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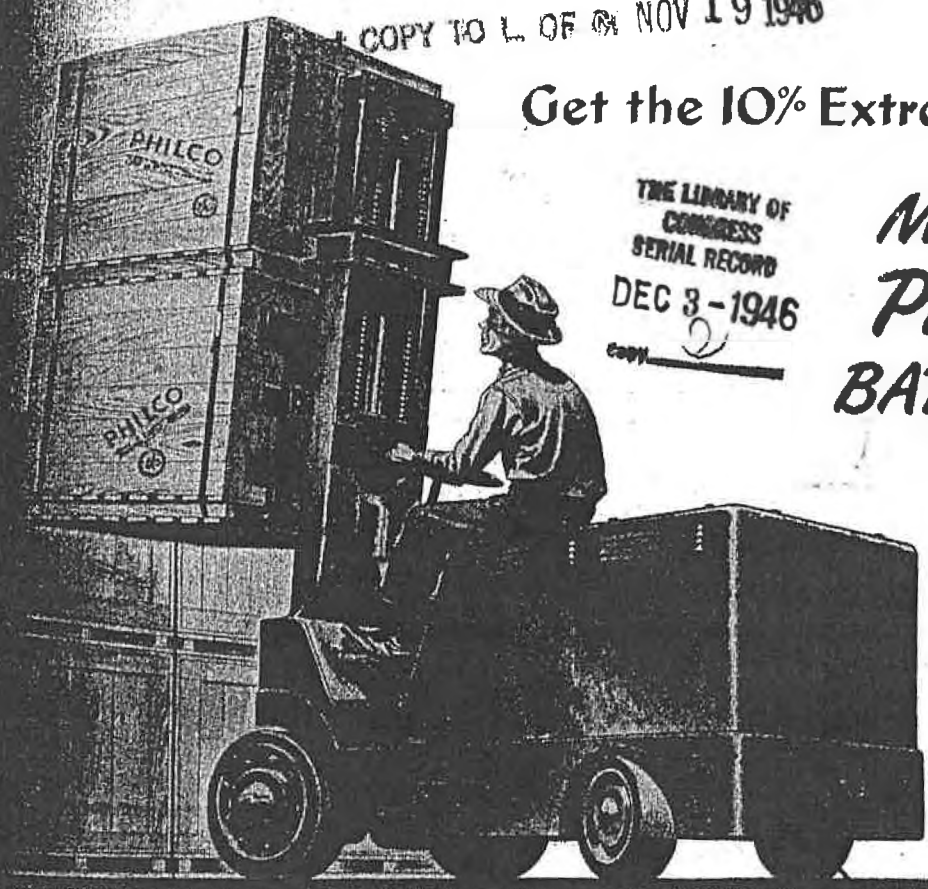
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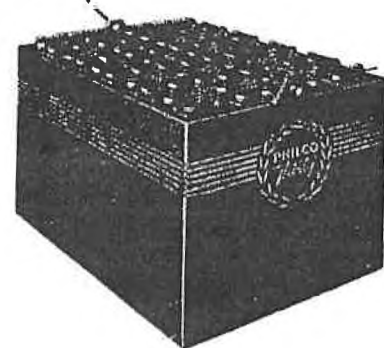
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Volume 64

Number 11

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PRESSURE BOILERS

*take more
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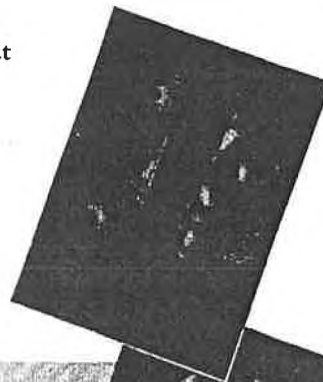
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DEVELOPING successful water treatment for high pressure boilers is a job for research chemists and engineers—not salesmen. Steam and water in high pressure systems are different—both in physical characteristics and in reactions involving scaling, corrosion and foaming. These differences are familiar to Nalco scientists—and are the reason that the Nalco System of Scientific Water Treatment in high pressure power plants is as effective and economical as it is in thousands of medium and low pressure installations.

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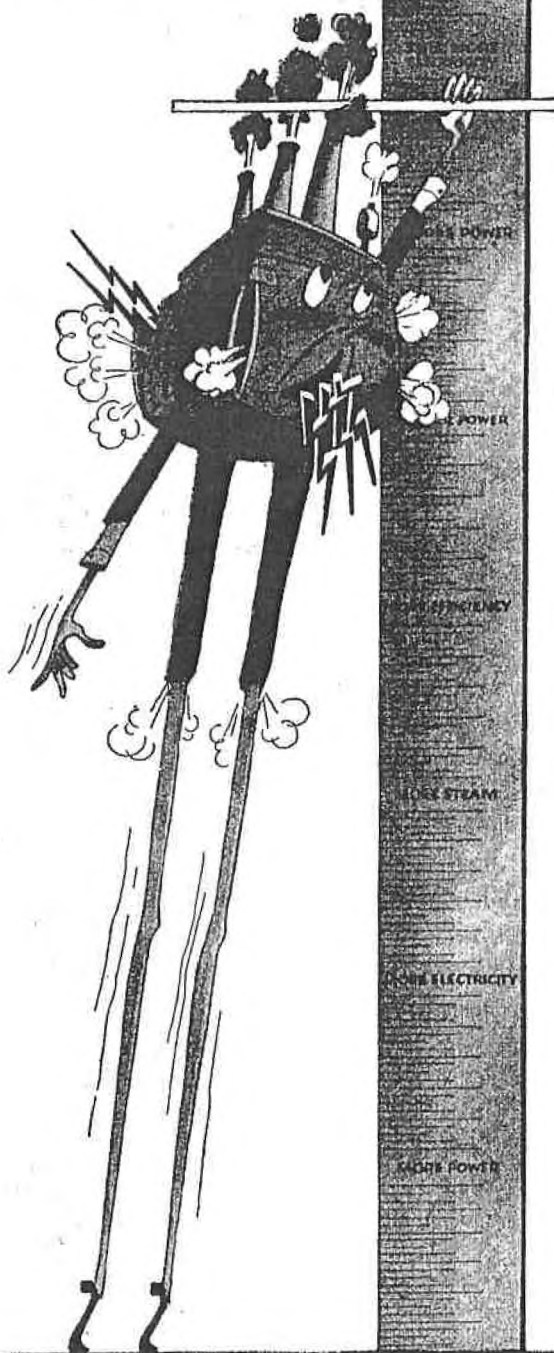
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BER, 1946

SOUTHERN POWER AND INDUSTRY

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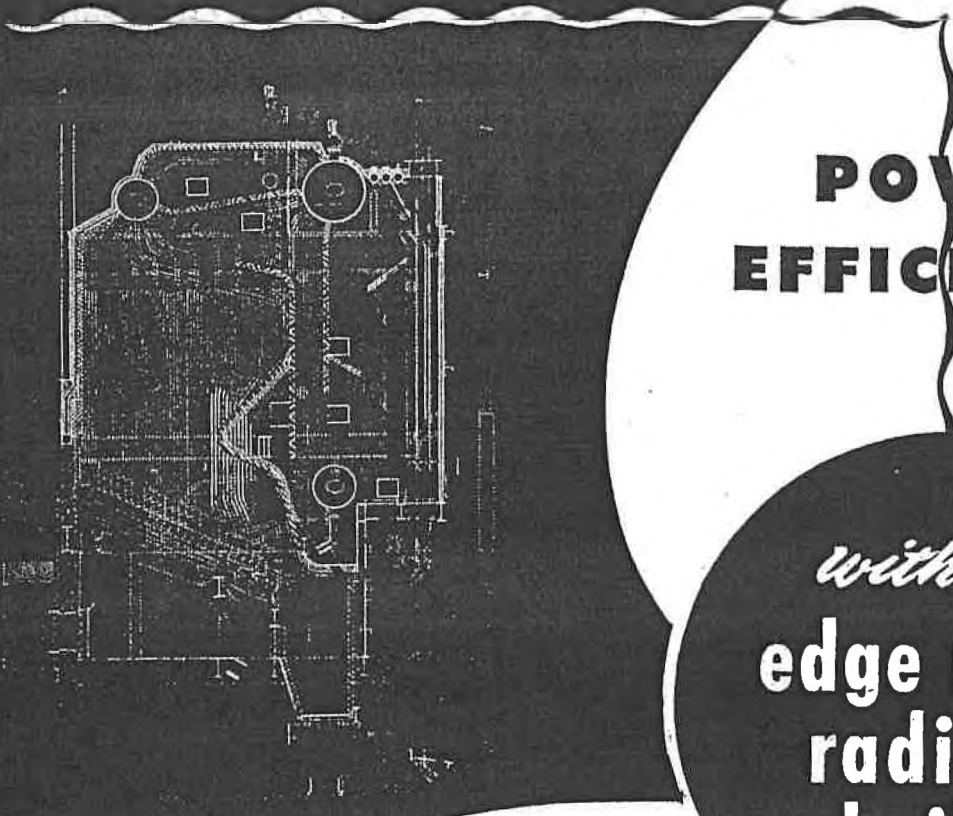
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POWER EFFICIENCY

with an
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radiant
boiler**

This installation covers two boiler units installed in a large southern plant. Each unit delivers 135,000 lbs. steam per hour at 300 lbs. pressure, final steam temperature of 575 degrees. Unit is fired with a multiple retort underfeed stoker and equipped with an Edge Moor vertical tube integral economizer.

To give you *more* power efficiency, Edge Moor Radiant unit design embodies all the advantages of a 3-drum boiler with a water-cooled furnace and maximum boiler tube surface exposed to radiant heat . . . all in a minimum of space.

This is the result of the combination of engineering skill and expert workmanship that for over three-quarters of a century have distinguished all Edge Moor products.

This arrangement provides for a large water storage, a generous steam liberation surface and quiet offtake drum. Furnace cooling is disposed for a minimum of maintenance and the best operation for the particular fuel to be burned. The ability of these units to steam quickly and deliver high ratings is a matter of record. Edge Moor Radiant Heat Boilers are available in a wide range of capacities, pressures and total temperature requirements. They are adaptable to all fuels and can be supplied with all boiler auxiliaries.

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EM

Facts and Trends

FOR SOUTHERN INDUSTRIAL AND POWER EXECUTIVES

November 1, 1946

POWER EQUIPMENT INNOVATIONS of the past several months will be featured at the 17th National Power Show to be held the first week of December in New York. A model of a gas turbine designed for power generation in the utility field will be displayed along with new combustion equipment, apparatus for pulverizing coal, small Diesel-electric units designed for portable use, "emergency" 50 to 500 hp self-contained boilers, and burners capable of firing coal, oil, and gas selectively or in combination. Machine tools, materials handling equipment, and power plant protective equipment will also be featured.

ALUMINUM ALLOY BEARINGS are now being developed for improved score, fatigue, and corrosion resistance in heavy load applications. Numerous reported service tests of solid aluminum alloy and steel-backed aluminum bearings indicate improved performance. Self-lubricating powdered aluminum alloy bearings are still in the formulative stage.

METHODS TRENDS - transparent plastic machine bearing models, fed with pigment colored oil, afford visual study of lubrication effectiveness . . . protective chemical packing compound applied with spray gun has tensile strength of 2,000 psi and elongation of 200 per cent and is stable from minus 40 F to plus 180 F.

OVER 1700 INDUSTRIAL - VOCATIONAL FILMS, available to industry on rental, purchase, or free loan basis, are listed in "The Index of Training Films" distributed by the Eastman Kodak Co., Rochester 4, N. Y. This classified industrial inventory of available training materials covers diversified fields in the Ceramic and Glass Industries; Chemical Industry; Electronics including Generators & Motors, Electrical Measurement, Motor Maintenance & Repair, Radio & Communication; Engineering; Diesel, Internal Combustion & Steam Engines; Foundry and Forging Practice; Hydraulics; Machine Shop Practice; and in the Plastics, Refrigeration, and Wood Working Industries.

REPRODUCTION OF WORKING DRAWINGS on metals, plastics, hard rubber, and other non-porous materials can be economically accomplished by the use of a new spray gun applied, light-sensitive, quick-drying, primer and coating. The process, carried out in ordinary room lighting conditions, consists of clear lacquer priming, coating, exposure to bright light of sensitized metal in contact with the drawing and washing with a 2 per cent solution of ammonia and warm water. Complex layouts can be produced in quantity and finished layouts withstand bending, shearing, and punching without loosening. It is applicable in the making of photo templates, wiring diagrams, instrument panels, dials, and for general decoration of metal, wood, and plastic surfaces.

MASS-PRODUCTION of packaged heat-pump units was encouraged at a recent South-eastern 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.

PLASTIC PARTS are now metal coated by various metal spraying and chemical reduction methods to increase their overall strength and dimensional stability and to improve corrosion, impact, and abrasion resistance.

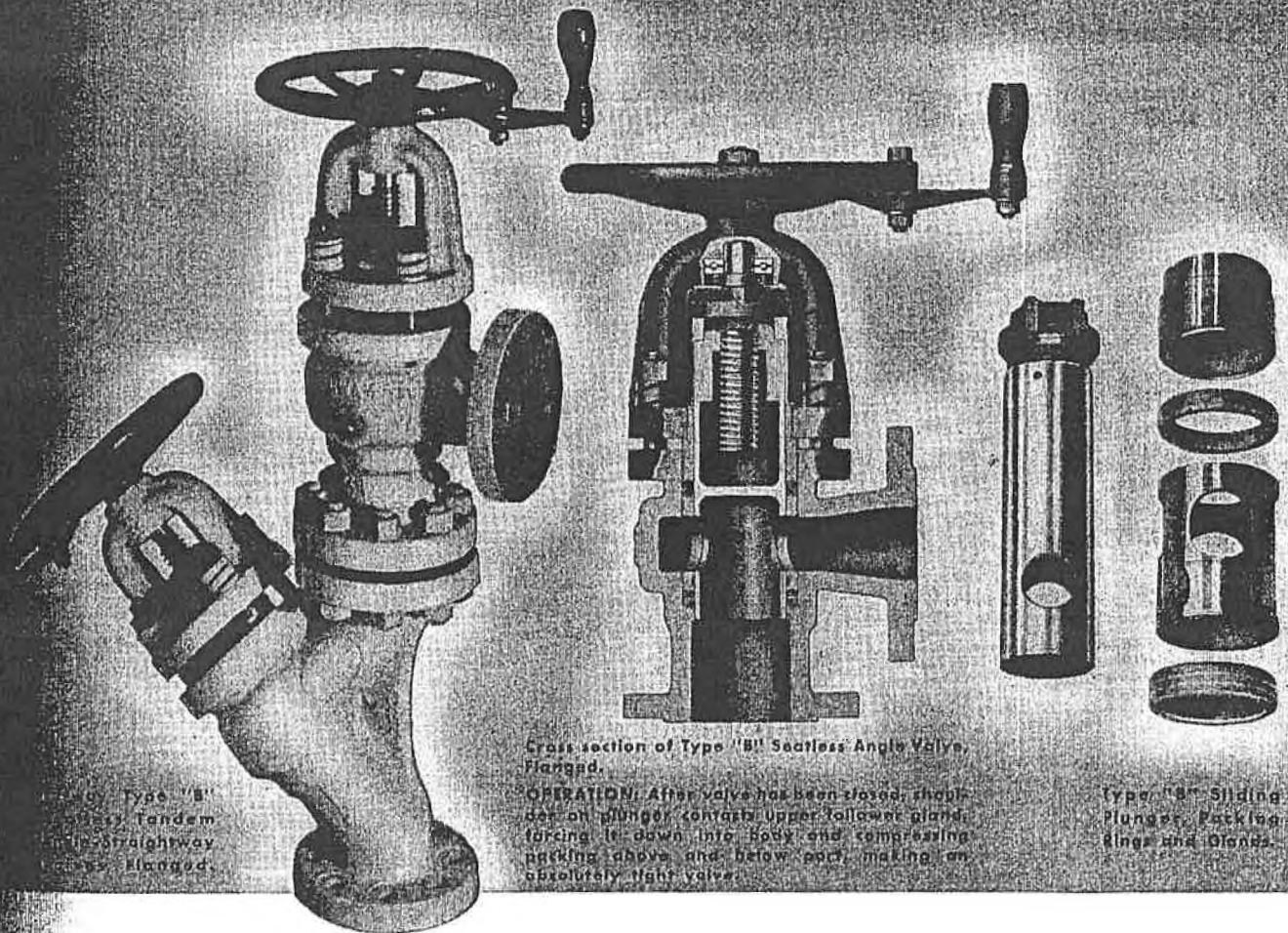
STEAM-TURBINE-BLADE DEPOSITS from any make turbine operating at a throttle pressure of 350 psi or better are sought by the steam-turbine and water-conditioning departments of Allis-Chalmers in order to collate data on deposits attributed to carry-over. Results of acceptable samples submitted will be forwarded to the sending plant operators. Full information can be secured from Dr. L. A. Burkardt, Research Laboratory, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

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.

Additional information on any of the above items will be furnished upon request.

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Cross section of Type 'B' Seatless Angle Valve, Flanged.

OPERATION: After valve has been closed, shoulder on plunger contracts upper follower gland, forcing it down into body and compressing packing above and below seat, making an absolutely tight valve.

Type 'B' Sliding Plunger, Packing Rings and Glands.

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This famous seatless design, first introduced by Yarway more than 35 years ago, has been constantly improved and adapted to meet modern service requirements. Mechanical and metallurgical research in Yarway's

own unique Steam Laboratory anticipates changing conditions... assures the finest in blow-off valves for today's boiler plants.

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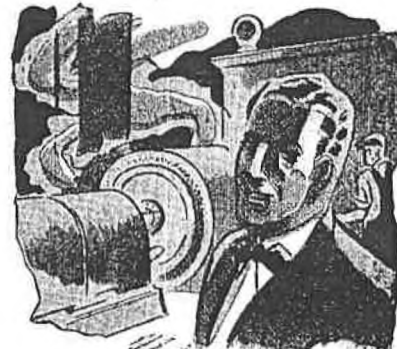
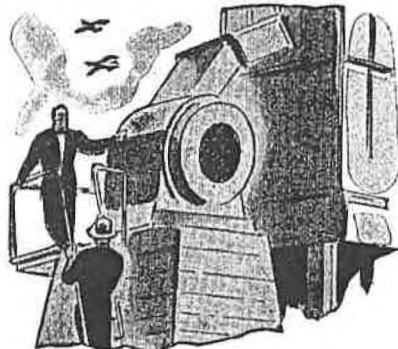
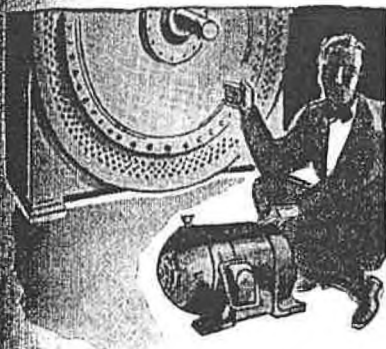
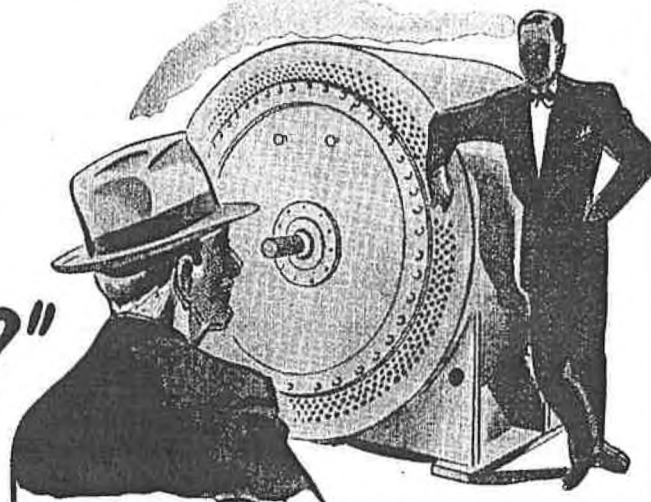
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We've R
system to
reduced
passages
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we've eli
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of course

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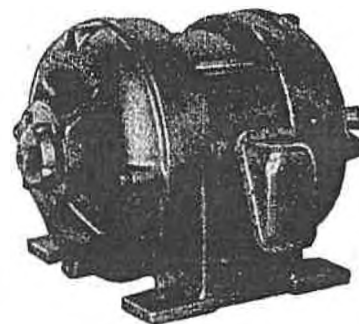
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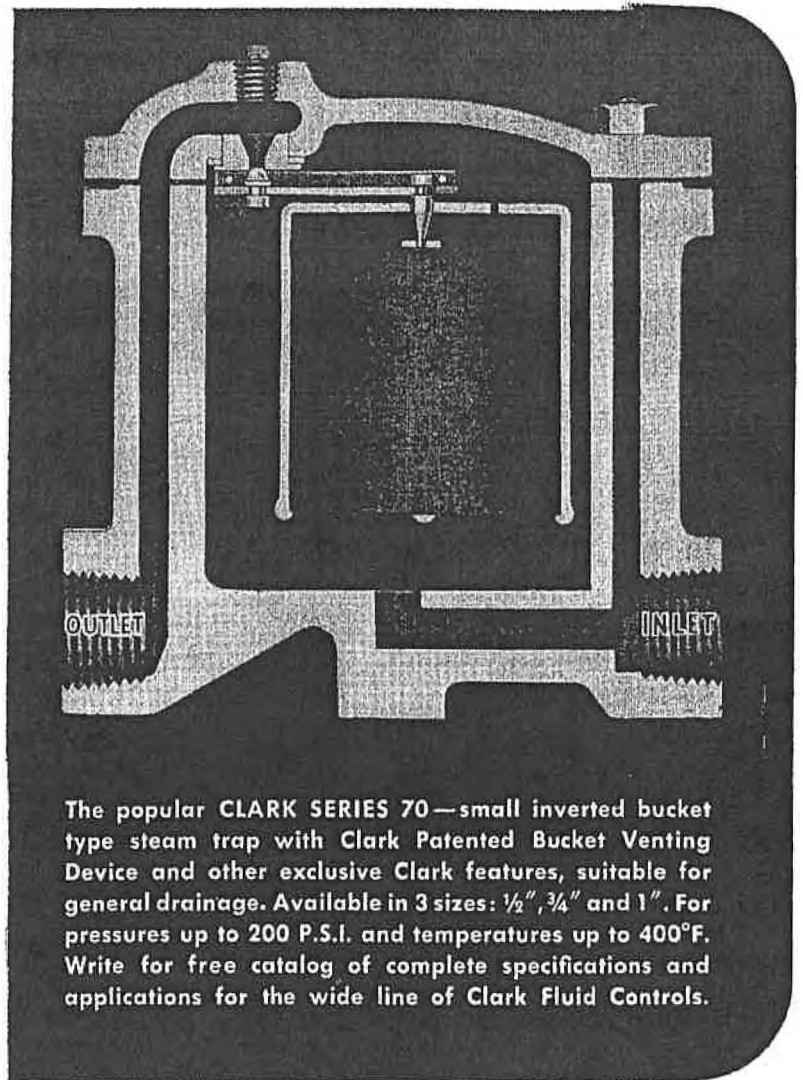
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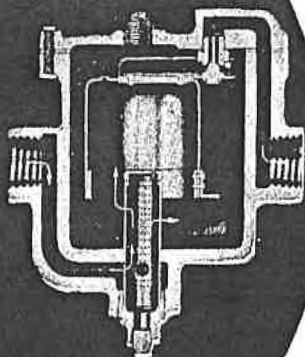
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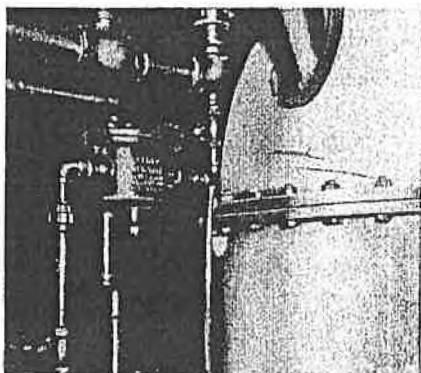
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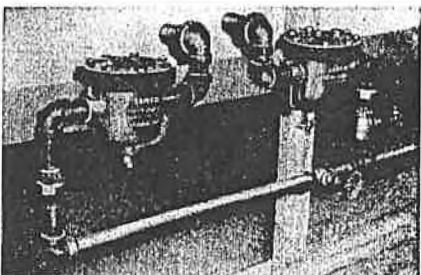
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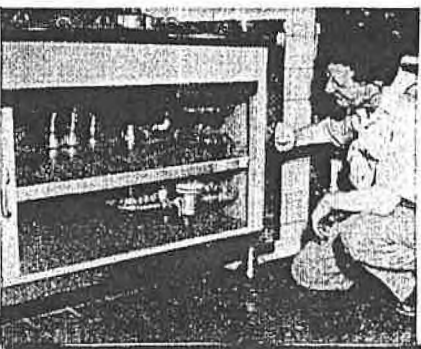
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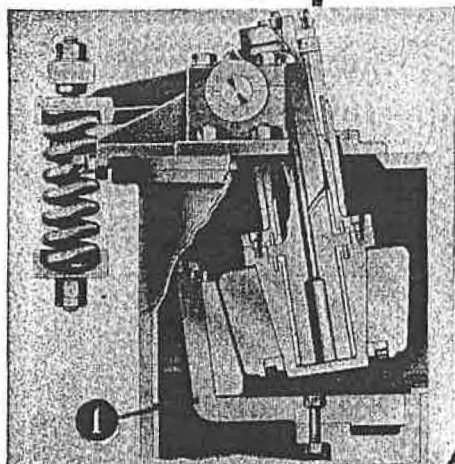


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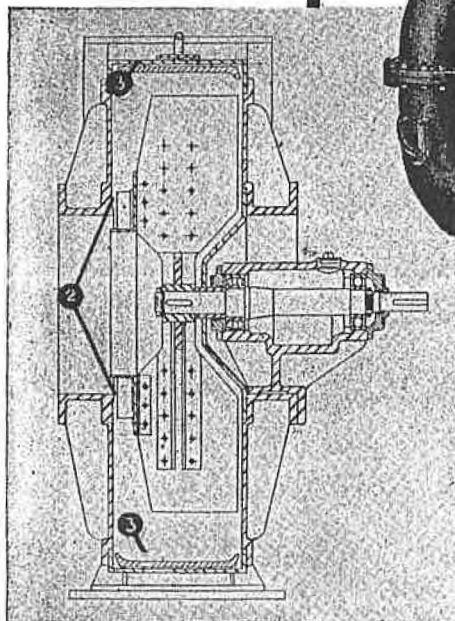
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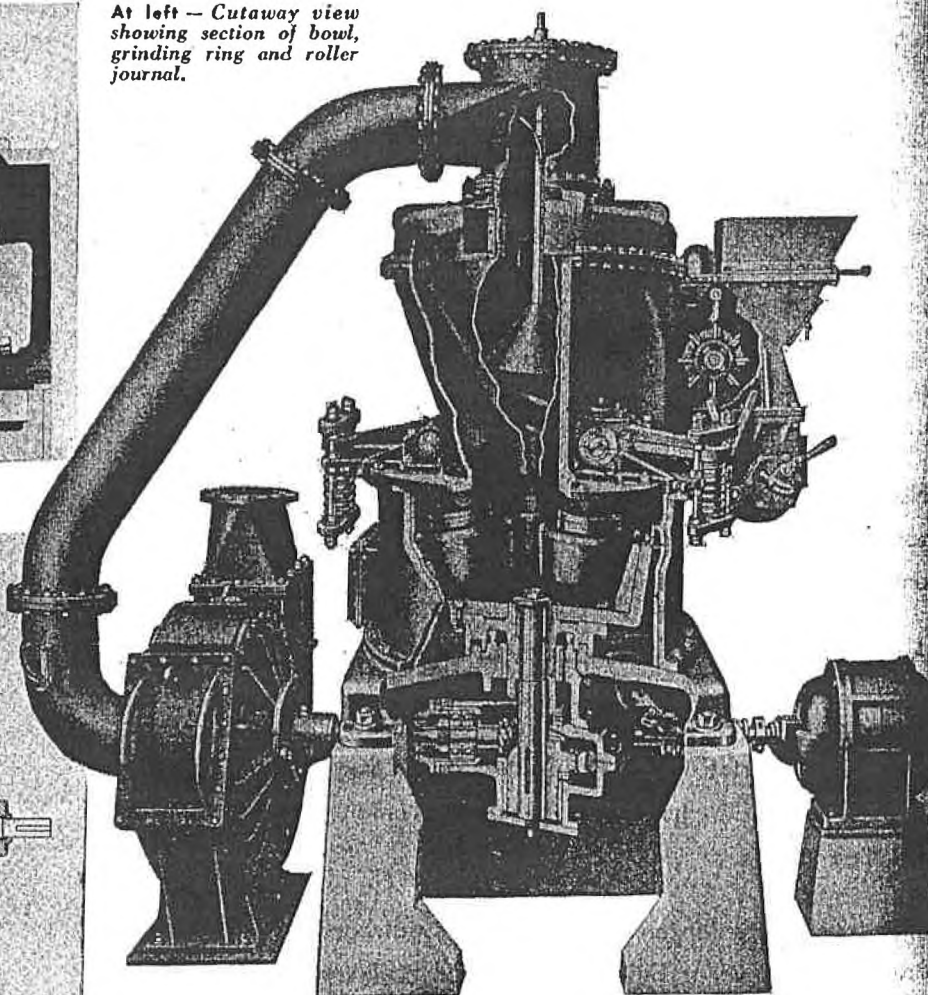
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At left — Cutaway view showing section of bowl, grinding ring and roller journal.



