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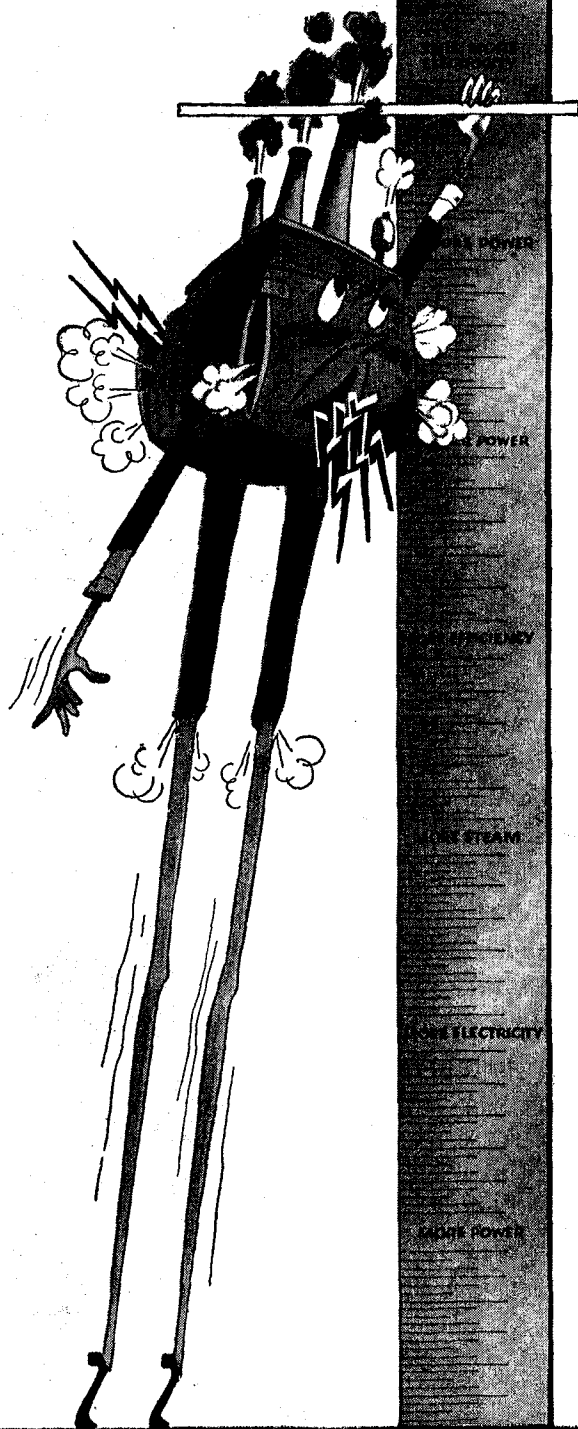
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Volume 64

Number 11

SOUTHERN

having power GROWING PAINS?



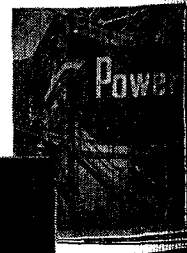
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EM

MASS-PRODUCTION of packaged heat-pump units was encouraged at a recent Southeastern Electric Exchange meeting in Birmingham of representatives of southern and southwestern electric light and power companies. The reverse cycle refrigeration specifications now developed contemplate automatic electric motor driven units for both cooling and heating commercial establishments. Authorities in the field believe that application of the principles of the heat pump to a unit designed for water heating will result in an even lower cost of electric water heating.

EQUIPMENT TRENDS - 5½ lb oscilloscope, incorporating cathode ray tube, vertical and horizontal amplifiers, linear time base oscillator, synchronization means, and self-contained power supply . . . 330 amp capacity Diesel engine driven arc welder . . . 30 lb portable cast aluminum air hoist with full load rating of 17 fpm.

PACKAGED SUB-STATIONS normally include only the transforming, regulating, and switching equipment beyond the high voltage entrance to the transformer. Packaged units including transforming, regulating, relaying, metering, and protective equipment are now available in various arrangements up to 45,000 kva and materially reduce engineering, drafting, and purchasing details on the part of the customer.

THERMAL PROCESSING AND TESTING from sub-zero to high temperatures is now an important factor in the research, testing, standardization, and production of plastics, liquids, metals, instruments, and chemicals. A sub-zero processing temperature of -150 F is commercially available for expansion fits, hardening of steel tools and jigs, and standardization of gauges and metals. Metallurgical research and relative humidity simulation units are in production with humidity controlled with temperature range of 35 F to 175 F.

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NOTED—high carbon and chromium ball bearings 1 millimeter in diameter for delicate instrument bearing applications . . . high strength rivet with alloy-steel 25 Rc cadmium plated pin head at one end and Al7S-T anodized collar which fits grooved end of pin. Has design shear strength of 75,000 psi . . . micrometer, employing electronic circuit in conjunction with micrometer screw thread. Affords accurate readings to .00005 in production testing lines . . . light weight, soil resistant, vinyl butyral coated, flexible work gloves which can be cleaned with standard solvents . . . 5 oz vest-pocket vibrometer measures machine vibrations from 450 to 50,000 cycles per min . . . grid bearings constructed of steel backing lined with gridded silver or copper for heavy load applications.

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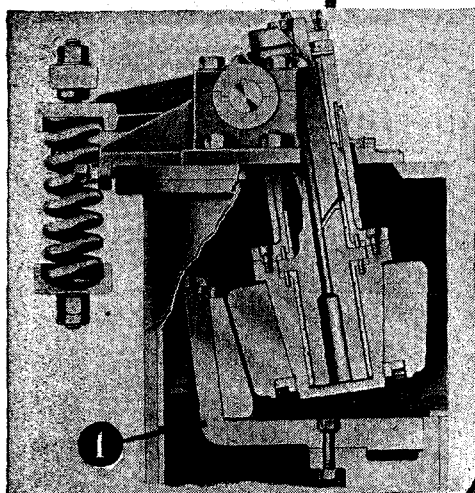
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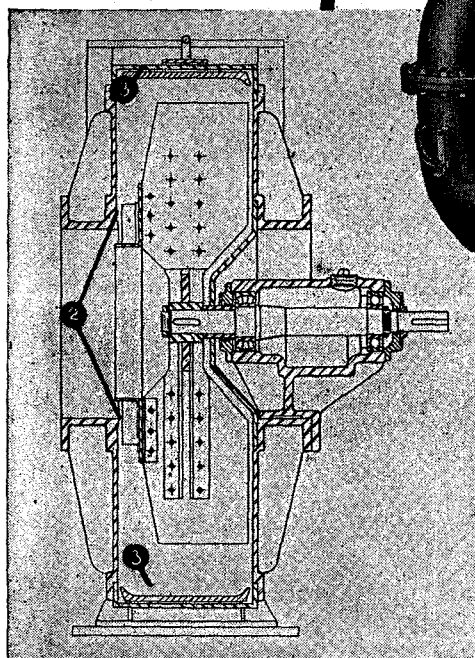
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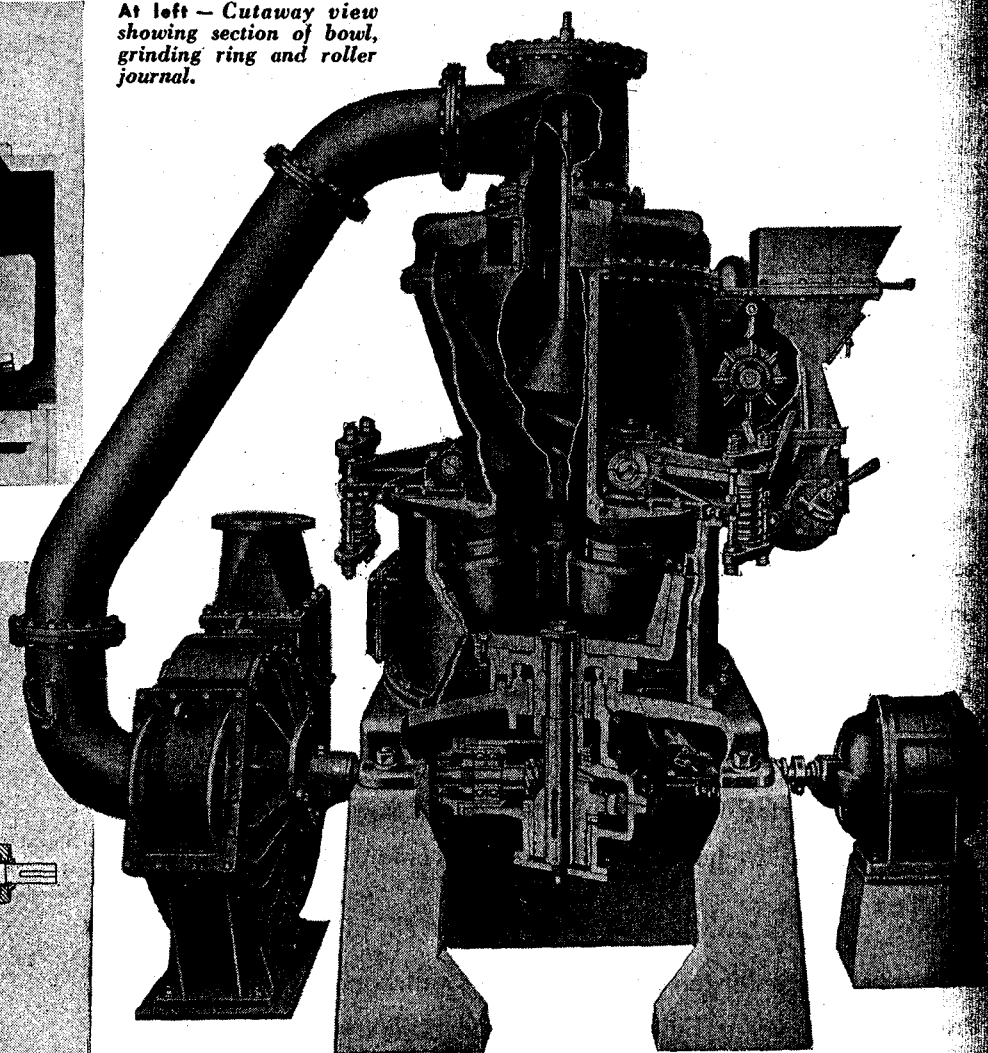
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At left — Cutaway view showing section of bowl, grinding ring and roller journal.



At left — Section through mill exhauster showing new shrouded fan wheel with "whizzer" blades.



COMBUSTION ENGINE

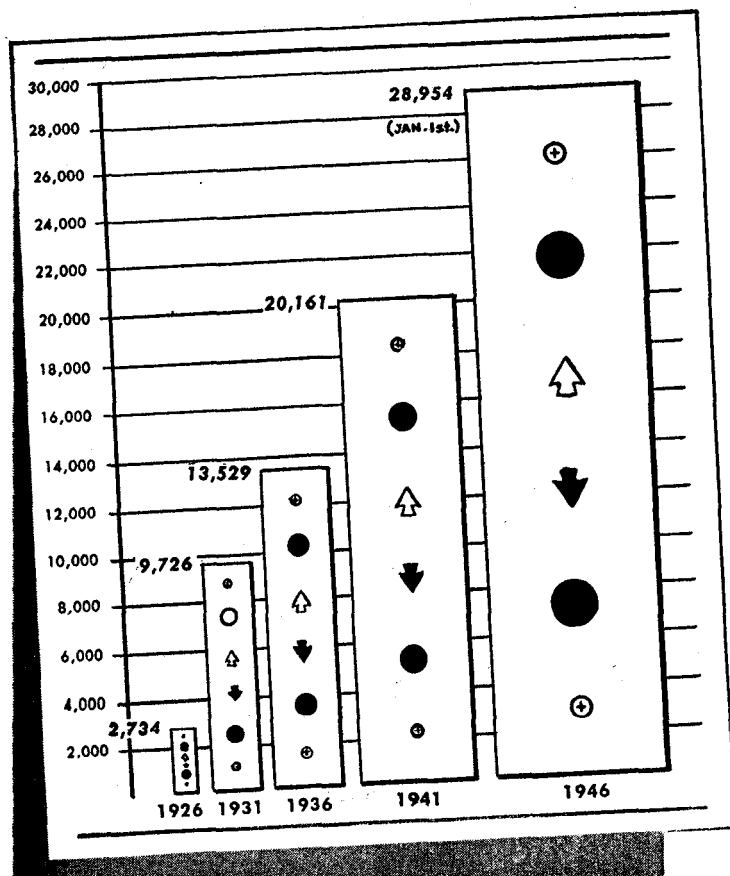
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20

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There are 245 Otis offices* but only one Otis Maintenance Service. • This service is a home town enterprise in operation, so that it may be adapted to the area it serves. It is a national enterprise in research, engineering and manufacturing so that each Otis elevator owner may have the best that concentration and quantity production can provide. • Perhaps the strongest indication of the merit of this service is its growth and development. For more than a quarter of a century, in good times and bad, Otis Maintenance has proved the wisdom of one policy, one system and national service for Otis Elevator owners. • Otis Maintenance provides complete care of Otis elevator equipment by the manufacturer. It is furnished at a flat monthly rate. Complete details are available through local Otis Elevator Company offices.

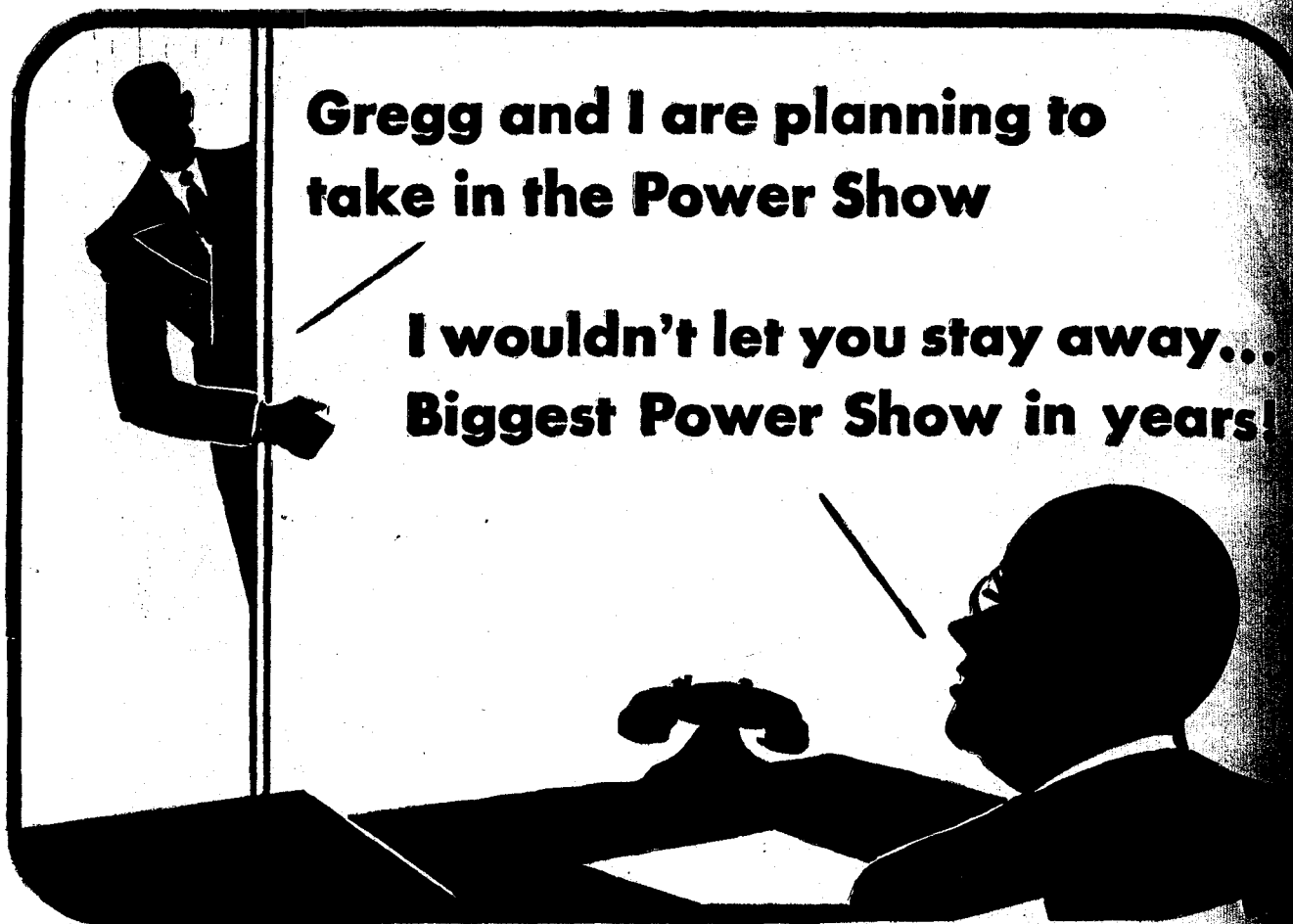


*Otis offices in 245 cities have but one interest . . . to provide the best and safest elevator and escalator transportation possible.



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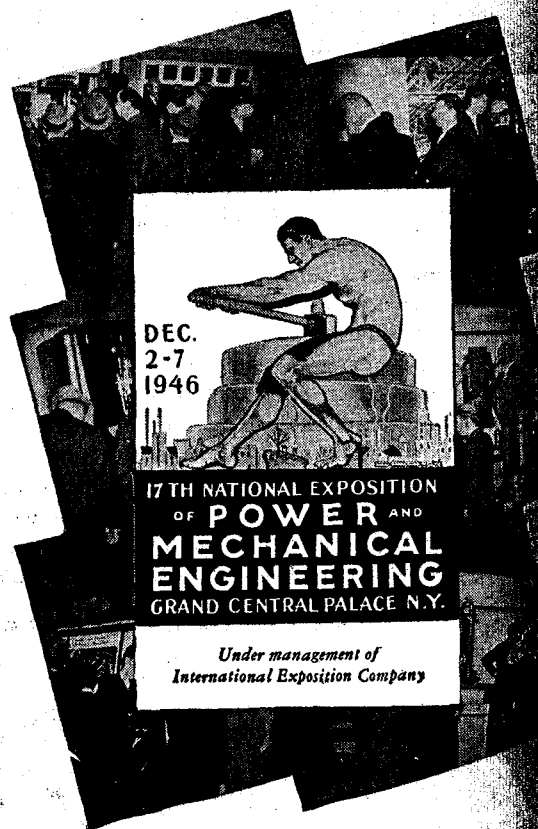


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Biggest Power Show in years!**

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The Power Show is open only to men in the power and mechanical engineering fields. General public is not admitted. Attendance by invitation or registration only. No member of your staff can afford to miss it.



17th NATIONAL POWER SHOW

GRAND CENTRAL PALACE, NEW YORK • DEC. 2-7, 1946

The **FACTS** on Boiler Water Conditioning

were not found in the textbooks

Digging up facts before they get in the textbooks is an old habit with Hall Laboratories—and it is a habit that has been of the utmost importance to every boiler plant operator.

Hall started that way twenty-four years ago, when they tossed theory aside and learned by careful experiment just what actually happens in a boiler, how scale is formed and deposited, and how it can be prevented. Today, the facts discovered at that time *are* in the textbooks, and the basic principle of the Hall system—maintenance in the boiler water of certain essential chemical equilibria—has met with practically universal acceptance.

The establishment of this principle was one of the most important steps ever taken in boiler water conditioning, but to Hall chemists it was only a starting point. Continuing their study of chemi-

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That, too, was a great step forward, and led to the creation of a new phosphate, developed from a sodium phosphate glass which had been neglected for nearly a century.

Fundamental research in factors pertaining to boiler water conditioning has been continued through the war, and it will remain an integral part of the work of Hall Laboratories. This continuous research is your assurance that they will always be ready to meet new problems created by changes in operating conditions and advances in boiler design.

Every plant that generates its own steam can profitably use Hall service, for Hall service *keeps boilers on the line*.

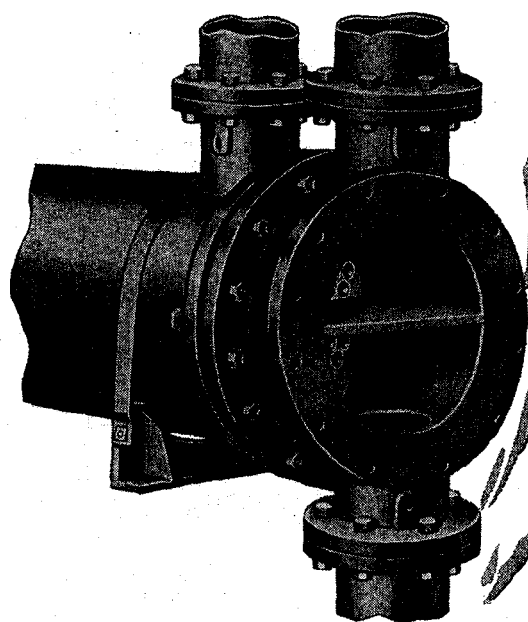
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HALL LABORATORIES, INC., HAGAN BUILDING, PITTSBURGH 30, PA.

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HALL SYSTEM *of Boiler Water Conditioning*

BIG MAINTENANCE JOB WITH YOUR OIL AND WATER COOLERS?



THE ROSS "CP" DESIGN MAY BE THE ANSWER TO YOUR PROBLEMS

In any cooling system, where two fluids are involved, one fluid will normally foul more than the other. Fouling naturally cuts heat exchange efficiency and creates service interruptions.

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To minimize maintenance, the fluid with the greater fouling tendency is passed through the *inside of the tubes* in the Ross design. For inspection or cleaning, you merely remove the channel cover plates. This gives you quick, easy access to tube interiors *without breaking any pipe connections*. Have you any idea how many hours this takes away from maintenance and adds to production time?

Bulletin 5322 covers details completely.

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DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

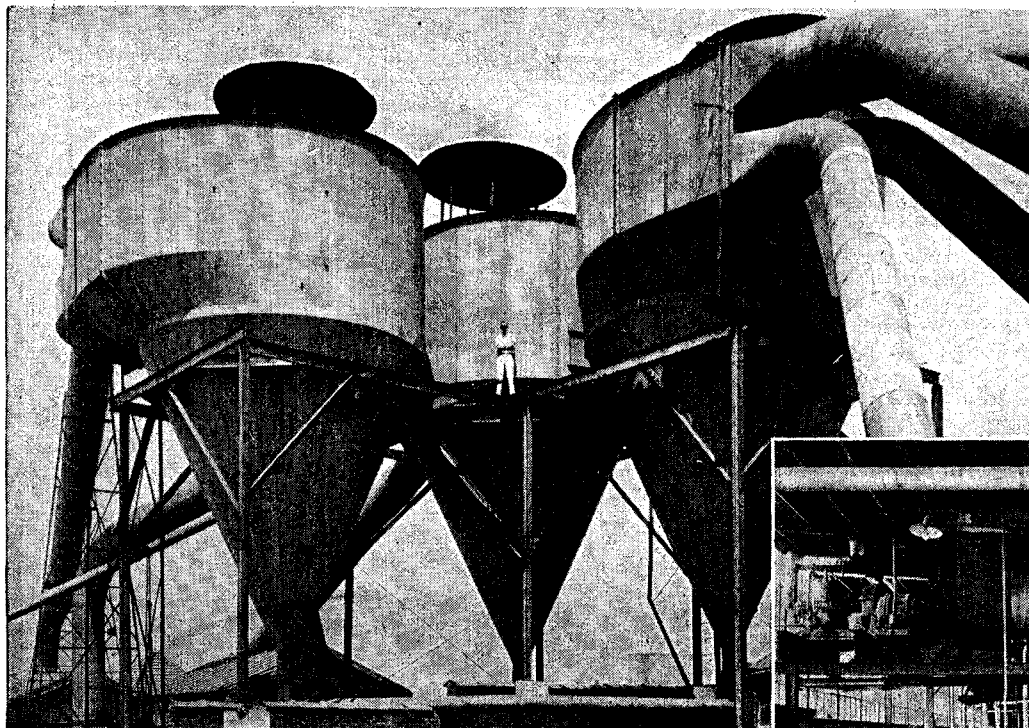
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ROSS EQUIPMENT IS MANUFACTURED AND SOLD IN CANADA BY HORTON STEEL WORKS, LTD., FORT ERIE, ONT.

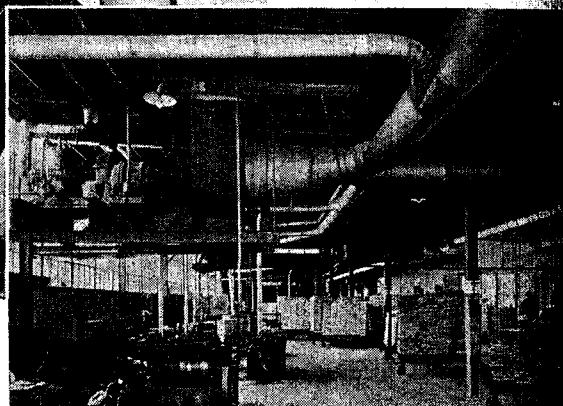
DUST CONTROL SYSTEMS

Custom-Built

TO MEET INDIVIDUAL PLANT REQUIREMENTS



Exterior and interior views of dust control system at large woodworking plant. Complete system planned, designed, and installed by Liberty Engineers.



No two plants, even in the same industry, are ever exactly alike. That's why efficient, economical dust control is a project calling for *trained engineering experience . . .* the professional "know how" which can literally *tailor* a system to meet the particular needs of the individual plant.

This is the procedure of Liberty engineers—not on some jobs but on *all* jobs. First, the individual dust control problem is thoroughly analyzed. Then a system is expertly planned to fit the job, including selection of the right units—wet, dry, or centrifugal. In these plans, units and structural

work are so located as to avoid interference with work processes and maneuverability. Finally, a complete system is installed and guaranteed by Liberty.

Dust control is too big and important for half-way measures. Don't take chances—get the unbiased facts from Liberty Engineers. For further information, write to:

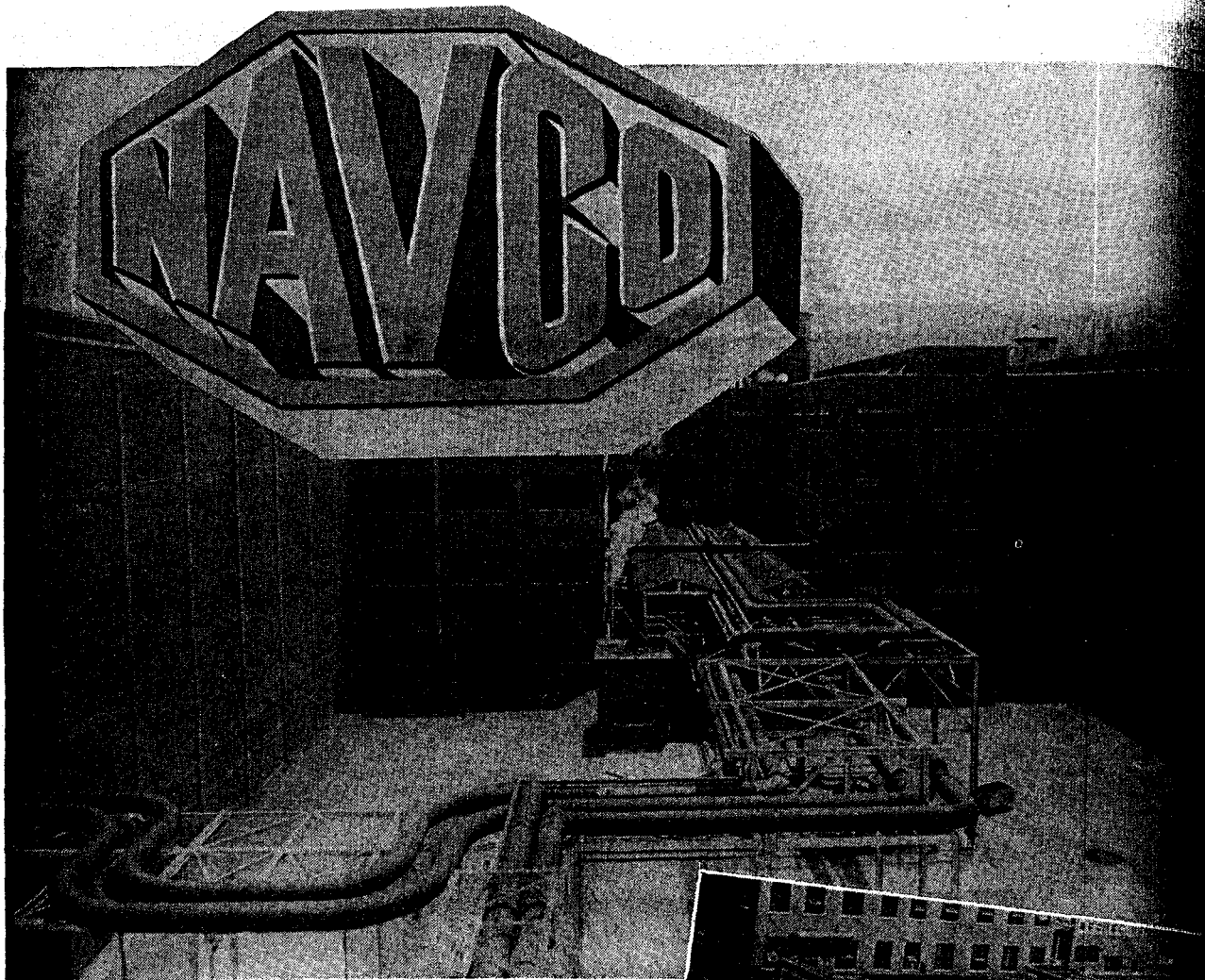
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The difficulties encountered in the fabrication and erection of Central Station and Industrial Piping are many and varied.

The high degree of skill acquired by Navco Engineers from long experience in solving unusual Piping problems is your assurance of economy and safety of operation.

Consult Navco for your next Piping Job.

