war consumer market was initiated by the chamber several weeks ago. The consumer analysis was undertaken on a comprehensive national scale when a preliminary pilot survey indicated that war's end will bring a tremendous demand for the products of industry.

The specific industry research, participated in by manufacturers and other segments of industry, is to analyze plant capacity needed for a continuation of "defense" needs after the war; plant capacity available for production of civilian goods; machine tools needed for reconversion; labor needed for reconversion and for production after the war; and time required for reconversion.

Steel Conservation Order To Be Amended Soon

An amendment to Steel Conservation Order M-126 further curtailing use of steel now is making the rounds for appraisal and will be issued shortly, it is indicated here.

Additional Advisory Committees Appointed

Formation of more industry advisory committees during the past week was announced by T. Spencer Shore, chief of the WPB Division of Industry Advisory Committees. They are:

Concrete Construction Mixers

Ralph H. Dano, acting section chief, Construction Equipment Section, is the government presiding officer.

Committee members: B. F. Devine, Construction Machinery division, Chain Belt Co., Milwaukee; L. S. Holden, Construction Machinery Co., Waterloo, Iowa; M. V. Gilson, Gilson Brothers Inc., Fredonia, Wis.; Lion Gardner, Jaeger Machine Co., Columbus, O.; W. B. Knickerbocker, Knickerbocker Co., Jackson, Mich.; George J. Dimond, mixer division, Koehring Co., Milwaukee; Walter Muller, Ransome Concrete Machinery Co., Dunellen, N. J.; H. E. Smith, T. L. Smith Co., Milwaukee; H. E. Moor, Lansing Co., Lansing, Mich.; and N. Essick, Essick Mfg. Co., Los Angeles.

Calculating Machines

N. G. Burleigh, chief, Services Branch, is the government presiding officer.

Committee members: E. F. Britten, Jr., Monroe Calculating Machine Co., Orange, N. J.; John S. Coleman, Burroughs Adding Machine Co., Detroit; Edgar B. Jessup, Marchant Calculating Machine Co., Oakland, Calif.; Raymond J. Koch, Felt & Tarrant Mfg. Co., Chicago; Carl M. Friden, Friden Calculating Machine Co. Inc., San Leandro, Calif.; H. A. Hicks, Remington-Rand Inc., Buffalo, N. Y.; and M. T. Snyder, Allen Calculators Inc., Grand Rapids, Mich.

Knife and Enclosed Switch Industry

John Gammell, of the General Industrial Equipment Branch, is the government presiding officer.

Committee members: Fred G. Kraut, Frank Adams Electric Co., St. Louis; C. L. Hull, Square D Co., Detroit, Mich.; C. W. Denny, Barkelew Electric Mfg. Co., Middletown, O.; T. J. Fleischer, Walker Electric Co., Atlanta; W. H. Frank, Bulldog Electric Products Co., Detroit; A. R. Johnson, Cutler-Hammer Inc., Milwaukee; P. C. Smith, Arrow-Hart & Hegeman Electric Co., Hartford, Conn.; and F. T. Wheeler, Trumbull Electric Mfg. Co., Plainville, Conn.

Electrodes and Rods Manufacturers

K. W. Ostrom, chief, Welding Section, is the government presiding officer.

Committee members: E. J. Brady, Alloy Rods Co., York, Pa.; T. Pierre Champion, Champion Rivet Co., Cleveland; L. M. Keating, A. O. Smith Corp., Milwaukee; H. J. Lange, Marquette Mfg. Co., Minneapolis, Minn.; J. F. Lincoln, Lincoln Electric Co., Cleveland; H. W. Reade, Air Reduction Sales Co., New York; W. W. Reddie, Westinghouse Electric & Mfg. Co., Pittsburgh; R. D. Thomas, Arcos Corp., Philadelphia; J. B. Tinnon, Metal & Thermit Corp., New York; and J. N. Walker, Union Carbide & Carbon Corp., New York.

Conveyor, Power Transmission

C. R. Heller, of the General Industrial Equipment Branch, is the government presiding officer.

Committee members: Briton Welser, Chain Belt Co., Milwaukee; E. J. Burnell, Link-Belt Co., Chicago; W. L. Dean, Mathews Conveyer Co., Ellwood City, Pa.; W. V. Casgrain, Mechanical Handling Systems Inc., Detroit; E. M. Carver, Dodge Mfg. Corp., Mishawaka, Ind.; M. F. Dunne, Pyott Foundry & Machine Co., Chicago; Guy A. Wainwright, Diamond Chain Co., Indianapolis, Ind.; T. Matchett, Robins Conveying Belt Co., Passaic, N. J.; H. S. Hersey, C. O. Bartlett & Snow Co., Cleveland; Howard Dingle, Cleveland Worm and Gear Co., Cleveland; W. L. Schneider, Falk Corp., Milwaukee; and E. F. Emmons, Union Chain & Mfg. Co., Sandusky, O.

Labor Shortage Reported Reducing Copper Production

Domestic copper production could have been some 5000 tons higher in July if sufficient labor had been available at the mines, representatives of primary copper producers reported to WPB.

Members of the copper industry advisory committee told Harry O. King, chief, Copper Branch, that Selective Service had taken as high as 20 per cent of the labor force in some mines; that shipyards, aircraft plants and military construction projects were offering wages with which copper mines could not compete, and that until recently productive efforts per miner had lagged.

Wage-Hour and Contracts Units Of Labor Department Merged

Secretary of Labor Frances Perkins has ordered consolidation of the Wage and Hour and Public Contracts divisions of the Department of Labor.

Consolidation will enable the divisions to carry out their responsibilities under the Fair Labor Standards Act and the Public Contracts Act.

Dominion Tightens Control Over Steel

TORONTO, ONT.

DOMINION government is taking more drastic action with regard to the conservation of steel and other metals for war industry. As a result of a new order curtailing use of metal in the manufacture of certain office furniture, more than 4200 tons of sheet metal will be conserved and made available to the war effort within a year, the Department of Munitions and Supply announces. The order, issued by Alan H. Williamson, provides that, except for joining purposes, no metal may be used after Sept. 1, in the manufacture of filing cabinets, shelving, lockers, safes and visible record equipment, unless a permit has been obtained from the controller.

"It is our intention to allow the use of fiber board or wood in the making of these items," Mr. Williamson stated. "In such instances the use of metal will be permitted in the manufacture of light frame to which the boards may be attached and of operating equipment for opening drawers." So that as little metal as possible may be used, the new order requires that all specifications for frame and other joining parts be submitted to the controller.

Except by permit, no person may make or sell, after Sept. 1, commercial washing machines or any other machinery used in commercial laundering or dry cleaning. The new order permits the manufacture and sale of repair parts and the order does not affect sale of second-hand machinery.

Trade Minister MacKinnon announced that after Sept. 2 export permits will be required before the export to any destination of agricultural implements and machinery parts valued at more than $25. Permits also will be required for export of tableware and kitchenware of china, porcelain, semi-porcelain, white granite and earthenware, and cartridges of 22 caliber and lighter.

As a substitute for tin plate, bonderized steel will be produced in two plants at Hamilton, Ont. The Steel Co. of Canada Ltd. and Dominion Foundries & Steel Ltd. have been granted priorities and received permission to use patent rights from United States authorities. Production of bonderized steel in Canada is expected to relieve to a considerable extent the large demand for tin and materially aid in making present reserve stocks of tin available for war production. At the plants of the two companies large additions are under way and arrangements have been completed for shipping special machinery and equipment from the United States. The first sheets of bonderized steel are expected to come from the local plants next month.

Under a subcontract from De Havilland Aircraft of Canada Ltd., General Motors Corp. of Canada Ltd., Oshawa, Ont., will manufacture warplane fuselages, according to an announcement by the Department of Munitions and Supply. Work on the fuselages will commence when rearrangements of facilities and tooling, now under way, are completed. Production is expected to start in January or February.

Gold production in Canada for June totaled 425,067 fine ounces, compared with 425,160 ounces in May and 451,964 ounces in June, 1941, the Dominion Bureau of Statistics reports. Output for the first six months of this year amounted to 2,491,519 fine ounces, compared with 2,636,246 ounces in the corresponding half of 1941. June gold production by provinces, with 1941 comparative figures in parentheses follow: Ontario, 237,980 ounces (268,100); Quebec, 90,723 ounces (87,591); British Columbia, 44,935 ounces (55,047); Manitoba and Saskatchewan, 29,456 ounces (27,078); Yukon, 10,152 ounces (9773); Northwest Territories, 10,219 ounces (4785); Nova Scotia, 1597 ounces (1622).

Canadian Division Set Up By War Production Board

Establishment of a Canadian Division to handle Canadian priorities problems in the Office of Operations of the War Production Board has been announced.

Joe Tucker will be director of the new division, with headquarters located with the Department of Munitions and Supply, Ottawa, Canada.

Creation of the Canadian Division is a further step toward co-ordination of munitions production, materials distribution and priorities controls in the United States and Canada. The Division will further effectuate the policy of placing firms engaged in war production on both sides of the border on an equal footing with respect to distribution of materials.

Artist Helps Small Contractors Visualize War Goods Blueprints

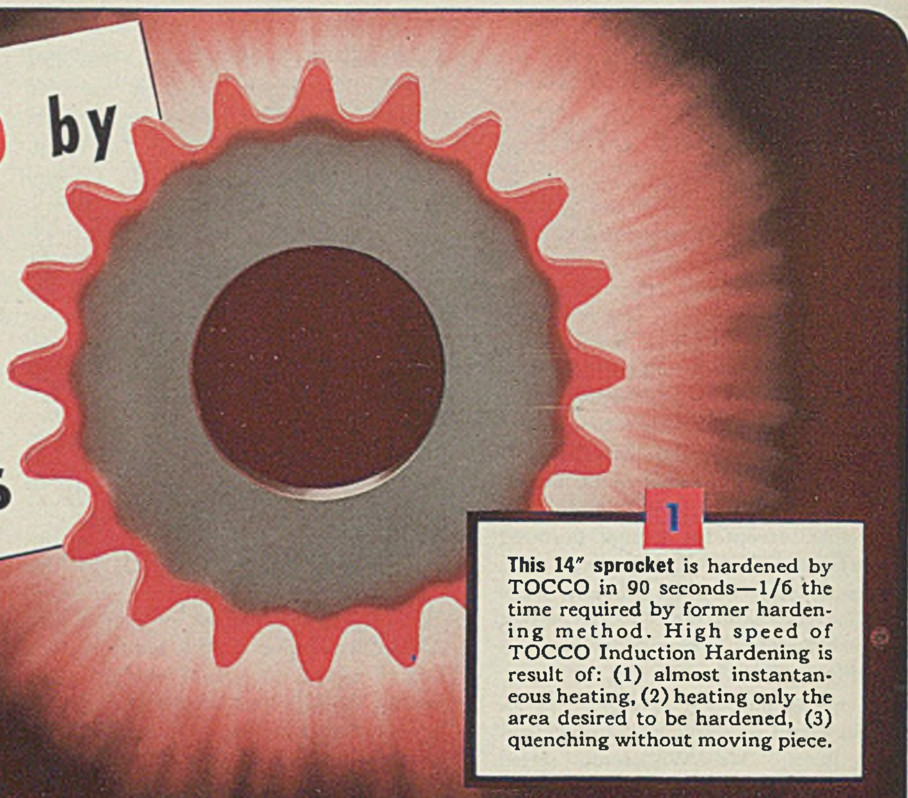
To help small manufacturers find their place in the war production program, the Chicago regional office of WPB has engaged a commercial artist who translates the technical description of a blueprint into a three-dimensional picture. According to Joseph L. Overlock, regional director, it has been found that small operators understand photographs and pictures better than blueprints or other description; thus they can be helped in visualizing a machined part needed by some war plant to complete a contract, and are able to decide more quickly whether their machinery and equipment can do the job.

In addition to taking over the copper mines of Croatia, once part of Yugoslavia, the German authorities, in their zeal to locate all available copper, have required the registration of church bells as well as utensils of copper, brass and bronze, according to reports received in this country.

NASH-KELVINATOR TO PRODUCE FLYING FREIGHTERS

SCALE model of the huge Vought-Sikorsky four-motor flying boat is being inspected by George W. Mason, president, and W. F. Armstrong, vice president in charge of war production, Nash-Kelvinator Corp., Detroit, as the company rushes to complete preparation for production of these flying freighters in a new southern plant

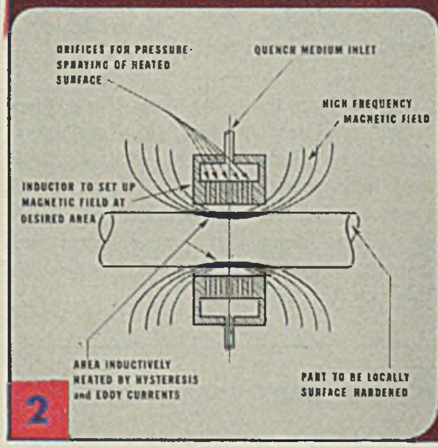
HARDENED by TOCCO IN 90 SECONDS



1

This 14" sprocket is hardened by TOCCO in 90 seconds—1/6 the time required by former hardening method. High speed of TOCCO Induction Hardening is result of: (1) almost instantaneous heating, (2) heating only the area desired to be hardened, (3) quenching without moving piece.

How TOCCO increases output and improves the product



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3

4

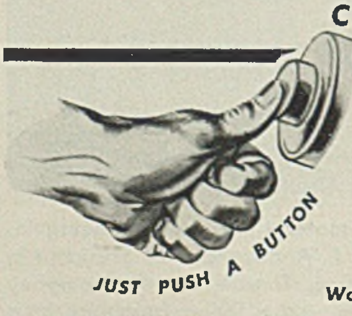
How TOCCO works. Inductor block with integral quench surrounds part or section to be hardened. Width and location of hardened areas are determined by design of holding fixture and inductor block. Depth of heating is determined by power input and heating time.

TOCCO Hardening is completely automatic. Controls pre-set. Push-button operation. Skilled operator not required. Rapid heating and quenching practically eliminates distortion. Improves working conditions because it is cool, clean, compact.

TOCCO is being used extensively for hardening armor-piercing shot and for other ordnance heat-treating work. TOCCO savings on one contract often pay for machine. Can be adapted to post-war products by simple change of work fixture.

Complete information in "The TOCCO Process" booklet. Free on request.

THE OHIO CRANKSHAFT COMPANY
CLEVELAND, OHIO



TOCCO

World's Fastest, Most Accurate Heat-Treating Process

HARDENING
ANNEALING
BRAZING
HEATING for forming and forging

MIRRORS of MOTORDOM

Wartime boom in motor capital a crazy-quilt pattern, at once ludicrous and alarming, but life rolls merrily on. . . . Strike caused by "boys feeling their oats"

DETROIT

NEVER in its long history of economic ups and downs has this city seen the feverish activity, the hub-bub, the crowds and the industrial boom which now engulf it. Civic pride restrains many from saying it, but actually the town has gone "screwy."

The volume of war production assigned to Detroit companies and plants with headquarters in Detroit is, of course, tremendous. On top of this is a full complement of navy, ordnance and air corps personnel, military and civilian, who are assigned to "follow through" on stuff going through the plants. In this arsenal of bureaucracy, as Raymond Clapper calls it, there appears to be some necessity for building up top-heavy staffs of expediters and inspectors.

Now the signal corps is moving in to establish a depot here, and plans to outfit trucks and other transport equipment with radios and signal devices which this arm of the military service handles.

So heavy has long-distance telephone traffic become that it has snowed under special long-distance operators and supplementary lists of regular operators have been drawn up and supplied to companies making extensive use of long-distance. This situation is not bettered any by the habit of various lieutenants and majors stationed here who "ring up" Washington several times daily and chat for as long as an hour on details of one single order.

Everybody "Wants In" on Boom

Prices on nearly everything are skyrocketing. One popular cafeteria, patronized by large numbers of people from automotive and suppliers' companies, now is charging fully 25 per cent more for food than a year ago—and doles out sugar by the single spoonful to boot. It is virtually impossible to locate a stenographer or secretary, and the turnover in this type of help is enormous under the temptation of higher wages.

Buildings are discovering the problem of hiring such types of help as elevator operators or of holding onto those now occupying such jobs is a continuous headache. If employes have not already left to take a job running a drill press in a war plant, they at least are spending their spare time in such pursuits as learning how to read a micrometer or how to operate a riveting gun.

Taxi drivers are pikers if they are not clearing $70 or $80 a week, and the instance was told this writer of a cab driver who actually refused a proffered 10-cent tip on a 25-cent ride, saying he had no use for dimes.

The Michigan Central railroad station currently is estimated to be handling daily traffic to and from trains of 33,000, while the Union Station has proportionately large crowds. Thousands of hopefuls are trekking in here by bus, train and private jaloppy from Georgia, Tennessee, Iowa and other remote points, answering the call of the "big money."

The new Combat-Automotive section of the Ordnance Department, piled on top of what was already the largest ordnance district in the country, will mean complete occupancy of the 40-story Union Guardian building, several floors of the National Bank building, six floors of the Fisher building, and the possibility of further space later. Plans are under way to install the largest telephone switchboard ever built in the Union Guardian, with 800 trunk lines and a dozen operators, plus 500 more lines to be installed Dec. 1.

Housing Problem Acute

Housing conditions throughout the city and environs are critical and should gasoline rationing be imposed on the middle west, as is now being forecast widely, the effect on many thousands of working people who drive from 100 to 250 miles a week just to and from work will be disruptive.

Large numbers of trailers and shacks are now occupied by war plant workers in outlying sections. Last week a manufacturer set up a display along Woodward avenue of a small "portable cottage" to house workmen's families unable to locate permanent residences. Living conditions in these makeshift quarters leave much to be desired, but to many they may be better than anything previously enjoyed, so the occupants manage to get along somehow.

Military aircraft wing their ways back and forth across the city day and night, from where and to where no one knows. The Wayne county airport is literally jammed to the fences with hundreds of combat planes, and Selfridge Field, 25 miles northeast, is being doubled in size to accommodate some new phase of aircraft transfer and dispatching. Groups of ferry command pilots throng the lobby of one of the downtown hotels daily.

A typical Steve Hanagan publicity photograph appeared in the papers last week, showing a 4-foot midget standing on the tail of a bomber under construction at the Ford Willow Run plant. Hanagan now handles certain phases of Ford publicity and the picture of the midget cowboy who had "refused to discard his cowboy suit for overalls", with a hammer stuck in his belt like a six-shooter and holding a screw-driver against a finished rudder for some unexplained reason, exemplified the Hanagan touch. Reportedly the midget "can do a great deal of work in tight spots not easily accessible to the average man."

Another new phase of military activity supposedly slated for this area encompasses all proving ground work except ballistics in connection with army vehicles now carried out at the Aberdeen Proving Ground in Maryland. Scene of the new testing work presumably will be in the vicinity of Pontiac, home of Yellow Truck. Only a short distance away is the spacious proving ground of General Motors, at Milford, Mich., which conceivably could also be drawn into the picture.

Labor troubles at the Buick aluminum foundry broke out into the open a week ago, after smoldering for several weeks. Two youthful workmen were dismissed for incompetency, after which a sitdown strike developed in the plant, ended only by intervention of the Army Air Forces. The sitdown was actually the culmination of a protracted series of disturbances, the core of which was a union attempt to change coremakers from piecework rates to straight hourly rates. To enforce their demands, still not settled finally, production rates on cylinder head cores were reduced drastically, from a normal of 40-50 per shift to around 20 per shift.

Union Disclaims Responsibility

The officer in charge of plant protection for the Army Air Forces in this district, after preliminary investigation, said he believed the strike "was caused by a group of 18 and 19-year old boys in the plant who are making bigger money than they have ever seen before, who have little or no sense of responsibility and who are feeling their oats. It does not appear that sabotage was involved." This statement suggests a lack of understanding of all the facts in the case. Eighteen-year old boys feeling their oats, and making more money than they ever thought possible, do not of their own volition slow down production of airplane engine cylinder heads to half of what can be produced in normal operations.

The UAW-CIO has a neat way of

parrying these disgusting interruptions on the part of labor. Union officials simply state "the strike is not authorized" and thus disclaim any responsibility, even though, as was the case at Buick, sub-leaders of the UAW actually appear on the picket line.

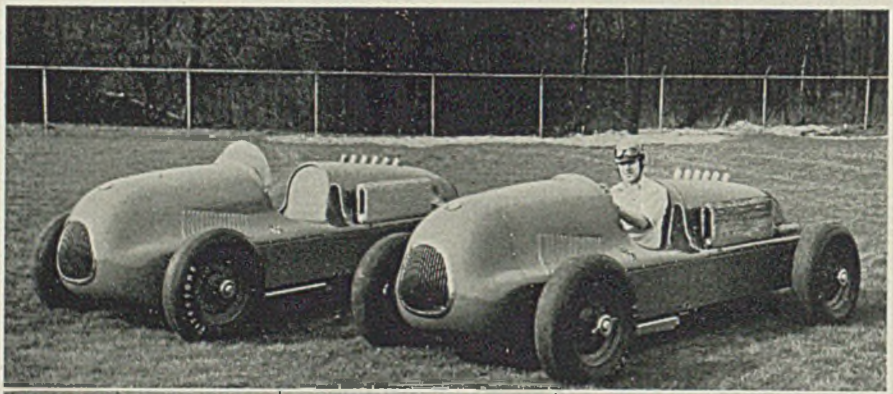
Another case of inexcusable interference on the part of unions with vital war work occurred recently at the Chrysler Tank Arsenal where 475 A. F. of L. construction workmen were pulled off the job by the secretary of the Detroit Building Trades Council because 40 CIO sheet metal workers were installing paint booths and ovens for a subcontractor. This action was taken in spite of the fact three other subcontractors doing similar work had followed the policy of hiring CIO men for sheet metal installation and A. F. of L. men for electrical work and pipefitting.

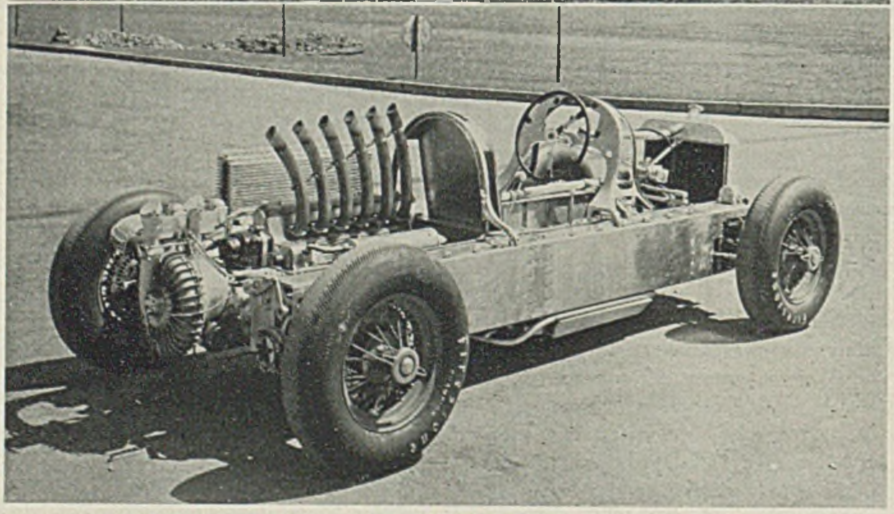
These seemingly trivial incidents probably do no serious harm to the overall war production program, in spite of the statement by E. J. Hunt, manager of the tank arsenal, that "this sabotage of our plant definitely holds up our future production schedules." Most of the differences are usually patched up after a fashion in a matter of hours and work is resumed. But they indicate something basically at fault in the minds of laboring men and union leaders. There is no acute consciousness of the serious nature of the war in which we are involved.

As a matter of fact, right in this tank arsenal, there is probably more "soldiering" on the job going on than even officials realize. Union shop stewards know it, however, and they talk about it to friends. To some it is a joke, to others it is criminal. One steward voiced the opinion that "a lot" of the men working at the arsenal never do a lick of work from the start of a shift to the quitting whistle, some even spending the hours in such pastimes as sleeping in spare turrets, etc.

Tests of Gulf Racing Cars for Future Design Halted by War

While automobile racing is "out" for the duration, the findings of research experts in such grueling tests as the Indianapolis Memorial Day race, last held in 1941, may well be translatable into oils, fuels and cars of the future. Until racing was suspended, the Gulf Research & Development Co., Pittsburgh, was carrying out a thorough program on racing car studies, principally to determine ways to obtain maximum performance on regular-grade gasoline and motor oils, to observe lubrication problems in high-duty engines, to note the importance of oil temperatures in design of bearings both of ordinary babbitt and of newer bearing alloys, to find the effect of supercharging on octane demand, the effect of different types of manifolding on breathing capacity in an engine, and friction loss in transmissions and rear axle gears. Through courtesy of R. J. S. Pigott, chief engineer for Gulf Research, STEEL is privileged to present some details of this development work.





Many innovations in automotive design have been incorporated in the late model racing cars designed by Gulf Research & Development Co., Pittsburgh, to study lubrication problems in high-duty engines. Unique design of welded steel box-frame containing fuel tanks and other novel features are seen in car below

The Gulf racer for 1941, an improvement over the 1940 design which set 33 new international speed records at the Utah Salt Flats, incorporates a novel means of protection for the fuel tanks, which were built into a box-section frame, the latter of 20-gage stainless steel.

Two of the tanks are incorporated in each siderail. The stainless steel box rails of the frame are connected in the center with a central cross member. Just ahead of the cross member is the tube which connects the four tanks through the central cross member.

Stainless steel frame members are covered on the inside with felt padding to protect the fuel tanks against chafing. Tanks themselves are of terne plate, while wheel mountings and central cross member are of S.A.E. X4130 steel assembled by welding. The wheel mountings comprise 24 separate pieces are welded together. All welded parts are heat treated to relieve stresses and improve physical properties.

The car itself, shown in lower view, has four-wheel drive and is individually sprung, with upper and lower radius arms and a pair of cantilever springs. Both hydraulic and friction shock absorbers are provided for each wheel. The friction shock absorber is mounted on the lower radius arm inner pin, and the hydraulic on the upper pin. Radius arms also are fabricated by welding and are of S.A.E. X4130. Engine is mounted at the rear, behind the driver. It has 183 cubic inches displacement and is supercharged with a centrifugal type blower. Note also the large oil cooler or radiator mounted on the outside of the chassis to one side.

The cars obviously as yet have not had the opportunity to prove the numerous innovations introduced in their construction. One of them, in fact, was unfortunately lost by fire the morning of the 1941 race.

Capacity Loading Requirement To Cause Difficulties for Shippers

STEEL shippers anticipate difficulties in the application of the Office of Defense Transportation order No. 18, requiring, with certain exceptions, that all freight shipped in carloads be loaded to the maximum carrying capacity of the cars.

The shippers recognize the necessity for loading cars to the maximum wherever possible, but believe the order lacks flexibility.

Traffic men have requested that the order, scheduled to become effective Sept. 15, be postponed 30 days.

Shipping schedules, for rolled products, are prepared days in advance of the rolling. Necessarily shipments are distributed according to priorities and to meet the pressing needs of the buyers. It will be impracticable, under such circumstances, to meet maximum capacity or load limit requirements, because, it is declared, no one will know when the schedules are made up what the load limits of the cars will be.

Of course, some shipments are exempt under the order—for instance, shipment of any commodity which has been allocated or limited by an order of an agency of the United States government in such quantity as to preclude shipment of an amount sufficient to meet the maximum loading requirements of the ruling.

One important modification appears definitely in sight, namely, exemption of less-than-carload shipments from the order.

Iron ore, it is pointed out, is a commodity that is probably as adaptable to the requirements of the order as any that could be mentioned. Usually the ore is loaded at one point and goes to one destination. Yet difficulties may be encountered here. One shipper cited an example. At his mine 18 to 25 cars of iron ore are shipped daily. The cars are all for one destination and those used are of the same capacity and in the same number service. The average loading per car is good, considerably above the marked capacity, which is the average nominal capacity of a car. Occasionally a car will be loaded to slightly over the load limit, but usually the load is under.

The cars are weighed at a distance from the mine, and the loaders must use care in seeing that the cars are not overloaded to avoid hauling them back for adjustment. The load limits of the cars vary. This shipper had before him a list of such cars, of which the lowest load limit was 125,900 pounds and the highest 129,900 pounds. If the latter car were loaded to the maximum carrying capacity of the former (125,900 pounds), it would be regarded as well loaded. Yet, he pointed out, under order No. 18 the railroad company would be unable to transport. In cases of this kind an average loading arrangement should and probably could be made which would satisfactorily meet conditions.

It is asserted that the shipper must certify that each car is loaded to a maximum carrying capacity. Yet in many instances, as in the case cited, the cars are weighed by the railroad considerable distances from the point of loading. How, it is asked, is the shipper to know until after the car is weighed whether the car is loaded up to the load limit.

Many Problems Presented

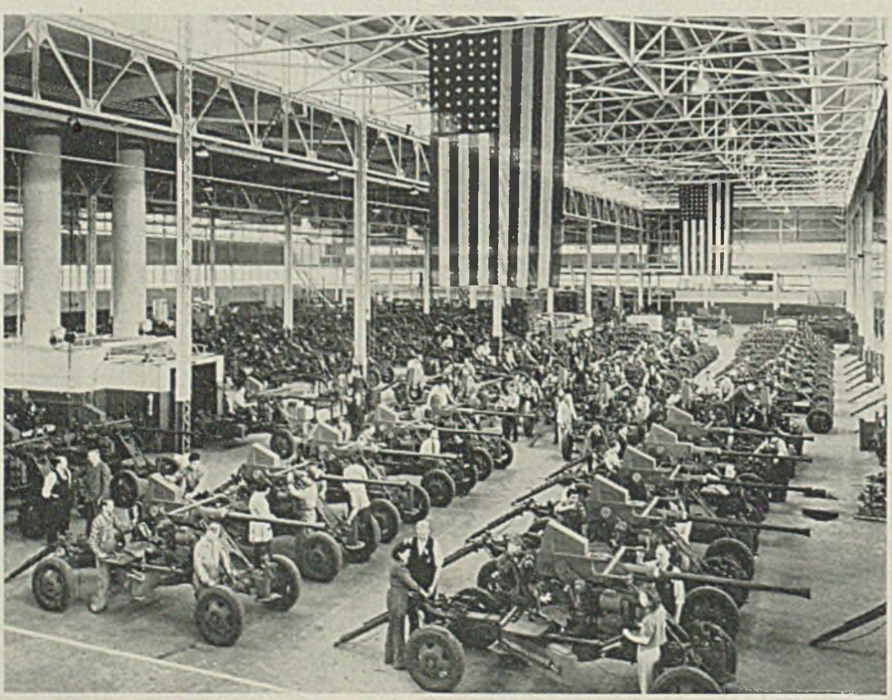
Various problems are cited by shippers, not to disparage the effort of increasing average carloadings, but rather to demonstrate the difficulties they will have in meeting the rigid requirements of loading cars to the maximum carrying capacity—in other words, to the load limit. If in the case of iron ore, a shipper were told that he must load to a point say 10 per cent above marked capacity, he would have a margin to work on without fear of overloading or of having cars rejected because they did not meet certain variable maximums.

Some shippers assert there will be no difficulty about coal and coke. These commodities, although not always being loaded up to the load limit, are loaded to the visible capacities of the cars, which is permissible under the order. The same should be true of iron and steel scrap generally, because, it is said, many cars of scrap are loaded to the full visible capacity though not up to the load limit. But here again, nevertheless, scrap shippers will not infrequently have trouble because of the difference in load limits. Moreover, it is believed the new regulation will retard the flow, pending accumulation at various points of full carload lots, and scrap shippers are appealing to Washington for relief.

One steel traffic manager in emphasizing the lack of flexibility said: "Mr. Eastman rightly described the order as 'drastic'. Having in mind that the load limit of a car is precisely the load limit, and not 100 or 1000 pounds less, many shippers will find out on Sept. 15 just how drastic it is."

As indicated above, the maximum car-

MASS ACK-ACK PRODUCTION WINS "E" AWARD



BOFORS 40-millimeter antiaircraft guns move five abreast into final assembly at a Firestone Tire & Rubber Co. plant. Akron, O., and Fall River, Mass., plants of the company recently have been awarded Army-Navy "E's" for excellence in war production. NEA photo rying capacity of the car is called the load limit and this weight figure is stenciled on the car. It differs from the marked capacity of the car and indicates to shippers the limit above which a car may be loaded beyond its marked capacity without overloading and thereby creating a transportation hazard.

The load limit is based on the car's axle capacity. The formula by which the load limit of any car is ascertained may be illustrated by taking a car of 100,000 pounds capacity (probably the bulk of gondola or mill type cars and coal carrying hoppers are of 100,000 capacity). Cars of 100,000 to 115,000 capacity may be loaded to a combined weight of car and lading of 169,000 pounds. From this figure the light weight of the car is deducted and the result is the load limit. As the light weight of cars of the same capacity varies considerably, the load limit also varies.

For instance, one shipper referred to three 100,000 capacity gondolas, which happened to be standing together. The load limit of one was 124,100 pounds, another 126,000 pounds and the third 131,800 pounds. He also referred to two 140,000-pound capacity gondolas, the load limit of one being 164,400 pounds and of the other 158,000 pounds. In the case of 140,000-pound capacity cars, incidentally, the maximum combined weight of car and lading is allowed to be 210,000 pounds.

Transportation Order Modified To Facilitate Barge Shipments

To facilitate transportation of freight by barge, ODT has suspended the maximum loading provisions of General Order ODT No. 18 as they apply to certain movements of freight in connection with water traffic.

By a supplementary order (Suspension Order ODT No. 18-1), which becomes effective Sept. 15, shipments loaded into a car by a water carrier subsequent to a movement of such shipments by water, and for the furtherance of such shipments, need not meet the maximum loading requirements.

This applies to commodities moving by water, thence by rail, and to commodities moving by rail, thence by water, and thence by rail to destination.

Also exempted from the general order's terms by the suspension order are such portions of shipments which, having been transported by water, are left over from the loading to capacity of one or more cars, and are required to move as a part of such shipments.

The suspension order does not cover shipments arriving from overseas and loaded into cars for movement by rail.

Dozen New Iron Ore Mines To Raise Year's Output by 1,634,000 Tons

TWELVE iron ore mines opened in the Lake Superior region this year will boost total available supplies by 1,634,000 tons. The new operations provide evidence that the mining industry is cooperating fully in turning out the record-breaking total of 90,000,000 tons required by the steel industry this year.

It is estimated that at least 100,000,000 tons will be required in 1943 and some place the figure as high as 110,000,000 tons.

Nearly half of the total of 1,634,000, or 785,000 tons, will be produced by seven newly opened mines of the Evergreen Mines Co. in the Mesabi and Cuyuna ranges. Butler Bros. will produce 620,000 tons from its Barbara and Louise mines in Itasca county, Minnesota. The latter is a new underground mine.

The balance will be produced by one mine each opened respectively by the M. A. Hanna Co. in Iron county, Michigan, Joseph G. Sellwood in Hibbing, Minn., and the Charleson Mining Co. in Itasca county.

All of the ore produced from these mines takes the $4.45 maximum price permitted by OPA. This maximum, incidentally, applies only to new or reopened properties. The top price applying to the leading producer, as an example, is $4.12.

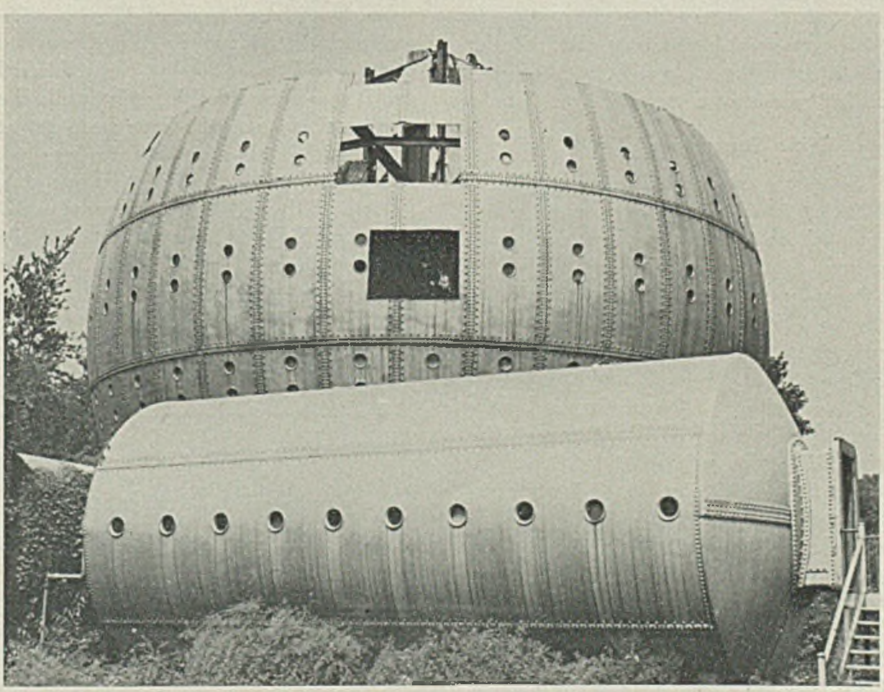
As OPA reported earlier this year, "Because Lake Superior ore producers are being called upon to furnish the nation's furnaces with a record total of 90,000,000 tons in the current season the OPA regulation contains a special provision to make opening of new mines attractive from a price standpoint."

Ore shipped from mines idle in 1940 and 1941 carry a maximum price equivalent to $4.45 delivered at lower lake ports for Mesabi non-Bessemer 51.50 per cent iron, natural content.

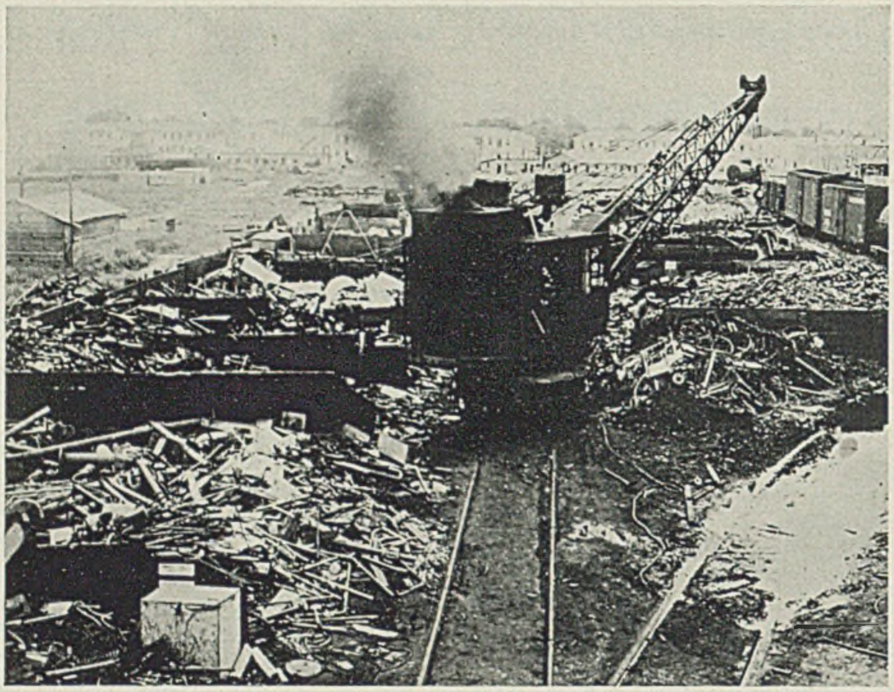
In a statement of consideration issued by OPA several months ago, it was pointed out that there are seven large sellers of merchant ore and about a dozen smaller operators who market to a large extent through the predominant seven.

The largest producer is the Oliver Iron Mining Co., U. S. Steel sub-

DIABETIC BALL PRODUCES 1000 TONS OF SCRAP



ONE thousand tons of scrap was reclaimed when this huge steel ball, part of a $1,000,000 Cleveland sanitarium for the treatment of diabetes under pressure, was dismantled. NEA photo



CHARLESTON, S. C., Navy yard has collected and sold 3000 tons of iron and steel scrap and 6000 pounds of rubber since May. Scrap is sorted into 43 bins from which it is handled by steam crane. Official U. S. Navy photo

sidiary, which became an important seller beginning with 1940. Cleveland-Cliffs Iron Co., operating largely in Michigan expects to sell a large tonnage in 1942.

Pickands, Mather & Co. also is an important factor in the merchant market. Oglebay-Norton & Co., according to the statement, operates two mines in Wisconsin and owns other properties in Minnesota which are now idle. Butler Brothers operates mostly in Minnesota and is primarily a merchant ore firm.

Nine Companies Ship 91.5%

Sixth on the OPA list is the M. A. Hanna Co. which produces a large volume of ore, of which only a small part is sold in the open market. Evergreen Mines Co. is a relatively newcomer to the field in that it has sold an important part of merchant ore only since 1940.

Lumping captive and merchant shipments together, OPA notes that nine companies shipped 91.5 per cent of the ore in 1941, as follows:

Oliver Iron Mining Co. 41.7 per cent; Pickands, Mather & Co. 18.9 per cent; Cleveland-Cliffs Iron Co. 8 per cent; Jones & Laughlin Steel Corp. 5.1 per cent; Evergreen Mines Co. 4.6 per cent; M. A. Hanna Co. 4.6 per cent; Butler Brothers 3.4 per cent; Republic Steel Corp. 3.1 per cent; Oglebay-Norton & Co. 2.1 per cent and all others 8.5 per cent.

OPA observes that the industry has operated for years on the basis of a published price at lower lake ports, the so-called "Lake Erie Price". The price has been determined by the first substantial sale made each season, whereupon it was published and became the basis for transactions that season. However, the published price was seldom the actual price. A contract might be negotiated at a "base" price of $5 with a 75-cent discount, in which case the actual price would be $4.25, but the published price would be $5. Equally well, the published price might have been set at $4.50 with a 25-cent discount per ton allowed.

Data gathered from sellers of merchant ore by OPA showed that 72.4 per cent of the total sold in 1941 was at discounts ranging up to 70 cents. OPA maximum prices now in effect for the 1942 season are based on the levels at which producers voluntarily sold their ore in 1941.

High-Grade Iron Ore Discovered in Nova Scotia

Discovery of high grade iron ore, 65 per cent metallic content, at Five Islands and the Economy Mountains in Nova Scotia has been reported. It is expected that mining operations will commence immediately, but the size of the deposits is not known.