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



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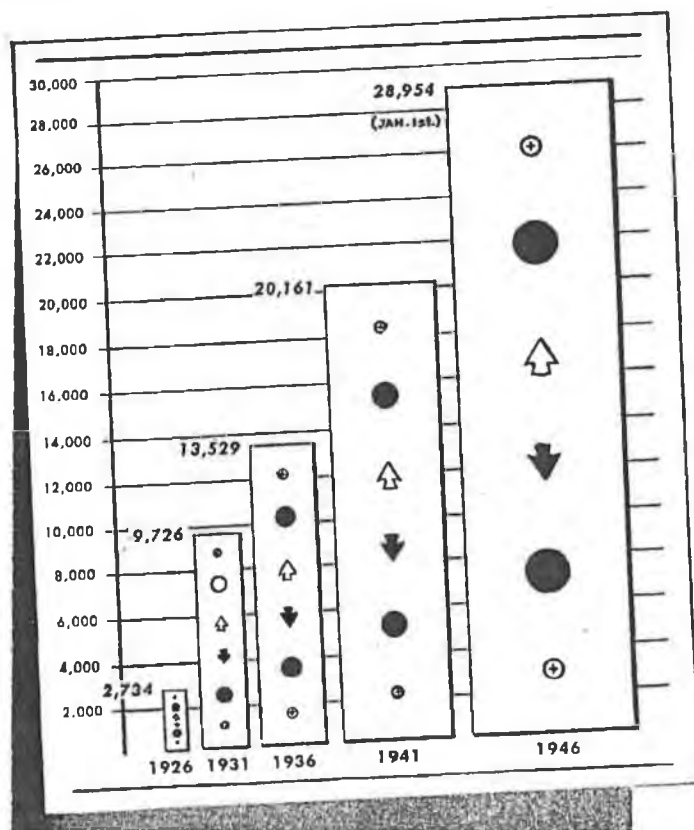
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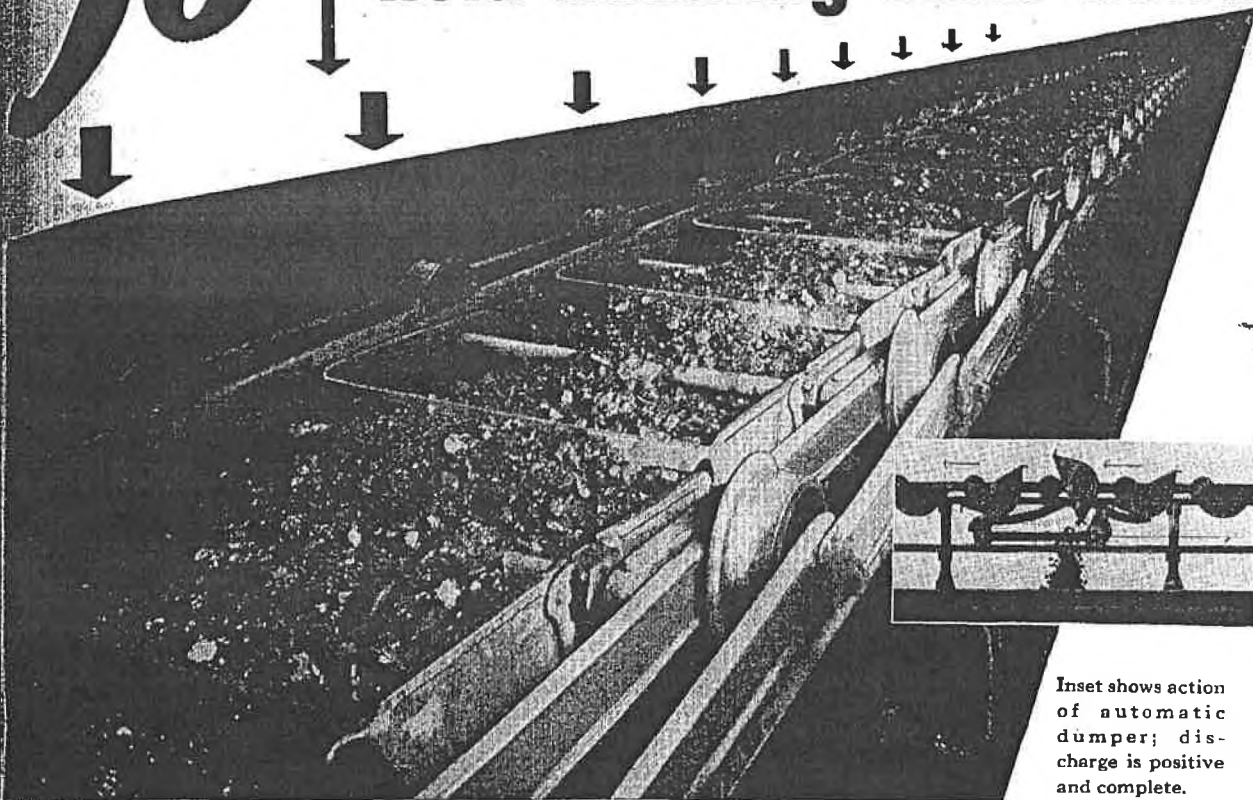
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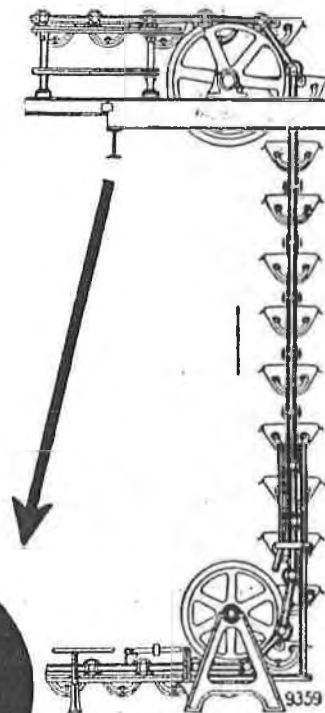
Inset shows action of automatic dumper; discharge is positive and complete.

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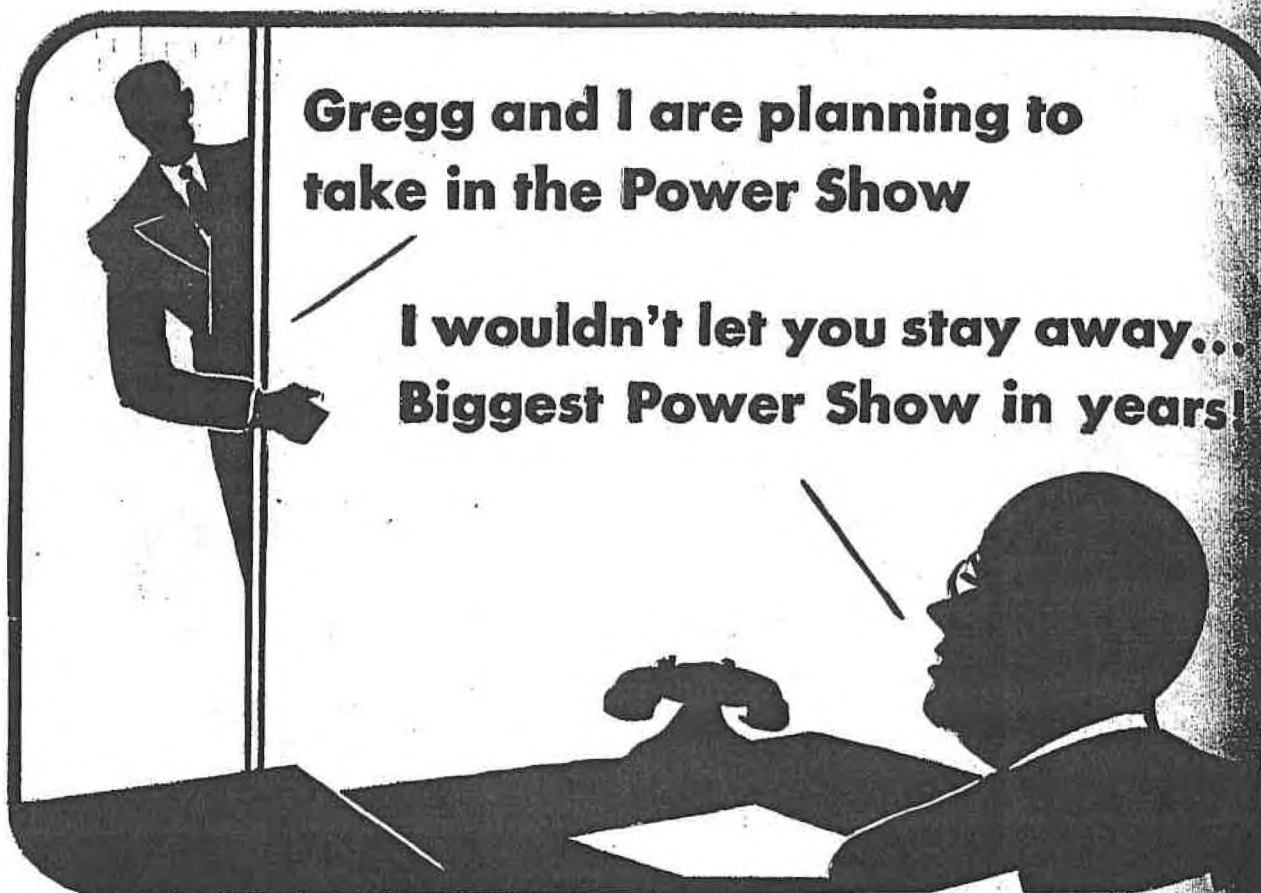
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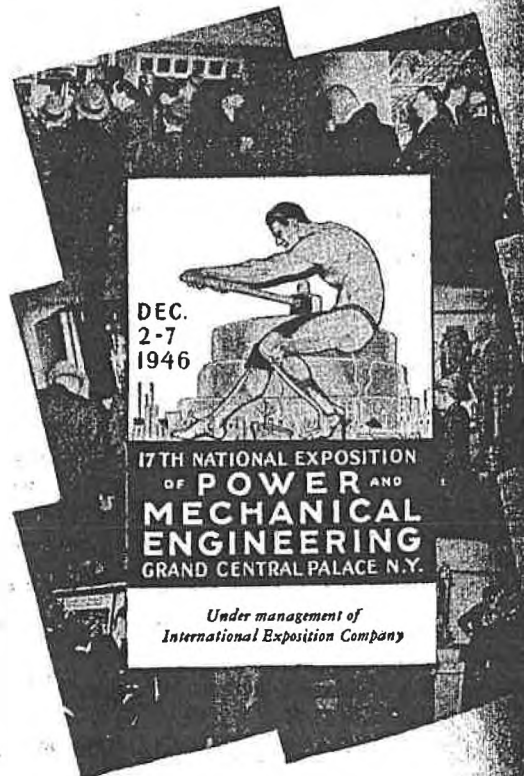
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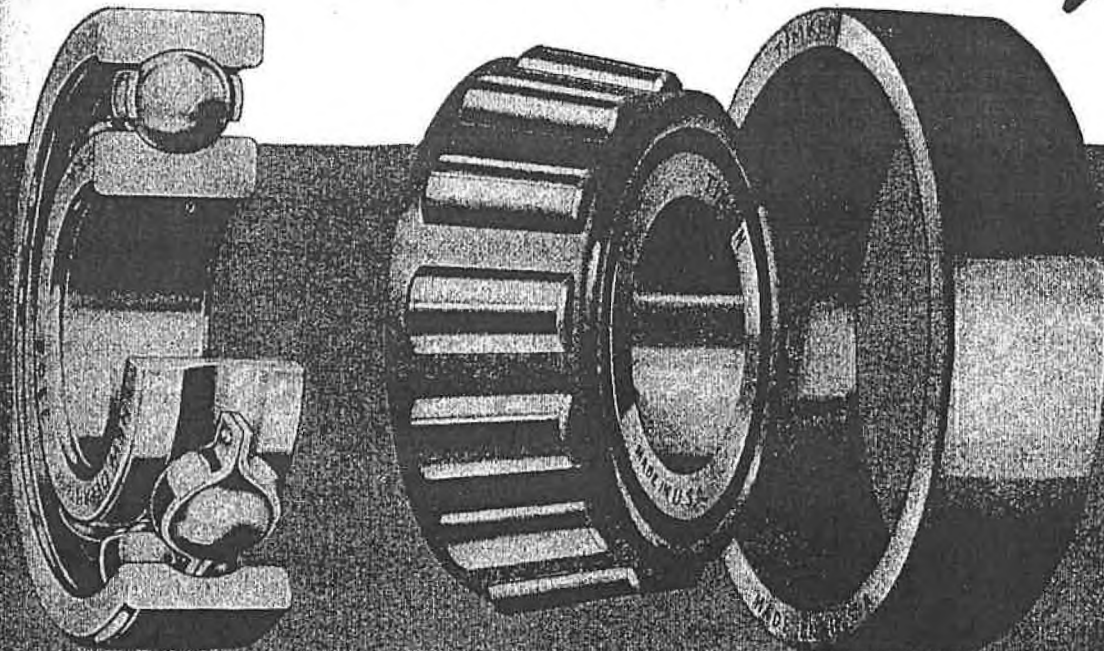
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Anti-Friction Greases FOR Anti-Friction Bearings



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MINIMIZES FRICTION LOAD ON MACHINERY

Anti-friction bearings not only act to minimize friction load on machinery; they serve long periods without lubrication and maintenance attention...*if the correct lubricant is used.*

For maximum serviceability of bearing and lubricant, special anti-friction bearing greases are required. Such a grease must be smooth...must keep a film of lubricant on balls or rollers and races...

must not bleed or separate...must not thin out nor thicken in use.

Highly developed manufacturing techniques and high quality oils of correct body are used in making Sinclair BEARING GREASE AF. All ingredients are carefully selected and controlled to produce a lubricant of long endurance and stability through extended periods of continuous operation. Ask our engineers for specific advice.

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

SOUTHERN POWER & INDUSTRY for NOVEMBER, 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-

cal reactions *at the temperatures and pressures encountered in steam boilers*, they brought about the use of phosphates in boiler water conditioning.

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*.

Write for full information.

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

A subsidiary of Hagan Corporation

HALL SYSTEM *of Boiler Water Conditioning*

HAGAN
HALL
LABORATORIES
PITTSBURGH, PA.

Here's what Hall Clients get:

1. Thorough study of all factors concerning water involved in producing steam. Boiler temperatures, pressures and ratings, boiler design, and other factors must be taken into consideration—not merely the constituents of the feed water.

2. Procedure for the proper treatment of boiler water.

A definite program of treatment to maintain the required chemical equilibria, plus instruction for frequency of blowdown and other matters related to proper functioning of the boiler.

3. Instruction of designated employees in making of essential control tests.

When proper conditions have been established, they must be *maintained*, in spite of variations in feed water and changes in operating conditions. Any boiler operator can, after instruction, follow the simple test routine developed by Hall chemists.

4. Periodic check up by Hall service engineers.

Experience in hundreds of plants is brought to your plant by these men, and often enables them to detect conditions that might otherwise be overlooked.

5. Periodic checking of samples by Hall Laboratories.

This is your assurance that testing at the plant is being carried out according to instructions.

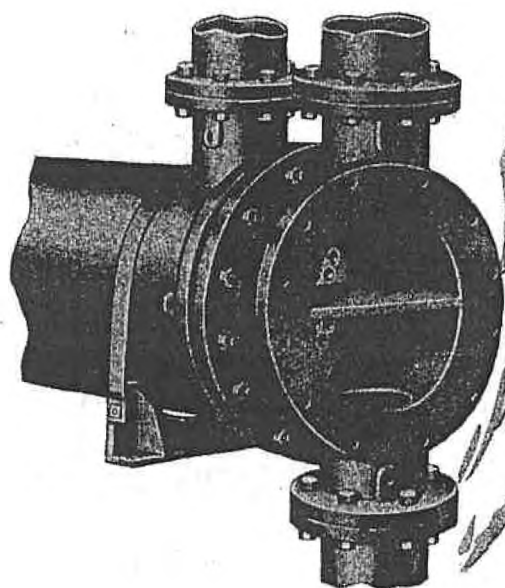
6. "Trouble shooting" as problems arise.

If trouble does occur, Hall engineers are prepared to trace it to its source, and give all possible help in correcting it.

PLUS the assurance that you not only have the most effective system of boiler water conditioning yet devised, but also that new developments in this field will be available to you as soon as their value has been established under actual operating conditions.



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.

The point is that fouling tendencies, most of the time, can't be avoided . . . but shutdown periods for cleaning *can be materially reduced*, and are with Ross "CP" Coolers.

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.

ROSS

FIRST IN HEAT EXCHANGERS

ROSS HEATER & MFG. CO., INC.

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.

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ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY

For power stations and industrial power plants of today and tomorrow, Crane has a lot to offer. Now, when you're planning to rebuild or expand, count on the complete Crane line to help speed and simplify every step of piping procedures—from design to maintenance.

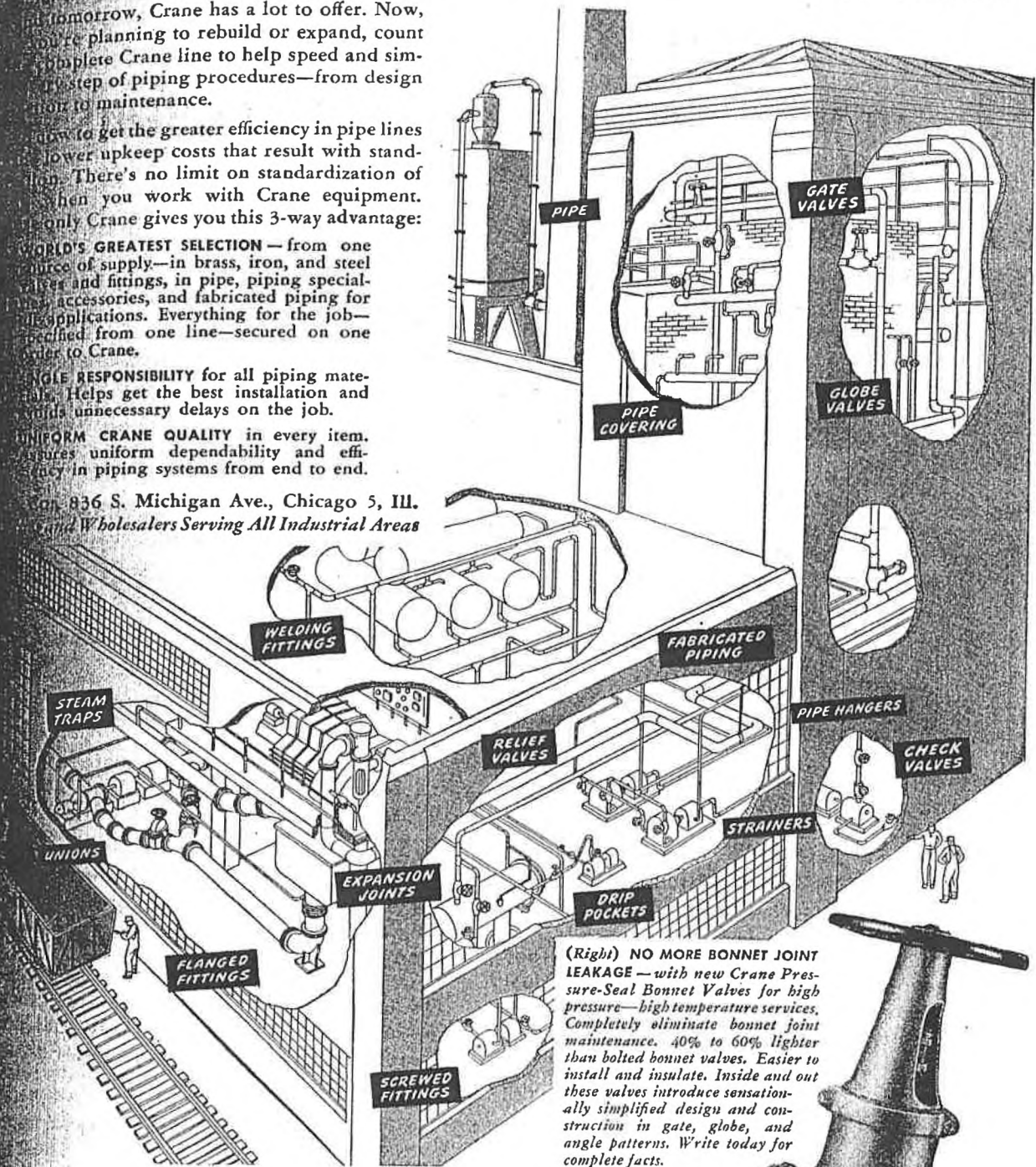
Now you can get the greater efficiency in pipe lines and lower upkeep costs that result with standardization. There's no limit on standardization of piping when you work with Crane equipment. Only Crane gives you this 3-way advantage:

WORLD'S GREATEST SELECTION—from one source of supply—in brass, iron, and steel valves and fittings, in pipe, piping specialties, accessories, and fabricated piping for all applications. Everything for the job—supplied from one line—secured on one order to Crane.

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UNIFORM CRANE QUALITY in every item. Assures uniform dependability and efficiency in piping systems from end to end.

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Crane Wholesalers Serving All Industrial Areas



(Right) NO MORE BONNET JOINT LEAKAGE — with new Crane Pressure-Seal Bonnet Valves for high pressure—high temperature services. Completely eliminate bonnet joint maintenance. 40% to 60% lighter than bolted bonnet valves. Easier to install and insulate. Inside and out these valves introduce sensationally simplified design and construction in gate, globe, and angle patterns. Write today for complete facts.

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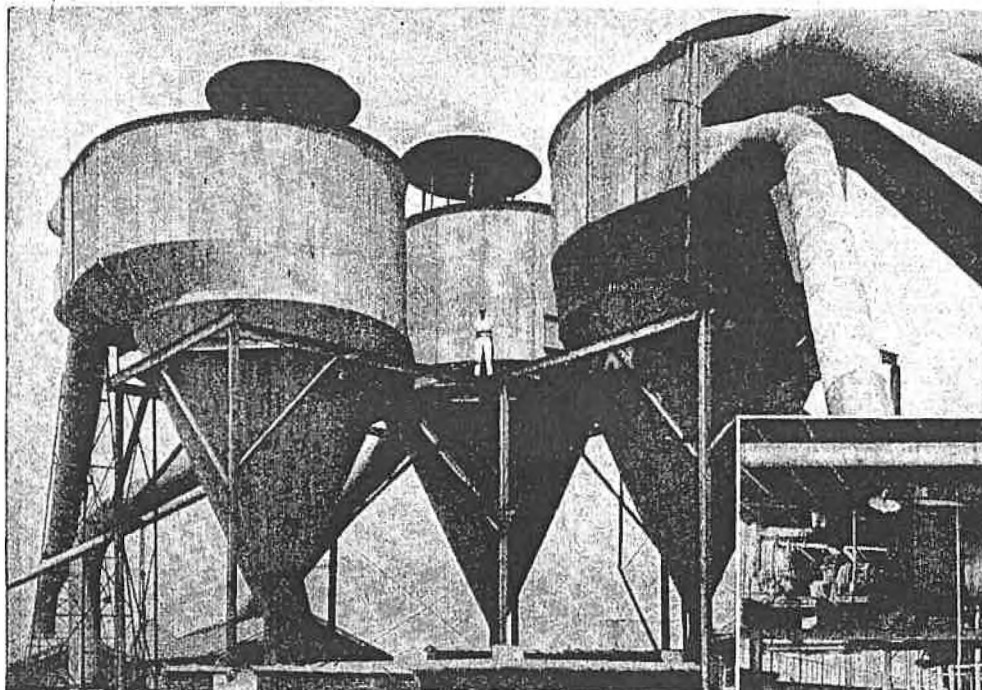
VALVES • FITTINGS
PLUMBING
PUMPS

SOUTHERN POWER & INDUSTRY for NOVEMBER, 1946

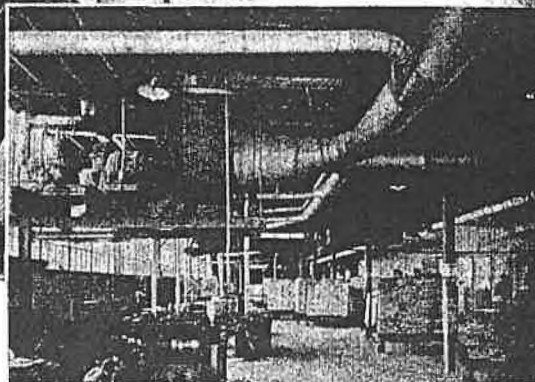
DUST CONTROL SYSTEMS

"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:

LIBERTY *Engineering & Mfg. Co.*

INCORPORATED

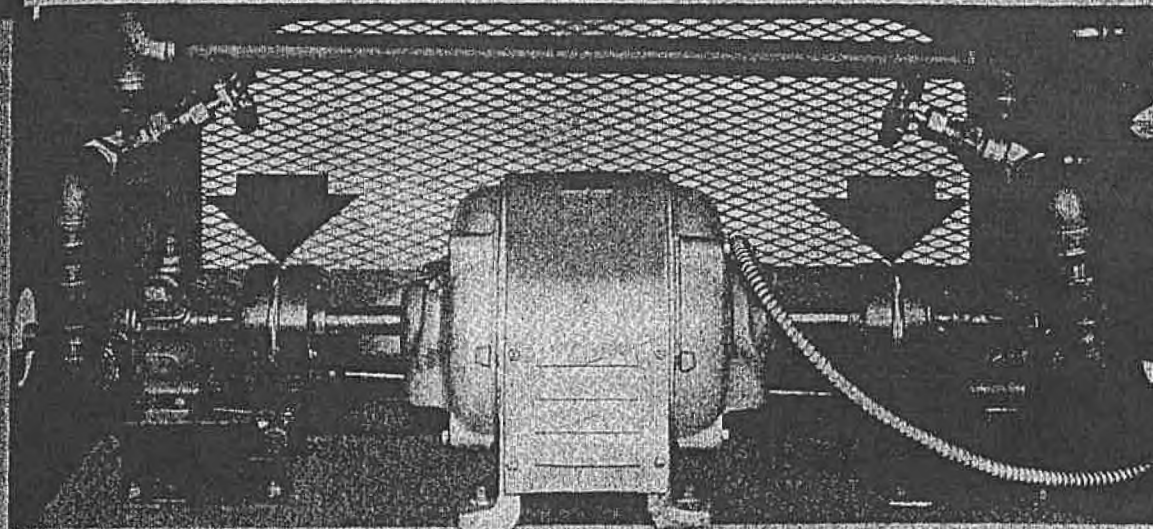
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A DIVISION OF THE KIRK & BLUM MFG. CO.