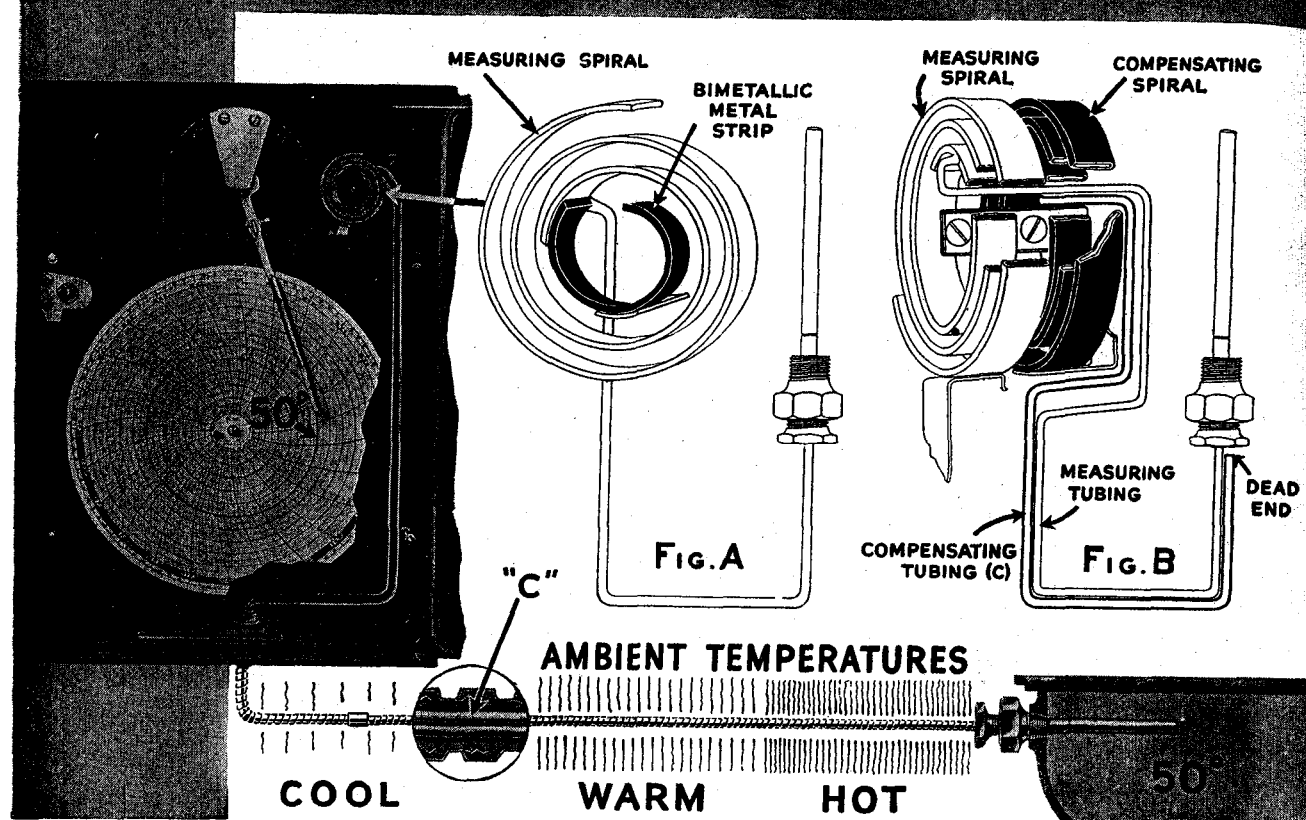


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Compensated for AMBIENT TEMPERATURES



PRECISION Recording or Indicating of true bulb temperature is a built-in feature of Brown Thermometers.

Errors due to ambient temperatures surrounding instrument case and capillary system are compensated for at the point of fluctuation.

Brown Mercury filled Thermometers (Fig. B) have two spiral actuating elements and two capillary tubes. The first, or measuring spiral is connected to the bulb through its capillary in the usual manner. The second, or compensating spiral, is connected to its capillary which is dead-ended at the bulb.

The two spirals expand in opposite directions and are connected directly to the pen shaft. Therefore, a change in temperature within the instrument case itself or at points along the capillary tubing will affect both actuating spirals to the same degree and the results will exactly neutralize each other. Thus, errors are eliminated.

Ambient temperatures have a negligible effect on Brown Gas filled Thermometers. Case compensation, all that is required for precision measurement, is accomplished by a bimetallic strip shown in (Fig. A).

When you install Brown Thermometers you can rely on their precision—be confident of their dependability.

Other features are fully described in Catalog 6706

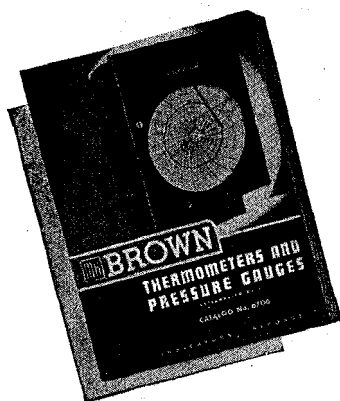
Write for a copy, THE BROWN INSTRUMENT COMPANY, a division of Minneapolis-Honeywell Regulator Company, 4505 Wayne Avenue, Philadelphia 44, Pa. Offices in all principal cities.

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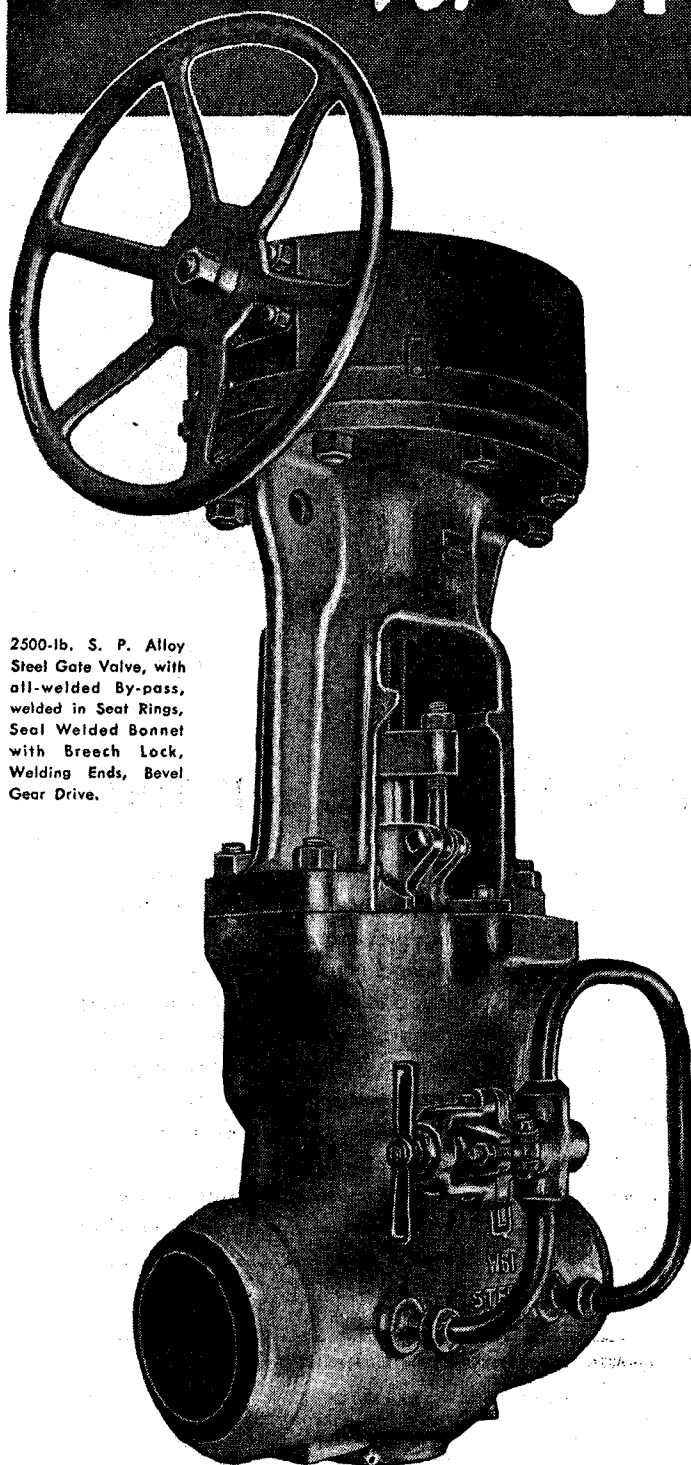


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THERMOMETERS

INDICATING...RECORDING...CONTROLLING

Look to **LUNKENHEIMER** for **STEEL VALVES**



2500-lb. S. P. Alloy Steel Gate Valve, with all-welded By-pass, welded in Seat Rings, Seal Welded Bonnet with Breech Lock, Welding Ends, Bevel Gear Drive.



...This Mark
is Your Assurance
of Highest Quality

• Long skilled in the manufacture of valves and ever responsive to industry's needs, Lunkenheimer pioneered in the development of Steel Valves.

With the application of higher and higher temperatures and pressures, operating conditions became increasingly severe. Lunkenheimer was ready with valves fabricated from materials that met the most exacting requirements.

And as new problems arise, Lunkenheimer metallurgical research, engineering knowledge and specialized manufacturing facilities can be depended upon to aid in their satisfactory solution.

SEE YOUR LUNKENHEIMER DISTRIBUTOR FOR BETTER VALVE SERVICE

Lunkenheimer manufactures a complete line of Bronze, Iron, and Steel Valves, Boiler Mountings, Lubricating Devices and Air Devices. Available from Distributors located in all industrial centers. There is one near you, fully equipped to assist with your (MRO) maintenance, repair and operating problems.

AT THE POWER SHOW — BOOTH 52

See the latest Lunkenheimer design of 1500-lb. S. P. Steel Breech Lock Gate Valves with Seal Welded Bonnet

In Attendance: FRANK P. RHAME, President; HARRY A. BURDON, Vice-President in Charge of Sales; WM. CARSON, Sales Engineer; FRED H. HEHEMANN, Chief Engineer; JOHN W. BOLTON, Chief Metallurgist; ALLEN W. LANDER, Eastern Sales Manager; WM. J. ANGEL, Manager, New York Branch.

THE LUNKENHEIMER CO., Cincinnati 14, Ohio

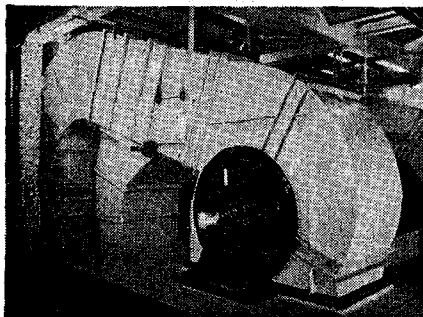
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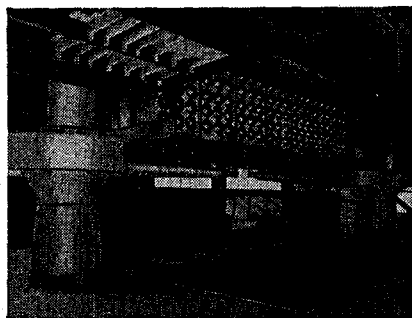


You, too, can crack the whip on THREE AT A TIME!

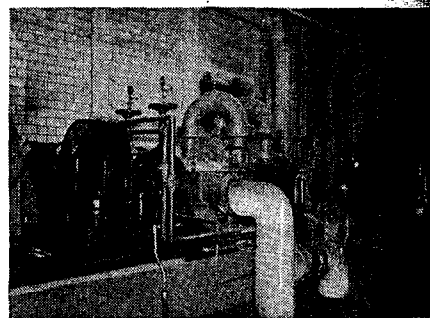
One source for technical information—undivided responsibility—less red tape when you buy all three from ABC! That's the way you can crack the whip on your problems on Mechanical Draft Fans, Fly Ash Precipitators, Variable Speed Control.



1 Mechanical Draft Fans of high operating efficiency and long life are standard with American Blower. Since 1891 we have built fans for many of the leading public utilities and a wide range of industrial applications.



2 Fly Ash Precipitators of simple, but effective design have resulted from our long association with power plants and power plant equipment. American Blower Precipitators have no moving parts, occupy minimum space.



3 Gyrol Fluid Drive was pioneered and introduced to industry by American Blower. Here is the answer to stepless variable speed control for both mechanical draft and boiler feed pump drive—a big help to overall power plant efficiency, too!



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AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

SOUTHERN POWER & INDUSTRY for NOVEMBER, 1946

BOILER LEVEL HELD

$\pm 1/2$ inch

AT EASTERN UTILITY

WITH no pressure control on the constant-speed, motor-driven centrifugal boiler feed pumps, water level is held within plus-or-minus one-half inch in this 675-psi Erie City boiler in service at an Eastern utility plant. Load changes, over a range from 65,000 to 150,000 pounds of steam per hour, mean marked changes in differential water pressure, but the COPES Flowmatic Regulator *automatically* compensates for such pressure variations.

The COPES Flowmatic is a two-element control, responsive to rate of steam flow and to changes in boiler water level. It is recommended for boilers subject to rapid or wide fluctuations in demands for steam. Direct- or relay-operated, depending on the service conditions, it may also be provided with remote control by air, permitting the control valve

to be installed at any desired location with respect to the steam-flow and water-level elements. Independent of all other controls and auxiliaries, it is as *dependable* as the single-element COPES, which has been setting performance standards for more than 33 years. The COPES Flowmatic has now been ordered for more than 1700 plants.

Performance Report, Bulletin 445, tells full story of this utility installation of COPES Flowmatic. Illustrated with a sectional drawing of the boiler and charts showing steam flow, feed flow and water level under typical conditions, it should be in your reference file. Write for it.

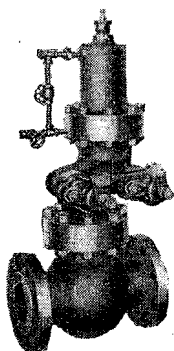
NORTHERN EQUIPMENT COMPANY

1163 GROVE DRIVE, ERIE 6, PENNSYLVANIA

Feed Water Regulators, Pump Governors, Differential Valves, Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS: Canada, England, France. Representatives Everywhere

★ GET CLOSER LEVEL CONTROL WITH **COPES FLOWMATIC**

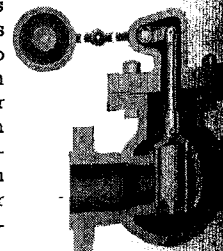


PUMP GOVERNORS

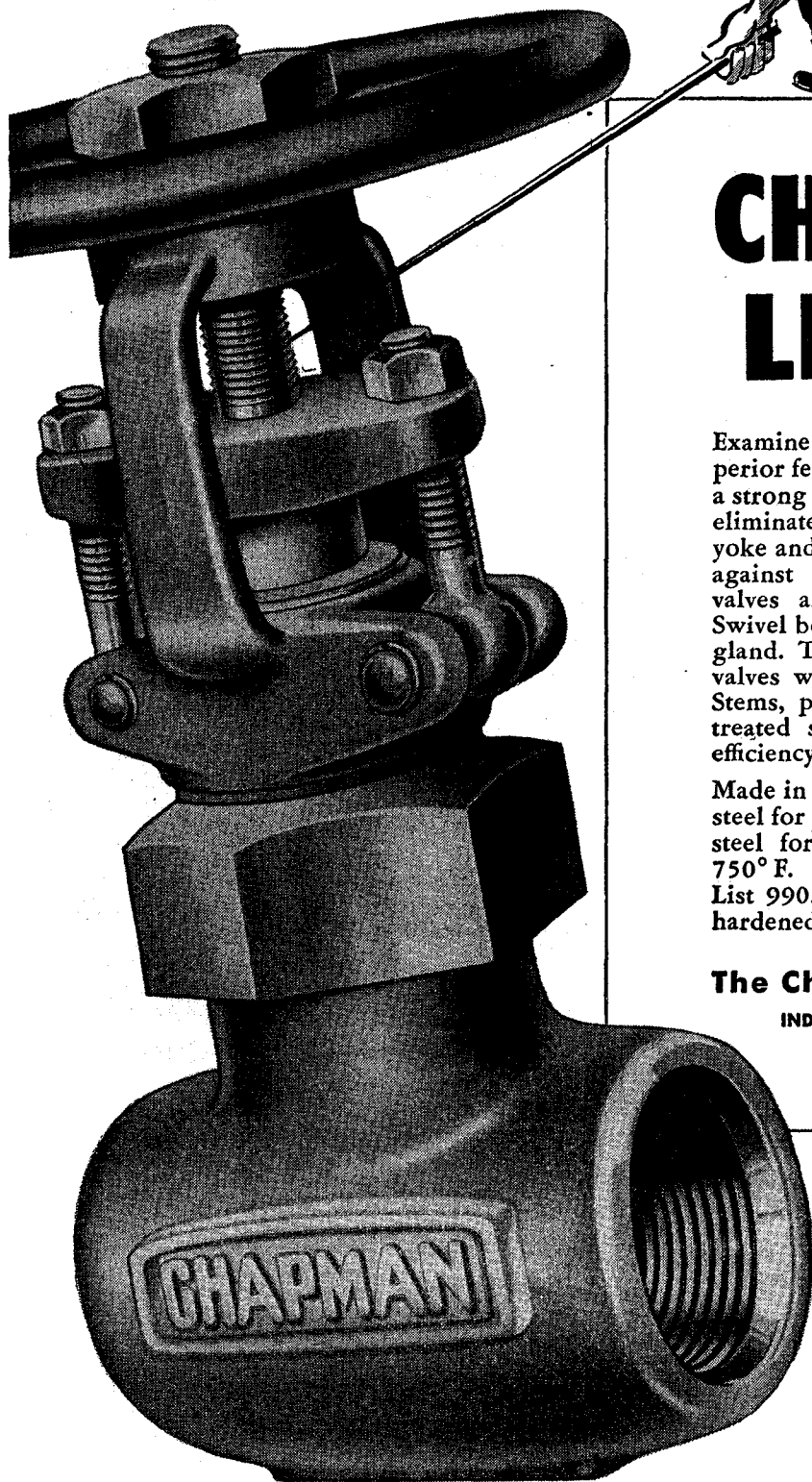
In most installations, especially where the load conditions do not warrant COPES Flowmatic control, good feed water regulation should begin at the boiler feed pumps. *Dependable* excess water pressure control for your feed system, no matter how simple or how demanding your needs, can be provided by COPES engineers. Write—outlining your operating conditions in detail—for their helpful recommendations.

BALANCED VALVES

Many plants have found savings by paying a few dollars more for COPES Balanced Valves for controlling make-up water to feed water heaters, level in open tanks, evaporator flows and other uses. Control is more accurate with the scientifically-balanced, practically-frictionless COPES. Operation continues satisfactory over a longer service life because of rugged construction. Write for data.



This is the way a Good Small Gate Valve should be built



CHAPMAN LIST 960

Examine the List 960, and note its superior features. It has a bonnet fitted with a strong forged steel packing gland. This eliminates exposed threading on the valve yoke and provides dependable protection against rust and corrosion when the valves are used in exposed locations. Swivel bolts are used to hold the packing gland. There are no gaskets to blow as in valves with flanged bonnet connections. Stems, plugs and seat rings are of heat treated stainless steel, insuring greater efficiency in working qualities.

Made in sizes from $\frac{1}{4}$ " to 2" — in carbon steel for pressures to 800 pounds; in alloy steel for pressures to 1000 pounds at 750° F. For higher pressures, specify List 990. Seats and plugs can be super-hardened for extra severe services.

The Chapman Valve Mfg. Co.

INDIAN ORCHARD, MASSACHUSETTS

Vertical transfer between floors.

Dispatch to multiple stations.

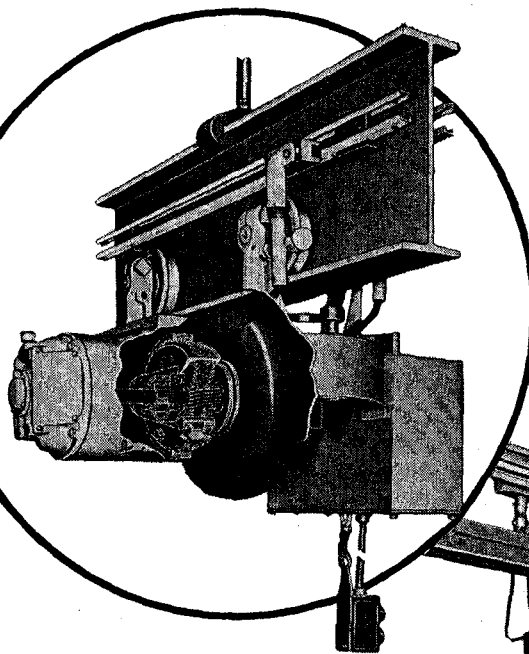
Delivery to fixed stations.

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Selective dispatch between multiple stations.

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American Tary Gear Tractor

American Spur Gear MonoTractor

Automatic Carriers For Overhead Handling

Through the application of simple electrical and mechanical devices, American MonoTractor Units perform automatic operations with extreme accuracy and reliability, saving costly handling labor and supervisory attention.

While unique in many features, such systems are built mainly from standard units. MonoTractors can be applied to carriers operating on any smooth bottom track. An American MonoRail Engineer is available for consultation in every important industrial area.



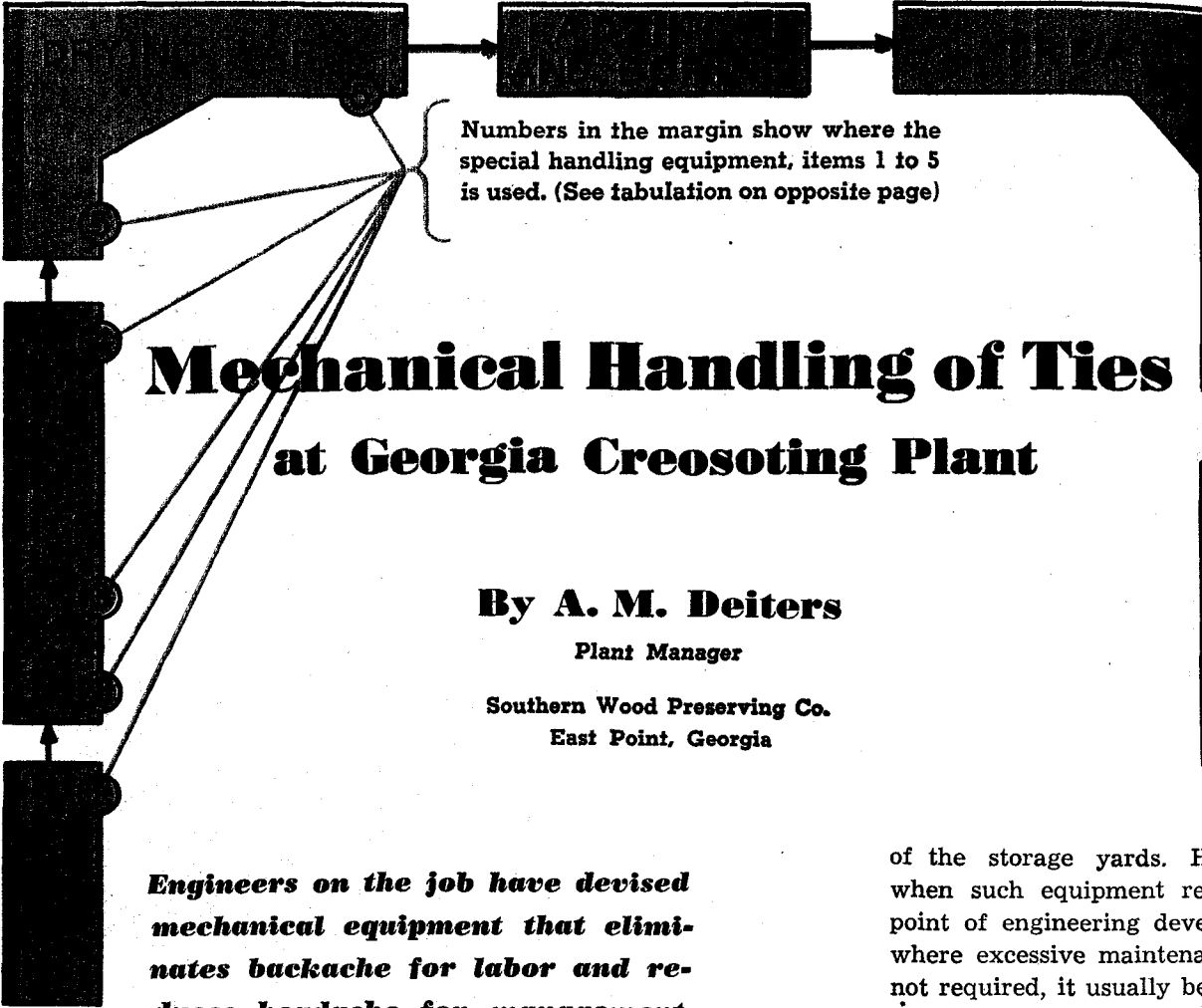
STANDARD
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SOUTHERN POWER & INDUSTRY for NOVEMBER, 1951



Numbers in the margin show where the special handling equipment, items 1 to 5 is used. (See tabulation on opposite page)

Mechanical Handling of Ties at Georgia Creosoting Plant

By **A. M. Deiters**

Plant Manager

Southern Wood Preserving Co.
East Point, Georgia

Engineers on the job have devised mechanical equipment that eliminates backache for labor and reduces headache for management.

THE subject of mechanically handling railroad cross ties at wood preserving plants has long presented a unique challenge to the materials handling engineer. The annual requirement of our railroads is approximately fifty million cross ties, therefore finding a solution to the handling problem is important. During the recent war, manual labor to do this heavy work became almost unobtainable, so studies of the subject were intensified.

Cross tie seasoning yards, covering from ten to one hundred acres, are usually laid out with railroad tracks on 120 foot centers. Green ties are received in box cars, which are spotted on a track opposite the point where the ties are to be stacked for seasoning. Five or six men, working as a crew, carry the ties from the car and place them in ricks at distances up to sixty

feet from the track. Even though these cross ties weigh from 200 to 275 pounds each, it has been common practice for these workmen to carry them—one man to each tie. During the seasoning period, the ties lose about 50 pounds of moisture each, and then they are carried from the seasoning rick back to the railroad track where they are placed on flat cars or treatment trams for transportation to other parts of the plant for further processing. Obviously, only workmen of unusually rugged physique can engage in this work, and it is not surprising that the available supply of such labor has been constantly diminishing.

Until recently, nearly all effort toward reducing the physical labor has been directed toward development of portable equipment which could be easily moved to all parts

of the storage yards. However, when such equipment reached a point of engineering development where excessive maintenance was not required, it usually became so heavy and cumbersome that it was no longer easily portable.

The development of various types of special duty trucks, however, has opened up a new avenue of approach based on the fundamental idea of stacking the ties into complete seasoning ricks as they are unloaded. Equipment for this purpose can be permanently located at one central point, thus eliminating the need of portability.

SPECIAL EQUIPMENT

The system developed at the East Point, Georgia, plant of the Southern Wood Preserving Company, has been in operation since October, 1945. Development of the following equipment was involved:

1. A machine to remove cross ties from cars, and place them on a conveyor immediately adjacent to the car.
2. A chain conveyor along which the ties move as they are cut to length. Space has also been provided to mechanically apply "anti-checking" irons.
3. A spacing table where the ties are assembled in layers, each properly spaced on stringer ties to provide

FIG. 2. BELOW. THE BOX CAR UNLOADER HAS JUST BEEN PLACED IN POSITION TO START UNLOADING A CAR OF CROSSTIES. THE MOTOR AND GEAR REDUCER AT THE REAR OF THE ROOM OPERATES THE LIFT CABLE. THE MOTOR AND GEAR REDUCER FASTENED TO THE PLATE OF THE MACHINE RACKS THE BOOM BACK AND FORTH.

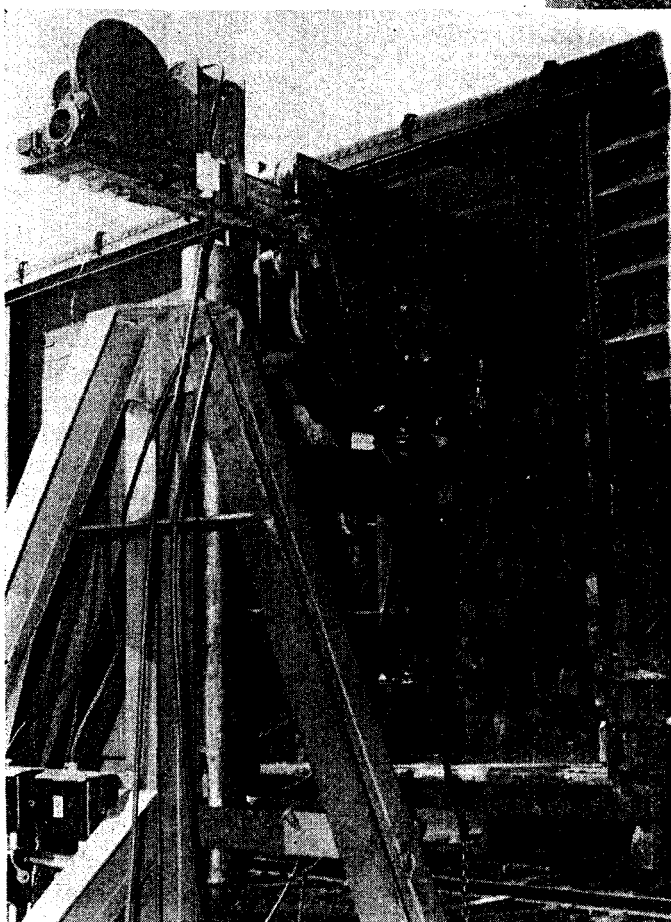


FIG. 4. THE BOOM IS EXTENDED TO PICK UP TIES ON THE NEAR SIDE OF THE CAR. TIES WILL THEN BE PUSHED THROUGH THE OPPOSITE CAR DOOR AND LOWERED TO A TRAM. NOTE THE OPERATOR IN THE FOREGROUND TO THE LEFT IS FREE TO MOVE AROUND AND STILL CONTROL THE UNLOADER.

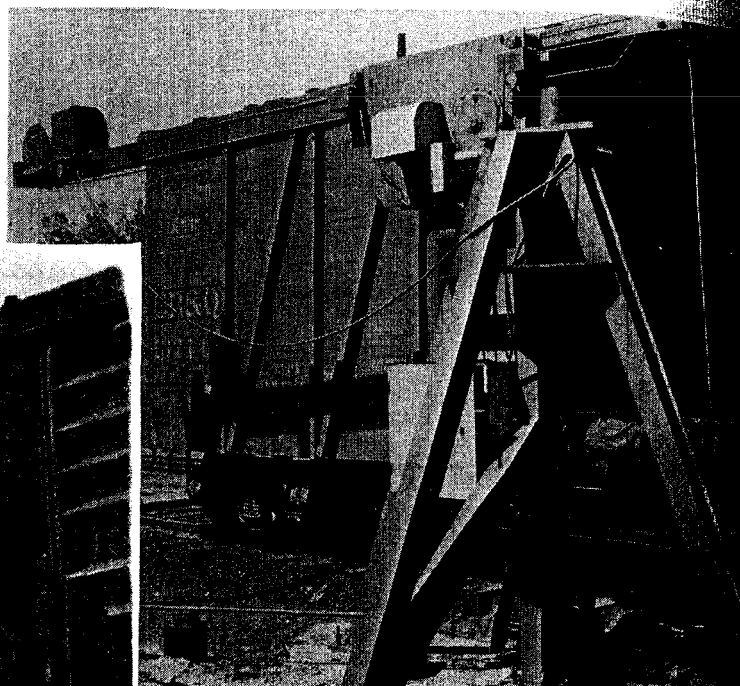
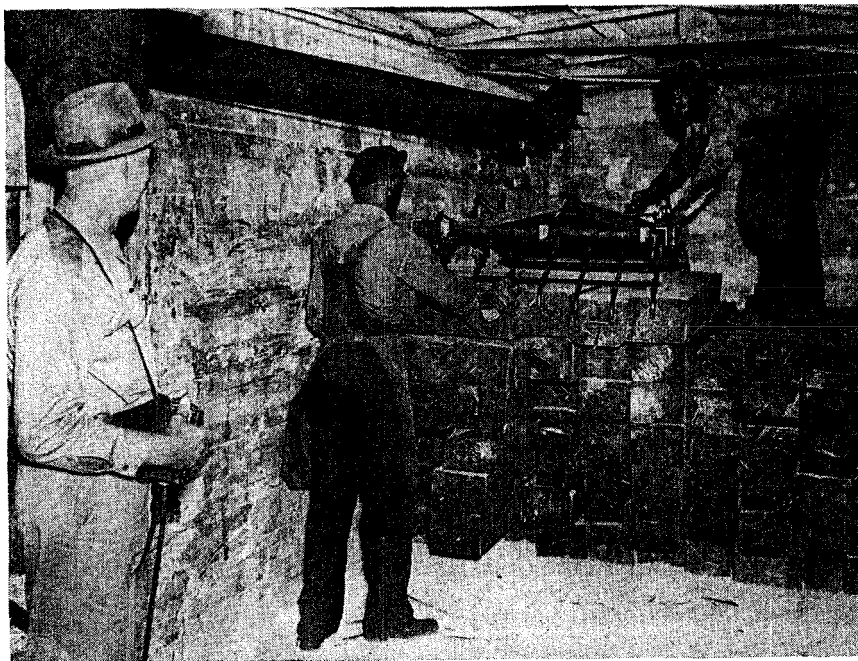


FIG. 3. A VIEW OF THE BOX CAR UNLOADER FOLDED BACK TO CLEAR THE RAILROAD TRACKS.

in the finished seasoning process presents an unusual problem. By means of a system of gravity rollers, power driven chains, guides and automatic stops, this has been accomplished with a minimum of manual labor.