Two-Thirds of Season's Ore Shipments Delivered

Office of War Information announces two-thirds of the ore to be brought down from the Lake Superior region has been checked off as "delivered." Ore docks at ports at the head of the lakes totaling shipments through Aug. 31 found that 60,272,470 gross tons had been shipped from six American ports.

Scrap Stocks Up 6 Per Cent in June Survey

Domestic stocks of steel and iron scrap at consumers', suppliers' and producers' plants at the end of June approximated 4,859,000 gross tons, an increase of 6 per cent over the 4,602,000 tons reported as of May 31, according to the Bureau of Mines.

This was attributed to an increase of 8 per cent in consumer stocks, with a decrease of 3 per cent in stocks held by producers and suppliers. Purchased scrap held by consumers was 8 per cent greater than at the end of May and home scrap 10 per cent.

The bureau reports scrap consumption in June at 4,464,000 gross tons, a decrease of 4 per cent from the 4,665,000 tons used in May, and at an annual rate of 1 per cent over the 1941 rate. Open-hearth furnaces consumed 59 per cent of the purchased scrap and 70 per cent of the home scrap.

NEW ORE MINES OPENED DURING 1942

Mine	Owner	Location	Anticipated 1942 Output (tons)
Barbara	Butler Bros.	Itasca County, Minn.	490,000
Louise	Butler Bros.	Itasca County, Minn.	130,000
Greenway Wash	Evergreen Mines Co.	Mesabi Range	200,000
Douglas	Evergreen Mines Co.	Mesabi Range	209,000
Maroco group:			
Maroco	Evergreen Mines Co.	Cuyuna Range	100,000
Trojan	Evergreen Mines Co.	Cuyuna Range	100,000
Onandaga	Evergreen Mines Co.	Cuyuna Range	35,000
Hopkins	Evergreen Mines Co.	Cuyuna Range	70,000
South Hillcrist	Evergreen Mines Co.	Cuyuna Range	70,000
Wauseca	M. A. Hanna Co.	Iron County, Mich.	90,000
Lamberton	Jos. G. Sellwood	Hibbing, Minn.	50,000
North Judd	Charleson Mining Co.	Itasca County, Minn.	90,000
Total anticipated new production in 1942			1,634,000

Meritorious Work Wins Recognition

THE NATION'S highest industrial tribute—the Army-Navy "E" banner—was bestowed upon management and employes of the Aetna-Standard Engineering Co., at Ellwood City, Pa., Aug. 31, in recognition of meritorious work which they have performed in the interest of national defense.

In presenting the award, Brig. Gen. H. C. Minton, district chief, Pittsburgh Ordnance District, said, "we have just reason to be proud of what has been accomplished during the first nine months of the war, but the fact remains that we have just started to take the initiative."

He emphasized that we are going to bomb Tokio and Berlin and we are going to have more battles like Midway, Coral Sea and the Solomon Islands. Turning to the employes attending the ceremony, he said you may feel that no one cares whether you produce or not. But when you feel like that go out and take a look at this Army-Navy production pennant flying above your plant and remember it was placed there in recognition of the fact that you did a good job of designing and producing munitions for your country and allies and that the war is not yet over. Remember, that you are all soldiers on the production line of freedom and that what you are doing for America is being done voluntarily and freely without regimentation or coercion.

The award was accepted by E. E. Swartswelter, president of the company.

Three distinguished workers of the company whose years of service total 110 years, were the first employes to be presented with the Army-Navy production award pin. These were L. Kistner, foreman of the toolroom, 38 years' service; Charles Hazen, toolroom employe, 36 years' service; and John Vogler, plant guard, 36 years' service.

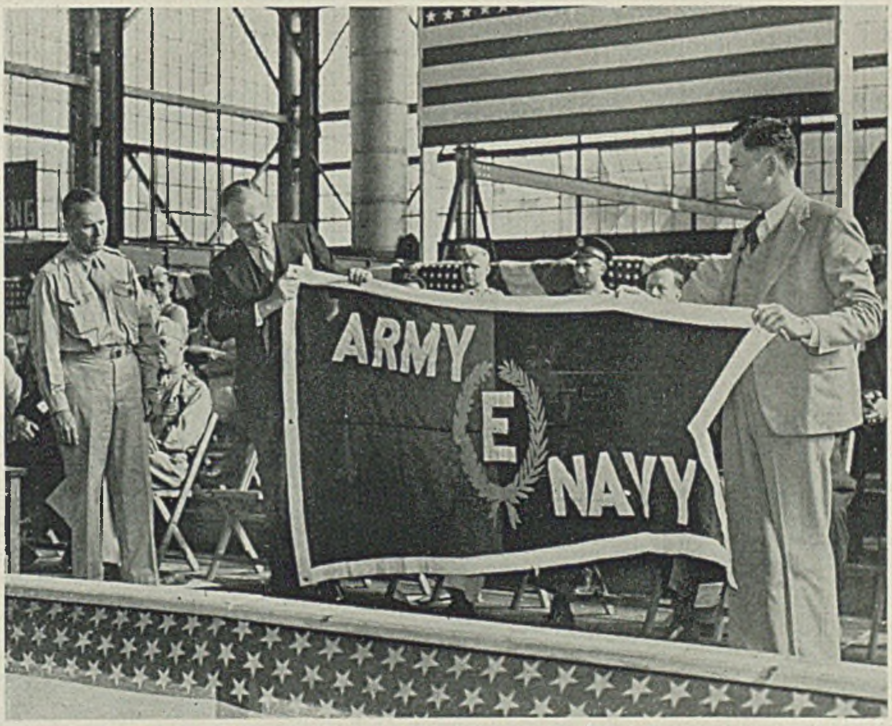
Over 300 employes were present at the ceremony which was broadcast over station WKBN, Youngstown, O.

Following the ceremony a tour of shop buildings was made by the many out-of-town gueses including G. A. Pugh, W. F. Thompson, M. Brainard, R. C. Stiefel Jr., A. M. Friend, F. Tod, J. V. Smith, T. L. Jackson, Judge C. F. Smith, H. Wines, B. Phillips, and W. George.

Other Recipients

Twenty-nine additional industrial plants have been selected to receive the joint Army-Navy Production Award in recognition of outstanding performance

"Tough problems have been met and solved," said Clayton R. Burt, president and general manager, Pratt & Whitney Division, Niles-Bement-Pond Co., West Hartford, Conn., when the company was presented the Army-Navy "E". At Mr. Burt's right, seated, is Lieut. Gen. W. S. Knudsen



Army-Navy "E" pennant being bestowed to management and employes of the Aetna-Standard Engineering Co. Award was presented by Brig. Gen. H. C. Minton, district chief, Pittsburgh Ordnance District, left, and was accepted by E. E. Swartswelter, president, Aetna-Standard, center, and by J. D. Francosky, SWOC representative, right on war work, it was announced last week.

The companies are:

Airtemp Division, Chrysler Corp., Dayton, O.

Aluminum Industries Inc., (Plant No. 1), Cincinnati.

Armstrong Brothers Tool Co., Chicago.

Bell Telephone Laboratories, New York.

Combustion Engineering Co. Inc., Chattanooga, Tenn.

Diamond T Motor Co., Chicago.

Federal Mfg. & Engineering Corp., Brooklyn, N. Y.

Frigidaire Ordnance Plant, General Motors Corp., Dayton, O.

Gadsen Ordnance Plant, Gadsen, Ala.

Goodyear Tire & Rubber Co., (plant No. 3) Akron, O.

Hammermill Paper Co., Erie, Pa.

International Flare Signal Division, Kilgore Mfg. Co., Tipp City, O.

International Harvester Co., Milwaukee Works, Milwaukee.

International Resistance Co., Philadelphia.

Kingston Products Corp., Kokomo, Ind.

Mergenthaler Linotype Co., Brooklyn, N. Y.

National Broach & Machine Co., Detroit.

National Supply Co., Ambridge plant, Ambridge, Pa.

National Tube Co., Christy Park Works, McKeesport, Pa.

New Britain Machine Co., New Britain, Conn.

Pressed Steel Car Co., Inc., Chicago.

Pullman Standard Car Mfg. Co., (Butler plant) Butler, Pa.

Saginaw Steering Gear Division, General Motors Corp., Saginaw, Mich.

Sundstrand Machine Tool Co., Rockford, Ill.

United Wallpaper Factories Inc., Chicago.

Veeder-Root Inc., Hartford, Conn.

Walter H. Eagan Co., Philadelphia.

William R. Bootz Mfg. Co., Evansville, Ind.

Worthington Pump & Machinery Corp., Holyoke, Mass.

Tin Research Bulletin Stresses War Economies

Methods by which tin, supply of which now is largely in enemy hands, may be saved is explained in the current issue of *Tin and Its Uses*, published by the Tin Research Institute.

One article shows that important economies may be effected in joining lead-sheathed cables both by using a solder less rich in tin and by the use of a new type joint requiring not more than one-third the quantity of solder needed for the traditional wiped joint.

A saving of 99 per cent can be effected by using a cup and cone type joint on lead pipes instead of the usual wiped joints. Ends of the pipes are shaped to male and female cones which are then sweated together with solder foil. A standard lead pipe joined in this way with only 0.05 ounces of solder withstood a pressure of 1130 pounds a square inch, the bulletin says.

Advantages of thinly coated electrolytic tin plate as a substitute for ordinary tin plate is subject of another article.

Recommendations for bearings with less tin by the technical advisory committee of the British Ministry of Supply are outlined.

The bulletin may be obtained without charge from the Battelle Memorial Institute, Columbus, O.

MEETINGS . . . .

American Gear Manufacturers Association: Twenty-fifth semiannual meeting will be held at Skytop Lodge, Skytop, Pa., Oct. 15-17.

American Society for Metals: Authorities in government and industry will speak informally and off-the-record on important phases of 25 topics, with all speakers acting later as members of an information panel for open discussion, at the annual meeting, Cleveland, during the week of Oct. 12.

The following subjects will be discussed:

Doing More with What We Have in Increasing Production from Open-Hearth Plants.

Increasing Yields of Electric Furnaces (Electric Steel Manufacture).

Problems Associated with the Large Expansion of the Steel Foundry Industry.

Doing More with What Alloys We Have by Using NE Steels (two sessions).

Doing More with Low Alloy and Carbon Steels by Use of Special Additions in Steel Manufacture ("Intensifiers").

Doing More with Available Tool Steels.

Speeding the Job by Better Production Heating for Softening (Hot Working & Annealing).

Speeding the Job by Better and Faster Production Hardening.

Manufacture and Heat Treatment of Magnesium Castings.

Fabrication of Aluminum Sheet.

Making Better Use of Secondary Metals.

Segregation, Collection and Reclamation of Scrap.

On Deep Drawing Problems (two sessions) I. Brass; II. Steel.

Speeding Production by Improved Metal Cutting Practice (two sessions).

Interpretation of Magnaflux and Other Surface Inspection Tests.

Use and Interpretation of Radiographic Inspection.

Current Achievements in Powder Metallurgy.

Training and Handling Inspectors.

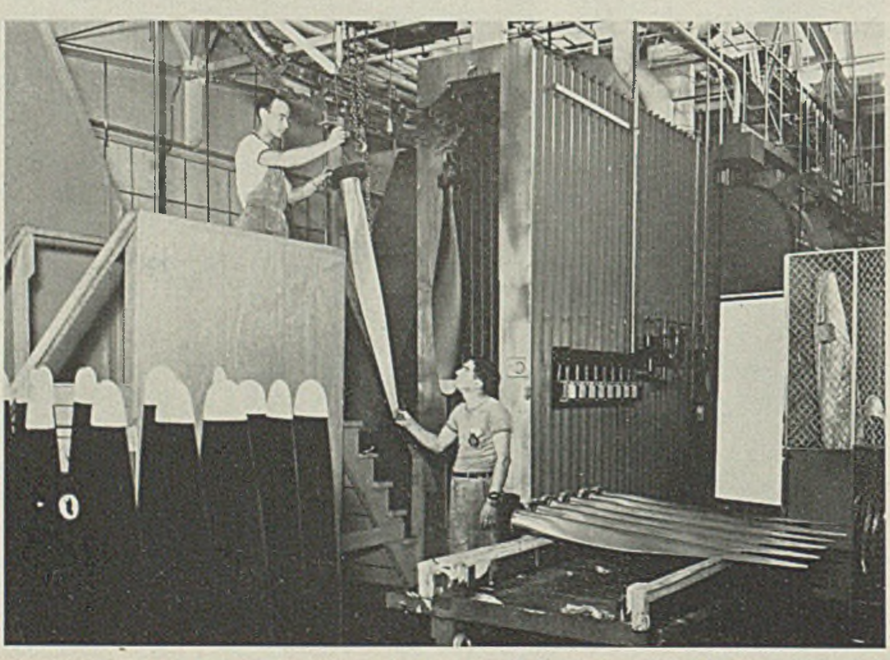
Getting By with Low Tin Alloys.

Salvage of Broken Tools and Maintenance of Equipment.

Employe Training in Metalworking Departments (Fabrication).

Methods and Materials for Surface Protection.

FINISHES PROPELLER BLADE A MINUTE



ENDLESS chain conveyor carries airplane propeller blades through final operations of cleaning, painting and drying at the rate of one a minute in a plant of Hamilton Standard Propellers division, United Aircraft Corp., East Hartford, Conn. Entire operation, requiring 41 minutes, is handled by six workmen

Industry's First Half Net Down 30 Per Cent

INCREASED tax reserves and higher operating expenses absorbed much of the profit resulting from industry's greater volume of production in the first six months of this year.

Although a large number of industrial companies earned higher gross income in the period than in the corresponding 1941 half, additions to tax reserves in the second quarter of 1942 contributed most to the declining trend in earnings apparent in the first three months.

In an analysis of the earnings statements of 333 industrial concerns, the National Industrial Conference Board points out that production during the half year reached new record levels averaging 17 per cent above the January-June period of 1941; that the decline in earnings of these firms from quarter to quarter during the first six months totaled 7 per cent, and in comparison with the second quarter a year ago, 33 per cent.

Of two groups studied, durable goods producers showed a decline in net earnings of 2 per cent from the first three months to the second quarter and nondurable goods companies reported a 14 per cent drop. For all companies giving tax figures, the reserve set aside for federal income tax accruals amounted to 74 per cent of taxable income, and a 14 per cent increase in income before taxes became a 2 per cent decrease after taxes.

Component industries varied from an 18 per cent decrease in profits for electrical products to a 6 per cent gain for machinery, railroad equipment and automobiles.

Net income of the entire 333 companies during the first six months totaled $586,000,000, compared with $839,000,000 in the like period last year, a decrease of 30 per cent.

Second Quarter Industry Trend

Second quarter earnings for durable war industries were lower in comparison with a year ago. Machinery corporations earned more than twice last year's comparable income before taxes; but tax reserves, now at 86 per cent of gross income, reduced the after-tax earnings to 22 per cent below 1941. Twenty-two iron and steel income reports showed a 32 per cent gain over April-June, 1941, before allowance for a tax reserve of 79 per cent; net income fell 28 per cent below last year. The automotive industry earned 6 per cent greater net income in the second quarter this year than in the first, but year-to-year comparison revealed a 41 per cent reduction after taxes.

Expert Says First Half Net May Not Be True Measure

Several reasons have been advanced for the belief that actual earnings of corporations for the entire year 1942 may not be off as much as first half reports would indicate. The expensive process of converting larger industries from peace to war goods, with completion of the change-over delayed until well into the first half, has been interpreted by Laurence H. Sloan, editor-in-chief, Standard & Poor's Corp., New York, as a primary factor. He stated the other reason was a misunderstanding of proposed tax rates.

Mr. Sloan said General Motors and Chrysler were good examples of large companies which had only recently finished converting their plants to war work.

"Taxes will not set gross income figures down so hard in the second half", he asserted. "Comparisons are thrown out of line because in the first half last year many companies did not set aside sufficiently large tax reserves. It is possible that tax reserves in the first half this year may be larger than needed in view of the course of the tax bill's progress in Congress."

Wickwire Spencer Steel Co.

Wickwire Spencer Steel Co., New York, and subsidiary, American Wire Fabrics Corp., report net income as $850,955 for the first half after taxes, contrasting with $560,432 in the period last year. Provision for income taxes, based on proposed rates, was $850,955, the same as net income after provision for taxes.

Granite City Steel Co.

Granite City Steel Co., Granite City, Ill., earned net profit of $254,490 in the six months ended June 30, after federal income taxes, based on proposed rates. No provision was necessary for excess profits tax. This compares with $118,023 in 1941.

DECREASED EARNINGS BY STEEL USERS REFLECT HIGHER TAXES, COSTS

AGGREGATE net income earned by 119 iron and steel consumers in the first six months of 1942 totaled $142,789,857, compared with $175,649,323 in the corresponding period last year, a decrease of $32,859,466, or approximately 18.7 per cent. Decrease reflects principally increased taxes, labor and material costs.

Accompanying tabulation summarizes earnings statements of 47 consumers. Prior compilation, including 72 companies, appeared in STEEL, Aug. 17, p. 66:

	1942	1941
Air-Way Electric Appliance Corp., Toledo, O.	$ 75,468	$ 55,914
American Chain & Cable Co. Inc., Bridgeport, Conn.	1,402,397	1,869,497
American Laundry Machinery Co., Cincinnati	565,340	1,393,872
American Locomotive Co., New York	2,551,732	2,141,520
American Machine & Foundry Co., New York	581,567	647,925
American Safety Razor Corp., Brooklyn, N. Y.	308,465	99,308
Aviation Corp., New York	2,478,291	662,234
Bendix Aviation Corp., South Bend, Ind.	11,035,022	9,507,894
Black & Decker Mfg. Co., Towson, Md.	995,316	1,233,962
Borg-Warner Corp., Chicago	3,086,366	5,312,960
Briggs & Stratton Corp., Milwaukee	531,578	651,987
Bucyrus-Erie Co., Milwaukee	531,084	1,074,539
Canada Wire & Cable Co., Leaside, Ontario	304,919	418,475
Compo Shoe Machinery Corp., Boston	†311,738	†248,491
Cooper-Bessemer Corp., Mt. Vernon, O.	304,401	243,291
Crosley Corp., Cincinnati	381,081	798,634
Chrysler Corp., Detroit	8,770,905	20,974,843
Diamond T Motor Car Co., Chicago	271,355	212,437
Electrical Products Corp., Los Angeles	140,450	168,316
Fairchild Aviation Corp., New York	423,350	365,049
Food Machinery Corp., San Jose, Calif.	907,800	‡868,236
Foster-Wheeler Corp., New York	679,550	487,787
Fruehauf Trailer Co., Detroit	635,991	1,137,977
Greenfield Tap & Die Corp., Greenfield, Mass.	253,936	320,067
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.	497,042	328,049
Hayes Mfg. Corp., Grand Rapids, Mich.	116,587	76,945
Ingersoll-Rand Co., New York	3,378,485	4,420,220
International Cigar Machinery Co., New York	443,535	522,340
Joslyn Mfg. & Supply Co., Chicago	423,258	593,370
Link-Belt Co., Chicago	1,019,578	1,307,015
Locke Steel Chain Co., Bridgeport, Conn.	191,104	260,767
McQuay-Norris Co., St. Louis	303,738	255,195
Maytag Co., Newton, Iowa	103,993	856,389
National Enameling & Stamping Co., Milwaukee	150,533	171,645
Outboard, Marine & Mfg. Co., Waukegan, Ill.	778,922	1,102,419
Parkersburg Rig & Reel Co., Parkersburg, W. Va.	252,936	118,787
Reece Folding Machine Co., East Cambridge, Mass.	8,256	13,839
Reo Motors Inc., Lansing, Mich.	409,258	147,994
Richmond Radiator Co., Uniontown, Pa.	42,371	111,341
Rheem Mfg. Co., Richmond, Calif.	410,771	329,766
Sperry Corp., New York	2,394,237	3,477,433
Square D Co., Detroit	767,321	1,397,346
Thatcher Mfg. Co., Elmira, N. Y.	32,088	256,145
Thompson Products Inc., Cleveland	824,477	923,199
Union Tank Car Co., Chicago	925,374	790,193
Universal Cooler Corp., Marion, O.	†141,024	*205,576
Walworth Co., New York	600,445	909,820

*Loss; †before federal taxes; ‡estimated.

Top Resale Prices for National Emergency Steels Fixed by OPA

MAXIMUM delivered prices for less-than-carload quantity sales at the warehouse and jobber level of new low-alloy emergency steels developed to conserve molybdenum, nickel and chrome, were announced last week by OPA.

The prices apply only to sales by warehouses, jobbers and other resellers of iron and steel products.

They are provided in Amendment No. 7 to Revised Price Schedule No. 49 on resale of iron and steel products, and became effective Sept. 4.

The amendment, besides providing ceiling prices for the new steels, makes revisions in prices of a number of iron and steel products, including pipe in western states, and heavy gage boiler and pressure tubes. The amendment also brings the schedule into conformity with Maximum Price Regulation No. 204 (idle or frozen materials sold under priorities regulation No. 13 of the War Production board).

To make alloying materials such as chrome, nickel and molybdenum go farther in the production of alloy tonnage, steel mills during the past three months have developed new types of low alloy emergency steels, such as the national emergency steels. These new low-alloy steels now are being delivered to warehouses. As they are made according to alloy specifications which were not in use April 16, 1941, base pricing date of Revised Price Schedule No. 49, warehousemen and other resellers had no prices for them.

Normal Markup Provided

The prices for the new low-alloy steels provided in Amendment No. 7 reflect approximately the same percentage mark-up over cost of material that is customary on other types of alloy steels handled by steel warehouses.

The amendment provides that the maximum prices it establishes for less-than-carload quantity sales of the new low-alloy steels shall be applicable to any alloy steels whose specifications were not used in production by mills on April 16, 1941, such as national emergency and American Iron and Steel Institute specifications of alloy grades, but not including carbon steel or tool steel grades.

For the purpose of low-alloy steel pricing, basing point cities for hot-rolled alloy steel are established as Bethlehem, Pa.; Buffalo; Canton, O.; Chicago; Massillon, O.; and Pittsburgh. Basing point cities for cold finished alloy steel are established as Buffalo; Chicago, Cleveland, Gary, Ind., and Pittsburgh.

The amendment provides that the maximum base price per 100 pounds for delivery by warehouses, jobbers and other resellers of low-alloy steels within the free delivery area of basing point cities shall be the aggregate of the following, adjusted upward or downward to the nearest 5 cents: (1) the mill alloy base price, as established by Price Schedule No. 6 (iron and steel), at any basing point city (hot-rolled or cold-finished, whichever is applicable), (2) mill analysis extras, as established by Price Schedule No. 6 (open hearth or electric furnace, whichever is applicable), and (3) a mark-up of 66 2/3 per cent of the aggregate of mill alloy base price and mill analysis extras.

Extras Are Designated

Base prices per 100 pounds for delivery at any destination other than the free delivery area of basing point cities shall be that combination of base prices for basing point cities plus less-than-carload freight rates in effect at the time of shipment from governing basing point to destination which results in the lowest delivered price.

Quantity extras shall be determined by combining the weight of one or more orders placed in one day, shipped at one time or at the seller's convenience, to one destination.

The item quantity extra, to be determined by quantity of one size, grade and finish shall be $1.25 per 100 pounds on an order of less than 300 pounds, 75 cents per 100 pounds on an order of 300 to 499 pounds, 50 cents per 100 pounds on an order of 500 to 999 pounds, and no item quantity on an order of 1000 to 39,999 pounds.

An order extra of $3 per 100 pounds may be charged on low-alloy steel orders which total less than 300 pounds. If the order extra is applicable and charged, the item quantity extra for less than 300 pounds may not also be charged. Hot-rolled alloys and cold-finished alloys need not be combined to determine total weight.

A charge of $2.50 per 100 pounds may be made when the operation of heat treatment (quenching and drawing) or double treatment (both annealing and normalizing or spheroidized annealing) are performed by the seller. A charge of $1 per 100 pounds may be made when either the operation of annealing or normalizing only is performed.

No charge may be made for straightening.

Size extras may be added but shall not exceed mill size extras.

Other quality extras may be added but shall not exceed mill extras as established in Price Schedule No. 6 or actual cost, whichever is lower.

Other customary and general discounts, terms and privileges, in effect April 16, 1941, shall be continued without diminution or extra charge.

Schedule 49 Is Revised

Besides providing maximum prices for low-alloy steel, Amendment No. 7 makes the following changes or additions to Revised Price Schedule No. 49:

1. Sales of surplus stocks of steel held by manufacturers of fabricated items are excluded from Revised Price Schedule No. 49, and are now subject to the provisions of Maximum Price Regulation No. 204 (Idle or Frozen Materials Sold Under Priorities Regulation No. 13 of the War Production Board). However, distress or stranded materials remain under Amendment No. 6 to Revised Price Schedule No. 49 until Oct. 1, 1942. Amendment No. 6 permits domestic resale of materials destined for export whose movement was blocked by the outbreak of war and which have accumulated freight, insurance and storage charges.

2. Maximum prices for cutting and threading pipe and tubular products are established as those in effect by jobbers as of April 16, 1941. Where the mill actually does the cutting and threading, however, the warehouse shall not charge more than mill extras for such operations. All sellers of pipe and tubular products must file by Sept. 16, 1942, the cutting and threading charges which were used on April 16, 1941 with OPA.

3. Specific maximum delivered prices for heavy gage boiler and pressure tubes are established. These permit a lower mark-up than those in effect on April 16, 1941. On shipments from warehouse stock, maximum prices on heavy gage boiler and pressure tubes shall be the lowest price resulting from the combination of mill carload basing point prices and less-than-carload freight from the basing point to the destination of the customer, plus the appropriate following mark-up: for shipments of 30,000 to 39,999 pounds or feet, a markup of 35 per cent; 20,000 to 29.999 pounds or feet, 40 per cent; 10,000 to

19,000 pounds or feet, 50 per cent; 5000 to 9999 pounds or feet, 55 per cent; 2000 to 4999 pounds or feet, 65 per cent; and under 2000 pounds or feet, 80 per cent.

4. When the services of jobbers are required to move tubular goods and line pipe now frozen in field stocks of oil and pipe line companies, recognized tubular goods jobbers, after the prior written approval of the transaction by the Office of Petroleum Co-ordinator, may make an additional charge not to exceed 3 per cent of prices established in Maximum Price Regulation No. 204.

5. Excluded from Revised Price Schedule No. 49 are sales by retailers, such as mail order houses and retail hardware stores, of pipe in quantities not greater than 5 standard lengths in diameters larger than 3½ inches, or 15 standard lengths of pipe with diameters of 3½ inches or smaller. Maximum prices for such sales now must be determined under the provisions of the General Maximum Price Regulation.

6. Sellers of standard pipe, seamless pipe, water well casing, large O.D. pipe, line pipe and wrought iron pipe originating from jobbers' stocks in Washington, Idaho, Montana, Oregon, Wyoming, California, Nevada, Utah, Colorado, Arizona, New Mexico and Texas (El Paso and Pecos only) are granted certain relief in transportation charges on shipments to points within the named States or to points west of the 103rd meridian within North Dakota, South Dakota, Nebraska and Texas. On such shipments any freight in excess of 30 cents per 100 pounds may be passed on to the buyer.

7. A differential of 90 cents per hundred pounds over April 16, 1941 prices for hard red sheets, and a differential of 70 cents per hundred pounds on billets are established on the Pacific coast.

8. The warehousing of iron or steel products is defined in the amendment as "resale of iron and steel products by a person who customarily carries on the purchase for resale of iron and steel products, and who operates a steel warehouse for that purpose (not a public warehouse), which warehouse is such person's place of business and is equipped with facilities for the receiving, shipping, storing, sorting, and performing of other services peculiar to the iron or steel products sold, such as cutting and shearing or burning.

Taps Salamander from Blast Furnace

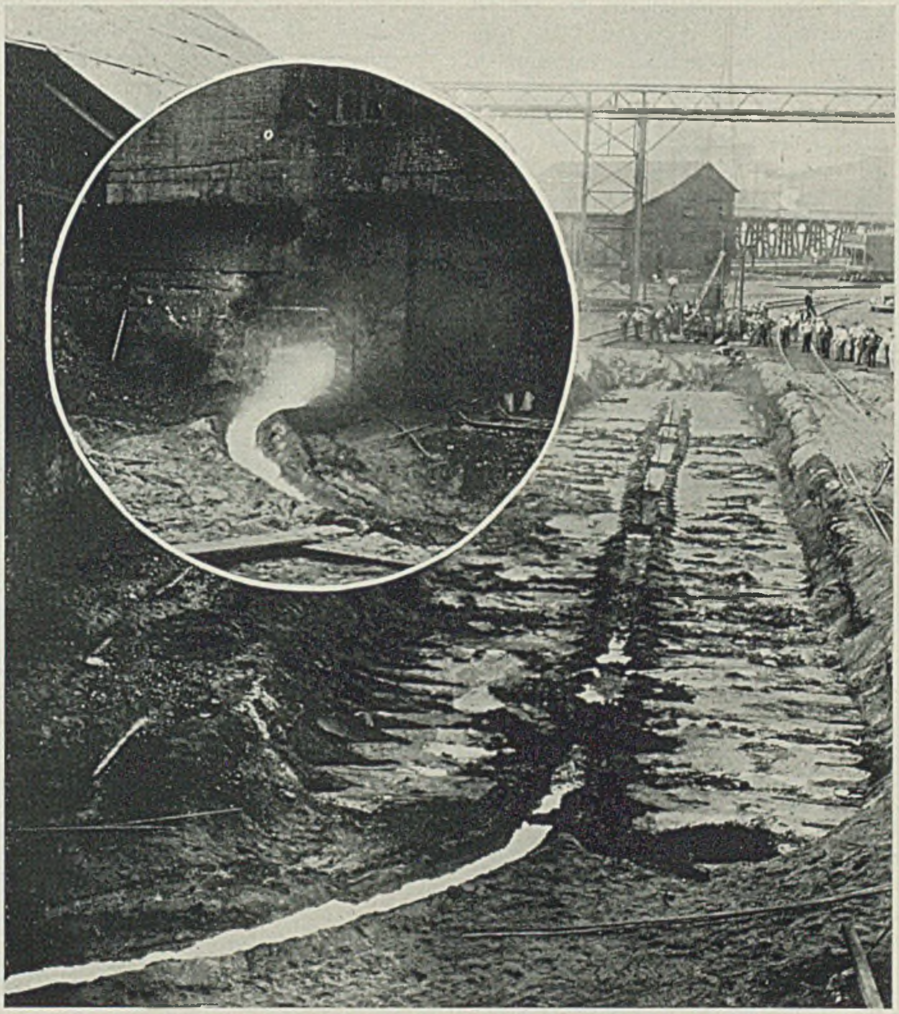
How often we hear the phrase, "there are tricks in all trades." Furnacemen at the blast furnace department of the Youngstown Sheet & Tube Co., Indiana Harbor, Ind., pulled one out of the bag, recently, when they tapped the salamander from No. 1 blast furnace in a molten condition shortly after the stack was blown out for relining.

Iron, which lies below the taphole of a blast furnace, freezes solidly when the furnace is blown out, and in the process of relining it usually is removed by dynamite, requiring two to three weeks of the relining time.

Furnacemen at the Indiana Harbor works planned for several weeks the removal of this iron in a molten condition. A sand bed was prepared in the yard adjacent to the furnace. When the blast was taken off the furnace a hole was drilled upward in its concrete foundation and then burned with oxygen until the metal began to flow. About 614 tons was taken out of the hearth in 35 minutes, which is about three times the normal rate of casting a blast furnace.

The time saved in dynamiting will permit this stack to go back into operation some 15 days sooner than would have been possible under conventional practice. Fifteen days of production on this furnace is about 12,000 tons of iron. This quantity of iron will make 20,000 tons of steel and this, in turn, is equivalent to 1000 large tanks or several ships.

While there is some hazard in handling molten metal in this manner, no person was injured or burned and it is probably safer than using dynamite.



Molten salamander iron, encircled view, flowing from hole drilled through concrete foundation after stack was blown out for relining. Other view shows prepared pig beds receiving the molten salamander. Pigs were removed in record time. All necessary safety precautions were taken

U. S. Steel Changes Name of Subsidiary

UNITED States Steel Corp. has changed the name of its new subsidiary, Tubular Products Inc., to Tubular Alloy Steel Corp. Tubular Products early this year acquired the existing plant of National Tube Co. in the Chicago district at Gary, Ind., for the purpose of producing seamless tubing of alloy and stainless steel essential to the war effort. Benjamin F. Harris, president of National Tube Co., is president of Tubular Alloy Steel Corp. E. N. Sanders is vice president, with headquarters at Gary. Principal products of the new company will be alloy and stainless tubing for Army, Navy and Maritime Commission requirements.

—o—

Vacuum Tube Division of the Radio, Television and Electronics Department. General Electric Co., New York, will henceforth be known as the Electronics Tube Division.

—o—

Pittsburgh Industrial Division of De Laval Sales & Service Inc., New York, as well as the Pittsburgh representation of De Laval Separator Co., New York, has taken over new quarters comprising a two-story building at 2040 West Liberty avenue, Pittsburgh. The Minute Man Flag will be flown from the new quarters in view of 100 per cent participation of employes in a 10 per cent war bond purchasing plan.

—o—

Earle M. Jorgensen Co. has completed a $1,000,000 forging plant in southern California. Equipment includes a 1000-ton hydraulic press and normalizing furnaces adequate for the processing of heavy forgings.

—o—

Olney J. Dean Steel Co., Chicago has leased its plant in Cicero, Ill., to Maremont Automotive Products Inc., Chicago. The Maremont company, which normally manufactures automotive replacement springs and mufflers, is now engaged in war work and expanding this production.

—o—

Cochrane Corp., Philadelphia, has appointed Energy Control Co., 3107 North Broad street, Philadelphia, representative in eastern Pennsylvania, southern New Jersey, Delaware and Maryland.

—o—

National Association of Suggestion Systems was organized in Chicago recently, with E. S. Taylor, director of the Pullman Co.'s employe suggestion system, as president. Mr. Taylor stated that the association hopes that "by stimulating millions of employes throughout the United States to produce suggestions, we will go a long way toward winning the war."

—o—

Executive sales office of Columbia Chemical Division of Pittsburgh Plate Glass Co., has been moved from New York to Pittsburgh. Also involved in the transfer are the chemical division's traffic and advertising departments. The move is a continuation of the company's program of co-ordinating its various divisions in the general office at Pittsburgh.

—o—

Perfect Circle Co., Hagerstown, Ind., announces building of a defense plant at Richmond, Ind. The factory, approved by the War Department, will be financed by Defense Plant Corp. An expenditure of several million dollars will be involved.

—o—

Western Mfg. Co., Detroit, has expanded its facilities for making gears and transmissions, in view of a 400 per cent increase in business the past two years. Since 1914, the company has designed and built transmissions for industrial and automotive uses.

—o—

Square D Co., Detroit, has opened two new branch offices to better serve war material producers in strategic areas. C. T. Nash, formerly with the company's New York office, has charge of the office at 146 Chestnut street, Springfield, Mass., and W. W. Hendrickson has been transferred from the Charlotte office to the new office at 303 Kensington road, Greensboro, N. C.

—o—

Maydwell & Hartzell Inc., San Francisco, has been appointed exclusive sales representative in California for Pittsburgh Screw & Bolt Corp., Pittsburgh.

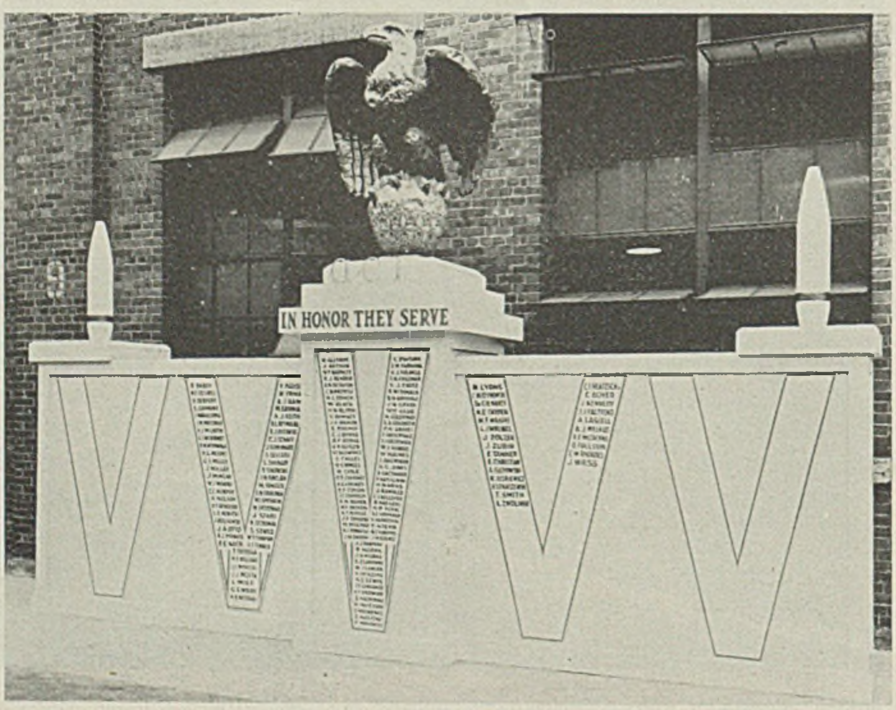
—o—

Screw Machines Products Co., Milwaukee, will build one-story 80 x 130-foot, factory building to cost $24,000.

—o—

Cutler-Hammer Inc., Milwaukee, is expanding its plant with erection of a factory building 136 feet long. Contract has been awarded to H. Schmitt & Son Inc., Milwaukee.

V's FORM HONOR ROLL AT ACF PLANT



HONOR ROLL of the shell plant of American Car & Foundry Co., New York, consists of a large plaque on which are outlined five large Vs in which are inscribed the names of employes in service

Aircraft Parts Plant Opened at Toledo

Northern Aircraft Products Division of Aviation Corp., has opened a plant in Toledo, O., for the production of hardened and ground parts for several different designs of airplane engines and for propellers. Other subsidiaries of Aviation Corp. in Toledo are the American Propeller Corp. making steel propeller blades, and the Liquid-Cooled Engine Division, now erecting a new plant.

Monthly Index Average Continues Uptrend

TREND of industrial activity in the iron, steel and metalworking industries continued upward throughout August. STEEL's weekly index averaged 173.5 last month, to record the fifth consecutive monthly increase. During July the monthly index figure was 171.0, while the low point this year of 164.6 occurred during March.

The index reached a new peak on both a monthly and weekly basis during August. In the latest weekly period ended Aug. 29 the index stood at 173.9, compared with the all-time peak of 174 recorded in the preceding week.

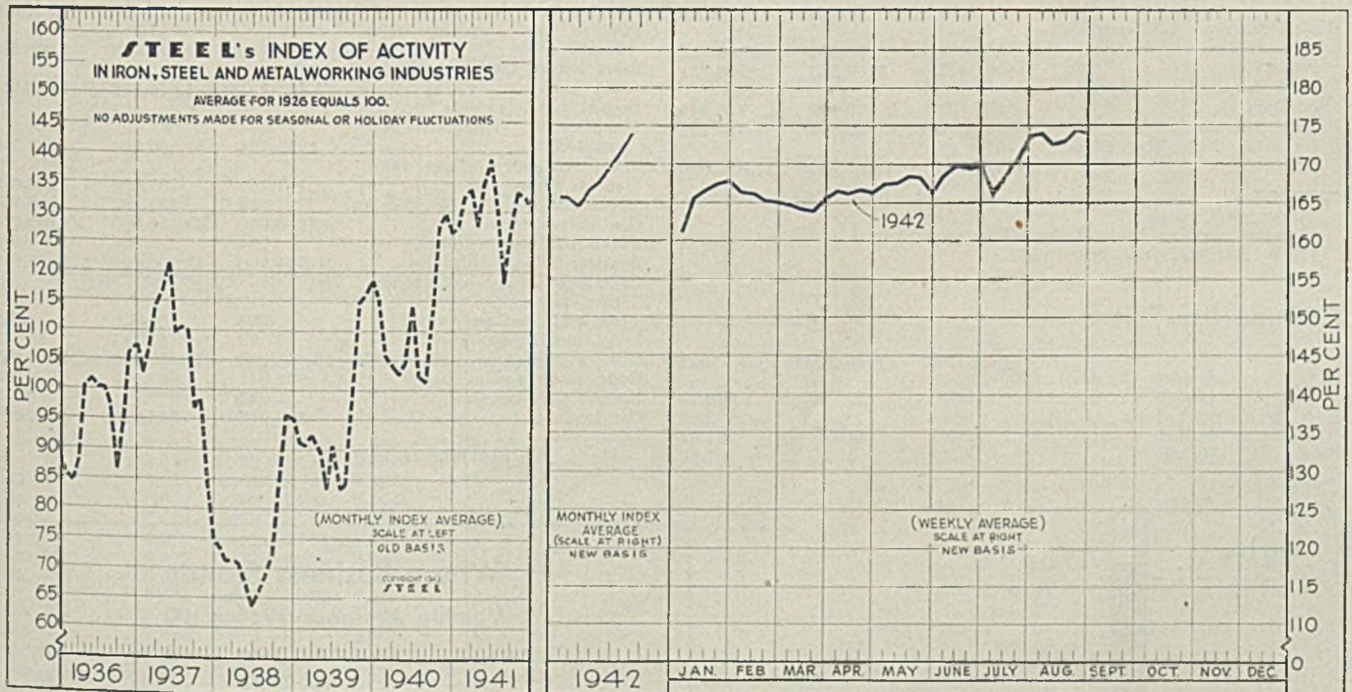
Steelmaking operations advanced one-half point to 98 per cent of capacity during the week of Aug. 29. A year ago the national steel rate stood at 96.5 per cent. Movement of steel scrap to mill yards has failed to record much improvement. In some centers it appears likely that ingot operations will have to be curtailed slightly in the near future, unless the scrap supply situation is measurably improved over the coming weeks.

Electric power consumption eased to 3,639,961,000 kilowatts during the latest period, compared with 3,673,717,000 in the preceding week. Power output is 11.6 per cent above that recorded in the like 1941 period.