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Modern Machines Deserve MORFLEX Couplings

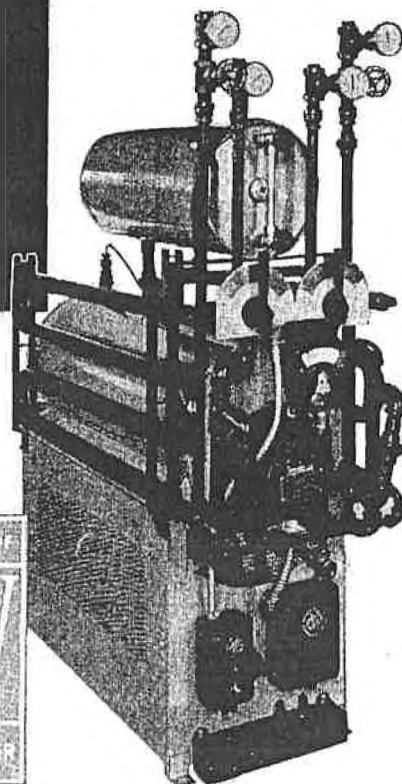
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John Royle & Sons, manufacturers of extrusion equipment, use Morflex couplings in the power drives of their temperature control units, which handle extruding temperatures of 90° to 500°.

Morflex couplings require no lubrication, are unaffected by gas, oil, dirt or weather. The exclusive Morse-designed Neoprene biscuit cushions shock, isolates vibration and uneven impulses, *prolonging machinery life*. MORSE CHAIN COMPANY—Ithaca, N.Y.—Detroit 8, Mich.

Available in a wide variety of stock sizes



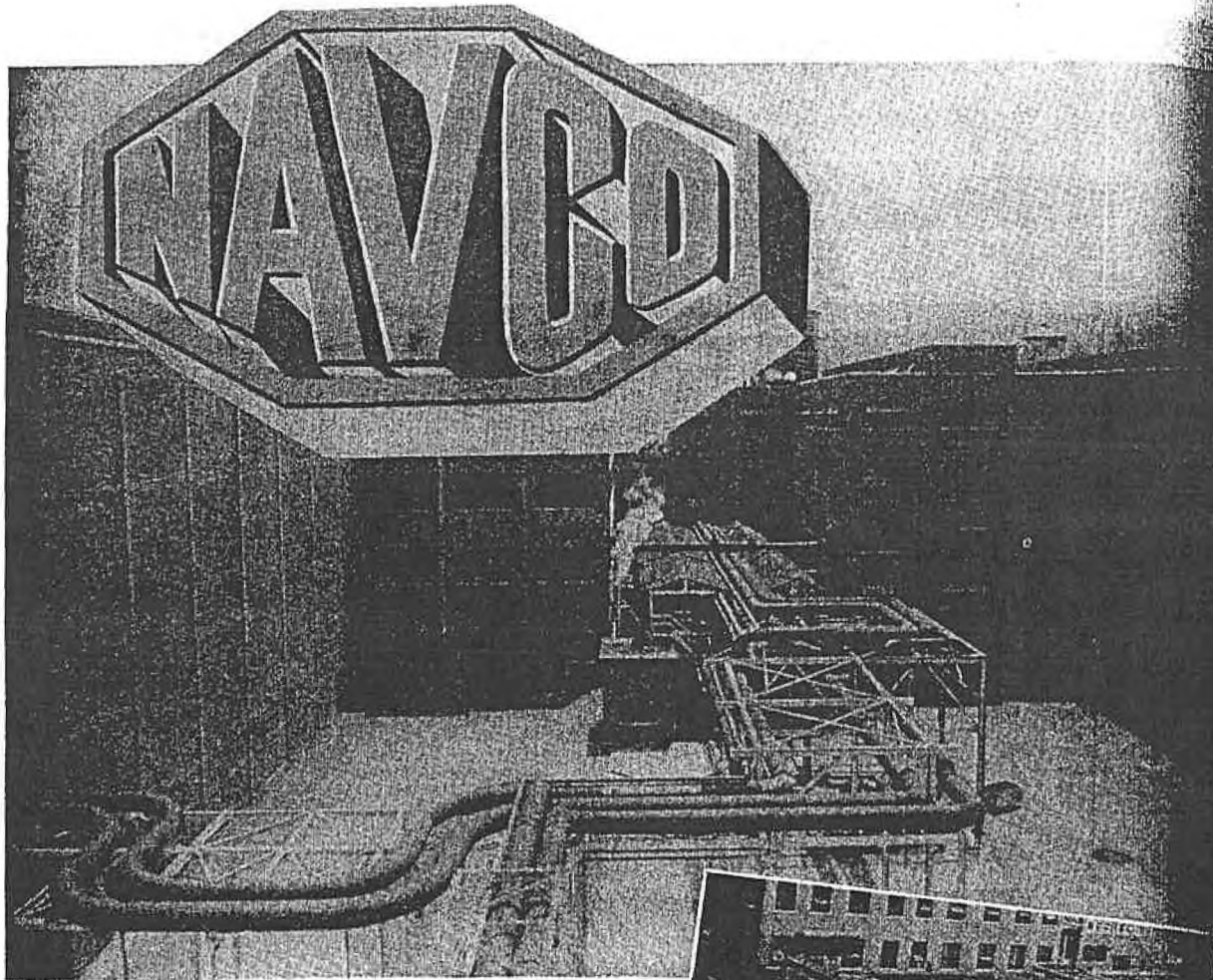
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ROLLER and SILENT CHAINS
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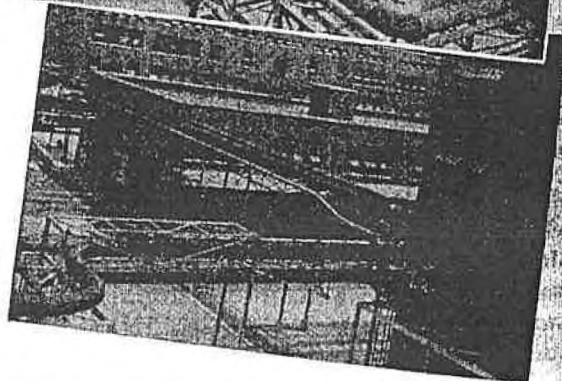
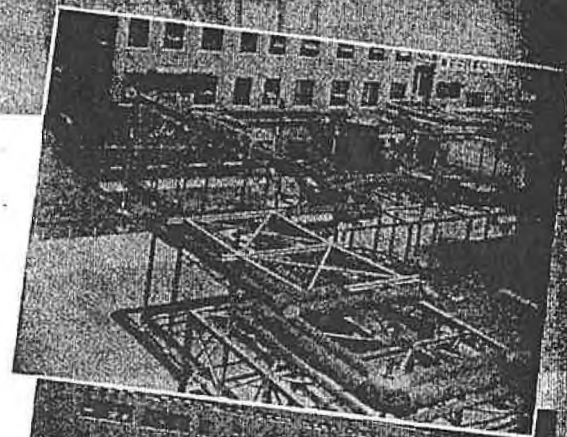


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The difficulties encountered in the fabrication and erection of Central Station and Industrial Piping are many and varied.

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.



NAVCO PIPING

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

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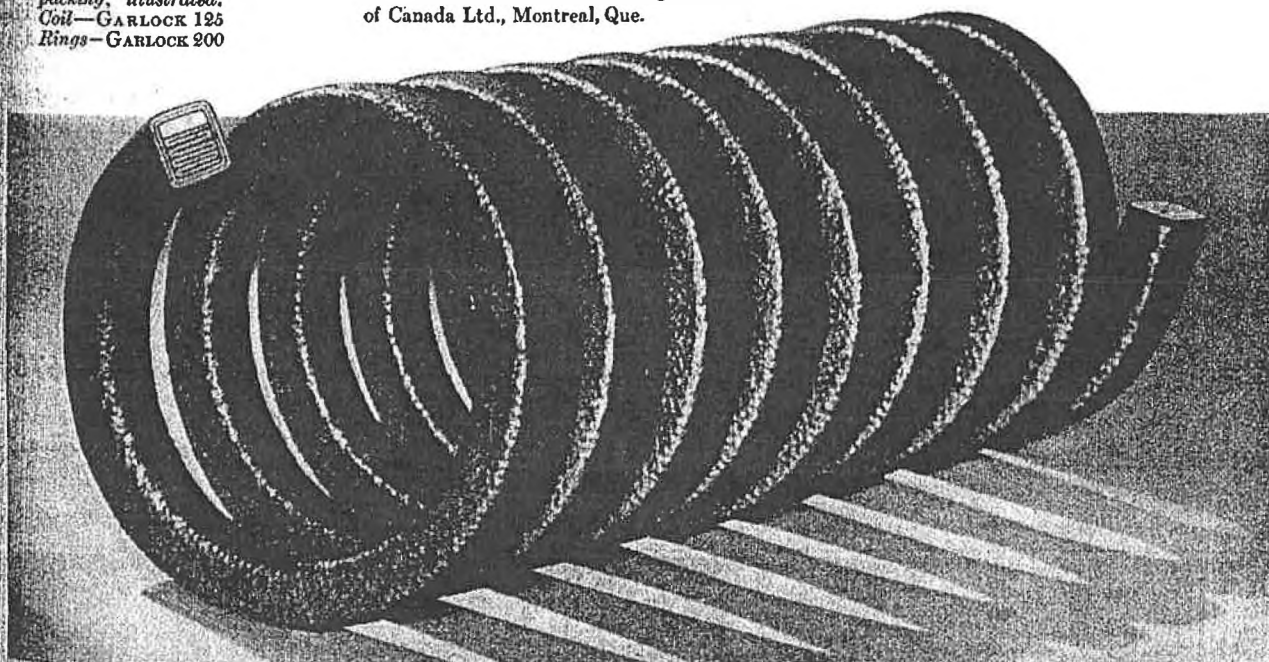
THE HIGH PRESSURE PACKING WITH THE LOW MAINTENANCE COST

GARLOCK 150

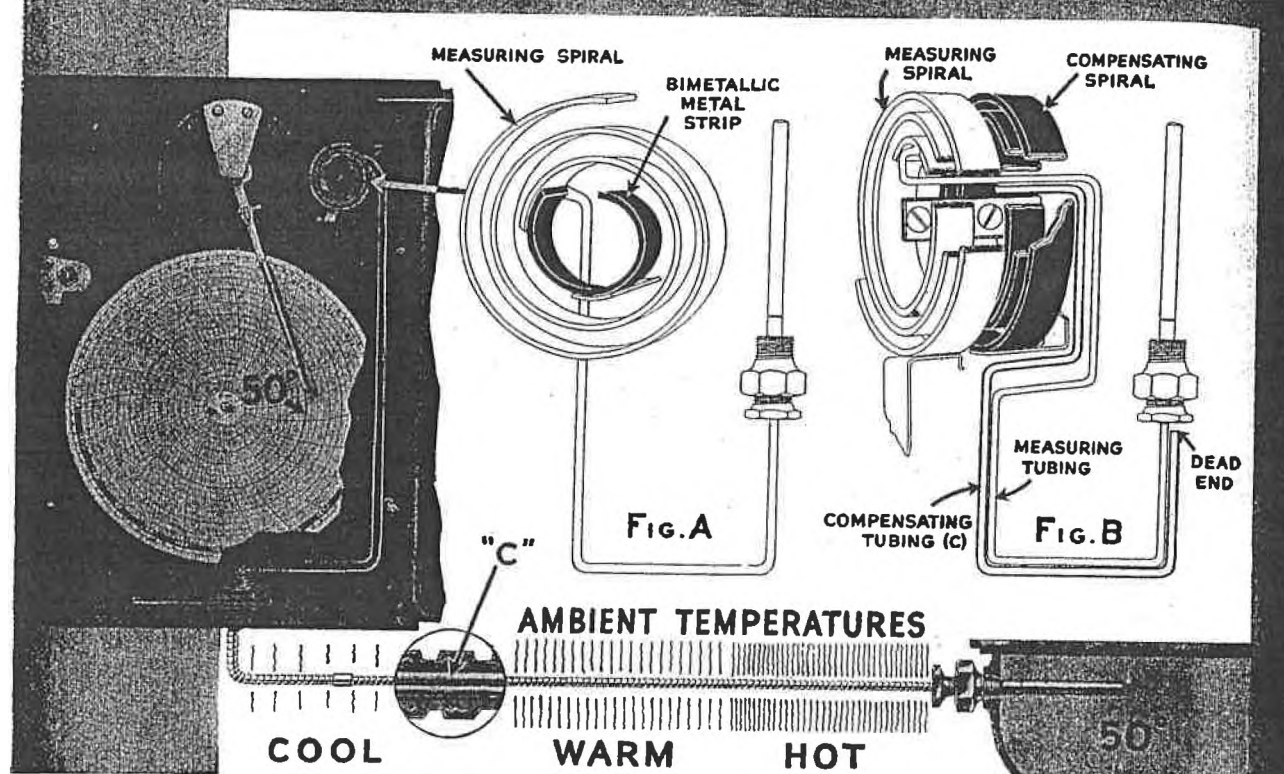
Low in maintenance cost because it gives such *long, dependable* service. Costly shut-downs for frequent repacking are avoided. Man hours and machine hours are saved. Use GARLOCK 150 on piston rods of engines, pumps, compressors, etc., against steam pressures up to 300 lbs.

The Garlock Packing Company, Palmyra, New York
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GARLOCK 150 *Spiral*
packing, illustrated.
Coil—GARLOCK 125
Rings—GARLOCK 200



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.

Toronto, Canada

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BROWN

THERMOMETERS

INDICATING...RECORDING...CONTROLLING

"I amazed our board when I showed them a 55% savings in material handling"

Turns
Overhead into
Profits

We want labor
to share
the benefits

Let an A.T.C. Specialist do the same for you!



Yes, such savings are possible. An A.T.C. Specialist will show you the record — give you proof that Automatic Fork Trucks bring business real profits . . . the dollar profits that 55% material handling savings represent.

These brawny giants of electric power have so many money-saving, energy-saving applications in your plant. By unit load pallet and skid principle, they move materials into, through and out of your

plant with easy efficiency—spare your workers gruelling work, make money for you where it formerly was costing you money.

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Give your business this chance to turn a fixed overhead into a fixed profit, while you lighten labor's load. Let an A.T.C. Material Handling Specialist survey your material handling. Mail the coupon.



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DIV. OF THE TALE & TOWNE MFG. CO.
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Please mail me, without cost or obligation, complete facts about AUTOMATIC FORK TRUCKS.

() Have an A.T.C. Material Handling Specialist call.

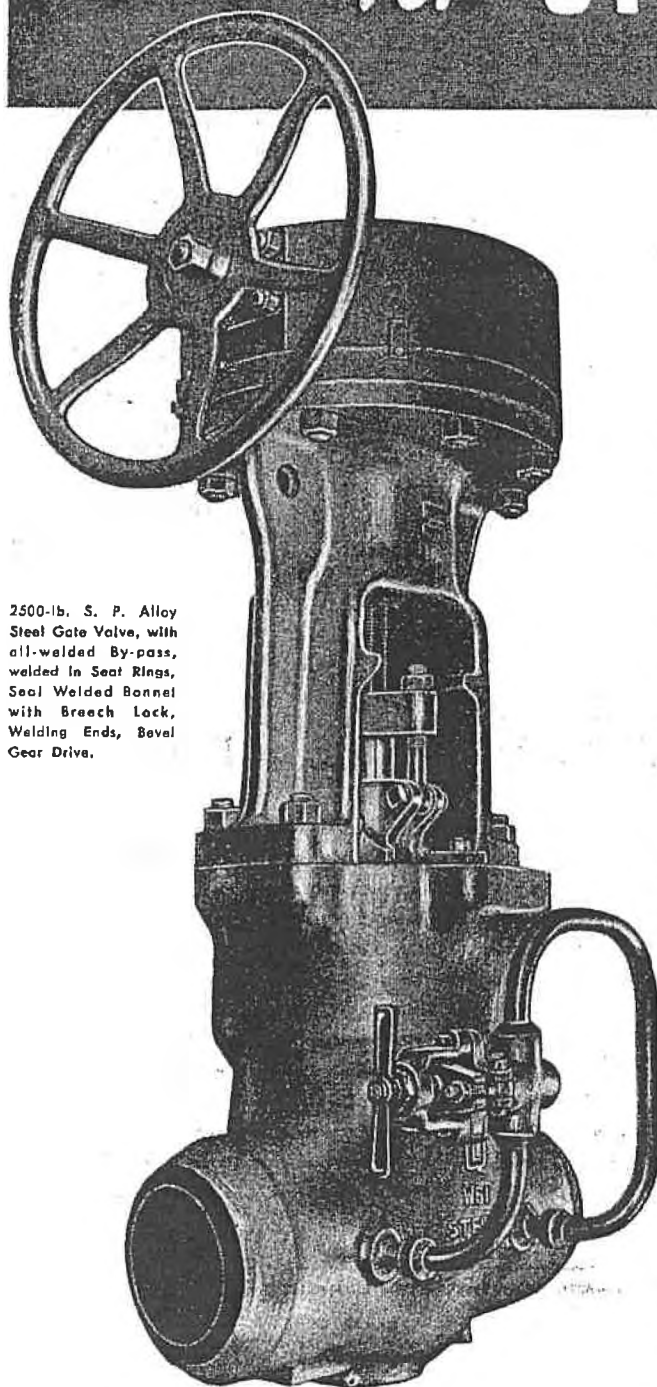
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Look to **LUNKENHEIMER** for **STEEL VALVES**



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 527

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. ANGELL, Manager, New York Branch.

THE LUNKENHEIMER CO., Cincinnati 14, Ohio
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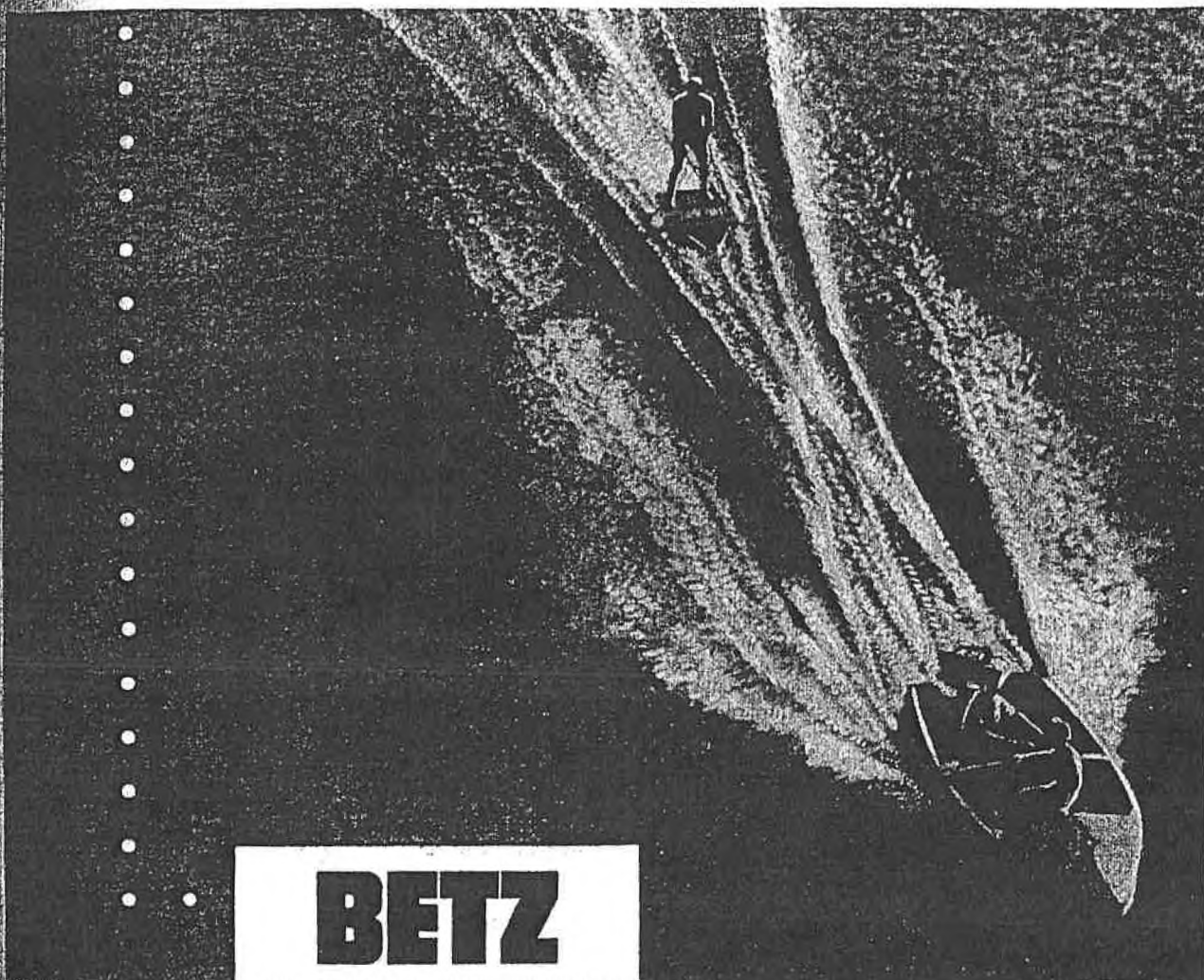
BETZ Boiler Water Conditioning IS A CONTINUOUS SERVICE

Efficient operation of any steam plant calls for properly controlled combustion, well-maintained auxiliaries and low maintenance. High on the list of important factors that affect efficiency is a complete—and *continuous*—program of boiler water conditioning. Such a service is provided by W. H. & L. D. Betz.

Betz continuing service consists of initial investigation, the establishment of plant control, a daily testing program for boiler room operators, periodic analyses of water samples in the Betz laboratories, frequent engineering reports by Betz engineers on plant operations, and a never-ending program of research.

Over 20 years of experience as water specialists has made the Betz boiler water conditioning service complete . . . economical . . . *continuous*. Our staff of engineers will welcome the opportunity of discussing your boiler water problems.

WRITE TODAY FOR FREE BULLETIN giving a practical explanation of the phenomena of boiler metal embrittlement (intercrystalline cracking)—a concise discussion of causes, detection and prevention. Ask for Bulletin No. 104—C. W. H. & L. D. BETZ, Gillingham and Worth Streets, Philadelphia 24, Pa.



BETZ

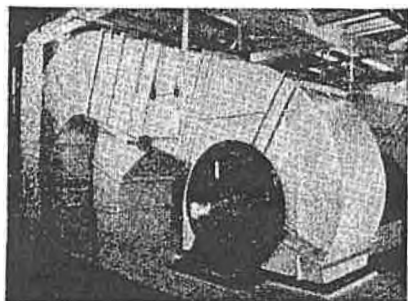
BOILER WATER CONDITIONING • COOLING WATER CONDITIONING
INDUSTRIAL WASTE TREATMENT

▲ Cover photograph from the *Betz Indicator*, a monthly publication devoted to the chemistry and practical applications of water conditioning. The *Betz Indicator* will be mailed without charge at your request.

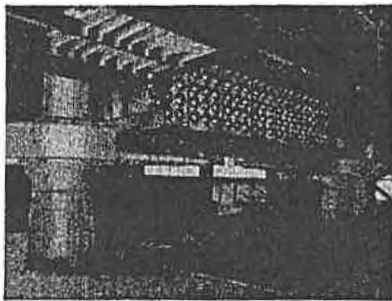


You, too, can crack the whip on THREE AT A TIME!

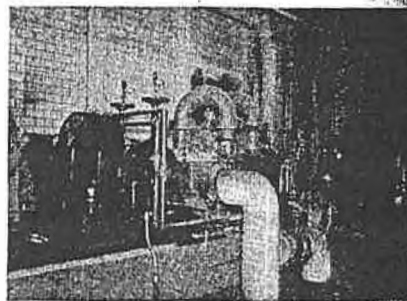
One source for technical information—undivided responsibility—less red tape when you buy all three from ABC! That's the way you can crack the whip on your problems on Mechanical Draft Fans, Fly Ash Precipitators, Variable Speed Control.



1 Mechanical Draft Fans of high operating efficiency and long life are standard with American Blower. Since 1881 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!



At your request, the nearest American Blower Branch Office will make a complete presentation with technical data and prices. Phone or write today.