After a layer of ties has been properly assembled with the stringer tie in position to provide air space beneath the layer, it is moved as a unit from the spacing table and placed on a small tram car.

GRAPPLE

It was, of course, necessary to design a grapple to pick up such a unit of ties and this has been worked out that, when the cross-ties come to rest on the tram car, the hooks automatically disengage themselves. The movement of the ties from the spacing table to the tram car is accomplished by a standard monorail hoist of 1½ ton capacity.

Immediately adjoining the central unloading station there is a series of five or six tracks on which the finished ricks loaded on tram cars can be assembled in train-loads. This is advisable because various species of cross ties are involved and ties are received from several different railroads. In this way each track receives only ties that

blocks. Another rick of green ties is then placed in position for the straddle truck to operate, and the procedure is repeated.

To avoid necessity for cross-yard roadways for the heavy carrier truck, an arrangement has been worked out whereby it mounts a special railway tram and is moved to any desired area by the locomotive.

It has been found that with good ground conditions, the straddle truck with a crew consisting of the driver and two ground men can easily handle four or five thousand ties per day.

During three or four rainy months last winter it was necessary to lay treads to support the straddle truck. To alleviate this condition, the truck will soon be equipped with tires of larger diam-

twelve ricks of dry ties has been assembled on tram cars, the switch engine moves them to the boring and adzing machine. At this point, the ties are moved from the rick to conveyors immediately in front of the machine by means of a monorail hoist and grapple similar to the one previously described.

RESULTS AND CONCLUSIONS

This system for handling ties has been in operation since October, 1945. Despite the fact that it involves radical departure from any previous method for handling ties, it was integrated into the overall plant operation without difficulty and all ties have been handled by this method since the first day it was used. Naturally, some minor changes were made,

but the operation has proceeded without interruption. During month of March, 1946, accurate records were kept of the performance of this equipment. Forty-four thousand, nine hundred and ninety green cross ties were unloaded from cars with the following results.

Central Unloading Station

45,905 ties unloaded, sawed to length and ricked on trams.
228 hours operation = 201 ties per hour.
7 men involved at this location = 28.9 ties per man hour.

Carrier Truck

45,905 green ties stored for seasoning.
21,470 dry ties removed from seasoning yard.

67,375 total ties handled.
197 hours operation = 342 ties per hour.
3 men involved in this operation = 114 ties per man hour.

It should be mentioned that the ground was very wet and soft during this period.

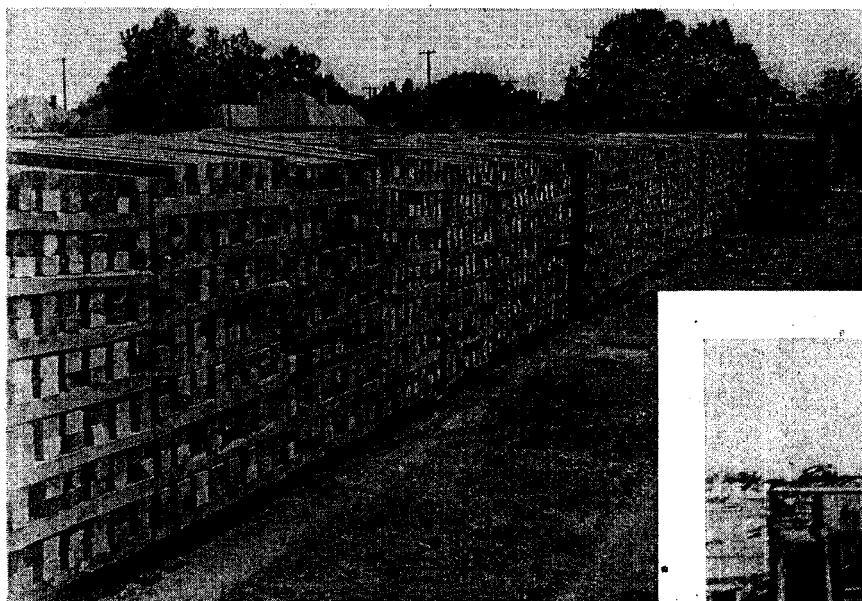


FIG. 8. LEFT, THE CARRIER TRUCK SHOWN AT THE END OF A LONG ROW OF CROSS-TIE RICKS. THE RAILROAD IS OUT OF VIEW AT THE NEAR END OF THE ROW.

FIG. 9. BELOW, A CLOSE-UP VIEW OF THE CARRIER, WITH A RICK OF TIES PICKED UP AND READY TO MOVE.



eter and lower pressure, and four wheel drive is being provided. Work is also being done to provide better drainage, and a small amount of crushed rock is to be placed to support the truck.

HANDLING DRY TIES

After the seasoning process has been completed, ricks of ties are moved back to the railroad track and placed on trams by the straddle truck, this being simply a reversing of the process just described.

When a train load of six to

A Good Lunch Helps

Pepperell Manufacturing Company Is Pleased With Its New Cafeteria For 3,000 Textile Mill Employees At Lindale, Georgia

By Francis C. Smith,

Editor

ALREADY a large mill in 1926, when purchased by its present owners, The Pepperell Manufacturing Company plant at Lindale has developed and grown constantly. As customs and techniques in the textile industry have changed Pepperell has changed—often setting the pace through the efforts of its own active research laboratories.

Much could be written on these technical advances, but this story is about feeding men and women—not machines and materials.

Many of industry's most recent advances have been in connection with employee relations—attitude, comfort, and efficiency of employees on the job. The war emergency did much to show that

many factors previously considered secondary or unimportant exerted a vital influence on plant output. Plant executives (encouraged and aided by government research) quickly found that war production could be improved by such provisions as clean rest rooms, "muscle while you work", and adequate mid-shift lunches. As proof of the

FIG. 1. GENERAL VIEW OF THE DINING ROOM.





FIG. 4. HERE IS WHERE SALADS ARE PREPARED.

none have expressed a desire to go back to snack wagons, soft drinks, bicarbonate, and aspirin tablets.

Prices are reasonable and the well-loaded trays show little indication of penny pinching. The colored workers eat well too in their own dining room where the same services and foods are provided.

Employees are encouraged to consider the lunch hour a recreation period. Smoking presents no objection because the eating place is air-conditioned and the smoke goes right out with the food odors. The whole plant is provided with music and the loudspeakers in the dining room seem especially appreciated.

It is clearly understood that the primary purpose of the cafeteria is to give the employees opportunity to eat good food in pleasant surroundings. Therefore employees who prefer to bring their own lunches are encouraged to eat in the cafeteria and use the tables, water service, etc., without charge. A good many exercise this privilege. No rules have been necessary to eliminate eating at the work spaces and in the aisles. The fact that now all eating is confined to the cafeteria has greatly improved sanitation in the work areas by eliminating improper disposal of food leavings, paper wrappers, etc.

The cafeteria costs the company some money, but management is not complaining. They seem to feel that it is money well spent and that the cost is more than offset by desirable results. Actually it costs the worker an average of about forty-three cents per meal (all meats are fifteen cents) and

this is made possible by the company absorbing all overhead costs: equipment, lights, water, air-conditioning, etc. Right now the prices charged do not quite pay off the food and labor expense, but the management thinks they may break even when more experience is gained. Of one thing they are certain, however, there will be no letdown in quality; they will continue to buy the best of foods and cook and serve them properly.

If you insist on talking about details the management will point out such benefits as ten percent reduction in absenteeism, definite improvement in efficiency, better health records, and higher employee morale. But they much prefer to simply say they are very happy about their restaurant venture and let it go at that. They think the intangibles, such as smiling faces and fellow employees enjoying a good lunch, outweigh dol-

lars and cents returns.

Many of the employees have been at Pepperell a long time (1641 out of a total of 3000 have service buttons showing over 10 years). And the managers have been there a long time, too. Most of the department heads and executives worked up from operators and mechanics. So you see they understand each other at Pepperell and that also helps make the taste good.

PRINCIPAL EQUIPMENT

Cooking—Electric and Steam

- 3—Open top electric ranges
- 7—Electric baking ovens for meat
- 1—Unit of four baking ovens for bread
- 2—Frying kettles (90 lb of fat)
- 1—Three tier steam pressure cooker for vegetables
- 1—Fifty-gallon jacketed kettle for soups

1—Power mixer

Salad Center

- 1—Salad table with cold pans
- 1—Salad sink
- 1—Power mixer
- 2—Refrigerators

Service Counters

Two counters, each as follows:

- 2—Meat pans (steam bath)
- 4—Vegetable holders (steam)
- 1—Soup server (steam)
- 1—Cold pan (½ ton ref.)
- 1—Ice cream dispenser
- 1—Cold drink service place
- 1—Coffee urn

Dish Washing:

Located on opposite side of space from cooking and serving. Dishes never go to the kitchen. Completely equipped with water, garbage disposal, driers, and

REFRIGERATION CAPACITY

Service

- Air Conditioning -----
- Bakery -----
- Salad Room -----
- Meats, Vegetables, Dairy Products -----
- Freezing Room -----

Total

FIG. 5. THE WELL EQUIPPED BUTCHER SHOP.



possible until these things have been done; any other plant layout should be regarded as temporary.

Process Cards

Prepare a manufacturing-process card for each important product or group of similar products, showing each machine needed and the time required for set up and fabrication. Determine the number of machines required for the assumed output. An allowance for lost time is necessary. This will vary with company methods, but 20 per cent is not unreasonable. Some companies have much less lost time.

Such charts cannot be safely prepared from memory; the engineer should follow each product through the plant, and note in great detail what happens to it. Compare operations and time on a rush order with routine orders. Study each card for possible changes in process through use of new machinery or different methods that will reduce labor costs or time in process. Look for simpler methods such as power-driven hand tools or for a grouping of machines that will permit one operator to serve several machines. Do not hesitate to operate an expensive machine 24 hours daily in order to justify its use. Analyze the possibility of separate departments for large quantity products.

Conveyors Cut Costs

The use of conveyors to move material from one machine to another will often reduce space and time in process. Consider such conveyors as scraper, belt, roller, platform, bucket, monorail, screw, and elevating. Chutes are sometimes possible. Between two slightly different levels, an elevating platform may be helpful. Automatic delivery to different floors or to roller conveyors should not be overlooked. Packing tables whose height can be quickly adjusted by push button will make bending unnecessary for employees. Any long-distance travel of material should be questioned. Determine the possibility of using pallets or skid platforms with hand or electric-lift trucks. Consider the use of tote boxes that nest and are designed to hold a given number of parts. Tote boxes can also be built

as pallets. See that material to be processed is delivered at the work level.

It may be possible to do certain work while material is in progress from one machine to another on a conveyor, such as inspection, grinding, spray painting, chipping of fins, drying, or preliminary assembling. There are other tricks the engineer will consider.

One way to pick up lost time is to make up a chart on each im-

portant machine that shows what is being done by the operator, the helper, and the machine during a cycle. A help in the preparation of such charts is a time chart on the machine that shows idle and operating time. Keep an eye out for bottlenecks, excessive time for tool sharpening, intermediate storage, lack of stock, and time taken to load machines. Any reduction in lost motion will permit reduction in inventory.

Section II

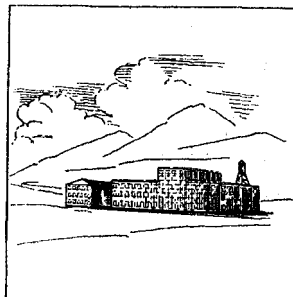
Picking the Site

TOO often, assumed limitations as to land available and as to location of streets, railroad trackage, and existing buildings are not examined critically. Frequently, more land can be obtained

at reasonable cost, topography can be smoothed, streets can be closed, trackage can be moved, and buildings can be torn down or moved. The possibility of moving the plant or a part of it to a new location should not be overlooked as labor available elsewhere may be more varied in character, better in quality, or cheaper. Again, freight rates may be lower, sales territory may be closer, raw material may be cheaper, and larger site may be possible. Other factors to be considered include better water supply, greater ease in waste disposal, raw-material supplies, taxes, and transit facilities. Decentralization of manufacturing is sometimes a solution to many problems. It may be obtained by each of several small plants making all products or only one or a few products.

Advertising Signs

An important detail in the layout of the plant is the locating of the buildings in order to get an attractive appearance from railroad, highway, and the air. The placing of the company's name on the



buildings should not be overlooked as an important advertising medium by day and night. It is often possible to get the proper signs to avoid possible conflict. What is countered here is the direction of prevailing winds, for an

dust from railroads or highways might cause troubles. Roadway coal handling, and ash disposal are sources of dirt in the plant grounds. These are factors in this problem of orientation of buildings.

Code Limitations

Inquiry should be made of insurance companies as well as municipal, state, and Federal authorities as to any codes in connection with hazards from dust, fire, explosion, fumes, corrosion, humidity, and electricity that might limit layout, force separate buildings, or control the design of buildings, piping, ducts, wiring, and similar items. The same common sense applies to any requirements for toilets, lockers, wash-rooms, drinking fountains, shower baths, fire exits, fire walls, enclosed stairways, cafeterias, or assembly halls. Racial segregation in toilets and similar facilities is required in some localities.

Local conditions as to foundation limitations, hurricanes, tornadoes, earthquakes, high river water, and extremes of rainfall

nothing is gained by chasing up and down stairs.

Financial Department

The various divisions of the financial department present no problem. Numerous, noisy accounting machines are extensively used in it and should be placed in a soundproof room, separate from other activities. The room should have its walls and ceiling finished with sound-insulating material for the benefit of the employees working there. Conference and directors' rooms may have to be provided. Partitions probably should be avoided except for the offices of key executives. As many of the partitions as possible should be of glass in the upper half.

Dimensions

Office buildings with 11 or 12 ft ceilings, with columns 15 or 16 ft apart, and long and narrow with a maximum width of about 60 ft. are most satisfactory in pro-

viding office space, daylight, and ventilation.

Recreation Facilities

Provision should be made for any recreational facilities that may be desirable. Even if not installed immediately, plans for their future use should be made. There is an increasing tendency in manufacturing companies to supplement local recreational facilities with company-owned bowling alleys, baseball diamond, swimming pool, dance hall, movie house, boxing ring, and similar sources of good employee relations. Decision on these facilities should be made before starting a plant layout. A site set aside for them is desirable, and may require a building.

Large plants have even gone to the extent of setting up nurseries for the children of female employees and shopping centers for busy workers. Decision on the latter facility should be with the expectation that prices are to be as low as obtainable elsewhere.

Justification, however, can be found occasionally for the multi-story building but when used, heavy machinery should be placed on the ground floor. Too much emphasis, particularly where land is cheap, has been given to the advantages of gravity flow. Power required to raise materials is usually more than required to overcome friction in moving horizontally.

Flow-Line Charts

Flow-line charts should be made showing existing and proposed movement of the various important products. A summary for each product should show distance travelled and time and labor required. Time studies are often necessary. A composite chart showing, with colored pencils on white prints, the movement of all important products will be helpful in obtaining improvements. Where more than one floor is involved, isometric diagrams are desirable.

Templets

Templets of all equipment, desks, benches, and cabinets should be made of various colored cardboard to the scale of 1/5 inch to one foot. Radial drills, for example, can then be quickly distinguished from lathes. Mark on each templet the serial number, type, and size of machine, and the position of operator, of belt or motor drive, and of starting control.

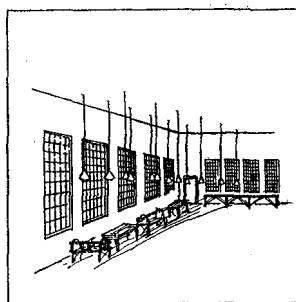
These templets should be located correctly to scale on cross-section tracing paper, or cloth equivalent to K. & E. 334½ T and 282½ G, or 288 G, with ten divisions to the inch. They may be held in place with map pins, thumb tacks, Scotch tape, paper cement, or wire staples. Overhead conveyors can be represented by pasting strips of colored, transparent paper in place. When locations have been approved, the outlines of the templets can be drawn in and white prints made. Each division on the print will represent six inches and thus clearances available are obvious at a glance. Further study can be given the layout by drawing colored lines to show movement of material.

Types of Flow Charts

Two types of flow-line charts should generally be tried. One type

Section IV Manufacturing Area

THE most active manufacturing department should get prior consideration in laying out a plant. This department will vary with the products made and might be the machine shop, foundry,



forge shop, wet building in a starch plant, cell building in an electrolytic plant, and so on. It might well be given a separate building with other departments grouped around it as feeders or receivers. A flow-line chart should be made showing the various departments in as direct a line as possible. Provision should be made for new buildings or extensions to old buildings. If several products are of varied nature, a composite flow-line chart

can be developed with colored pencils on a white print. Width of pencil lines can be varied as in a highway-traffic chart to bring out the dollar value of labor in the various products. Do not be content

with one or two layouts, a noted designer of industrial plants claims to have made as high as 34 layouts for one plant before selecting the one best layout.

One-Story Building

The one-story building has numerous advantages in low first cost and in low operating cost through saving in supervision, in space wasted for stairways and elevators, and in operating cost of elevators.

department. A separate stores department for purchased-finished or semifinished parts such as bolts and screws, may be desirable. Space for the storage of spare motors, belting, and miscellaneous repair parts should be provided. Its location near the maintenance department is desirable. The finished store room should be near the shipping department. Small plants will consolidate some store rooms in order to reduce operating overhead. Arrange to stock and ship material in as large units as possible in order to reduce handling.

Maintenance, Tool, and Inspection Departments

The maintenance department should be near that factory section where most repair work may be anticipated. It should be used by electricians, pipe fitters, and millwrights.

The tool room should be located, if possible, to serve more than one department, but more than one tool room may be necessary; cost of attendance should be balanced against the waiting and walking time of employees in determining the number of tool rooms.

Location of inspection departments will depend on product made and extent of inspection necessary. Inspection in transit from machine to machine is possible. The raw-material inspection and testing should be near the receiving department and raw-material stores. The final testing department should be near the finished stores and the shipping room.

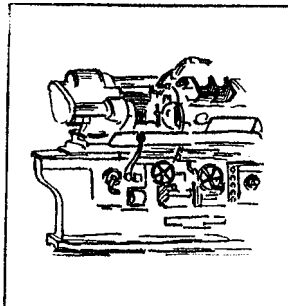
Balconies

Foremen's and production manager's offices should be so located that shops may be supervised without the appearance of doing so. Balconies may be used for offices, light manufacturing, training of new employees, research on new products, or even storage.

The best use of a balcony or mezzanine floor is frequently for toilets, wash rooms, and lockers. Such facilities should be distributed about a plant so employees can reach them easily. Lockers should be so set on concrete curbs that refuse cannot accumulate under them or behind them and the rooms should be provided with benches. Forced ventilation for lockers is desirable.

Section VI

Equipment



SCALES, measuring devices, meters, hand or electric-lift trucks, portable roller - conveyors, hand-operated hoists and trolleys, and even travelling cranes are necessary equipment for receiving and shipping departments. The exact equipment selected will depend on materials to be handled. Many carload shipments will make a track scale desirable. Electric-lift trucks are frequently advantageous in loading and unloading freight cars, particularly where the use of skid platforms and pallets has been standardized. Space must be provided for the storage of the trucks when not in use and for their charging station. Ramps instead of elevators are desirable for trucks and possible trailers but the angle of inclination should not exceed 6° to $7\frac{1}{2}^{\circ}$, or possibly 10 per cent. The route used by them should be as direct as possible.

Efficient Packing

Cartons, shredded paper, glue, and labels should be arranged for the convenience of the packer in reaching them without moving from position. Material to be packed should reach the packer by trucks, on conveyors, or through chutes. Several lines of parallel roller conveyors at right angle to the packer's table and behind him are valuable in preliminary sorting and delivery of material to be packed.

Stencils should be filed in cabinets in order department or shipping room and, where repeat customers are involved, should reach the packer with the order.

Crating material on incoming supplies can often be reclaimed advantageously and reused. Provision for reclaiming should be made in the receiving department, and the

reclaimed material should be stored by width and length on racks in the shipping department. Cut-off and rip saws and single - spindle bore may be required for crating lumber.

Store Rooms

Scales, measuring devices, portable conveyors, hand and electric lift trucks, hand-operated hoists and similar equipment are needed in store rooms, depending on material to be handled. Cut-off saws and shears are also necessary in order that only exact quantities of metals requisitioned may be passed out. Desks and filing cabinets for storeroom clerks are, of course, necessary as well as doors with spring locks and counters over which material may be passed out.

Storage Facilities

Shelving and bins should be at right angles to wall, in parallel rows, and of equal length in order to conserve space. Main aisles should be wide enough for trucks and sub-aisles should be wide enough for two men to pass. All bins should be multiples of a unit size and spacing between shelves should be some multiple of an assumed unit distance. Racks for steel rods and piping are necessary in such number that classification is possible by length or size and kind.

Paint, oil, solvents, and similar dangerous products should be kept in a special store room that is separated from the rest of the factory by fire walls and fire doors. A separate building is frequently desirable.

Lumber should be stored on racks to prevent warping. The racks should be located so that lumber can be put in them through doors from outside the factory.

which has been determined by a fiat decision or an appropriation. If a company cannot erect the complete plant at one time, spread the building program over a period of years on a definite plan.

Sound reduction is desirable even in the shops. Machinery may be mounted on pads, and walls and ceilings may be covered with sound-insulating material.

Power Cost

An analysis is usually necessary to determine whether power shall be purchased or generated. It is beyond the scope of this article, but possibilities can be indicated.

Where no large amount of process steam is required, power can be generated with Diesels. The cooling water and exhaust gases from them can be used in connection with a waste-heat boiler to develop steam for process and for heating the plant. Peak demands for steam can be met with the use of supplementary fuel on the boiler. About 3000 Btu per brake hp can be usually recovered from the Diesels but as high as 5000 Btu are possible by raising the temperature of the cooling water. A manufacturing plant in a cool climate, as an approximation, is likely to require for heating, assuming one shift daily, about 0.8 lb. of steam per degree day per 1000 cu. ft.

Where considerable process steam is needed, the use of back-pressure or condensing and bleeding steam turbines is usually a possibility. Steam from the turbine goes to process and heating, and power can be developed frequently for about $\frac{1}{8}$ or $\frac{1}{4}$ cent per kw. hr.

The size of the power plant required in relation to the proposed factory will indicate whether a separate building to house it is desirable. The power plant, in any case, should be located centrally to the loads upon it for steam, compressed air, high-pressure water for fire protection, and electricity in order that the transmission lines required may be short. Consideration is necessary as to delivery of fuel and its storage and to the disposal of ashes.

Light and Power

Light and power lines should be designed for possible plant expansion

as well as for possible larger motors on some machines. Ducts are available where connections to machinery can be taken off at almost any point. These ducts permit, at small expense, the rearrangement of machinery that is certain to be required in time by changing business conditions. Numerous panel boxes will be helpful. Each machine should have its own stop-and-start push button. The distribution circuits should be split up so the entire shop will not be down for one short. Provide for high intensity of illumination, at least as much as 50 foot candles, on fine machine work, fine assembly, and drafting. Intensity as high as 500 foot candles may be required for color matching. Remember that production will be considerably higher with good illumination. Consider the use of glass block in addition to steel sash in increasing daylight illumination. Consider also the use of heat-ray-removing glass in south, east, and west walls. Paint walls and ceilings a light color or white to increase reflection. Paint equipment with soft colors such as yellow and green for eye-ease.

Building Details

Annunciator and call stations, as well as time clocks, are required for convenience of employees. Soundproof telephone booths are needed in the shops. Drinking fountains should be iced and located within short walking distance of groups of employees.

Provide for fire protection with high-pressure water lines, hose, reels, hose carts, fire extinguishers, automatic CO₂ tanks, fire pump, elevated water tank, sprinklers, fire-alarm boxes, and similar facilities to the satisfaction of the fire insurance company.

Watchmen's key stations should cover the entire plant with a minimum of walking and with the approval of the fire insurance company.

Windows in any monitors should be electrically operated.

Outlets for cleaning and washing machinery should be not over 50 ft apart. Compressed-air, steam, water, vacuum, oxy-acetylene, hydrogen, and gas-fuel lines should be placed in roof trusses of one-

story buildings so changes can be made easily. Another possibility is in a tunnel down the center of building, but arrange draining of the tunnel.

Heating

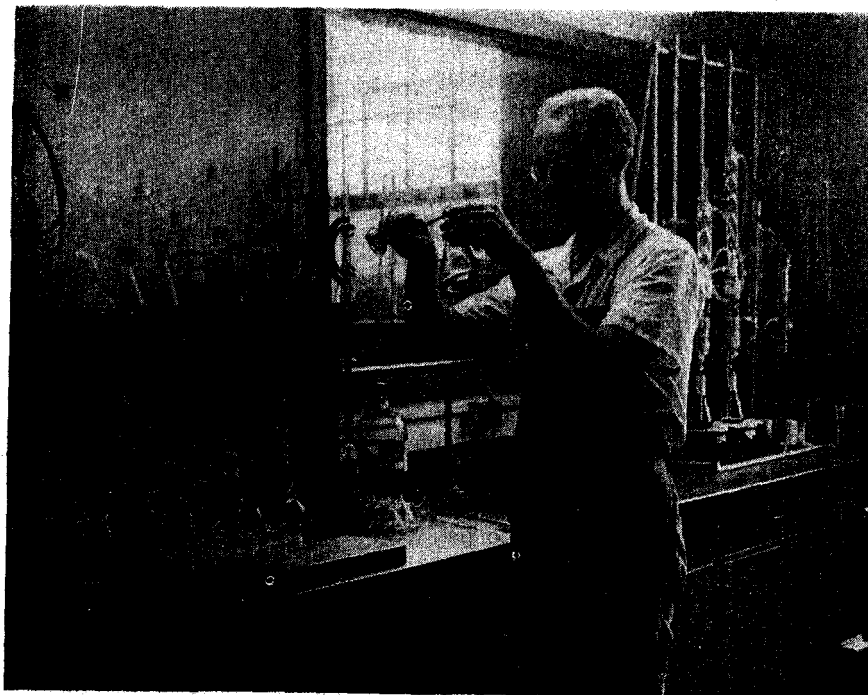
If air conditioning is contemplated at some future date, design building for its eventual installation at minimum cost. Consider possible use of glass block building walls with windows for light and not ventilation can be supplied by forced ventilation with use of air filters. Heating can be by blast unit heat supplemented by low-pressure steam for small plants and for hot water for large plants.

Roof and Floors

The roof should be insulated for reduction of heat in summer and of heat loss in winter. Concrete floors should be sloped to drains and coves built at base of walls for ease in cleaning with water and steam hose. Wood blocks or rubber mats over the concrete are easy on employee's feet. Lay floors on top of concrete if possible for light and clean manufacturing. Watch out for special floor requirements for acids or alkalis. A heating room, for example, will require special flooring. Surface concrete floors should be given special treatment to reduce dust and dusting. Steel floor plates should be used where trucking is heavy and frequent.

Choice of Building Type

Industrial plants should have few columns as costs and layout permit. Spans should be less than 20-25 ft. and may be as great as 150-300 ft. A high floor is a big help in rearranging machinery for economy of installation and movement. Steel or forced-concrete structural is usually specified for a factory building. Skill in design of forced concrete will usually pay costs about as low as structural steel and brick. Mill-building construction with wooden beam columns and brick walls is usually the cheapest and, with sprinklers, for some types of manufacturing.



DR. F. W. HAYWARD OF THE INDUSTRIAL RESEARCH INSTITUTE OF THE UNIVERSITY OF CHATTANOOGA CHECKS PROGRESS ON CANDY IMPROVEMENT.

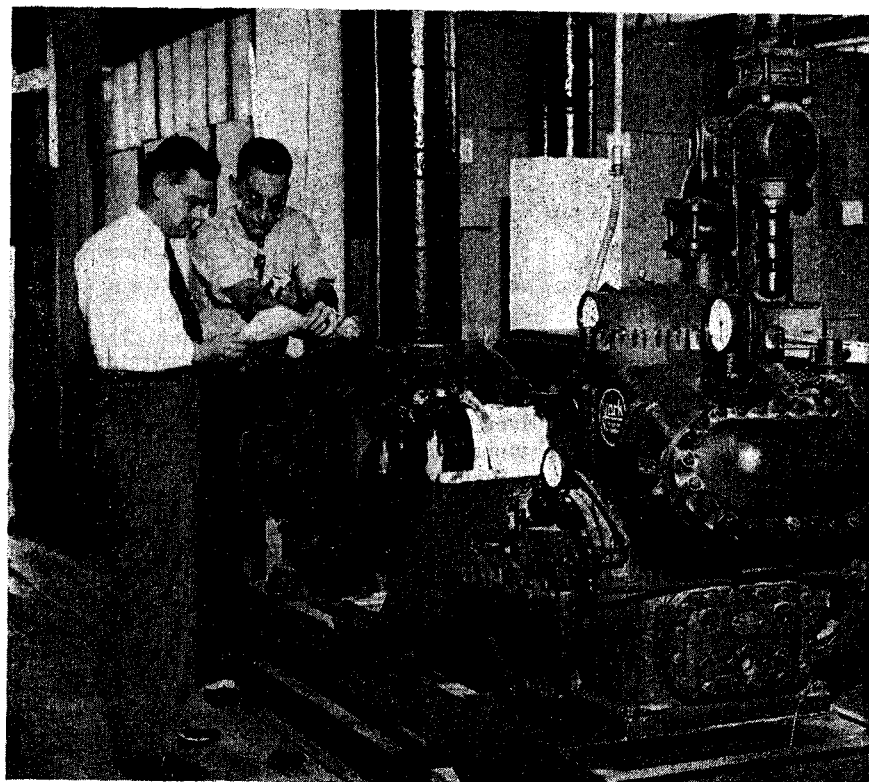
Progress In Candy Making

By

R. A. Brock
Brock Candy Company

and

F. W. Hayward
Industrial Research Institute



THE Brock Candy Company of Chattanooga, which has been in continuous operation since September 1, 1909, has grown to be the South's largest candy manufacturer and one of the leaders in the industry. At present, this company serves over 3,000 jobbing accounts in seventeen states.