July output of machine tools totaled 28,300 new units, valued at $113,600,000, according to WPB. June shipments of 26,600 units had a value of $111,100,000; while July, 1941 output was valued at $57,900,000. Production has reached a rate of $1,360,000,000 annually, or 76 per cent greater than the 1941 output of $771,400,000.

Foundry Equipment Manufacturers Association's new orders index climbed to 800.8 during July.

Building construction in the 37 eastern states declined during July to a total value of $943,796,000, according to monthly report of F. W. Dodge Corp. The latest figure



STEEL'S index of activity declined 0.1 point to 173.9 in the week ending Aug. 29:

Week Ended	1942	1941	Mo. Data	1942	1941	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931
June 27	169.8	138.8	Jan.	165.7	127.3	114.7	91.1	73.3	102.9	85.9	74.2	58.8	48.6	54.6	69.1
July 4	166.5	120.9	Feb.	165.6	132.3	105.8	90.8	71.1	106.8	84.3	82.0	73.9	48.2	55.3	75.5
July 11	168.9	133.4	March	164.6	133.9	104.1	92.6	71.2	114.4	87.7	83.1	78.9	44.5	54.2	80.4
July 18	172.1	133.2	April	166.7	127.2	102.7	89.8	70.8	116.6	100.8	85.0	83.6	52.4	52.8	81.0
July 25	173.6	132.9	May	167.7	134.8	104.6	83.4	67.4	121.7	101.8	81.8	83.7	63.5	54.8	78.6
Aug. 1	173.8	123.3	June	169.4	138.7	114.1	90.9	63.4	109.9	100.3	77.4	80.6	70.3	51.4	72.1
Aug. 8	172.8	117.5	July	171.0	128.7	102.4	83.5	66.2	110.4	100.1	75.3	63.7	77.1	47.1	67.8
Aug. 15	173.3	118.2	Aug.	173.5	118.1	101.1	83.9	68.7	110.0	97.1	76.7	63.0	74.1	45.0	67.4
Aug. 22	174.0	118.5	Sept.	....	126.4	113.5	98.0	72.5	96.8	86.7	69.7	56.9	68.0	46.5	64.3
Aug. 29	173.9†	118.2	Oct.	....	133.1	127.8	114.9	83.6	98.1	94.8	77.0	56.4	63.1	48.4	59.2
			Nov.	....	132.2	129.5	116.2	95.9	84.1	106.4	88.1	54.9	52.8	47.5	54.4
			Dec.	....	130.2	126.3	118.9	95.1	74.7	107.6	88.2	58.9	54.0	46.2	51.3

†Preliminary.

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

compares with the all-time peak of $1,190,264,000 recorded in the preceding month, while in July, 1941 construction was valued at $577,392,000.

Domestic scrap consumption totaled 4,600,000 gross tons during July, off slightly from June total of 4,608,000 tons. In the comparable 1941 month scrap consumption totaled 4,415,000 gross tons.

U. S. Bureau of Labor's index of wholesale commodity prices recorded only a slight gain of 0.1 point to 98.7 during July. A year ago the index stood at 88.8.

Steel ingot production averaged 94.5 per cent of capacity during July, based on the increased capacity as of July 1. In June, steel output was at the 96.4 per cent level based on Jan. 1, 1941 capacity. In July, 1941 the rate was 93.3. Shipments of finished steel products, reported by the United States Steel Corp., totaled 1,765,749 net tons during July, compared with 1,774,068 in June and 1,666,667 in July a year ago.

BUSINESS BAROMETER

Financial Indicators

	July, 1942	June, 1942	July, 1941
30 Industrial Stocks†	106.94	103.75	127.57
20 Rail Stocks†	25.63	23.59	29.60
15 Utilities†	11.75	11.93	18.48
Average Price of all listed bonds (N.Y.S.E.)	$95.76	$95.50	$95.04
Bank Clearings daily average (000 omitted)	1,170,985	1,165,824	1,071,325
Commercial Paper, interest rate (4-6 months)‡	0.69%	0.63%	0.56%
Com'l loans (000 omitted)	$10,696,000	$10,740,000	$10,453,000
Federal Reserve ratio (per cent)	87.1	89.3	91.0
Capital flotations (000 omitted)			
New Capital	$40,679	$96,482	$300.739
Refunding	$101,472	$104,824	$316,731
Federal gross debt. (millions of dollars)	$77,136	$72,422	$49.540
Railroad earnings‡	$118,730,968	$109,628,364	$93,316,121
Stock sales, New York Stock Exchange	8,373,550	7,466,443	17,870,000

†Dow Jones series.
*Leading member banks Federal Reserve System.
‡June, July and June respectively.

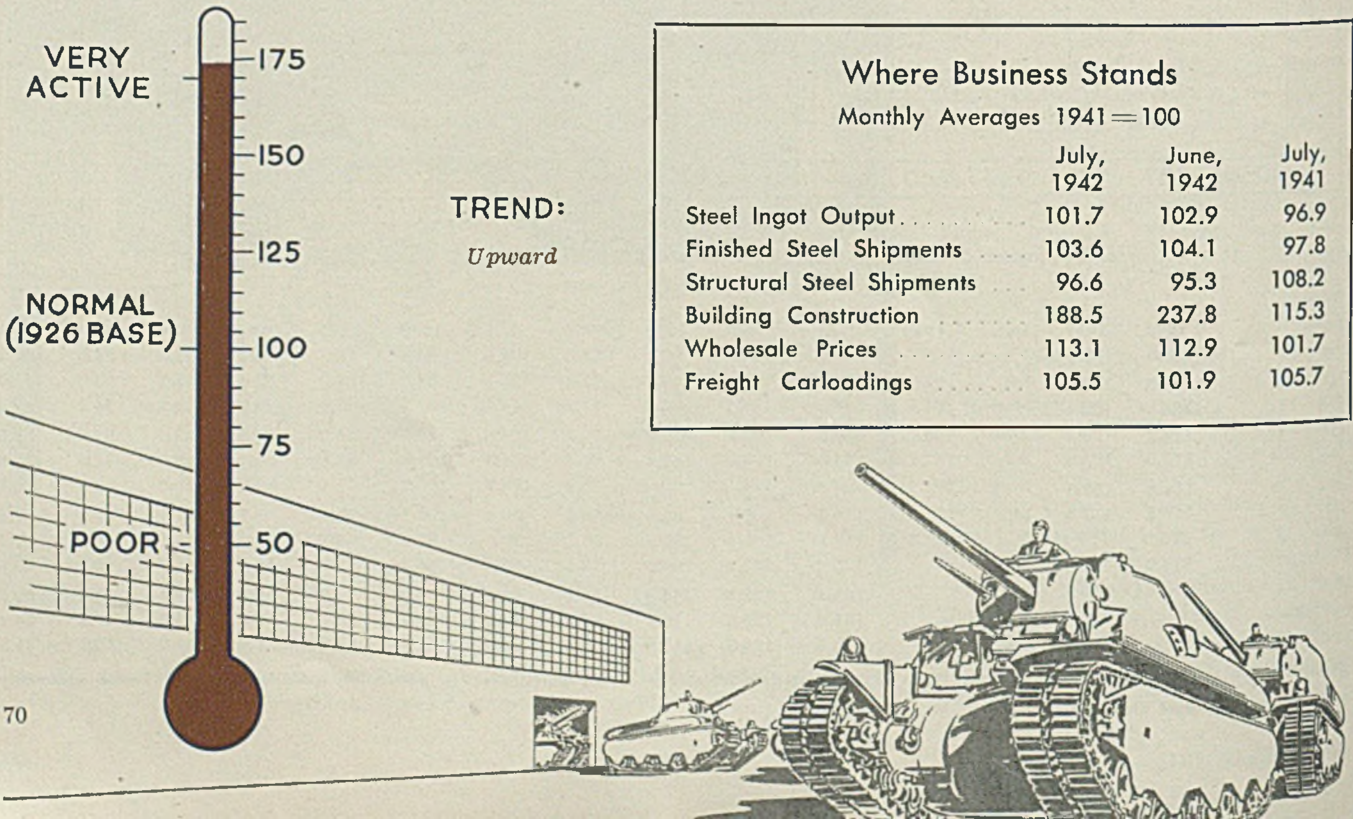
Commodity Prices

	July, 1942	June, 1942	July, 1941
STEEL's composite finished steel price average	$56.73	$56.73	$56.73
U. S. Bureau of Labor's index	98.7	98.6	88.8
Wheat, cash (bushel)	$1.268	$1.164	$1.04
Corn, cash (bushel)	$1.013	$0.99	$0.86

Industrial Indicators

	July, 1942	June, 1942	July, 1941
Munitions Output, Index (WPB)	350	303	64
Commerce Dept.'s Mfgs. Index†:			
Orders	294.0	270.0	229.0
Shipments	202.0	203.0	170.0
Inventories	173.2	170.4	132.0
Iron and Steel Scrap consumption (tons)	4,600,000	4,608,000	4,415,000
Gear Sales Index	344	373	298
Foundry equipment new order index	800.8	774.0	358.1
Machine Tool Output	$113,600,000	$111,100,000	$57,900
Finished steel shipments (Net tons)	1,765,749	1,774,068	1,666,667
Ingot output (average weekly; net tons)	1,617,381	1,636,866	1,541,227
Dodge bldg. awards in 37 states ($ Valuation — 000 omitted)	$943,796	$1,190,264	$577,392
Fabricated structural steel shipments (Tons)	181,193	182.699	203,026
Steel castings output (Net Tons)†	131,458	131,492	113.988
Coal output, tons	47,700,000	48,410,000	44,080,000
Business failures; number	764	804	908
Business failures; liabilities	$8,548,000	$9,906,000	$13,422,000
U. S. Dept. of Labor (90 industries, factory):			
Av. wkly. hrs. per worker†	42.6	42.6	41.3
Av. weekly earnings†	$37.99	$37.43	$31.88
Cement production, bbls.	16,833,000	16,022,000	16,000,000
Cotton consumption, bales	995,041	966,940	929.782
Freight Car Awards	1,025	.	6.458
Car loadings (weekly av.)	858,019	828,927	859,298

†June, July and June respectively.



TREND:

Upward

Where Business Stands

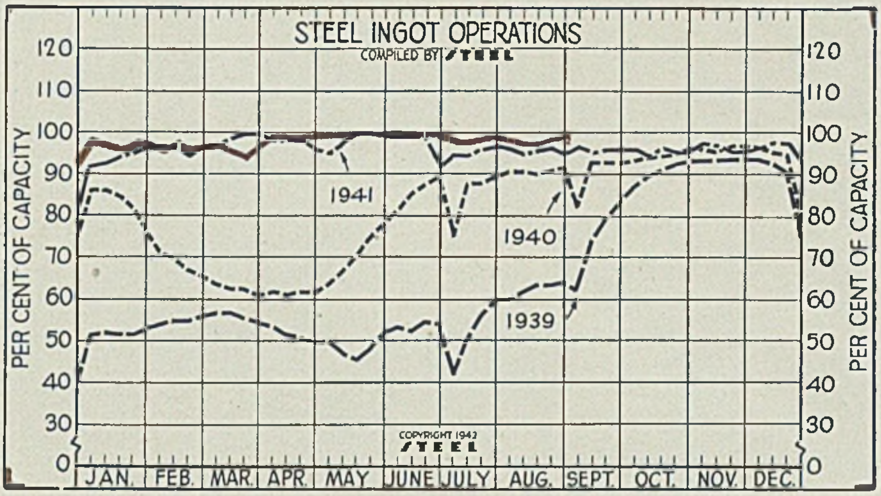
Monthly Averages 1941 = 100

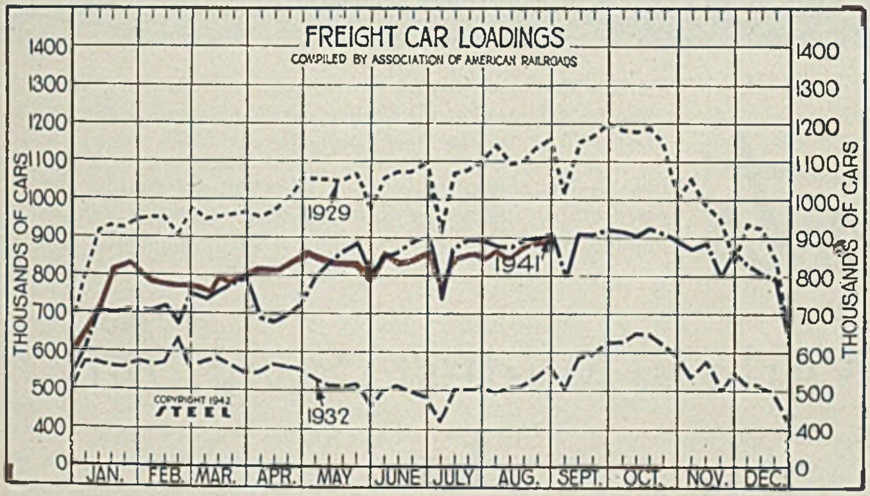
	July, 1942	June, 1942	July, 1941
Steel Ingot Output	101.7	102.9	96.9
Finished Steel Shipments	103.6	104.1	97.8
Structural Steel Shipments	96.6	95.3	108.2
Building Construction	188.5	237.8	115.3
Wholesale Prices	113.1	112.9	101.7
Freight Carloadings	105.5	101.9	105.7

Steel Ingot Operations

(Per Cent)

Week ended	1942	1941	1940	1939
Aug. 29 ...	98.0	96.5	91.5	64.0
Aug. 22 ...	97.5	96.0	90.5	63.5
Aug. 15....	97.0	95.5	90.0	63.5
Aug. 8 ...	97.5	96.5	90.5	62.0
Aug. 1....	98.0	97.5	90.5	60.0
July 25....	98.5	96.0	89.5	60.0
July 18....	98.0	95.0	88.0	56.5
July 11....	97.5	95.0	88.0	50.5
July 4 ...	97.5	92.0	75.0	42.0
June 27 ...	98.5	99.5	89.0	54.0
June 20 ...	99.0	99.0	88.0	54.5
June 13 ...	99.0	99.0	86.0	52.5
June 6 ...	99.0	99.0	81.5	58.5
May 30 ...	99.0	99.0	78.5	52.0
May 23 ...	99.0	100.0	75.0	48.0
May 16 ...	99.5	99.5	70.0	45.5
May 9 ...	99.0	97.5	66.5	47.0





Freight Car Loadings

(1000 Cars)

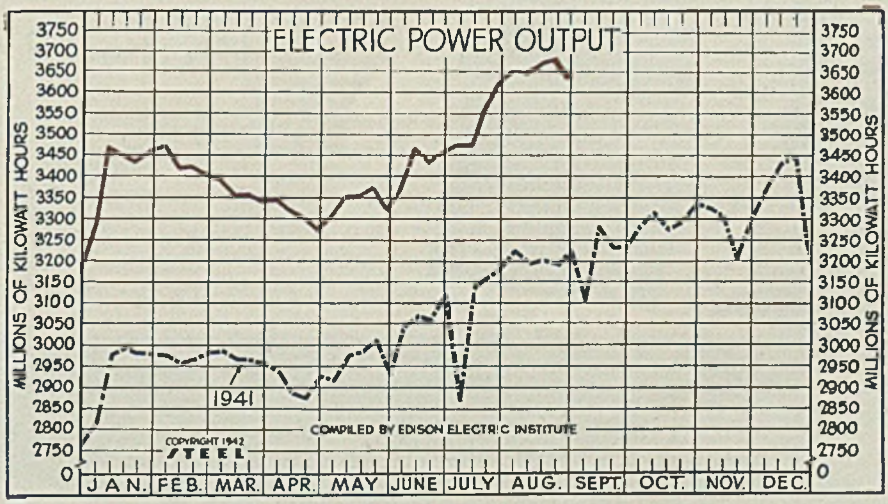
Week ended	1942	1941	1940	1939
Aug. 29	875†	913	769	689
Aug. 22	869	900	761	722
Aug. 15	869	890	743	674
Aug. 8......	850	879	727	665
Aug. 1	864	883	718	661
July 25......	856	897	718	660
July 18......	857	899	730	656
July 11	855	876	740	674
July 4......	739	741	637	559
June 27......	858	909	752	660
June 20......	840	886	728	643
June 13	833	863	712	638
June 6	855	853	703	635
May 30	796	802	639	568

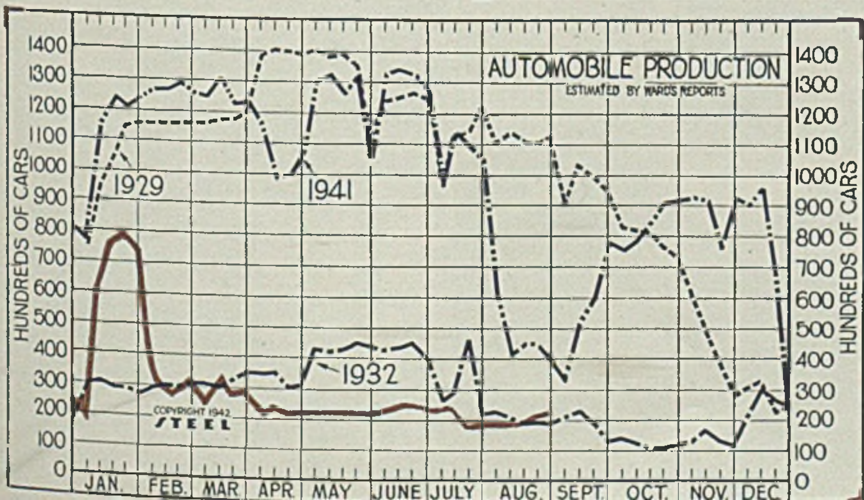
† Preliminary.

Electric Power Output

(Million KWH)

Week ended	1942	1941	1940	1939
Aug. 29	3.640	3,224	2,736	2,434
Aug. 22	3.674	3 193	2 714	2.442
Aug. 15.......	3,655	3,201	2,746	2,454
Aug. 8.......	3,649	3,196	2,743	2,414
Aug. 1.......	3,649	3,226	2,762	2,400
July 25	3,626	3,184	2.761	2,427
July 18.......	3,565	3,163	2,681	2,378
July 11.......	3,429	3,141	2,652	2,403
July 4.......	3,424	2,867	2,425	2,145
June 27.......	3,457	3,121	2,660	2,396
June 20	3,434	3,056	2,654	2,362
June 13.......	3,464	3,066	2,665	2,341
June 6.......	3,372	3,042	2,599	2,329
May 30.......	3,323	2,924	2,478	2,186
May 23.......	3,380	3,012	2,589	2,778
May 16	3,357	2,983	2,550	2,235
May 9.......	3,351	2,975	2,516	2,239
May 2.......	3,305	2,915	2,504	2,225





Auto Production

(1000 Units)

Week ended	1942	1941	1940	1939
Aug. 29....	21.1	40.0	27.6	25.2
Aug. 22....	20.2	45.5	23.7	17.5
Aug. 15....	19.2	45.6	20.5	13.0
Aug. 8....	19.2	41.8	12.6	24.9
Aug. 1....	18.3	62.1	17.4	28.3
July 25....	18.3	105.6	34.8	40.6
July 18....	17.9	109.9	53.0	47.7
July 11....	23.0	114.3	65.2	61.6
July 4....	22.7	96.5	52.0	42.8
June 27....	22.9	127.9	87.6	70.7
June 20....	23.2	133.6	90.1	81.1
June 13....	22.3	134.7	93.6	78.3
June 6....	22.0	133.6	95.6	65.3
May 30....	21.5	106.4	61.3	32.4
May 23....	21.6	133.6	96.8	67.7

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

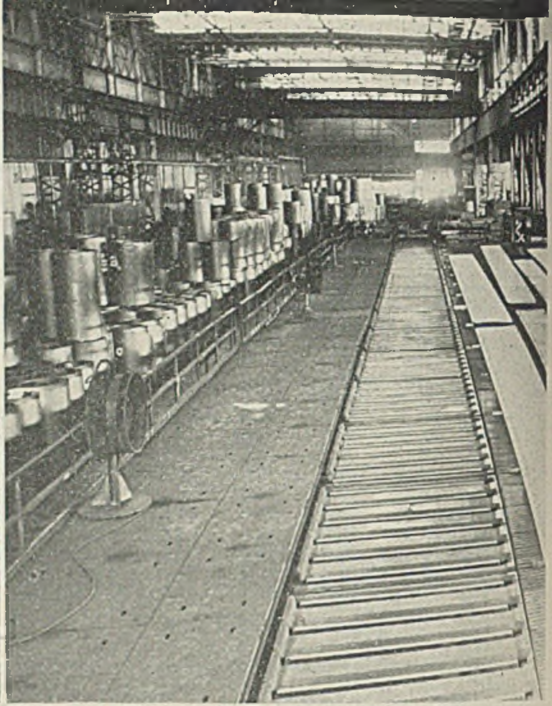


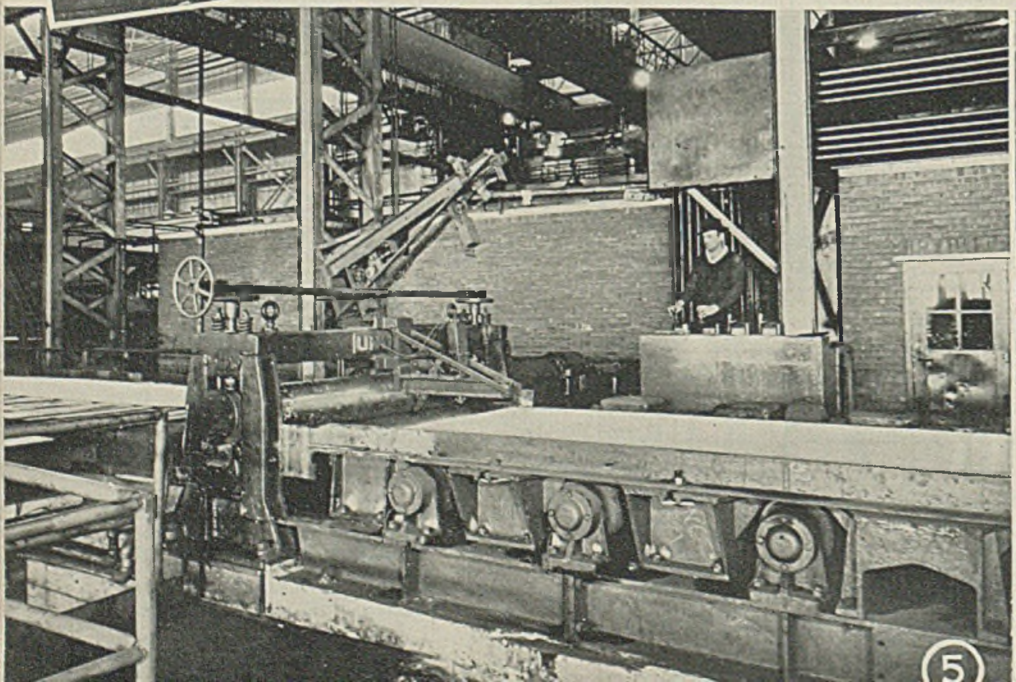
Fig. 1—More than 30,000 tons of slabs can be stored in this enclosed slab yard at the 98-inch continuous strip mill of Republic Steel Corp., Cleveland

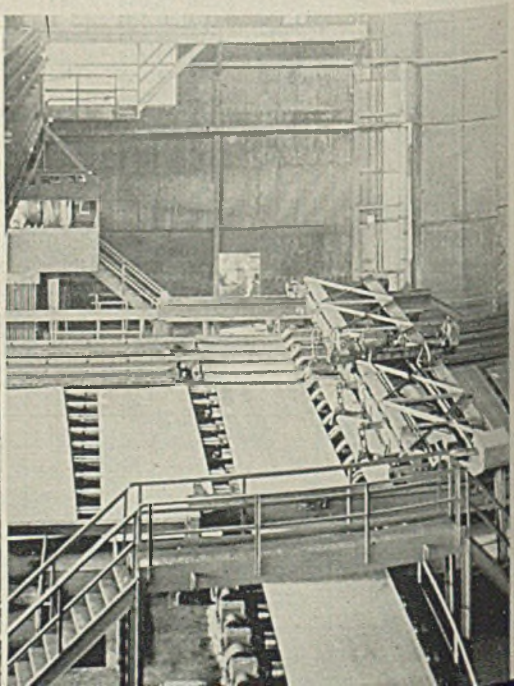
Fig. 2—The change in handling procedure for plate as compared to strip commences as the hot steel emerges from the last finishing stand. Strip at this point is passed through a spray

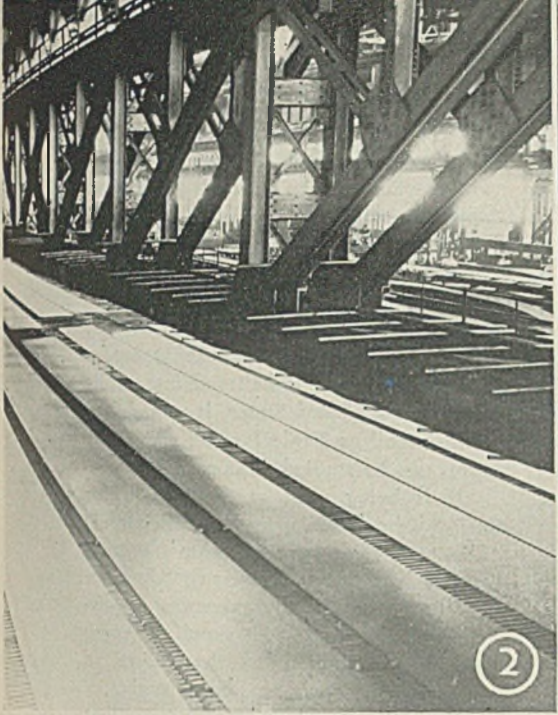
Converts World's Widest Strip Mill To Plate Production

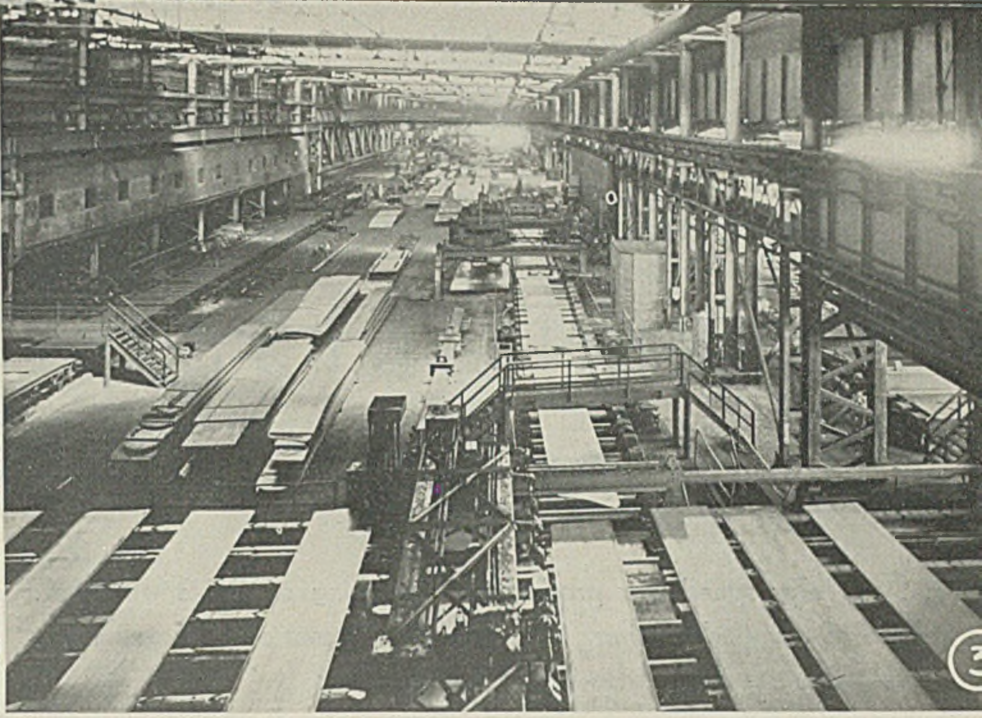
Fig. 4—Clearly marked with size and heat numbers, most of the steel shown here is destined to be made into plate vitally needed in the shipbuilding program of the country

Fig. 5—A new pinch roll has been installed at the entry to the first section of the new transfer tables to control the feeding of the steel plate. Plate from the hot mill transfer table arrives









of water on a long runout table and then wound into coils or cut into sheets by a flying shear located just beyond the last finishing stand. Plate, on the other hand, is sent on through the new hot roller leveler and onto the hot bed transfer, shown here, where it is checked for gage and then moved across into the new plate mill processing line

Fig. 3—In enlarging the existing plate production facilities, several pieces of equipment, including a roller leveler, side-trimming shear, up-cut shear, side piler and gage, which had been part of an original ½-inch plate mill line, were relocated to better advantage in a new ½-inch plate line shown here. A second plate line, located in a new bay at the right beyond the building columns, has been installed to handle lighter plate up to ½-inch

WHEN THE history of the United States' participation in World War II is written it will unquestionably be filled with many examples of industry's swift transformation of production facilities to wartime purposes.

Not the least of the outstanding accomplishments in this field to date has been the conversion of a major part of the capacity of the world's fastest and widest strip mill to the production of steel plate vitally needed for shipbuilding.

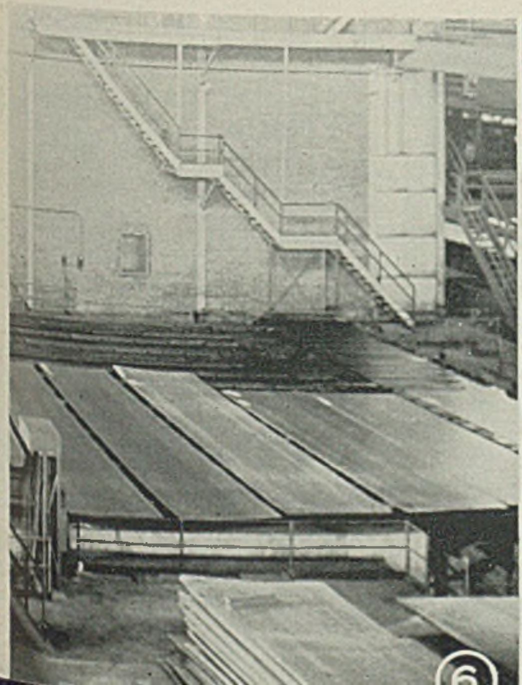
The mill had been completed by Republic Steel Corp. in 1937. It was, and is, regarded as a model plant for the production of these steel products. Early in 1941, executives of the company foresaw the serious need for greatly increased tonnages of steel ship plate. With a

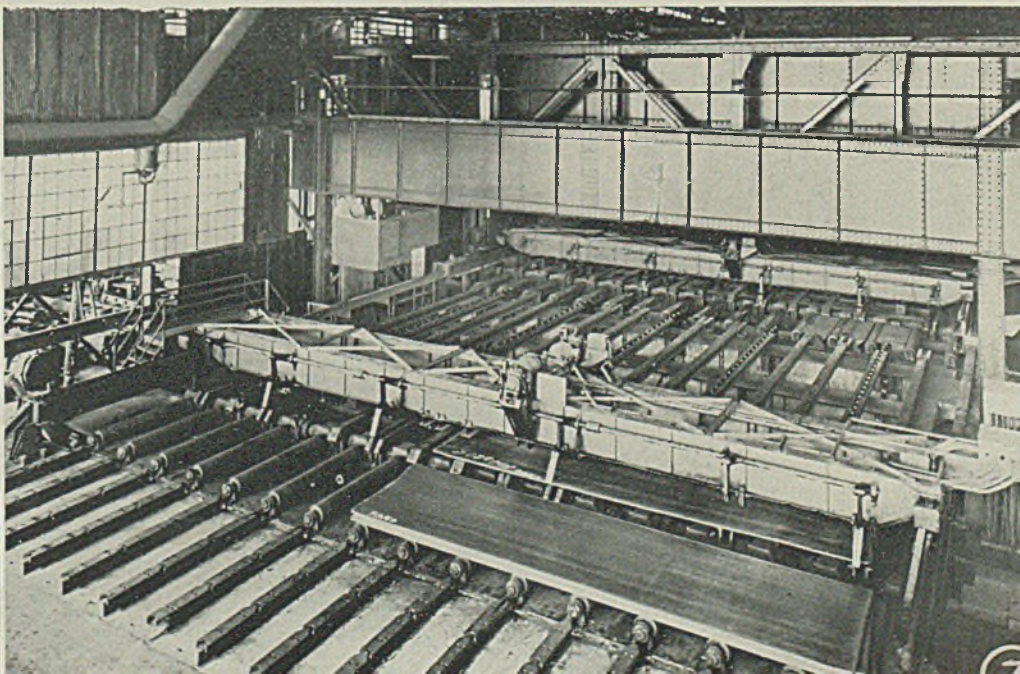
(*Please turn to Page 110*)

at this pinch roll over a long conveyor table equipped with up-cut shear and side piler

Fig. 6—Two adjoining transfer tables, capable of handling plate up to 53 feet long, were installed to receive the plate as it comes from the hot mill transfer table over a long filler table. A cascade arrangement has been successfully worked out which permits the accumulation by pusher cranes of a number of plates at the entry to each of the two new plate lines. Lighter plate is taken off at the first cascade, shown in the lower left foreground, and heavier plate at the second, located at the entry to the second plate line further on to the left

Fig. 7—Plate has been unloaded from the section of transfer table between the first and second pusher cranes to show the arrangement of conveyor feed mechanism by which the steel plate is moved across the bed. Lighter plate is unloaded at the first line and heavier plate at the second line, shown in the immediate foreground at the right. Operators control the equipment from a pulpit above and to the left of the transfer tables



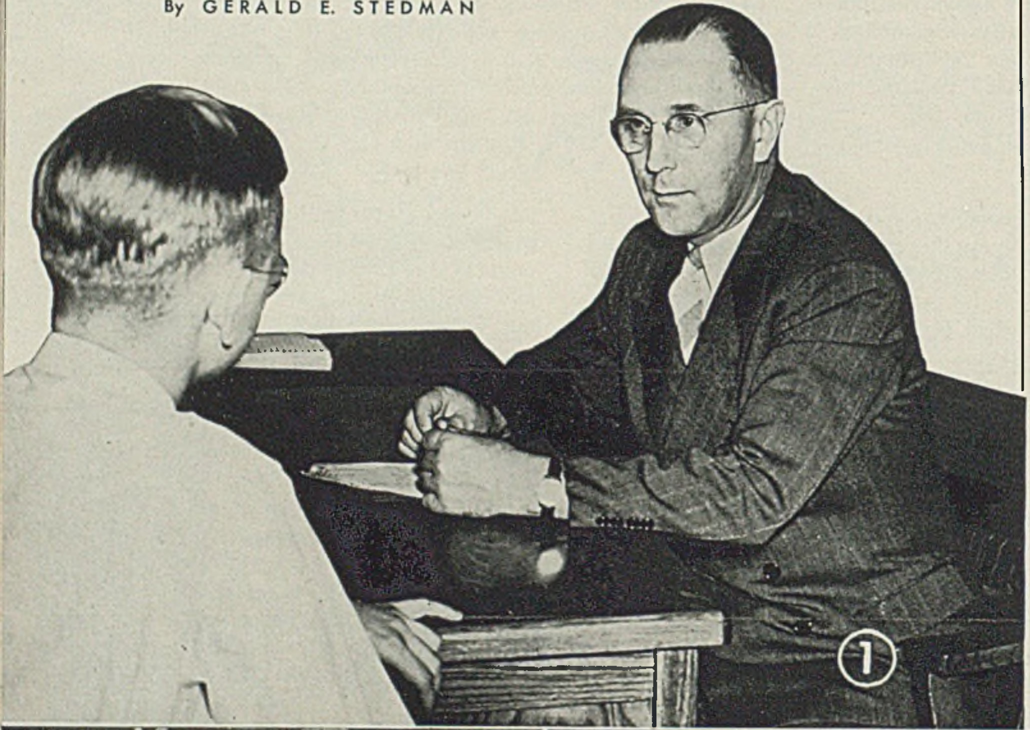


Co-operative Management-Labor

APPRENTICESHIP PLAN

. . . . helps speed war production by making available workmen with well-rounded training. More than 50 per cent of the apprenticeship graduates are now in supervisory positions

By GERALD E. STEDMAN



ONE VITAL activity in which both industry and labor can warmly co-operate with definite mutual benefits is *apprentice training*.

An outstanding successful co-operative apprenticeship program is that developed by The Murray Corp. of America, Detroit, and Local Union No. 2, UAW-CIO. This apprenticeship agreement, because it is believed first of its type in the United States, is reproduced here in full as Table I so its many features can be studied. See page 120.

It is being used as the pattern for many other such management-labor affiliation for apprenticeship training which have either been negotiated recently or are in the processes of discussion. No movement supplies a more sound contribution to the future of America. It deserves careful study.

From the abundance of comments that could be quoted, these attest the merits of the Murray "Learn While You Earn" apprenticeship plan:

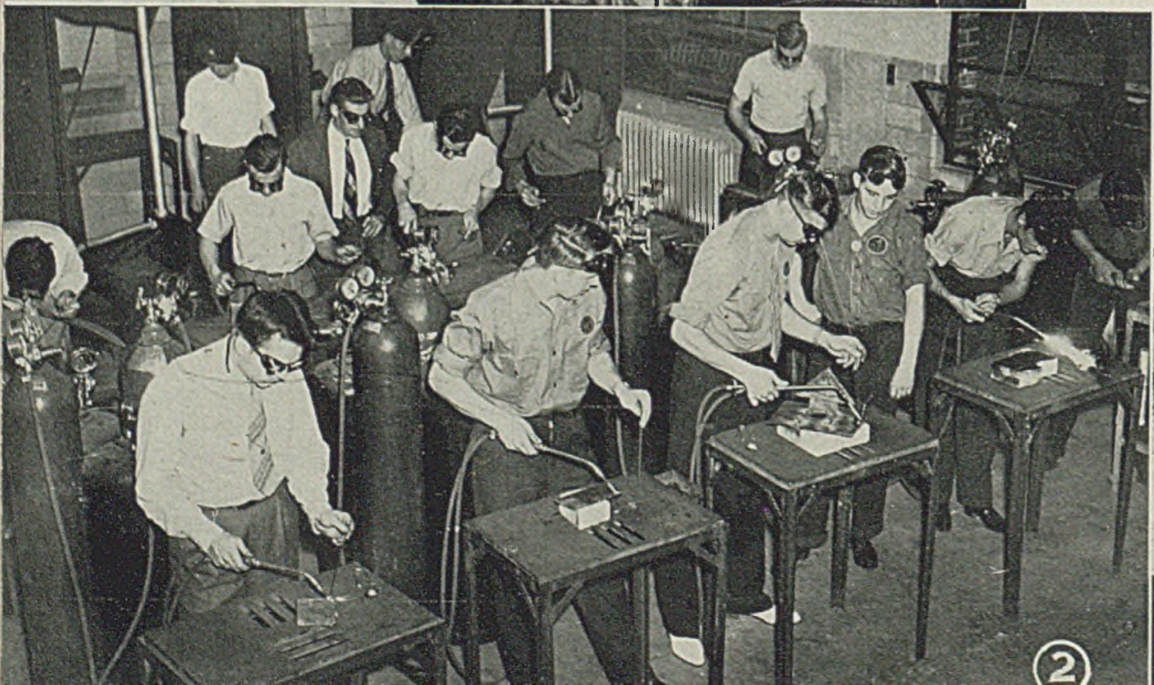
". . . . most effective system of apprenticeship in the country."—Thomas Diamond, vocational education department, University of Michigan.

"Hundreds of apprenticeship pro-

Fig. 1—Much of the success of the Murray apprenticeship program is due to the close intimate personal contact established and maintained with each boy by Mr. Goodwin, apprentice supervisor. Here he is shown giving guidance to a new apprentice

Fig. 2—Murray apprentice welding class, conducted at Detroit's Wilbur Wright Vocational high school by Murray instructor, J. Madison, center rear

Fig. 3—Murray apprentices at work in plant class room studying blueprint reading. Note the standard apprentice uniform always worn by apprentices when on the job



grams similar to Murray should be established in Detroit. Murray had set up the standard for the country."—William F. Patterson, chief of apprenticeship, Federal Commission of Apprenticeship, United States Department of Labor.

"I have never seen a scheme that gives an apprentice a more complete and thoroughly rounded training experience than that obtainable at Murray."—Thomas H. Quigley, head of industrial education department, Georgia School of Technology.

From the preface of the agreement, quoting Lloyd T. Jones, president, Local No. 2, UAW-CIO: "This agreement was made to fill a want that has long existed in the auto industry—to bring about a better understanding and cooperation between labor and industry."

From all of this, it is apparent that the Murray apprenticeship program is more than a start in the real direction. It is the answer to a problem now desperately felt and which will become increasingly important in the country's productive affairs. There would be no acute pirating of skills among producers or stealing of skilled jobs by untrained labor had such a program been popular during the depression '30's. Assuredly the war has stimulated these evils, but their high cost in personnel turnover

Fig. 4—This is the apprentice application form. All statements are investigated

Fig. 5—A monthly report on attitudes and ability of his foreman is a feature of the apprenticeship program

Fig. 6—Every three months, the parents of the apprentice receive a report on his progress and attendance. It must be signed and returned just like a school report card

APPRENTICE APPLICATION

THIS APPLICATION WILL BE INVESTIGATED

Please Print With Ink

Date

Full name

Address

City Phone No.

Trade desired

Why do you choose this trade?

Birthdate

Place of birth

Descent

Height Weight

Color of eyes

Color of hair

Are you color blind?

Applicant's Photograph

Snap Shot will do

Resident of what city?

How long?

Years of high school?

Graduate? Date

Name of high School

City State

Special studies

What studies did you like best?

Attend college or university? How long?

Name of college or university

Special studies

Other education

Form 634

Name

Trade

No.

What is your rank or standing in class work?

Are you right or left handed?

Do you attend church?

Name of church

Have you a police record?

Physical defects

Have you ever been an apprentice?

Where?

Reason for leaving?

Are you married?

Will you attend night school?

Would you attend college if possible?

What would you study?

What rate would you expect?

If employed, what is your present rate?

Parent's or guardian's full name

Address

Relation of guardian

Occupation of guardian

Place of employment

Relatives now employed by this company

Number in family and ages

Is all of the information given correct?