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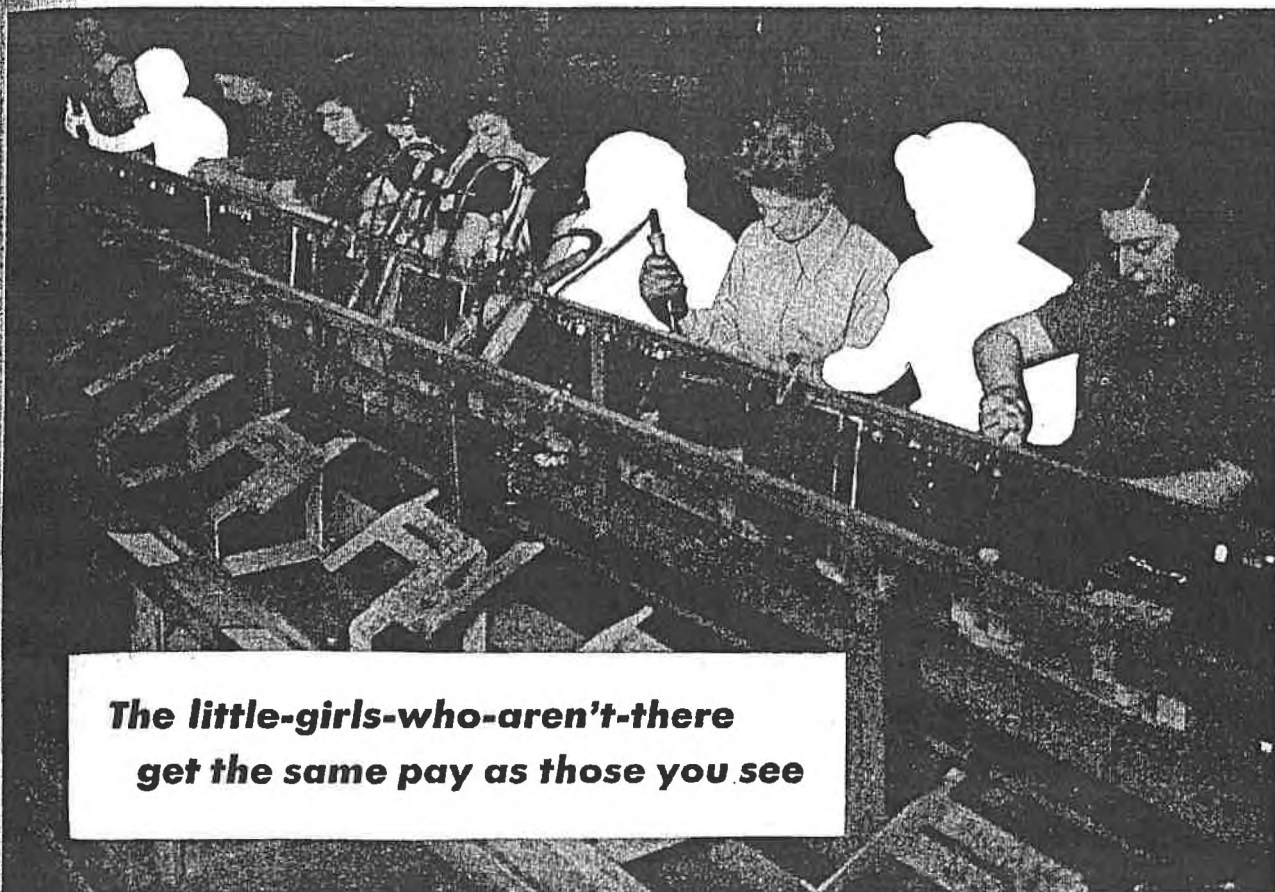
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

SOUTHERN POWER & INDUSTRY for NOVEMBER, 1946

Wire ahead...

for productive payrolls



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get the same pay as those you see**

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TODAY'S WORKERS need today's wiring. . . . Inadequate wiring, obsolete wiring, over-taxed wiring, over-extended wiring can cut operators' efficiency from 25 to 50 percent and reduce production accordingly.

To visualize the importance of adequate wiring, walk down your own production lines, mentally blank out every third

worker. Then, check with your plant power engineer, your consulting engineer, electrical contractor or power salesman and make sure there's no such handicap in your plant.

A wiring survey now, may save costly shut-downs and expensive alterations later.



ANACONDA WIRE & CABLE COMPANY

SOUTHERN POWER & INDUSTRY for NOVEMBER, 1946

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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

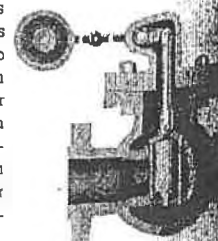


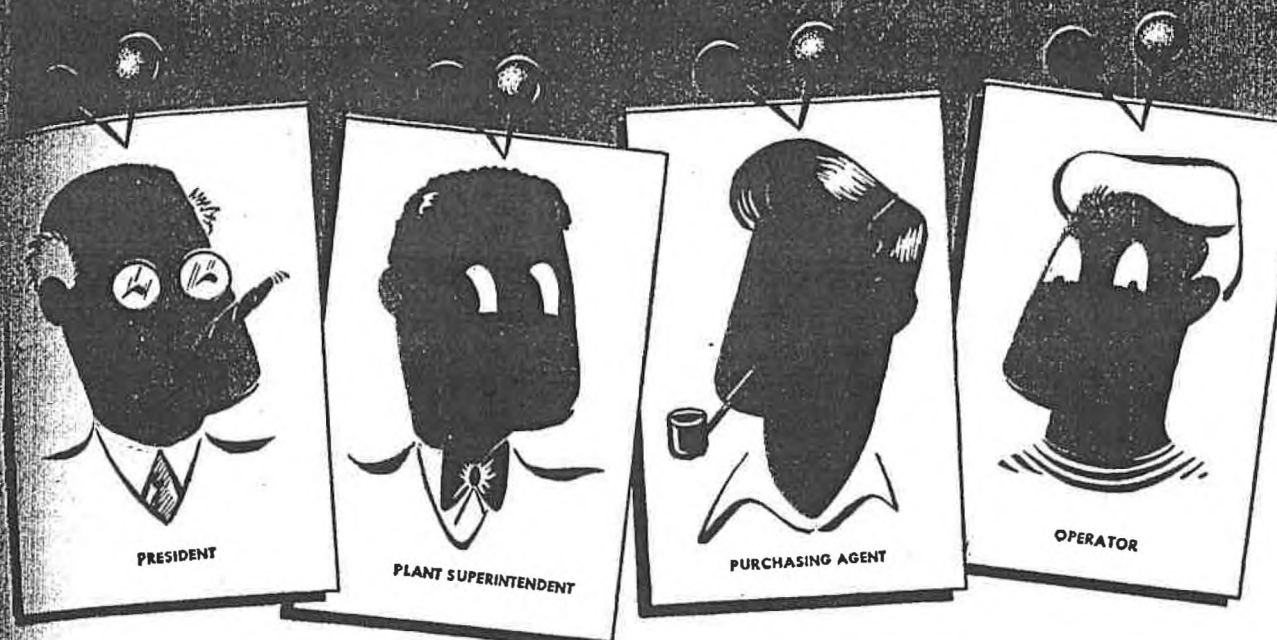
PUMP GOVERNORS

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.





PRESIDENT

PLANT SUPERINTENDENT

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OPERATOR

WITH A LO-HED ON THE BEAM!

Right! Everybody—operator, foreman, super and the Boss are happy with a Lo-Hed on the beam. Because they know from past experience that a Lo-Hed is built for the job and stays on the job . . . with little or no trouble.

Take, for instance, the Lo-Hed One Ton hoist. A typical Lo-Hed, constructed on the original low headroom principle (a plus feature for which you pay no premium), with heavy duty hoist motor, straight line spur gear drive, multi-rope hook block, 100% positive automatic stop, automatic lowering and holding brakes, and many more dependable, low maintenance features.

(Lo-Hed Hoists are built in capacities from 1/4 to 12 tons.)



◀ MOTOR DRIVEN TROLLEY TYPE

HAND GEARED ▶ TROLLEY TYPE

ALSO AVAILABLE WITHOUT TROLLEY



LO-HED ELECTRIC HOISTS

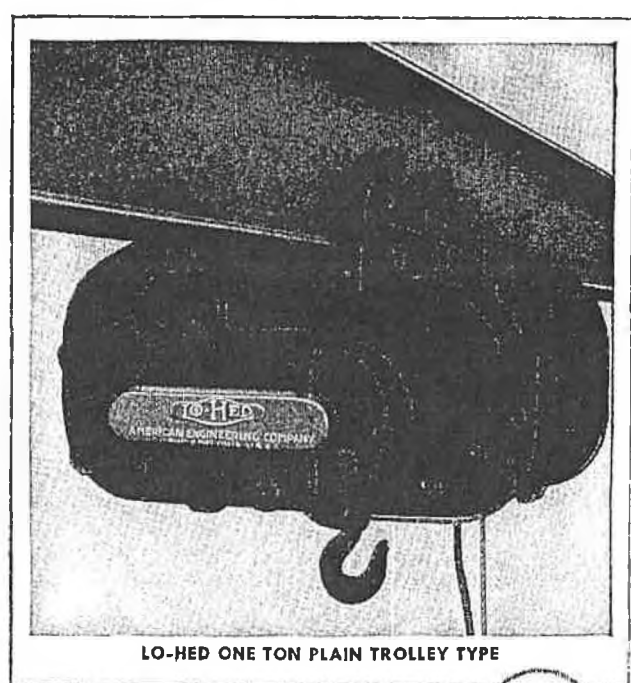
Take the Load off Your Shoulders



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AMERICAN ENGINEERING COMPANY
 2402 Aramingo Ave., Philadelphia 25, Pa.
 Please send me without obligation your complete catalog of Lo-Hed Electric Hoists.

Name _____
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LO-HED ONE TON PLAIN TROLLEY TYPE

ANOTHER PRODUCT OF



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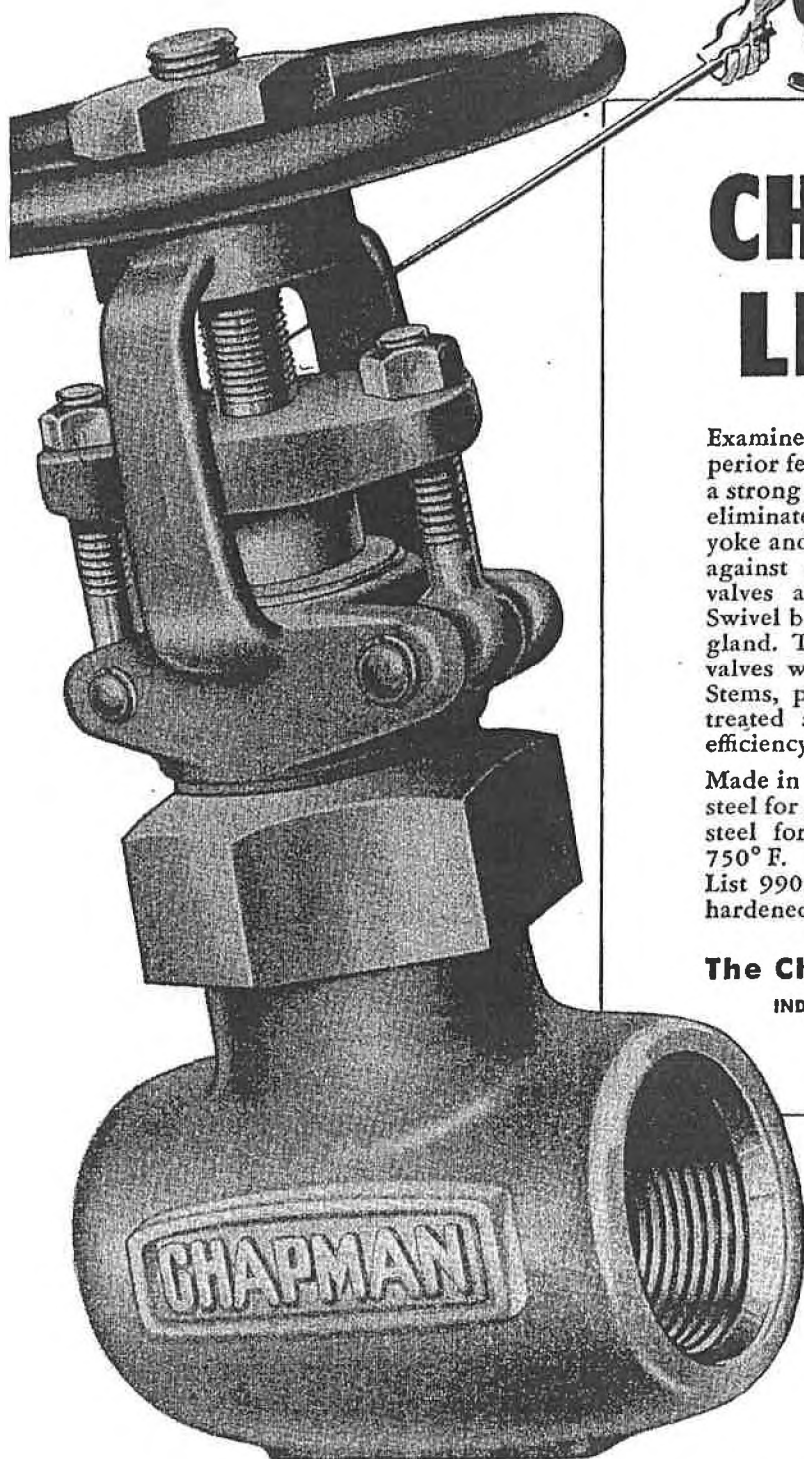
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:R, 1946

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

Timely Comments

Inflation Avoidable

THE obvious defense against inflation is increased production. And to get production workers must go to work; being on the payroll is not sufficient. Some will say that materials constitute the limiting factor, but in a land of ample resources, availability of materials depends on the combined efforts of labor and management—no work, no materials. For example, fabricators can't work because there is no steel. But there could be steel if miners were mining, if scrap yards were providing scrap, if smelters were smelting, if rollers were rolling. Finding the cause and effecting a cure is a job for unions and management. They are not solely interested in their own plants. They are dependent on other workers, other management.

Goods a-plenty will hold prices in line, but even assuming the nation is ready to go to work, we will not get goods a-plenty in a day. There will be an appreciable interim period. And during that period prices will rise, and there is no way to completely prohibit the rise. Complete and perfect price controls on both labor and commodities would theoretically prevent it. But who believes we could inaugurate and enforce complete and perfect controls? Feeble efforts, anything short of perfect, would only result in defeating the goal of quickly attaining goods a-plenty production.

During the interim period we must depend largely on forbearance. Manufacturers must resist the temptation to raise prices and labor must resist temptation to make unreasonable demands.

The tools for controlling inflation are in the hands of the people, not government. And, as usual, the basic desires of management and labor are the same, but cooperative effort toward gaining these desires is lacking.

Army Scientists

BOTH the Army and the Navy have been criticized by thoughtful scientists for a tendency to underestimate the revolutionary aspect of new weapons, including the atomic bomb. Many high officers in the Army have been heard to say that even in the next war it will be the infantry that really does the fighting and the winning. An even greater number of admirals have promised that the Navy will need only a few changes in design to withstand atomic weapons and that the fleet, in future wars, will be as valuable as ever.

The Army and the Navy are not alone in this

"thinking in the past." Many of the people generally do not seem to realize that, at most, a few thousand, well-guided, atomic rockets could reduce any industrial nation to a state where further effective resistance would be impossible.

However, this truth seems to be gradually dawning on the Army, at least. General Eisenhower has announced a new policy for War Department research and development. It is designed to apply the nation's civilian scientific resources to the solution of military problems.

At the moment, General Aurand, who is head of this division of the War Department, is bringing into this division, on an annual rotation basis, a group of top-flight engineers and scientists recruited from the laboratories of our educational institutions, foundations, and industries. They will assist him in the same manner as military personnel assigned to the division.

This "drafting" of scientists and engineers is much more sensible, so far as security of the nation is concerned, than the drafting of eighteen-year-olds for general inductee training. We do, of course, need a sizable army for occupation and policing in Europe and Asia, but it is the application of scientific developments rather than the infantry that will win the next war, if there must be one. Wise diplomacy and world federation could eliminate the necessity of using either scientists or youth for military purposes, but it seems that, so far, nations, if not the people in them, demand home rule.

Fewer State Barriers

LOUISIANA, whose legislature has recently passed a number of laws to encourage the establishment of industry within the state, has made permanent the liberalized war-time maximum weight for motor freight vehicles. Before the war, heavy motor freight vehicles were forced to stop at almost every state line for weighing and inspection to see that their weight was not greater than allowed by state laws. To speed highway motor freight, maximum weights were liberalized for the duration. In making permanent these liberalized war-time maximum weights for motor freight vehicles, Louisiana has taken a big step toward breaking down state barriers and expanding the open-door policy of reciprocity.

Tennessee, Virginia, and North Carolina, among others, have improved their size and weight limits within recent months. The way to build business is to help, not hinder, motor carriers. More states could adopt the same attitude with profit to themselves.

Vertical transfer between floors.

Dispatch to multiple stations.

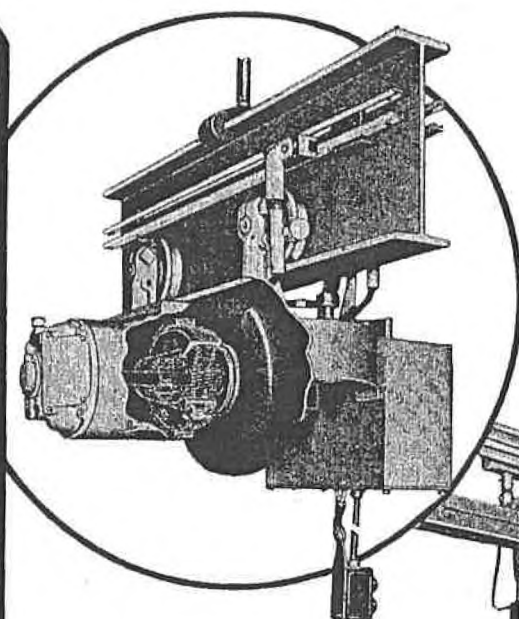
Delivery to fixed stations.

Delivery to multiple stations.

Delivery to movable stations.

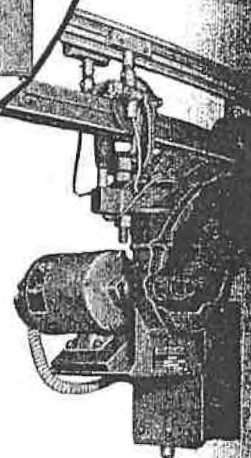
Selective dispatch between multiple stations.

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SOUTHERN POWER & INDUSTRY for NOVEMBER, 1951

Industry Speaks

Paul G. Hoffman

President, Studebaker Corporation,

Speaking before the Fall Meeting of A.S.M.E. in Boston, where he received the Gantt Memorial Medal for "distinguished achievement in industrial management as a service to the community," said in part:

"IT IS relatively simple to provide jobs for all if the citizens of a state are willing to give up their freedoms, and if they are willing to make job security the one objective of their existence."

Mr. Hoffman then described the worker's goal, in addition to job security, as being five fold, including:

1. Employment of his own choosing, that is well-paid, productive, worthwhile and satisfying.
2. Opportunity to grow and develop materially, intellectually, socially and spiritually.
3. Political freedom, the opportunity for self-government through chosen representatives, and the attendant individual liberties of person and of property, freedom of speech, freedom of press, freedom of worship and freedom of peaceful assembly.
4. Opportunity to live in a progressive economy that affords an abundance of things for the worker's material welfare, and under a government that promotes these goals for all the people and their children.
5. Opportunity to live in a world of peace — at home and abroad.

"All these objectives can be attained simultaneously and continuously only by maintaining our American system of capitalism. Under that system, and that system alone, is it possible to carry on the economic activities of a nation without infringing upon the liberties of the people or their rights to representative government.

"The best proof of this statement is attested by the economic and political progress made by the United States since its founding. Not only have our free citizens produced more goods and services per capita and distributed more material benefits to more people than have other men under any other system in any period of history, but in addition, an environment has prevailed that has brought about the fullest flowering of political and individual freedom so far known to mankind.

"The one best way to insure the maintenance of our capitalistic system is to adopt measures that will bring about an even better functioning of the system in the



future than has prevailed heretofore. If we take full advantage of the potentialities of our capitalistic system, and if we remain at peace, the real income of most of our people can be doubled within the next 25 years and we also can realize largely the age-old dream of abolishing poverty.

"But before we can discuss intelligently measures for improving the functioning of our economy we had best try to find out what makes it tick, what its strength is, and its weakness. The great strength of our system lies in its dynamic quality and its major weakness is its tendency toward instability. On the basis of this analysis our course of action is indicated clearly. We should try to find measures which will enhance its dynamism and moderate its tendency toward immoderate fluctuations.

"Perhaps mine is the voice of an optimist, but I believe that if we do these things, we shall see during the next 25 years an unparalleled progress toward achieving conditions in this land of ours which will mean not only equality of opportunity for all, but also certainty of opportunity for every man, woman and child to grow and develop materially, intellectually and spiritually. Therein will lie the strength, the power and the grandeur of the America of tomorrow."

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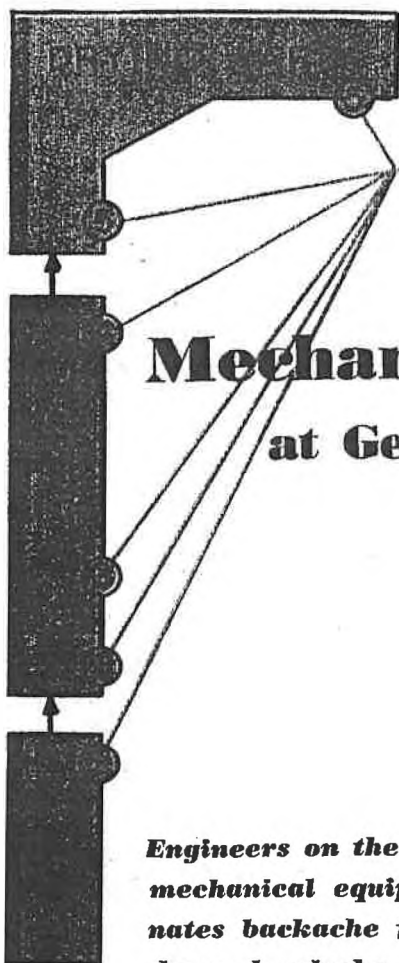
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MPANY

7, OHIO

MBER, 1946



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

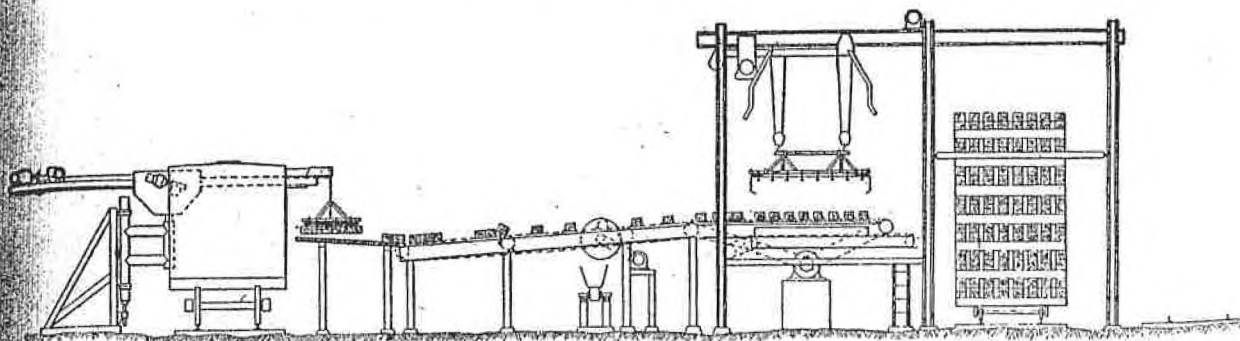


FIG. 1. DIAGRAM OF THE BOX CAR UNLOADER AND TIE STACKING EQUIPMENT.

air circulation between individual ties and layers.

4. A grapple designed to pick up the complete layer along with the stringer tie.

5. A straddle type truck of proper size and capacity to remove such a completed rick from the tram car and deposit it in proper position on the tie seasoning yard.

CAR UNLOADER

The car unloading device, while primarily designed for the removal of cross ties from box cars, might readily be adapted to the handling of other heavy objects. It is mounted on a three-legged frame, securely bolted to a concrete foundation. The boom, which can be extended into either end of the car, is pivotally mounted on this frame. In actual operation, the box car is placed with the car door centered opposite the unloader. After the boom is swung into the car door, anchor chains are fastened to hold the unloader firmly in the desired position.

An electric motor mounted on the side of the machine supplies power for moving the boom horizontally back and forward. Power for raising and lowering the load is provided by a motor and cable drum mounted on the back end of the boom.

A grapple designed to pick up five or six ties is attached to the end of the lift cable. The boom is projected into the car, turning either right or left as desired, and the grapple lowered on a "lift" of ties. As the grapple is raised, the hooks are freed by hand so they can drop into place and engage the ends of the ties. When the ties are raised clear, the boom is racked back toward the machine base.

Then, as a workman guides one end of the ties out the far door of the car, the boom is racked forward. When the ties are outside the car, they are revolved through 90 degrees and lowered to a chain conveyor. As the ties come to rest on the conveyor, the grapple automatically releases the ties. The boom is then racked back into the car and the operation is repeated.

After the first forty or fifty ties are removed, work proceeds at the rate of five or six ties per minute. The time required to change over to another car varies from seven to ten minutes.

CHAIN CONVEYOR

As the ties move along the chain conveyor, they are engaged by

guides that arrange the ties in position to be cut to the desired length. The cutting is controlled by a cam arrangement so integrated with lugs on the chain that the ties are moved past the saw one at a time, about 30" apart.

Just beyond the saw a space of seven or eight feet is provided where "anti-checking" irons may be applied. The application of these "anti-checking" irons at a central point makes possible the use of air hammers, whereas, when the job is done on the seasoning yard, only manual labor can be used.

SPACING TABLE

Arranging the ties so that proper air circulation will be obtained

SPECIAL HANDLING EQUIPMENT

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 air circulation between individual ties and layers.
4. A grapple designed to pick up the complete layer along with the stringer tie.
5. A straddle type truck of proper size and capacity to remove such a completed rick from the tram car and deposit it in proper position on the tie seasoning yard.

EDITORS NOTE:

The principal features involved in the handling process here described were developed by the author and his associates in cooperation with materials handling equipment manufacturers, and are covered by patents.

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.

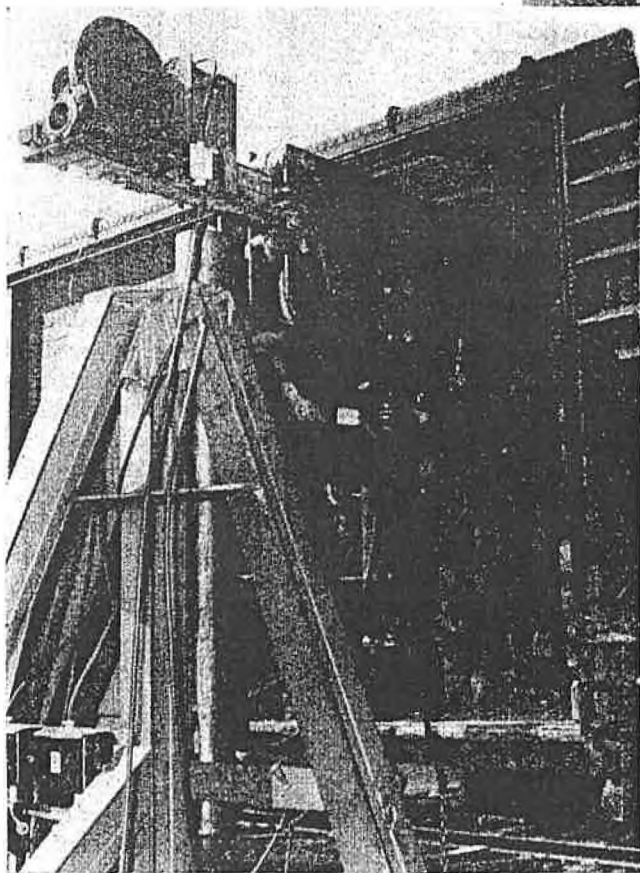


FIG. 4. THE BOOM IS EXTENDED TO PICK UP TIES ON THE NEAR SIDE OF THE CAR. TIES WILL THEN BE PUSHED THROUGH THE OPPOSITE CAR DOOR AND LOWERED TO A TRAM. NOTE THE OPERATOR IN THE FOREGROUND TO THE LEFT IS FREE TO MOVE AROUND AND STILL CONTROL THE UNLOADER.