At the outset, the Brock products were principally high grade bonbons, chocolates and a few bulk goods. Later on, the line was expanded to include assorted penny goods, Easter and Christmas specialties and packaged marshmallows. Until war conditions forced their discontinuance, great quantities of chocolate cordial cherries were so manufactured.

At the beginning of World War II when conservation of raw materials was mandatory and our armed forces needed large quantities of candy bars, the Brock Candy Company cooperated with the War Food Administration and converted its production to five and ten cents packages. A large proportion of its allotted raw materials was used for manufacturing of chocolate covered nut rolls and chocolate covered fudge bars. At present, these bars, hard candies, gum drops, and marshmallows are the principal products of the company.

Since the beginning of World War II, the supply of sugar, corn syrup, and chocolate has been very short. On the other hand, an almost unprecedented demand for candy has developed. Consequently, candy production has been controlled by the supply of raw materials rather than by plant capacity or consumer demand. During this time every effort was made to maintain the quality of the finished products.

During this post war period while production was still limited by material shortages, the Brock Candy Company has undertaken an extensive modernization program. Thus, the Company will be prepared for planned expansion.

W. B. REILLY, VICE PRESIDENT (LEFT) AND R. A. BROCK, SECRETARY (RIGHT) DISCUSS THE BROCK CANDY COMPANY DISCUSS OPERATION OF COMPRESSING UNIT FOR AIR CONDITIONING SYSTEM.

the packing rooms, no troubles of this type have been observed. The candy may be quickly packaged in its original fresh condition and shows no tendency towards sticking. Prior to the conditioning of the shipping room, many chocolate products had to be sent to cold storage until cars were available. It is now possible to keep them in the shipping room until they can be placed in refrigerator cars. In this way, the expense of cold storage and extra handling costs is avoided.

The most surprising result of air conditioning is the improvement in machine efficiency which has been noted. In hot, humid weather, sticky candy stuck to the wrapping and packaging machines until they would not function properly. Production line shutdowns of an hour or more occurred while the machines were cleaned so they could be used again. Since the installation of air conditioning, these delays no longer occur, and these same machines run without interruption from morning to night.

Air conditioning has already proven its value to the Southern candy manufacturer by increasing production efficiency, promoting worker morale, and improving product quality.

X-Ray Inspection

Foreign material of any kind is always objectionable in food products. Every possible precaution is taken during the process of manufacture to prevent contamination of the finished product. Each defective piece of candy constitutes a potential consumer complaint against the producer with its attendant unfavorable publicity.

Peanuts, as a result of the methods used in their cultivation and harvesting, usually contain relatively large amounts of small stones and pellets of clay. The greater portion of this material is removed by screens, mechanical separators, and hand picking but, in spite of the utmost precautions, certain stones which resemble peanuts in size, density, and appearance escape detection and are consequently included in the finished product. The X-Ray equipment recently installed by the Brock Candy Company is of great value in the detection of such defective can-

dy bars.

In this process, the wrapped candy bars, in trays of twelve, are conveyed through a darkened booth where they are observed by the inspector as they pass over an X-Ray source. The pieces of stone or clay appear as black spots in the bars. Any tray containing a stone is mechanically rejected from the production line by means of a lever operated by the inspector. At the end of the day, these bars are individually inspected, the defective bars thrown out.

Since the installation of X-Ray inspection, an appreciable number of stones have been detected daily, and by their removal the consumer is assured of receiving a product of highest quality.

Control Laboratory

Until quite recently, most candy factories have operated with little or no technical control. Chemical laboratories were formerly un-

known to the industry, and operations were run by rule of thumb methods. The candy manufacturer depended entirely on the reliability of his supplier for quality and uniformity of raw materials, and process control was based on the judgment and techniques of skilled candy makers. Quality was measured mostly by consumer reactions as reflected in sales volume. This method of operation works only when raw materials of uniform quality are available and when there is a high turnover in experienced staff. However, it takes years of practice for an inexperienced candy maker to develop into a skilled craftsman, and such men are difficult to replace. Today, when few are interested in spending years to develop the techniques required by a skilled candy maker and when the uniformity of raw materials is

(Continued on page 80)

OPERATOR INSPECTS BOXES OF CANDY BARS IN X-RAY BOOTH.



tion of dust by classifying the response into four groups. These are:

(a) **Pneumoconiosis**—The dusts producing this type reaction are harmful only when inhaled. The principal materials producing this type reaction are free silica and asbestos dust. On inhalation, these two materials produce specific lung pathology and from the standpoint of disability, present the most important of the dust exposures.

(b) **Toxic Reaction**—(As poisoning by lead, cadmium or radium) These materials produce harmful effects when taken into the body both by inhalation and ingestion. With reference to lead and its compounds which may be present in the atmosphere as particulate matter, it has been fairly well established that entrance into the

body by inhalation is more important mode of entry than the same material taken by mouth. This is primarily due to the fact that when such materials are taken into the body by inhalation, the major portion is taken into the blood stream, whereas, a considerable part of that taken by mouth is removed by certain organs of the body.

(c) **Metal Fume Fevers**—These conditions result from the inhalation of finely divided fume particles. The importance of metal fume fever has been brought to the attention of industry by the great amount of welding which has been an important industrial tool for the past few years. Where burning or welding is done on surfaces which have been galvanized, the problem of metal fumes becomes immediately important.

This is also a problem in foundries where the pouring of brass is done.

(d) **Allergy**—This type reaction is in general produced by pollen and certain organic dusts.

Common Industrial Dusts

Carbonates are usually combined with either calcium or magnesium. They normally occur in nature as calcite and magnesite or as dolomite, which contains both magnesium and calcium carbonate. Limestone and marble contain considerable amounts of these carbonates. Some of the materials from which cement is made.

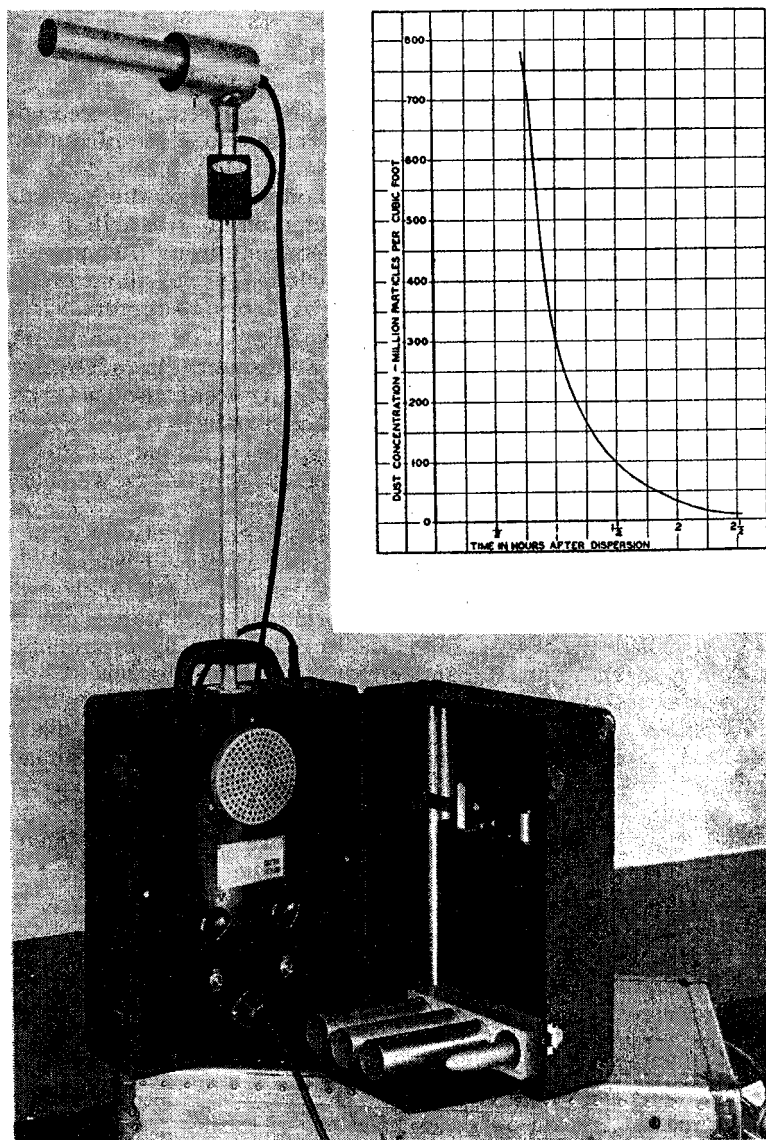
Due to the solubility in body fluids, these materials are removed when taken into the body by inhalation. The presence of carbon dioxide in such fluids is an important factor influencing the solubility. The same thing applies to the presence of carbon dioxide in water which comes into contact with these materials. In the presence of carbon dioxide the carbonate is converted to the more soluble bicarbonate, thus adding to the ease with which it is removed by solution.

Experimental and practical observations on carbonate dusts indicate that these materials are not harmful when taken into the body by inhalation. This is probably due to the fact that they are easily removed due to their solubility.

Sulfates are common industrial materials and this general class may be illustrated by gypsum which is calcium sulfate. This is a common material and is widely used in many industrial operations. It is generally considered that this type material is non-toxic and does not present any particular problem from a health standpoint.

Oxides vary considerably in their physiological reactions. The general nature of the reaction will be dependent on the metal from which the oxide is derived. Where such metals are specifically toxic, as would be the case with arsenic or lead, a specific toxic reaction could be expected from the inhalation of the oxide. However, other oxides appear to be relatively harmless, particularly where the metal is of a non-specific type. This is the case with iron oxide. The mining of iron results in the exposure of a great number of men to the oxides.

FIG. 2. THE ELECTROSTATIC PRECIPITATOR AS USED FOR COLLECTING ATMOSPHERIC SAMPLES OF DUST AND FUMES. INSERT SHOWS RATE OF SETTLING OF DUST.



persed system. For the collection of dust samples, several instruments may be employed.

Much of the early work done on the control of silicosis in the mining areas of South Africa was carried out with the Konimeter. This instrument has been used some in this country, however, it has not met with the popularity which is enjoyed by certain other methods. From the standpoint of collecting efficiency, the electrostatic precipitator is probably the choice instrument, however, most of the work done on correlating atmospheric dust concentrations with medical findings has been based on samples collected and counted by the Greenburg-Smith technique. The collecting device employed is an impinger unit which samples at the rate of one cubic foot per minute.

Counting by this technique is done under light field. The percentage of free silica in a dust sample is usually determined by either chemical or petrographic methods.

Permissible concentrations of dust have been established for free silica, asbestos, and other materials. For both silica and asbestos, 5 million particles per cubic foot is considered as maximum working concentration. The U. S. Public Health Service has suggested a procedure by which the total dust concentration in millions of particles per cubic foot is multiplied by a percentage of free silica. If the resulting figure is more than 5 million particles per cubic foot, the condition is considered unsafe. If less than 5 million, the condition is considered safe. There should be considered certain limits of dustiness for any type of dust,

whether it be merely a nuisance value or health consideration. To most industrial hygienists, 50 million particles per cubic foot is the maximum atmospheric concentration of dust under which an employee should work. It should be pointed out that the only way of determining both the nature of the dust and the actual concentration is by direct sampling and similar procedures for the counting of dust.

Case History

MANY industries having problems of dust control recognize the existence of such problems to varied degrees. Some take passive attitudes, while others apply sound engineering procedures which result in a real job of dust control. Such modern engineering methods are used by the LeTourneau Company of Toccoa, Georgia.

This particular plant manufactures heavy road grading equipment and its major dust problem lies in operation of a foundry for the protection of basic steel parts. It is interesting to note that this Company considers the control of dust as a part of the general overall production schedule and as a result has its control methods integrated into general plant operations.

Although there are several methods which can be used for control of dust, ventilation, both in the form of general and local exhaust, probably offers the most satisfactory method and it is this approach which has been used by the LeTourneau Company. For general ventilation in the foundry,

two 15-foot fans are installed which handle 500 thousand cubic feet per minute each. Actually the material removed by these fans is made up principally of smoke rather than true dust.

Two electric arc furnaces are operated and these are equipped with roof fans located immediately above the units. These fans handle 60 thousand cubic feet per minute each. Again, the major portion of the material coming from the arc furnaces is smoke rather than true dust, and comes from the alloy and flux material charged into the furnaces.

A problem of dust control in any foundry is the shakeout operation. This is particularly true where shakeout is mechanical and handled on a vibrating screen or grate. Here, a line conveyor system is used to bring the casting directly to the shakeout grate. A canopy type hood is installed immediately over the grate itself. In addition to canopy, side enclosures are provided which prevent air leakage. The fan serving this hood delivers 35 thousand cubic feet per minute, which results in a high capturing velocity at the entrance and discharge ports. An excellent job of dust control results on this particular operation.

Sand conditioning in many foundries is a dusty job. With the LeTourneau Company this is handled by means of local exhaust ventilation and three bag type filters handling 6 thousand cubic feet per minute each. Tumbling operations for cast cleaning are also provided with local exhaust ventilation.

(Continued on page 80)

FIG. 6. LOCAL EXHAUST ON TUMBLERS FOR CAST CLEANING.

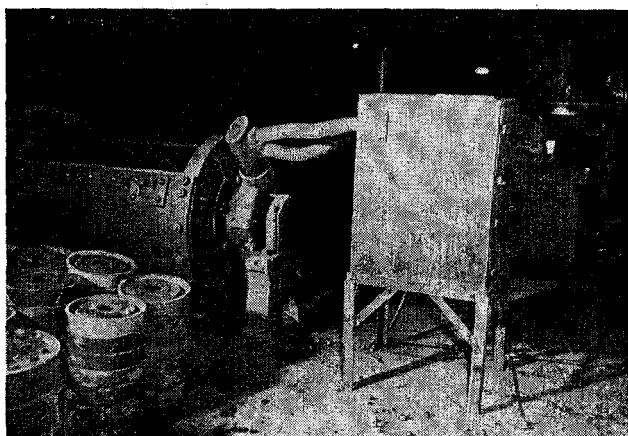
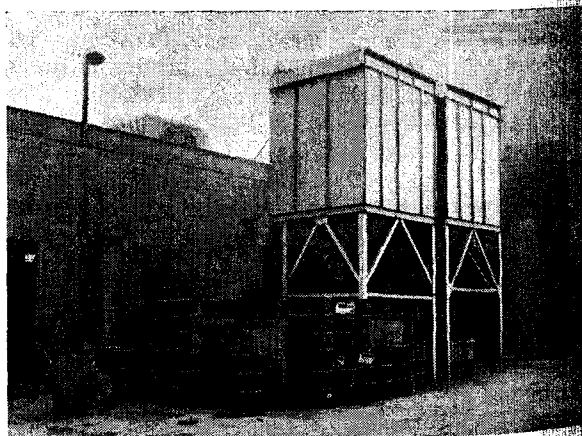


FIG. 7. BAG HOUSE AND SAND BLAST UNIT FOR CAST CLEANING.

Courtesy LeTourneau



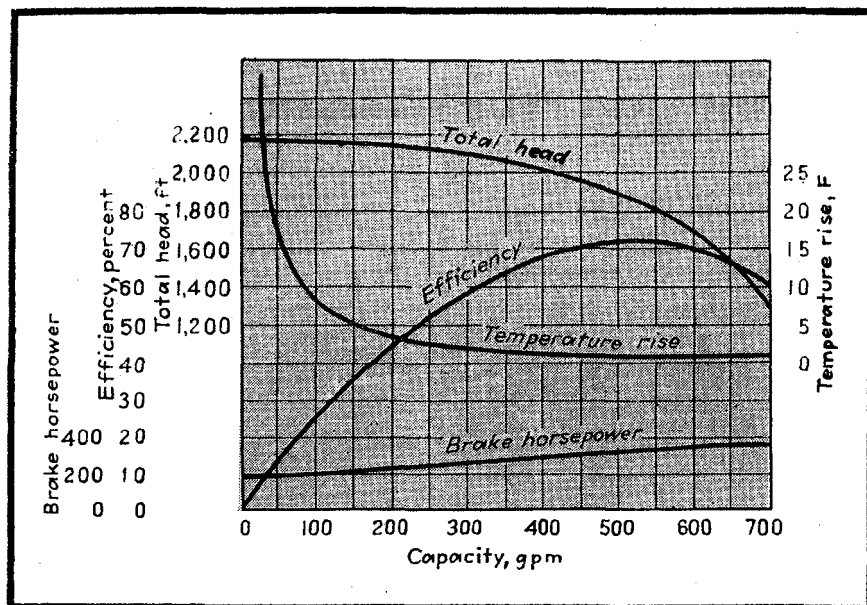


FIG. 2. PERFORMANCE CHARACTERISTICS OF A 500 GPM, 1800 FT HEAD, BOILER FEED PUMP.

formula and permits, in addition, the determination of the minimum permissible capacity, once the maximum permissible temperature rise has been selected.

The chart can be used to plot a temperature rise curve directly on the performance curve of a centrifugal boiler feed pump, as shown on Fig. 2, which represents the characteristics of a boiler feed pump designed to handle 550 gpm of 250F feedwater against a total head of 1800 feet. It will be seen that the temperature rise increases very rapidly with a reduction in flow, for the losses at low deliveries are greater, while

the total flow which must absorb the developed heat, is low. Thus, it will be seen from Fig. 2 that for a capacity of 50 gpm, the temperature rise is 18F while, at the full capacity of 550 gpm, it is less than one degree.

If the boiler feed pump is of a type which is fitted with a balancing device such as a balancing disc or drum, a certain portion of the suction capacity is returned to the pump suction or to the direct contact heater at the pump suction. The discharge capacity of such pumps does not represent the true flow taking place through the pump. The formula and the chart

on Fig. 1 can still be used, however, provided that a corrected value is used for the efficiency. This correction automatically takes care of the discrepancy between the apparent capacity (discharge capacity) and the true flow.

$$e = e_p \left(\frac{Q + Q_d}{Q} \right)$$

Where e is the corrected efficiency, e_p is the pump efficiency, Q is the capacity at pump discharge, and Q_d is the capacity of the balancing disc leak-off.

EXCESSIVE TEMPERATURE

Since boiler feed pumps are generally called upon to operate in a very wide load range, all the way from practically shut-off to full load, the problems involved in the operation of a feed pump at light loads are of an extremely important nature and must be treated with this in mind.

It is almost common knowledge that a pump operated at shut-off would soon over-heat and fail. Specifically, the various effects of an excessive temperature rise in a boiler feed pump are as follows:

1. Excessive expansion at the balancing joints and ultimate binding and seizing of adjacent parts of the pump which are designed to operate with a definite clearance.
2. Ultimate decrease in the pressure margin over flashing in the first stage impellers and consequent cavitation and binding.
3. In the event that the pump incorporates a balancing device, the vapor pressure of the heated water in the balancing chamber at the exit from the balancing device may rise to the pressure existing in the pump with consequent flashing in the relief chamber and possible even in the balancing device itself.

All of these effects undoubtedly shorten the life of the various component parts of the boiler feed pump if allowed to be carried to an extreme. Therefore, to protect the pump from the damage incidental to an excessive temperature rise, precaution must be taken to avoid operation of the pump at abnormally low flows. Inasmuch

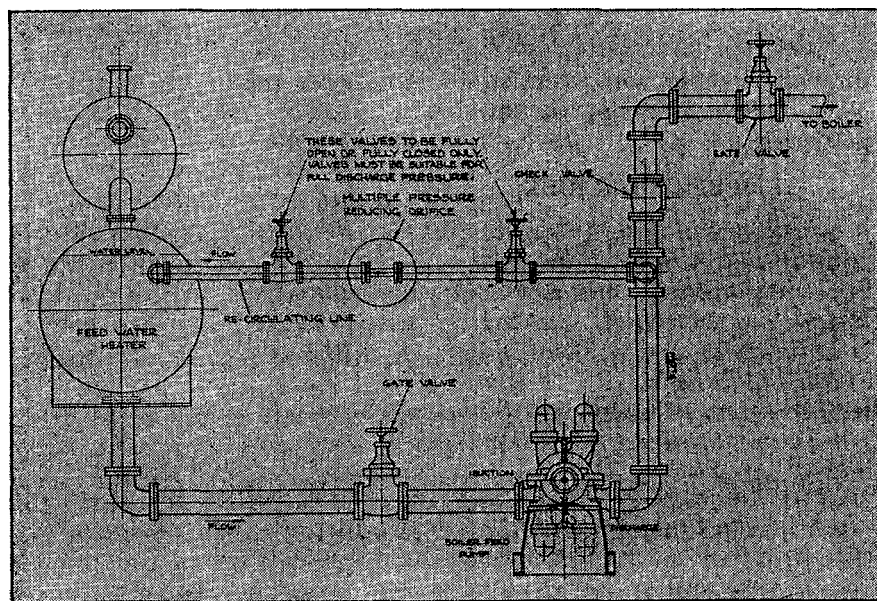


FIG. 3. ARRANGEMENT OF MULTIPLE PRESSURE REDUCING ORIFICE BASED ON MANUAL CONTROL OF BY-PASS.

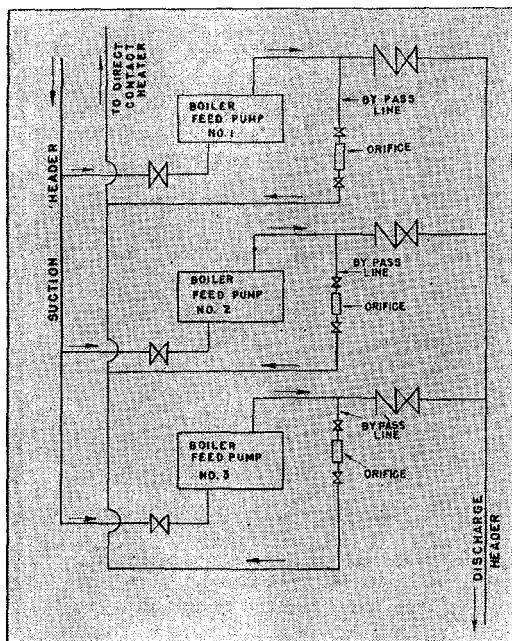
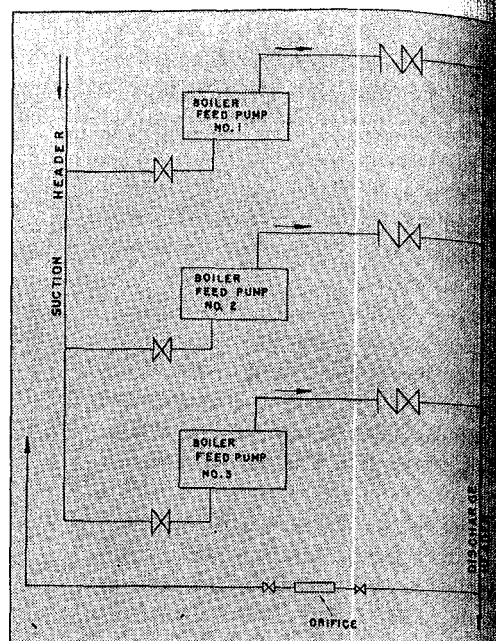


FIG. 6-A. CORRECT INSTALLATION OF BY-PASSES FOR A GROUP OF 3 BOILER FEED PUMPS.

FIG. 6-B. INCORRECT ARRANGEMENT. THIS BY-PASS INSTALLATION DOES NOT PROVIDE PROPER PROTECTION.



will do the rest.

As a short cut, it may be also stated that the minimum capacity should be held to approximately 30 gpm for each 100 bhp at shut-off. Thus, on Fig. 2, the brake horsepower at shut-off is 200 hp and the minimum permissible capacity becomes

$$30 \times \frac{200}{100} = 60 \text{ gpm.}$$

ARRANGEMENT OF BY-PASS

In the event that the boiler feed pump takes its suction from a direct contact heater, it is necessary to return the by-pass recirculating line back to the heater rather than

directly to the suction line of the feed pump. This avoids a cumulative effect of the temperature rise and allows the recirculated feedwater to mix with the feedwater held in the storage space of the heater. Thus, the heat increment received in the boiler feed pump is passed into the heater, and the temperature of the feedwater entering the pump suction cannot exceed the saturation temperature corresponding to the heater pressure. The recommended arrangement is shown in Fig. 3. It will be seen that the by-pass line originates ahead of the discharge gate valves and check valves. Normally, it should be introduced into the

heater storage space at a point below the minimum water level. This is done in order to reduce the noise caused by the flashing of the returns to steam. However, if the feedwater is withdrawn from an intermediate stage of the pump, passed through a closed heater, and re-admitted to the pump, the by-pass return should be admitted into the steam space above the maximum water level. With this arrangement, the entrance into the heater should be adequately baffled.

Since the feedwater in the recirculation line is under a pressure corresponding to the pump discharge pressure, it is necessary to locate a throttling orifice in this line, the physical dimensions of this orifice determining the amount of recirculation through the by-pass. The orifice must be designed on the basis of the minimum flow through the pump.

The arrangement illustrated in Fig. 3 is based on a manual control of the by-pass. Two valves are used, one on each side of the orifice. One of these valves usually remains open and is closed only to isolate the orifice during inspection or renewal while the pump and heater are in operation. The second valve is the control valve and should always remain in either a wide open or completely closed position to avoid unnecessary wear.

When the discharge pressure ex-

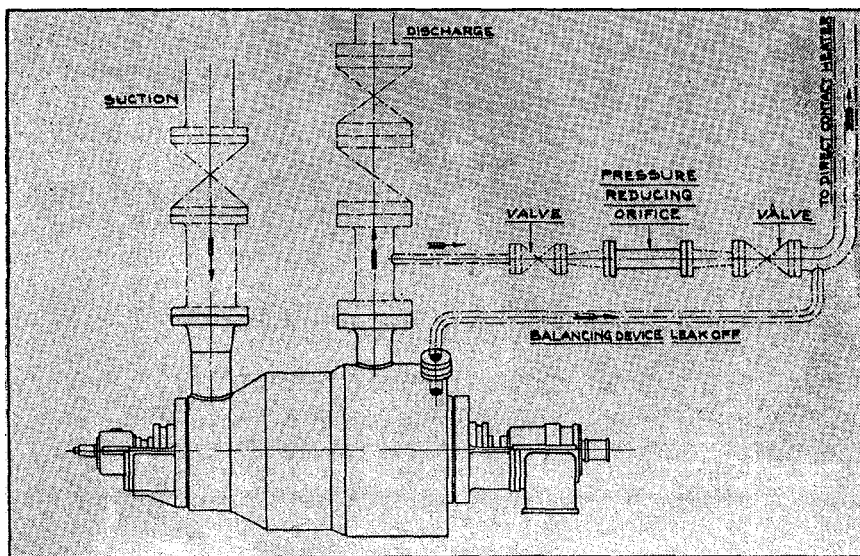


FIG. 7. BY-PASS AND BALANCING DEVICE LEAK-OFF ARRANGEMENT.

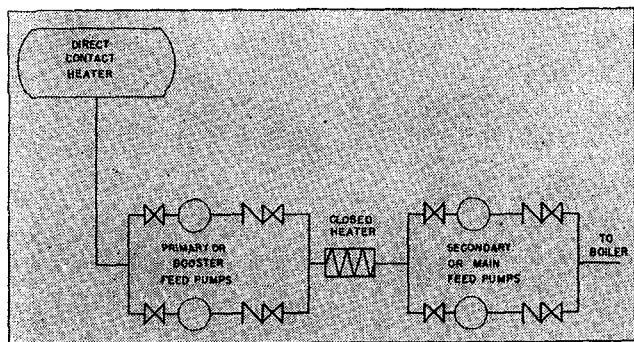


FIG. 8. IN SYSTEMS OF THIS TYPE, BOTH BOOSTER AND MAIN FEED PUMPS REQUIRE INDIVIDUAL BY-PASS PROTECTION.

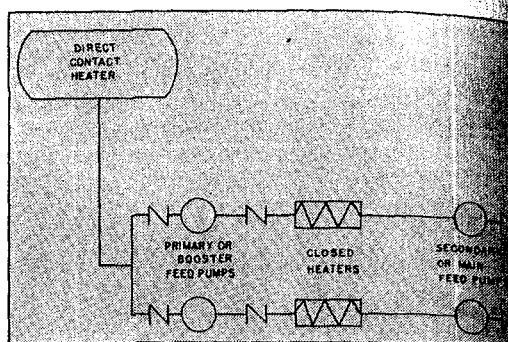


FIG. 9. WHEN BOOSTER AND MAIN FEED PUMPS ARE OPERATED AS SINGLE UNITS, A SINGLE BY-PASS MAY BE USED.

ceeds approximately 300 psi, a throttling device comprised of a series of orifices is advisable for the double purpose of reducing wear of the individual orifices and eliminating the excessive noise incidental to the high pressure drop through a single orifice.

For low pressure application, the orifice can be manufactured from a stainless steel rod, bored to size, and placed in the by-pass line. Fig. 4 shows the performance of such an orifice, and the recommended installation is illustrated on Fig. 5. The length of pipe to be installed beyond the orifice itself is intended to allow for a gradual dissipation of the velocity energy in the flow issuing from the orifice, while the pipe plug at the end of the length of pipe permits renewal of a part which ultimately wears as a result of the jetting action of the high velocity flow.

When an installation involves several boiler feed pumps, each of these must be provided with its own by-pass ahead of its check and gate valve, as shown in Fig. 6-A. The use of a single by-pass orifice, starting from the common discharge header as shown in Fig. 6-B, would provide no protection if the total flow was reduced, and one of the pumps developed a high enough discharge pressure in excess of another pump's to close its discharge check valve. Of course, the individual lines may be manifolded on the downstream side of the pressure reducing orifice.

If the boiler feed pump is provided with a balancing device, the leak-off from this is generally returned to the direct contact heater at the pump suction. The leak-off and recirculating lines may be

manifolded in order to reduce piping, as shown on Fig. 7. It may be unnecessary to warn the power plant operator against manifolding these lines ahead of the pressure reducing orifice. Such procedure would lead to complete failure of the pump immediately upon opening the by-pass control valve, since this arrangement would impose pump discharge pressure on the balancing device relief chamber, and the balancing device would become inoperative.

Theoretically, when two pumps are operated in series, only a single by-pass is necessary, provided the recirculation is returned to a point in the boiler feed cycle located ahead of the first, or primary pump. The amount of the by-pass is determined by the operating conditions of the main or secondary feed pump, since the latter is generally developing a greater pressure than the primary feed pump and requires more heat dissipation at low flows. However, a certain amount of care must be exercised when several primary pumps are operated in parallel so that no condition may arise so that the check valve or gate valve of one of the primary pumps becomes closed while the pump itself is running. For this reason, it is generally recommended that, unless the primary and main feed pumps always operate as an integral unit, the primary feed pumps be provided with their own by-pass protection.