Signature of applicant

I find the above statement to be correct and true

Parent's or guardian's signature

Recommended by

Remarks

DO NOT FOLD

4

MONTHLY APPRENTICE SHOP RECORD

Name Shop No.

Kind of Work Month

Times Tardy Days Absent in Dept.

Note Check one item in each column.

Safety Habits	Ability to Learn	Willingness to Work	Accuracy	Productivity	Personal Habits
Very Careful ☐	No Ability ☐	Hard Worker ☐	Generally Poor ☐	Fast ☐	Intolerable ☐
Careful ☐	Limited Ability ☐	Steady Worker ☐	Below Standard ☐	Moderate Fast ☐	Needs Discipline ☐
Sometimes Careless ☐	Average Ability ☐	Works in Spells ☐	Sometimes Careless ☐	Moderate Slow ☐	Average ☐
Careless ☐	Better than Avg. ☐	Needs Discipline ☐	Meets Inspection ☐	Slow ☐	Good ☐
Very Careless ☐	Unusually Skillful ☐	Loafs ☐	First Class ☐	Very Slow ☐	Very Satisfactory ☐

REMARKS

MURRAY CORP. OF AMER. Foreman

5

QUARTERLY APPRENTICE REPORT

Name Quarter Ending

Trade

LEGEND
Grade A — Exceptional
B — Satisfactory
C — Average
D — Unsatisfactory
E — Very Poor

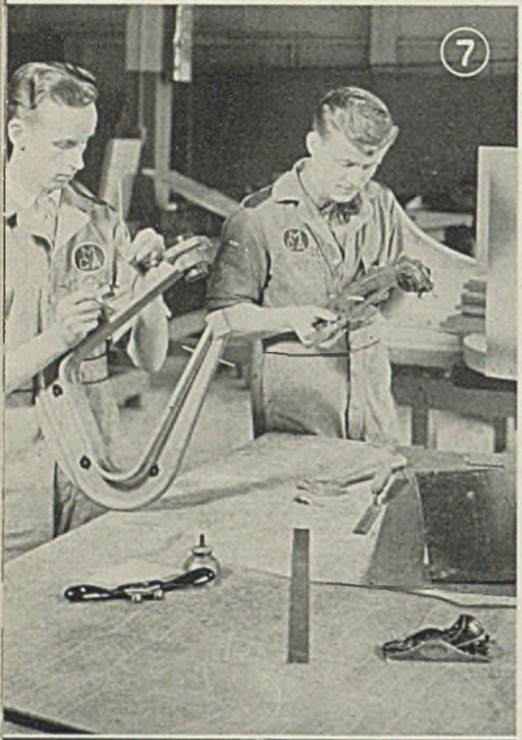
Months	SHOP RECORD									SCHOOL RECORD						
	Days Absent	Times Tardy	Safety Habits	Ability to Learn	Willingness to Work	Accuracy	Productivity	Personal Habits		Hours of Class	Hours Absent					

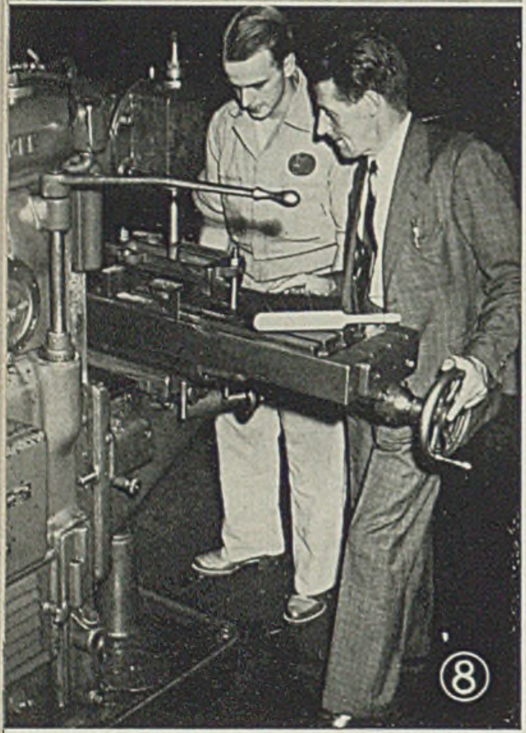
REMARKS

THE MURRAY CORP. OF AMER.
7700 RUSSELL ST

Parent or Guardian's Signature — Please Sign And Return — Supervisor

6





and the long, inefficient and expensive acquisition of skills by such careless methods cannot be tolerated for long.

The Murray agreement, dated Dec. 6, 1940, represents the culmination of a constructive program resting solidly upon the evolution of apprenticeship activities which an alert Murray management has been carefully evolving since September, 1934, when it appointed Albert Goodwin as its director of apprenticeship.

Mr. Goodwin joined Murray in 1927, won stripes in tool engineering, pioneered the need for apprenticeship training, was given an assignment by the Murray management to develop the program, surveyed the plant, set up standards and selected first apprenticeship classes. He worked in liaison with the Wilbur Wright high school staff, whose principal, O. Frank Carpenter, has been gradually extending that school's "Cooperating with Industry" program. This highly effective training program was detailed STEEL, Aug. 31, p. 50, 1942.

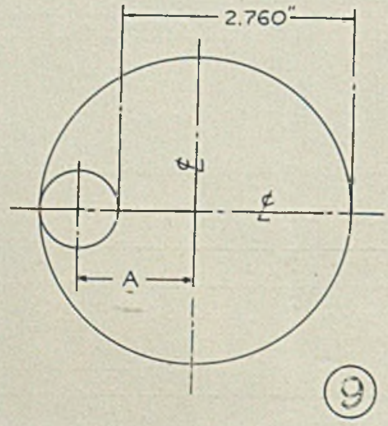
These are the men who set up the Murray program. Mr. Goodwin has since interviewed many thousands of boys, all of whom he has taken apart to find "what makes them tick." He is a composite of psychologist, human relationist, disciplinarian, engineer, instructor and supervisor—with an inventive training mind.

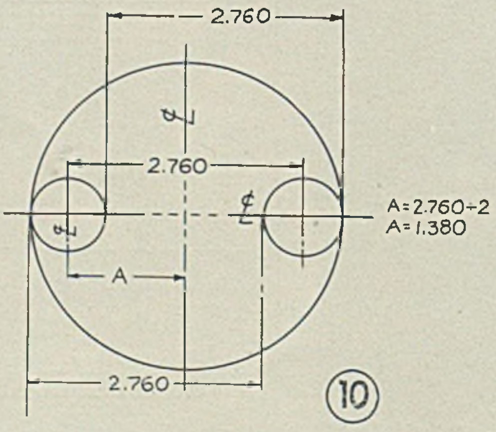
Fig. 7—These pattern making apprentices are hard at work handling production jobs. All work is on actual production

Fig. 8.—Apprentice learning how to handle a milling machine from his Murray instructor, J. Madison. All instruction given the apprentice on machine work is personalized as part of the "tell-show-do" method of training followed here

Fig. 9—Problem presented by this drawing is how to determine the dimension A from the one known dimension, 2.760 inches. Boys tear their hair over this one and then are amazed when they see the simple solution, Fig. 10

Fig. 10—Here is the extremely simple solution to the problem presented in Fig. 9. The lesson it teaches is largely psychological—that it pays to look for the obvious, easy answer





Local union officials early recognized the unusual values of Murray apprenticeship training efforts and so were glad to incorporate Mr. Goodwin's methods, program and procedure into the apprenticeship agreement.

A joint apprenticeship committee, consisting of three company and three labor members, facilitates the government of the Murray apprenticeship program. The agreement is sufficiently flexible to establish any new standards which seem feasible. There is excellent concord among members of this committee, which meets once each month to clear all details of its responsibility.

Term Covers Four Years

The conditions of apprenticeship are that applicants must be between the ages of 18 and 20, physically sound, with sufficient high school education and capable of meeting the standards of the company, subject to the approval of the Federal Committee on Apprenticeship of the United States Department of Labor. The director of apprenticeship is responsible for interviewing, qualifying and selecting such apprentices, subject to the approval of the Murray committee. The apprenticeship term is four years, covering 8000 working hours. This includes time excused from work to attend Wilbur Wright high school for training in related subjects. The rate of apprenticeship pay is approximately 45 per cent of standard journeyman's rate to start, with an increase of 3 cents per hour each 500 hours until apprenticeship is completed.

Shop schedules are set up for the various trades and include such experiences as to make the apprentice proficient. Transfer of trades is permitted upon committee approval. New schedules and trades can be added as needed. The apprentice attends school 4 hours per week, 36 weeks per year, to get related education, being paid at the shop rate for such schooling with the proviso that the apprentice shall voluntarily match this time by an equal number of hours on his own time on approved subjects.

The director of apprenticeship keeps unusually careful records. Some of the forms used are shown in Figs. 5 and 6. The apprentice is graded monthly on

(*Please turn to Page* 118)

The time to start salvaging material is *before* it becomes scrap! Stainless Steel is worth more to you and to the war effort in usable strip and bar form, than it is as scrap.

Check *all along the line* for ways to conserve Stainless Steel by reducing scrap loss. Find new ways to reduce rejects that are costly in terms of wasted time and wasted material. Here are a few practical suggestions—to add to the methods you are already using to *get the most from every pound of Stainless Steel.*

If You Are FORGING Stainless...

Reduce rejects by making sure that this metal with low thermal conductivity is preheated slowly and brought up to proper forging temperature. Always run furnaces at the proper forging temperature, not hotter. To keep forging operations going at full speed, it may be possible to heat more bars and billets at the same time.

If You Are GRINDING Stainless Steel...

When grinding, avoid deep scratches by always using the proper wheel. Don't increase wheel pressure to save time. This overheats the metal and can cause discoloring or distortion. And always use the proper lubricant. Your grinding wheel manufacturer can help you make sure that the proper wheel and lubricant are used for each job.

Check the Water On TUMBLING Jobs!

Another way to reduce Stainless rejects! On all tumbling jobs, make sure that the water used is "soft." Hard water forms an insoluble lime soap, impossible to remove. And balls so coated do not impart a satisfactory finish to the work. Hard water should be reduced to "soft" water before charging the barrel. This is done by adding 1 oz. of trisodium phosphate per gal. of hardness, per 100 gals. of water. Your local water company can tell you the grains of hardness per gallon in your water.

SIX MORE WAYS to Conserve Stainless and Reduce Scrap Loss

1. *An embossed rib will add strength, and may permit the use of lighter gauge strip.*
2. *Check your physicals. Undersize material can cause wrinkling in the die. Oversize may explain tearing or galling.*
3. *Keep dies or draw rings highly polished and smooth.*
4. *Longer die life and smoother stampings result when draw rings are "finish stoned" with a fine stone — not a wheel.*
5. *Avoid sharp edges on rolls by using a slight radius.*
6. *Re-check layouts where parts are stamped from Stainless Strip... to reduce skeleton scrap loss.*

AND when you have reduced scrap loss to the absolute minimum, salvage the rest. It is VITAL to Victory!

★ Get in the Scrap for Victory ★

QUICK ANSWERS to Your Fabricating Problems

If you could use additional helpful information on fabricating Stainless Steel, a note on your company letterhead will bring you any of the following Carpenter Data Sheets:

Machining Blanking Punching Sheering Forming Drawing Spinning Cold-Heading Grinding Polishing Buffing Tumbling Ball Burnishing Welding Riveting Soldering

And remember that your nearby Carpenter representative can give you the benefit of his diversified experience with Stainless fabricating problems.

THE CARPENTER STEEL COMPANY
139 Bern Street Reading, Penna.

Carpenter STAINLESS STEELS

BRANCHES AT Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

NEW AERO (NE) STEELS

AS A PART of the National Emergency (NE) Steel Specification project, which has the objective of standardizing production of steel products, a Technical Advisory Committee on Aeronautical Steels was formed under the chairmanship of J. B. Johnson, chief, Materiel Laboratory, Air Corps, Wright Field. The membership of this committee is listed on page 82.

The committee was charged with the responsibility of selecting from among the available specifications a limited number which would cover all the various aircraft requirements. A second phase dealt with the development of alternate steels which could be used to replace the conventional low-alloy steels to meet the needs for conservation of critical alloying elements. A third phase dealt with simplification and standardization of sizes, which by agreement has been referred to the SAE Aircraft Materials and Processes Coordinating Subdivision.

The first part of this work resulted in the selection of a list of conventional low-alloy and corrosion-resistant steels covering bar, sheet and tubing which the committee felt should provide for all the needs of aircraft producers with the exception of a few highly specialized steels which had very limited application.

This list, Table II, covers carbon, low-alloy and corrosion-resistant steels which are now used extensively and for which applications are well established. Both government and commercial specifications are listed, which permits continuation of present practices of designations on drawings, and in ordering and stocking these materials. This list does not include specifications for the steels which are used in relatively small quantities by a few individual fabricators for special applications.

Work on the second part of the program is not yet complete but has resulted in the adoption of a tentative list of alternate steels. These substitute steels, which are termed National Emergency Aeronautical Steels, have entirely new compositions and have been so selected as to permit the most advantageous use of critical alloying elements, much of which are contained in the scrap from which these alternate steels are produced. The compositions of these alternate steels have been set up in such manner as to provide properties comparable to those of the conventional low-alloy steels, to meet fully all performance requirements and to make available a larger tonnage of steel for aircraft production.

Table I is the list of specifications based upon new chemical compositions selected by the WPB. They are submitted as preferred alternate steels for the low-alloy steels listed in Table II. These steels may be used after the fabricator of the airframe, engine, propeller or accessory is satisfied that the application does not adversely affect the performance of the equipment for which he is responsible, and after he has received the necessary approval from the purchaser of the equipment.

The basic number of the specification is listed in the tables. However, the issue in effect at the date of invitation for bids or inquiry applies.

All fabricators of airframes, engines, propellers and accessories are requested to adhere to these lists of preferred specifications as closely as possible and to effect the greatest practical conservation of critical alloying elements by the proper selection of applicable compositions.

Changing conditions which apply to critical alloying elements and the need for a comprehensive program of tests which are required in making substitutions have heretofore prevented the establishment of a list of specifications which might be considered standard over any length of time. In order to overcome this difficulty, the Administrative Committee of N.E.S.S. has authorized the publication of the two lists of steels as above described. Publication is being made at this time in order that the entire industry may have knowledge of the recommendations of this committee to the end that all concerned may actively co-operate in this standardization program.

The Army Air Forces and the Navy Bureau of Aeronautics have authorized aircraft fabricators to investigate the properties of these National Emergency Aeronautical Steels with a view to their utilization as standard steels. This program of test work has reached the stage where many manufacturers of airframes, engines, propellers, and accessories have undertaken tests to determine the properties of these steels. Test results have been most encouraging. In many cases, the new steels, even though in some cases having less total alloy content than those which they are designed to replace, have shown superior properties. Laboratory and model tests are in progress both in this country and in England, and it is planned to disseminate the results of this test program as widely and as quickly as possible. All such information is being cleared through Mr. Johnson at Wright Field.

This entire program is expected to facilitate production of aircraft, to effect large savings of critical materials and to go far in achieving the present goal in the 1942-43 aircraft production program.

TABLE I—Tentative Alternate Steel Specifications Incorporating Chemical Compositions Recommended by War Production Board

ALTERNATE STEEL							
		Composition (5)					Aeronautical Material Specifications for which tentative alternate steels are suggested for investigation (4)
Tentative AMS No.	Form	Carbon	Manganese	Nickel	Chromium	Molybdenum	
AMS 6260	Bar	0.08-0.13	0.70-0.90	2.00-2.50	0.80-1.10	0.30-0.40	AMS 6250 and AMS 6240
AMS 6262	Bar (1)	0.08-0.13	0.70-0.90	2.00-2.50	0.80-1.10	0.30-0.40	AMS 6252
AMS 6263	Bar	0.11-0.16	0.70-0.90	2.00-2.50	0.80-1.10	0.30-0.40	AMS 6253
AMS 6264	Bar	0.15-0.20	0.70-0.90	2.00-2.50	0.80-1.10	0.30-0.40	AMS 6254 and AMS 6242
AMS 6270	Bar	0.12-0.17	0.70-0.90	0.40-0.60	0.40-0.60	0.15-0.25	AMS 6290
AMS 6272	Bar	0.15-0.20	0.70-0.90	0.40-0.60	0.40-0.60	0.15-0.25	AMS 6292
AMS 6274	Bar	0.18-0.23	0.70-0.90	0.40-0.60	0.40-0.60	0.15-0.25	AMS 6294
AMS 6280	Bar	0.27-0.33	0.70-0.90	0.40-0.60	0.40-0.60	0.15-0.25	AMS 6370
AMS 6320	Bar	0.33-0.38	0.75-1.00	0.40-0.60	0.40-0.60	0.20-0.30	AMS 6310, AMS 6330 and AMS 6380
AMS 6322	Bar	0.38-0.43	0.75-1.00	0.40-0.60	0.40-0.60	0.20-0.30	AMS 6312, AMS 6332, (6) AMS 6380 AMS 6382 and AMS 6448
AMS 6325	Bar (2)	0.38-0.43	0.75-1.00	0.40-0.60	0.40-0.60	0.20-0.30	AMS 6315 and AMS 6335 (6)
AMS 6327	Bar (3)	0.38-0.43	0.75-1.00	0.40-0.60	0.40-0.60	0.20-0.30	AMS 6317 and AMS 6337 (6)
AMS 6355	Sheet	0.27-0.33	0.70-0.90	0.40-0.60	0.40-0.60	0.15-0.25	AMS 6350
AMS 6357	Sheet	0.33-0.38	0.75-1.00	0.40-0.60	0.40-0.60	0.20-0.30	AMS 6352
AMS 6530	Tubing	0.27-0.33	0.70-0.90	0.40-0.60	0.40-0.60	0.15-0.25	AMS 6360
AMS 6535	Tubing	0.33-0.38	0.75-1.00	0.40-0.60	0.40-0.60	0.20-0.30	AMS 6365

(1) Same as 6260 except for Hardenability requirements
(2) Heat Treated—105,000 psi
(3) Heat Treated—125,000 psi
(4) The application of the alternate steels may be subject to approval by the agency procuring the equipment
(5) The limits on the chemical elements in the table are for the mill or heat analysis. Limits based on check analyses of the finished product are given in the individual specifications
(6) Steels conforming to the SAE 3100 series were deleted from Table I since these steels are non-standard for aircraft usage and are being replaced by other chemical compositions

Percentage of Phosphorus, Sulfur and Silicon of all of the above steels.

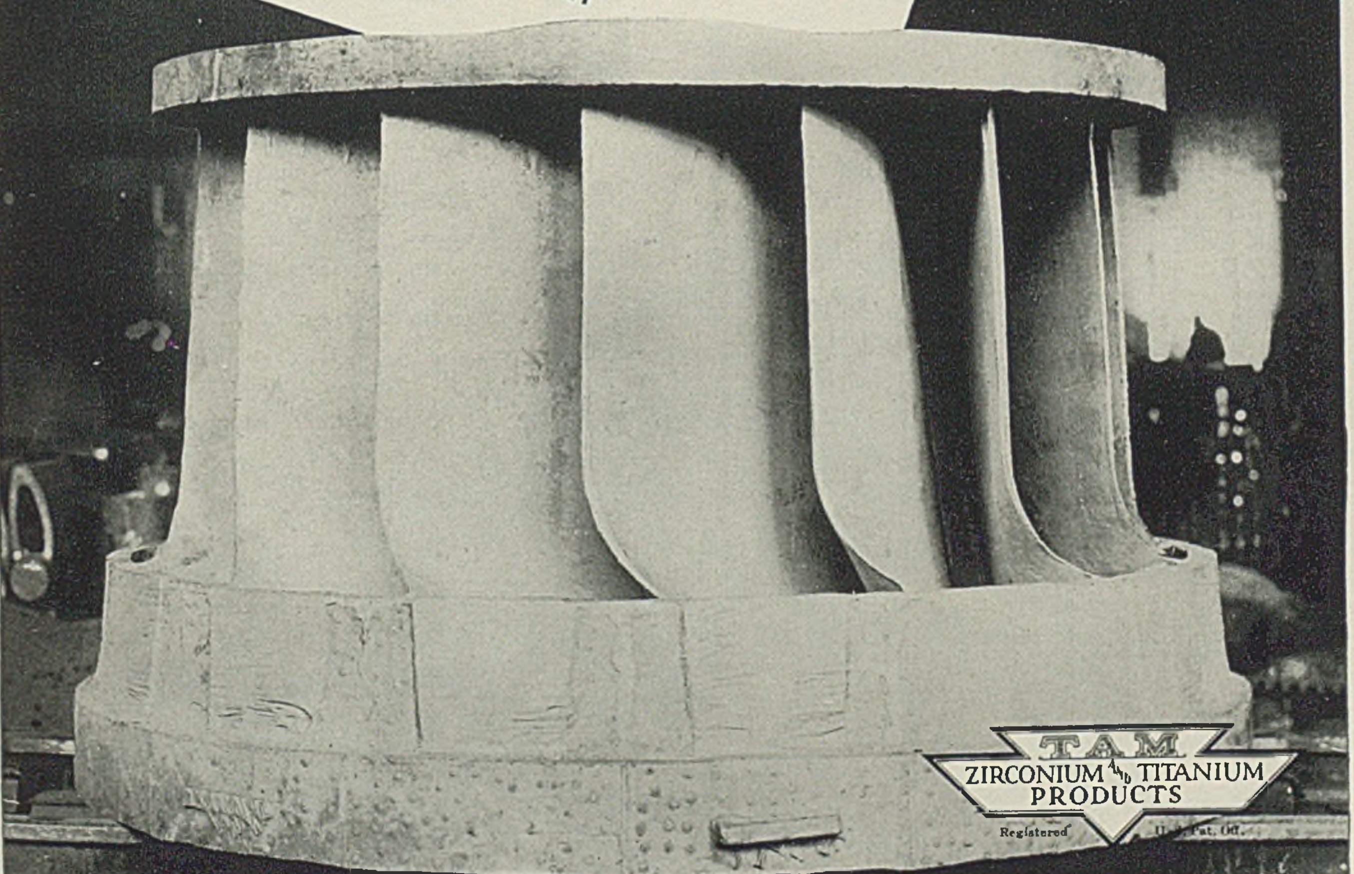
Phosphorus—0.040 Maximum
Sulfur —0.040 Maximum
Silicon —0.20-0.35

SMOOTH FACES
FOR CASTINGS

TAM Zirconite super-refractory mold and core washes produce smoother surfaces and reduce cleaning costs

By resisting the burning-in of the molten metal, TAM Zirconite Mold and Core washes speed up output of good castings by reducing the number and time of cleaning and finishing operations. Available in three grades: Zirconite A has a melting point above 3775° F.; Zirconite B has a melting point above 3600° F.; and Zirconite C, for special uses, has a melting point above 3600° F. They are quickly mixed by adding to water, and can be applied by either spraying, swabbing or painting on cores and molds. Write for complete details, today.

TITANIUM
ALLOY MANUFACTURING COMPANY



Zirconite Wash was used on this 94,000 pound .30-.35 carbon steel casting—11'6" high 14' diameter. Of special interest is the fact that no nails were used in the facing.

GENERAL OFFICES AND WORKS: NIAGARA FALLS, N. Y., U. S. A.
EXECUTIVE OFFICES: 111 BROADWAY, NEW YORK CITY

Representatives for the Pacific Coast . . . BALFOUR, GUTHRIE & CO., San Francisco, Los Angeles, Portland, Seattle, Tacoma
Representatives for Canada . RAILWAY & POWER ENG. CORP., Ltd., Toronto, Montreal, Hamilton, Winnipeg, Vancouver, Sydney
Representatives for Europe . . . . T. ROWLANDS & CO., Ltd., 23-27 Broomhall St., Sheffield, England

TABLE II—Conventional Aeronautical Steel Specifications

CARBON STEELS—Bars and Forgings

General Trade Designation		Government Specifications: Army-Navy	Army	Navy	NAF	Air Corps	Commercial Specs.
Screw Stock	(1112)	—	—	46S17	—	—	AMS 5010
1.3 Manganese, Free Cutting	(1117)	—	—	—	—	—	AMS 5022
1.5 Manganese, Free Cutting	(1137)	—	—	—	—	—	AMS 5024
1.5 Manganese, Free Cutting, Heat Treated	(1137)	—	—	—	—	—	AMS 5025
	(1015)	—	—	46S32	—	—	AMS 5060
	(1022)	AN-QQ-S-646	—	—	—	—	AMS 5070
	(1035)	AN-S-4	—	—	—	—	AMS 5080
	(1095)	AN-S-5	—	—	—	—	AMS 5132

CARBON STEELS—Sheet and Strip

General Trade Designation		Government Specifications: Army-Navy	Army	Navy	NAF	Air Corps	Commercial Specs.
Deep Drawing, Annealed, Cold Rolled	(1010)	—	—	—	—	—	AMS 5040
Cold Rolled	(1010)	—	—	—	—	—	AMS 5042
Half Hard	(1010)	—	—	—	—	—	AMS 5044
Cold Rolled	(1020)	AN-S-11	—	—	—	—	—
Annealed	(1070)	—	—	47S27	—	—	AMS 5120
Annealed	(1095)	AN-QQ-S-666	—	—	—	—	AMS 5121
Hard	(1095)	—	—	—	—	—	AMS 5122

CARBON STEELS—Wire

General Trade Designation		Government Specifications: Army-Navy	Army	Navy	NAF	Air Corps	Commercial Specs.
Zinc Coated—Soft	(1015)	AN-QQ-W-43[illegible]	—	—	—	—	AMS 5033
Zinc Coated—Hard	—	AN-QQ-W-423	—	—	—	—	—
Music Wire Commercial	(1080)	—	—	—	—	—	AMS 5110
Music Wire Best Quality	(1090)	AN-QQ-W-441	—	—	—	—	AMS 5112
Heat Treated	(1070)	—	—	47S4	—	—	AMS 5115

CARBON STEELS—Tubing

General Trade Designation		Government Specifications: Army-Navy	Army	Navy	NAF	Air Corps	Commercial Specs.
Seamless—Annealed	(1010)	—	—	—	—	—	AMS 5050
Welded—Annealed	(1010)	—	—	—	—	—	AMS 5053
Seamless	(1025)	AN-WW-T-846	—	—	—	—	AMS 5075
Welded	(1025)	AN-T-4	—	—	—	—	AMS 5077

LOW ALLOY STEELS—Bars and Forgings

General Trade Designation		Government Specifications: Army-Navy	Army	Navy	NAF	Air Corps	Commercial Specs.
5 Ni	(2512)	—	57-107-18	—	EMS 3	—	AMS 6240
5 Ni	(2517)	—	—	—	—	—	AMS 624[illegible]
3.5 Ni, 1.5 Cr	(3310)	—	57-107-22	—	EMS 4 & 5	—	AMS 625[illegible]
3.5 Ni, 1.5 Cr	(3310)	—	—	—	—	—	AMS 6252
3.5 Ni, 1.5 Cr	(3316)	—	—	—	—	—	AMS 6253
3.5 Ni, 1.5 Cr	(3316)	—	—	—	—	—	AMS 6254
1.8 Ni, 0.25 Mo	(4615)	—	—	46S32	EMS 8	AC10240	AMS 6290
1.8 Ni, 0.25 Mo	(4617)	—	—	—	—	—	AMS 6292
1.8 Ni, 0.25 Mo	(4620)	—	—	—	—	—	AMS 6294
1.8 Ni, 0.25 Mo	(4635)	—	—	—	EMS 69	—	AMS 6310
1.8 Ni, 0.25 Mo	(4640)	—	—	—	—	—	AMS 6312
1.8 Ni, 0.25 Mo 105,000 TS	(4640)	—	—	—	—	—	AMS 6315
1.8 Ni, 0.25 Mo 125,000 TS	(4640)	—	—	—	—	—	AMS 6317
Carbon-Molybdenum	(4037)	AN-S-9	—	—	—	—	—
1.25 Ni, 0.6 Cr	(3135)	AN-QQ-S-690	—	—	—	—	AMS 6330
1 Cr, 0.2 Mo	(4130)	AN-QQ-S-684	—	—	—	—	AMS 6370
1 Cr, 0.2 Mo	(4137)	AN-QQ-S-752	—	—	—	—	AMS 6380
1 Cr, 0.2 Mo	(4140)	—	—	—	—	—	AMS 6382
1.8 Ni, 0.75 Cr, 0.25 Mo	(4328)	—	—	—	—	—	AMS 6410
1.8 Ni, 0.75 Cr, 0.25 Mo	(4337)	AN-QQ-S-756	—	—	—	—	AMS 6412
1.8 Ni, 0.75 Cr, 0.25 Mo	(4340)	AN-QQ-S-756	—	—	—	—	AMS 6415
1.35 Cr	(52100)	—	57-107-13	—	EMS 70	—	AMS 6440
Chromium, Vanadium	(6150)	AN-QQ-S-687	—	—	—	—	AMS 6448
Nitralloy	(—)	—	57-107-28	—	EMS 47	—	AMS 6470
Nitralloy	(—)	—	—	46-S-30	—	—	—

LOW ALLOY STEELS—Sheet and Strip

General Trade Designation		Government Specifications: Army-Navy	Army	Navy	NAF	Air Corps	Commercial Specs.
1 Cr, 0.2 Mo	(4130)	AN-QQ-S-685	—	—	—	—	AMS 6350
1 Cr, 0.2 Mo	(4135)	AN-QQ-S-686	—	—	—	—	AMS 6352
Chrome-Vanadium	(6150)	—	—	—	—	—	AMS 6455
Low-Alloy No Commercial Designation	(—)	AN-QQ-S-676	—	—	—	—	—

LOW ALLOY STEELS—Wire

General Trade Designation		Government Specifications: Army-Navy	Army	Navy	NAF	Air Corps	Commercial Specs.
Chrome-Vanadium Annealed	(6150)	—	48-7	—	EMS 20	—	AMS 6450
Chrome-Vanadium Annealed	(6150)	—	—	W-42	—	—	—

NOTE: Tubing may also be ordered under the specifications listed for Bars and Forgings. The properties and tolerances in such cases shall be as agreed upon by vendor and purchaser.

LOW ALLOY STEELS—Tubing

General Trade Designation		Government Specifications: Army-Navy	Army	Navy	NAF	Air Corps	Commercial Specs.
Seamless, 1 Cr, 0.2 Mo Normalized	(4130)	AN-WW-T-850	—	—	—	—	AMS 6360
Seamless, 1 Cr, 0.2 Mo 125,000 TS	(4130)	AN-WW-T-850	—	—	—	—	AMS 6361
Seamless, 1 Cr, 0.2 Mo 150,000 TS	(4130)	AN-WW-T-850	—	—	—	—	AMS 6362
Seamless, 1 Cr, 0.2 Mo 180,000 TS	(4130)	AN-WW-T-850	—	—	—	—	AMS 6363
Seamless, 1 Cr, 0.2 Mo Normalized	(4135)	AN-WW-T-852	—	—	—	—	AMS 6365
Seamless, 1 Cr, 0.2 Mo 125,000 TS	(4135)	AN-WW-T-852	—	—	—	—	AMS 6366
Seamless, 1 Cr, 0.2 Mo 150,000 TS	(4135)	AN-WW-T-852	—	—	—	—	AMS 6367
Seamless, 1 Cr, 0.2 Mo 180,000 TS	(4135)	AN-WW-T-852	—	—	—	—	AMS 6368
Seamless, 1 Cr, 0.2 Mo 200,000 TS	(4135)	AN-WW-T-852	—	—	—	—	AMS 6369
Welded, 1 Cr, 0.2 Mo Normalized	(4130)	AN-T-3	—	—	—	—	AMS 6510

CORROSION RESISTANT STEELS—Bars and Forgings

General Trade Designation		Government Specifications: Army-Navy	Army	Navy	NAF	Air Corps	Commercial Specs.
18 Cr, 8 Ni	(Type 302)	AN-QQ-S-771	—	—	—	—	—
18 Cr, 8 Ni 2.5 Mo	(Type 316)	AN-QQ-S-771	—	—	—	—	—
16 Cr, 2 Ni	(Type 431)	AN-QQ-S-770	—	—	—	—	—
13 Cr, Free Machining	(Type 416)	—	—	46S18	—	—	AMS 5610
13 Cr, 1 Ni	(Type 414)	—	—	—	—	10080	AMS 5615
17 Cr	(Type 440)	—	—	46S18	—	—	AMS 5630
17 Cr, Free Machining	—	—	—	—	—	—	AMS 5632
18 Cr, 8 Ni Free Machining	(Type 303)	AN-QQ-S-771	—	—	—	—	AMS 5640
18 Cr, 8 Ni Swaging	—	—	—	46S18	—	—	AMS 5641
18 Cr, 8 Ni Heat Resistant	(Type 321 & 347)	—	—	46S18	—	—	AMS 5645
Cr, Ni, W, Valve	—	—	—	—	EMS 12	—	AMS 5700
Cr, Ni, Si, Valve	—	—	—	—	EMS 11	—	AMS 5705
Cr, Si, Ni, Valve	—	—	—	—	—	—	AMS 5710

CORROSION RESISTANT STEELS—Sheet and Strip

General Trade Designation		Government Specifications: Army-Navy	Army	Navy	NAF	Air Corps	Commercial Specs.
18 Cr, 8 Ni Heat Resistant	(Type 321 & 347)	AN-QQ-S-757	—	—	—	—	AMS 5510
18 Cr, 8 Ni Deep Forming	(Type 302)	AN-QQ-S-772	—	—	—	—	AMS 5515
18 Cr, 8 Ni Cold Rolled, Annealed	(Type 302)	AN-QQ-S-772	—	—	—	—	AMS 5516
18 Cr, 8 Ni Cold Rolled, 125,000 TS	(Type 302)	AN-QQ-S-772	—	—	—	—	AMS 5517
18 Cr, 8 Ni Cold Rolled, 150,000 TS	(Type 302)	AN-QQ-S-772	—	—	—	—	AMS 5518
18 Cr, 8 Ni Cold Rolled, 185,000 TS	(Type 302)	AN-QQ-S-772	—	—	—	—	AMS 5519
18 Cr, 8 Ni 2.5 Mo	(Type 316)	AN-QQ-S-772	—	—	—	—	—

CORROSION RESISTANT STEELS—Wire

General Trade Designation		Government Specifications: Army-Navy	Army	Navy	NAF	Air Corps	Commercial Specs.
18 Cr, 8 Ni Welding	(Type 347)	—	—	46 R 2	—	AC 10285	AMS 5680
18 Cr, 8 Ni Annealed	(Type 302)	—	—	—	—	—	AMS 5685
18 Cr, 8 Ni Spring	(Type 302)	—	—	—	—	—	AMS 5688
18 Cr, 8 Ni, 2.5 Mo Spring	(Type 316)	AN-QQ-W-423	—	—	—	—	—
18 Cr, 8 Ni, 2.5 Mo Screen	(Type 316)	—	—	—	—	—	AMS 5690

CORROSION RESISTANT STEELS—Tubing

General Trade Designation		Government Specifications: Army-Navy	Army	Navy	NAF	Air Corps	Commercial Specs.
18 Cr, 8 Ni Seamless, Heat Resistant	(Type 347 & 321)	AN-WW-T-858	—	—	—	—	AMS 5570
18 Cr, 8 Ni Welded Heat Resistant	(Type 347 & 321)	AN-WW-T-861	—	—	—	—	AMS 5575
18 Cr, 8 Ni	(Type 302)	AN-WW-T-855	—	—	—	—	—

NOTE: Tubing may also be ordered under the specifications listed for Bars and Forgings. The properties and tolerances in such cases shall be as agreed upon by vendor and purchaser.

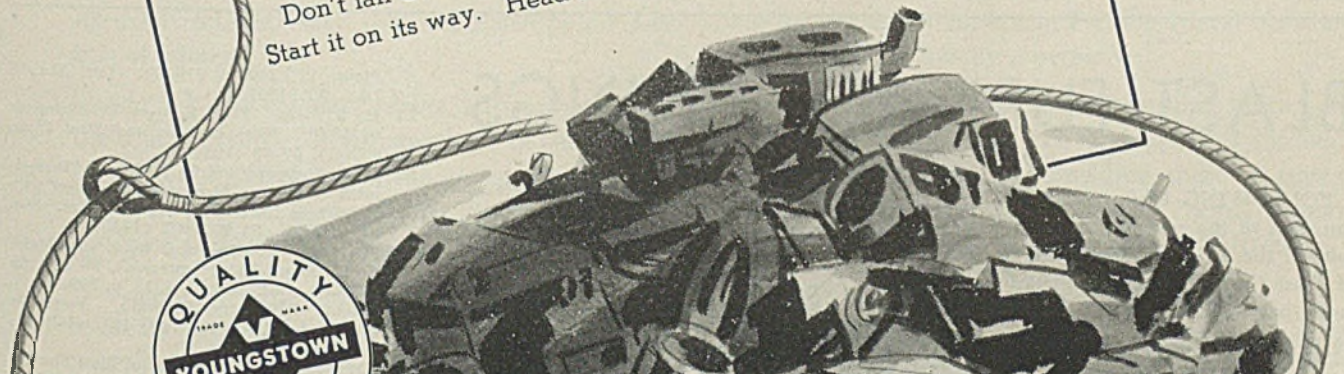
HEAD IT FOR THE LAST... "Round-up"

AMERICA is engaged in the biggest round-up of all history -- a round-up of junk for conversion to war materials.

Yet millions of tons of idle metal are still in hiding, in spite of this nation-wide campaign. Some of it may be in your home, or factory, or warehouse Worn-out machinery, pipe, wire, sheet metal, odds and ends -- all, converted to scrap, will go to produce more than double their own weight in prime fighting steel.

To collect the 6,000,000 EXTRA tons of scrap steel that our war needs dictate, means that YOU and every other citizen must contribute every pound of useless metal you can corral.

Don't fail Uncle Sam in this drive. Get out YOUR scrap. Start it on its way. Head it for its last round-up.



THE YOUNGSTOWN SHEET AND TUBE COMPANY
YOUNGSTOWN, OHIO

TABLE III—Technical Advisory Committee on (NE) Aeronautical Steels

Chairman: J. B. Johnson, Chief Material Section, Materiel Division, Air Corps, USA, Wright Field, Dayton, Ohio.

Secretary: John Mitchell, Metallurgical Engineer, Alloy Division, Carnegie-Illinois Steel Corp., Pittsburgh, Pa.

Government:

Representing the War Department:

J. B. Johnson, Chief, Material Section, Materiel Division, Air Corps, USA, Wright Field, Dayton, Ohio.

Representing the Navy Department:

Lt. W. P. Goepfert, Bureau of Aeronautics, Washington, D. C. Alternate: N. Promisel, Met., Bureau of Aeronautics, Washington, D. C.

Representing Army-Navy Aeronoutical Board:

Lt. S. D. Daniels, Army Air Corps, Washington, D. C. Alternate: Lt. T. W. Johnson, Navy Air Corps, Washington, D. C.

Representing the Federal Specifications Executive Committee:

Lt.-Col. John H. Frye, Office, Chief of Ordnance, Industrial Service, Washington, D. C.

Industrial Consumers & General Interests:

L. D. Bonham, Process Engineer, Lockheed Aircraft Corp., Burbank, Calif.

H. A. Campbell, Research Engineer, Solar Aircraft Co., San Diego, Calif.

B. Clements, Chief Metallurgist, Wright Aeronautical Corp., Paterson, N. J.

Eric Dudley, Materials & Standards Engineer, Airplane Division, Curtiss Wright Corp., Buffalo, N. Y.

W. H. Graves, Chief Metallurgist, Packard Motor Car Co., Detroit, Mich.

R. B. Gray, Chief of Laboratories, Glenn L. Martin Co., Baltimore, Md. Alternate: Paul W. Boone, Glenn L. Martin Co., Baltimore, Md.

A. W. F. Green, Materials Engineer, Pratt & Whitney Aircraft Division, United Aircraft Corp., East Hartford, Conn.

R. L. Heath, Chief Metallurgist, Allison Division, General Motors Corp., Indianapolis, Ind.

Horace C. Knerr, President, Metallurgical Laboratories, Inc., Philadelphia, Penn.

R.R. Moore, Senior Metallurgist, Naval Aircraft Factory, U. S. Navy Yard, Philadelphia, Penn.

C. L. Stevens, Ford Motor Co., Dearborn, Mich.

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W. G. Bischoff, Timken Roller Bearing Co., Canton, Ohio.

L. L. Ferrall, Metallurgical Engineer, Rotary Electric Steel Co., Detroit, Mich.

John Mitchell, Metallurgical Engineer, Alloy Div., Carnegie-Illinois Steel Corp., Carnegie Bldg., Pittsburgh, Penn.

M. J. R. Morris, Chief Metallurgical Engineer, Republic Steel Corp., Massillon, Ohio.

E. T. Walton, Supt. of Metallurgy & Inspection, Crucible Steel Co. of America, Midland, Penn.

Henry Wysor, Metallurgical Engineer, Bethlehem Steel Company, Bethlehem, Pa.

Tubes

J. S. Adelson, Chief Metallurgist, Steel Tubes Div., Republic Steel Corp., Cleveland, Ohio.

H. R. Lewis, Chief Metallurgist, Ohio Seamless Tube Co., Shelby, Ohio.

A. J. Williamson, Chief Metallurgist, Summerill Tubing Co., Bridgeport, Pa.

E. C. Wright, Chief Metallurgist, National Tube Co., Frick Bldg., Pittsburgh, Pa.

Stainless—Flat and Bars

L. S. Bergen, Associate Director, Metallurgy & Research, Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y.

E. H. Davidson, Metallurgical Engineer, Structural, Plate-Stainless Steels, Carnegie-Illinois Steel Corp., 1208 Carnegie Bldg., Pittsburgh, Penn.