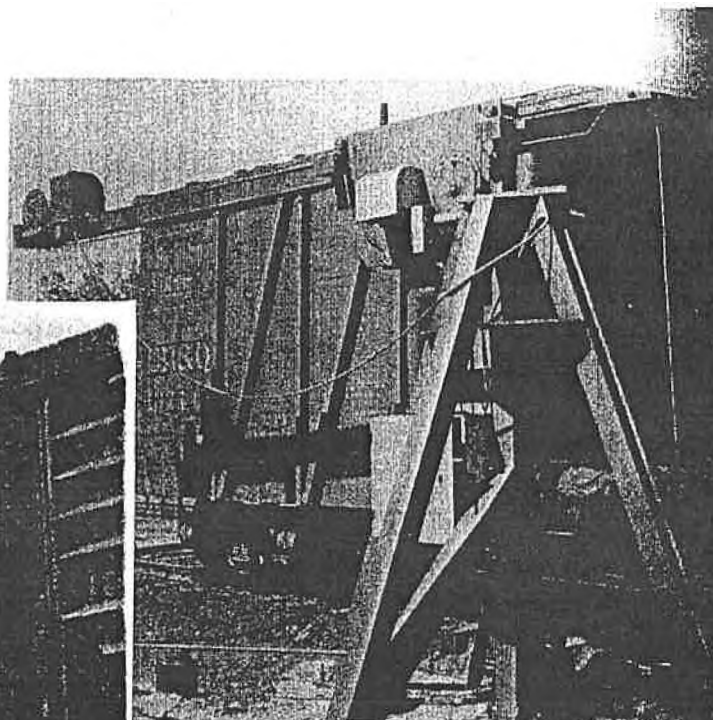


FIG. 3. A VIEW OF THE BOX CAR UNLOADER FOLDED BACK TO CLEAR THE RAILROAD TRACKS.

in the finished seasoning room 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 and move 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-load. 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

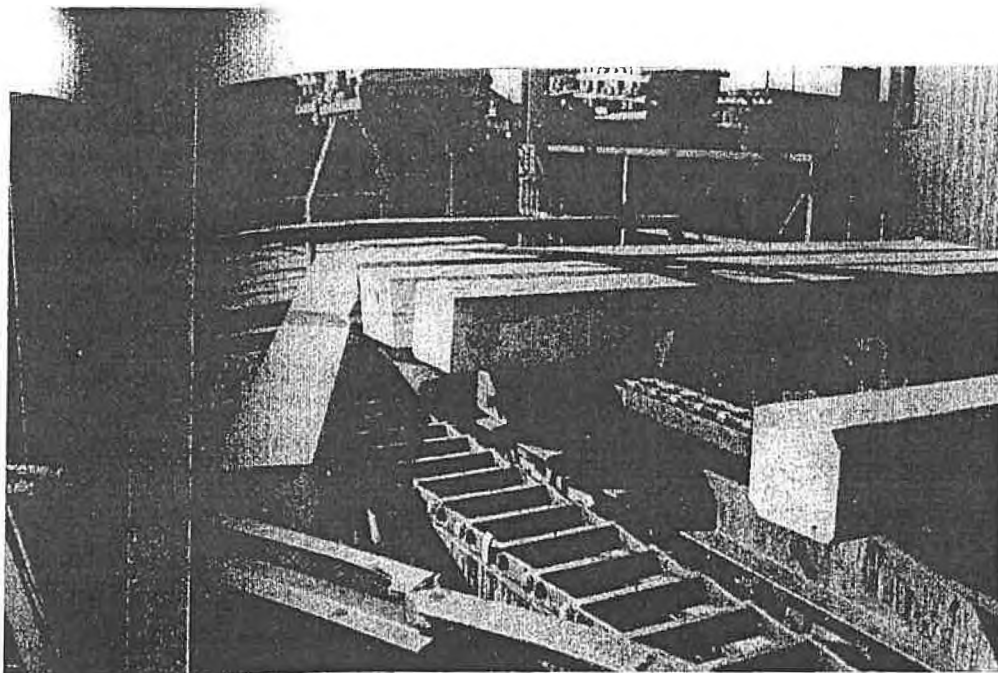


FIG. 5. ABOVE, THE SPACING TABLE. NOTE THE STRINGER TIE FINDING ITS WAY ALONG THE GUIDE BEING PROPELLED BY THE CHAIN SHOWN IN THE FOREGROUND. THREE TIES HAVE BEEN ASSEMBLED ON THE SPACING TABLE WITH THE SPACER IN POSITION TO RECEIVE THE FOURTH TIE.

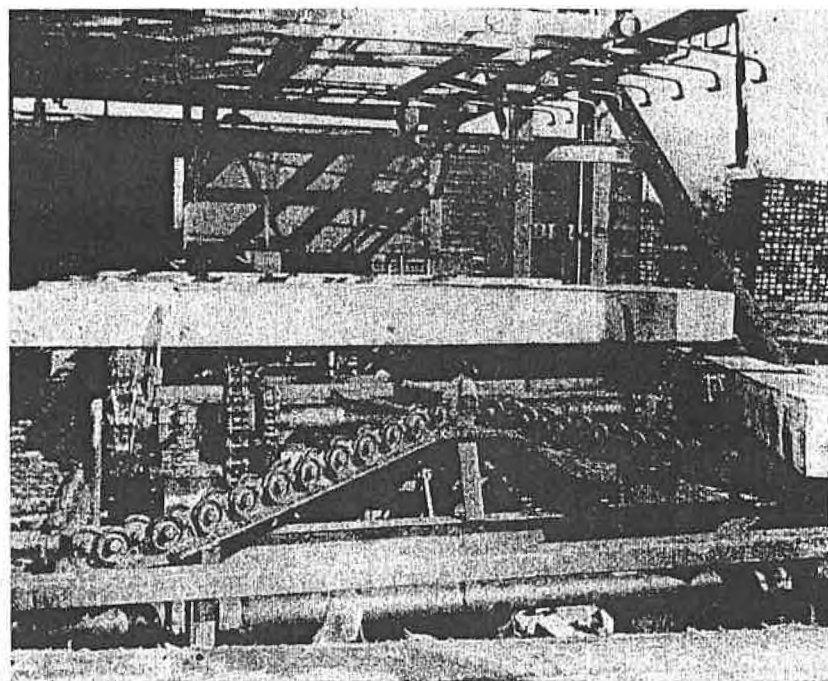
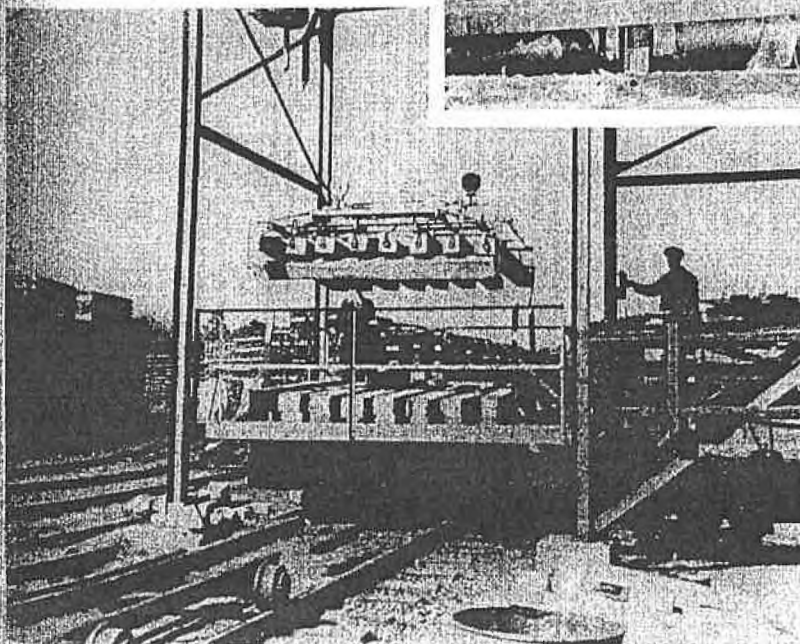


FIG. 6. RIGHT, THE SPACING TABLE WITH PARTICULAR EMPHASIS ON SOME OF THE MECHANISM FOR PLACING STRINGER TIES. THE STRINGER TIE ON THE EXTREME RIGHT IS BEING PULLED SLOWLY INTO POSITION UNDER THE LAYER OF TIES. AS ONE END OF THIS STRINGER TIE DESCENDS THE GRAVITY ROLLERS SHOWN IN THE FOREGROUND, A CHAIN ENGAGES AND CONVEYS THE STRINGER TIE. THIS CHAIN IS SIMILAR TO THE ONE SHOWN AT THE EXTREME LEFT. THE GRAPPLE SHOWN ABOVE IS READY TO DESCEND UPON THE ASSEMBLY OF TIES AS SOON AS IT IS COMPLETE.



will be placed in the same seasoning stack.

When a suitable number of loaded trams have been assembled, they are moved to the seasoning yard by a small gasoline locomotive in trains of from 4 to 12 ricks of 127 ties each.

CARRIER TRUCK

When the tram train arrives at the proper point in the drying yard, it is then necessary to remove the ricks from the trams and deposit them in rows perpendicular to the track. A straddle type carrier truck is utilized at this time.

The carrier truck has a clearance 9' wide and about 15' high.

FIG. 7. LEFT, A VIEW OF AN ASSEMBLY OF TIES READY TO BE DEPOSITED ON A RICK. AT THE LOWER LEFT IS AN EMPTY TRAM CAR.

When a rick of ties has been placed on the railroad track opposite the point where it is to be placed for seasoning, the carrier truck (moving perpendicular to the track) mounts the railroad track astride the load, picks up the rick of ties high enough to clear the tram car, and then backs off the railroad track and proceeds to the desired point where the ties are deposited on creosoted stacking

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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 the month of March, 1946, accurate records were kept of the performance of this equipment. Forty-five thousand, nine hundred and fifty 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.

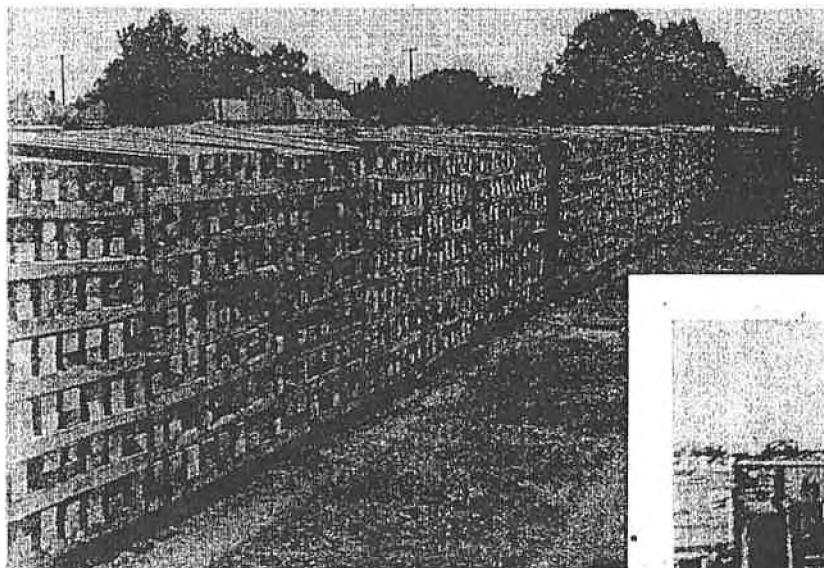
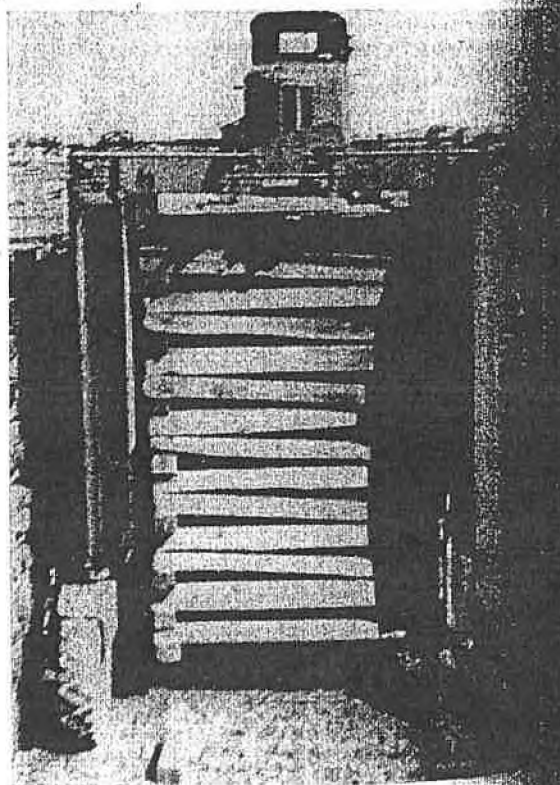


FIG. 8. LEFT, THE CARRIER TRUCK SHOWN AT THE END OF A LONG ROW OF CROSS-TIE RICKS. THE RAILROAD IS OUT OF VIEW AT THE NEAR END OF ROW.

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

Cost Data

Operation	Green ties, cars to storage	Dry ties, storage to A&B Mach.
Tie carrier piece rates	3.8c	3.0c
New method	23 ties per man hr. = 3.0c	78 ties per man hr. = 1.0c

During the period this test was made, and it was necessary to lay treads on the ground to support the carrier truck. The time consumed for this work is included in the truck operating time.

There are many items entering into the total cost of handling cross ties. The equipment discussed entirely replaces manual carrying of ties. A comparison of costs, reduced to its simplest form, is tabulated herewith.

The cost of gasoline, oil, and electricity is almost negligible, amounting to approximately five cents per tie on each green and dry tie handled. It is too early to predict maintenance charges, but indications are that they will be small. These charges, along with interest and reserves for depreciation should approximate five cents per tie on 500,000 green and dry

ties handled per year.

There are a number of intangible but nevertheless real advantages in operation under the new system. It has been found that inclement weather causes practically no interruption of daily operation whereas this factor caused considerable lost time when the work was done by tie carriers.

It is too early to predict what might be expected in the way of accidents. It is significant, however, that during the first eight months' operation, when the men had to familiarize themselves with the equipment, only two loss-of-time accidents occurred, neither serious. We have no records to compare with this, but believe the record, using machines, will be fully as good as with manual labor. Furthermore, a number of tie handlers developed bad sacro-

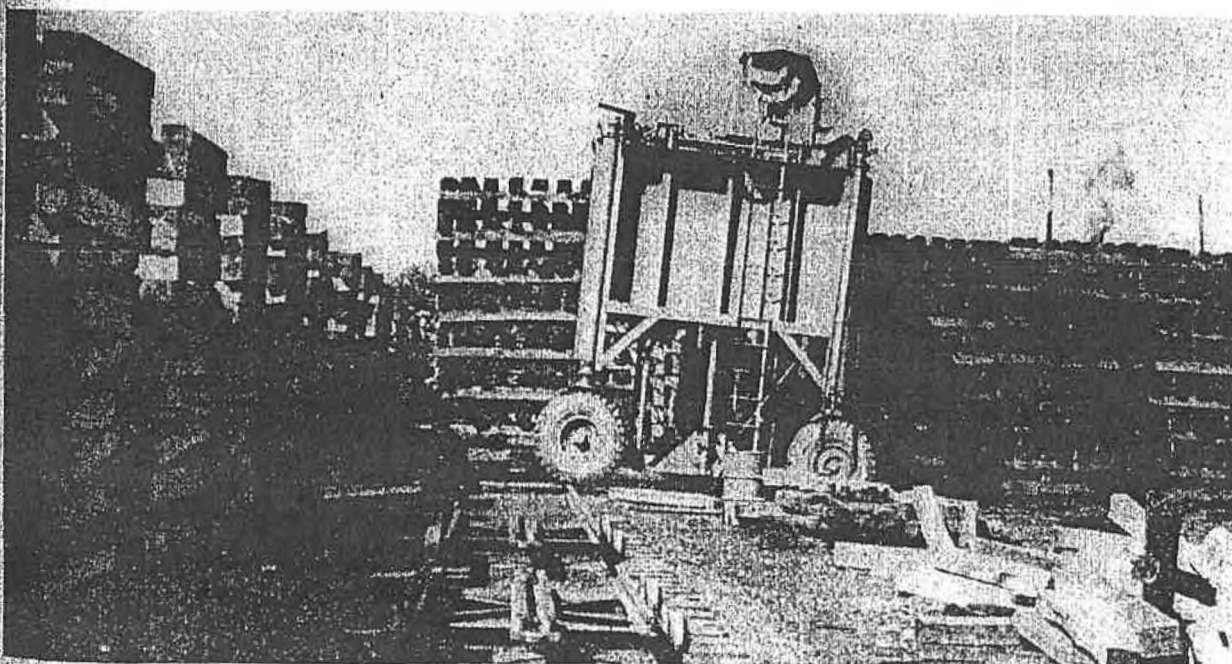
illiacs, injured shoulders, and other ailments due to the very heavy work previously involved.

Since it is now practicable to carry ties much greater distances from the railroad track than with the old method, it follows that tie yards can now be laid out with fewer tracks. In our case, we have already removed one track, making room for storage of an additional 40,000 cross ties.

The important thing, however, is that the job of carrying cross-ties is so laborious that workers are almost unobtainable, and that this job is now being done by the use of mechanical equipment in such a way that ordinary workmen can be quickly trained to do an acceptable job.

It should be understood that this materials handling equipment, capable of handling such heavy loads of cross-ties and bringing about the sizeable saving shown, was developed through the cooperative efforts of the company's management, engineering staff, labor, and materials handling equipment manufacturers. Everyone interested in these problems added something to the solution. A number of ideas coming directly from the yard laborers are included in the design of various pieces of equipment.

FIG. 10. THE ROSS CARRIER DESCENDS FROM THE RAILROAD TRACK AFTER PLACING A RICK OF DRY TIES (127) ON A RAILROAD TRANSFER CAR. NOTE THE MIRROR THAT IS FASTENED TO THE TOP OF THE CAR TO ASSIST THE OPERATOR.



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

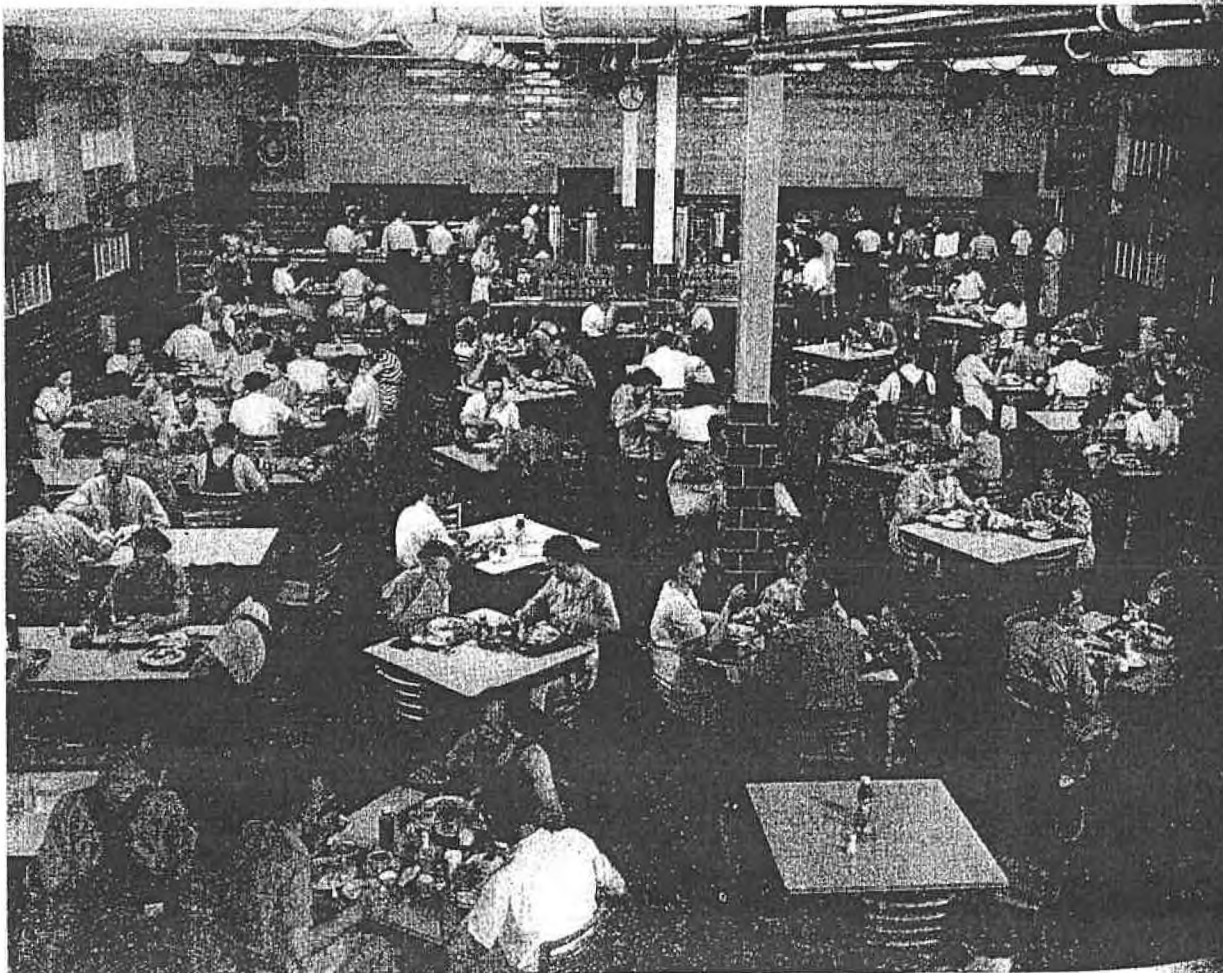
ALREADY a large mill in 1926, when purchased by its present owners, The Pepperell Manufacturing Company plant at Lindale has developed and grown constantly. As customs and techniques in the textile industry have changed Pepperell has changed—often setting the pace through the efforts of its own active 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, "must while you work", and adequate mid-shift lunches. As proof of the

FIG. 1. GENERAL VIEW OF THE DINING ROOM.



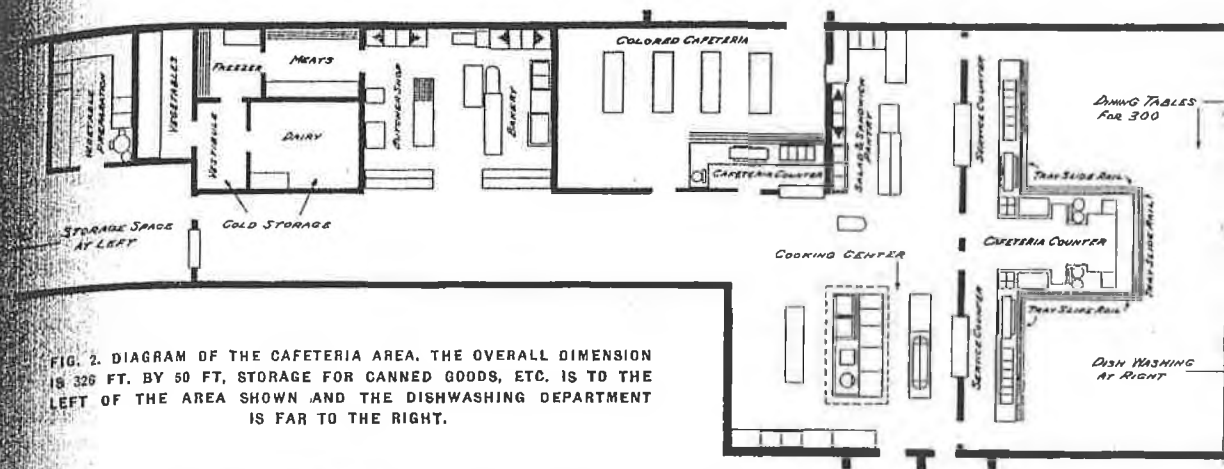


FIG. 2. DIAGRAM OF THE CAFETERIA AREA. THE OVERALL DIMENSION IS 326 FT. BY 50 FT. STORAGE FOR CANNED GOODS, ETC. IS TO THE LEFT OF THE AREA SHOWN AND THE DISHWASHING DEPARTMENT IS FAR TO THE RIGHT.

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considered it exert output and research production which project, "music inadequate of the

emphasis placed on such programs, war agencies gave high priorities for materials needed for these improvements even during the most urgent stages of our conflict. The Pepperell Cafeteria, presently to be described, was allocated the needed materials right when the war demands were greatest.

New Cafeteria

To best meet plant needs, a cafeteria has to be located at a central, convenient point in the mill so that employees can reach it quickly and have ample time for a leisurely lunch without overstaying the allotted time. Pepperell's ample new cafeteria located on the third floor of the new dye house was opened to employees on March 10, 1946, and has been serving something like 1800 hot meals a day ever since.

There is no more eating in the work areas or "getting someone to watch the machine while you grab a bite". Machinery is shut down by groups on prearranged schedule so that each employee's lunch period is free of plant duties. Thus the thirty-minute lunch period is one of relaxation and rest. That arrangement, alone, eliminates considerable indigestion.

The plant operates on normal eight-hour work shifts, and the machine shut-downs are so scheduled that the cafeteria's comfortable seating capacity of 300 people is never exceeded. For example, 900 employees of the day shift eat between 10:30 A.M. and 12:30 P.M., but they do not all shut their machine down at the same time. About 100 employees leave their work places each ten minutes—

so that in about two hours 900 people have been fed (each having thirty minutes) without exceeding the 300 limit which is set by seating capacity.

The three serving periods are: 10:30 A.M. to 12:30 P.M., 5:00 P.M. to 7:00 P.M., and 2:00 A.M. to 3:00 A.M.; but the kitchen operates continuously. That arrangement obviates necessity for storing cooked food, thereby giving each customer a freshly cooked meal. In fact, most of the foods are cooked in relatively small batches as required, and all foods, including breads and pastries, are prepared in the kitchen—ice cream being the only exception.