Certain difficulties may arise in connection with the disposal of the recirculation feedwater from the pump by-pass when the boiler feed cycle is such that the feedwater is deaerated in the condenser, and no direct contact heater is used. The

by-pass must then be returned to the condenser itself although it may be possible to accomplish the by-pass at the boiler pump suction, provided a pressure changer is located in the recirculation line to lower the temperature of the by-pass to that at the pump suction. Since, in such a case, there is generally a closed check valve between the condensate pump and the boiler feed pump and, therefore, the condensate is at a temperature appreciably lower than that of the recirculation, the cooling medium in the heat exchanger may well be the condensate itself. Thus, the heat from the by-pass is regained just as if the by-pass were discharged into a direct contact heater.

In determining the size of the heat exchanger required, it must be remembered that the boiler feedwater is throttled from discharge pressure down to a pressure approximately equal to the suction pressure and that a temperature rise accompanies the drop of pressure through the pressure reducing orifice. This temperature rise in degrees F can be expressed as:

$$dT = \frac{H}{778}$$

where H is the total head in feet.

The temperature at the exit of the orifice is equivalent to the saturation temperature, plus the temperature rise in the pump itself and the rise through the throttling orifice.

BY-PASS ON STANDBY PUMPS

Under normal conditions, when the boiler feed pumps are operating at average loads, the by-pass

lines in the discharge of the individual feed pumps are held closed. However, whenever there exists the possibility that the pump may be operating at light flows or when the pump may operate against a closed check valve, the by-pass valve should definitely be open. The recirculating lines should be opened on all the pumps involved whenever it is expected to switch from one of the main feed pumps to the standby pump.

If the switching operation is carried out manually, the operator should open the by-pass valve on the pumps prior to bringing the standby pump on the line. After normal conditions have been re-established, the by-pass is closed. If, on the other hand, the standby pump is operated automatically, provision must be made for the by-pass to be open at the proper time.

This can be achieved by leaving the by-pass valve open on all pumps while they stand idle. If the by-pass leads to the direct contact heater from which the pump takes its suction, no flow takes place through the by-pass, since no pressure differences exist in the circuit to cause this flow. If the by-pass leads to a lower pressure point in the feed cycle because of the absence of a direct contact heater, the flow which will take place is very small, as a result of the lower differential, compared to the flow which takes place under normal operating conditions. In order to understand this clearly, it is necessary to remember that a throttling orifice is always located in the by-pass line, the physical dimensions of this orifice determining the amount of recirculation through the by-pass.

A numerical example will best illustrate the effect of the prevailing pressure differential on the by-pass flow. It will be assumed that the pump in question is designed to handle 300,000 lbs per hour of 300F feedwater against a discharge pressure of 1200 psi. It will be further assumed that the suction pressure, including the vapor pressure, is 75 psi gage, and that the pump discharge pressure at shut-off is approximately 1375 psi. There is no direct contact heater in the feed cycle, and the recircula-

tion returns to the condenser so that the pressure differential across the throttling orifice is about 1390 psi. In order to limit the temperature rise to 15F, the size of the orifice will be such that with a differential pressure of 1390 psi it will pass approximately 45,000 lbs per hour. If the pump is standing idle and the by-pass valve is open, the differential pressure across the orifice is reduced to 90 psi, under which conditions the total flow which takes place is approximately 10,000 lbs per hour, which is a relatively small flow. Incidentally, this flow can readily fulfill the functions of the warm-up flow generally recommended for standby pumps.

In the event that the recirculation by-pass is operated automatically, the problem disappears altogether, as the by-pass remains open as long as the pump is idle and is not closed until the flow through the pump reaches the desirable minimum.

AUTOMATIC CONTROL OF BY-PASS

Within the last few years, power plant operators have indicated a growing interest in automatic control of the by-pass, especially in high pressure installations where the trend is towards automatic control of all the phases of operation. This involves some sort of actuating mechanism which will open and close the by-pass at the proper time. The mechanism itself must be subjected to an impulse governed by the flow through the boiler feed pump, a great number of impulses being available for this purpose. The most frequently used automatic arrangement is based on a flow meter control.

The operation of the flow meter control is quite simple. A flow meter element is located in the pump suction or discharge line to operate two mercury switches. The contacts are so adjusted that the first contact completes the circuit on a decreasing flow but permits no by-pass until the second contact has been made at a still lower flow. This provides an overlap to prevent hunting as the interval between the two contacts exceeds the amount of the by-pass flow and as the circuit is not brok-

en until the total flow has increased to a value above the point of the first contact. The circuit is made to operate a solenoid valve admitting air pressure to the control diaphragm of the by-pass valve itself.

Because the orifice used to measure the flow induces an appreciable pressure drop, and located in the pump suction would act to reduce the available positive suction head, it is recommended that this orifice always be located on the discharge side of the pump.

BY-PASS LOSSES

There frequently arises the misconception that the excess expenditure of power resulting from operating the pump with the by-pass open is equivalent to the by-pass capacity expressed in percentage of the full load capacity. This is entirely incorrect, as an analysis of Fig. 2 will disclose, as it has been stated, the by-pass flow for this pump should be 45 gpm, it corresponds to 10.9% of the full load capacity of 550 gpm. At the same time, the increase in power consumption between a capacity of 100 gpm with by-pass closed and 160 gpm with by-pass open is only 15 hp, or less than 1% of the full load horsepower. In addition, it must be realized that a direct comparison of the power consumption at two flows does not provide a correct evaluation of the loss incidental to the operation of the by-pass. In order to establish the real amount by which the use of a by-pass decreases the net productivity of a steam power plant it is necessary to determine the amount of heat wasted at any capacity corresponding to the sum of the original capacity and the by-pass flow. The differentiation between "power consumption" and "heat wasted" is based on the concept of the "thermodynamic efficiency" of a boiler feed pump contrasted with the nominal straight power consumption efficiency. The former concept credits the boiler feed pump with the heat generated within the pump after correcting this heat on the basis of the thermal efficiency.

(Continued on page 123)

Labor Turnover

By Philip Panfield

A few simple rules, intelligently applied, will decrease Labor Turnover and improve industrial relations.



LABOR turnover is one of the most serious problems facing American business and industry today. The importance of labor turnover is to be seen in the cost involved. Every new employee introduced into an establishment represents a definite cost, whether or not he develops into a skilled and profitable worker. If he proves to be a "floater" or has been put on the wrong job and has to be retrained or replaced, his cost to the company increases still further.

The cost of labor turnover has not been worked out for all lines of industry, but these figures, for the ladies' apparel industry, will give some idea of what it costs an employer to break in a new employee:

Advertising	\$ 0.40
Hiring and clerical work	0.60
Instruction	2.50
Wear and tear on machines	5.00
Loss in production.....	20.00
Spoiled work and mistakes	10.00
Accidents	2.00
	\$40.50

Thus, before a new employee has any value to a plant engaged in the ladies' apparel industry, he represents an outlay of \$40.50. Which, of course, is money lost unless that employee stays on.

How can a manufacturer de-

termine what his turnover is and check it against the average for his industry?

One simple formula is as follows:

Let R = replacements.

Let M = the average number of employees at work during the period.

Then, the turnover, T, can be determined as

$$T = \frac{R}{M}$$

It is preferable that turnover figures be stated in terms of causes, and then the formula should be modified as follows:

Let Q = quits.

Let D = discharges.

Let L = layoffs.

Then, turnover can be determined as:

$$T = \frac{Q}{M}; \text{ or } \frac{D}{M}; \text{ or } \frac{L}{M}$$

Net labor turnover, which is a term commonly used in discussing average labor turnovers in different lines of business and industry, is determined as follows:

$$NLT = \frac{100 R}{M}$$

Net labor turnover can be expressed on a monthly or an annual

basis by letting

S = total separations.

A = unavoidable separations.

M = average working force during the period.

Then

$$NLT = \frac{(S-A) 100}{M}$$

Armed with such definite figures, the employer may know exactly where he stands on the labor turnover situation, and, if his turnover proves too high, he can take remedial measures.

Sometimes it is not enough to classify labor turnover by department or for the business as a whole. Turnover figures must often be determined by departments. Then the analysis may show which department head does not know how to handle his employees.

In general, high labor turnover occurs among workers who have short service records. In one instance, a survey showed that employees having service records of two years or more, the turnover was 11%, while in the case of those having records of less than one month, the turnover was 10%.

Frequent absences are often

forerunner of "quits" and should be noted and investigated.

Without going into the question of time out accidents and occupational diseases, let us consider some of the less-often-mentioned but none-the-less definite causes for labor turnover. These causes are as varied as they are interesting.

Among them may be cited:

1. Monotony.
2. Long hours.
3. Excessive overtime.
4. Unwholesome environment, caused by fumes, dust, or poisonous substances.
5. Cramped and strained positions of work.
6. Assignment of workers to jobs for which they are not physically or mentally qualified.
7. Lack of suitable luncheon facilities.
8. Unscrupulous foremen.
9. Lack of an efficient piece-work system.
10. Lack of a transfer and promotional plan.
11. Lack of cooperation.
12. Insufficient compensation.

Sometimes the real reason for a "quit" cannot be determined, but at other times, if patience is used, valuable information may be secured.

At any rate, if intelligent handling is to be given the problem of turnover, at least as much care should be taken in interviewing the employee when he quits as was taken when he was employed. Such a procedure will pay for itself many times over in promoting employees' goodwill and efficiency and reducing the firm's turnover to—or below—a normal.

New Employees

A new worker should receive an adequate explanation of the aims and policies of the company.

And company labor policies should always be stated specifically and issued to all new employees in printed form. All employees, whether new or old, should be contacted along these lines, either through folders in their pay envelopes or through a house organ published once each week or at least once each month.

Maintaining the right relations with employees is fundamental to

the success of any company and must be based on the spirit of honesty and justice.

The following policies may form the basis for better industrial relations:

1. To pay all employees a just wage for services rendered.
2. To maintain reasonable hours of work and safe working conditions.
3. To provide continuous employment consistent with business conditions.
4. To place employees in the sort of work best suited to their abilities.
5. To help each employee to progress in the company's service.
6. To aid employees in time of need.
7. To encourage thrift by the establishment of an employees' credit union.
8. To cooperate with employees in social, athletic, and recreational activities.
9. To accord to each employee the right to discuss freely with executives any matter concerning his own or the company's interest.

Management is primarily interested in profits through maximum production. The principal aims of the employee are security and increased earnings. A basic policy such as outlined above is in the interest of both parties concerned and is the only sort of a policy which, in the long run, will lead to agreeable relations, teamwork between employer and employees, and profits for the company concerned.

Morale

Industrial morale has sometimes been defined as "an attitude of feeling toward the organization and fellow-workers". But morale really results from making just and reasonable demands upon employees—demands which, while producing profits for the employer, never-the-less enable them to win the rewards of achievement; to gain a certain indescribable personal satisfaction; to acquire a feeling of contentment while at the same time gaining for themselves a living wage.

Bad morale is reflected in high

labor turnover. It might be called the thermometer of business health. Proper selection of employees; proper placement in positions they are best qualified to fill; proper training in the jobs to which they are fitted, and periodic check-ups to see how employees are getting along on the job all should hold turnover down.

But if your surveys show a high a labor turnover, the following procedure will help bring it down to normal:

1. Assist in arranging transfers of workers to other departments.
2. Inform the personnel department of any proposed layoffs.
3. Hold special jobs in reserve for slack seasons.
4. Use dull periods to shut down the plant for vacations.
5. Train workers on several jobs so they may be more readily assigned to other work.
6. Spread overtime among workers equitably.
7. Fill supervisory and other advanced positions by promotion from within the organization.

Employment

It goes without saying that centralization is essential for a successful organization today to centralize the management of employees in an employment department rather than permitting it to be done by foremen or department heads.

The employment department manager must not only have a good vision and a pleasant personality, he must also have good powers of analysis, a knowledge of human nature, and a first-hand understanding of the jobs to be filled and the necessary requirements of the men and women hired to do them.

Learn Causes

But employment is only one factor in the building of a successful organization. Knowledge of the causes of labor turnover; how to determine labor turnover; how to check it against known standards in different lines of industry; how to get at the underlying causes of turnover and be able to check too high a turnover rate are equally essential.

Damage by Fly Ash Erosion

By

Harry M. Spring

TWO recent occurrences nearly resulting in serious accidents are described so engineers may be better prepared to prevent forced shut-downs in their plants and avoid the possibility of serious accident.

A bent tube, two drum 475 psi, watertube boiler, in which gases are directed through three passes in a horizontal plane, was fired by pulverized coal. It was equipped also for firing with other suspension fuels. The usual draft fans were installed.

In less than fourteen months from the date the boiler first went on the line, inspection revealed severe wasting of a number of tubes. The wasting occurred on the external surfaces, and the tubes affected were all in a localized area in the third pass where high velocity of gas flow existed. Deterioration penetrated 80% of the wall thickness in the tubes.

Study of the baffling, the location of the wasted areas, and the nature of the defects left no doubt that the action was the result of abrasion by fly-ash and unburned particles of combustible.

The second instance of abrasive

damage was even more serious. Here, a bent tube watertube boiler operating in the 400 pound range was fired by pulverized anthracite

FIG. 2

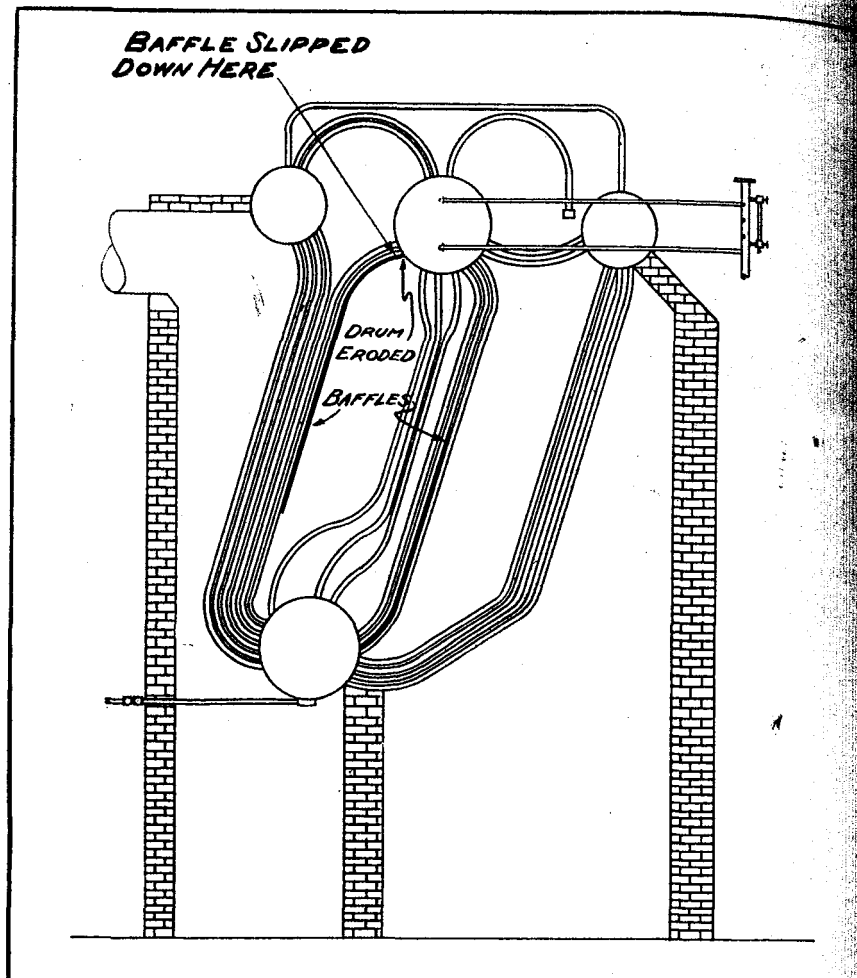
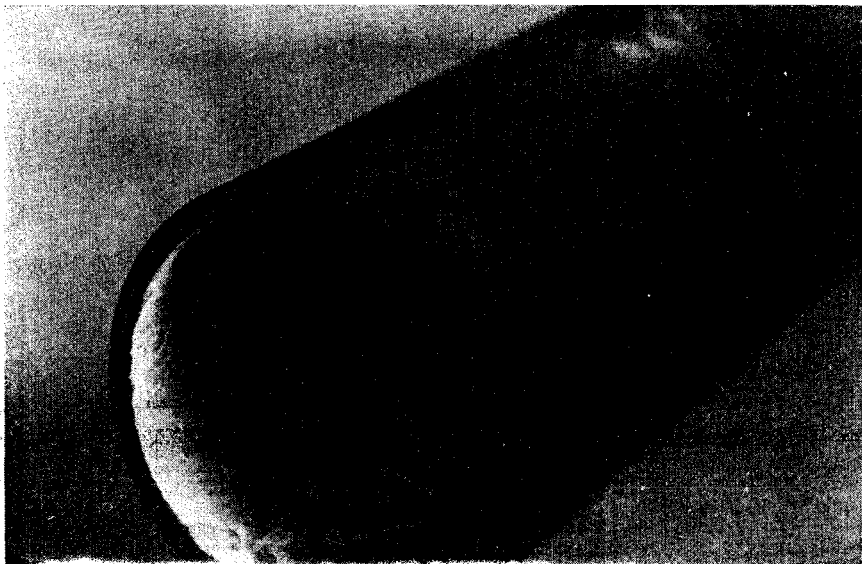


FIG. 1

coal, the abrasive qualities of which are particularly severe.

Investigation was underway to determine the cause of tube leakage when the erosion was discovered. In the course of examination, a suspended baffle was found settled so that a gap $\frac{1}{4}$ in. to 1 in. in width resulted between the top of the baffle and the bottom of the middle steam drum. (Fig. 1.) Differential in draft pressures in the two passes caused gases with entrained fly ash and particles of soot to sweep through the gap at high velocity. This sand blast effect had worn a groove in the drum, the groove extending over 12 ft in a longitudinal direction and for a depth of $\frac{1}{2}$ in. in places. Tubes, too, were cut by the erosive blasting, some being reduced in thickness by

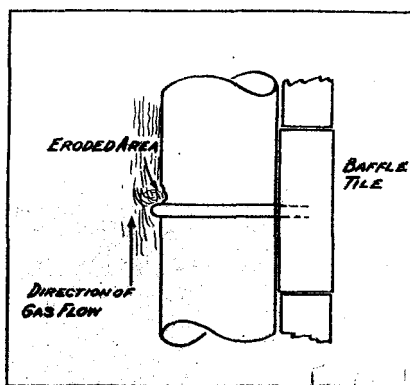


FIG. 3

at least 75%. Figure 2 shows the condition of the tube that failed.

Other tubes were found eroded adjacent to U bolts holding baffle tiles. The U bolts provided sufficient interruption in gas flow to cause eddy currents and localized impingement. (Fig. 3.)

Erosion by particles of fly ash

and unburned fuel has also been found in stoker-fired boilers.

At the time of each shutdown for cleaning and preventive maintenance (at least once every four months), all areas vulnerable to erosive attack should be examined. Areas most susceptible are:

1. Where flow of gases makes a turn, throwing out particles of solids.
2. Behind any cracks, breaks, or gaps in a gas baffle.
3. Adjacent to any projection that might divert normal flow of gases.

Should the boiler be provided with an induced draft fan, observe the condition of the blading. Abnormal wear may be indicative of erosive attack in the boiler.

Careful attention by all engineers to the problem of erosion may well prevent a serious accident.

in the plant.

The modernization program of the Brock Candy Company is taking place at a time when any product, regardless of quality or cost, can be sold. The real bottlenecks today are shortages of materials and skilled personnel. However, progressive business men know that these conditions are only temporary and that within a few years, companies which do not guarantee quality will not be able to sell their products. The Brock Candy Company will continue to be a leader in its field because it has refused to sacrifice quality of its products in hard days when consumer demand is greater than the supply of raw materials and because it has inaugurated a program of constant improvements.

Candy Making

(Continued from page 60)

not be taken for granted, a chemical laboratory is essential.

The Brock Candy Company is now in the process of constructing a modern chemical laboratory and training a technician to perform control analyses. The laboratory, which is located in a large air conditioned room near the candy cooking operations, is equipped with modern stone-topped laboratory benches, the latest chemical glassware, and such special analytical instruments as balances, vacuum oven, refractometer, and pH meter. Provision has been made for such analyses as moisture, invert sugar, viscosity, pH, melting point, and refractive index. Many of the control tests have been developed specifically for the Brock Candy Company, and new procedures will be added from time to time as the need arises.

The Industrial Research Institute of the University of Chattanooga has cooperated with the Brock Candy Company in selecting the equipment, outlining and developing analytical procedures, and training a technician to operate the control laboratory. A research

project on improvement of the quality of candy has been sponsored by the Brock Candy Company at the Industrial Research Institute of the University of Chattanooga.

Since all raw materials will be analyzed and tested in the company laboratory, variation in properties will be detected before the material is used. This procedure will assure products of uniform quality, since inferior raw materials will be discarded and formulations will be based on the actual analysis of high grade raw materials rather than on standard procedure which do not make allowance for variation in the ingredients. Analysis and testing will assure high quality of finished products and permit any difference in quality to be detected. In this way, any unavoidable errors in manufacture can be corrected and adequate controls instituted to prevent their recurrence.

The facilities of the control laboratory will also be available for the evaluation of research and development work being carried out in the factory. In addition to maintaining the production of uniform high quality products, the personnel and equipment of the control laboratory will be available for many other technical assignments

Dust

(Continued from page 64)

tion and dust arrestors as is shown in the photograph. Note that the exhaust is applied through the trunnion of the tumbler.

In foundry operations or in other industrial type processes, housekeeping is an important factor influencing the generation of dust. This foundry employs a five horsepower vacuum cleaner for floor maintenance. By this procedure loose dust, sand, and filings, like, is removed from the floor and is not projected into the atmosphere by the movement of machinery, scuffing of feet, and the like. This is one impressive point in the operation of this particular foundry. Excellent housekeeping is combined with a good procedure for materials handled.

In all of the attempts at dust control at the LeTourneau Company, employee cooperation is obtained. Employee cooperation comes through planned program of employee education and employee participation in affairs involving the health of the worker.

Periodic dust samples collected in the LeTourneau foundry indicate atmospheric concentrations of various operations well below what is considered as maximum safe working limits.

Measure

Protection OF SMALL MOTORS

in terms of

Production

and you'll install

BUSS FUSETRONS

*throughout your
electrical system to protect all of them*

Here's Proof...

Fusetrons Eliminate Average of Two Motor Burnouts per Month on Fan Motors.

"Steam is exhausted from the rooms where we empty our bone char by exhaust fans of two types—a 36 inch fan operated by $\frac{1}{2}$ h. p. motor and a 24 inch fan operated by $\frac{1}{4}$ h. p. 3 phase—220 volt motor. The grilles or louvers open to the northeast right over the Delaware River. High winds will therefore sometimes stall the motors and in a very severe storm, the wind may even reverse the direction of the motor while it is running. Also, the starting current is increased greatly when the blades are revolving in the opposite direction, due to high wind.

"Prior to 1942, at least two of these fan motors were replaced every month, due to burnout. Replacement was very difficult and expensive due to the fact that the fans are mounted right below the ceiling and above steam pipes.

"Early in the summer of 1942 we installed 8 ampere Fusetrons for the $\frac{1}{2}$ h. p. motors and $6\frac{1}{4}$ ampere Fusetrons for the $\frac{1}{4}$ h. p. motors. Up to August of 1945 we had not had to replace a single fan motor protected by Fusetrons."

David J. Coles, Electrical Engineer,
McCahan Sugar Refining Co.,
Philadelphia, Pa.

Motor Repair Co. Won't Guarantee Motor Rewind Job Unless Motor is Protected by Fusetrons

"We have found Fusetrons and Fustats (Fusetrons with a tamper resisting base for 125v. circuits) so satisfactory for the protection of small motors that for a number of years we have refused to give a warranty with a rewind motor job unless the owner installed a Fusetron or Fustat to protect the motor. We saw to it that the size used would give burnout protection.

"We are convinced that this policy of installing a Fusetron or Fustat to protect all rewind motors has saved us a lot of unjustified complaints—and no one knows how much expense taking care of motors within the warranty period."

A. H. Wolf, Superintendent
of Motor Repair Dept.
Swanson-Nunn Electric Co.
Evansville, Ind.

BUSS FUSETRONS

Electric Circuit Troubles

By Thomas Trail

A little smart investigating will save a lot of grief in locating electric circuit troubles.

WHEN trouble develops in an electric circuit, it is wise to do a little investigating before dismantling fixtures and disconnecting wiring. Such procedure can save both time and energy.

First, check for current at various locations with a test lamp. If the fuses prove to be all right, and yet no current indication can be found in the defective circuit, make a careful checkup to determine if there are any switches or other types of control devices in the circuit anywhere. If no switches or control devices are found, then it is time to examine wiring or open splices at probable sources of trouble.

There have been a number of instances where defective circuits and devices caused needless waste of much time and work before the troubles were cleared up. In each instance the cause of the trouble turned out to be simplicity itself.

Several lighting fixtures in the service corridor of a large hotel refused to light. New bulbs were tried but to no avail. The electrician then proceeded to disconnect fixtures and check splices. The lamps were located at a considerable height and this further delayed the work. Hour after hour went by while the workmen labored and perspired but still did not find the trouble. Finally he could think of no other check to make. Discouraged, he stepped from the ladder and his eyes fell upon a tumbler switch on one wall of the corridor. He walked over and flipped it and immediately the lights blazed on. He had spent

nearly a half day finding out that someone had merely snapped off the switch.

An electrician was called to a shoe store one day to find out why part of the shoe window lights would not light. The store manager reported that the lights had worked perfectly on the preceding business day. The electrician tried fuses, fuse cabinet switches, new lamp bulbs, removed the face from the fuse cabinet, opened wire junctions, removed fixtures and canopies, but still the lights did not light. This had taken more than five hours of discouraging work. Finally, in rechecking the wires leaving the fuse cabinet, he noticed that an unusually large number of them left the cabinet through a large conduit, yet he reasoned that it was unnecessary to have so many wires to feed so few lamps.

Thinking that the wires might lead to switches he searched the rear of the store carefully but no switches could be found. The manager insisted that the only switches he used to light the lamps were the branch circuit switches in the fuse cabinet. He also had explained that a time switch controlled all his lights when the store was closed.

The electrician then decided to take a look in the public corridor at the rear of the store. The building in which the store was located contained a number of shops and each had an entrance on this corridor. Right outside the door he found a gang installation of key switches. Drawing a key from his pocket he began to try the

switches. Only one switch in the gang clicked and the "dead" lamps flashed on brightly.

It developed that someone known to the shoe store manager had tripped this long-disused forgotten switch, thus cutting the circuit to his window.

On another occasion an electrician spent considerable time checking starters, fuses, switches and pressure controls on an air conditioning system. He finally discovered that the failure was simply to the fact that the temperature of the outdoor air at the time was lower than the system temperature setting, consequently thermostat contacts were open when they should have been.

A similar instance occurred when an air conditioning fan failed to start. A checkup was made, splices on the motor opened, still no current indication was obtained. Finally it was discovered that an unnoticed mercury switch intended to shut down the system in the event of fire, had been knocked from its normal position in some manner, thus tilting the mercury tube and opening the circuit.

All these instances show that time can be wasted when a careful investigation of all possible sources of trouble is not first carried out before dismantling equipment. Though these examples reflect unfavorably upon the electrician involved, they still were not amusing as an incident involving a maintenance mechanic who had been entrusted with the job of installing new lighting fixtures in hotel guest rooms. After the fixture was in place, the circuit was turned on but the lamps glowed faintly. The maintenance man suggested that perhaps more lamps were needed. But an electrician, noting the dimness of the lamps, checked the fixture wiring. He found that the two sockets in the fixture had been connected in series. When questioned about this the maintenance man replied that he had connected them according to the notice on a label inside the fixtures. This label turned out to be a union sticker signifying that the fixtures had been made by union workmen. The label bore a number and the words "Series

A History of Power

By Carl J. Eckhardt, Jr.

CARL GUSTAF PATRIK DE LAVAL

1845 - 1913

The Use of High Pressure and High Temperature Steam For Turbines Is Initiated.

CARL Gustaf Patrik De Laval was born in Blosenberg in the Province of Dalecarlia, Sweden, on May 8, 1845. He was the son of a captain in the Swedish army. As his surname indicates, de Laval's forebears were of French origin. They had, however, been residing in Sweden for a considerable time. Early members of the family had served Gustavus Adolphus. De Laval's military heritage seems to have been a very rich one.

Information with regard to de Laval's boyhood experiences does not appear to abound. From his early youth he demonstrated that he possessed courage and endurance. He was intellectually alert and he possessed the capacity for making close observations. By a peculiar paradox, de Laval sought no military greatness. He yearned to carry on campaigns in the field of science. His intellect was keen. His choice of a life's work was, therefore, a wise one.

In 1863, de Laval entered the University of Upsala at the age of eighteen. His work as a student was characterized by his inherent desire to delve into the fundamental truths of the laws of nature and the developments of the science. He thrust himself wholeheartedly into his work. Regular rates of progress were not sufficient to satisfy him. He applied himself to his work with such zeal and enthusiasm that he was graduated from college in three years.

Virtue was rewarded for de Laval completed his work with distinction. He was, as a matter of fact, at the head of his class in all of his studies.

De Laval recognized the virtue which attended an effort to complement his technical training with practical experience. After graduation he entered the employ of the Stora Kopparberg Company of Bergslad, but his work as a draftsman confined him more than he wished to be confined, and with the passage of time, he realized that he could hope to profit from graduate work. He returned to school and registered for graduate courses in physics and mathematics. In the year 1872, the degree of Doctor of Philosophy was conferred upon him.

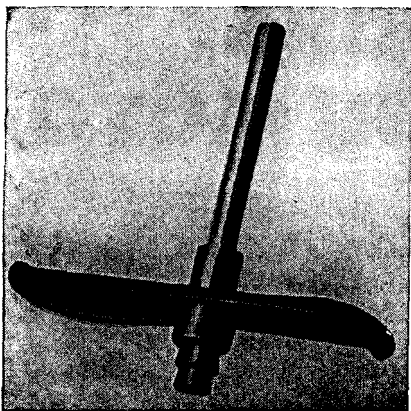
Having thus finished his formal education, de Laval returned to the employ of Stora Kopparberg Company. Since he did not like continuous indoor activity, he was assigned to the task of doing chemical research work. He was soon sent to the Hartz mining district in Germany to make observations which would be useful to his employer in the erection and operation of a manufacturing establishment to be constructed at Falun. In this instance the production of sulphur and sulphuric acid were of primary importance.



CARL GUSTAF PATRIK DE LAVAL

After a short period of service, Laval resigned from this position in order to enter business for himself. He undertook to establish a glass factory. Unfortunately, however, his ability as a business man was not sufficient order to keep this plant in operation. The failure left de Laval heavily in debt. He realized that he was under compulsion to seek work in the ranks of other business enterprises. In 1875, he entered the employ of the Klosterverken Iron Works where he served in the capacity of mechanical engineer. His creativity now began to assert itself. During this period of service he patented two of his ideas. One of these was a device to effect a more satisfactory distribution of air in Bessemer converters. The second invention involved a crucible for galvanizing purposes.