B. H. DeLong, Chief Metallurgist, Carpenter Steel Co., 101 West Bern St., Reading, Penn.

H. A .Grove, Metallurgist, Alloy Steel Division, Republic Steel Corp., Massillon, Ohio.

R. A. Lincoln, Metallurgical Engineer, Allegheny Ludlum Steel Corp., Brackenridge, Penn.

Consulting Members:

J. G. Morrow, Chief Metallurgist, Steel Co. of Canada Ltd., Hamilton, Ontario.

H. L. Chamberlain, Supply Directorate, British Raw Materials Mission, 1801 K St., Washington, D. C.

F. H. Saniter, Supply Directorate, British Raw Materials Mission, 1801 K St., NW., Washington, D. C.

BLAST FURNACE LININGS

FOLLOWING bibliography is a continuation of the references which accompanyed the article, "Mechanism of Wear of Blast Furnace Linings", in last week's issue, page 75:

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10. R. Schenk and W. Heller. "Experimental Studies on the Processes in the Blast Furnace," *Stahl u. Eisen*, 25 (1905) 1121-1124, Oct. 1.
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Co-Disintegration of Refractories

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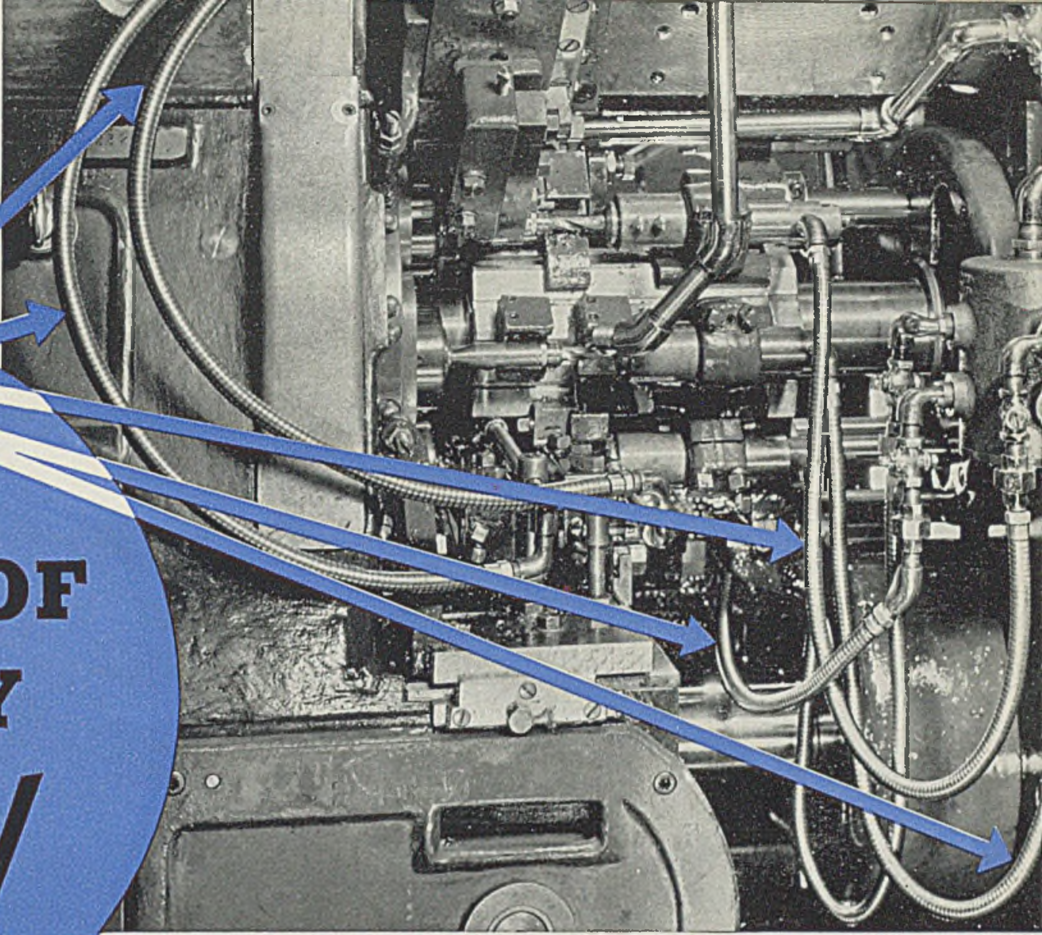
(*Please turn to Page* 130)



These ARTERIES OF INDUSTRY *MUST NOT FAIL!*

The lifelines of this mechanical era of war and its industrial heart must be of such enduring strength and flexibility that there can be no question of failure.

Metal is the one dependable material possessing the characteristics to withstand all of the stresses of steam and air pressure, the deteriorating effects of oil, liquids and gases, and destructive vibration . . . and still retain the required flexibility.

American Seamless Flexible Metal Tubing, made by corrugating drawn rigid *Seamless* Tube, and American Metal Hose, wound from strip metal, are in the forefront of the battle lines . . . from the depth of sea and earth to the fighting heights of the stratosphere.

This company is still serving most of its regular buyers . . . because they have always been . . . and are now . . . the leading industrialists, whose production is the backbone of both peace and war. Added to these, of course, are the many new plants organized expressly for war production — whose use of American Flexible Metal Hose and Tubing is practically a necessity.

For all connecting and conveying duties, for vibration control, for the correction of misalignment and for protective shielding, there's a type of American Flexible Metal Hose or Tubing — some of which are shown on the reverse of this sheet.

Seamless SS-50 *graphically tells the story of American Seamless Flexible Metal Tubing — gives you important tables and accurate engineering data so necessary under present war conditions.*

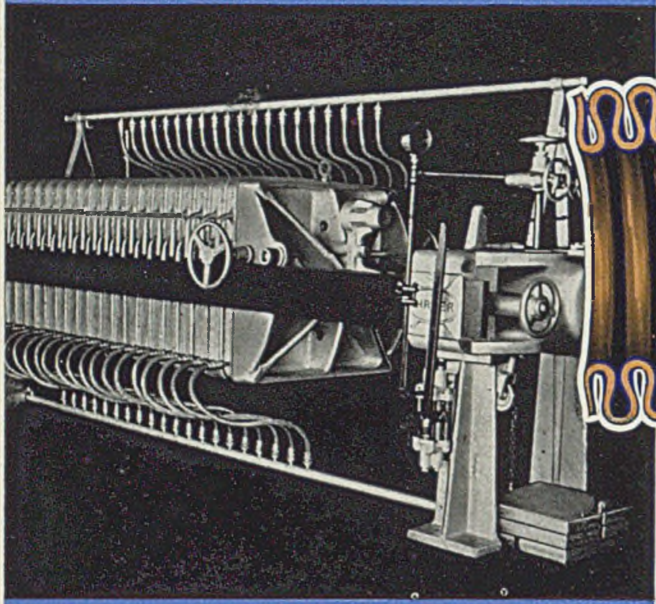
Aircraft Bulletin A-48 *provides the essential facts in the form of up-to-the-minute specifications on American Metal Hose Aircraft products — flexible low tension shielded conduit, fittings, flexible aluminum and stainless steel tubing, ferrule attaching machines, etc.*

American Metal Hose

ANACONDA
from mine to consumer

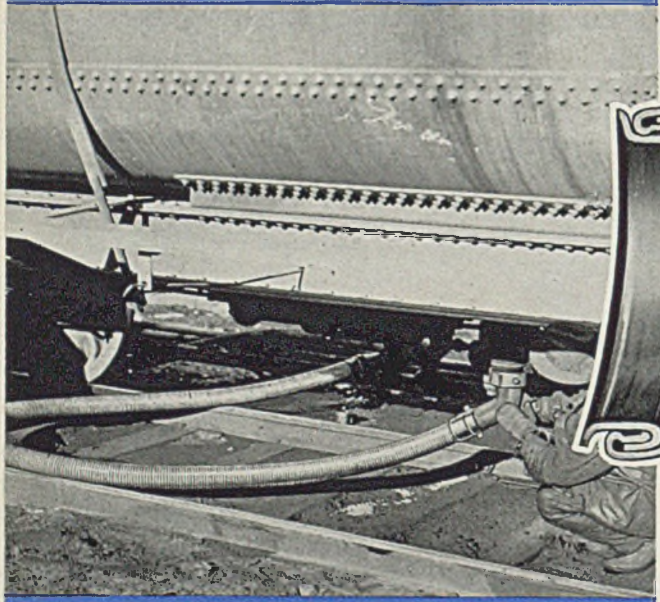
AMERICAN METAL HOSE BRANCH of THE AMERICAN BRASS COMPANY

General Offices: Waterbury, Conn. • • Subsidiary of Anaconda Copper Mining Company

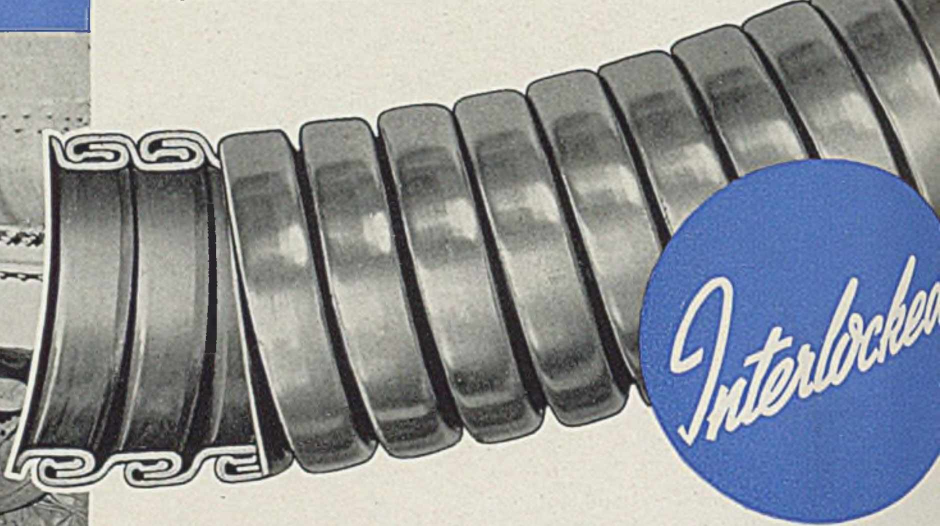


Large Filter Press equipped with American Seamless Flexible Metal Tubing for connections to steam feed and exhaust manifolds.

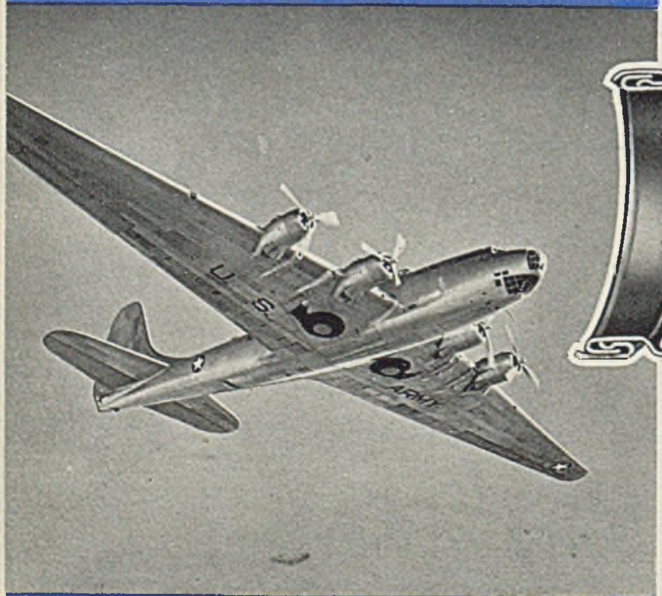
Note that flexibility is developed in American "Seamless" by corrugating the solid walls of rigid metal tubing after it has been "stretched" to the correct wall thickness. Thus, a continuous flexible metal tubing, with no seams, no laps, no welds, no joints — ideally suited to convey steam, oil, hot water, solvents, gases and some chemicals, made in various metals. For pressure work, one or more braided wire jackets are added.



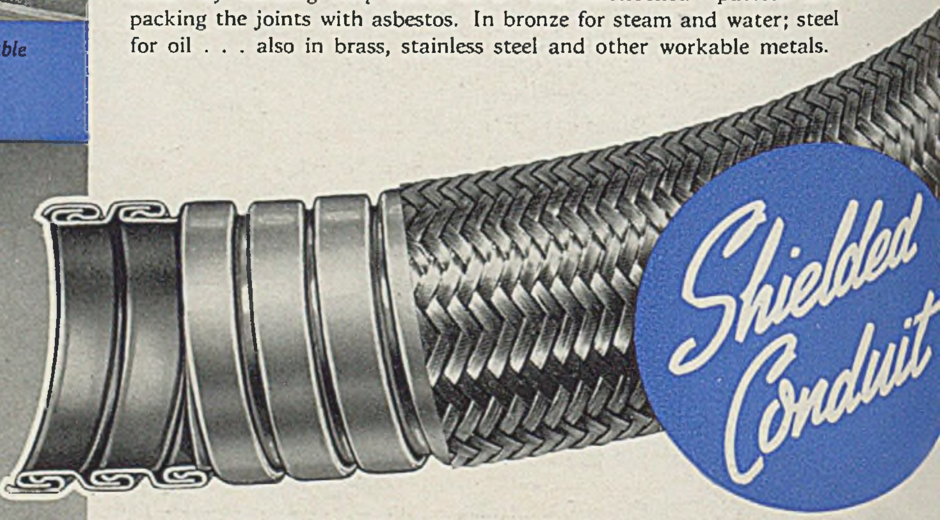
Unloading Oil Tank Car with a length of durable American Flexible Steel Oil Hose.



The toughest type of extremely flexible metal hose, especially suited to "heavy duty" all around service in conveying steam and oil. Made by winding strip metal in a "full interlocked" pattern and packing the joints with asbestos. In bronze for steam and water; steel for oil . . . also in brass, stainless steel and other workable metals.

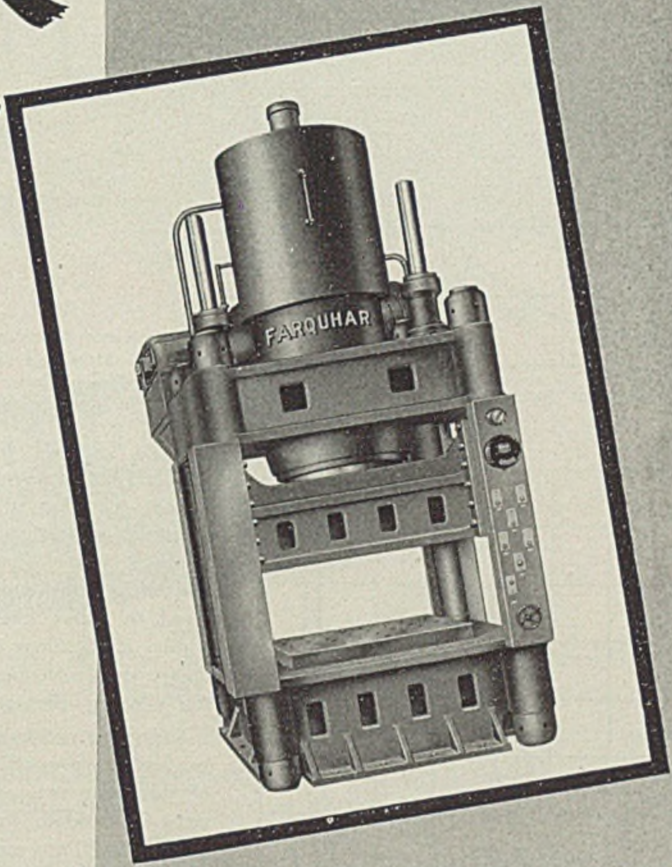


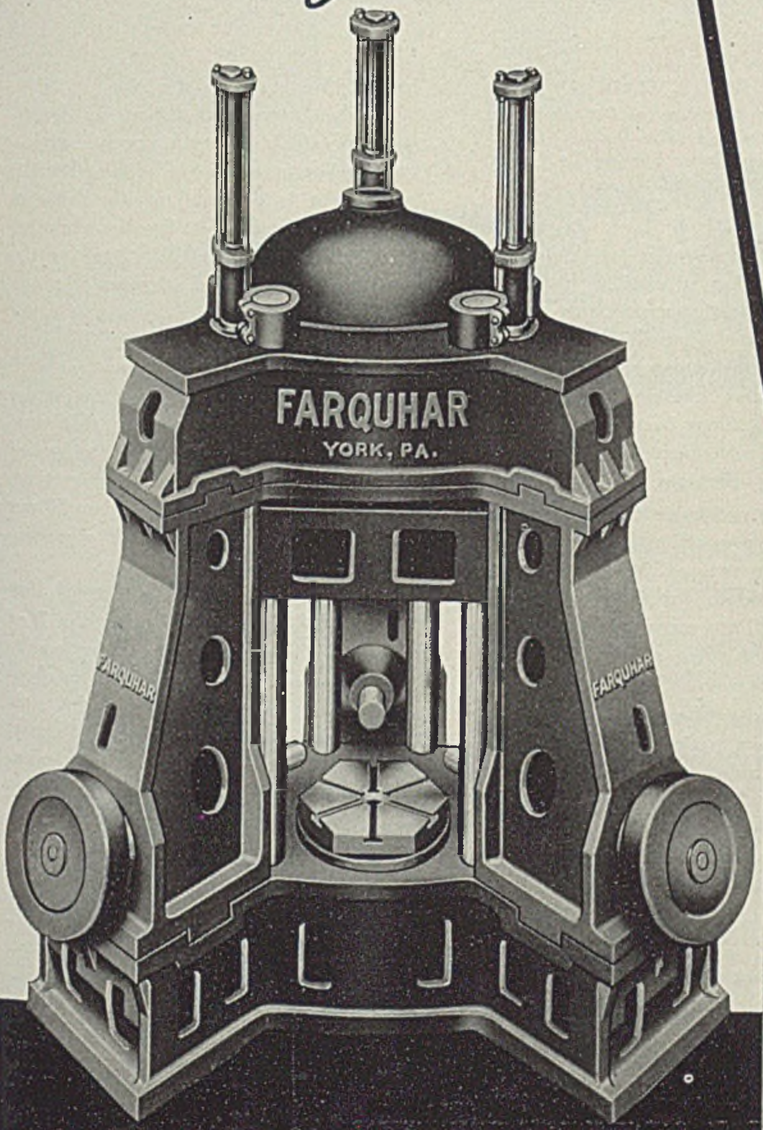
American Flexible Aluminum Shielded Conduit and conduit fittings are used on military aircraft for shielding the wiring of the electrical system.



American Flexible Metal (low tension) Shielded Conduit is strip wound from aluminum. Used by the aircraft industry for shielding electrical wiring. Made to specifications of both the Army and Navy. Also available is a special flexible metal housing for parachute ripcords; flexible heat ducts and shielded conduit fittings.

POWER
to Spare



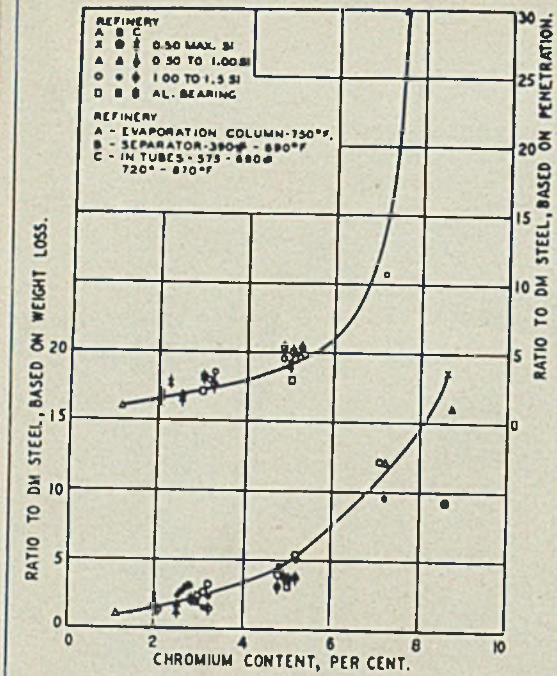


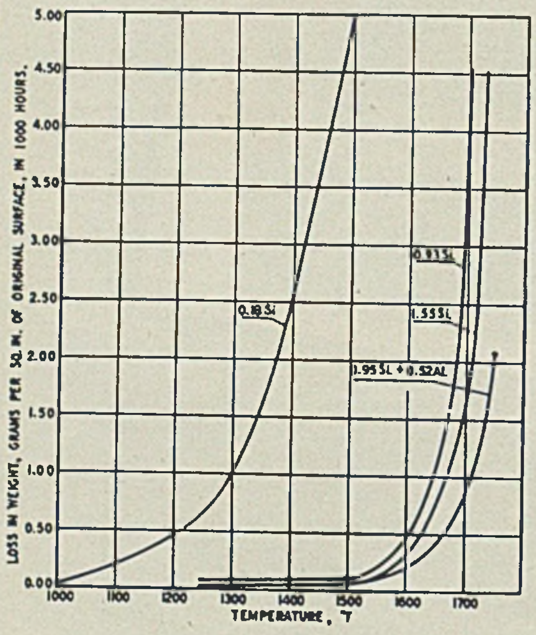
Farquhar Self Contained Hydraulic Presses from three tons up, with power to spare for longer life, are built for every conceivable purpose. These two are excellent examples of presses for making aircraft parts. On the left is a giant 7200 ton Forging and Extrusion Press. Above is a 1500 ton Forming Press.

One of the first to enlist in the war effort, Farquhar started building smokeless powder presses in 1938 and has built over a thousand of them since. (Note: Farquhar built smokeless powder presses for the first world war.) Today, in addition to these indispensable units, Farquhar is building presses for finishing operations: shell and cartridge case piercing and drawing; gun and shaft straightening; forging and extrusion; blanking and forming of aircraft parts; flanging and forming at shipyards, and many other operations so needed to help our fighting forces on to victory.

FARQUHAR
Self Contained
HYDRAULIC PRESSES

A. B. FARQUHAR CO., Limited
Hydraulic Press Division • YORK, PA.





CONSERVING ALLOY STEELS

. . . . *in petroleum processing equipment by specifying lower alloy contents can lead to important savings as explained here*

By C. L. CLARK
*Research Metallurgical Department
Steel and Tube Division*
Timken Roller Bearing Co.
Canton, O.

WHILE considerable work is being done to develop substitutes for the alloy steels containing appreciable amounts of such scarce elements as chromium and nickel, the severe service encountered in tubes for cracking stills and similar applications in the petroleum industry demands appreciable amounts of the alloying elements.

Corrosion resistance to hot petroleum products is proportional to the amount of chromium present. Molybdenum, too, must be added, for the straight-chromium steels are susceptible to temper embrittlement after service at elevated temperatures.

The severity of corrosion in different cracking units varies greatly, depending upon the crude used and the operating conditions. Thus the amount of chromium required also varies, up to 9 per cent chromium, or 18 per cent chromium and 8 per cent nickel—the familiar 18-8 stainless steel.

While chromium additions are necessary for steels for such service, appreciable economies can be obtained if the equipment is designed on the basis of furnishing equipment for the duration of the emergency rather than for the usual extended life of 10 years or so.

For example, if in a given unit 5 per cent chromium gives a life of 10 years, then replacements for this unit as well as proposed new units operating under the same conditions and on the same charging stock could well be either of the 1.25 or 2 per cent chromium type, resulting in a saving of more than 50 per cent in the chromium which otherwise would be required.

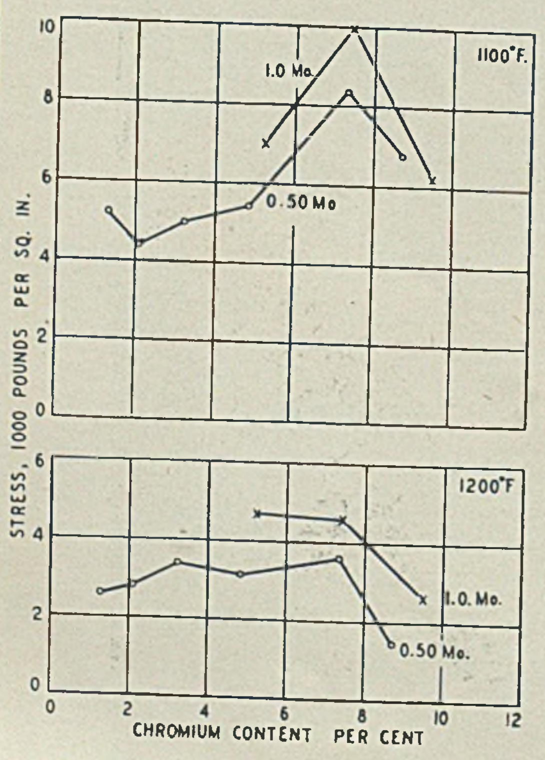
Likewise, certain applications of 18-8 stainless could be handled by the 7 or 9 per cent chromium grades, thus resulting in appreciable savings both in chromium and in nickel. While this procedure does, of course, require estimating the duration of the present emergency, most of our war effort must likewise be based on quite similar estimates.

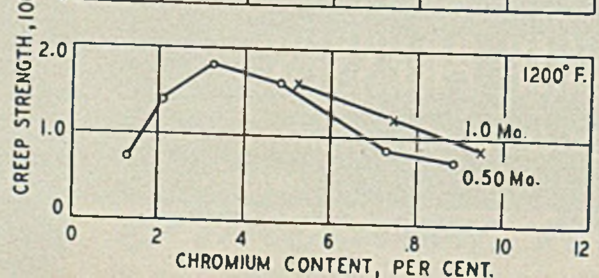
Since many of the orders for cracking-still tubes and especially those for replacement in inventory are relatively small, more rigid standardization of these steels is advisable to conserve melting

(*Please turn to Page* 123)

[1] "High Temperature Strength Characteristics Available for Design of Cracking Still Tubes," *Oil & Gas Journal*, Jan 8, 1942.

From *Refiner & Natural Gasoline Manufacturer*.

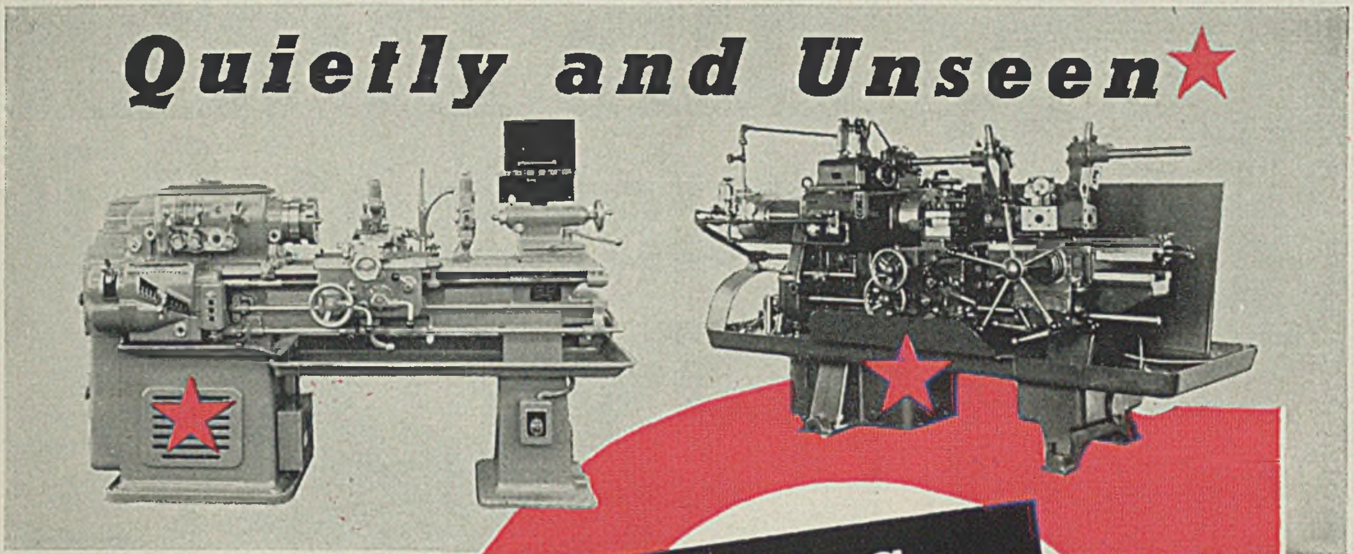




(Top to Bottom, Left)—Fig. 1—Comparative corrosion results from three refineries, based on the corrosion ratio to DM steel. Fig. 2—Influence of silicon and aluminum additions on the oxidation resistance in air of 4 to 6 per cent chromium-molybdenum steel. Fig. 3 — Influence of varying the chromium and molybdenum content on the rupture strength

Fig. 4 — (Left) — Influence of varying the chromium content on the creep strength

Quietly and Unseen



CENTURY MOTORS power the precision production of thousands of machine tools

One of the largest Exclusive Motor and Generator Manufacturers in the World.

Century Motors are the unseen dependable servants of thousands of operators of machine tools engaged in War production. Because of their unusual freedom from vibration, Century Motors do not handicap the precision of the machine tool.

From the largest machines involving heavy shock loads to the smallest of precision machine tools, you'll find Century Motors standing the gaff of continuous, 3-shift duty — they are engineered to meet the demands of such service.

The wide range of Century Motor types and sizes can well save *you* time and money by simplifying proper motor selection. For assistance in the quick solution of your motor problems, call in your nearest Century Motor Specialist without delay.

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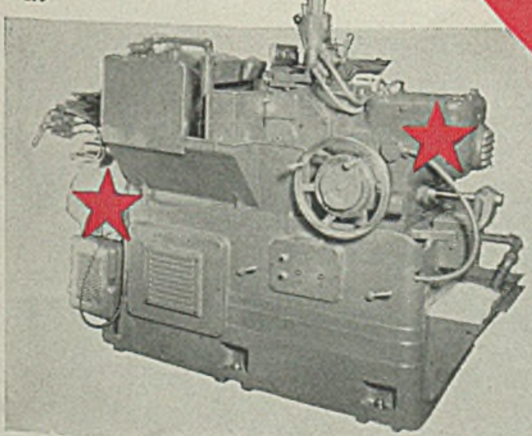
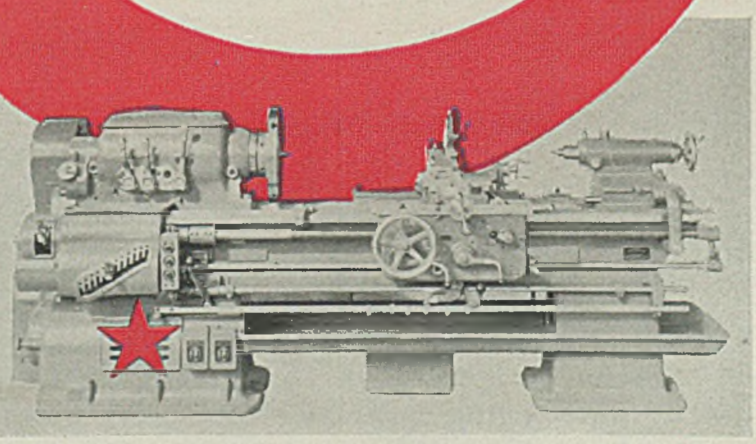
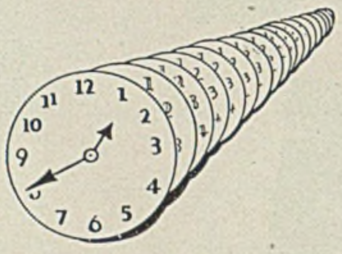
290





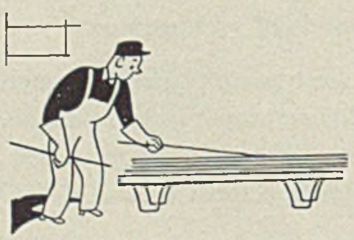
168 Hours per Week!

Modern industrial trucks are working 168 hours a week. This is necessary to keep war production lines adequately supplied with materials. Other trucks, not so modern and, up to this time, never even considered for such continuous service, can be batteried to give the same kind of service. Write our nearest office for suggestions.



Alibis are Seldom Alkaline.

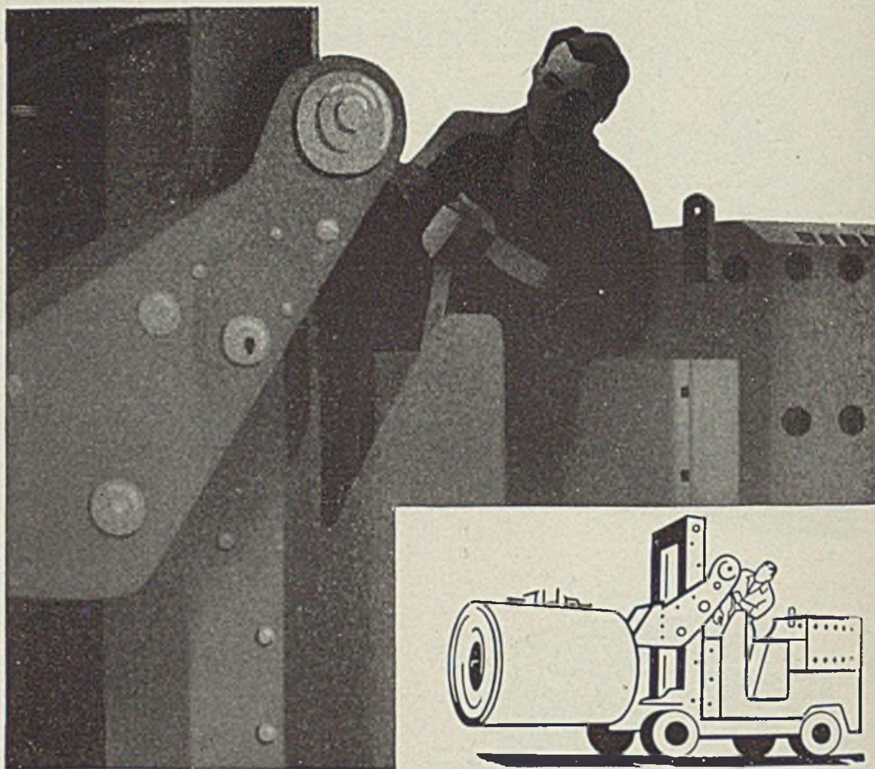
For every production dip there must be a suitable explanation. Few material-handling delays have ever been attributed to failure of an alkaline battery. Its performance is predictable. It does not fall down on the job without warning. On such reliability are production records written.



Skid Racks. Many war plants are producing parts machined to close tolerances which require careful protection against damage in handling through the subsequent processes. By the use of skid racks they have not only avoided spoiled work but have also saved many handling motions. And, they have avoided time losses that could never be retrieved. When a plant is on a war schedule, there's no time left!

Edison Storage Battery Division
Thomas A. Edison, Inc.
WEST ORANGE, N. J.

THIS POWER must not fail



Battery industrial trucks are literally the internal supply lines of our war industries. They keep materials on the move all the way from incoming to outgoing carriers. Their power-units are their strength . . . they must not fail.

And that's the biggest single reason why over half the battery industrial trucks of America are powered by Edison Alkaline Batteries. They provide the most dependable battery power the world has ever known, an Edison invention. Dependability is the reason for their success in mines, on railroads, throughout industry and aboard ship. Electrically, chemically, structurally, they are made to order for today's stringent demands.

INDUSTRY NEEDS THE DEPENDABILITY OF

Edison Alkaline BATTERIES

Monorail Handling System

. . . . with drop sections speeds sheet metal fabricating operations

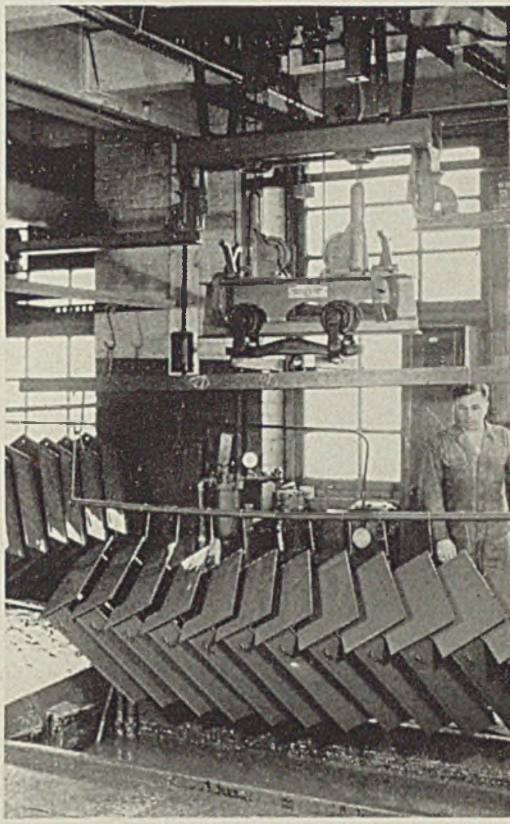


Fig. 1—*Drop sections such as this one over a dipping tank greatly facilitate the processing operations since much of the work can be performed without removing it from the handling system. Note the rack carrier is extremely flexible in design, thus enabling a wide variety of parts to be carried easily*

IN THE three large plants of the Art Metal Construction Co., Jamestown, N. Y., are thousands of feet of Tramrail that make it possible to convey, by the overhead route, the various metal parts that enter into the fabrication of modern steel file cases, desks, partitions, doors and other metal equipment of which Art Metal is one of the leading producers.

From the receiving platform and through the many manufacturing departments the overhead Tramrail conveyor system is a big factor in making possible real efficiency in materials handling and production. Time wasted on unnecessary rehandling has been reduced considerably. Materials come in a continuous flow when wanted, thus eliminating the need for skilled workers to be idle for periods of time waiting for parts with which to work.

A 2-ton pack of steel sheets is being unloaded from the truck in Fig. 2. The hoist is a manually operated 3-ton Cleveland Tramrail chain hoist. The steel packs are secured in the sheet lifter by use of the handwheel. The usual heavy tugging and lifting are eliminated with this equipment. One man can easily unload a truck of steel packs and deliver them inside the plant in quicker time than formerly required and with far less danger of injury.

Drop sections such as the one dipping file drawers in enamel in Fig. 1 do much to speed the cleaning and painting of parts. Racks loaded with parts are passed through a sequence of operations such as cleaning, drying, dip painting, dripping, baking, and so on, without ever being touched by hand or removed from the Tramrail system.

The carriers with loaded racks are easily conveyed to the drop sections installed over the various tanks. The sections lower the parts into the solutions and elevate them to the original level, permitting the carriers to roll on to the next point.

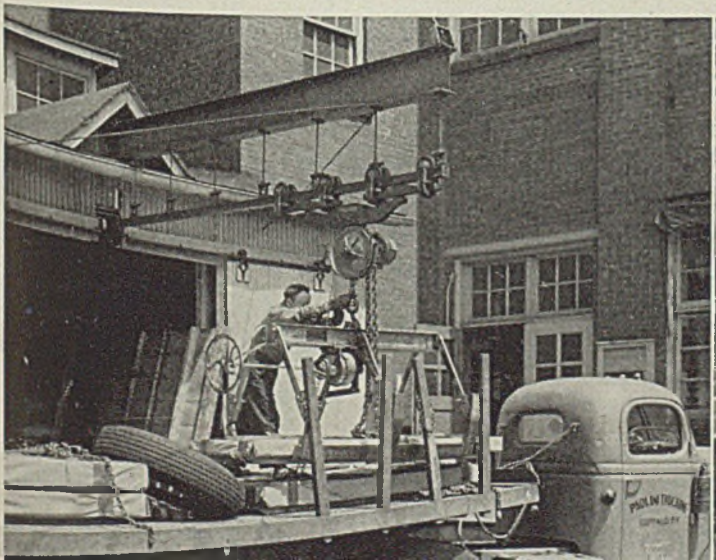
While the Tramrail system in itself provides tremendous advantages, it often makes possible the use of other equipment which brings about still greater savings. Such is the case in the department where Art Metal cleans and paints file drawers. Because of the Tramrail equipment it was possible to install and operate a degreaser in which parts are dipped and thoroughly cleaned in a few minutes in a chemical vapor atmosphere. Because the chemical vapor used in the new process is toxic, drop sections were found an ideal means of putting this fast working agent to use.

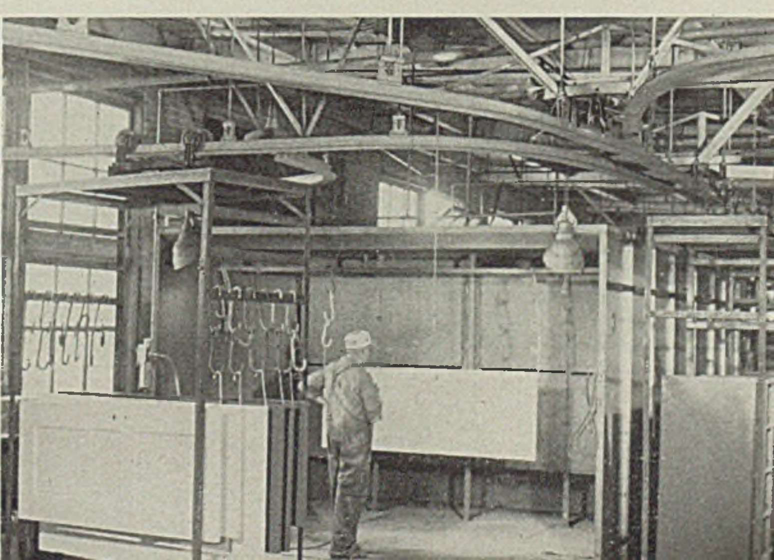
Doors and a great many parts are spray painted as illustrated in Fig. 3. Note the convenience that this arrangement provides from a materials-handling viewpoint. Also observe how easily the painted items can be moved on with little danger of being touched or damaged.

The installation of Tramrail made possible the introduction of various methods and equipment which, combined, helped better production efficiency far more than was expected. A vivid indication of this is the fact that only two bake ovens are required in one department where 12 were required before. And Art Metal executives readily credit the use of the efficient handling system in large part for this achievement.

Fig. 2. (*Left*)—*Sheet pack lifter and Tramrail hoist enable one man to handle 2-ton packs of steel sheet as monorail system extends out over truck loading and unloading area*

Fig. 3. (*Right*)—*Painting is speeded and the work protected by these monorail carriers. All illustrations furnished by Cleveland Tramrail Division, Cleveland Crane & Engineering Co., Wickliffe, O.*





Eyes and Ears for the Army and Navy are made of steel tubes!

HOW would you like to climb into the control tower of a battleship and look *through* the mechanical eyes which can spot an enemy ship miles beyond unaided sight? Or go into the crowded control room of a destroyer and listen through the mechanical ears which reveal the heart throbs of a submarine lurking beneath the sea? Or visit an observation post for our land forces where the *tubular* range finder is posted to spot enemy artillery, and the sensitive sound detectors to catch the drone of approaching aircraft long before it can be seen?