Equipment

As will be seen from the accompanying plan, the space allocated to the cafeteria as a whole is liberal. In fact, the storage, prep-

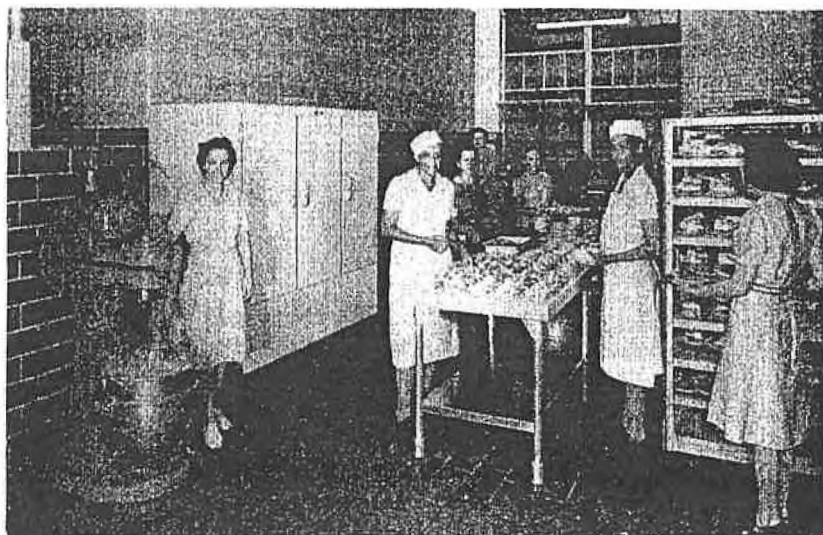
aration, cooking, and service space looks all out of proportion to the eating room, but when consideration is given to the ten-minute scheduling previously mentioned, the reason for this becomes clear.

Even the most remote corners of storage spaces show evidence of careful design and construction, with especial emphasis on sanitation and minimum maintenance. Walls are of ceramic tile — red wainscot and cream above. Floors in the kitchen are ceramic tile and in the dining room asphalt tile is used. Stainless steel is used extensively — sinks, serving counters, work tables, etc.

Results

Do the employees like it? Well, they eat there, and the expressions on their faces indicate enjoyment. Some of the girls complain of difficulty with figure control, but

FIG. 3. A GENERAL VIEW OF THE MAIN COOKING CENTER.



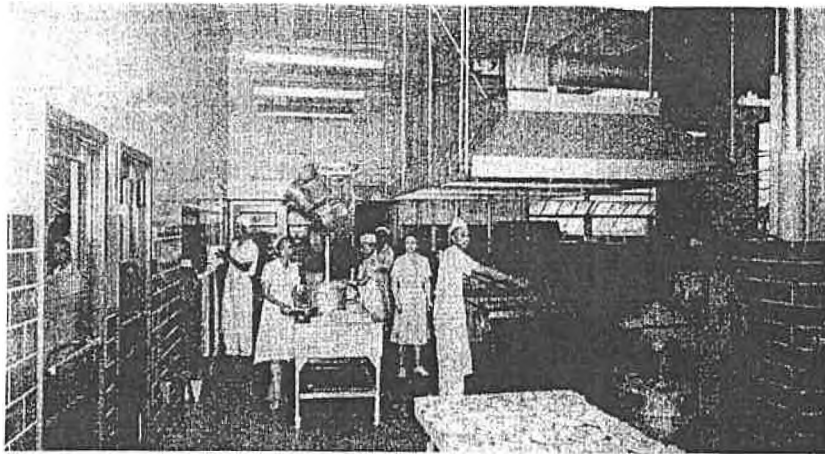


FIG. 4. HERE IS WHERE SALADS ARE PREPARED.

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 wear service buttons showing over 10 years). And the managers, too, have been there a long time, too. Many 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 food 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 ($\frac{1}{2}$ 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 waste garbage disposal, driers, and etc.

REFRIGERATION CAPACITY

Service

Air Conditioning -----

Bakery -----

Salad Room -----

Meats, Vegetables, Dairy

Products -----

Freezing Room -----

Total

FIG. 5. THE WELL EQUIPPED BUTCHER SHOP.



Profits in Plant Layout

An article in eight sections complete in this issue, discussing every phase of wise plant layout.

I Consider the Product	49
II Picking the Site	50
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(c) Bachrach

By Gregory M. Dexter

Consulting Industrial Engineer
on
Business Management Problems

Section I

Consider The Product

NUMEROUS important factors in plant layout are often overlooked. An executive will argue that a study of plant layout is not worth while, that his plant handles such varied work that no one best layout is possible, or that no change is economically possible. A summary of important factors involved, however, should show that there are few plants where a careful study of layout will not pay big profits.

Production vs. Sales

Approximate curves of production and monthly sales by units of products made for a typical year



should be compared. Ascertain the normal working day and week. Approximate estimates of storage space required for raw material, purchased parts, and completed equipment or material can be made from the curves. Possible storage of finished products near sales centers as a means of smoothing production, reducing factory storage, and improving service to customers should not be overlooked. Uniform production is an important way of reducing cost of labor and equipment. It permits good labor relations.

Provision for increased production in five or ten years, for new

products, new buildings, and new machinery should be made. Exact decisions are not possible on these points but qualitative analysis of them will usually give valuable guidance.

Design of Product

Eliminate poor selling items as every unnecessary product complicates the plant layout. Redesign all products for as much standardization as possible using standard bolts, screws, chemicals, and other components that may be bought more cheaply from large manufacturers. Redesign for increased sales appeal through better packaging. Use welded shapes instead of castings or use plastic parts instead of metal, with an eye to lower costs through such changes. Change processing methods to obtain better quality, particularly if obtainable at little or no increase in cost. The best plant layout is not

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.

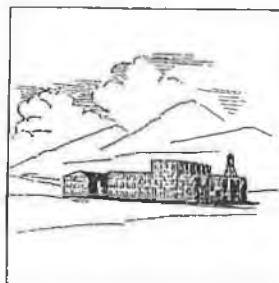
It may be possible to do certain work while material is in progress from one machine to another on a conveyor, such as inspection, grinding, spray painting, chipping of fins, drying, or preliminary assembling. There are other tricks the engineer will consider.

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 card 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 by day and night is often possible with the proper signs. A possible conflict of direction of prevailing winds, for an-

dust from railroads or highways might cause troubles. Roadway, coal handling, and ash disposal sources of dirt in the plant grounds 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 community 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

shows the machine the proper time to idle an eye on the time taken for reduction

should not be overlooked. Provision for them is sometimes possible with little increase in capital cost of new buildings. Records of the local building department or of neighboring plants are often helpful in the design of building or machinery foundations.

Necessary clearances and height of platforms and canopies for railroad service can be obtained from the local railroad. Tank-car or boat shipments of various liquids or gases such as ammonia, sulfur dioxide, gasoline, fuel oil, caustic soda, molasses, and similar products involve varying requirements as to storage, piping, earth

dikes, and similar safety measures that are readily determined from manufacturers of such commodities, public carriers, and insurance companies.

High chimneys and elevated tanks involve codes for the safety of airplanes. Safety measures inside and outside a plant are covered by requirements of insurance companies and are included in various pamphlets of the National Safety Council, Inc.

Adherence to these codes are the secret of low insurance rates by the Factory Mutuals or by the Factory Insurance Association of the stock fire-insurance companies, and for workmen's compensation.

control for large charts is desirable.

Rest Rooms

A rest room for women should have couches, easy chairs, high foot-rests that can be used as stools, metal waste-container, toilet-seat sterilizers, full-length mirror, shelves and plenty of hooks in toilets, and mirror and shelf over each wash basin. If the company has no cafeteria, a refrigerator, electric stove, and dinette in the rest room are worth while. Shower baths are appreciated, especially if work is done under hot or dirty conditions.

Reception Room

The vestibule and reception room are often supervised in small plants by the telephone operator, but this has the drawback that visitors while waiting can often pick up confidential data from the operator's conversations. A beautiful front entrance to the factory is necessary and should be made the focal point that first attracts the visitor. The atmosphere of the reception room should be in keeping with the architectural design. A lavatory and private telephone booth for visitors are desirable.

Personnel and Medical

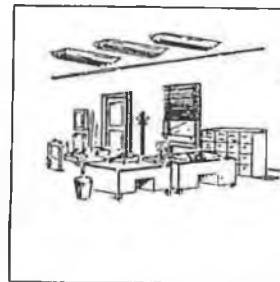
Admission to the personnel and medical departments should be direct in order to avoid confusion with inter-office movement of company employees. The personnel department requires private interview rooms and, in large plants, a comfortable waiting room. The medical department must have facilities for physical and eye examinations as well as first aid. Its location between the personnel department and the manufacturing floor is an advantage.

Filing and Stenographic

A central filing department for the engineering and manufacturing departments in small plants is often justified. The sales and purchasing departments usually do better by controlling their own files. Similar arrangements are desirable on stenographic service. But any central file or stenographic pool should be on the same floor with the departments it serves;

Section III

Office and Employee Facilities



A STATEMENT of the number of employees required in the general offices and their desired location will determine whether a separate office building is needed. Overhead costs are frequently

reduced and a smoother-running organization obtained if the general offices and the plant are located near each other. When the two are separated by miles, the paper work necessary is increased. Make a flow-line chart for the general offices and for the central mail room, as described later for the plant.

Visitors to the plant are usually most interested in contact with the sales, engineering, purchasing, and manufacturing departments. Their location on the ground floor of the plant or office building is therefore an advantage. The sequence is logical as orders coming into the plant usually do so from sales to engineering, where they are broken into material to be purchased from outsiders and material to be produced by the manufacturing department. Financial or accounting

and general executive departments can be well placed on a floor above. The space required in the offices will vary from 50 to 100 sq ft or more per person, depending on extent of executive staff and

company policies in allotment of working space. Provision should be made for the additional space that may be needed from any increased governmental control.

The traffic department for incoming and outgoing shipments is advantageously made a part of the purchasing department. The latter should have room for a sample cabinet and catalog file.

The library should be adjacent to the engineering department.

Manufacturing Dept.

The manufacturing department should have space for a laboratory, visiting inspectors, night watchmen and guards, janitors' closets, production control, costs, men's smoking room, women's rest room, and a meeting room for foremen. Ample wall space in production

should not be considered as an advertising medium. It might be possible with signs, but it might conflict with the prevailing conditions for any highways, roadways, disposal of grounds, problem of

side of in well as a general audience in connection, dust, fire, and human, that might be a building of building, and comment on the elements for, ns, drink, aths, fire, ed stair, ibly halls, iletts and, quired in

founda- mes, tor- gh river: 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.

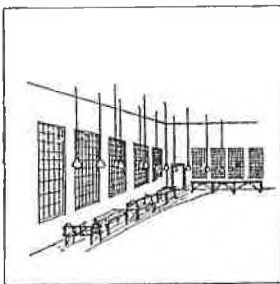
These templets should be located correctly to scale on cross-section tracing paper, or cloth equivalent to K. & E. 334 1/2 TC and 282 1/2 G, or 288 G, with ten divisions to the inch. They may be held in place with map pins, thumbtacks, Scotch tape, paper cement, or wire staples. Overhead conveyors can 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.

for process layout is based on the grouping of like machines such as lathes, radial drills, etc., and the movement of material back and forth among the various groups. The other type, or product layout, is based on continuous movement in as direct a line as possible from the receiving to the shipping department with machines provided as needed in sequence to perform the various manufacturing steps. Sometimes a combination of the two types of flow can be used to advantage as when various parts are manufactured in different departments and then brought to a conveyor assembly line. A great variety of products will usually require the grouping of like machines.

Machine Location

Aisles should be wide enough for two trucks to pass. Widths of 6 to 14 feet are commonly used. Corners should be curved so trucks may go around them easily. Make sure that any extension of a machine such as a milling-machine table will not interfere with passage in the aisle.

Allow space for hand tools, tool boxes, and for additional equipment to meet the demand for increased production. A study of reasons for idle-time of existing equipment may give clues as to improvements needed in the new layout.

Space will be needed at each machine for four tote boxes or equivalent. One tote box will contain material being processed and another material waiting to be processed. Two more tote boxes will be needed to care for the processed material, as sometimes material is not moved as soon as it is processed. Instead of tote boxes, space might be needed for skid platforms or trucks. The use of skid platforms for the storage of heavy tools or material will eliminate handling and reduce costs.

Further Requirements

Leave space on the floor for the assembly of complicated or heavy machinery. Clearances around each machine should be large enough to permit operators to work comfortably and to handle the longest piece of material coming

to them. With steel and lumber, required clearances become great and may be as much as 20 ft. in a woodworking plant. Space for machine repairs may be necessary. Bulky or heavy material may require hand-operated hoists or cranes beside various machines. Overhead travelling cranes may be needed for an entire shop. Floor space should also be set aside where material and tools for various shop orders may be assembled for issuance to operators. This space should be enclosed by wire netting so its contents cannot be used as a source of supply for jobs already in the shop.

Benches and Tables

Benches should be at right angles to a building wall with windows, preferably the north wall. Revolving tables may be used to reduce space needed for assembly operations. Such tables and all assembly tables should be designed with clear space under them so female workers will not snag their

stockings. Table tops might well be fitted with fiber board or linoleum in order to avoid chilling operators' arms. Foot rests are sometimes provided. A standard height of about 37 inches should be adopted, depending on work performed.

Machine Operation

By the proper use of tote boxes, skids, conveyors, and similar helps, the picking up and putting down of articles can be avoided. Make sure that operators do not do the work of laborers.

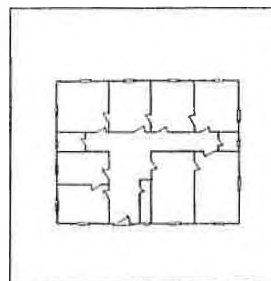
Individual motor drives for machines are usually preferable but machines with small motors may sometimes be advantageously grouped for line-shaft drive.

Consult key operators and foremen as to possible improvements in layout of machines, process charts, and flow lines. They will often have good ideas. Regrouping of machines and changes in sequence or kind of operations should in particular be discussed.

Section V

Locating Departments

TRY to put noisy departments in closed rooms and thus protect the workmen in quieter departments. Shops should be located in reasonable order in relation to each other, such as pattern shop, foundry, machine shop, and welding shop; or wet building, dryer building, pulverizer building, scale house, and warehouse for a starch plant. Pattern shop should be near pattern storage. The engineering department should be near the pattern shop and machine shop. The welding plant should be near the power plant in order to reduce length of power cables. The shop for spray painting, lacquering, or dipping should generally be



between the point of final assembly and the shipping department.

Fireproof vault for storage of duplicates of engineering drawings and of pattern records might well be placed in the engineering department.

Materials Handling

The ideal plant has its receiving department with trackage and roadway at the opposite end of the plant site from the shipping department with its trackage and roadway. Where only one track and roadway are possible, the receiving and shipping departments are side by side. Raw material stores should be near the receiving

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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.

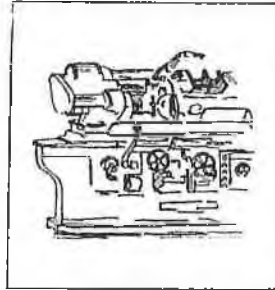
Location of inspection departments will depend on product made and extent of inspection necessary. Inspection in transit from machine to machine is possible. The raw-material inspection and testing should be near the receiving department and raw-material stores. The final testing department should be 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 in racks in the shipping department. Cut-off and rip saws and single - spindle borer 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 door. A separate building is frequently desirable.

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

without the necessity of rehandling from trucks or railroad car. A cut-off and rip saw are the minimum requirement at the lumber rack.

Waste Storage

Provision for storage of waste near shipping department where it can be moved easily by truck or railroad is desirable. Various reclaiming devices such as sieves, rakes, and filters are available. Some inexpensive care in reclaiming waste will often increase its sales value materially. Collection of waste by conveyors or blowers instead of trucks is sometimes possible.

Tool Room

The equipment needed for a tool room will depend upon the elaborateness of the work to be done. A lathe, milling machine, and grinder are certainly the minimum requirement. A woodworking plant, for example, will need a large amount of special saw-sharpening and cutter equipment. Racks and shelving for tools, dies, and fixtures so they can be easily found, as well as drawing and filing cabinets for the storage of engineering drawings and standard instruction sheets, are obviously necessary. Here, also, doors with spring locks and counters where tools may be issued should be provided.

Maintenance Department

The equipment in the maintenance department should include a lathe; milling machine; pipe-threading machine; cut-off saw; shear; some wood-working tools such as a variety saw, planer, and lathe; spray-painting equipment; ladders; and benches. The exact set-up again will depend on the size of plant and extent of maintenance work contemplated. Several trucks and storage space for them should be provided. Each truck should be completely equipped with the hand tools needed by one trade such as millwright, pipe fitter, and electrician. There is no economy in mechanics chasing back and forth for tools and material needed for a repair job.

The oil truck with tanks to service various machine tools and op-

erating equipment should be stationed here.

Roadways and Parking

The separation of incoming from outgoing traffic on roadways is desirable. Provide the roadways with easy curves and ample width for passing. It should be easy for trucks to back up to loading and unloading platforms. An enclosed shed over such platforms will reduce labor costs in inclement weather. Where trucks have to unload heavy material at a machine shop or foundry, an air lock with two sets of doors will protect workmen in the shops in cold weather.

Parking lots should be well drained and not too big. The driveways in them should be hard surfaced and wide. All parking spaces should be well gravelled and clearly marked. Several parking lots are often desirable in order to reduce the distance employees have to walk between factory and automobile in bad weather. An underground or overhead passage at railroad trackage between parking lots and factory is desirable as a safety measure. Sheds are sometimes provided for the cars of executives but may cause some ill feeling among subordinates.

Garage space for company trucks and automobiles with repair shop and gasoline pumps should be located between or near the ship-

ping and receiving departments.

Entrance to the roadways and parking lots should be past a watchman's booth. Do not forget to heat the booth with electricity or steam. Time clocks are sometimes located there advantageously. A telephone connection from the booth to the central switchboard and, in large plants, a direct connection to the office of the captain of the guards are desirable.

Armed guards and wire fences were necessary during the war but are repugnant to most Americans; insist on results by vigilance of guards coupled with courtesy in order that fences and side arms may be dispensed with. An emergency-alarm connection to police headquarters is to be preferred to the atmosphere of a prison.

Comfort and Beauty

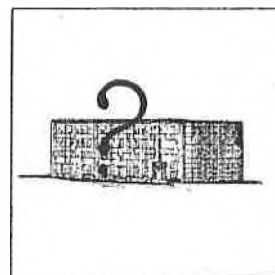
Platforms with covering sheds and windbreaks are desirable where employees have to wait for buses or trolleys. They should be well lighted at night. Covered walks between buildings where traffic is heavy are worth while.

Landscaping necessary to make the factory appear attractive should not be overlooked. It is astonishing what beautiful results can be obtained for a small expenditure by a competent landscape architect. Beauty at a factory has a definitely favorable effect on employees' morale.

Section VII

Other Layout Problems

A PLANT need not be ugly. Lines can be put into the brick or concrete at little or no expense that will carry the eye with them to create an impression of beauty and style. The location of sash



and doors can be such as to add to the impression. Build the plant around the desired layout only after thorough study of it has been completed. Never try to put equipment into a plant the size of

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 heaters 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 or steam hose. Wood blocks or rubber mats over the concrete are easy on employee's feet. Wood floors on top of concrete are possible for light and clean manufacturing. Watch out for special floor requirements for acids or alkalis. A heat-treating room, for example, will require special flooring. Surface concrete floors should be given special treatment to reduce wear and dusting. Steel floor plates should be used where trucking is heavy and frequent.

Choice of Building Type

Industrial plants should have as 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 space and movement. Steel or reinforced-concrete structural frames with brick or concrete walls is usual specification for a factory building. Skill in design of reinforced concrete will usually pay costs about as low as structural steel and brick. Mill-building construction with wooden beams and columns and brick walls is usually the cheapest and, with sprinklers, for some types of manufacturing.

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Success in getting low costs in manufacturing depends on the same question that scientists use in research, namely "Why?" It should be asked concerning every operation, movement, delay, storage, grouping of machines, lack of machines, type of machine, and other steps involved in the manufacture of each product. The question typifies the inquiring mind.

An engineer, however, should not be content with his ability in asking that question. He should learn from machinery salesmen and technical articles what other manufacturers are doing. His presence in the library for hours should be considered in his favor. He will soon learn that there is an astonishing amount of data available to the seeker that will help greatly in the formulation of a program for the rehabilitation or layout of a plant.

Recommendations

A comparison of the summaries for various layouts as to distances

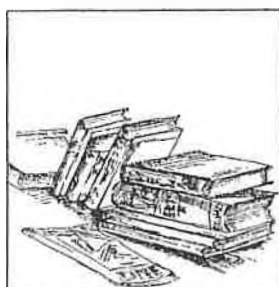
travelled, time and labor required, volume of building space, cost of buildings and equipment, extent of backtracking, and number of times flow lines cross will help to determine the best layout. Even then it will be necessary to know whether the necessary expenditure must be paid for from earnings in six months or other periods ranging up to five years. It is generally desirable to keep plant investment low. Some decisions can be made only on the basis of what is good policy in relations with labor. Even the question of return on investment must be viewed with caution. A company sometimes has to pay for improvements out of obsolescent reserves without regard to return on investment if competitors are getting lower costs with more modern equipment. A newcomer in an industry has the advantage frequently of purchasing new and more efficient equipment at little or no more cost, even less cost, than equipment generally in use by established manufacturers. It is the newcomer's methods that have to be watched closely by the established manufacturer.

Section VIII

Research Library

ANY executive or engineer who is to engage in the laying out of a plant will find his work easier by familiarity with the books listed below. Many excellent books are available but those listed will give material help on the problems involved. The methods outlined in them are the guides to big profits in plant layout.

Ramsey, G. R. and Sleeper, H. R. *Architectural Graphic Standards*. New York, N. Y.: John Wiley & Sons, Inc., 1941



Seelye, Elwyn E. *Data Book for Civil Engineers*. New York, N. Y.: John Wiley & Sons, Inc., 1945. Vol. 1, Design.

Dimension sheets on foundations, floors, roads, coal trestles, drainage, water-treatment plants, and similar subjects.

Dimension sheets on details such as radiators, telephone booths, windows, railroad clearances, stair proportions, driveways, kitchen equipment, toilets, shower baths, and requirements for sports such as tennis courts, bowling alleys, and similar facilities.

Strock, Clifford, and Hotchkiss, C.H.B. *Air Conditioning Engineers' Atlas*. New York, N. Y.: The Industrial Press, 1939.

Extensive climatic data for about 100 cities and maps covering the country.

Muther, Richard. *Production Line Technique*. New York, N. Y.: McGraw-Hill Book Co., Inc., 1944.

Concise, popular presentation of industrial methods, including plant layout, conveyors, assembly, and similar problems.

Wiren, Alexis R. and Heyel, Carl. *Practical Management Research*. New York, N. Y.: McGraw-Hill Book Co., Inc., 1945.

The approach needed by the executive who would lay out a new plant or rehabilitate an old plant.

Knoeppel, E. E. and Seybold, Edgar R. *Managing for Profit*. New York, N. Y.: McGraw-Hill Book Co., Inc., 1937.

Simple methods for determining sales to justify a new plant, reductions in cost to earn a specified profit, and similar financial engineering problems.

Cuno, Charles W. "Economic Factors in Chemical Plant Location", *Chemical Engineers' Handbook*, edited by John H. Perry. New York, N. Y.: McGraw-Hill Book Co., Inc., 1941.

Methods outlined are applicable to any kind of plant.

Hudson, Wilbur R. *Conveyors and Related Equipment*. New York, N. Y.: John Wiley & Sons, Inc., 1944.

Concise discussion of material handling methods with engineering data. No data on lift trucks and similar equipment.

Stocker, Harry E. *Materials Handling*. New York, N. Y.: Prentice-Hall, Inc., 1943.

Data on lift trucks, pallets, and similar equipment. Discussion on warehouse design.

Barnes, Ralph M. *Motion and Time Study*. New York, N. Y.: John Wiley & Sons, Inc., 1937.

Numerous suggestions on ways of obtaining motion economy.

Barnes, Ralph M. *Work Methods Manual*. New York, N. Y.: John Wiley & Sons, Inc., 1944.

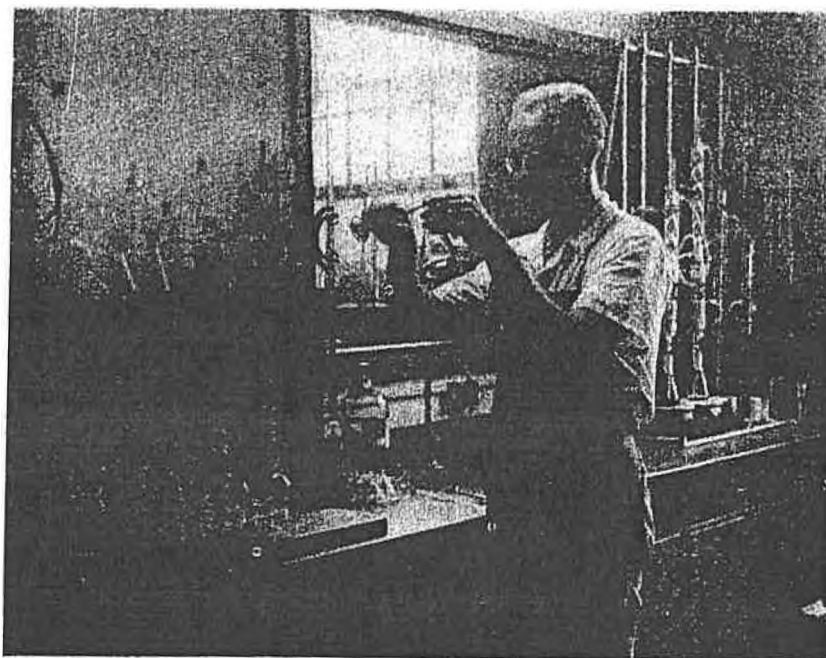
Summarizes preparation of process charts, flow diagrams, man and machine charts, and similar data needed for a plant layout.

Vilbrandt, Frank C. *Chemical Engineering Plant Design*. New York, N. Y.: McGraw-Hill Book Co., Inc., 1942.

Chapters on plant location to supplement Cuno, above, and on flow diagrams for the chemical plant.

Alford, I. P. and Bangs, John R. *Production Handbook*. New York, N. Y.: The Ronald Press Co., 1944.

The reference manual before consulting more specialized books and articles.



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

Progress In Candy Making

By

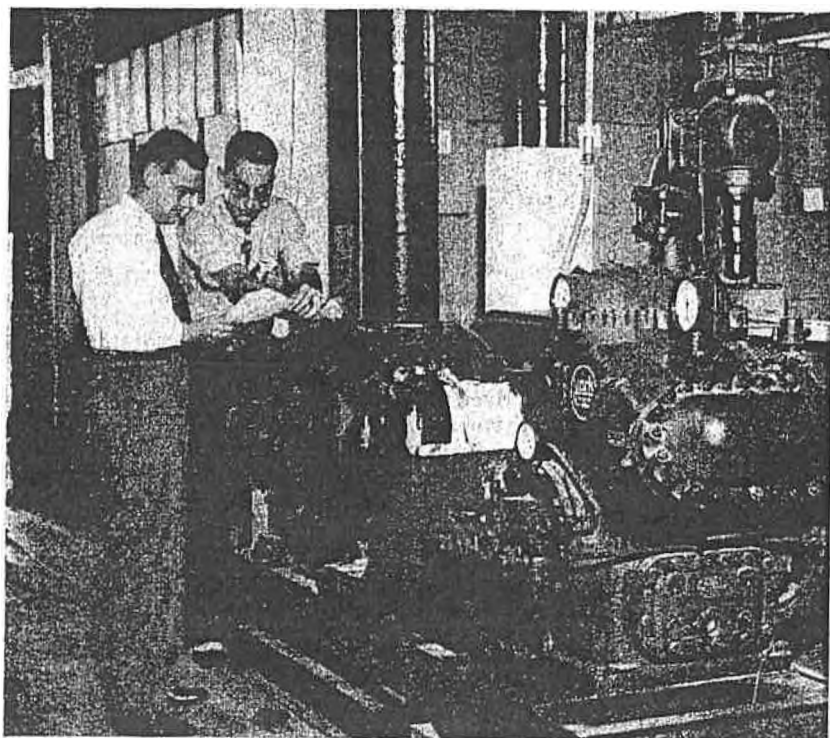
R. A. Brock

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 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 also 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 manufacture 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 sirup, 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) OF THE BROCK CANDY COMPANY DISCUSS OPERATION OF COMPRESSING UNIT AND AIR CONDITIONING SYSTEM.