Even though de Laval's work involved few applications of centrifugal devices, he became very much interested in them. A crude centrifugal device had come into his possession. He employed his spare time in refining this piece of equipment and in thinking of a manner in which it could be applied in a more



DE LAVAL'S STEAM TURBINE OF 1883

useful fashion. It then occurred to him that it might be employed to separate cream from milk. When his efforts to enlist the enthusiastic support of his employer in this venture failed, de Laval decided to give up his position. He resigned and returned to Stockholm.

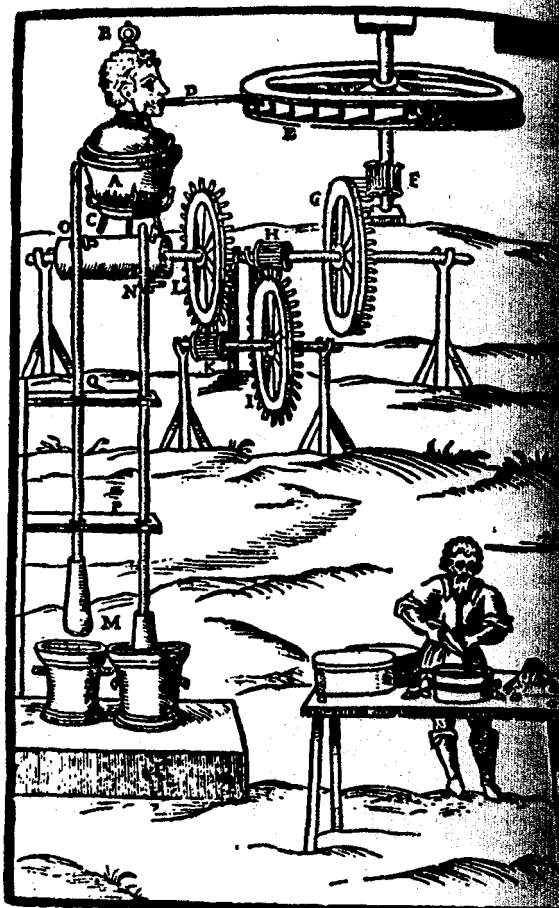
He began in 1877 to try to raise a sufficient sum of money to construct a factory in which his separating device might be manufactured. Success did not at once attend his efforts. The indifference with which de Laval's predecessors had been plagued likewise harassed him. His lasting qualities were, however, substantial. His faith in the usefulness of the device which he had refined before leaving the employ of the Klosterwerken Iron Works remained unshaken. In the ultimate, a modest sum of money was raised. With these funds The Separator Company, Ltd., was created. From the outset it was successful. The length of time required to develop this enterprise into a going concern was not long. The value of his product was readily apparent. It was accepted immediately by the agencies for which it was intended.

De Laval's interest in the flow of elastic media was aroused as early as 1870. He determined to improve the character of the flow of steam used for sand blasting devices. He was, at the same time, concerned with the task of finding an appropriate prime mover for his separating device. Devices possessing high rotative speeds were essential to the satisfactory operation of the separator. Inasmuch as the steam turbine was inherently a high speed apparatus, de Laval constructed a very small and simple turbine in 1882. The principle of operation involved was an old one. It had originally been demonstrated by Hero of Alexandria in the first century A.D. As might be supposed, the design of the steam flow path was crude. This circumstance accounted

for the poor economy with which it operated. The improvement in performance depended upon the design of nozzles which possessed passages of an appropriate order. De Laval then began to devote his thoughts to nozzle design. His S-shaped rotor was developed in 1883.

The function of the nozzle which de Laval now attempted to design was to convert heat energy to kinetic energy. The nature of the design needed to be such as to impart considerable velocities to the working substance. In accomplishing this task the physical properties of steam had to be taken into consideration. De Laval determined that the weight of the steam discharged by a nozzle in a given period of time depended upon the cross sectional area of its smallest section. He realized that the power which could be developed depended upon the weight of the steam flowing and the "spouting" velocity. Under such circumstances the greatest amount of power could be expected for a given rate of flow with the highest "spouting" velocities.

De Laval's efforts to find an expedient means for converting heat energy into kinetic energy resulted in the development of the de Laval nozzle. It was designed to take into consideration the fact that as the steam was expanded, the velocity first increased more rapidly than the specific volume. As the steam then flowed from the throat, outward, the specific volume of the steam increased with more rapid reductions in pressure than velocity. The shape of the nozzle from the throat outward needed, for that reason, to be divergent. The path or approach to the throat of de Laval's nozzle consisted of a more or less rounded entrance which converged to the throat. This well known nozzle form was developed in 1888. In 1889 he applied for American patent rights. The U. S. Patent Office apparently did not share with de Laval his enthusiasm for the usefulness of his device. It did not at once grant the patent which he sought.



BRANCA TURBINE WHICH DE LAVAL IMPROVED.

The velocities with which steam issued from the de Laval nozzle were extremely high. To use this kinetic energy gainfully he was under obligation to employ rotative speeds which embodied high peripheral velocities. The principle of operation originally employed by Hero of Alexandria was now discarded. Instead, de Laval attempted to use the principle of operation suggested by Branca in 1629, namely, the impulse turbine. In order to secure a favorable relationship between the velocity of the issuing jet and the peripheral velocity of his rotors, it was frequently necessary for de Laval to resort to rotative speeds ranging from 10,000 to 30,000 revolutions per minute.

In 1893, de Laval exhibited his nozzle at the Chicago World's Fair. The claims which he made for it were substantiated. In the following year his request for an American patent was granted.

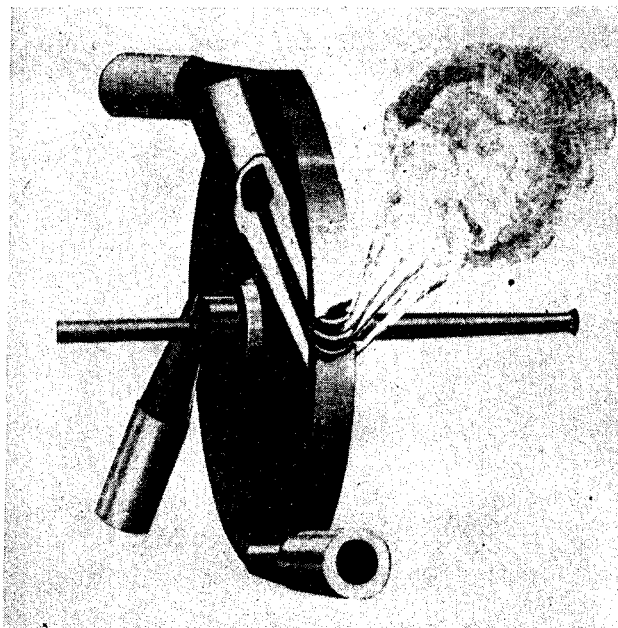
High rotative speeds in turbine rotors introduced lubrication problems. He sought to eliminate these troubles by resorting to the use of oil introduced into the bearings under centrifugal force. Although the separating devices needed high rotative speeds, they could not be operated at speeds as high as 25,000 revolutions per minute. The worm and wheel

were, therefore, introduced into de Laval's power transmitting system.

De Laval's ideas with reference to the impulse turbine constituted a splendid success. It is to de Laval that the world is indebted for developing the impulse turbine, a "grotesque" idea of Branca, into a device of great usefulness. His arrangement of the rotating disc and the manner of fastening the blades to it were ingenious and praiseworthy. In the absence of proper balancing devices, de Laval reduced the rotor shaft to a very small diameter to make it flexible. Thus the turbine rotor was permitted to rotate about its center of gravity which was not coincident with the central axis of the turbine shaft.

Unfortunately, de Laval's business acumen was not of the same high order as his technical skill. The Separator Company, Ltd., was now making very satisfactory progress, but de Laval could not bring himself to be satisfied with results achieved by a going concern which depended upon the fruits of his previous labors. The inquisitive character of his mind appeared to thwart all hopes which he may have possessed for financial success. The enlargement of knowledge, however, seemed more important to him than the accumulation of material wealth. In the years which followed he was to engage in numerous researches. In some phases of this work he was indeed a pioneer.

In this early stage in the development of the steam turbine, de Laval sought to introduce the use of high steam pressures and temperatures. The size of the units designed ranged from five to one hundred horsepower. Pressures of the order of 1400 to 2800 pounds per square inch were involved. The systems which he envisaged consisted of a steam generating unit, a turbine generator, and a condenser together with their accessories and auxiliaries. Since no steam generating system had theretofore been operated at such pressures, de Laval applied himself to the task of preparing suitable designs. Six such units were installed in Stockholm in 1897 for the purpose of supplying power for the Stockholm Exhibition. The manufacturing establishment in which these devices had been constructed was located at Jarla,



IMPROVED DE LAVAL TURBINE

Sweden.

In that same year, units designed by de Laval were actually employed to generate power while provided with steam at a pressure which began to approach the critical pressure for steam, 2800 pounds per square inch. Conventional boiler designs were unsatisfactory for such operating conditions, for steam temperatures of the order of 700 to 750 F were likewise involved. The heat absorbing surface of the boiler consisted of a tube arranged in a helical fashion. De Laval exercised the care to subject this tube to a test pressure twice as great as that at which he wished to operate. This power generating unit was arranged in such a fashion that a pinion on the turbine spindle was used to rotate two geared generator shafts at reduced speeds.

De Laval had learned from experience that it was not always possible to employ rotative speeds which provided peripheral velocities which bore the right relationship to the velocity of the steam issuing from the nozzles. He continued, however, to arrange his devices so that the entire pressure drop occurred in a single nozzle or single set of nozzles all of which operated under the same conditions. To eliminate the inefficiency which would otherwise have resulted from the high residual velocities of the steam issuing from the blades of a rotor possessing a single row of blades, he resorted to the use of velocity staging. Two rows of rotating blades were employed. A row of stationary blades was placed between the two rows of rotating blades. The

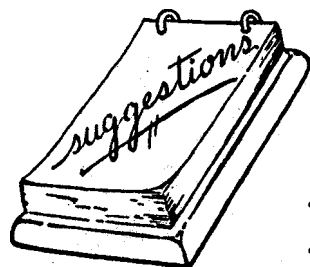
steam departed from the first rotating row of blades at a considerable velocity in a direction opposite to that at which it entered. It was, therefore, the function of the stationary row of blades to reverse the direction of the steam so that the steam would enter the second row of blades in the same direction as that in which it entered the first row. In this manner, the impulsive force exerted by the steam was employed in a more gradual fashion.

Important features of the newly designed prime mover were numerous. A few of them may be enumerated here:

1. Hydraulically operated steam admission valve.
2. Automatic pressure control achieved by regulating the position of a blast gate between the boiler furnace and the draft fan.
3. Over-fuel-bed air injection to improve combustion conditions.
4. Pre-heated air supplied to the furnace for combustion by a system which simultaneously cooled the furnace walls.
5. Removal of the air and non-condensable gases from the condenser by the use of ejectors.
6. Special devices for cooling the boiler by the introduction of air externally in the event of sudden reductions in load.

De Laval was destined to experience many difficulties because he was a pioneer. As such, his thinking processes were far ahead of the time in which he lived. His courage in undertaking research in the high pressure and high temperature field in the generation of power deserved to be admired. He could not, however, extricate himself from the inherent difficulties which a lack of knowledge imposed. The greatest amount of trouble was experienced in his steam generating system. Boiler tube failures constituted the most serious problem. De Laval had foreseen the possibility of this difficulty. In order to minimize the consequences of such tube failures, the boiler had been designed to possess the smallest feasible water storage capacity. Such tube

(Continued on page 122)



Helping the MAN-IN-THE-PLANT

A Section of Praactical Discussion

Readers are invited to send in kinks, ideas, and suggestions.

Payment is made for each contribution published.

Routing Operation Improved

IT is necessary in performing intricate flat routing operations to reduce the vibration of the head and arm of the router to a minimum.

HAROLD PETERSON, of the BEMIS BRO. BAG Co.'s KANSAS CITY PLANT, suggested this simple adjustable spring and turnbuckle assembly which is attached to the arm on the flat router. By removing the dead

weight of the router head and arm from the supporting bar along the edge of the table, this assembly affords a smoother and easier routing operation.

Magnetic Street Cleaner

OUR streets and alleys had a lot of old nails and tacks in them as is usual. We wanted a magnet to pick them up and the local Army Base gave us one. It was wound for 120 volts DC and has 12 coils

on it. We could not find a suitable DC generator anywhere, so we finally reconnected the magnet coils in 3 sets of 4 coils each so we could use our portable engine driven welding set for current supply. We set the welding set in a room and hung the magnet out the door. With this makeshift "Sweep" we picked up nearly 800 pounds of nails, bits of wire and tacks in one day.

While the outfit is heavy and cumbersome it works perfectly and the only added expense is a small amount of additional gasoline the welding engine burns.

E. A. ROBERTS

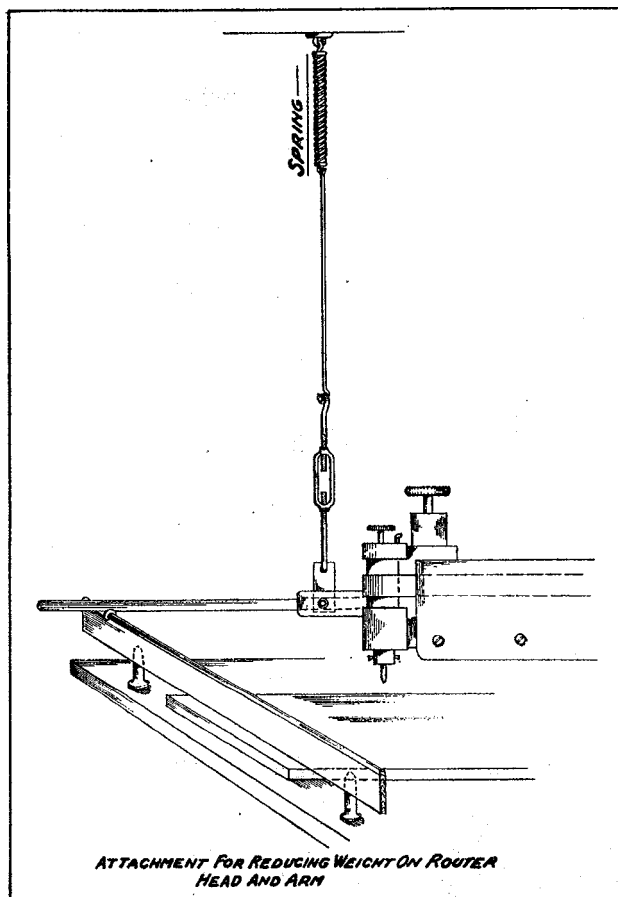
City Clerk, Carlsbad, N.M.

Simple Air Manifold

HERE is a simple air cooling device originally designed for the cooling of tank cars that have been steamed for cleaning or repair but applicable to many similar operations.

Two 3/4" nipples were welded into a 2" x 6" nipple at a 45 degree angle. A short 3/4" nipple was welded into the top of a 2" nipple for the air hose connection and the unit welded to a 4" x 1 1/2" beam which serves as a base. A rope attached to the beam and handle can be used to raise and lower the apparatus.

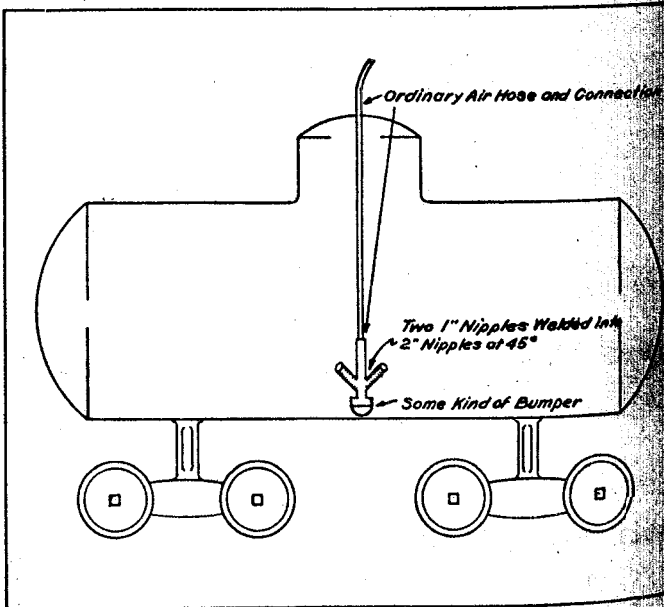
J. R. RUCKER
Humble Oil &
Refining Co.
Ingleside, Texas

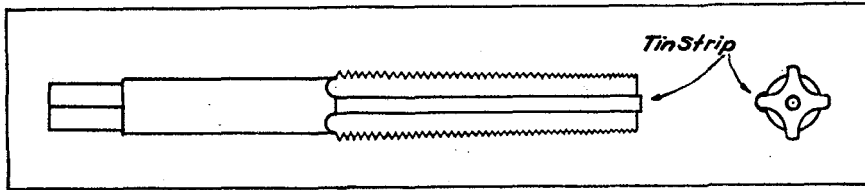


ATTACHMENT FOR REDUCING WEIGHT ON ROUTER HEAD AND ARM

ROUTING AID

AIR MANIFOLD





Loosening Tight Bolt-Threads

SOMETIMES on a repair job the thread on a bolt or stud will be found a trifle too full, so that a perfectly threaded nut cannot be run on. If the bolt or stud is inaccessible for reducing the thread with a stock-and-die and the tool room does not afford a die-nut of the requisite size, a taper tap of the right size may be used to loosen the thread in the nut.

To do this cut a strip of thin sheet tin a trifle wider than a set of

teeth on the tap and long enough to extend a little over the end, as shown in the sketch, and bend it at right angles lengthwise so that it will straddle the row of teeth. Then enter the tap in the nut and drive it through with the wrench. A little coaxing may be necessary in getting it started, but the tin strip will follow through and loosen the thread. Only the first tap of the set of three—the taper tap—can be used. The job could not be done with either the plug or bottoming tap.

O. C. POWEY (KAN.)

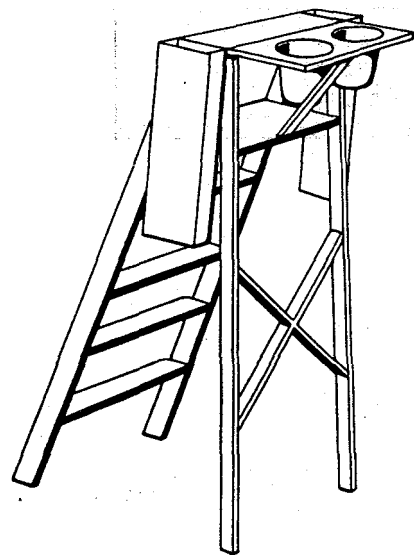
Special Ladder Aids Maintenance

TO maintain the high lighting levels of small fluorescent installations in plants, offices, and institutions, engineers of Eylvania Electric Products Inc. have developed this "all-purpose" maintenance ladder, which is easy and in-

lution and the other for rinse water.

A systematic plan of fluorescent maintenance insures continuous peak performance of fluorescent lamps and fixtures with minimum diminution of light output. In one case dirt caused a 27% loss.

The cleaning agent to be used depends on the type of reflecting surface. Reflectors which are only slightly dirty can be rubbed with a damp cloth, but to remove hardened dirt on a porcelain enamel surface, an efficient and concentrated "soapless" soap will do a thorough job with a minimum amount of effort and leave the surface clean and sparkling. Synthetic enamel surfaces, however, require a green soap solution briskly applied. On an aluminum reflector, the solution must be as neutral as possible, since even mild alkalinity or acidity will destroy the reflectivity of the metal finish. A green soap solution or one of the special wax or wax emulsion cleaners which have been specifically developed for cleaning aluminum are recommended. Glass surfaces of lamps and diffusers are best cleaned with trisodium phosphate, and no rinsing is necessary.



expensive to build. By the addition of sheet metal or wood racks to any ladder, spaces are provided for burned-out lamps, new lamps, starters, cleaning cloths, and two buckets, one for the cleaning so-

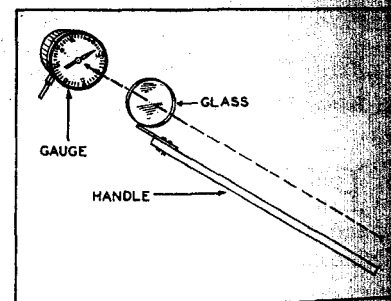
Freezing Facilitates Water System Repairs

WHEN repairs must be made on branch water lines, difficulty in shutting off the flow of liquid is quite frequently experienced. This may be the result of faulty valve obstructions under valve seat surfaces that interfere with complete closure, or the inability to close the sectionalizing valve designed to isolate the affected section without interfering with the continuity of some essential process.

In the event such a problem arises, it is very often possible to stop the flow of water for a long enough period to enable the performance of needed maintenance by the simple expedient of freezing the liquid in a short section of pipe just ahead of the point where repairs are needed. This can be very easily done by surrounding the exterior surface of the pipe with dry ice (solidified CO₂) until enough water is frozen to seal the line and effectively withstand the pressure.

Freezing should be done only on a straight section of pipe, free of valves, sags, and fittings. During the freezing process, the isolated end of the line should be protected against excessive pressures by bleeding off a small amount of liquid continuously.

W. N. HUDSON (ALA.)



Reading Meters and Gauges

A MAGNIFYING glass mounted on a wood handle, will prove helpful in reading meters, gauges, thermometers, etc. in out of the way places. By holding the glass at a proper distance from the instrument, the reading will be magnified sufficiently to be easily seen from a distance. The drawing shows how the glass is fastened to the handle.

THOMAS PERKINS (MD.)

News of the Month

Active Power Market Reflected In Demand For Power Show Space

Continued reorganization and expansion of industries everywhere will sustain a heavy demand for power equipment during many months to come, forecasting a period of steady employment and more settled business confidence. First reports from the list of almost 400 exhibitors

booked for the 17th NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING reveal a firm market for their products now with an increase in prospect when they can show their new lines. Some of these will be announced during the fall, but many will be unveiled at the Exposition, which is to be held in Grand Central Palace, New York, December 2 to 7.

All industries are power consum-

FUTURE EVENTS Of Engineering Interest

American Welding Society, 33 West 81 St., New York, N. Y.
Nov. 17-22—Annual Meeting, Atlantic City, N. J.

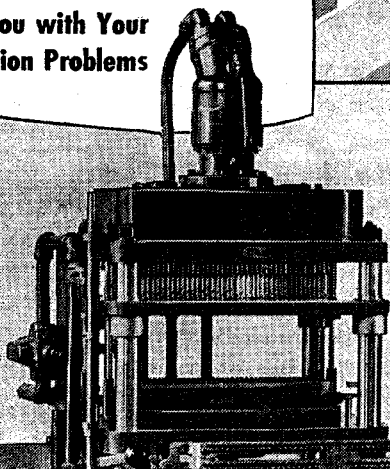
National Metal Congress, Wm. H. L. Managing Dir., 7301 Euclid Ave., Chicago, Ill.
Nov. 18-22—Exhibition, Atlantic City, N. J.

American Society of Mechanical Engineers, E. Davies, Secretary, 29 W. 38th St., New York 18, N. Y.
Dec. 2-6—Annual Meeting, Hotel Pennsylvania, New York, N. Y.

American Institute of Electrical Engineers, E. E. Henline, Secretary, 29 W. 38th St., New York, N. Y.
Jan. 27-31—Winter Convention, New York, N. Y.

Ingenious New Technical Methods

To Help You with Your
Reconversion Problems



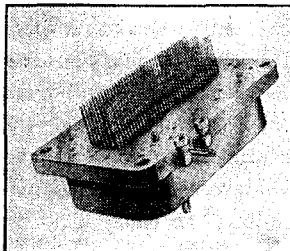
12,000 Holes per Hour! With New Gearless Multiple Spindle Drillhead!

The Zagar Gearless Drillhead can accommodate up to 400 drills in one head—drill up to 400 holes at one time! This revolutionary unit runs noiselessly and vibration-free on needle, tapered roller and precision ball bearings, and is lubricated by a patented automatic oiling system to insure trouble-free operation.

With this unit all holes are drilled at one pass, and valuable time is saved by the elimination of indexing and extra handling. It may be used on standard drill presses, or furnished as a complete hydraulic machine by the factory.

Another time saver, as well as a help on a tedious job, is chewing gum. The simple act of chewing seems to make the work go faster, easier—helping to relieve worker's fatigue—so that a better piece of work can be turned out with greater safety. Wrigley's Spearmint Gum may be used even when both hands are busy—right where the work is being produced.

You can get complete information from
Zagar Tool, Inc.
23881 Lakeland Blvd., Cleveland 17, Ohio



Zagar 220 Spindle Gearless
Drillhead



AA-98

ers, and therefore preparation for the Exposition clearly indicate the attitude and purposes of industrial planners as interpreted by those whom they must rely for machinery and manufacturing equipment. The requirement starts with the plant and various means to get from power to production and continues through to numerous product applications. Lists of exhibits are compiled constitute an extensive catalog covering all kinds of industries from the standpoint of power needs and also such processes as fuel, heat, steam, and water supplies, materials handling and others. A great majority of exhibitors have participated in the Power Shows at two-year intervals and are returning with the firm of their post-war products. This year will also see a good number of exhibitors.

New designs will be featured most of the exhibitors, with emphasis on the use of specially selected materials including a number of new special alloys, and, where weight saving is an object, combination of light pressed steel shapes, aluminum and occasionally magnesium. Makers of many items, such as valves, will offer interchangeable parts of various metals in other standard units, affording selection according to the type of fluid handled and the temperature and pressure requirements involved.

Though highly diversified, the principal influence of the Exposition is in developing a wider knowledge of the economical transformation of energy in fuel into power, and the key classifications of exhibits with pumps and conveyors for handling

ing liquid and solid fuels and run on through boilers, turbines, burners and stokers, blowers and exhaust fans, valves and piping, traps, blow-downs, liquid level indicators and controls, as well as auxiliaries of many kinds to turbine generators. All these range from the compact little "packaged" boiler to the scale of the huge steam generator in the public utility field.

Electrical Engineering Exposition

Widespread interest in the forthcoming ELECTRICAL ENGINEERING EXPOSITION has already been demonstrated by the variety of exhibits already enrolled for the display, which is to be held in the 71st Regiment Armory, in New York City concurrently with the Winter Convention of the American Institute of Electrical Engineers, next January 27-31.

Factors making the Exposition especially timely are the new demands for exhibitors' products created by reconversion of industries,

launching of new manufacturing plants, especially small ones; both new and converted; retail stores and service establishments. This movement involves changes in character of demand, especially in power and appliances; expansion of works; new installations. Means of production, creating confusion in many dislocations at present, demanding projections and planning. Many of the engineering aspects will be clarified by the first of the year when the Exposition is held, when a great deal of material now available will be placed in view, a considerable number of items being exclusive to this display.

A qualified audience is assured by the method which has been adopted of admitting visitors by invitation and registration only, excluding the general public. The pattern provides for an interchange of information, establishes liaison and provides conferences between financial, management interests, consulting engineers, designers and manufacturers of all types of equipment.

Honeywell Promotes Koch

ALFRED H. KOCH, who became known throughout the southern textile industry while regional branch manager of the MINNEAPOLIS-HONEYWELL REGULATOR COMPANY in Atlanta, has been promoted to Philadelphia branch manager of the company.

Koch, who started with Honeywell's Brown Instrument Division in 1929, later served in Chicago, Minneapolis, Honolulu and Cleveland in the sales department of that division. He was made Atlanta branch manager in 1938 and was promoted to regional manager, with headquarters in Atlanta, in 1942.

Koch became widely known throughout the southern textile field



PEERLESS PUMPS

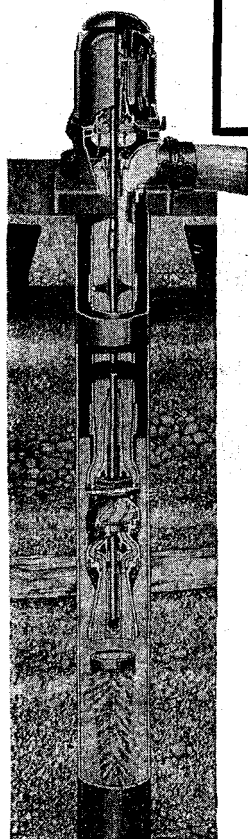
Vertical and Horizontal Types

A FULL RANGE OF SIZES AND CAPACITIES

- Built to serve Exacting Conditions in Ice Plants, Refrigeration, Air-Conditioning, Packing Industries, Industrial Water Services.

WORLDS of WATER for INDUSTRIAL USES with PEERLESS VERTICAL TURBINE PUMPS

Developing capacities from 15 to 30,000 g.p.m., against heads up to 1,000 feet, Peerless Vertical Deep Well Turbine Pumps assure a constant and clean water supply. Many exclusive engineering features, such as Double Seal - Double Bearing Bowl Construction, give added assurance of long life and maintenance of efficiencies. Peerless Deep Well Turbine Pumps are available in both oil or water lubricated types (water lubricated illustrated) and are adaptable to all forms of drive.

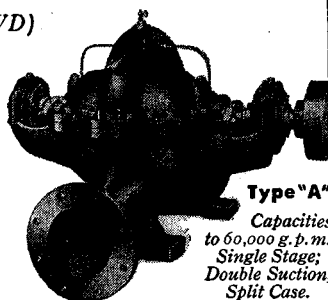


Peerless HORIZONTAL CENTRIFUGAL PUMPS

(Formerly DAYTON-DOWD)

PEERLESS UTILIZES NEW PRINCIPLES OF HYDRO-DYNAMIC DESIGN!

Capable of continuous low-cost service and maintained efficiencies, Peerless Horizontal Pumps are available for practically every variety of general pumping service. Peerless Engineers are available to recommend the proper pump size and drive to meet your requirements.



Type "A"

Capacities
to 60,000 g.p.m.
Single Stage;
Double Suction;
Split Case.

PEERLESS PUMP DIVISION

FOOD MACHINERY CORPORATION

Los Angeles 31, California • Quincy, Illinois • Canton 6, Ohio

Distributors in all Principal Cities



it's your boiler



SCALEY'S after!

Large and small industries are safeguarding their
boilers from scale, corrosion, pitting, and caustic
embrittlement by using **ALKEN CERTIFIED SCALOFF**.
Individual formulas to correct your condition.
Complete analytic reports and service.
Write for free check-up of your conditions.
ALKEN CERTIFIED SCALOFF*— Water Treatments
A guaranteed product of

ALKEN • MURRAY CORP.
1841 Broadway, New York 23, N. Y.
Southern Representatives in Your Area
*Reg. U. S. Pat. Off.

NEWS—Continued

through his activity in helping develop the Brown Moist-O-Gram allied slasher room equipment, introducing it to the industry, so worked with mills in the installation of complete automatic equipment for continuous bleaching and the application of temperature and humidity control for air conditioning in textile field.

Koch will succeed J. C. [Name], who has been acting manager of Philadelphia office, and will continue his work in the textile field.

Dorsey has been placed in charge of all manufacturers' business in Philadelphia and, henceforth, will supervise all such activity in the southern part of Honeywell's sales zone. He joined Minneapolis-Honeywell in 1920 in the research department of the Philadelphia office. Since that time, he has been in the service and wholesale departments in Philadelphia and was acting branch manager in 1940.