Maybe you didn't know it, but these "eyes and ears" which are largely responsible for the surprising accuracy of American gun fire are built with substantial amounts of *seamless* steel pipe and tubing.

But vital and numerous as these devices are, they represent only a part of the amazing contribution of pipe and tubing to our military operations. The ships to be built in 1942-43 will use enough pipe and tubes to reach one and a half times around the world! Powder plants, arsenals, factories, defense housing and equipment require a staggering tonnage, while millions of shells, demolition bombs, tank parts, and aircraft accessories create an amazing total in the war effort.

That's why the vast facilities of NATIONAL Tube Company follow 'round the clock with an endless stream of production. That's why the processes which made NATIONAL Seamless famous in times of peace are so valuable today. And that's why before you ask the question, "What about pipe and tubes?", you already have the answer. NATIONAL Pipe and Tubes have definitely gone to war!

NATIONAL TUBE COMPANY

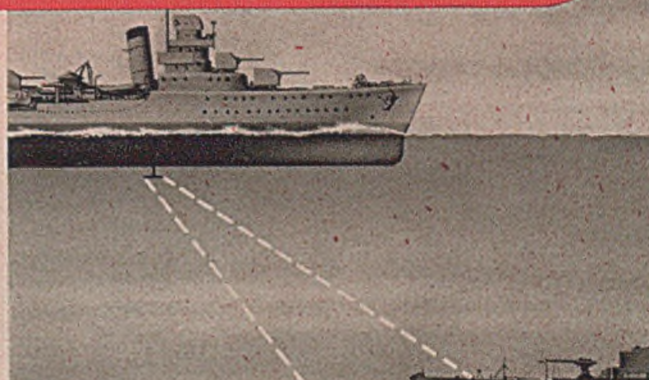
Pittsburgh, Pa.

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

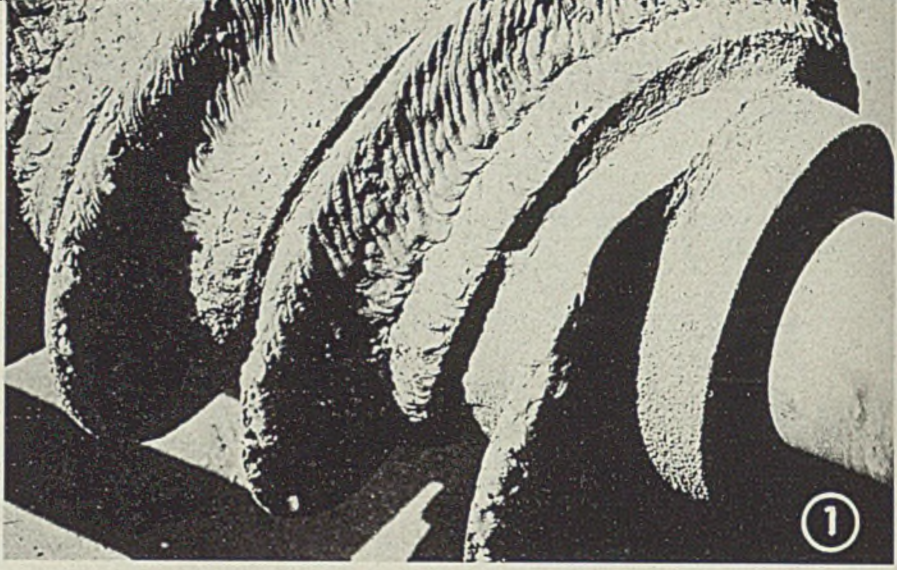
UNITED STATES STEEL

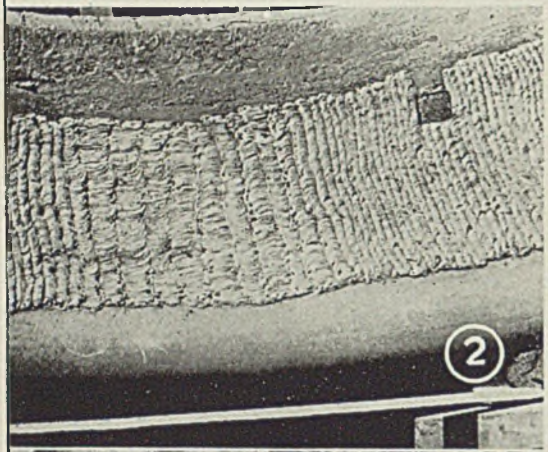
← **SUPERSENSITIVE** ears for detecting airplanes miles away. Shelby Seamless Tubing is used for sound conduction equipment mounted on a framework of seamless pipe.

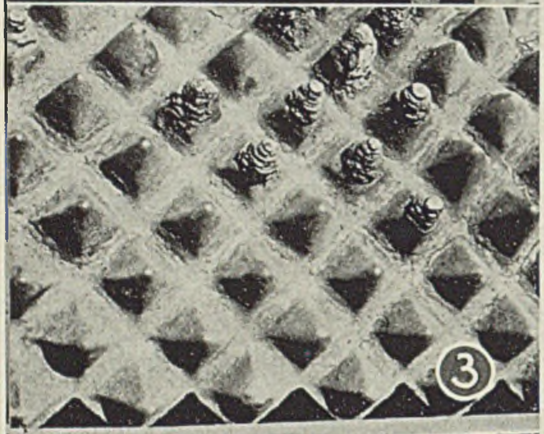
→ **DETECTING SUBMARINES** without seeing them. Listening devices using seamless tubes are used to locate the direction of submarines.

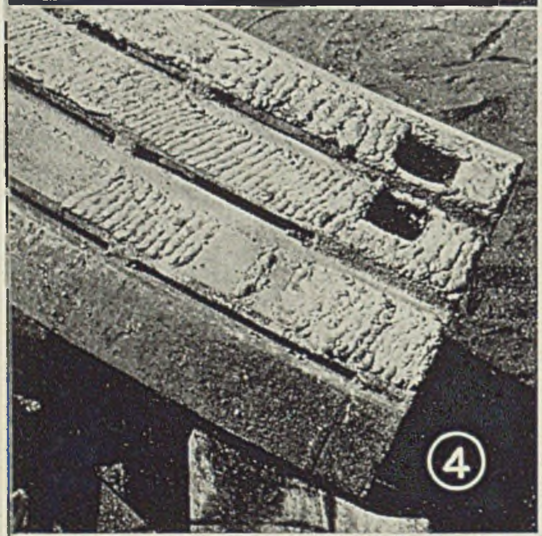


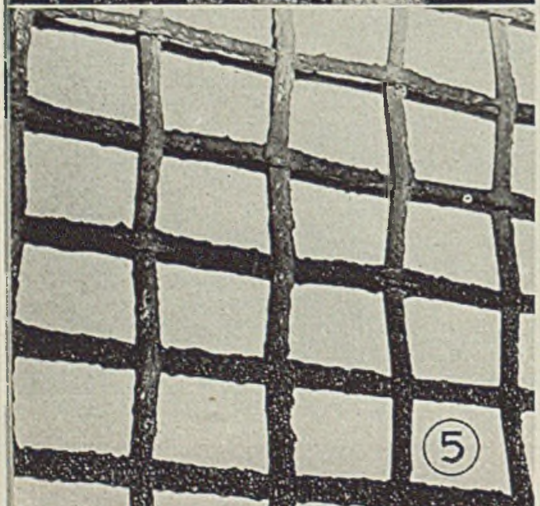
PIPE AND TUBES











WELDING

In Gas Plant Maintenance

By E. W. P. SMITH
Consulting Engineer
Lincoln Electric Co.
Cleveland

ARC WELDING in gas plant maintenance requires a basic knowledge of welding as well as of the requirements or services to be met in the gas plant. Welding of steel in plant maintenance, new pipelines, repair of pipe lines, repair and replacement of castings, and hard surfacing are typical applications. Now, with arc welding playing such a vital part in war production and with the urgent need for increased output of implements of war, it is necessary that former welding speeds be considered inadequate and steps be taken to increase them still further. The logical way to bring about a radical improvement in anything—whether it is a welding process or the design of a product—is to get back to fundamentals, to erase the thought of everything that has gone before and get a fresh start.

From a paper presented before the American Gas Association, New York, May 25, 1942.

Following this reasoning, a new "Fleet-Fillet" technique has been developed which has increased the arc speed of 12 feet per hour (in the late 1920's for the equivalent of a ⅜-inch horizontal fillet with bore or washed electrode weld to a present arc speed of 65 feet per hour. (See STEEL, June 1, 1942, p. 70).

Removing Broken Studs: In maintenance work, the problem of removing broken stud bolts is frequently encountered. By the method described here

Fig. 1—Closeup of section of cast steel worm after it had been salvaged by resurfacing with one layer of Abrasoweld. Worm was worn to point where it had been discarded. Cost of new worm was $75 which compares with a cost of only $25.50 for the reconditioning job, which in turn will outwear a new worm. Teeth of the worm gear driven by this worm are likewise reconditioned when worn at a cost of only $93.50 which compares with $600 for a new worm gear—and job is done without removing gear

Fig. 2—A section of a cast steel skirt, each gas producer having eight of these units. Skirts are 1½ inches thick when new, wear severely in middle portion but fail mechanically if allowed to become thinner than ½-inch. Building up section at this point by surfacing with Abrasoweld avoids necessity of replacing casting at cost of $97.44 which compares with reconditioning cost of only $10.20—a saving of $87.24 on each job

Fig. 3—Teeth of this cast iron segment of a coke crusher are easily built up to correct height for maximum effectiveness by deposition of hardsurfacing material. Worn points already built up can be seen along with others worn but not yet built up

Fig. 4—These worn flights of a Ni Hard grate section from a gas producer were built up by applying first a layer of Ferroweld, then a layer of Abrasoweld. Surfaced area showed only a little wear after a year of service

Fig. 5—Coke screens can be reconditioned successfully provided that at least half of the original section of the rods has not been worn away. If more than half has been worn away, rods are likely to break when reconditioned since the hard surfacing material resists abrasion well but does not withstand shock loads which must be taken by the rod material forming the screen

Heat Treatments MUST HIT THE MARK TOO!

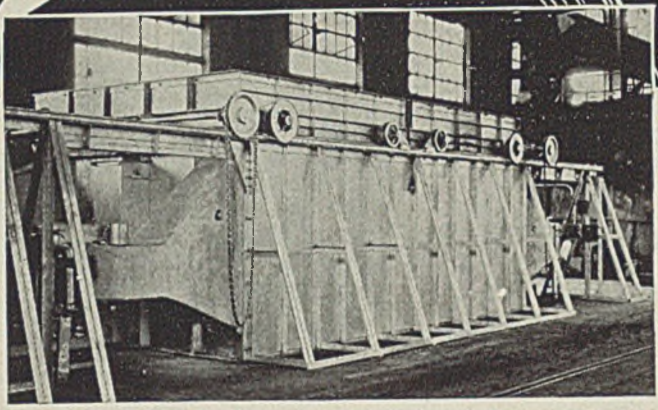
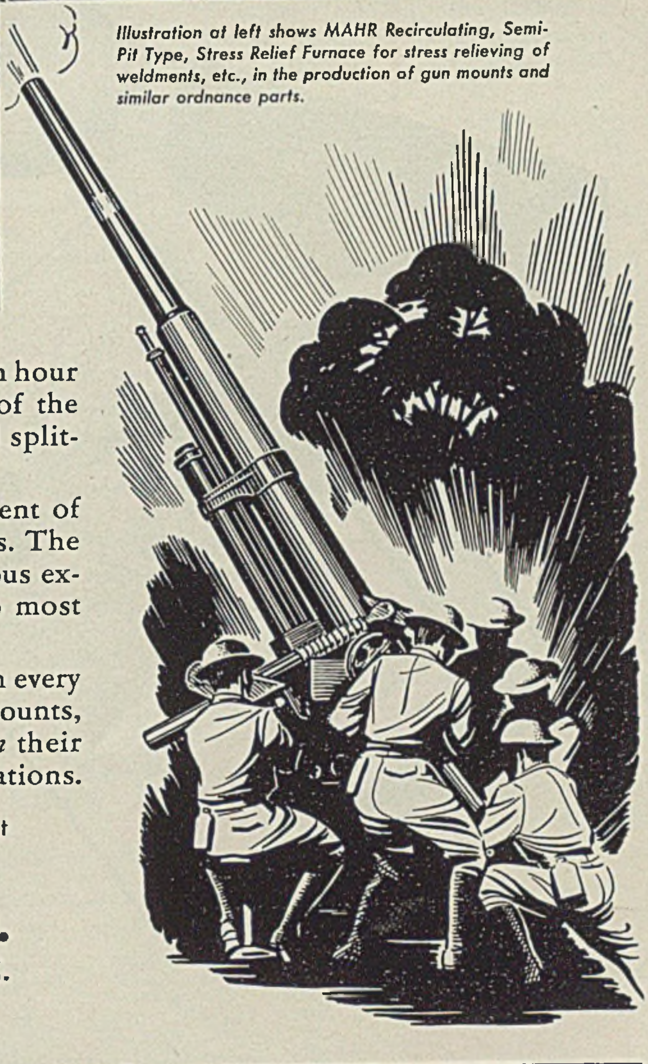


Illustration at left shows MAHR Recirculating, Semi-Pit Type, Stress Relief Furnace for stress relieving of weldments, etc., in the production of gun mounts and similar ordnance parts.



RAIDERS! Two or three miles up—flying 300 miles an hour or better! Knocking bomber or fighter planes out of the sky requires the utmost in precision manufacture and split-second aiming of the "ack-acks".

Obvious indeed is the need for accurate heat treatment of the exact type needed for gun barrels and gun mounts. The barrels must withstand the intense heat and tremendous explosive power of rapid firing. Mounts are subject to most violent strains and vibrations.

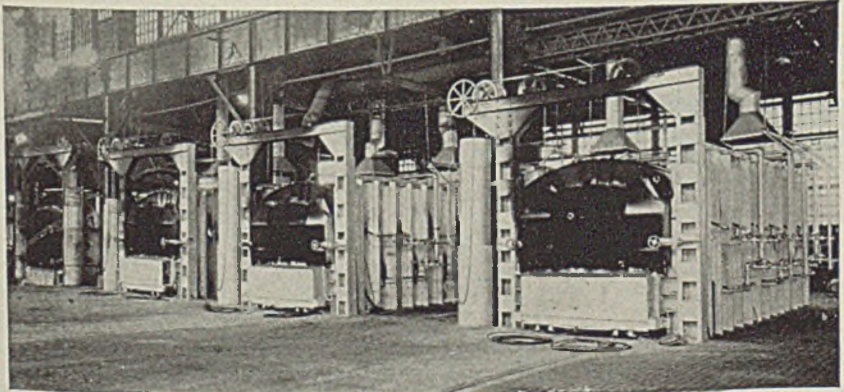
MAHR Furnaces are successfully "hitting the mark" with every type of heat treatment needed for gun barrels and mounts, planes, tanks, warships. MAHR Furnaces have *proven* their merit in thousands of wartime and peacetime applications.

A MAHR ENGINEER CAN HELP YOU on *any* heat treating problem . . . Write, wire or phone today.

MAHR MANUFACTURING CO.

DIV. DIAMOND IRON WORKS, INC.

GENERAL OFFICES—MINNEAPOLIS, MINN.
SALES OFFICES IN PRINCIPAL CITIES



A Battery of MAHR Car Type Furnaces, made in double and single end type for normalizing and annealing of gun barrels—90 mm. to 155 mm.

FOR EVERY HEAT TREATING NEED

	Furnace Types:	*Other MAHR Equipment:*
ANNEALING	CAR BOTTOM	RIVET FORGES
CARBURIZING	PIT	TORCHES
BAKING	PUSHER	BURNERS
HARDENING	ROLLER HEARTH	BLOWERS
FORGING	CONTINUOUS	VALVES
DRAWING	POT	SMITHING FORGES
STRESS RELIEF	ROTARY	

MAHR FURNACES

Throw your "SCRAP" into the fight—NOW!

For a Quick Answer
TO CRITICAL METAL PROBLEMS

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Learn How CMP Precision Light Gauge Strip Steel is Successfully Replacing More Critical Metal

Don't let shortages of light gauge copper, brass and other non-ferrous metals slow down your essential war production. Phone us immediately. Get the information and production data on CMP paper thin strip steel applications that release more critical metal.

By utilizing the wide range of physical properties available in CMP precision cold rolled strip it is possible that the vital service characteristics of your present material can be retained.

It won't take long to find out if we can assist you as we have others. And it might be the answer for product improvement plus better production. Your call today could help speed the Victory.

CMP STRIP STEEL
PRECISION COLD ROLLED

THE COLD METAL PRODUCTS CO.

SUBSIDIARY OF THE COLD METAL PROCESS CO., YOUNGSTOWN, O.

the broken bolts can be removed in about 1/20th the usual time by use of arc welding. The method ordinarily used by machinists involves the drilling of the stud with a small drill, following this with a larger drill to remove as much of the stud bolt as possible without touching the threads, and then breaking out the remaining thin shell with a small tool. The hole generally must be retapped, adding a fourth operation.

To use the new method, first lay a mat above the broken stud. The inside diameter of the nut should be slightly larger than the outside diameter of the stud bolt. Build the stud up with weld metal using the electric arc. Weld it to the nut.

The bolt then has a regular head and may be removed with an ordinary wrench. In some cases a frozen stud bolt will require that the area surrounding the bolt be heated to expand it and permit the bolt to be removed. The method permits removal of an average of 20 broken studs per hour, whether or not they are broken off on an angle.

Used for Many Jobs

In maintenance of coke ovens, the electric arc was applied to standpipes, suction mains, fuel mains, take-off tees, ells, valve bodies and collecting mains. Maintenance work with electric welding around the oven waste gas stacks included fabricating a ladder to the top of a 200-foot stack, welding the hood inside and out at the top of the stack, applying new rings over old ones at the top of the stack. Maintenance of the thionizer included welding patches on one side, welding the band around the top to keep water from running down the side, and fabricating stove pans.

In the producing plant, the electric arc welded manhole plates in water jackets. In repairing coal unloading hoppers, the electric arc welded loosened seams and put in patches. In coal and coke bin maintenance, patches and partitions were involved and new bins were built. Coal and coke conveyor or buckets were fabricated complete. Coke conveyor troughs were patched.

A locomotive crane frame boom was repaired in four hours at an estimated saving of $150 without dismantling. New side sheets were installed on clam shell buckets and the lips of the bucket were restored to their original size. Such miscellaneous equipment was fabricated using scrap steel in many instances. This work included stairways, ladders, gear guards and other items. The preceding list of jobs done by electric welding by no means exhausts the possibilities for economical use of the process. Maintenance men, who remember that electric welding can be used on almost any metal, find new uses for the process practically every day.

The gear case of a small locomotive was saved by electric welding—the bearings and bell being built up and hard faced with weld metal. The total cost of this work was approximately $15. To buy the parts new would have cost much more.

An interesting application of electric welding was on a casting which formerly had a bushing made of solid stainless steel. This bushing was quite expensive but is now made at much lower cost by using the electric arc to apply a layer of stainless steel over the carbon steel now used in the balance of the casting.

Piping: Here are the reasons why shielded arc welding does every piping job better for less money:

—Permits large total cost savings by reducing piping costs 20 per cent or more because of its simplicity and speed.

—Greatly lowers installation time because it does away with delays in detailing, fitting extra parts, applying supports, inserting gaskets, etc. Piping installation time can be cut as much as 50 per cent.

—Permits use of pipe of thinner wall sections because the full strength of pipe is developed throughout the joints, offsets, etc. This saves money in pipe tonnage.

—Permits use of smaller size because streamlining pipe joints reduces friction losses and increases the capacity of any given size of pipe. Pipe of smaller sizes can, therefore, sometimes be used without any sacrifice of carrying capacity. This permits savings in pipe costs.

—Excludes many fittings, which simplifies work and speeds installation all along the line in piping work.

—Eliminates patterns and castings because all types of piping fittings can be made from standard steel pipe and plate. Mufflers, elbows, ells, expansion joints, etc., can be made by shielded arc welding at a fraction of the cost of other methods.

—Minimizes resistance to flow since inner pipe surfaces are left smooth and changes in direction of flow are made gradually.

—Saves space since welding goes readily into tight corners to connect piping. No need to leave extra space for wrench clearances and other tools required by ordinary methods.

—Allows simpler, more flexible design by elimination of complicated connection detailing, etc., and allows greater flexibility in layout.

—Provides greater strength and rigidity because properly welded joints are stronger than the pipe itself. That's why welded piping systems can be forgotten.

—Assures permanently leakproof connections because the joint metal is denser, more corrosion resistant.

—Makes curving pipe easy since any shape can be fabricated by cutting pipe, fitting the pieces together and welding them into a unit.

—Applies supporting members readily for one structural part can be joined to another directly and without use of intermediate connecting pieces. Saves time, material and labor.

—Simplifies painting or insulation for the streamlined pipe connections are smooth for easy painting or application of insulation. Material can be applied in long lengths—no cutting and fitting around projections.

—Provides neat appearance by doing away with unsightly projections.

—Makes alterations easy for welding

(*Please turn to Page* 125)

TABLE I—Pipe Welding Procedure Data

Size of Pipe, Inches Dia.	Wall Thickness	Beads or Passes	Electrode, Diam., Inch	Current Amps.	Actual Welding Time, Min. Per Joint	Lbs. of Electrode Per Joint
2	0.154	1	5/32	120	5.5	0.35
		2		140		
3	0.216	1	5/32	120	7.0	0.44
		2		140		
4	0.237	1	5/32	120	9.0	0.64
		2	3/16	160		
		3	3/16			
5	0.258	1	5/32	120	11.3	0.81
		2	3/16	160		
		3	3/16			
6	0.280	1	5/32			
		2	3/16	120	13.5	0.96
		3	3/16	160		
8	0.322	1				
		2	3/16	150	17.8	1.33
		3		170		
10	0.365	1				
		2	3/16	150	22.0	1.65
		3		170		
		4				
12	0.375	1				
		2	3/16	150	26.5	2.0
		3		170		
		4				
14	0.375	1				
		2	3/16	150		
		3		170	31.3	2.3
		4				

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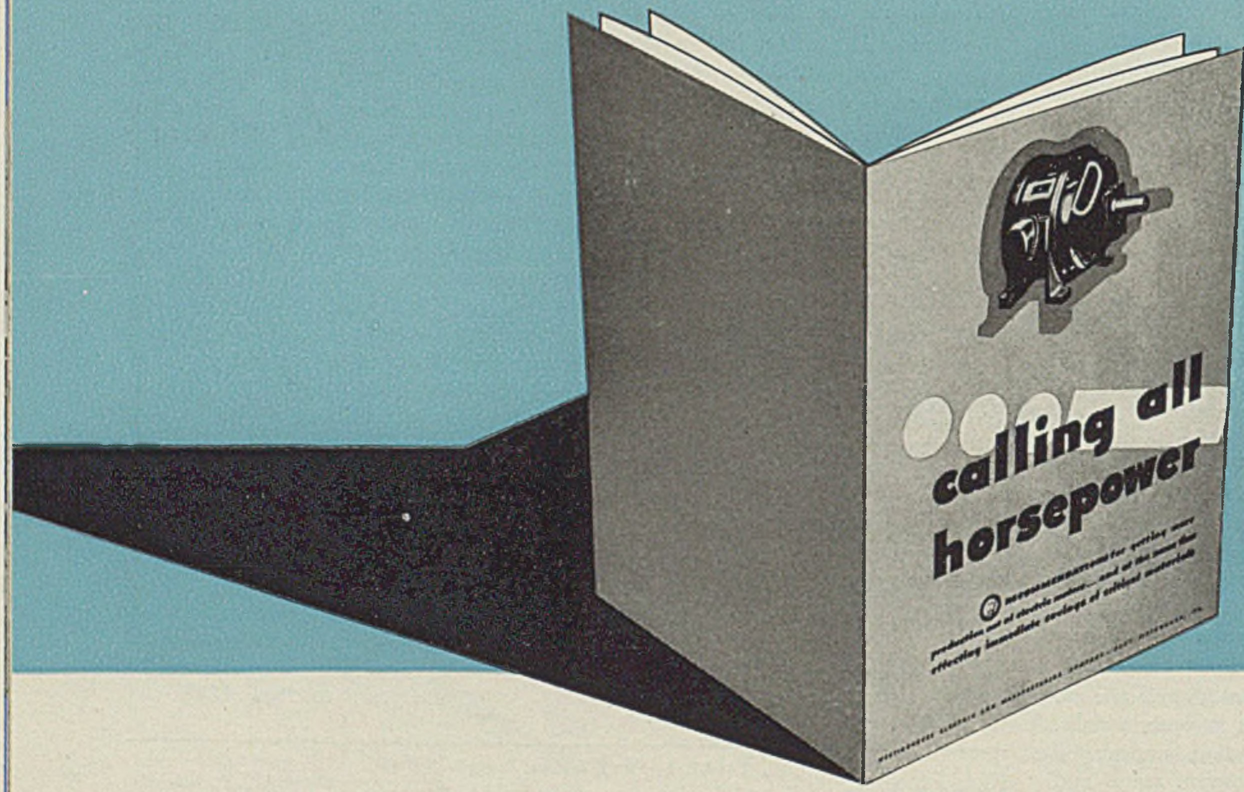

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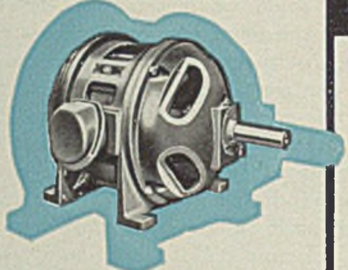

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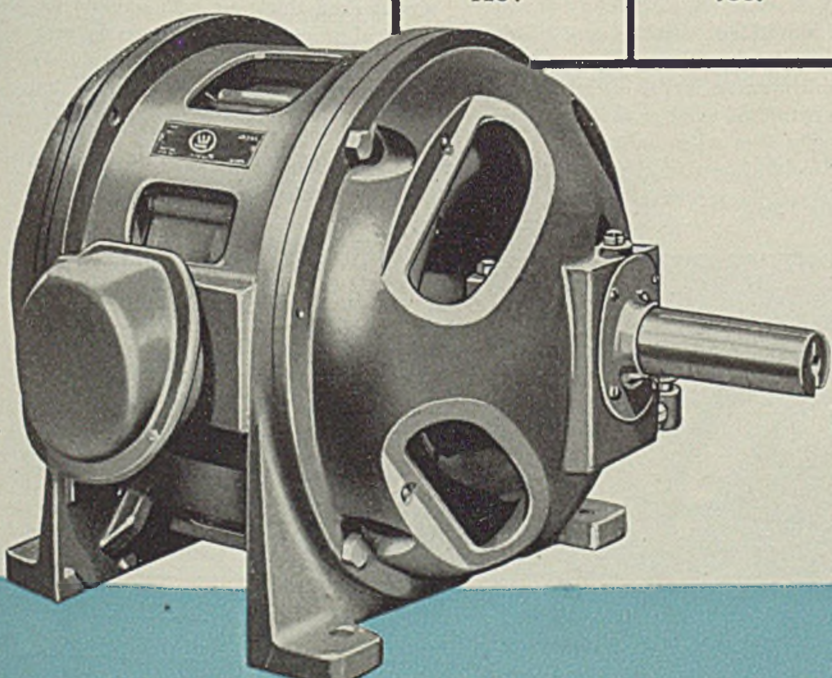
1.88	1.5	2.	14
3.75	3.	5.	19
6.25	5.	7.5	63
9.38	7.5	10.	80
25.0	20.	25.	106
37.5	30.	40.	186
62.5	50.	60.	320
125.	100.	125.	550



STANDARD WESTINGHOUSE MOTORS ARE GENERALLY AVAILABLE FOR PROMPT DELIVERY FOR WAR JOBS

Motors and Control

WESTINGHOUSE

How To Determine the Fabricating Qualities of

NICKEL ELECTRODEPOSITS

Nickel electrodeposits in war work are of sufficient importance in many cases to warrant control of the physical properties of the electrodeposit. These may correspond to those of the base metal or other desirable characteristics may be provided. The important thing is that nickel electrodeposits can be produced to have exactly the degree of ductility, hardness, fabricating and service properties desired to meet a particular set of war service requirements.

A satisfactory comparative means of routine checking the properties of nickel is presented. The method can also be used to determine the physical properties of other electrodeposited metals

By F. P. ROMANOFF*
Apollo Metal Works
Chicago

THE USE of prefinished metals has progressed to the point where it is desirable and necessary to produce a more uniform product applicable to parts requiring specification thicknesses with fabrication qualities. These deposits should permit considerable deformation without appreciable loss in protective properties.

To determine the qualities of nickel deposits required for good fabrication performance of "prefinished" nickel-coated sheet steel and copper, electrodeposits were prepared in several commercial baths and in controlled laboratory solutions. All specimens were prepared under conditions found necessary for optimum ductility wherever practical.

Deposits on sheet steel and copper were measured for thickness magnetically, microscopically or chemically. Stress-strain diagrams were made using values obtained on the Olsen Tour-Marshall design of stiffness machine. The nickel deposits tested on the latter instrument were 0.010 to 0.020-inch thick. Cup tests were made on an Ericksen machine. Some cups were then examined microscopically to determine the minimum thickness of the deposit at which fracture takes place. Some specimens of bright nickel were also examined.

Previous work (*Transactions of the Electrochemical Society* 64, 251-266, 1934; and *Proceedings of the American Electroplaters' Society*, 1934) resulted in the development of a qualitative test for ductility and the properties could be determined to a limited degree. This was a modified Ericksen test, consisting of pressing a 1-inch ball into the nickel-coated metal to a depth of 0.225-inch so that the deposit on the surface of the metal would be stretched, using deposits 0.0002-inch thick on sheet copper or steel.

If the base metal used were copper, visual inspection would determine the type of deposit. A satisfactory ductile deposit would not disclose any of the red copper color through the nickel. Hard and average nickel electrodeposits always permitted copper to be exposed and readily seen when subjected to this test. The thickness of the base copper also affected the results, which had to be interpreted accordingly.

It was found that nickel deposits, ductile according to this test, could be increased in thickness up to 0.016-inch (the maximum applied on these tests) without showing fracture under deeper cup tests. In the case of this type of deposit, cups drawn to the fracturing point of the base metal failed to disclose copper when the deposit was 0.0003-inch or more and did not cause any significant decrease in the drawing qualities of the base.

The qualitative test on 0.0002-inch deposits on a copper base 0.024-inch thick showed that an original area of 0.785-inch could be increased to 0.98-inch, approximately 25 per cent, without showing any fracture of the nickel. The area of the cups is not increased uniformly, as the part near the dome is increased in area to a much greater extent than that near the base. So the actual elongation of the strained nickel was greater.

Reports on the mechanical properties of electroplated nickel have shown elongation values up to 28 per cent in 2 inches and up to 37 per cent in 1 inch (W. A. Wesley, *Proceedings of the American Electroplaters' Society*, 1938, p. 63, and Gardam and Macnaughton. *Transactions Frad. Society* 1933, p. 29, 753).

It was possible to produce deposits of any desired thickness with uniform mechanical properties, but this was not practical under the prevailing conditions. In an effort to develop a practical test

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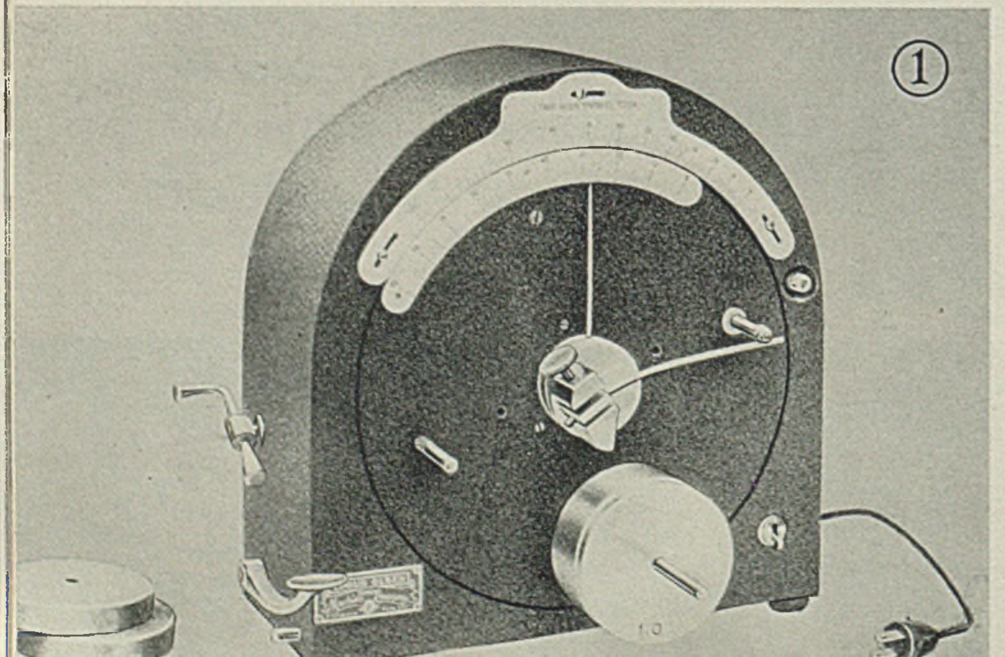
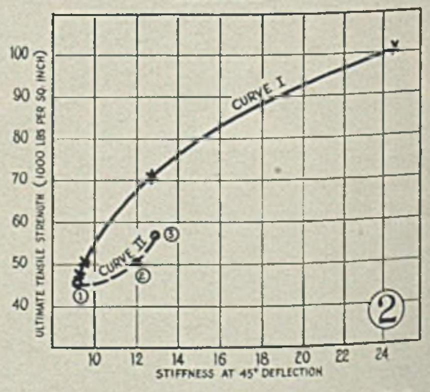


Fig. 1—Olsen-built Tour-Marshall design stiffness tester utilized here

Fig. 2—Stiffness versus tensile strength. Stiffness values at 45 degrees deflection of low carbon steels. Curve I from average of several different tempers, all steel from same mill. Curve II represents No. 4 temper steels from three different mills. Fig. 3 shows stiffness curves for these materials



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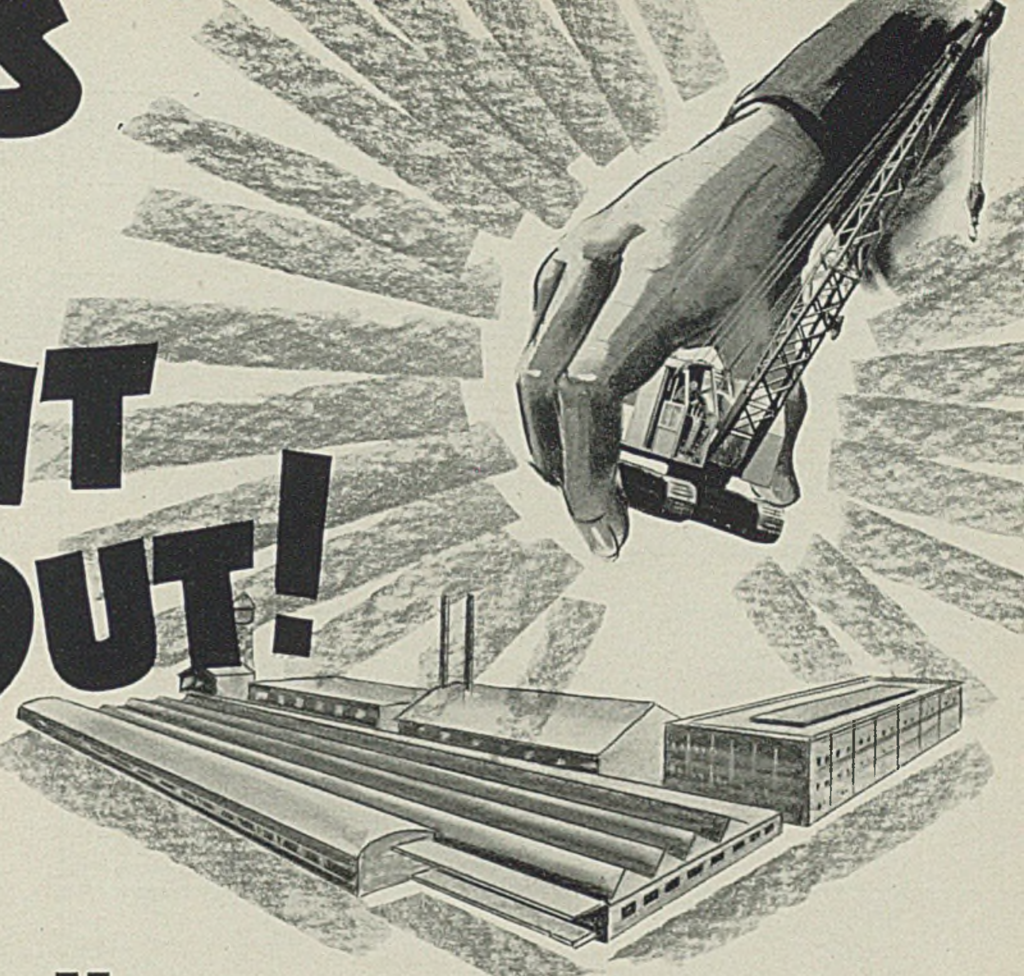

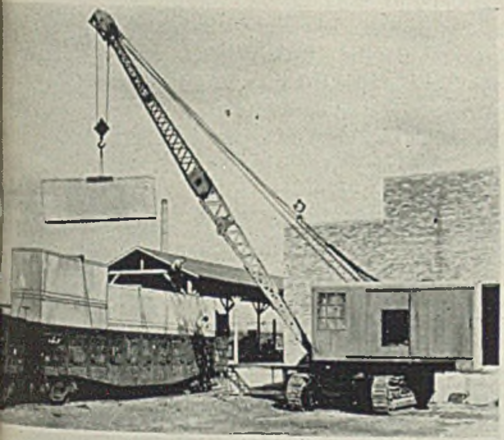

Above: Handling boxed goods

Left: Loading castings

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Right: Unloading pipe

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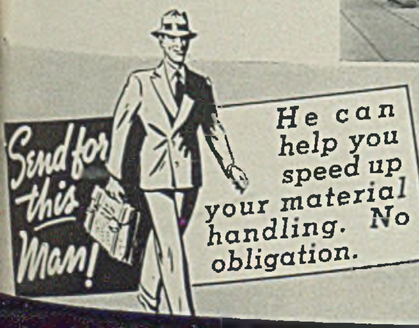

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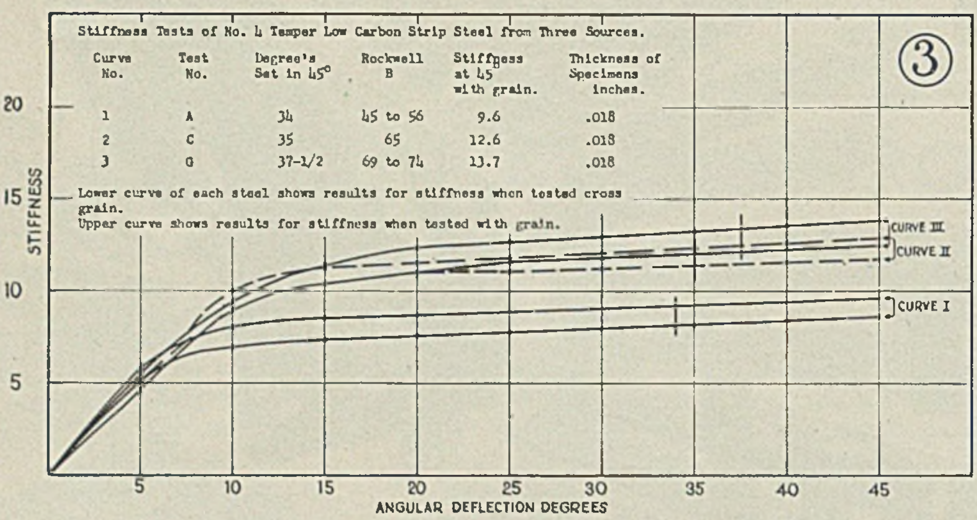

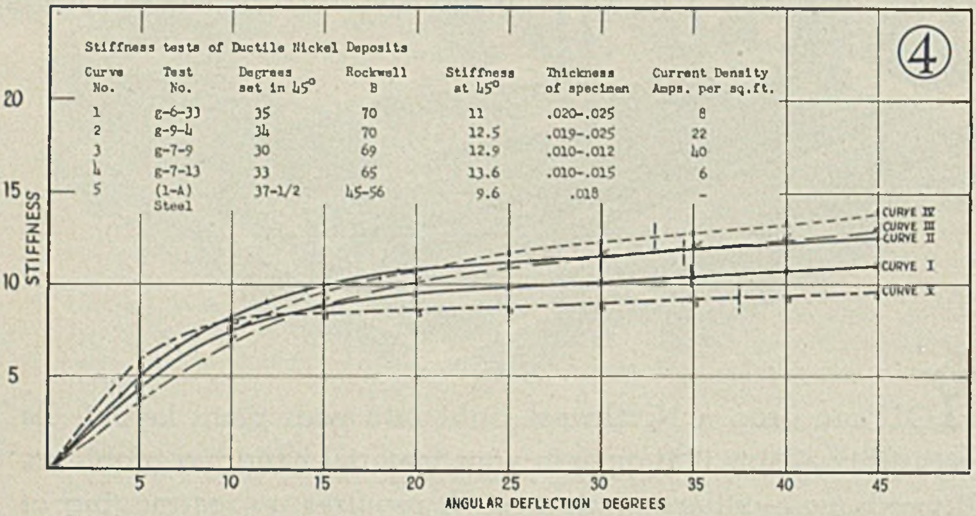

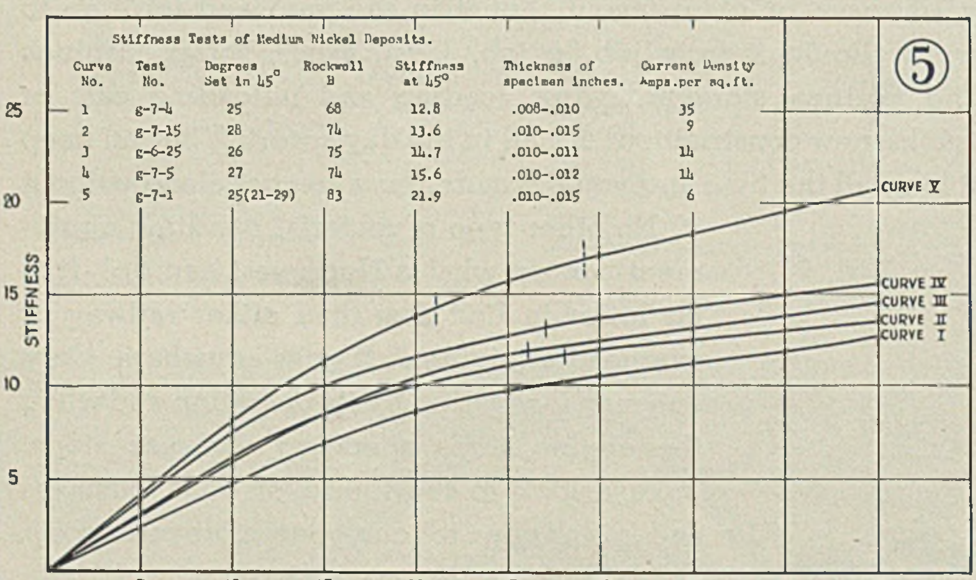

Fig. 3—Curves of No. 4 temper steel from three sources. Although hardness values vary considerably, the stiffness values check closely. Note difference with direction of grain

Fig. 4—Stiffness tests of ductile nickel. Set angles lie between 30 and 35 degrees; hardness from 65 to 70 rockwell B. Stiffness values at 45 degrees lie between 11 and 14. Each curve represents a different bath. Four or more tests were made on several specimens for each curve

Fig. 5—Medium nickel stiffness curves. Curve 5 is also shown in Fig. 6

for routine determination of the physical properties of these deposits, a standardized procedure was evolved requiring deposition of nickel between the limits of about 0.010 and 0.020-inch in thickness. These thicknesses can be deposited in 5 to 10 hours from most baths as the current density did not seem to have much effect on the physical properties. The deposits in this thickness range could easily be obtained with the same mechanical properties at both the start and finish of a run.