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production when raw ma-
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modernization program in-
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of air conditioning, in-
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of a quality control labor-

Completion of the program
result in better working con-
greater production capac-
and more uniform products of
higher quality.

Air Conditioning

Refrigeration of certain rooms
always been necessary for the
performance of some operations in
the manufacture of candy. Appli-
cation of chocolate coatings would
otherwise be impossible at summer
temperatures in the South. How-
ever, control of both temperature
and humidity (air conditioning) is
a relatively recent innovation in
candy factories in this region.

The Brock Company has just
completed the installation of
equipment for the air conditioning
of its offices and rooms used for
drying, storage, wrapping, pack-
ing and shipping its candy pro-
ducts. Already evident are its
beneficial effects on personnel,
product handling, and machine ef-
ficiency.

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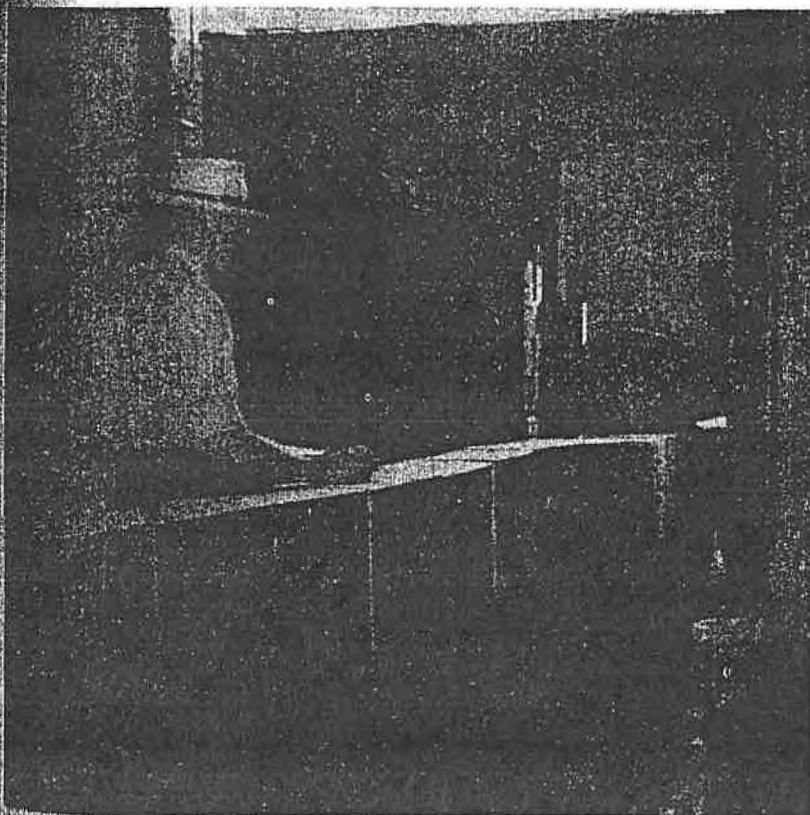
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BOXES OF CANDY ARE PASSED THROUGH X-RAY UNIT FOR FINAL INSPECTION.

***New application of air conditioning
and X-ray inspection assure quality
of product and ease of handling.***

FINAL PRODUCT IS TRANSFERRED DIRECTLY FROM AIR CONDITIONED SHIPPING
ROOM TO REFRIGERATED BOX CARS.



ducts. Already evident are its
beneficial effects on personnel,
product handling, and machine ef-
ficiency.

The effects on the well being and
efficiency of the personnel are re-
markable. Previously, fatigue was
so great during the hot summer
weather that by the end of the day
the workers were nearing physical
exhaustion. Since the installation
of the air conditioning system, the
employees show very little fatigue
and are nearly as fresh at the end
of the day as in the morning.
Working efficiency is greatly in-
creased, and the morale of the
workers vastly improved.

Equally important are the ef-
fects of air conditioning upon
product quality and ease of hand-
ling. Until its installation, hard
candies, gum drops, and other
items of this nature were subject
to "sweating" on hot, humid sum-
mer days. They could not be hand-
led at all until a cooler, drier day
allowed them to dry out. Since the
introduction of air conditioning in

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 turnover in experienced artisans. However, it takes years of practice for an inexperienced candy maker to develop into a skilled craftsman and such men are difficult to come by. 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.



Industrial Hygiene

Importance of Dust

By N. V. Hendricks

Chief Engineer Industrial Hygiene
Service, Georgia Department
of Public Health

**Nearly all types of modern
industry are concerned
with dust and its control.**



Courtesy M. S. A. Co.

FIG. 1. THE MIDGET IMPINGER USED FOR COLLECTING ATMOSPHERIC DUST SAMPLES.

THE annual cost to industry from uncontrolled dust amounts to a staggering figure. In many cases the problem of dust is dismissed by management as only a nuisance. In other plants, the recovery of certain dusts is economically sound, especially where the particulate matter may contain precious metals or may carry valuable processing stock. Aside from any nuisance or economic loss resulting from the escape of dust there are certain dust exposures which may result in acute health hazards. This is especially true of dusts containing a high percentage of free silica, asbestos, or other toxic materials. Where health considerations are involved in such exposures, legal aspects present themselves. In most states where occupational diseases are compensable, specific coverage is given to those disabilities resulting from the inhalation of silica dust.

Definitions

Many times true dusts are confused with fumes, smokes, mists, and fogs. In order to differen-

tiate between the origin of these materials, a definition of them is in order.

DUSTS are formed by the reduction of earthy materials and are usually produced by such operations as crushing, grinding, buffing, etc. The particle size of dusts may vary considerably, ranging from sub-microscopic to visible.

FUMES are formed by condensation and sublimation. Chemically, they are metallic and are usually the oxides of such metals as zinc, and lead. The particle size is usually below one micron.

Smoke comes from the burning of organic material and its particle size is usually less than one-half micron.

Mists and Fogs result from the condensation of water vapor on suitable nuclei, and the particle size will vary with given conditions.

General Properties

As a substance is reduced in particle size, there are certain general properties of the material which are changed. On breaking up a solid into finely divided particles, the surface area is greatly enlarged and therefore the space

occupied is greatly increased. As an example, a piece of quartz one centimeter on each side when crushed to where the particles of one micron in size will present a system containing 10^{12} number of particles. The total surface area will be 6 square meters. If these dust particles are dispersed onto the atmosphere in such manner that the concentration will be 100 million particles per cubic foot, the space occupied by this dispersed system will be 10 thousand cubic feet.

The chemical activity of a solid is considerably increased by a reduction in particle size. Thus the rate of oxidation is increased as is evidenced by occasional disastrous dust explosions. The phenomena of adsorption becomes more important as gases are more easily adsorbed on the surface of the smaller particle.

From the standpoint of health hazards resulting from dust exposures, the physiological properties of dust vary somewhat with the particle size. It is an accepted fact that with exposures to silica dust, the smaller the particle size, the greater the hazard.

Physiological Response

Drinker has summarized the reactions resulting from the inhala-

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 in the carbonate. Limestone and marble contain considerable amounts of these carbonates, and do the materials from which cement is made.

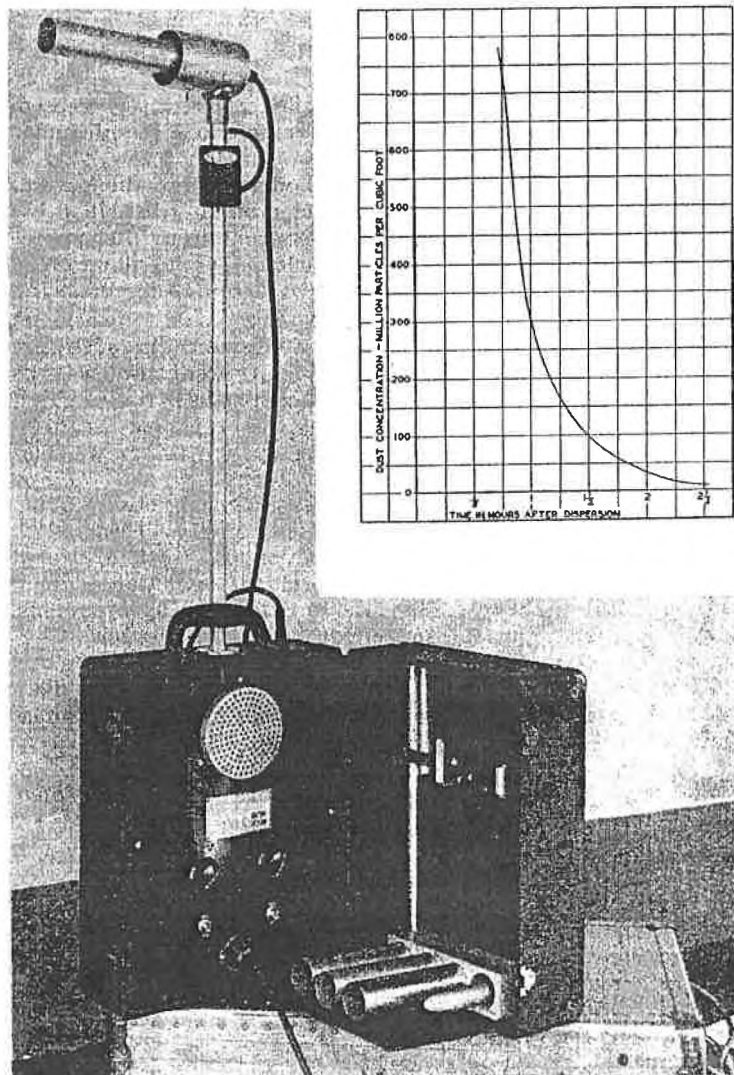
Due to the solubility in body fluids, these materials are removed when taken into the body by inhalation. The presence of carbon dioxide in such fluids is an important factor influencing the solubility. The same thing applies to the presence of carbon dioxide in water which comes into contact with these 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 dust 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 reaction. In general the 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 of 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.



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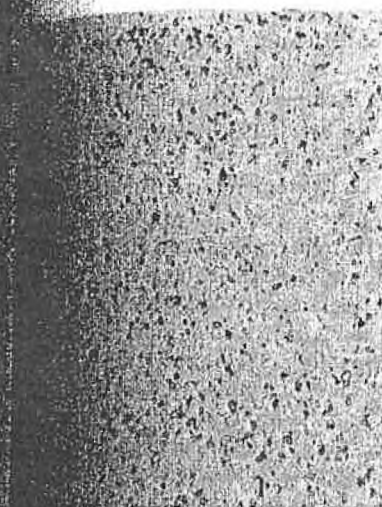


FIG. 3. GEORGIA KAOLIN DUST MAGNIFICATION 130X.

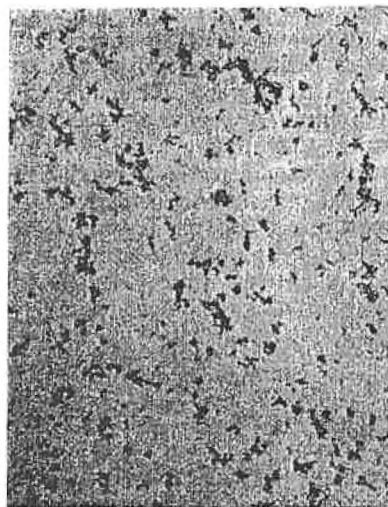


FIG. 4. QUARTZ DUST (SiO_2) MAGNIFICATION 130X.

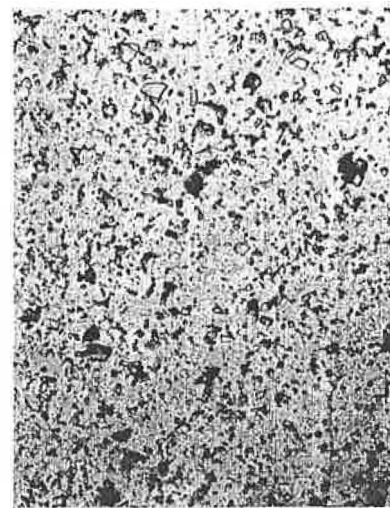


FIG. 5. CALCIUM CARBONATE DUST MAGNIFICATION 130X.

this metal. However, it appears that exposure to the dust of iron does not produce pathology unless such exposure is accompanied by the pressure of free silica.

The mining of coal results in exposure to coal dust which contains a high percentage of carbon. Detailed studies of exposure to coal dust have been made by the U. S. Public Health Service and other agencies. It has been found that, in general, coal dust is retained in the lungs only when such dust contains a high percentage of free silica. Although coal dust may be deposited in the lungs of exposed individuals, the condition resulting is usually not considered disabling unless silica is present.

Silicates make up an important class of industrial materials and are used principally in the production of ceramics and similar materials. Talc, kaolin, mica, clays, etc., are chemically silicates and their widespread industrial application results in a great number of employees being exposed to this type dust. With the exception of asbestos, which is a silicate, this general class of materials does not appear to produce a disabling condition, except in isolated cases, when taken into the body by inhalation.

Asbestos is the only silicate known at the present time which produces a lung pathology comparable with that resulting from exposure to silica dust.

Of all the dust found in industry, probably the most important is free silica or silicon dioxide. It occurs in the form of quartz, flint, sandstone, and chert; and is as-

sociated with many other minerals and ores. The disabling condition resulting from the inhalation of free silica is known as silicosis and has long been a problem with industries such as stone cutting, granite, foundry, abrasive, and the like, where silica is used in processing. There are relatively few industrial operations which might result in direct exposure to pure silica dust. The importance of silica lies in its association with other materials. As an example, in foundry operations the dust generally will contain clay and materials of a non-silicious character, so that the actual percentage of free silica may be relatively low. This is also true in exposures to coal, iron oxide, and the mining of ores. When hard rock or silica is present, these dusts become important mainly due to the presence of silica rather than to the inherent properties of the parent material.

Factors Influencing Hazards

In evaluating the exposure to a dust there are several factors which should be taken into consideration. The duration of exposure is important, as it will indicate in a general way the total amount of dust which might be expected to have entered the body. Obviously other factors enter into such an evaluation of total dustiness, and these will be discussed later. History of past exposure is important. This is particularly true where an individual is exposed to silica dust. This point is of extreme importance to industry due to the fact that a worker may have contracted silicosis under a

previous employment. Where such a condition exists, the desirability of preemployment examination is obvious.

The concentration of dust breathed is important as this, within certain limits, will determine the possibility of development of dust diseases. Considerable research and practical observations have been made in the field of dust exposures to correlate clinical findings with atmospheric concentrations. For free silica, asbestos, and some of the other materials, fairly definite standards have been established. The nature of dust is important primarily from the standpoint of free silica content. This is particularly true of mixed dusts which constitute the majority of industrial exposures. The volume of air breathed enters into the picture as it directly influences the amount of dust which will be taken into the body. The rate of respiration or amount of air breathed in general will be determined by the physical effort required on the particular job. Where heavy work is being done, naturally an individual will require more ventilation than where less physical effort is involved.

Dust Measurements

In addition to the factors influencing dust hazards, it is necessary to make direct dust measurements in order to obtain a true evaluation of any dust exposure. Such measurements are made by the actual collection of dust samples, the counting of the dust particles, and by the identification of the materials making up the dis-

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.

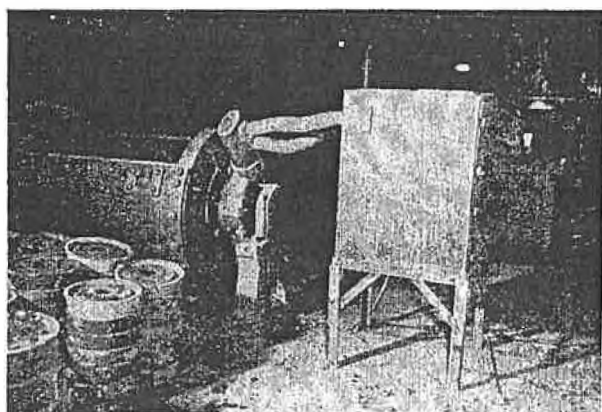
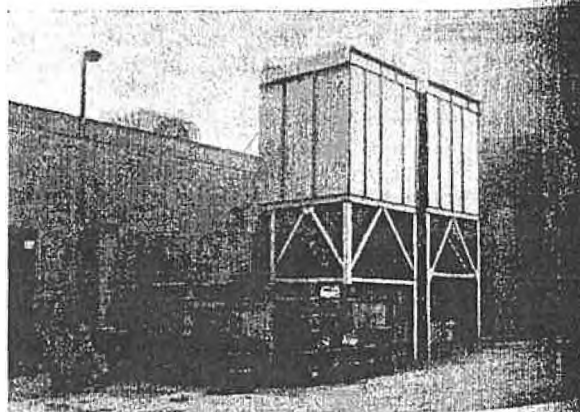


FIG. 7. BAG HOUSE AND SAND BLAST UNIT FOR CAST CLEANING.

Courtesy LeTourneau



Centrifugal Boiler Feed Pump Installation, Operation and Maintenance

Igor J. Karassik

Applications Engineer
Worthington Pump & Machinery
Corporation

Temperature Rise
Excessive Temperature
Minimum Capacity
Arrangement of By-Pass
By-Pass on Standby Pumps
Automatic Controls
By-Pass Losses

It can no longer be said that the problems arising from the operation of centrifugal boiler feed pumps at reduced capacities have received insufficient attention in the technical and professional literature. Contrasted to the situation a short ten years ago, when neither quantitative nor even qualitative information was available to the steam power plant operator, formulas, charts, and entire treatises have been devoted, within the last decade, to the subject matter of protection against overheating of boiler feed pumps.

The first phase of the educational program on this subject concerned itself with introducing factual information to the designer of new steam power plants to insure the inclusion of suitable protective measures. This program is now ready to enter a secondary phase—that of disseminating the information even farther, partly through repetitive tactics, partly

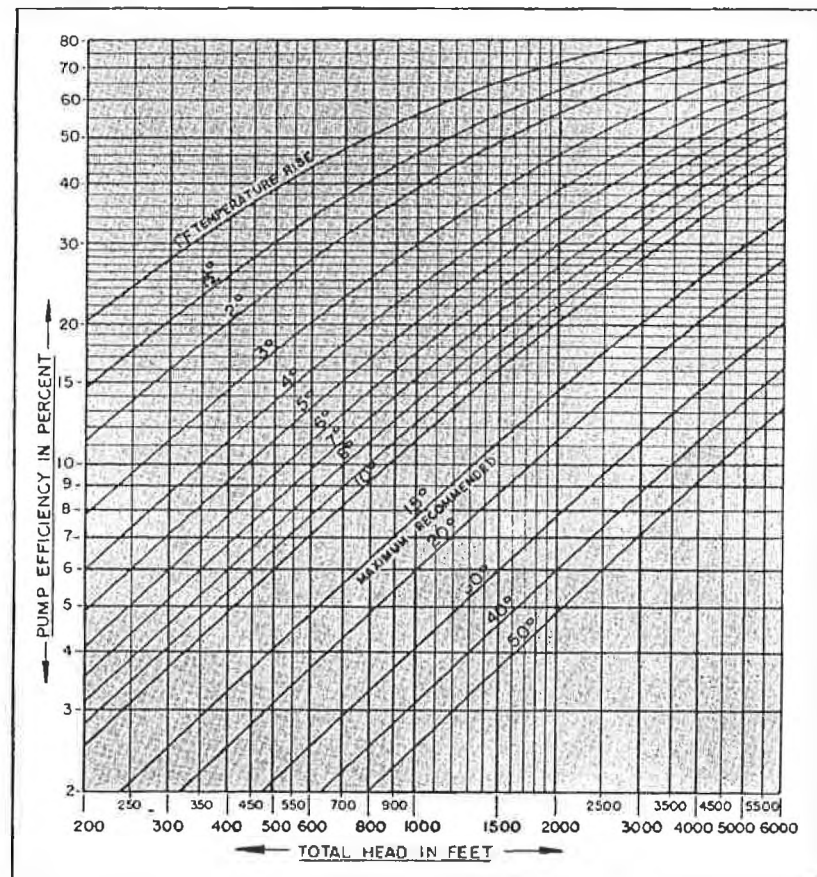


FIG. 1. CHART FOR DETERMINING TEMPERATURE RISE IN A CENTRIFUGAL PUMP, KNOWING TOTAL HEAD AND EFFICIENCY.

through devoting more attention to older plants operating at lower pressures.

TEMPERATURE RISE

In a centrifugal boiler feed pump, the difference between the brake horsepower consumed and the water horsepower developed represents the power losses within the pump itself, all this power loss being transformed into heat. For practical reasons it is accurate enough to assume that all this heat is transferred to the feed-water passing through the pump. The actual amount of temperature rise in degrees F at any given operating condition can, therefore, be easily determined from the fol-

lowing formula:

$$dT = \frac{(BHP - WHP) 2545}{W}$$

Where dT is the temperature rise, BHP is brake horsepower, WHP is water horsepower, and W is the pump capacity in pounds per hour. This formula may also be expressed as:

$$dT = \frac{H}{778} \left(\frac{1}{e} - 1 \right)$$

H being the total head in feet and e being the efficiency. This latter form is more readily used in connection with the conventional pump performance curve. The chart reproduced as Fig. 1 offers a graphical representation of this

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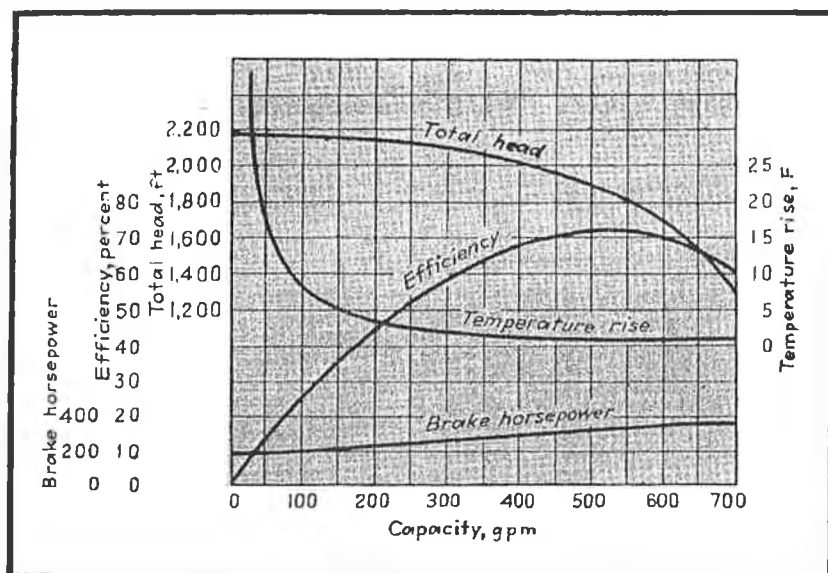


FIG. 2. PERFORMANCE CHARACTERISTICS OF A 500 GPM, 1800 FT HEAD, BOILER FEED PUMP.

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 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 seize. Specifically, the various effects of an excessive temperature rise in a boiler feed pump are as follows:

1. Excessive expansion at the packing 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 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 relief chamber and produce even in the balancing device itself.

All of these effects will 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

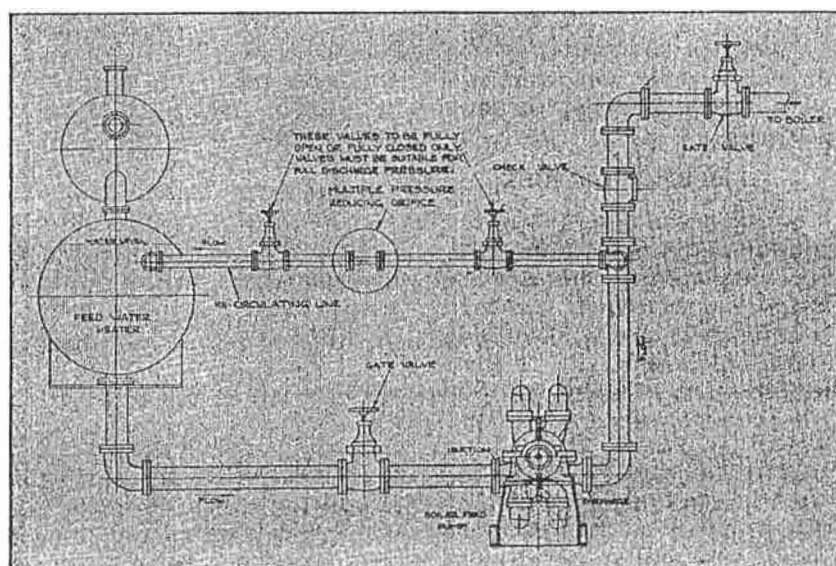


FIG. 3. ARRANGEMENT OF MULTIPLE PRESSURE REDUCING ORIFICE BASED ON MANUAL CONTROL OF BY-PASS.

capacity of the boiler feed pump is solely governed by the water regulator which is controlled by the main turbine load. The resulting rise or fall of the water level, some specific means must be applied to maintain predetermined minimum flow through the boiler feed pump regardless of turbine load.

This is achieved by installing a by-pass in the discharge line from the boiler feed pump. This by-pass is located on the pump side of the discharge gate valve and check valve and leads to some region of lower pressure in the boiler feed cycle. The capacity of the by-pass is such that should the demand at the boiler fall to zero, or should one of the valves become closed while the pump is running at full speed, the flow through the pump will not fall below the predetermined permissible minimum.

The operation of the by-pass is then regulated by means of either manually or automatically controlled valve.

MINIMUM CAPACITY

Inasmuch as the temperature rise within a boiler feed pump varies with capacity, it is obvious that the minimum permissible capacity will eventually depend on the maximum permissible temperature rise. The factors which determine this are quite numerous and include such variables as the available and required net positive suction heads and the operating temperature. This precludes the possibility of establishing a rigid rule, for these factors themselves will vary with each installation. It is necessary to consider each factor individually, determine the maximum temperature rise dictated by this factor, and finally select the lowest of these separate maximums as the maximum permissible temperature rise for the installation in question.