Nichols Appointments

P. H. NICHOLS & COMPANY, Inc., Ga., announce the appointment of JAMES G. NICHOLS as Sales Engineer, who will promote the sale of various products as handled by the company.

They also wish to announce the appointment of Mr. H. G. Lequin, Superintendent of Erection and Service Engineer. Mr. Lequin will advise the installation of stokers of various types of Fuel Burning Equipment, together with the Control Equipment, and he will act as Service Engineer on all of equipment.

This company represents the Stoker Corporation, Worcester, Mass.; The Swartwout Company, Cleveland, Ohio; Schutte & Koerting Company, Philadelphia, Pa.; Brooke Engineering Company, Philadelphia, Pa.; Pittsburgh Piping & Equipment Company, Pittsburgh, Pa.; Jerguson Valve & Gage Co., Somerville, Mass.

Canton Stoker Appointment

The CANTON STOKER CORPORATION, Canton, Ohio, announces the appointment of the DILLON SUPERIOR, RALEIGH, N. C., as sales representatives in central North Carolina large heavy-duty industrial and commercial stokers. The Dillon company is one of the oldest and most experienced equipment representatives in this area.

DARTS

are Quickly Demountable

**TWO BRONZE SEATS
GROUND TO A TRUE
BALL JOINT PERMIT
EASY UNCOUPLING**

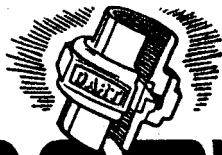


Whenever you wish to move a Dart Union to a new location, you'll find no trouble in uncoupling it. Because of its two bronze seats which have been ground to form a true ball joint, it closes to a drop-tight connection without excessive wrenching. Thus, undamaged, it will open easily whenever needed elsewhere.

Body and nut are of high-test air-refined malleable iron—are practically unbreakable.

Ask your supplier to send Darts—the most economical unions in length of service.

E. M. DART MANUFACTURING CO.
Providence, R. I.



DART
UNIONS

NEWS—Continued

T. C. I. Expansion

A two year construction improvement program in process steel-making, aimed at Southwestern needs, was announced by TENNESSEE COAL, IRON AND ROAD COMPANY.

The company is a subsidiary of the United States Steel Corporation, the South's greatest steel producer.

The construction program is undertaken at the Fairfield Mill, of the T.C.I. company at Birmingham.

The main objective of the program is to modernize and improve facilities for the production of sheets through a conversion from the Tennessee company's present hot-rolled method to the cold-reduced method of producing sheets. Another major improvement will be the installation of equipment for the production of galvanized sheet metal in coils, making Fairfield one of the few mills in the country capable of providing such material.

Included in this modernization program are the installation of a 72-inch four-high, four-stand cold-rolling mill; 48-inch continuous pickling and cleaning lines; two continuous galvanizing lines, one handling material in widths ranging from 20 to 30 inches and the other in widths of 20 to 48 inches; and annealing and shearing facilities of latest design.

Memphis Industrial Expansion

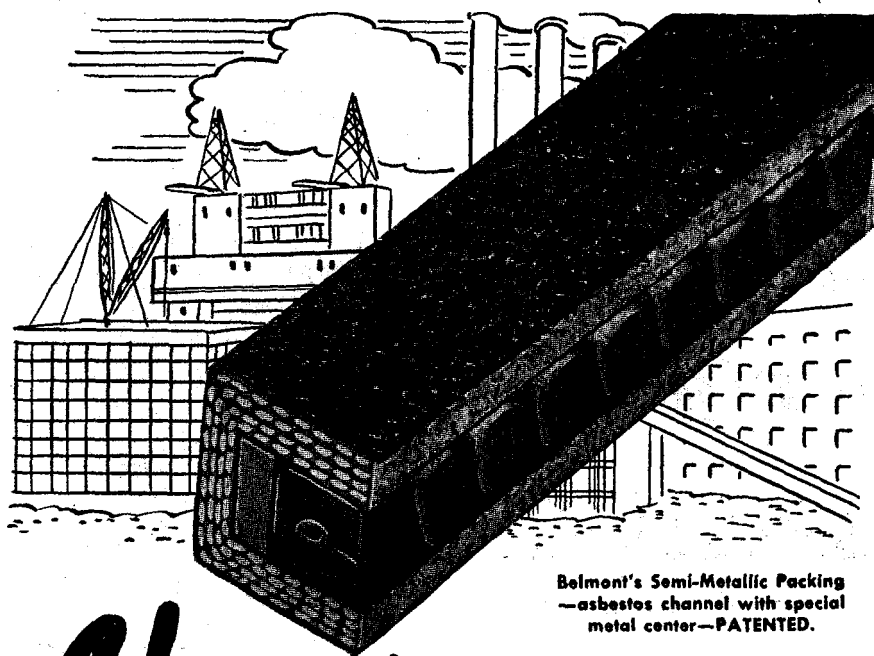
The 261 acre National Fireworks Inc. plant near CORDOVA, TENNESSEE, has been purchased by Mr. Frank G. Hickman, editor and publisher of The Cotton Trade Journal.

The newly organized CORDOVA INDUSTRIAL DEVELOPMENT Co. will establish an industrial community on the site of the wartime shell loading and incendiary bomb plant and will lease or sell tracts for manufacturing or distributing businesses.

Mr. Hickman stated that any industry which requires fairly large open areas of floor space and needing more than the average overhead clearance will find the manufacturing buildings adaptable to these uses.

Union Electric Has New Department

A new department in the Power Production Division known as the "Steam-Electric Plants Department"



Belmont's Semi-Metallic Packing
—asbestos channel with special
metal center—PATENTED.

Closest to Frictionless Seal

Soft metal volutions which bulge toward the rod under gland pressure make Belmont's No. 865 Semi-Metallic Packing the ideal seal for high-pressure steam rods, valve stems and air compressor rods. It's a tight, metal-to-metal, practically frictionless seal.

The unique, spirally-wound metal is encased in a stitched asbestos channel. The packing is so flexible that it can be formed around small diameters.

Have your Belmont distributor furnish you with Belmont's 865

(ring form) or 866 (spiral form). For low pressure steam, hot and cold water rods and plungers and ammonia rods, specify Belmont 860 (ring) or 861 (spiral)—same as 865, with stitched rubber-and-duck channel on three sides.



IN THE BLUE-AND-ORANGE BOX

THERE IS A BELMONT PACKING FOR EVERY SERVICE... Belmont distributors are located in every large industrial center, ready to give you prompt delivery from local stocks.



THE BELMONT PACKING AND RUBBER CO.

Butler and Sepviva Streets
Philadelphia 37, Pa.

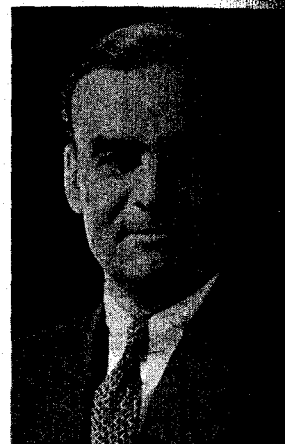
NEWS—Continued

chase from the Reconstruction Finance Corporation of the Wayne (Ind.) plant where they manufactured turbochargers during the war. Given \$5,000,000 for the plant, according to the Company's announcement.

It is expected that more than 100 persons will be employed at the plant as soon as installation of production lines is completed. In the past several months the plant has been in limited operation, employing upwards of 700 persons.

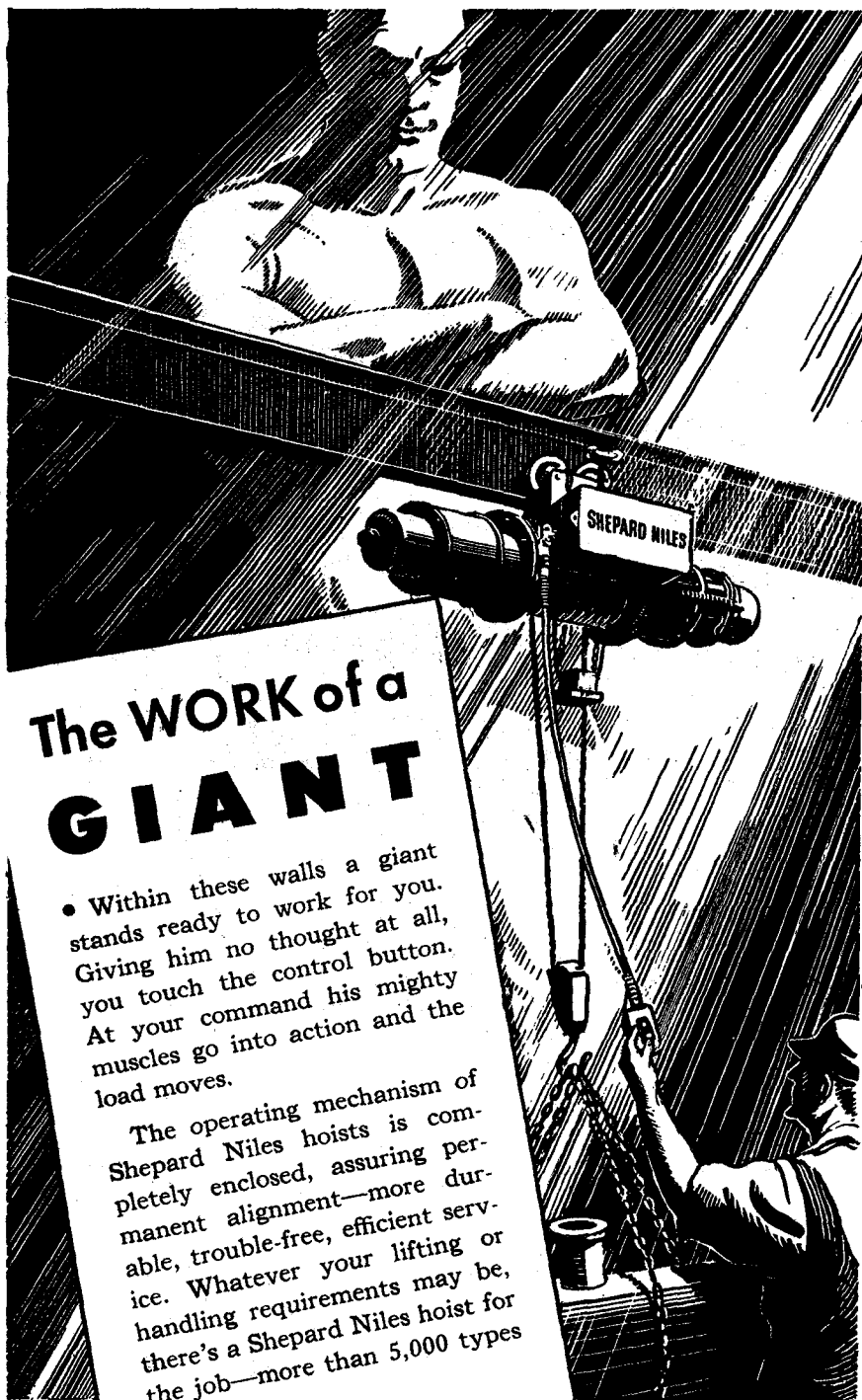
Taylor Elected Executive Vice President of Lincoln Electric Co.

C. M. TAYLOR has been elected executive vice president of the LINCOLN ELECTRIC COMPANY by the board of directors.



Mr. Taylor has been with The Lincoln Electric Company since 1917, having been granted a leave of absence for service in World War I. He enlisted in the Air Corps in 1917, returned at the end of the war, and he became a foreman. Later he was placed in charge of the company's time study and methods department, advanced to assistant superintendent, and then superintendent. In 1927 he was appointed vice president in charge of sales and has served on the board of directors since 1927.

Mr. Taylor is a member of the American Welding Society, Cleveland Chamber of Commerce, Mayfield Country Club, the Union Club, and Alpha Delta Phi fraternity. He was educated at Prospect Elementary School in East Cleveland, Shawmut School, and Western Reserve University.



The WORK of a GIANT

- Within these walls a giant stands ready to work for you. Giving him no thought at all, you touch the control button. At your command his mighty muscles go into action and the load moves.

The operating mechanism of Shepard Niles hoists is completely enclosed, assuring permanent alignment—more durable, trouble-free, efficient service. Whatever your lifting or handling requirements may be, there's a Shepard Niles hoist for the job—more than 5,000 types and sizes.

Powerful and rugged, Shepard Niles Cranes are available in any desired capacity and span—designed to handle greatly varying loads with precision, safety and economy. Shepard Niles Cranes have the same sound, progressive features as do the Shepard Niles Hoists. A request will promptly bring illustrated bulletins.

Shepard Niles

CRANE & HOIST CORPORATION

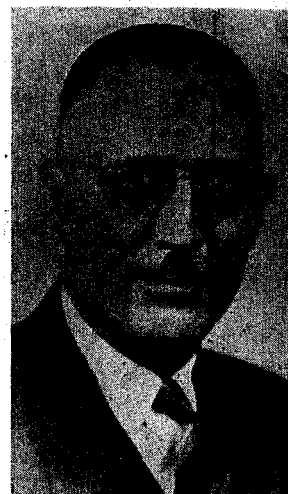
455 SCHUYLER AVENUE • MONTAUR FALLS, N. Y.

The experience and facilities of Shepard Niles engineers are at your service. Plan ahead now for the right material handling equipment. Your inquiry will receive prompt attention.

NEWS—Continued

Permutit Washington Appointment

JOHN C. TRACEY, former Lt. Colonel of the U. S. Army Engineers, has been named Sales Engineer of the WASHINGTON, D. C. office of the PERMUTIT COMPANY.



Mr. Tracey, whose experiences include eighteen months of road and airfield construction and maintenance on the Ledo Road in the China-Burma-India theater, left the St. Louis office of The Permutit Company in 1941 to join the army. He was head of the Water & Sewers Section of the Repairs and Utilities Branch, O.C.E. for 2 years in Washington before going overseas in 1944.

U. S. Rubber Purchases Two Southern Plants

UNITED STATES RUBBER COMPANY has purchased the combed yarn plant of RUBY COTTON MILLS, INC., GASTONIA, N. C., in a move to further diversify its production of textile products.

The plant, employing 300 men and women, has 19,000 spindlers. The purchase price was \$1,300,000 for the buildings, equipment, and land plus an additional sum to be determined by audit for raw materials and other assets.

The plant will continue to operate under the present management, with Don Maddox in charge as superintendent. Production of 20's and 50's combed yarn will continue without interruption.

United States Rubber Company also purchased from the War Assets Administration the modern manufacturing buildings at MILAN, TENN. The new facilities will be used for the

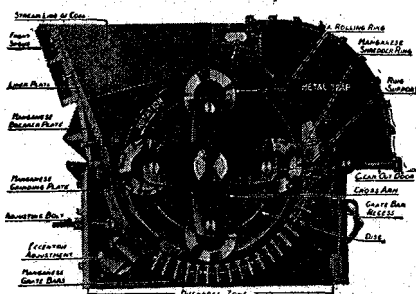
CRUSHERS

GRINDERS

SHREDDERS

CHOPPERS

*Custom-built
to fit every
requirement*



No matter what your crushing problem requires, whether it's speed—heavy-duty use—severe continuous usage—flexible operation—low operating cost—wide range of reduction—rapid, uniform crushing or high capacity output, you'll find an American Crusher especially suited to your particular needs.

Americans are not "all-purpose" crushers but are custom-built to fit specific crushing requirements and are built in many different sizes and many different models, with capacities as high as 500 TPH.

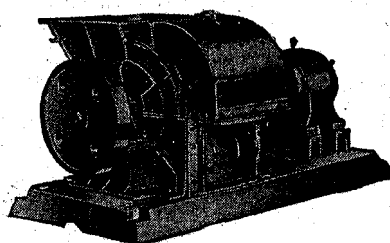
In manufacturing plant, quarry, coal mine, power plant, laboratory—wherever an efficient crushing operation is needed, you'll find Americans fulfilling every requirement. Americans offer a wide range of uniform reduction and crush a large variety of friable and fibrous materials.

Write us about your specific crushing problem and receive complete crushing data and specifications.

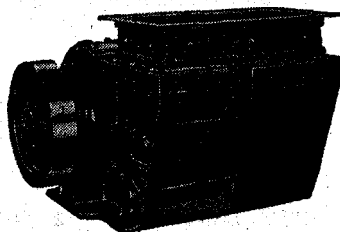
American PULVERIZER COMPANY
Originators and Manufacturers of
Ring Crushers and Pulverizers
1243 MACKLIND AVE.
ST. LOUIS 10, MO.



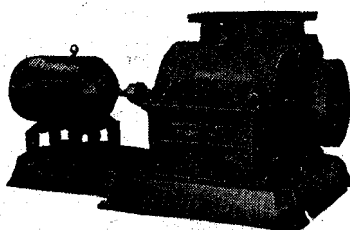
AC SHREDDER RING CRUSHER



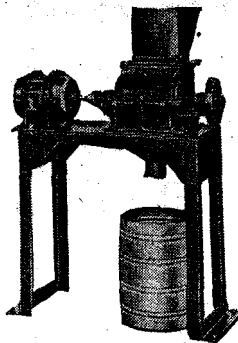
TYPE S CRUSHER



HAMMERMILL and HOG



24 SERIES RING OR HAMMER TYPE



LABORATORY MILL

NEWS—Continued

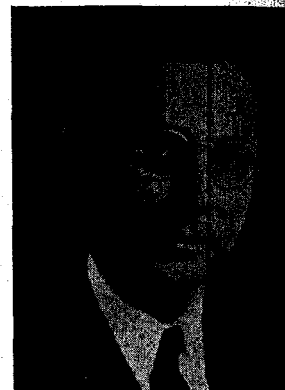
manufacture of fabric rubber-casual shoes.

The buildings bought by the rubber company were units of the Creek Ordnance plant, an important shell loading plant during the war.

Installation of heavy machinery such as mills, calenders, and vulcanizers will be started by United Rubber Company at once. Manufacturing operations are scheduled to begin in the fall.

Oakite Sales Manager

Announcement is made by Oakite Products, Inc., New York, of the appointment of J. C. LEONARD as Sales Manager of its Industrial Market Division. Associated with the Oakite organization in the servicing of specialized cleaning materials.



equipment for over 22 years, the 16 years of which was in the capacity of Manager of the Company's Chicago Division, Mr. Leonard assumed new duties on September 1, 1946. He will direct the marketing and selling activities of Oakite's industrial field staff from the general office of the company in New York.

Tucker Is Lindsay Representative

The LINDSAY CORPORATION, Madison Park, Illinois, announces the appointment of Thomas B. Tucker as Southern regional representative. Tucker's offices will be at the Candler Building, Atlanta 3, Georgia.

A.S.R.E. Atlanta Chapter

The American Society of Refrigerating Engineers announces the Atlanta section has been organized to increase the activities of the society in this area.

The first meeting was held September 20 at the Biltmore Hotel.



The NEW molded "Vee" type packing engineers have been looking for

Palmetto Pyramid is an all-purpose molded "Vee" type packing that seals firmly by mere finger-tightening. It is designed according to recently developed and thoroughly proven principles.

Performance of this much-talked-about packing is entirely automatic. Its sealing action is effected by internal pressure. The greater the internal pressure—the tighter the seal!

The unique "arrowhead reservoir"—one of the features of Palmetto Pyramid—actually stores and distributes the lubricant. Friction and wear are thereby appreciably reduced; packing and equipment life are substantially lengthened. And—look at the heavy wall construction!

Palmetto Pyramid is used for reciprocating as well as rotary motion. It is recommended for all types of hydraulic and pneumatic equipment handling hot or cold water, steam, oil, gasoline and most types of solvents and acids.



"It pays to know your Palmetto Packing Distributor!"

GREENE, TWEED & CO.

Manufacturers of PALMETTO Packings

BRONX BLVD. AT 238th ST. NEW YORK 66, N. Y.
Plants at New York, N. Y. and North Wales, Pa.

GREENE, TWEED & CO. New York 66, N. Y.

☐ Send me descriptive literature covering PALMETTO Pyramid Packings

☐ Send a PALMETTO representative to discuss packing

Name

Company

Street

City State

This coupon is for your convenience. Mail it today!

NEWS—Continued

Carrier Sales Manager

Appointment of ARTHUR P. LIN as Vice President and Sales Manager of CARRIER CORPORATION is announced by Edward J. Shanklin, Senior Vice President.

Effective November 1, 1946, Shanklin will be in charge of Carrier's domestic sales activities.

A vice president of Carrier Corporation since 1941, Mr. Lin has been associated with the company since his graduation from the University of Kentucky in 1919. During this period he has served in sales and executive capacities. He is present is Vice President in charge of Dealer Sales.

STATEMENT

of the ownership, management, etc., required by the Acts of Congress, August 24, 1912, and March 3, 1907, SOUTHERN POWER AND INDUSTRY, published monthly at Dalton, Ga., for 1, 1946.

State of Georgia, County of Fulton. Before me, a Notary Public, in and for said State and County aforesaid, personally appeared E. W. O'Brien, who having sworn according to law, deposes that he is the Managing Director of SOUTHERN POWER AND INDUSTRY. The following is to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid corporation for the date shown in the affidavit required by the Act of August 24, 1912, as amended by the Act of March 3, 1907, embodied in section 537, Postal Laws and Regulations, printed on the reverse of the to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, E. W. O'Brien, Smith Publishing Co., Atlanta, Ga.; Editor, Francis C. Smith, Atlanta, Ga.; Managing Director, Eugene W. O'Brien, Atlanta, Ga.

2. That the owners are W. R. O'Brien, Smith Publishing Co.; Estate of W. R. O'Brien, Atlanta, Ga.; O. A. Sharpless, Atlanta, Ga.; J. C. Cook, Atlanta, Ga.; W. J. Rooker, Atlanta, Ga.; T. W. McAllister, Atlanta, Ga.; W. O'Brien, Atlanta, Ga.; Mrs. E. W. O'Brien, Atlanta, Ga.; Richard P. Smith, Atlanta, Ga.

3. That the known bondholders, mortgagees and other security holders, owning or holding 1 per cent or more of total amount of bonds, mortgages, or any other securities, are, None.

4. That the two paragraphs next following giving the names of the owners, stockholders, and security holders, if any, contain only the list of stockholders and security holders as they appear upon the books of the company, but also in cases where stockholders or security holders appear upon the books of the company as trustees, any other fiduciary relation, the name of the person or corporation for whom such stock is acting is given; also that the two paragraphs contain statements embracing the full knowledge and belief of the stockholders and security holders as to the circumstances and conditions under which they appear upon the books of the company, hold stock and securities, in capacity other than that of a bona fide owner, and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in said stock, bonds, or other securities, as stated by him.

E. W. O'BRIEN, Managing Director, Sworn to and subscribed before me, 25th day of October, 1946. SEBA J. JONES, Notary Public. My commission expires Feb. 19, 1947.

New Equipment

Flexible Polishing Wheel

The MANHATTAN RUBBER DIVISION of RAYBESTOS - MANHATTAN, INC., Passaic, N. J., announces its latest addition to its line of polishing and finishing wheels. The new wheel is the most flexible of this series of soft neoprene bonded polishing wheels. The wheel is bonded with a specially modified compound of neoprene impregnated with abrasive grain.

This neoprene wheel can be varied over a wide range of densities depending on its ultimate application. This Manhattan wheel has already found its place for finishing on stainless steel, glass, non-ferrous and precious metals. It is supplied in the finer abrasive grain sizes or with pumice, rottenstone, or other mild abrasives and is very effective in blocks and rubbing pads as well as in wheel form.

Industrial Oil

THE TEXAS COMPANY announces three additions to the line of Regal Oils, which are designed for turbines and hydraulic and circulating systems.

The new lubricants are classified as Regal Oils AZ, F, and G.

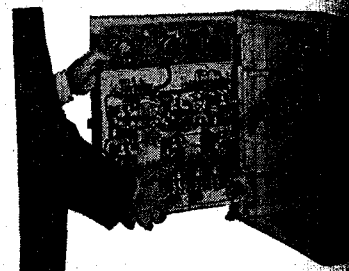
The first of these is suitable for use in hydraulic equipment in sub-zero temperatures, and the latter two are developed for use in mills where rust and oxidation inhibited oils of corresponding viscosity are needed. These oils are rust and oxidation inhibited oils which prevent clogging of oil lines, scoring of journals, and sticking of governors in marine and stationary turbine installations as well as rusting and sludging in hydraulic and circulating systems at both idle and operating temperatures.

The oils separate easily from water, do not foam, and are non-corro-

sive to bearings. Tests have shown that the new oils are many times more resistant to oxidation than turbine oils not containing inhibitors.

Welding Timers

The CONTROL DIVISION of GEORGIA ELECTRIC COMPANY, Schenectady, N. Y., announces the redesign of a complete line of sequence and sequence-weld timers for resistance welding. The new design permits quick change of the welding sequence, easy inspection and

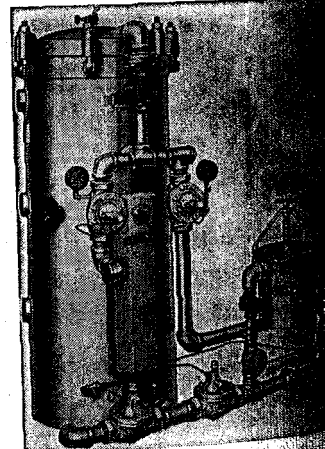


tenance, and remote operation. It includes an improved electronic circuit which makes possible the consistent welding speed essential for high-production welding with timing intervals.

It coordinates the mechanical operation of an air- or fluid-operated spot or projection welder with the flow of welding current as determined by a synchronous or asynchronous weld timer. For less exacting applications, the sequence-weld timer provides the necessary control of the mechanical sequence of operations and non-synchronous control of time.

Water Filter

BOWSER, INC., Fort Wayne, Indiana, announces a new series of water filters for industrial water filtration. Known as the Fig. 61 series, Bowser filters range in capacity from 15 to 500 gpm with 7



FEDDERS-QUIGAN CORPORATION

BUFFALO 7, N. Y.

square feet of filtering area. These filters occupy much less space than is needed for conventional sand filters.

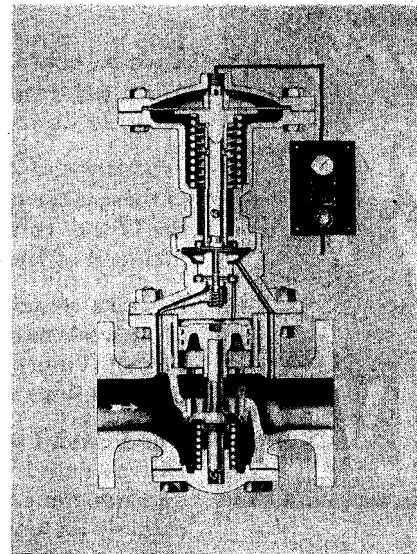
Filter elements are tubular, plastic impregnated cartridges which support the filtering medium. Diatomaceous earth is deposited evenly on these cartridges from the pre-coat pot and removes particles as small as $\frac{1}{2}$ micron.

Remotely Adjusted Valves

The LESLIE COMPANY, 261 Grant Avenue, Lyndhurst, N. J., announces a new single-seated, internal pilot, piston operated reducing valve designed to be remotely adjusted from a conveniently located air loading panel.

Known as Class LT-3, this reducing valve with the Type ARP air loading panel is especially adaptable to process piping arrangements that require hazardous or inconvenient readjustments of inaccessibly located valves.

In operation, the reducing valve is



adjusted to the desired pressure setting by air pressure supplied by the air loading panel. The constant loading force on the upper diaphragm of the reducing valve opens the controlling valve and is balanced by a constant reduced pressure proportional to the loading force.

Furnished in high pressure bronze or cast steel body with flanged or screwed ends, these valves have com-

pletely interchangeable replacement parts, stellite seat rings, and hardened stainless steel main valves.

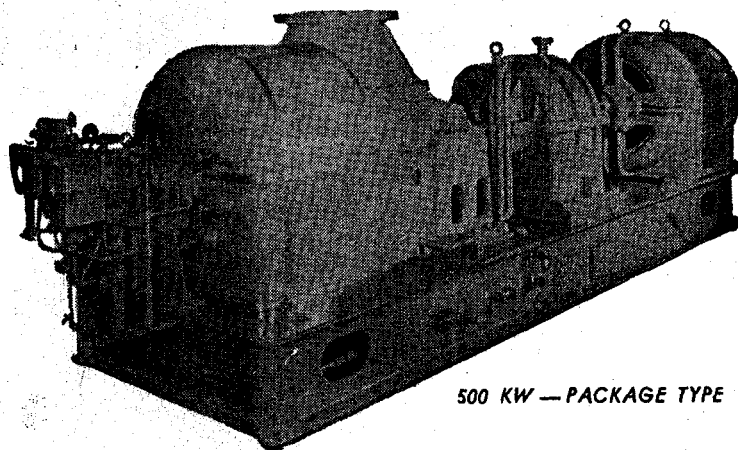
Automatic Water Feed Control

COMBUSTION CONTROL CORPORATION, 77 Broadway, Cambridge, Mass., announces the Fire-eye Boiler Water Control, Type 15GK1, which is an automatic control for maintaining desired boiler water level and instantly turning off fuel supply and sounding an alarm at a dangerous low water level. The equipment contains no moving parts, no float bellows seals, no vacuum tubes requiring replacement. It is an alternating current control that combines a probe circuit and transformer to operate a direct current relay through a rectifier. Direct current is used in the relay circuit to eliminate chatter, increase contact pressure, and make possible the use of low alternating current voltages in the probe circuit.

The probe fitting is mounted parallel to the water column and wired to the control. There are three probes within the fitting. The top and middle probes determine the high and low water level at which the boiler

MURRAY

STEAM TURBINE GENERATING UNITS



500 KW — PACKAGE TYPE

MURRAY also produces

Mechanical Drive Turbines—Horizontal and Vertical
Reduction Gears
Steam Boilers

The unit shown was one of thirty designed to deliver 500 KW alternating current on steam at 285 lb. Gauge initial pressure, 700 degrees F. total temperature and 27 inches vacuum. Provided with a rigid structural steel baseplate and with all service connections except generator leads above the floor line, the machine can be handled as a unit and installed with a minimum of preparation.

While "Package Type" units were furnished for export for installation in remote areas not previously supplied with power, the design can be utilized for small industrial plants for main or standby power supply.

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

BUILDERS OF STEAM POWER EQUIPMENT FOR THREE-QUARTERS OF A CENTURY

NEW EQUIPMENT—Continued

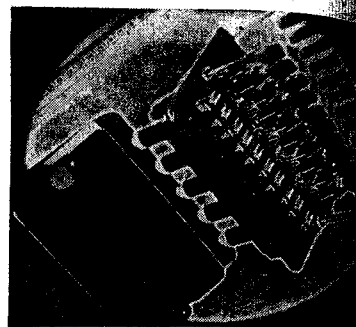
feedwater pump is turned off and on to maintain constant water level. The lowest probe defines the danger point below which water must not fall.

These feedwater controls are supplied for every make, type, and size of steam boiler, with any method of firing, and for any pressure to 300 lb per square inch.

Switch Board Switch

WESTINGHOUSE ELECTRIC CORP., Pittsburgh, Pa., announces a new test switch for rapid, accurate testing of switchboard instruments, meters, and relays from the front of the board. Designed with up to ten elements and rated at 250 v, 30 amp, combinations of current and potential switches are included as required for the various types of instruments to be tested.