In order to determine the physical properties of these thin deposits, the usual tensile testing equipment for thin metals was found impractical because of the difficulty in preventing fracture in the jaws of the specimen holders, as well as machining difficulties. A large number of specimens are required because of breakage and the tests could not be made routine on account of the time required.

All deposits were therefore tested for hardness on the rockwell superficial machine and on the Olsen stiffness tester of the Tour-Marshall design for development of stress-strain curves and an indication of ductility. The superficial rockwell values were converted to rockwell B values for convenience, using Wilson Chart 38.

The stiffness tester operates on the cantilever-bend principle and is shown in Fig. 1. A cantilever bending of the specimen is obtained by rotating the vise in a counter-clockwise direction by a motor, pressing the free end of the specimen against the underside of a roller pin which projects from the dial face. This dial is part of a pendulum, which is free to swing on ball bearings concentric with the rotating vise. Different capacity ranges are obtained by placing different weights on the pendulum pin.

A deflection scale from 0 to 90 degrees is engraved on the dial face. The deflection pointer moves with the vise. The load is indicated on the upper scale and is proportional to the angle through which the pendulum has been deflected from the horizontal. The weight and pendulum length are chosen according to the gage and material. The range of the deflection indicator is chosen according to the material and convenience or desired information. In these tests, a range of 45 degrees for deflection was used and the observed load scale readings were taken every 5 degrees or less of deflection. The data obtained from this stiffness tester is plotted with the angle of bend versus the bending load resulting in a curve which resembles the stress-strain diagram. The load varies approximately with the cube of the thickness (H. L. McBride, *American Society for Testing Materials*, Vol. 37, part 11,

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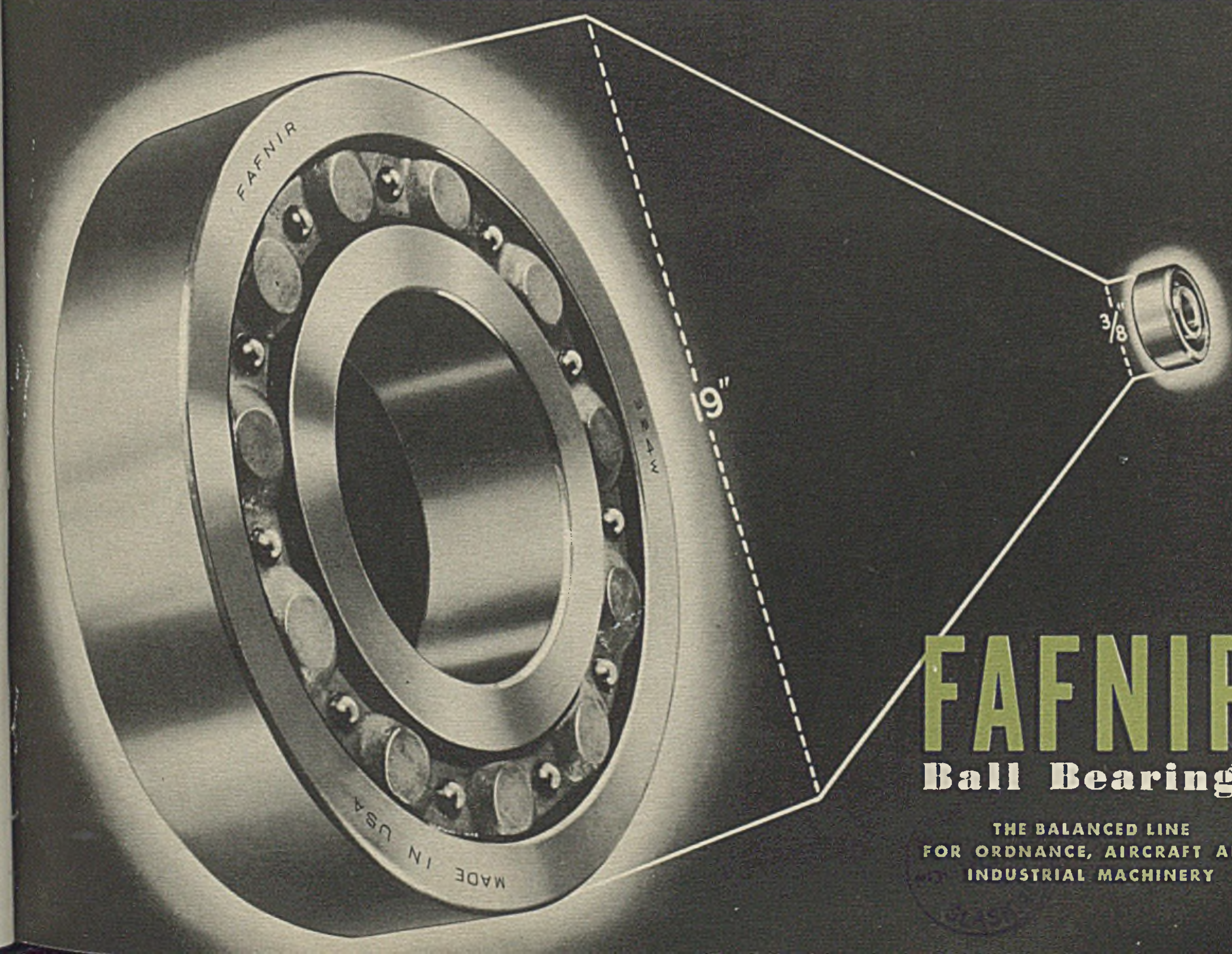

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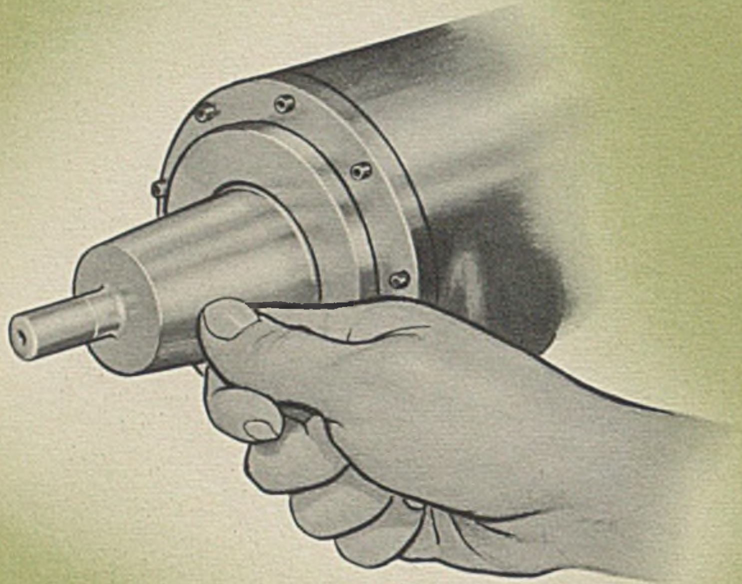

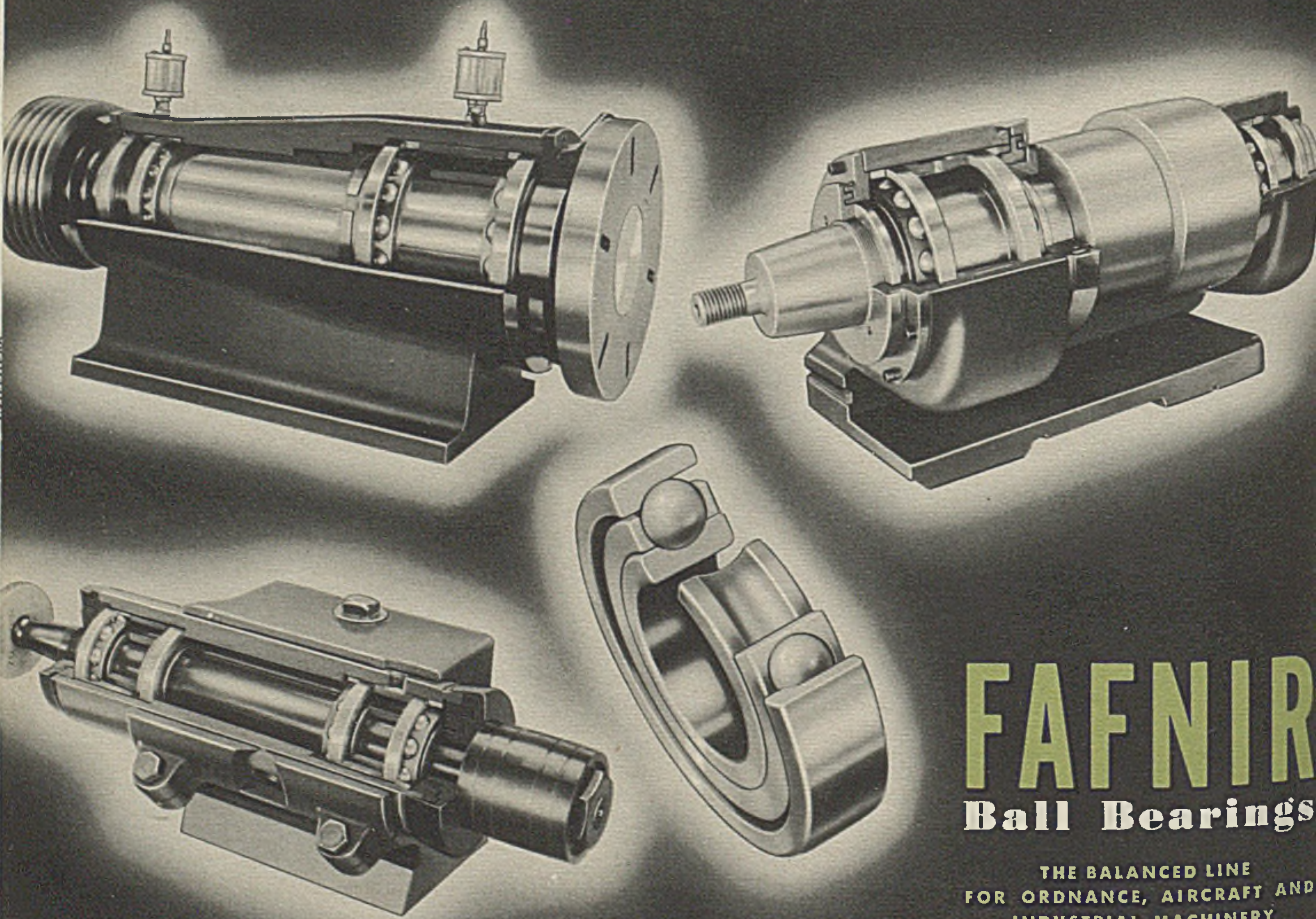

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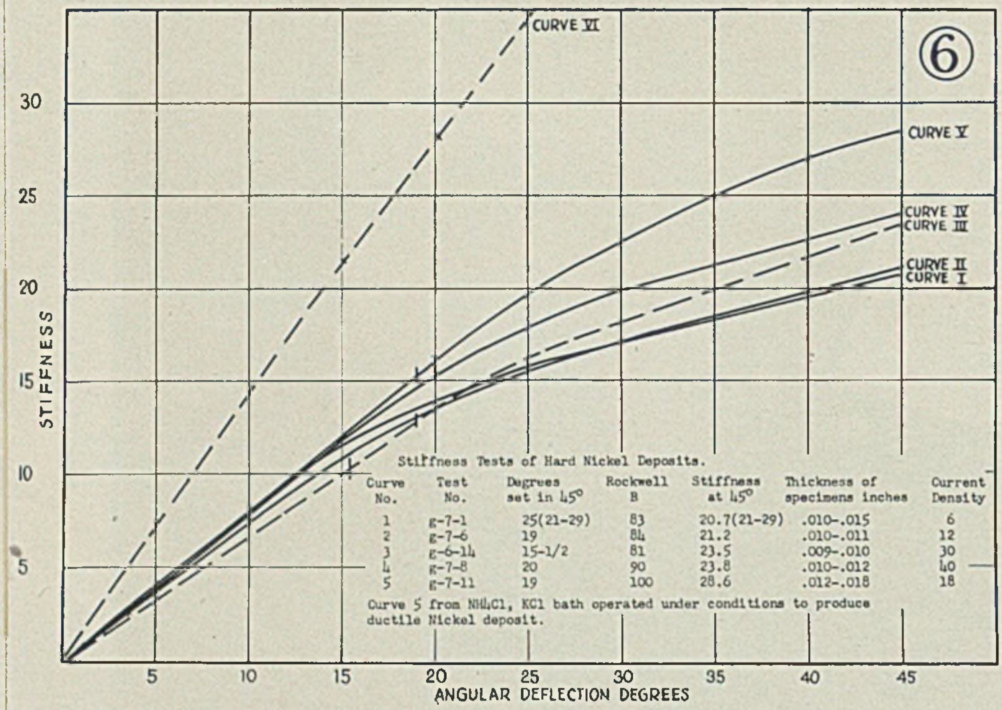


Fig. 6—Hard nickel stiffness curves. Curve 6 represents a bright nickel deposit. There was no set angle; hardness was 58 *rockwell C; stiffness at* 45 *degrees was* 56.9*; deposit thickness was* 0.016 *to* 0.017*-inch*

p. 146 et al., 1937).

As check tests were made on specimens which varied in thickness as much as 50 per cent, computations for thickness correction provided values which gave almost identical points on the curves for duplicates of any given material. Exact checks can be obtained by observing certain refinements of the tests, such as notching the specimen. The shape of the curve as it passed the electric limit is characteristic of the internal structure of the material since nickel deposited under controlled conditions from the same type of bath always gave similar yield curvature regardless of difference in thickness or width.

The angle made by the straight portion of the curves with the horizontal is an indication of the modulus of elasticity as determined in tension has been developed from this angle. Although certain types of material can be bent to fracture, exact tensile strength valuations have not been computed from results obtained on this instrument. After completion of the 45-degree bend, the motor lever is released and the vise backed up using the hand crank. When the load indication becomes zero, as indicated by a contact light, the "set angle" resulting from the bend is indicated by the deflection pointer. Data have been presented by MacBride (see above reference) indicating some correlation between the set angle and the elongation. It has been found in the tests on nickel deposits that a definite correlation exists between the ductility as noted by the cup test and this "set angle" or "spring back", as well as the stiffness values obtained at 45 degrees. The values derived from the stiffness machine are referred to as stiffness numbers or values. These are stress values and are obtained by conversion to standard thickness using an exponential value of the load somewhat less than the cube.

Stress-strain curves were made on several strip steels within the temper range predominantly utilized for the production of prefinished metals and the set angle or ductility index noted. This was done in order to note whether a similarity did exist between the nickel deposit and the base. Fig. 3 shows these curves for No. 4 temper steel from three sources of supply. These curves illustrate the values obtained by applying the stress in a direction with and across the direction of rolling.

Four or more specimens of each type were run. In every case the agreement of results was very close, the consistency of the test being indicated by actual plotting points on some curves. This grade of steel in general had a yield point at stiffness values between 5 and 10. The maximum stiffness at the 45-degree angular deflection varied from 8 to 14.

The set angle on all grades was between 34 and 38 degrees. The set angle remained the same in stiffness tests with and against the grain for all specimens tested for any one steel.

Comparative tests were made with the same steel on an Olsen universal tensile machine and curves prepared with corrections for thickness and width variations (Fig. 2). Although results corresponded roughly, no exact numerical relationship was determined. Both tests showed steel No. 1 to be of lower tensile strength than steel No. 2, and steel No. 2 lower than steel No. 3. The stress strain curves show the stiffness values at 45 degrees to be in the same order. Rockwell B values of these materials were 45 to 56 for steel No. 1, 65 for steel No. 2 and 68 to 72 for steel No. 3. These values indicate the nonuniformity of indentation hardness tests of the commercial material, specimens of which, for each steel, were taken from the same sheet within a few inches of each other. This nonuniformity is not unusual in the strip product from rimmed steel when variations are encountered.

In general these hardness values seem to coincide with the stiffness as shown in the curves. The ductility as indicated by the set angle, a vertical line on the stiffness curves, does not show a numerical relation to the rockwell values or to actual elongation values obtained on the universal Olsen testing machine.

However, there is some relationship, and actual performance in fabricating prefinished metal with these materials shows that these base metals are interchangeable for most jobs involving mild drawing, stampings, etc. Stiffness values obtained on these metals, when arranged in increasing values, correspond to a similar arrangement of these materials according to tensile-strength values.

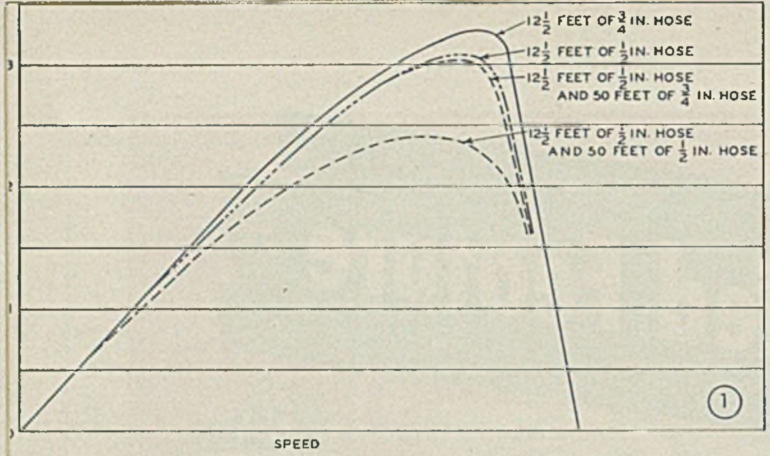
The two curves in Fig. 2 illustrate the relation between the tensile strength versus stiffness for strip steel. These curves were found useful for comparing approximate relationships of stiffness numbers and tensile strength. Since steel itself varies somewhat, the curves are only for illustrating that some relationship does exist. These curves were used to obtain comparisons of nickel deposits and do correspond to a degree with the values obtained for tensile strength by other investigators.

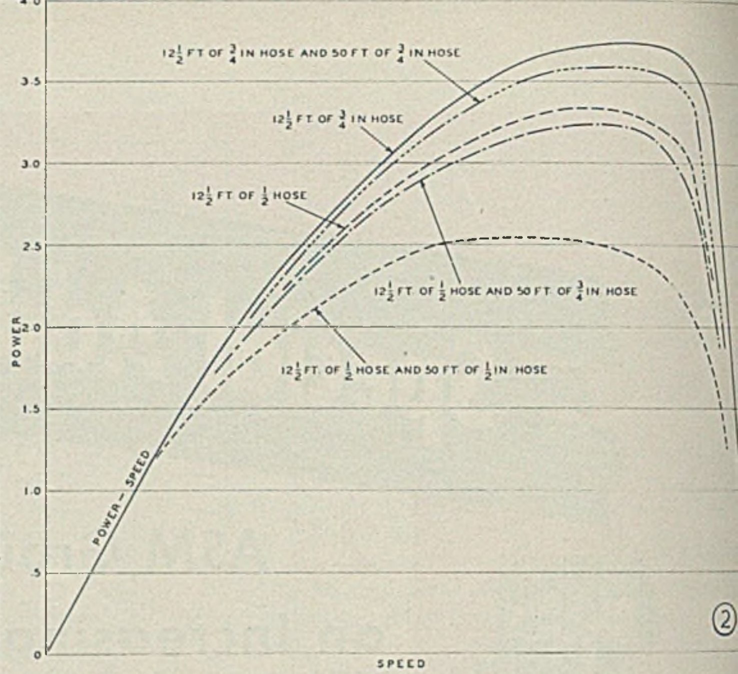
(*Please turn to Page* 116)

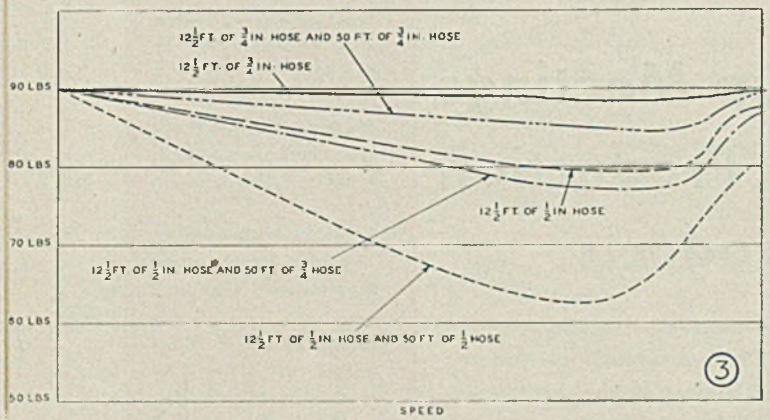
TABLE I—Test Results and Conversions

Type of Nickel	Rockwell B	Set Angle, Degrees	Stiffness at 45 Degrees Deflection	Corresponding Conversion Value Tensile Strength lb. per sq. in.	Brinell*
Ductile	65-70	30-35	11-13.5	50,000- 72,000	115-125
Medium	68-75	25-28	13.0-15.5	60,000- 80.000	121-137
Hard (ordinary)	81-90	15-20	21-24	95,000-102,000	153-185
Hard	100	19	28.5	110.000	240

*From Wilson Mechanical Instrument Co. Chart No. 38.







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Clean, dry air at suitable pressure is a prerequisite for smooth operation and long life. For best results the average tool requires about 90 pounds pressure at the inlet. Few users realize to what extent pressure drops as the rate of air flow increases. They are careful about maintaining pressure at the compressor, and frequently check the hose inlet, but rarely do they devote sufficient thought to the pressure at the tool itself. The error of this is evident. The pressure at the tool determines the power the tool will develop.

If certain fundamentals are neglected, if simple precautions are not taken, substantial power losses will occur between compressor and tools. A large share of these losses is apt to result from the use of improper hose and fittings, but they can be virtually eliminated at small expense by changing hose hookups. Hose, couplings, nipples, and members that are not suitable restrict the air flow and reduce the working pressure at the tool.

Hose Setup: To emphasize this, the effect of various hose arrangements on the performance of a heavy-duty grinder is graphically illustrated in Fig. 1. Obviously, for best performance, a ¾-inch hose should be utilized with a tool of this size—one consuming 55 to 65 cubic feet per minute at 90 pounds pressure. The curves also indicate that a 12½-foot whip of ½-inch hose may be employed in conjunction with a longer ¾-inch hose without serious loss of power.

On many jobs long lengths of ½-inch hose are commonly in service, but the loss of power (25 per cent and more) is a high price to pay for any minor advantages gained by the use of the smaller hose. From the operator's standpoint, flexibility has in the past constituted an advantage in the case of the latter, but with the introduction of highly flexible ½ and ¾-inch diameter hose, that advantage can no longer be claimed for it.

Similar performance curves of a Multi-Vane drill with various hose arrangements are shown in Fig. 2. Corresponding curves indicating the pressure at the throttle have been plotted in Fig. 3 and illustrate not only the actual drop from the 100-pound pressure maintained in the line but to what extent rate of air flow affects pressure drop. While a 12½-foot length of ½-inch may be used with a tool consuming 75 to 85 cubic feet per minute, there will be a power loss of about 10 per cent, compared with a similar length of ¾-inch hose. Loss of pressure always means less work done by the tool.

In Table I are data for determining the hose arrangement best suited for any air-operated tool. In making a selection, the hookup should be based on the air consumption of the tool when operating under full load—maximum horsepower. The figure will be found in the first column. On the same horizontal line are the various pressure drops for different hose combinations. By choosing the acceptable drop for the tool in question it is possible to determine quickly the length and diameter of hose required.

In many layouts, much of the pressure drop is attributable to hose couplings, nipples, and menders. As the hole through these fittings is of necessity smaller than that in the hose, it is important to use fittings having the largest practicable inside diameter. Certain shops commonly standardize on ½-inch hose and equip all hose whips with ½-inch hose to ¼-inch pipe nipples. Tools having air-inlet pipe taps larger than ¼-inch must then be provided with reducing bushings if they are to be used with the existing

TABLE I—Pressure Drop, Pounds per Square Inch
Based on 100 Pounds per Square Inch Line Pressure

Air Flow Cubic Feet Per Minute	12½' of ¼" Hose	50' of ¾" Hose + 10' of ¼" Hose	8' of 5/16" Hose	10' of ⅜" Hose	12½' of ½" Hose	25' of ½" Hose	50' of ½" Hose	12½' of ¾" Hose	25' of ¾" Hose	50' of ⅜" Hose	50' of ½" Hose + 10' of ¼" Hose	50' of ½" Hose + 10' of ⅜" Hose	50' of ½" Hose + 8' of 5/16" Hose	50' of ⅝" Hose + 12½' of ½" Hose	50' of ¾" Hose + 25' of ½" Hose
10 to 11	5.0	0.9	...	...	...	...	...	...	...	5.3	0.7	1.4	...	...	...
11 to 12	5.9	1.0	...	...	...	...	...	...	...	6.2	0.8	1.6	...	...	...
12 to 13	6.8	1.2	0.4	...	...	...	...	...	...	7.2	0.9	1.9	...	...	...
13 to 14	8.0	1.4	0.5	...	...	...	...	...	...	8.4	1.1	2.2	...	...	...
14 to 15	9.3	1.6	0.6	...	...	...	...	...	...	9.8	1.3	2.5	...	...	...
15 to 16	**11.0**	1.9	0.7	...	...	...	...	...	...	**11.6**	1.5	2.9	...	...	...
16 to 18	**14.0**	2.4	0.8	...	...	...	...	...	...	**15.0**	1.9	3.5	1.7	...	...
18 to 20	**19.6**	3.0	1.0	...	...	...	...	...	...	**21.4**	2.4	4.5	2.0	...	...
20 to 25	...	4.3	1.4	0.7	1.0	1.3	...	...	...	...	3.5	6.4	2.6	1.3	...
25 to 30	...	6.6	2.1	1.0	1.5	2.3	...	...	...	...	5.2	9.8	3.8	1.9	...
30 to 35	...	9.5	3.1	1.3	2.1	3.6	...	...	...	...	7.3	**13.7**	5.3	2.6	...
35 to 40	...	**12.8**	4.2	1.7	2.8	5.2	...	...	...	...	9.6	**18.4**	7.1	3.5	...
40 to 50	...	**19.3**	6.3	2.4	4.1	8.0	...	...	...	...	**14.0**	...	**10.4**	5.2	1.8
50 to 60	...	...	9.6	3.7	6.3	**12.2**	...	...	...	...	**21.8**	...	**16.0**	7.8	2.3
60 to 70	...	...	**13.5**	5.3	9.0	**17.4**	0.9	1.4	1.9	...	...	...	**22.8**	**11.1**	3.0
70 to 80	...	...	**18.7**	7.1	**12.4**	...	1.1	1.7	2.5	...	...	...	...	**15.0**	3.7
80 to 90	...	...	**25.0**	9.0	**16.1**	...	1.4	2.2	3.2	...	...	...	...	**19.8**	4.6
90 to 100	...	...	...	**11.1**	...	...	1.7	2.7	4.0	...	...	...	...	...	5.8
100 to 120	...	...	...	...	...	...	2.3	3.5	5.6	...	...	...	...	...	7.9
120 to 140	...	...	...	...	...	...	3.2	4.8	8.0	...	...	...	...	...	**11.2**
140 to 160	...	...	...	...	...	...	4.3	6.6	**11.0**	...	...	...	...	...	**15.5**
160 to 180	...	...	...	...	...	...	5.6	8.7	**15.2**	...	...	...	...	...	**20.4**
180 to 200	...	...	...	...	...	...	7.2	**11.0**	...	...	...	...	...	...	...
200 to 220	...	...	...	...	...	...	9.0	...	...	...	...	...	...	...	...

Recommended Hose Arrangements for Air-Operated Tools: Under the heading "Air Flow Cubic Feet Per Minute", find the rate of flow comparable to the air consumption, at maximum horsepower, of the tool being used. Select the acceptable pressure drop for that tool to determine a suitable hose arrangement using a value from those given in lightface type above. Hose arrangements indicated by boldface type will lead to an excessively high pressure drop, with a proportionate reduction in power for the tool. All computations are based on the use of Ingersoll-Rand Type A couplings.

TABLE II—Comparison of Air-Passage Areas of Typical Hose Nipples

Tools	Nipple Size	Hole Diameter, Inches	Air Passage Area Square Inches
Hammers	½-in. hose to ¼-in. pipe	17/64	0.055
Rotary*	½-in. hose to ¼-in. pipe	11/32	0.093
Rotary*	½-in. hose to ⅜-in. pipe	13/32	0.130

*Drills, grinders, impact wrenches, etc.

hookup. The error of this practice is evident.

Table II gives a comparison of the air-passage areas of typical hose nipples for hammers, drills, grinders, etc. Examination of it will reveal that chipping hammers and similar percussion tools use less air than do rotary tools. For that reason a ½-inch hose to ¼-inch pipe nipple designed for chipping hammers has a smaller hole than that supplied for drills, grinders, etc. It will also be observed that the substitution of the ½-inch hose to ⅜-inch pipe nipple for the respective ½-inch hose to ¼-inch nipple will, in the case of hammers, give an air passage with more than twice the area and in the case of rotary driven tools approximately 40 per cent greater.

Air mains and lines should be large enough to avoid excessive pressure loss under conditions of maximum flow. In air lines, as in aftercoolers, water is precipitated as the air cools. For this reason pipe lines should be provided with means for drawing off or trapping the water before it reaches the hose outlets. It is advisable to pitch the mains in the direction of flow so that both flow and gravity will carry it to traps or water legs placed at frequent intervals. These should be emptied regularly and should never be allowed to become full—inoperative. Automatic traps make it possible to dispense with manual draining.

Down-pipes or hose should never take off directly from the bottom of air mains. Connections should be made at the top of the main, and a long-radius return bend should be used. Adherence to this rule will help to prevent water from reaching the tools. Leaders, valves, and hose connections should be large enough to permit passage of the maximum amount of air for efficient operation of the tool or tools on the line. This is particularly important if the system is provided with manifolds each serving several hose lines.

Leaks, however small and of little consequence individually, are important for their cumulative effect is loss of pressure and a proportionate reduction in power. Before the war, many plants using compressed air made a practice of testing for leaks at regular intervals. This was usually done on a Saturday afternoon or Sunday. Today, with most industries working full time, week-end shutdowns are not always possible. As a result, maintenance of the compressed-air systems is more vital than ever, and air mains, hose, coupling, etc., should receive daily attention. If this is done, leakage can be kept at a minimum.

Frequently when more air-operated tools are added to a system no thought is given to the increased demand on the compressors themselves. If the capacity of the existing plant is too small to handle it, then one or more units should be installed. A constant-speed compressor can deliver only a given volume of air per minute at a prescribed pressure, and if this volume is less than the combined requirements of the tools, the line pressure necessarily drops.

The compressor intake should be placed where it will obtain the coolest, driest, and cleanest air available, and, where practicable, the air should be taken from outdoors on the north side of the building. Ducts should be of ample size and as short and direct as possible. Steam pipes, escaping steam, and wet or dusty locations should be avoided. Putting the intake near the roof, floor, or on the ground is not recommended, and adequate screening and intake filters should be provided.

The percentage of moisture carried by compressed air varies with the temperature and is a matter that requires careful attention because the humidity in most parts of the world is relatively high. As the temperature drops after compression, water is precipitated. To eliminate as much of it as possible, compressors should be equipped with intercoolers, aftercoolers and receivers of ample size. These should be kept drained and in good working order.

For installations where the piping system does not supply clean, dry air, the use of separators and filters at hose-connection points is recommended. A good separator kept properly drained will remove nearly all the entrained water; but a poor one is practically worthless. Most separators do not have adequate water-storage capacity and, unless provided with an auxiliary receiver or automatic trap, soon cease to function. Air filters remove pipe scale, rust and any other foreign matter that might impair the tool. Many tools have air strainers, and these must be kept clean and free from obstructions to prevent air restriction. There should be a strainer or filter at each hose outlet, particularly where pipe lines are old or are used intermittently.

Because of their weight and the space required, built-in lubricators are not always included in pneumatic tools. In addition, gear chambers, hammer cases, bearings, etc., should receive proper quantities of recommended greases.

From *Compressed Air Magazine*.

Converts Strip Mill

(*Concluded from Page 73*)

record monthly output at that time of approximately 11,972 tons a month, Republic began installing equipment in its strip mill which would permit the utilization of this efficient giant mechanism for plate production. The additional facilities required were installed in record time and the output of plate began to climb immediately.

Month by month, records were broken until today Republic's plate output is nearly 500 per cent. greater than it was 18 months ago. As the steel plate tonnage increased, it of course became necessary to decrease the output of the sheet and strip for which the mill was originally intended.

Equipping the mill to turn out 5/16-inch and ½-inch plate in vastly increased quantities centered around two important steps: First, the installation of sufficient additional conveyor table facilities to transfer the plate to the shears. Second, the installation of an effective hot leveling unit for the initial flattening of the plate immediately it left the hot mill line. This unit has been installed at the end of the hot mill line just ahead of the hot mill transfer table, and can be moved into position for leveling or out of position for coiling strip in five minutes.

Hot mill equipment, except for the addition of the new leveler, has not been changed in any respect. Commencing with the furnaces where the steel is heated to a white-hot rolling temperature, the slabs are sent through the four roughing and six finishing stands, in much the same fashion they would be if destined to be made into strip instead of plate.

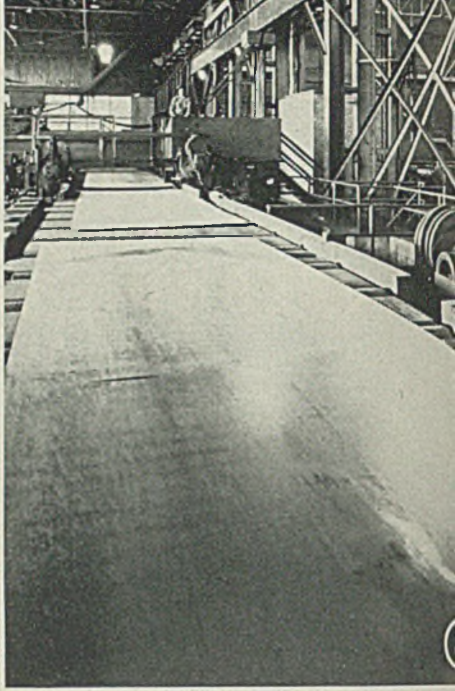


Fig. 8—Heavier plate is handled on this new ½-inch line which is housed in the new bay added to the main mill building. Overhead cranes have reduced human exertion to a minimum, at the same time providing additional safety for operators

The length of slab from which material over 48 inches wide is rolled is limited to 8 feet, as this is the longest slab which can be broadsided. To roll any material over 48 inches wide, up to and including 90 inches, the 48-inch slab must be given a broadside pass for width. Any plates under 48 inches wide can be made from slabs up to and including 192 inches long. The final dimensions of plate which can be produced are 53 feet x 90 inches wide. In shipbuilding, particularly, wide plates help speed construction because they present fewer seams or laps to be riveted or welded.

Where Plate Handling Begins

The change in handling procedure for plate as compared to strip really commences as the hot steel emerges from the last finishing stand. Strip at this point is passed through a spray of water on a long runout table and then wound into coils or cut into sheets by a flying shear located just beyond the last finishing stand. Plate, on the other hand, is sent on through the new hot roller leveler and on the hot bed transfer, where it is checked for gage and then moved into the new plate mill processing line.

In enlarging the existing plate production facilities, several pieces of equipment, including a roller leveler, side-trimming, shear, up-cut shear, side piler and gage, which had been part of the original ½-inch plate mill line, were relocated to better advantage in a new ½-inch plate mill line housed in a new bay added to the main mill building.

A second line, parallel to the relocated ½-inch line, handles lighter plate up to ½-inch.

Two adjoining transfer tables, capable of handling plate up to 53 feet long, were installed to receive plate from the hot mill transfer table over a long filler table equipped with up-cut shear and side piler as well as a pinch roll.

The pinch roll has been installed at the entry to the first section of the new transfer tables to control the feeding of the steel. A cascade arrangement has been successfully worked out which permits the accumulation by pusher cranes of a number of plates at the entry to each of the two plate lines. Lighter plate is taken off at the first cascade and heavier plate at the second.

In designing the plate processing lines mechanical handling has been provided wherever possible. Both lines are equipped with magnetic depilers, skew tables and roller conveyor sections. Overhead cranes, serving all sections of the department, have reduced human exertion in the handling of the plate to a minimum, while at the same time providing additional safety for the operators.

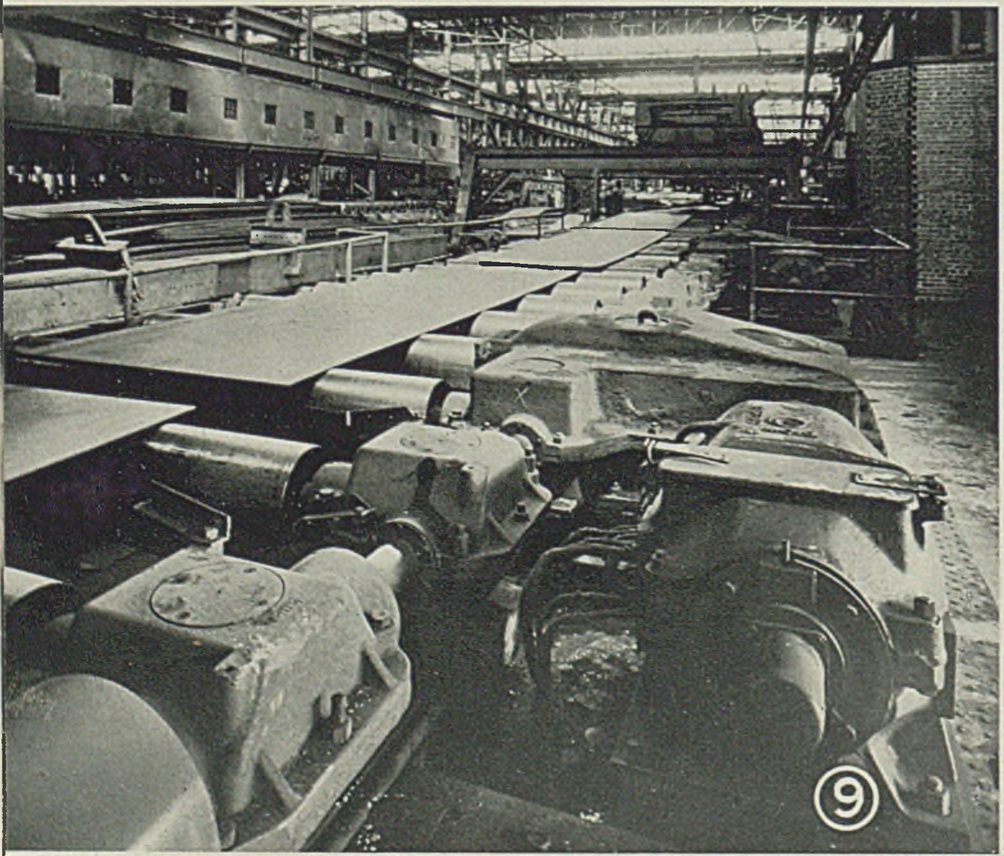


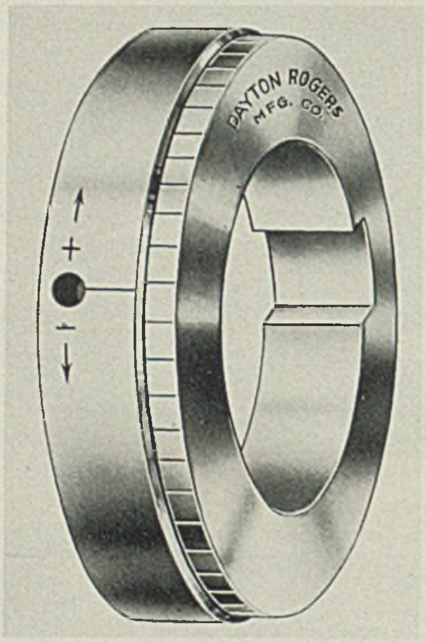
Fig. 9—Lighter plate is taken off the transfer tables first and sent through this ⅜-inch line. In designing the plate processing line, mechanical handling has been provided wherever possible. Both plate mill lines are equipped with magnetic depilers, skew tables, and roller conveyor sections

INDUSTRIAL EQUIPMENT

Direction Indicator For Spacing Collars

Dayton Rogers Mfg. Co., 2835 Twelfth avenue South, Minneapolis announces an improved direction indicator for its precision adjustable spacing collars for milling machine cutter arbors. It definitely tells the operator which way to rotate the sleeve to obtain the desired adjustment.