Individual switches are of the knife blade type and are separated



by barriers. Moldarta switch handles are recessed for inserting identification cards. Each switch handle is drilled for insertion of an interlocking bar to tie together any three adjacent handles. The right-hand switch, when used for a trip circuit, is provided with a red handle for identification.

Automatic Welding Studs

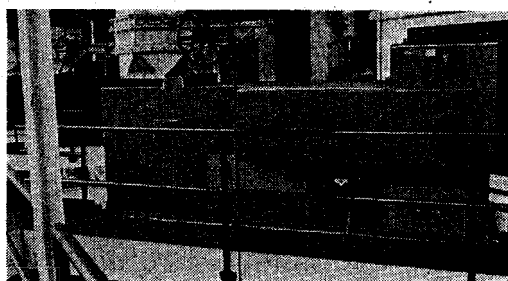
NELSON SALES CORPORATION, 1000 Street at Toledo Avenue, Lorain, Ohio, has recently developed Nelson staybolt studs for use on high pressure heating boilers and high pressure jacketed vessels.

The Nelson studs are automatically welded to the inner plate through holes drilled or punched in the outer shell. Welding is accomplished by the Nelson stud welding gun operating from a d-c welding generator.

After the staybolt stud is automatically welded, the projecting stud end is broken off with a hammer blow at the groove provided, leaving the stud end flush with the outer plate surface. A flat washer is then dropped over the stud end, which is positioned in line with the outer surface of the plate by the shoulder provided on the stud. The washer acts as a back-up for the plug welding operation which completes the staybolt installation. No problems of fit-up are encountered.

COAL PRICES ARE UP!
KEEP POWER COSTS DOWN

WEIGH
all coal accurately
on Richardson
automatic scales



Southern textile mill installation of two Richardson Combination Elongated Scale-Conveyors feeding pulverizers to 150,000-lb. boiler. Three other Richardson Scales feed automatic stokers of three small boilers.

The Richardson Coal-Weighing, Conveying, and Feeding System gives you up-to-the-minute, continuous readings — at sight — of weights of coal consumed by individual boilers. You don't have to guess — you can instantly determine the amount of steam generated per pound of coal by each boiler, compare evaporation rates and k.w.h. produced — thus spotting possible losses at the source.

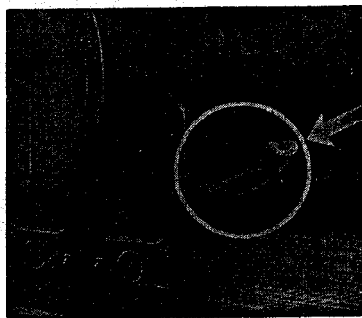
Richardson provides you with a complete bunker-to-boiler weighing and feeding system. It is adaptable to large and small plants because there are stationary and portable scales as well as the conveyor-scale combination illustrated, for either pulverizer or stoker-fired boilers.

Eliminate guesswork on boiler efficiency — check it right . . . by weight!
Write for Bulletin No. 1143.

RICHARDSON SCALE COMPANY, Clifton, N. J.
ATLANTA • BOSTON • BUFFALO • CHICAGO • MINNEAPOLIS • WICHITA
NEW YORK • OMAHA • PHILADELPHIA • SAN FRANCISCO • DETROIT • PITTSBURGH • MONTREAL • TORONTO

1792

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The NATIONAL Boiler Girth Seam PROTECTOR

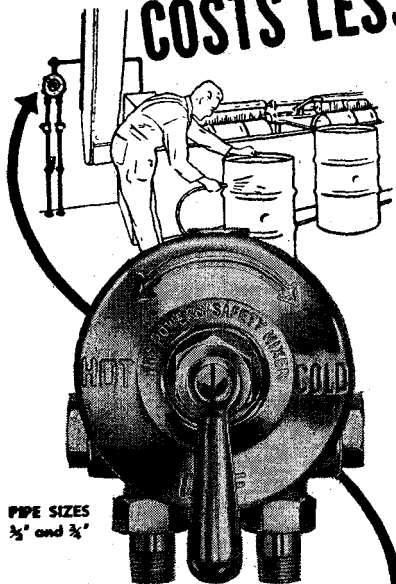
For 28 years plants who want to play safe have been turning to National Boiler Girth Seam Protectors for efficient protection against fire-cracking and pressure leakage and their accompanying dangers. Investigate this inexpensive, easily installed boiler protection system today.

NATIONAL BOILER PROTECTOR CO.
DAYTON, OHIO
(Write for Bulletin 5-A)



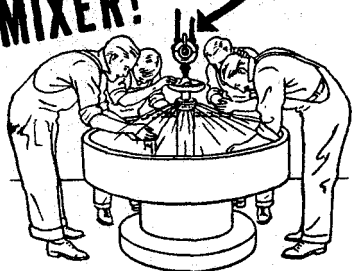
BEST KNOWN NAME IN
WATER TEMPERATURE CONTROL

**HOT WATER
COSTS LESS**



PIPE SIZES
 $\frac{1}{2}$ " and $\frac{3}{4}$ "

**WITH THIS
STEAM AND WATER
MIXER!**



● Powers Type D Mixer gives you hot, warm or cold water at any temperature you want.

● Heats water in most economical way... mixes steam with cold or hot water. Heats only what you need when you need it.

● Easy to install. Can be used wherever a supply of steam and water is available at 10 to 100 lbs. pressure. Write for Circular 3013-B or phone our nearest office.

OFFICES IN 47 CITIES

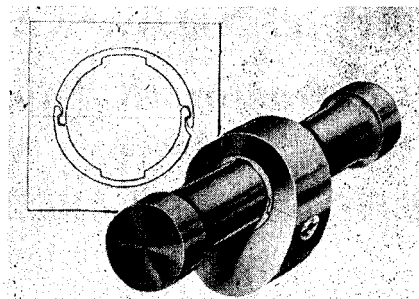
Atlanta, 135 Luckie St. N.W.
Birmingham, Box 27, Homewood
Station
Greensboro, 1034 Jefferson Stand-
ard Bldg.
New Orleans, 309 Vincent Bldg.

THE POWERS REGULATOR CO.
OVER 50 YEARS
OF WATER TEMPERATURE CONTROL

NEW EQUIPMENT—Continued

Interlocking Retaining Rings

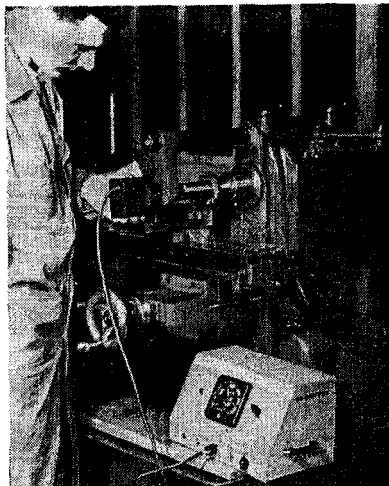
WALDES KOHINOOR, INC., Long Island City 1, N. Y., announces the Truarc Interlocking Ring, Type 5107, which may be fitted over a shaft in a radial direction so that the ring forms a complete annular shoulder of uniform section height around the circumference of the shaft. This eliminates the wide gap characteristic typical of conventional open type "C" rings. This feature substantially increases the normal thrust capacity of the ring.



Consisting of two mating halves that interlock, the ring is of dynamically balanced design and particularly suitable for equipment involving high rates of rpm such as spindles of textile machinery. Because of its positive interlocking action, the ring cannot be lifted out of its groove by high centrifugal forces or by linear expansion caused by friction with abutting parts or surfaces. Disassembly of the ring requires nothing more than a prying action with a screw driver.

Electronic Tachometer

SPECIAL PRODUCTS DIVISION of the GENERAL ELECTRIC COMPANY, Schenectady, N. Y., announces a new electronic tachometer designed for



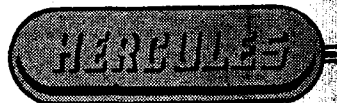
measuring rotating speeds from 10 to 50,000 rpm. Weighing only 10 lbs., the new tachometer is useful for production testing of equipment instantaneously without the necessity of permanent attachment. It can be used to indicate the speeds of electric motors, machine tools, automobiles and aircraft engines, pumps, blowers, and other types of rotating equipment.

The electronic tachometer consists of a small pick-up head, 6 ft. of flexible cable, and a measuring unit with a panel-mounted indicating unit reading directly in rpm. Either a low-speed or high-speed head can be used with the instrument. The pick-up heads consist of a light interrupting disk and a phototube. Light shining upon the phototube through the openings in the rotating disk produces input signals which are then transferred to the measuring unit which indicates rpm.

Machine Tool Coolant System

INJECT-A-FLOW PUMP COMPANY, 67 North Willow Street, Montclair, N. J., has developed a self-contained filtering system designed to remove

**659,000
Now in Service**



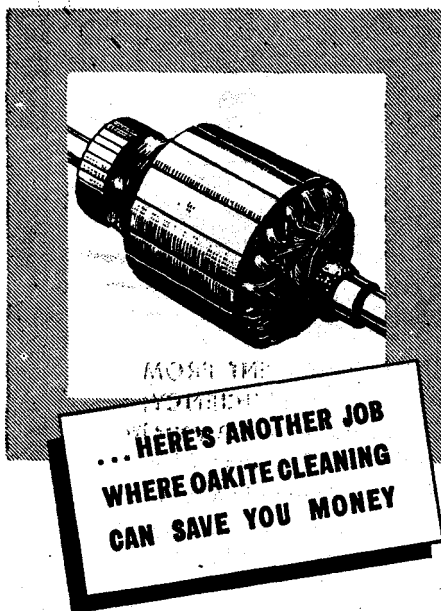
FLOATS

Established in 1894, Hercules Float Works now has 680,000 units in operation in the industry and ships of the world. Not one of these floats has been returned during the one-year guarantee period, except by reason of faulty or non-understandable specifications.

Hercules Float Works are the originators of Seamless Copper Floats.

"Quality First" is the Hercules motto. It pays to specify HERCULES Floats.

HERCULES FLOAT WORKS
200 Franklin St. Springfield, Mass.



Strip Insulation From Motor Windings This Low-Cost Way!

Whenever you are faced with the problem of stripping insulation and varnish from copper windings or coils before reconditioning electrical equipment try doing this work the fast, effective Oakite way. A brief immersion of units in a tank charged with that heavy-duty alkaline cleaner . . .

OAKITE TEST X

. . . quickly, thoroughly, safely removes varnish, lacquer, dried-on oil and dirt. Insulating tape is so thoroughly softened that it can be easily unwound without resorting to time-consuming knife-scraping.

Use Oakite Test X also for stripping paint from motor housings and other painted metal surfaces. For further details on this and many other maintenance jobs send for a copy of the new Oakite Power Plant Digest. It's yours FREE on request!

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Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized*
CLEANING
MATERIALS • METHODS • SERVICE

History of Power

(Continued from page 90)

ruptures were, for that reason, rarely accompanied by great violence. They did, however, thwart de Laval's purposes.

The cause of this trouble was in reality seated in the qualities of the feed water. As the water was evaporated, scale forming materials were deposited upon the interior tube surfaces. This incrustation served as an insulating medium. The tube lost its capacity to transmit heat as rapidly to the water as it was being absorbed by radiation and convection from the furnace. As a result of this circumstance, the tube was over-heated. When it was subjected to high temperatures it no longer possessed the physical properties which were essential to withstand the extremely high pressure involved. Tube failures were inevitable.

Experimental work of this character requires the expenditures of considerable sums of money. Sweden was at the same time in the throes of a depression. This circumstance complicated de Laval's problems very materially. He could not restrain himself from engaging in bold ventures. With the passage of the years he was compelled to relinquish the important financial position which he had held in The Separator Company, Ltd.

In an effort to recoup his financial losses, de Laval engaged in several enterprises which were not concerned with the construction of steam turbines. One of these ventures had as its object the development and manufacture of milking machines. This effort was unsuccessful. He devoted both his energy and his resources to a project in which he hoped to develop an advantageous means of refining low grade Swedish zinc ores.

This undertaking failed in the vicissitude left de Laval with few financial resources. At this time The Separator Company, Ltd., of which de Laval was now no longer executive, was a thriving concern. The board of its directors realized that Laval could have lived a life of ease after having developed the invention which it now manufactures, but that he had not felt this virtuous course of action. The company felt the urge to reward Laval for this character, and it awarded him a pension of 12,000 kronor.

De Laval's death occurred in Stockholm on February 2, 1913. His career was an important and impressive one. From a financial point of view he had made no substantial material progress, for his failures rendered nil the effects of his successful undertakings. From a scientific point of view he left a valuable endowment for those who would follow in his footsteps. His life experiences were characterized by significant circumstances. He was afraid to try to make progress by taking bold strokes. His insatiable desire to make progress was, moreover, such that he could not bring himself to spend long periods of time on his ideas. Instead of carrying out intensive development work, he chose to put his ideas to the test.

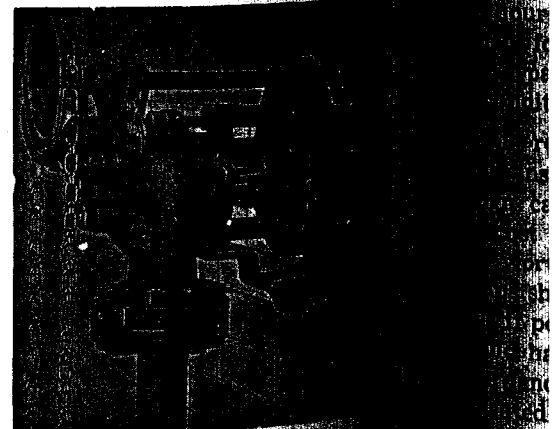
The character of his philosophy was rare. He regarded each completed successfully as a challenge to do more and better things. The people of his time lacked, in a measure, the capacity to appreciate work with propriety because he "lived far ahead of his time." The course of his career he was a member of the Swedish House of Lords. Many years were to pass before the full implication of his work was to be appreciated in a proper manner.

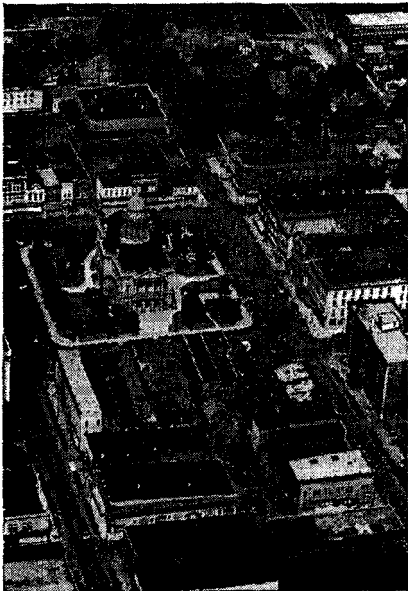
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—Marion, a busy, progressive and forward looking city of east central Indiana gets its entire water supply from Layne Well Water Systems. And taking a tip from the city are a brewery, a food processing plant, a radio and television station, two meat packers, a military home, a wire and rubber manufacturer, a glass company, a laundry and a wire and cable company—all of whom have their own individual Layne Water System plants.

—Seldom does an industrial product enjoy such dominating preference as is accorded to Layne Well Water Systems by Marion City and Factory executives. Such preference was earned through recognized reputation of superior quality and basically sound operation economy.

—Layne Well Water Systems are known to be the best that specialized engineering research can produce—and the best that American dollars can buy. For late catalogs and illustrated literature address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

HIGHEST EFFICIENCY

Layne Vertical Turbine pumps are available in sizes to produce from 40 to 16,000 gallons of water per minute. High efficiency saves hundreds of dollars on power cost per year.

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**WELL WATER SYSTEMS
VERTICAL TURBINE PUMPS**

CATALOGS AND BULLETINS

(Continued from page 12)

3094 DUST COLLECTORS—Bulletin 310—Describes integral dust collector specifically applicable to the grinding and buffing industry. Also illustrated is a "packaged" electrical precipitator which may be attached directly to the integral unit where higher efficiency is required. **THERMIX ENGINEERING COMPANY**, Greenwich, Conn.

3095 SYNCHRONOUS MOTOR CONTROL—Booklet, 20 pages—"The ABC of Synchronous Motor Control" tells the HOW and WHY and WHEN and WHAT of modern synchronous motor control. Contains 45 diagrams and photographs. **ELECTRIC MANUFACTURING COMPANY**, Minneapolis 13, Minn.

3096 TOOLS—Booklet, 24 pages—"Engineering Data on the Care and Operation of Celfor Drills" presents facts of a technical nature that will aid in selecting proper tools, maintaining proper balance between tool capacity and job requirements, and indicate the correct methods of tool maintenance and rehabilitation. **CELFOR TOOLS**, division of Clark Equipment Company, Buchanan, Michigan.

3097 ELECTRICAL EQUIPMENT—Catalog No. 46-1, 8 pages—Describes "Rotating Electrical Equipment" manufactured by the Company. Includes general description of a-c, d-c, and Universal motors for applications not met by standard motors; dynamotors and converters, motor-generator sets, a-c and d-c generators, gas and elec-

tric generating plants. **ELECTRIC SPECIALTY COMPANY**, Stamford, Connecticut.

3098 SILICONE FLUID—Pamphlet, 4 pages—Contains a table of physical properties, vapor pressure curves, a graph of pumping speeds, and a demonstration of inherent stability of organo-silicon polymers. **DOW CORNING CORPORATION**, Midland, Michigan.

3099 PIPE AND FITTING MATERIALS—Chart, 4 pages—"Chart of Pipe and Fitting Materials", deals with cast, intermediate alloy, stainless and special analysis steels, and covers A.S.T.M. specifications, chemistry, service limitations, welding procedure. **TUBE TURNS**, Louisville 1, Ky.

4000 LIXATE BRINE—Pamphlet, 4 pages—Describes operating economies of the Lixate Rock Salt Dissolver producing regenerating zeolite water softeners. **NATIONAL SALT COMPANY, INC.**, Scranton, Pa.

4001 CONTROLLER—Bulletin 231—Describes Model 40 Controller, the latest addition to Foxboro line of instruments for process control. Large illustrations show plain many features of design which make this model a wholly new instrument. **FOXBORO COMPANY**, Foxboro, Mass.

INSTANTANEOUS SERVICE

MARION Gulf Stream Hot Water Heater

Utilize low pressure or live steam to assure abundant hot water. **GULF STREAM** heats swiftly through four concentric tubes, including outer shell, providing intimate steam and water contact.

● Steam fills central tube and annular space between two middle tubes. Water enters through pipe at extreme left, fills annular space between central tube and one surrounding it and between shell and next inner tube. Slidable packing glands at shell ends

provide for expansion and contraction, prevent strains and leaks. Condensate moves to trap and returns to system, conserving heat value. Here is **ECONOMY** and **DEPENDABILITY**. Line ranges from 4" to 8" in diameter, 4' to 12' in length. Capacity ranges



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For Any Fluid -- Any Apparatus

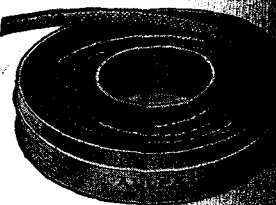
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YOU don't have to remove old packing to repack with ALLPAX. Its square cross section makes ALLPAX easy-filling in any stuffing box. Try it once and you, too, will be enthusiastic over its easy application, tight efficiency and long wear. Write us for full details.

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J. H. H. VOSS VALVES

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VALVE BEATS IN 4 VALVES PROVE
AGAIN THAT VOSS VALVES MAKE
COMPRESSORS RUN BETTER THAN
WHEN THEY WERE NEW.

Read This Letter

MONTICELLO ICE COMPANY
Owned and Operated by
A.T. REYNOLDS & SON
9 High Street, Monticello, New York
and Kiamasha, N.Y.
October 23rd, 1942

J. H. H. Voss Company
785 East 144th Street
New York, N. Y.

Dear Sir:

Approximately June 15, 1939 we installed a complete set
(4) of your Voss Valves in our 9-7/8" x 14" 257 r.p.m.
Norwalk-Carbondale ammonia compressor. Since that time
these valves have operated approximately 18,000 hours
without ever having been dismantled. At the present
time valves are still operating as good as the day they
were installed. However because of the long service
they have given we have been wondering if it would not
be advisable to ship them to you for inspection and
replacement of any worn parts.

At the present time this machine is out of service and
will be for perhaps another two months. During this
shutdown period we would like to get it in the best
condition possible so that we have no interruptions
after we start.

We would appreciate your advice on above.

Very truly yours,
MONTICELLO ICE CO.

THIS IS THE **VOSS VALVE**

AS GOOD AS NEW AFTER
18,000 HOURS OPERATION
AT 257 R. P. M.

Write us today for estimates — send
sketches or samples of your old valves
to

J. H. H. VOSS CO.

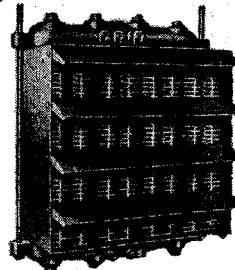
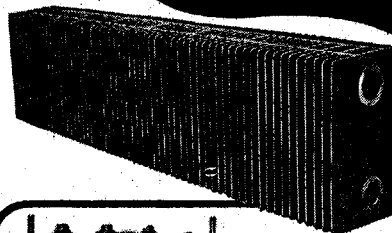
785 E. 144TH ST. CORNER WALES AVE. NEW YORK, N.Y.



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LAST AS LONG
THE PIPES FURNISHING
STEAM TO
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 - No soldered, brazed, welded or expanded connections to become loose or develop leaks.
 - No electrolysis to cause corrosion, leaks, or heating failures.
- It's the material that makes the difference in Grid Unit Heaters. That's why they are free from maintenance expense. Many units have operated over 16 years without maintenance. Complete information may be obtained from any of our southern representatives listed below. Ask them for new booklet "Grid Unit Heaters".

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IRON**
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Mr. W. F. Moerlin
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Mr. Emil Gathmann

D. J. MURRAY MANUFACTURING CO.

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A fully automatic Thermal Relay (fluorescent starter) scientifically made to assure maximum economy of operation, greater reliability and more consistent performance.

A thermostatic switch equipped with silver contacts, carbon resistor and nichrome heater coil, bonded in a ceramic insulating material of high dielectric strength.

Licensed under
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Others Pending

You'll find Industrial Electronics Corporation products in factories, office buildings, stores, railroad terminals, shipyards, school-rooms . . . everywhere contributing to the comforts of American Life.

The (SP-15-20) for use with either 15 or 20 watt lamps
The (SP-30-40) for use with either 30 or 40 watt lamps
The (SP-100) for use with 100 watt lamps

Ask for descriptive literature

INDUSTRIAL ELECTRONICS CORP.

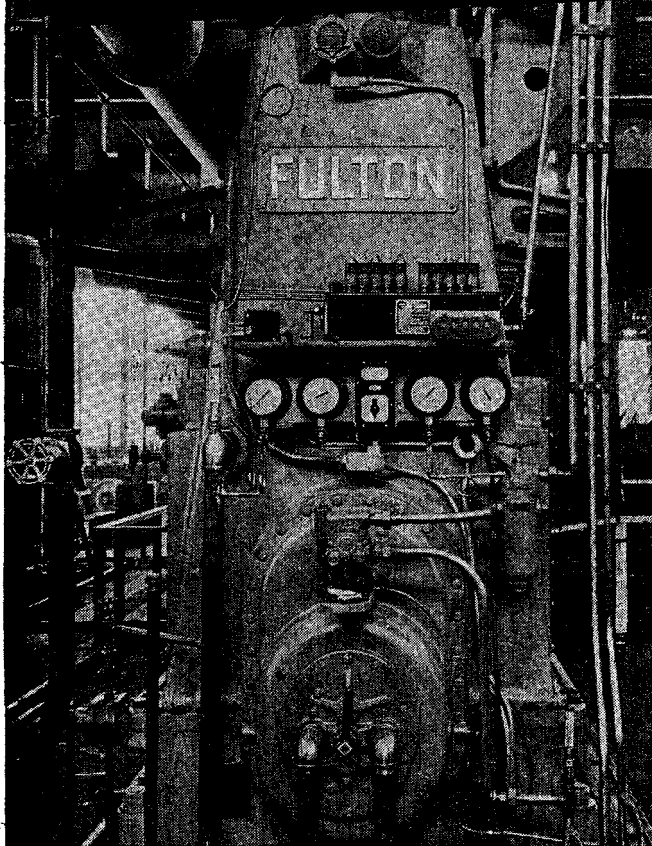
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Newark, N. J.

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assure **PERFECT**
CYLINDER LUBRICATION
for **FULTON DIESELS**



● Manzel Lubricators have proved their dependability and efficiency in the exacting service of Diesel lubrication. As a result, the Fulton Iron Works and other leading engine manufacturers rely on Manzels.

Manzel Model 94 Lubricators pump against any pressure usually found in Diesel engines. They deliver the oil drop by drop exactly as needed. The clear view liquid sight feed shows exactly the amount delivered to each friction point on each pump stroke.

Write for Catalog 94-B.

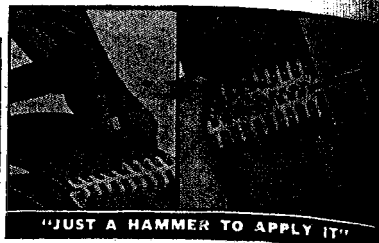
MANZEL BROTHERS CO.

Subsidiary of **FRONTIER INDUSTRIES, INC.**

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Builders of **HIGH PRESSURE** for half
METERING PUMPS a century

BELT LACING
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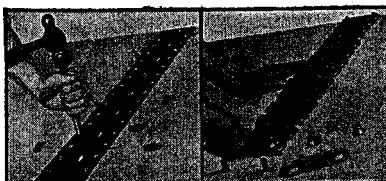
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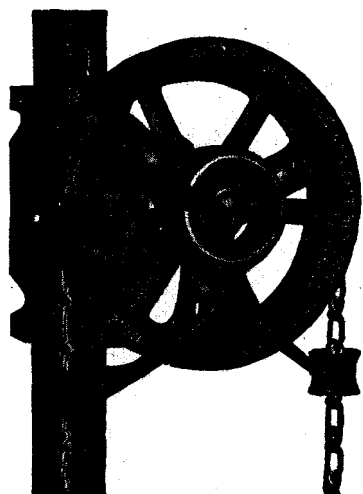
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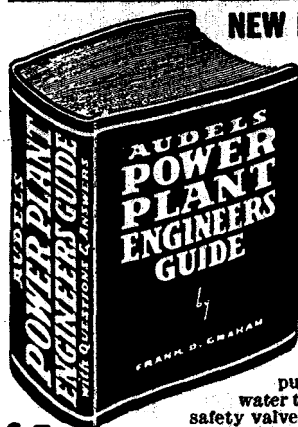


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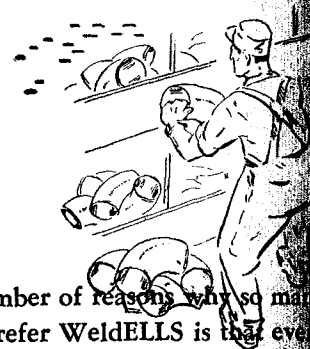
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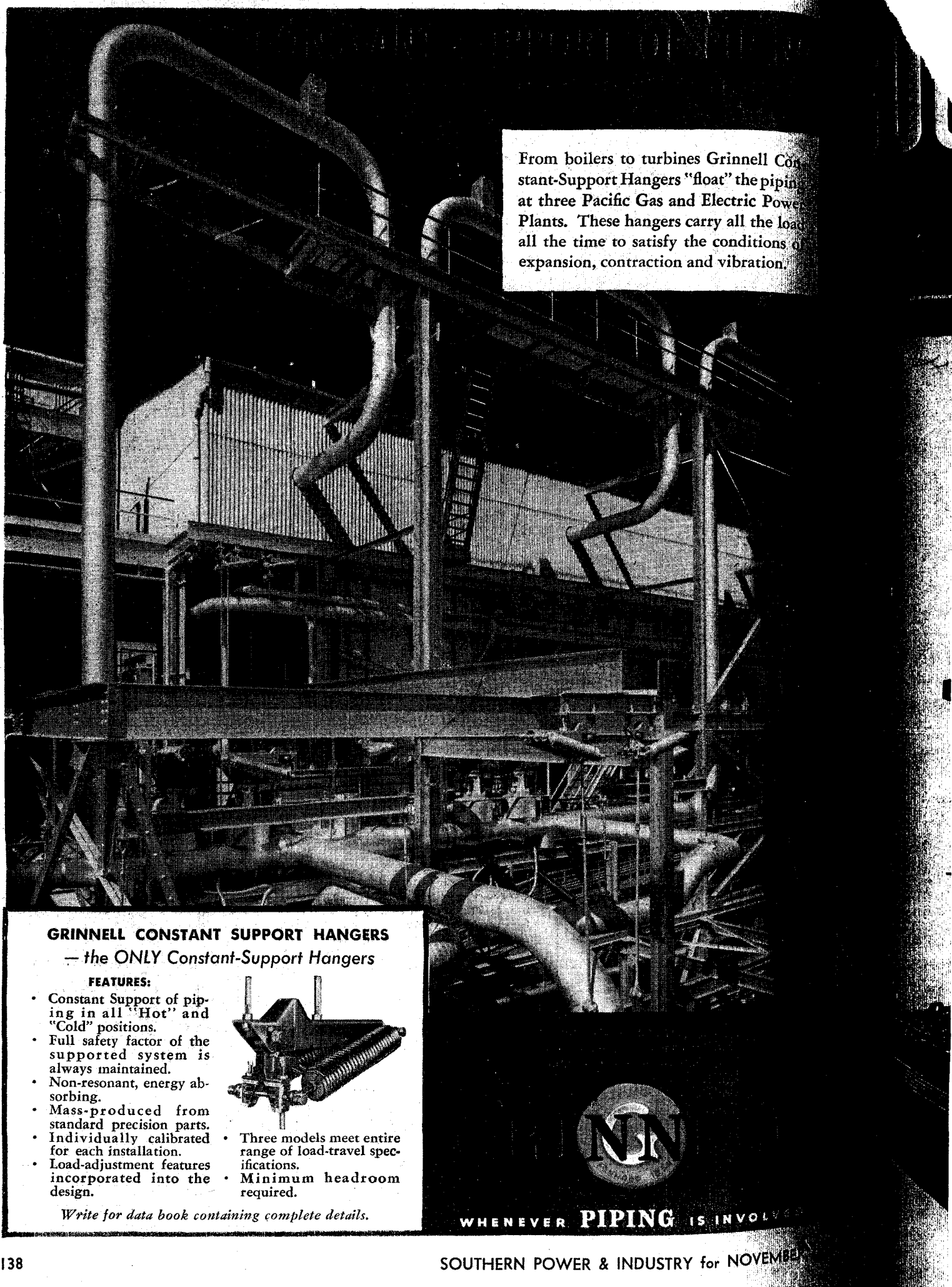
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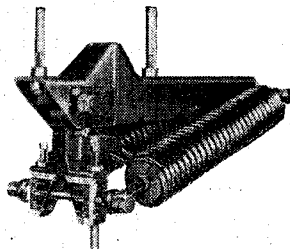


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