The adjustable spacing collars not only eliminate the use of milling machine cutter arbor shims but make it possible for the operator to get the desired adjustment more quickly and accurately, due to the fact that quarter-

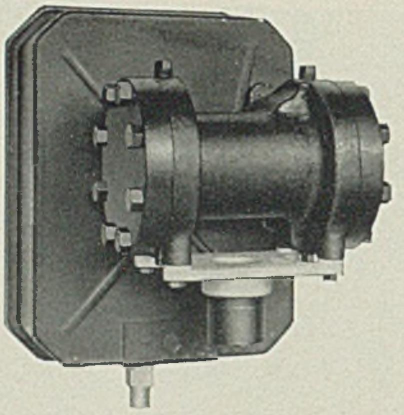


thousandths graduations are easily obtained. The collars are of special alloy steel made in eleven sizes for all cutter arbors from ⅝ to 3 inches.

Aneroid Manometer

Taylor Instrument Cos., Rochester, N. Y., has introduced a new Aneroid Manometer for flow or liquid level. Absence of mercury or other liquid in this unit is said to remove possibility of product contamination and the hazard of mercury being blown due to line surges or carelessness. Its further advantages are that sealing liquids are rarely required and mercury is released for the war effort.

Replacing the stuffing box on the instrument is a new torque tube assembly which presents a completely closed system and is designed to eliminate friction and lubrication. According to the company, metal bellows incorporated respond to the pressure variations and insure faster response under ordinary cir-

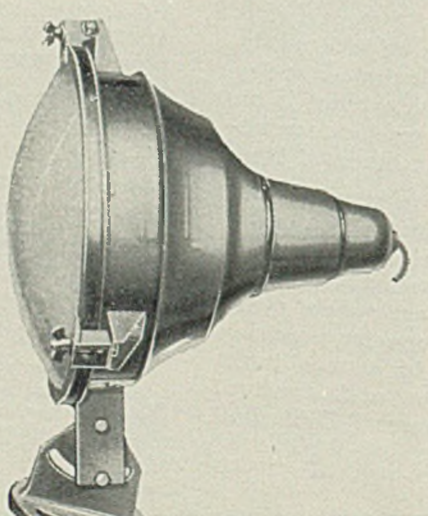


cumstances with immediate reaction to sudden changes in flow.

The bellows are built to withstand high over-range without damage. Under steady flow conditions the unit is reported to be accurate within 1 per cent of scale range. It is available for all types of indicating and recording meters and controllers, and is supplied for standard ranges between 20 and 500 inches of water.

Floodlight

Pittsburgh Reflector Co., Oliver building, Pittsburgh, announces a new floodlight for outdoor floodlighting applications. Employing a minimum of critical war materials, it is available in four wattages; with three light distributions—a broad beam for close-range lighting, a narrow beam for intermediate range

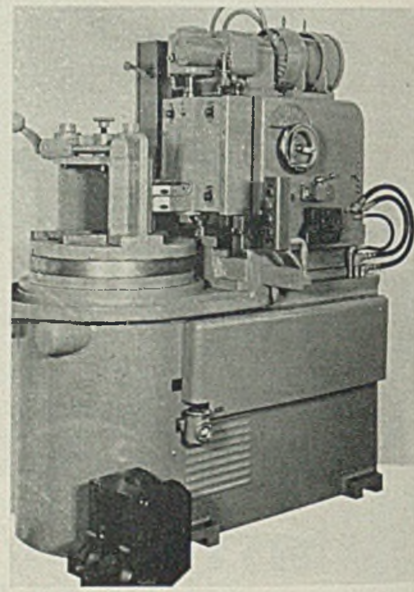


and a concentrated beam for long-range service.

Control for these changes is effected through a Permaflector—a "shaped mirror" silvered glass reflector. The silver reflecting surface is hermetically sealed between the glass and a copper backing, retaining its high reflecting efficiency indefinitely. Housing of the unit is of spun steel treated to resist corrosion. Cover glass is convex and heat-resisting, available either stippled or clear, in steel cover ring with gasket.

Milling Machine

Snyder Tool & Engineering Co., East Lafayette, Detroit, announces a special machine with which auto production methods are applied in milling extractor trunnion pockets in gun breech rings. It cuts kidney-shaped slots without spe-



cial attachments such as tracers ar duplicators.

When the work piece is loaded in the locating fixture of the machine, and the cycle starting button pressed, the tool spindles start to rotate and the tool spindle slide advances into position while the fixture table starts to oscillate the work through a short arc which controls shape of slot. Latter is cut in steps which are adjustable from a few thousandths of an inch to 1/32-inch deep per oscillation of the table.

Oscillation of table and tool advance are hydraulically operated and electrically controlled. The machine consists of three principle sections—the base, containing hydraulic equipment and piping, the rotating table mechanism for the work-holding fixture, and, the spindle head housing with its column and feed mechanism.

Mechanism to oscillate the table, located in the base, is hydraulically actuated by two hydraulic plunger cylinders. Its control is by means of reciprocating cycle hydraulic panels, mounted on the side of the machine and equipped with trip-dogs to adjust the length of the arc through which the table oscillates. The plungers register against solid stops at the end of the stroke.

The work spindle is driven from an electric motor mounted on top of the base, through pick-off gear drive through a spindled shaft, hence to the spindle housing proper. The spindle housing in the column assembly is mounted upon ways which allow it to move out of the way for loading and unloading. In the column also are contained the hydraulic fluid motor and lead screw mechanism which moves the tool into the work in steps.

Stops for the main slide are bevelled at 45 degrees and located one on either side of the ways. These not only stop the slide but also hold it down on the ways. Coolant is supplied from a side-mounted coolant trough equipped with a chip basket in which all chips collect.

Voltage Regulator

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has introduced a DT-5 electronic voltage regulator for regulating output voltage of alternating and direct-current generators, providing the output voltage is more than 46 volts. It operates from a 3-phase alternating current power supply and acts as a grid-controlled rectifier to supply the direct-current field current to the generator, or the exciter of the generator, being regulated.

Sensitivity is plus ¼-per cent when alternating current supply voltage does not vary more than plus 5 per cent from nominal rating. The regulator is built on a Micarta panel 1 inch thick, and is designed for master panel mounting.

Tubes are protected by a screen cover instead of a cabinet. Features of the unit are low maintenance, reliability of operation and a high degree of regularity. An anti-hunt circuit, built into the regulator, prevents the regulator from overshooting when close regulation is required.

Pressure Controller

Minneapolis-Honeywell Regulator Co., Minneapolis, is offering a safety water pressure controller for manufacturing plants, especially those located in areas in which bombing is apt to occur.

Water pressure must be kept above certain limits in order not to become a hazard. Most manufacturing plants use water for cooling purposes, where a drop in pressure will cause damage unless the operator is warned immediately. War production plants are especially open to two possible causes of pressure drop—aerial bombs and saboteurs.

The new device consists of a controller which will sound an alarm bell as soon as the pressure drops. The bell controlled by the unit may be located any place in the plant most convenient for the person responsible.

Pressure Control

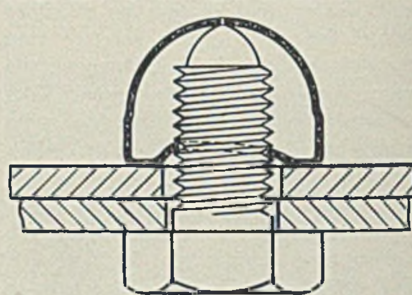
Hannifin Mfg. Co., 621 South Kolmar avenue, Chicago, announces a new sensitive pressure control for its hydraulic presses said to provide complete control of ram movement and of working pressure by a single hand lever or foot pedal, with an operating cycle that allows fast, accurate and easy handling of work.

According to the company, initial movement of the control lever causes the press ram to move down rapidly at nominal pressure. With the control in this approach position the ram will move down until it touches the work and then stop. The gage will show practically no pressure. Further movement of the control lever beyond the approach position causes pressure to be exerted by the ram, the working pressure being proportional to the distance control lever is moved.

Any required working pressure at the ram, it is said, up to the capacity of the press, is obtained by moving the control lever down. Releasing the control lever at any point returns the ram automatically to top position with a high speed return stroke. Between operations the ram stands at top position and the oil pump idles at zero pressure.

Self-Locking Nut

Palnut Co., 61 Cordier street, Irvington, N. J., announces a new self-locking acorn type Palnut which is being offered in three bolt sizes—No. 6-32, No. 10-24 and ¼"-20. It is of the same de-



sign of the former nuts—stamped of spring steel, heat-treated and plated, having the same spring steel jaws that close in and grip the bolt thread when the nut is tightened, except that the six upright sides have been extended up and crowned over, coming together at the top to form an acorn or cap nut design. Extremely light in weight but relatively strong, it can be used alone, and also to lock regular nuts tight on heavier types of assembly.

Women's Work Glove

Industrial Gloves Co., Danville, Ill., recently perfected a glove for use by women workers. Of light weight horsehide,

it is said to wear exceptionally well on hard jobs—yet remains soft and flexible. It is being made in three sizes—small, medium and large.

The glove features an open back to provide coolness and an elastic web band across this opening to keep it snug fitting. Thumb and first two fingers of the glove are reinforced by an extra thickness of leather. A 2-inch band of leather extends up over the wrist to provide extra protection.

Welder's Eyeshield

Jackson Products, 3265 Wight street, Detroit, is offering a new welder's eyeshield for use during welding operations. It is easily attached to any standard make helmet, and it tends to eliminate reflected glare, affording wide vision and protecting the eyes from flying scale from chipping hammer or wire brush.

The eyeshield allows loading of welding holder, set-up work and accomplish other details without raising the visor. The shade is light green in color and fits the face comfortably. Also, it may be worn over prescription glasses.

Air Circuit Breaker

General Electric Co., Schenectady, N. Y., announces a new high-speed type AG-1 air circuit breaker to minimize "arc back", and application of which is said to lessen the possibility of power interruptions in war plants using direct current for the reduction of vital metal such as aluminum and manganese, and for various continuous processes. It removes short circuits in less than one cycle, or faster than 1/60 of a second.

Arc back, the company points out, is a short circuit on the power system during which the current can increase to excessively high values. For a single rectifier, the rate of increase of current can be as much as six million amperes per second. Such rates of rise are due to the fact that current flowing through the anode circuits of a rectifier immediately feeds into the anode circuit where the arc back occurs.

Other rectifiers on the same bus also will feed into the faulty circuit. This reverse current flow in the circuit of the faulty anode circuit must be interrupted before it reaches proportions that will cause damage to the rectifier and associated equipment. By interrupting the circuit in less than one cycle, the new circuit breaker limits the current that can flow into the faulty anode to values of less than 50,000 amperes.

One reason why the breaker can do this is because its design utilizes the effect of magnetic loop expansion. This works to a double advantage. Where the circuit is normal, the increased pressure at the contacts prevents burning of their surfaces. But when the breaker is tripped during abnormal circuit conditions, the magnetic loop expansion effect helps get the contacts separated quickly.

The breaker has an arc chute of the magnetic blow-out type which multiplies the magnetic effect of the current through it and rapidly lengthens the arc back to its extinguishing point.

Nickel Electrodeposits

(*Continued from Page* 104)

Fig. 4 shows the results of stiffness tests on nickel deposits which were ductile according to the qualitative tests by the Ericksen cup method. Curve 5 is that of the most ductile grade of steel tested, and the other curves fall within the stress-strain range shown for this temper of steel as noted in Fig. 3. The set angles for the curves for nickel in Fig. 4 are all between 30 and 35 degrees. The rockwell B values fall between 65 and 70.

These ductile nickel deposits when applied to copper or steel, even when very thick, cause only slightly if any lower fracture values during Ericksen cup tests when compared with those values obtained on the uncoated base metal. The rockwell values are practically in the range of those obtained on the steel shown in the curves in Fig. 3, and the curves in general fall within the same grouping. Also they show a definite yield point.

If we estimate the tensile strength from the curves in Fig. 2, which were obtained by plotting stiffness at 45 degrees deflection versus tensile strength for the several different steels tested in Fig. 3, we obtain a tensile strength for the ductile nickel specimens between 50,000 and 60,000 pounds per square inch. These values fall within the range of tensile strength values found by other investigators for "soft" electro-nickel (see Wesley and Gordon references above).

Most dull nickel deposited in plants where solutions are continuously or periodically filtered and purified have medium stiffness values. A few stiffness curves of specimens of this type of nickel from several baths are shown in Fig. 5. These deposits when 0.0002-inch thick showed a faint but decided red copper color on visual examination (copper being used as the base metal) when a cup was extruded by a 1-inch ball to a depth of 0.225-inch as described above.

The hardness of these deposits varied from 68 to 83 rockwell B, although the latter value was obtained on a set of specimens which had set angles ranging from 21 to 29. This was the only specimen which had duplicates with a variation of more than 2 degrees for the set angles for different thicknesses. The stiffness curve for this specimen fits in more readily with hard nickel than medium as seen from curve 5 in Fig. 5, which is also shown as curve 1 in Fig. 6. The set angles obtained on the series of medium hard deposits in general were 25 to 28 degrees.

Curve Indicative of Deposits

As these specimens were from baths which showed less ductility upon the use of the ball extrusion test, this type of curve was considered indicative of medium nickel deposits. These stiffness curves do not show as definite a yield point as do the curves of ductile nickel in Fig. 4. There seems to be some relation between the lack of a definite yield point and "hardness or decreased ductility". The stiffness at 45 degrees slightly overlaps the ductile nickel values, being 13 to 15.5, omitting curve 5 which has a stiffness value of 22. The latter value corresponds to a tensile strength of 98,000 pounds per square inch if we use the conversion curve I in Fig. 2 for steel. The value corresponds to that reported by Wesley of 98,900 pounds per square inch for medium electro-nickel.

However, the lower stiffness values, in a fairly close grouping on the same conversion curve, give us tensile strength values from 70,000 to 80,000 pounds per square inch. Only curve 1 of Fig. 5 has a stiffness value which falls on the conversion curve II, Fig. 2. This low value would provide a tensile strength of 58,000 pounds per square inch.

These values are based on conversions for cold-rolled steel, which has a grain orientation in the plane of tension. The electro-deposited nickel grain structure is at right angles to the plane of tension. Therefore, although close agreement with results of other investigators is obtainable in some cases through the use of these curves, they do not permit numerical conversions. Point 1, on curve II of Fig. 2 was obtained on steel of the same type as that represented on the conversion curve I, made by the same mill. Points 2 and 3 on curve II were from other mills and are of different chemical analysis. These points correspond to the steel as shown in Fig. 3. Therefore, the conversions at best are useful only as a rough guide and do not represent true values.

A set of stiffness curves for hard nickel deposits is shown in Fig. 6. All of these represent deposits which show bad cracking when subjected to the ball test previously described. Curve No. 1 in this set was described above as curve 5 in Fig. 5.

These same deposits which are placed in the "hard" nickel group have set angles from 15 to 20 degrees. The rockwell B values range from 81 to 100, the latter value being obtained on a deposit from a solution suggested by Wesley containing ammonium and potassium chlorides. Aside from this, conditions of the bath and operation were such as to produce a ductile deposit.

The hard deposit shown by curve 5 Fig. 6 has a stiffness value of 28, which would correspond to a higher tensile strength than could be obtained by conversion from Fig. 2. Wesley obtained 132,000 pounds per square inch for the deposits of this type.

The remainder of the hard deposits in Fig. 6 are grouped so the stiffness values at 45 degrees fall between 21 and 24, corresponding by conversion (curve 1 Fig. 2) to tensile strength values of 96,000 to 102,000 pounds per square inch. This corresponds to the values obtained for No. 1 temper of cold-rolled steel. The hard nickel curves show very indefinite yield points, if any. This occurs when material has a tendency to work harden as distortion or cold working proceeds and is usually characteristic of hard metals.

(*Concluded in Sept. 21 Issue*)

Issues Manual On Carbon Steel Sheets

Another steel products manual on carbon steel sheets designated as section 11 was issued recently by the American Iron and Steel Institute, 350 Fifth avenue, New York. Divided into four parts, it includes general definitions and manufacturing practices. One part deals with packaging, loading and shipping, timely and doubly important in view of today's shipping schedules.

Apprenticeship Plan

(*Continued from Page 76*)

safety habits, ability to learn, willingness to work, accuracy, productivity, personal habits. A quarterly transcript of this record is sent to the parent or guardian for inspection and signature. The apprentice operates under an indenture contract and either party thereto may present any complaint to the committee for adjustment.

Although the company may decrease working hours or transfer the apprentice to other departments if business conditions necessitate, the continuity of employment on an uninterrupted basis is established.

The apprentice can be disciplined for failure to obey shop rules and can be discharged for inability to learn, unreliability, unsatisfactory work, lack of interest in his work and education, insubordination or improper conduct. He has the right of appeal to the committee.

At the conclusion of his training, the apprentice receives a certificate of journeymanship, which is in the form of a leather-covered pocket-size booklet. This includes his photograph, signature, physical description, the certificate of graduation, detailed hours of shop experience, grade and hours of related school subjects and, finally, a personal characteristics rating covering the entire period of apprenticeship. This is an invaluable property which practically guarantees the craftsman preferred employment anytime and anywhere at top rates. Mr. Goodwin admits that apprentices are trained so well and their Murray journeymanship certificate is so widely valued that unusual temptations are offered. So far, however, the losses are very small.

This apprenticeship training naturally increases the latitude of promotion remarkably. Better than 50 per cent of these journeymen, all under 30 years of age, are in supervisory positions. The adaptability of such rounded experience to fit any leading position is highly encouraging. Random inspection indicates that such finished apprentices are now acting as machine shop foremen, superintendents of production, jig and fixture builders, motion study technicians, precision inspectors, estimators, full-size layout men, die leaders, designers, plant layout men, model builders and leaders, and many other responsible positions. In fact "head", "in charge", "leader", "supervisor", "foreman" and "department superintendent" are hooked up with these journeymen's names all over the Murray plants.

Several Schedules Offered

There are a number of schedules covering the varied trades involved in the Murray apprenticeship program. Months of experience in each detail is stipulated. The complete apprenticeship agreement, reprinted here as Table I shows details of the shop work scheduled for the various courses. The experience on the different machines does not follow in the sequence as shown on the schedules. Note that apprenticeship courses are set up in tool and die making, electrical maintenance and construction, model and pattern building, drafting, sewing machine repair, pipe fitting and air conditioning.

If the apprentice progresses more rapidly than the time allowed, remaining time is employed in extension subjects involved in the various schedules.

Murray apprentices take classroom work in related subject matter at the Wilbur Wright high school, under the supervision of Al Goodwin. The curriculae are given in the apprenticeship agreement, Table I, p. 120.

The would-be apprentice first fills out an application card reproduced here as Fig. 4. It is thoroughly investigated by Mr. Goodwin, who also interviews the boy's parents. The applicant is figuratively "taken apart" in a series of interviews which cover inclination, background, father's trade, physical fitness, ability to learn, work aptitude, alertness, co-operation, personality, neatness, enthusiasm, talkativeness, stubbornness, temparament, impression, poise, handling, reliability, future possibilities.

When acceptable, he is referred to the Industrial Relations Department, where standardized intelligence tests are given and the boy is interviewed by the Murray psychologist. A personnel audit is made and a thorough physical examination given. Upon the successful completion of these tests the boy is hired.

A request for approval and registration of the individual apprentice is made to the State Board of Control for Vocational Education on a triplicate form. When the State Co-ordinating Committee on Apprenticeship has acted, the candidate has been duly indentured and proceeds with his directed training.

The apprentice is required to fill out a daily shop report of the type of work, hours of experience in each department. These are accumulated on a monthly apprentice experience chart, showing time spent. He is likewise required to have his school instructor fill out a certificate of attendance covering his related school work. These records are again accumulated on an individual yearly apprentice record. After his first year, he can join the union.

The foreman of the department in which the apprentice is working each month is required to complete a monthly apprentice shop record, shown in Fig. 5. Here, by the check system, the apprentice is accurately graded as to safety habits, ability to learn, willingness to work, accuracy, productivity, personal habits. These foreman reports are accumulated on a quarterly apprentice report shown in Fig. 6. This contains both his school and shop record for the inspection and signature of his parents. Also, these reports are regularly inspected by Murray management.

This unusually thorough apprenticeship program is profitable to the boy and to the company almost from the start, even though a high educational cost is involved. The boys have declared their life ambition, are anxious to push ahead to some other experience, are more accurate, have more initiative, and are being taught to sail on their own. With this well-rounded training, they swiftly become adaptable, making it possible to shift them from department to department when unexpected production demands arise. This is particularly true in war production when schedules expand suddenly to form bottlenecks on machining operations that can be temporarily loosened while the employment department is scurrying to find permanent operators.

A recent example was a sudden demand for Keller operators. Apprentices were shifted to fill the gap until Keller operators could be found.

The accident ratio of apprentices in production to that of the journeymen in the same department is very low—approximately 25 per cent. Part of this low accident rate is caused by the initial stress on safety given the apprentice. When inducted, he is provided with an unusually well organized book, *A Good Mechanic Seldom Gets Hurt*, by Herman R. Graham, B.S., published by the American Technical Society, Chicago. In 93 pages, every conceivable safety factor covering all types of bench and machine work is succintly defined and illustrated.

The last page contains a pledge and a notice that the boy has studied the book. He is required to sign this and, thereafter, is carefully examined to assure that he has studied it. The book then becomes his personel property for reference thereafter. These boys are never permitted to forget the fact that "a careless man is a hazard".

"You can't take swimming lessons from a catalog", Mr. Goodwin expounds. He believes in making the boy want to be independent. His entire training setup is designed to teach the boy never to run away when in trouble. He believes that guidance is most needed at the time when things go wrong. These boys are forced to think for themselves. They are encouraged to struggle their way out. Their individual judgement and decisional powers are developed. "The problem becomes impossible only when you make it so," is a principle which he early demonstrates to all of these boys.

A decidedly unique method developed to teach that principle is the use of tandem blueprints, the first setting up a problem, either mathematical or psychological for the boys to struggle over; the second, an easy solution to be presented after they have racked their brains. Figs. 9 and 10 show a sample of this technique. Fig. 9 presents the problem—determine dimension *A*. Fig. 10 presents its extraordinarily simple solution. This demonstrates a point in psychology—how prone we all are to make the simple appear difficult. The blueprint plots the determination of a dimension, *A*, between the parallel diameters of two circles, perpendicular to a common centerline. When the problem blueprint, Fig. 9, is studied, boys tear their hair trying to solve it. Its simplicity, as shown in the tandem blueprint, Fig. 10, astonishes them. It is so self-evident that they carry this illustration in their minds as they approach every problem in shop practice and are thereby taught to discover the obvious.

The Goodwin "tell-show-do" technique has had much to do with the success of the Murray apprenticeship program. He believes in teaching the boys to think, not in thinking for them. They work out their own problems, find their own mistakes, discover their own ingenuities, under this leadership—but the instructor is there to help when the going has really become tough.

This is the Murray apprenticeship plan. It provides the pattern, the agreement, the records, the procedure and the schedules that can be adapted to suit almost any apprenticeship training need. The extension of such industry-labor cooperation as this will produce great benefits for all concerned. Here is a needed endeaver. Here is a charted example.

As for the boys, there is no greater protection for any youth looking into the future than the assurance that he holds a journeyman's card that shows he is capably trained to handle a variety of skilled tasks creditably.

Table I—Murray-Union Apprentice Agreement

ARTICLE I—Duration of Agreement

Section I: This agreement shall continue in full force and effect until terminated or modified with the consent of both parties in the manner hereinafter provided. If either party desires to terminate or modify this agreement, it shall at least thirty (30) days prior to the date when it purposes that such termination or modification become effective, give notice in writing of the termination or modification. The other party within ten (10) days of said notice shall either accept or reject the proposal or request a conference to negotiate the proposition. No notice to terminate or modify this agreement shall be given by either party, prior to Jan. 1, 1942.

ARTICLE II—Recognition

Section 1: A Joint Apprenticeship Committee shall be established, as hereinafter provided, empowered to bargain collectively in respect to rates of pay, hours of employment or other conditions of apprenticeship for apprentices employed by the company.

Section 2: The Joint Apprenticeship Committee shall be composed of six (6) members. Three (3) members shall be selected by the Company, and three (3) members selected by Local No. 2, UAW-CIO; the identity of whom is established by the signatures on this agreement. A chairman and a secretary shall be elected, and meetings shall be held monthly.

ARTICLE III—Apprenticeship Training Standards

Section 1: Conditions of Apprenticeship A. QUALIFICATIONS: (1) Applicants to be

eligible for apprenticeship must be between eighteen (18) and twenty (20) years of age inclusive; be physically sound, have sufficient high school education and meet the Apprenticeship Standards as established by the Company, subject to the approval of The Federal Committee on Apprenticeship.
(2) New Standards may be established as the needs require.

B. INTERVIEWING, QUALIFYING, AND SELECTING APPRENTICES: (1) Apprentices shall be under the direct supervision and guidance of a Director of Education selected by the Company. (2) The interviewing, qualifying and selecting of applicants for apprenticeship, based upon the standards established, shall be an exclusive function of the Director of Education. (3) The Director of Education shall secure the approval of a majority of the Joint Committee before an apprentice is employed.

C. TERM OF APPRENTICESHIP: (1) The term of apprenticeship must not be less than four (4) years or less than eight thousand (8000) working hours, which includes time excused from work to attend school on related instructions. (2) If the apprentice does not satisfactorily complete his apprentice training in the above length of time, the committee may extend the time necessary to meet his needs.

D. RATE OF PAY: The apprentice shall receive the rate of 65c per hour to start, and shall receive an increase of 3c per hour every five hundred (500) hours of work until he has completed his eight thousand (8000) hours.

E. SHOP SCHEDULES: (1) Shop Schedules shall be set up for the various trades and will include such experiences as are necessary to make the apprentice thoroughly proficient. (2) The time schedule for various experiences shall be as hereinafter indicated in Section 2. (3) An apprentice may be transferred during his apprenticeship training period from his prescribed trade to another trade as indicated in Section 2 upon the approval of the Committee. (4) New Schedules and trades may be established by the company as the industrial need warrants.

F. RELATED SUBJECT MATTER: (1) The apprentice shall attend such classes as prescribed and approved in Section 3. (2) The apprentice shall be excused from work to attend school four (4) hours per week, thirty-six (36) weeks per year; this time shall be charged to educational expense and will be paid at the rate the apprentice is receiving on the job; providing that said apprentice shall voluntarily attend school for an equal number of hours on his own time, on subjects as approved in Section 3. (3) School time charged to educational expense shall not be eligible for overtime. (4) The apprentice will not be paid for attending school on days he fails to report for work.

G. RECORDS: (1) Records of the apprentices' experience shall be kept in the office of the Company's Director of Education, and a copy shall be furnished to the Committee upon request. (2) The apprentice shall be graded monthly on the following:

(a) Safety Habits
(b) Ability To Learn
(c) Willingness To Work
(d) Accuracy
(e) Productivity
(f) Personal Habits

(3) A quarterly transcript of these records shall be sent to the parent or guardian of the apprentice for inspection and signature.

H. ADJUSTING DIFFERENCES: In the event of a complaint or controversy arising between the Company and an apprentice concerning the apprenticeship agreement, either party may appeal to the Committee for adjustment of such complaint or controversy.

I. CONTINUITY OF TRAINING: During the term of apprenticeship, the apprentice's program shall be uninterrupted. The apprentice shall be given reasonably continuous employment, but should business conditions warrant, the Company may decrease the working hours to suit its needs; or an apprentice may be transferred to such departments where related work is available and a continuity of employment may be accomplished.

J. DISCIPLINE: (1) An apprentice may be disciplined for failure to obey all shop rules as published. (2) An apprentice may be discharged at any time for:

(a) Inability To Learn
(b) Unreliability
(c) Unsatisfactory Work
(d) Lack of Interest in His Work or Education
(e) Insubordination
(f) Improper Conduct

(3) An apprentice who has been discharged may appeal to the Joint Apprenticeship Committee for a hearing within thirty (30) days. In no event will he be compensated for back pay should he be reinstated by the committee.

K. GRANTING OF CERTIFICATE OF JOURNEYMANSHIP: Upon satisfactory completion of the apprenticeship as required by the standards, the company shall furnish the apprentice with a certificate of journeymanship, bearing the company's name, the course completed, and containing a transcript of his apprenticeship record; including shop experience, related subject matter, and personal characteristic rating.

L. SENIORITY: Apprentices starting subsequent to January 1, 1939, shall be credited with three (3) years occupational seniority on their trade upon graduation.

M. RATIO OF APPRENTICES: A sufficient number of apprentices shall be added each year to graduate a minimum of fifteen apprentices yearly. However, this number may be increased from time to time as the industrial needs require. Such increases must have the approval of the Joint Apprenticeship Committee.

N. UNION MEMBERSHIP: Apprentices shall be permitted to join the Union on completion of one year's service.

O. APPROVAL: This agreement shall be subject to the approval of The Federal Committee on Apprenticeship.

Section 2: Shop Schedules

A. TOOL AND DIE MAKERS

Bench and Vise	12 months
Shaper	4 months
Lathe	4 months
Vertical Mill	2 months
Horizontal Mill	2 months
Boring Mill	2 months
Radial Drill	2 months
Surface Grinder	1 month
Blanchard	1 month
Internal & External Grinder	2 months
Keller	4 months
Turret Lathe	1 month
Slotter	2 months
Machine Repair	1 month
Planer	1 month
Heat Treating	1 month
Die Tryout	6 months
Total	48 months

(If the apprentice progresses more rapidly than the time allowed, the remaining time will be used for the following)

Template Making
Inspection
Jigs & Fixtures

B. ELECTRICAL MAINTENANCE AND CONSTRUCTION

Contact Switches	1 month
Magnetic Contactors	2 months
Cables	3 months
Transformers	4 months
Spot Welder Maintenance	6 months
Butt Welder Maintenance	3 months
Gun Welder Maintenance	2 months
Welder Set Up	3 months
Motors	3 months
Hycycle	3 months
Construction	3 months
Truck Maintenance	2 months
Elevator Maintenance	3 months
General Maintenance	3 months
Wiring	4 months
Experimental	3 months
Total	48 months

C. MODEL AND PATTERN BUILDING

Bench	6 months
Patterns	4 months
Core Boxes	3 months
Machine Work	1 month
Machine Maintenance	3 months
Finishing	1 month
Tracing	1 month
Templates	2 months
Shaper Forms	2 months
Hammer Forms	3 months
Layout	1 month
Models	6 months
Clay Models	3 months
Wood Models	3 months
Plaster Casts	3 months
Small Patterns	3 months
Mockup Patterns	3 months
Total	48 months

D. DRAFTING

Sketching	3 months
Mechanical Drawing	3 months
Body Drafting	6 months
Metal Work	4 months
Production Work	6 months
Detail Design	4 months
Checking Drawings	2 months
Panel Layout	2 months
Plant Layout	3 months
Tracing	2 months
Fixture Design	2 months
Die Design	2 months
Body Experimental	6 months
Templates	3 months
Total	48 months

E. PIPEFITTING AND AIR CONDITIONING

Pipefitting	12 months
Steamfitting	3 months
Heating	6 months
Valves	2 months
Gauges—Air Regulators	2 months
Air Conditioning	6 months
Refrigeration	4 months
General Maintenance	3 months
Sprinkling System	3 months
Air Lines	3 months
Plumbing	4 months
Total	48 months

F. SEWING MACHINE REPAIR

Bench and Vise	8 months
Shaper	3 months
Lathe	4 months
Horizontal Mill	3 months
Drill Press	1 month
Surface Grinder	2 months
Blanchard	1 month
Heat Treating	1 month
Sewing Machine	12 months
Gangstitcher	3 months
Multipleater	3 months
Fixtures and Folders	3 months
Templates	3 months
General Experience	1 month
Total	48 months

Section 3: Related Subject Matter:

A. FIRST YEAR

Shop Mathematics
Technical English
Industrial Economics
Industrial Chemistry
Principles of Engineering Drawing, and Body and Die Blueprint Reading.
Drafting and Views of Diagonal Sections
Safety Practices
Use, Care, and Reading of Tools
Machine Shop Technology

B. SECOND YEAR
- Applied Mathematics
- Metallurgy
- Shop Theory
- Die and Part Print Detailing
- Practical Methods and Proper Machines To Use
- Slide Rule
- Machine Shop Technology
- Compound Indexing

C. THIRD YEAR
- Metal Analysis
- Heat Treating
- Arc and Acetylene Welding
- Panel Design
- Gear Calculating and Cutting
- Machine and Die Design (Arranged to put former experience into practice)

D. FOURTH YEAR
- Methods Engineering
- Elements of Supervision
- Strength of Metals
- Tool and Die Design
- Hydraulics

Saving Alloy Steels

(*Continued from Page* 86)

capacity and thus prevent the accumulation of overages in steel mills. The present 25 to 30 different analyses available for this type of service could probably be decreased to 10 or fewer under present conditions. The work being done on the NE (National Emergency) steels is aimed at this result.

Before the proper reduction can be made in the chromium content of a steel for a given application, however, it is necessary to know the effects of this change on the surface stability and high-temperature strength. To assist in evaluating these characteristics, the following data are presented.

Corrosion Resistance: Resistance of steel to the attack of hot petroleum products is proportional to the chromium content. However, slight differences in operating conditions and in the composition of the charging stock also influence the corrosion losses.

If, however. the losses are expressed as a ratio to that of a given steel, then the results from different refineries are more readily comparable. This is illustrated in Fig. 1, which gives the findings from three different refineries based on their ratio to DM steel analyzing 1.5 per cent chromium, 0.75 silicon, 0.50 molybdenum. Chromium content is the factor influencing corrosion resistance, although increased silicon or the addition of aluminum does cause a further improvement.

Regardless of whether corrosion is considered on the basis of weight loss or penetration, a fairly definite relation exists between the corrosion resistance and the chromium content, even though the conditions in the three refineries were different. These results indicate that the 5 per cent chromium steels are roughly five times as resistant as the 1.5 per cent chromium steels; while the 7 per cent chromium grades are twice as resistant as the 5 per cent; and the 9 per cent are twice as resistant as the 7 per cent chromium steels. Actual operating records from certain refineries substantiate these relationships, which were developed from standard API strip corrosion specimens.

From this it follows that, insofar as corrosion resistance is concerned, a tentative guide, at least, exists for decreasing the chromium content if the steel now used is giving what is considered to be too long a life for present emergency conditions. In other words, if a 9 per cent chromium steel is now lasting 10 years, a 7 per cent chromium grade should have a life of about 5 years, and a 5 per cent chromium steel about 2½ years.

Oxidation Resistance: Chromium content by itself is not overly effective in imparting a high degree of resistance to oxidation or scaling at temperatures of 1250 to 1500 degrees Fahr. unless it is present in amounts beyond 10 per cent. The effect of chromium in this respect can be greatly improved by an increase in the silicon content or by the addition of aluminum. This condition is shown in Fig. 2. Whereas the straight

5 per cent chromium-molybdenum scaled excessively at temperatures in excess of 1250 degrees Fahr., an increase in the silicon content to either 1 or 1.5 per cent imparted good oxidation resistance even at temperatures up to 1500 degrees Fahr.

Insofar as the conservation of chromium is concerned, reductions can be made in the intermediate alloy steels without greatly changing the oxidation resistance. Any loss in scale resistance, due to a decrease in the chromium content, could be more than compensated for by an increase in the silicon. In fact, available data indicate silicon to be seven times as effective as chromium in imparting oxidation resistance to chromium-bearing steels.

Tube-wall loss, due to scaling, can also be reduced by a more careful control of combustion conditions and of furnace atmospheres. Too rigid restrictions on maximum tube-wall temperatures are not advisable, however, as this might decrease to an undue degree the operating cycle and thus interfere with production.

High-Temperature-Strength Characteristics: Chromium likewise has an influence on the high-temperature strength, but it is not true that the strength is proportional to the chromium content. From this it follows that a decrease in the chromium content does not necessarily decrease the strength, and in fact it may result in an improvement in this property.

There is not as yet general agreement as to the high-temperature-strength characteristics most suitable for design. Some use the creep resistance while others resort to the rupture strength. Insofar as cracking-still tubes are concerned, the stress-rupture characteristics are believed the most suitable for they not only afford a basis for design but also show the behavior of the steel under overheating conditions and give an indication of the degree of bulging or deformation to be expected prior to the rupture of the tube.[1]

Fig. 4 shows the influence of chromium content as well as molybdenum on the creep strength (0.01 per cent per 1000 hours) at 1100 and 1200 degrees Fahr. The steels containing 5 per cent or less chromium are of normal silicon content, while the higher chromium steels contain 0.50 to 1 per cent silicon. At both temperatures, the 2 to 5 per cent chromium steels possess a higher creep strength than those containing greater or smaller amounts of this element. A decrease in the chromium content would not, therefore, necessarily have a detrimental influence on the creep strength.

A similar comparison with respect to the 100,000-hour-rupture-strength values is given in Fig. 3. At 1100 degrees Fahr. the rupture strength does increase with increasing chromium content up to 7 per cent; while at 1200 degrees Fahr. the rupture strength is nearly constant as the chromium content varies from about 3 to 7 per cent. Since the majority of tube failures occur at the higher temperatures—that is, during overheating due to coke deposition—it would again appear that a decrease in the chromium content would not too greatly affect the life of the tube from the standpoint of the rupture strength.

Conclusions: While in the majority of cases chromium additions are necessary to steels for cracking-still tube service, it is believed a conservation of chromium can result by:

(1) Designing new equipment for the estimated duration of the present emergency rather than for an extended period of 10 years or more.

(2) Making replacements in present operating units on the same basis as above.

(3) For the smaller orders—that is, those requiring less than a complete heat of steel—limiting the number of possible

steels so as to prevent the accumulation of overages in steel mills and to conserve melting capacity.

(4) For the larger orders, selecting the proper analysis so as to take full advantage of the known influence of certain other elements such as silicon or improving and supplementing the effect of chromium.

Such a procedure requires that more attention be given to the essential physical properties which, in the case of steels for cracking-still service, are (1) surface stability against the attack of hot petroleum products on the inner surface and combustion furnace gases on the outside wall, and (2) high-temperature strength. Data have been presented to show the influence of chromium content to each of these characteristics.

Gas Plant Maintenance

(*Continued from Page* 95)

joins new piping to old, fabricates new fittings, permits making any and all alterations quickly and easily.

Welding piping with the electric arc is noted for its simplicity. The pipes to be joined are placed in position cold and with a minimum of preparation. Practically all the preparation required is the cutting of standard pipes to desired length, butting the pipe together with a proper space of approximately 1/16-inch between the ends and holding the pipe in this position by means of a suitable clamp. This done, the arc welding operator touches the electrode to the pipe and fuses the pipe together in a single homogeneous joint.

Procedure data, speeds and amount of electrode required for welding butt joints in standard weight pipe in horizontal position are given in Table I.

Reconditioning Line Pipe: Many natural gas pipe lines are repaired in operation with full pressure on by means of arc welding. Welding under pressure is considered more safe than welding a line that is full of gas without pressure because under this latter condition, explosive mixtures of gas and air might be encountered.

Where small leaks are found, a quick bead can be run over the leak to stop it, then a permanent weld made. If the leak is bad, a patch or jacket should be clamped to the pipe and then the weld made around it. As a precaution, it is always advisable to have a shovel-full of loose dirt and a gas fire extinguisher handy when welding under leaky conditions.

Many companies find it necessary in repairing gas lines to recondition their coupling as well as the pipe. In a case such as this where the line is given a complete overhaul, service on the line is naturally discontinued. There are two general practices used in reconditioning lines in this manner.

Some companies do their reconditioning work at a central plant; others do this work along the pipe line right-of-way. The procedure in each case is practically the same. Where the central plant method is used, the worn sections of pipe are usually replaced with new or reclaimed pipe as soon as they are removed, thus requiring a stock of replacement pipe.

The following procedure is used by a large gas company in a complete overall reconditioning job with all work done along the right-of-way. The particular case is that of a 16-inch line 25 miles long, originally laid in 20-foot lengths, joined by couplings about 25 years ago. The steps are:

First, after ditch was dug, pipe was lifted out and supported on timbers over ditch.

Second, coupling bolts were torch-cut and pipe was rolled away from ditch.

Third, pipe-cleaning crew with hammers and chisels removed earth and rust scale. Corroded spots were well cleaned to expose sound metal.

Fourth, an inspector chalk-marked all corroded areas which were to be built up with weld metal.

Fifth, four 20-foot pipe lengths were joined into one 80-foot section. Joints were plain end butt type with back-up ring. The pipe was lined up and tacked.

Sixth, mounted on dollies the pipe was roll-welded with two passes of 5/16-inch mild-steel shielded-arc electrode, averaging 3 joints per hour per man. Each section was stress-tested and drop-pressure tested.

Seventh, corroded pits were filled in with 5/16-inch mild steel shielded arc electrode.

Eighth, filled-in areas varied in size from small spots to large patches a foot square.

Ninth, majority of line was relaid without protective coating. It is claimed that the reconditioned line is in better shape than the original when new.

Repair and Replacement: With wartime allocations and other restrictions making it ever increasingly difficult to obtain steel replacement parts, many companies are breaking this bottleneck wide open by fabricating replacement parts from scrap steel.

And the happy note about the whole thing is that in most cases such fabricated parts are far from being merely makeshifts. Actual experience is proving that reclaiming through welding not only costs but a fraction of the new part, but can result in obtaining replacements which are decidedly stronger, smoother and longer-lived than the originals. See data given in accompanying illustrations.

A cylinder head was found to have short life in an application where line deposits were a factor. The cast head was cooled by water and the combined action of the heating up and the line deposit was to cause checking, making the head no longer suitable for operation. It was replaced by one made of arc welded steel, and the new head continued to operate until the passage was entirely blocked by the line deposit, lasting 10 times as long as a cast iron cylinder head. And it weighed 45 pounds less. The longer life provided makes important savings in plant maintenance. The head was made simply by cutting steel plate to proper size, assembling the pieces and fusing them together into a single unit.

Hard surfacing with the electric arc provides a ready means of reclaiming worn parts of equipment. The process eliminates waiting for replacement parts and provides wearing qualities equal to or better than the original part.

Electrodes are available for the deposition of different types of surfaces, each having its own characteristic. These