Fortunately, it is never necessary to establish the value of the minimum permissible capacity very accurately. The difference in power consumption is negligible even if this capacity were to be established more or less empirically and on the safe side. On the basis of past experience, it can be said that where the maximum

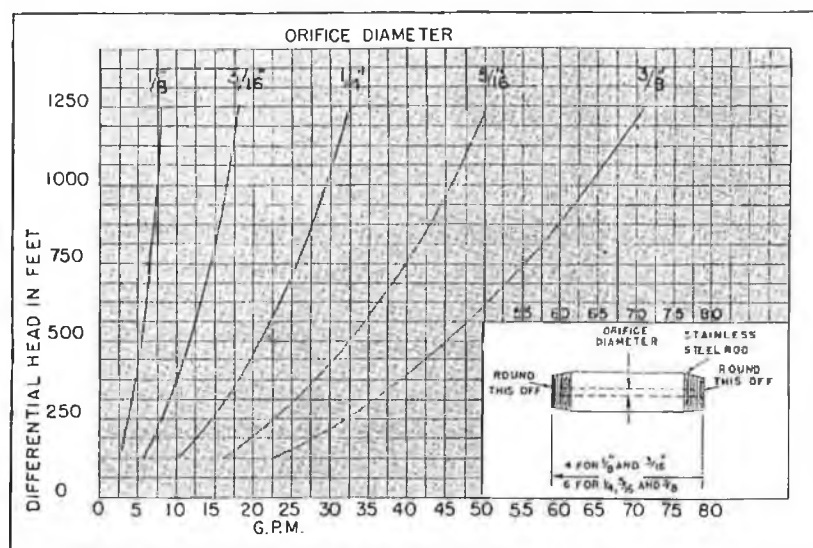


FIG. 4. PERFORMANCE CHART FOR SINGLE BY-PASS ORIFICE.

temperature rise is held to 15F, no danger of overheating the pump or of flashing in the first stage impeller exists. It is recommended that the temperature rise be held to this maximum, unless some special reason exists in an exceptional installation to warrant a greater or a lower maximum permissible rise.

Fig. 1 can be used to determine the minimum capacity, as the pump total head curve is fairly flat near the shut-off conditions. The intersection of the head curve at low flow and the curve corresponding to 15F rise will yield the pump efficiency at minimum recommended capacity. A glance at the pump performance curve

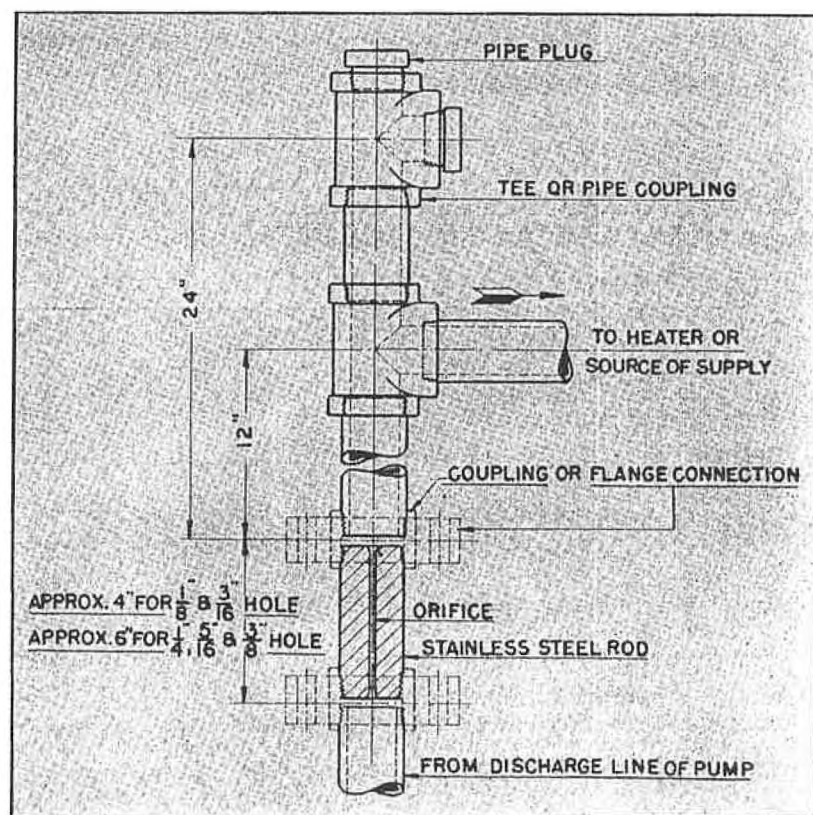


FIG. 5. DETAILS OF RECOMMENDED PRACTICE FOR INSTALLATION OF ORIFICE IN BY-PASS LINE.

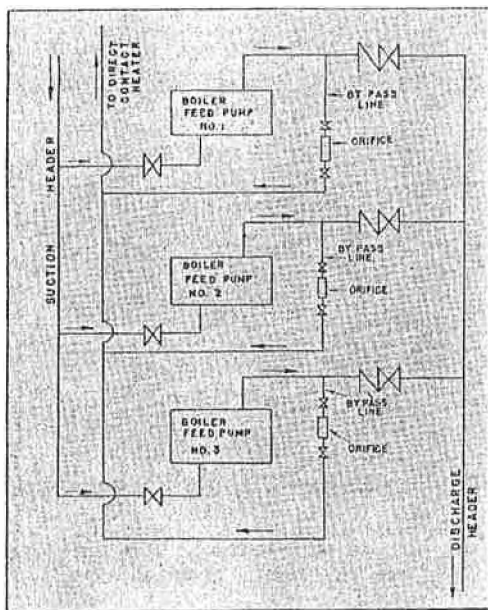
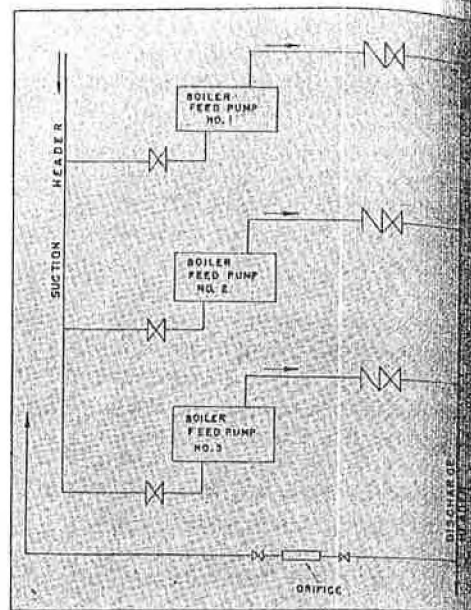


FIG. 6-A. CORRECT INSTALLATION OF BY-PASSES FOR A GROUP OF 3 BOILER FEED PUMPS.

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

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

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-

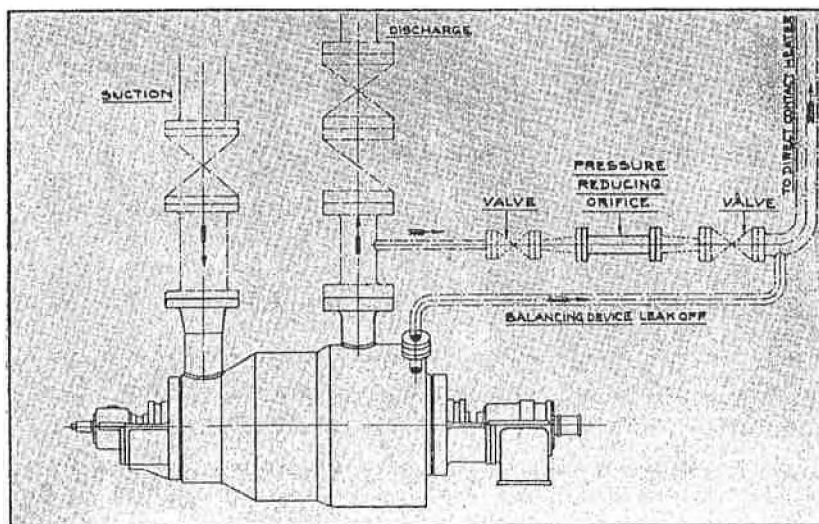
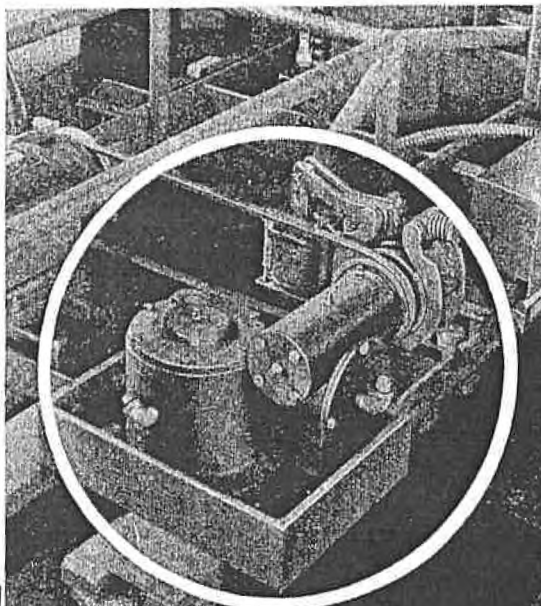


FIG. 7. BY-PASS AND BALANCING DEVICE LEAK-OFF ARRANGEMENT.

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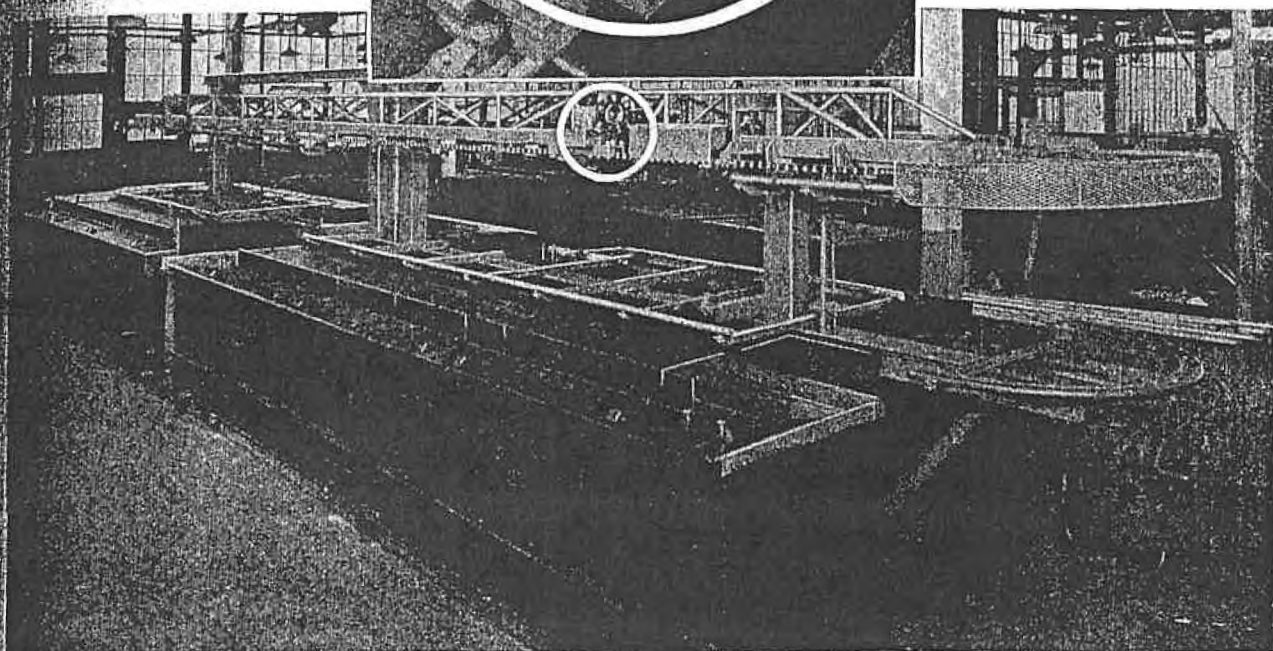
(AT RIGHT)
Close-up of WHS No. 4 1/2 BDV
reducer in drive assembly.



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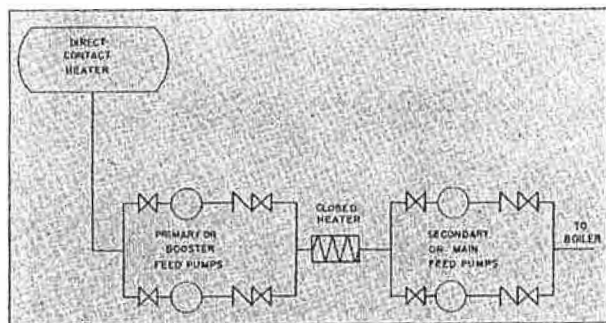


FIG. 8. IN SYSTEMS OF THIS TYPE, BOTH BOOSTER AND MAIN FEED PUMPS REQUIRE INDIVIDUAL BY-PASS PROTECTION.

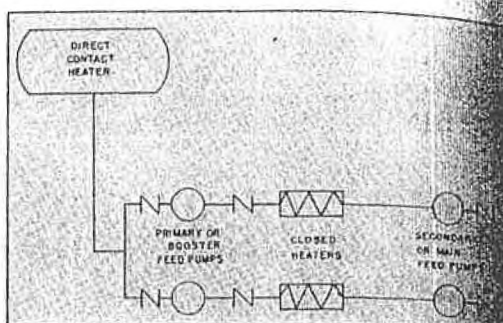


FIG. 9. WHEN BOOSTER AND MAIN FEED PUMPS ARE OPERATED AS SINGLE UNITS, A SINGLE BY-PASS MAY BE USED.

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 recirculation line to lower the temperature of the by-pass to that at the 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 by-pass, 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 the direct contact heater.

In determining the size of the heat exchanger required, it must be remembered that the by-pass feedwater is throttled from the charge 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:

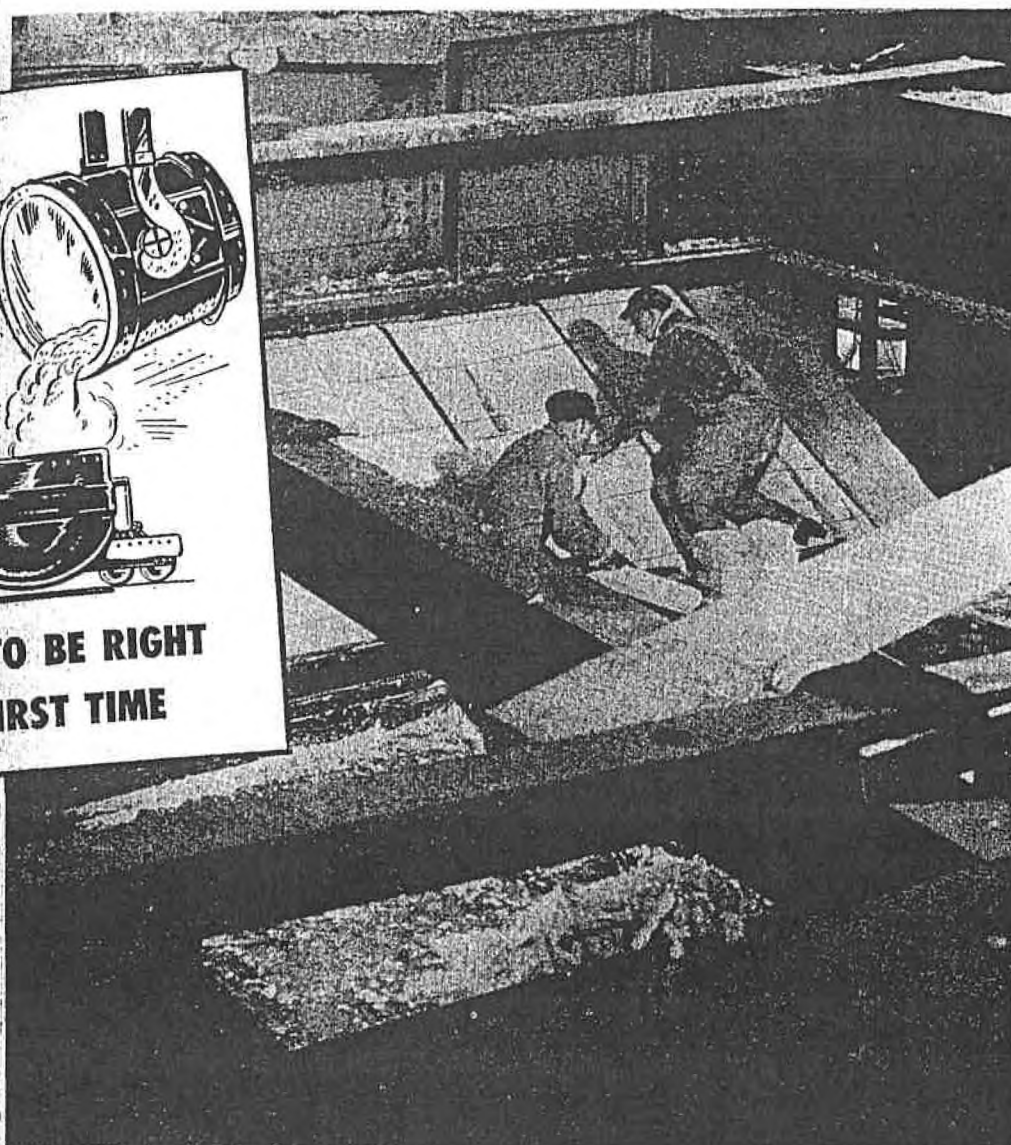
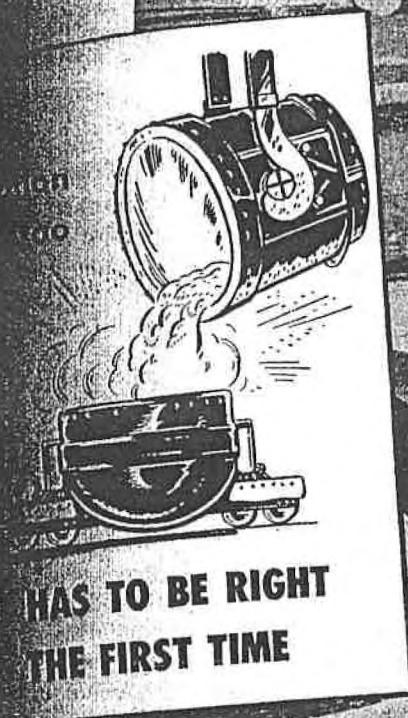
$$dT = \frac{H}{778}$$

where H is the total head in feet.

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

BY-PASS ON STANDBY PUMP

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



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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 indicated in the pump suction work 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

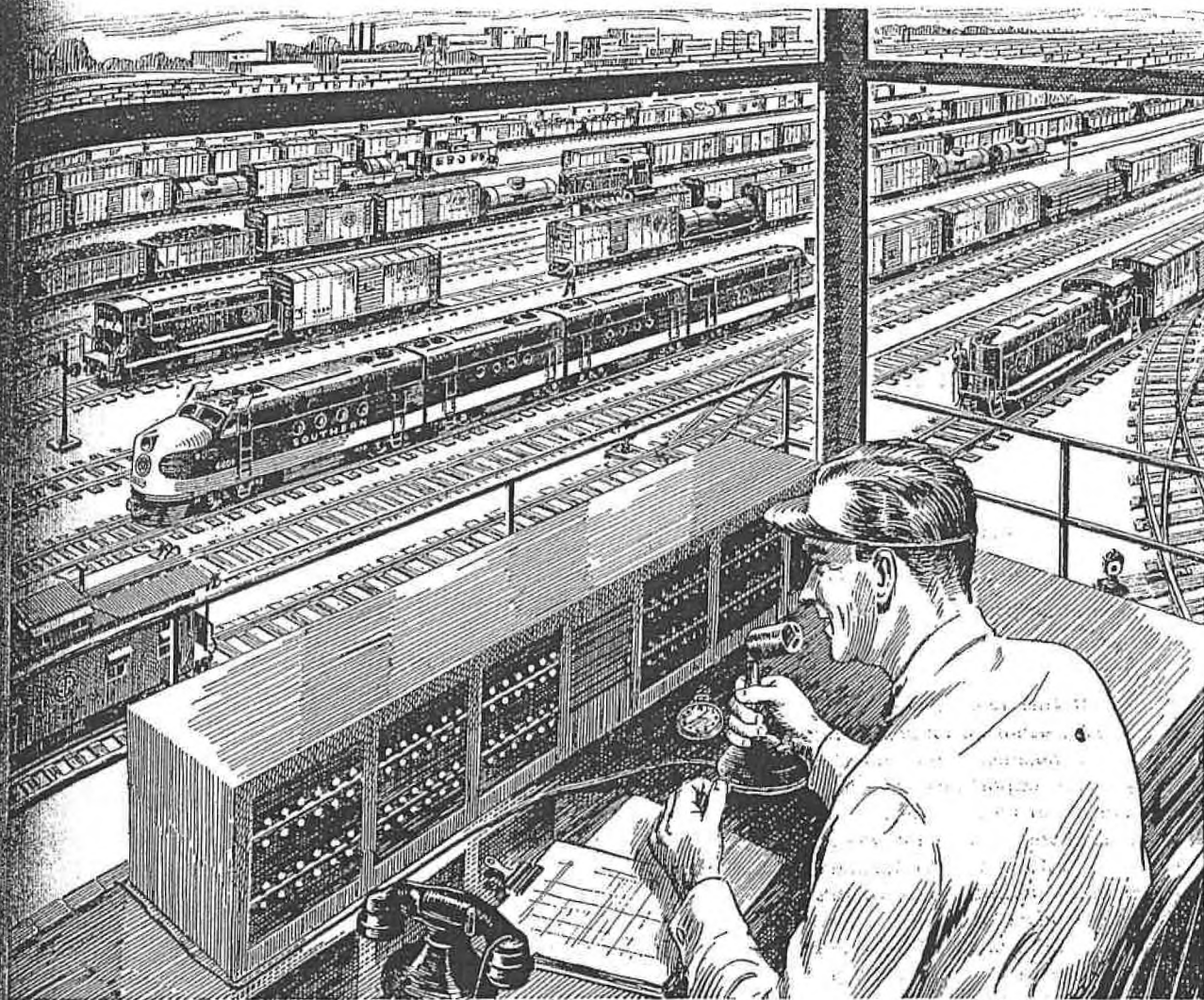
There frequently arises the misconception that the excess expenditure of power resulting from operating the pump with the by-pass open is equivalent to the by-pass capacity expressed in percentage of the full load capacity. This is entirely incorrect, as an analysis of Fig. 2 will disclose, as it has 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 5% 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)

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Man with a 32-track mind



He's moved upstairs . . . this Southern Railway yardmaster!

Yesterday he ran his legs off in all kinds of weather trying to be all over his yard at once. Today he sits in a glass-enclosed, air-conditioned tower sixty feet above the ground... acres of tracks spread out before him.

Through the magic of electronics he gives orders and instructions to switching crews and others throughout the yard... and the men can report back to him over this two-way communicating system...thus speeding the "making up" into trains of as many as 5,000 freight cars a day.

Progress? You bet!

Always on the alert for new methods . . . never taking anything for granted . . . we're doing our best to provide the kind of mass transportation service that is so vital to the continued growth and prosperity of the South.

Whether it's pioneering with the first Diesel freight locomotive or building a tower for the "man with a 32-track mind," the Southern Railway is...and will continue to be...a railway that is always looking for, and finding, better ways to "Serve the South."

Ernest E. Norris

President

SOUTHERN RAILWAY SYSTEM



SOUTHERN POWER & INDUSTRY for NOVEMBER, 1946

BER, 1946

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 also. 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 of two years or more, the turnover was 11%, while in the case of those having records of less than a month, the turnover was 100%.

Frequent absences are often

Double Check BOILER WATER LEVELS

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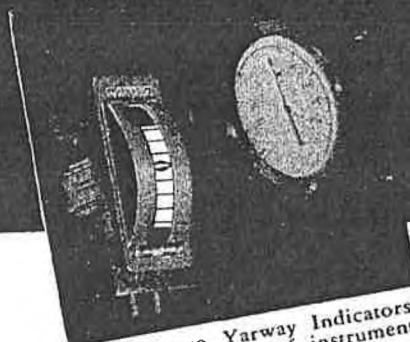
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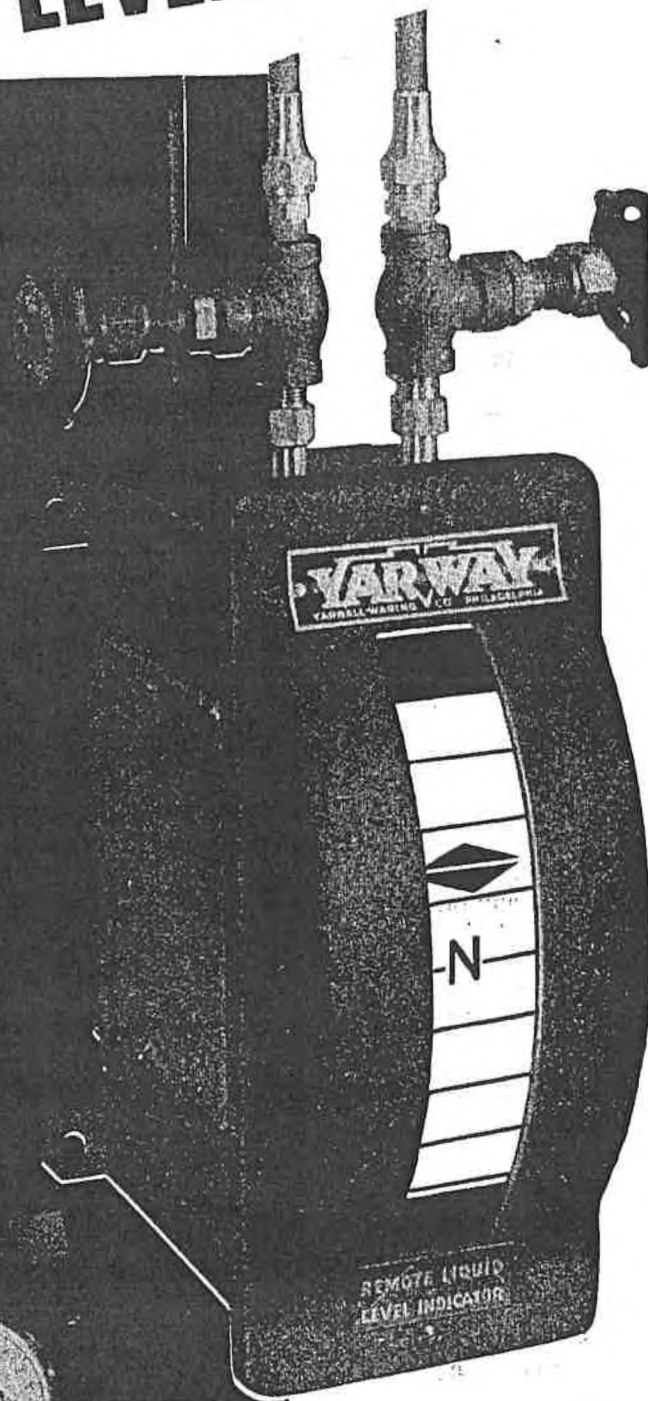
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Typical instrument panel mounting of Yarway Indicator in rubber manufacturing plant.



One of two Yarway Indicators mounted on end of instrument panel in boiler room of Western utility.



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YARWAY

REMOTE LIQUID LEVEL INDICATOR

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 termed 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 serve to hold turnover down.

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

1. Assist in arranging transfer of workers to other departments.
2. Inform the personnel department of any proposed layoffs.
3. Hold special jobs in readiness 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 it is essential for a successful organization today to centralize the hiring 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 business vision and a pleasant personality, he must also have good power 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 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 is equally essential.

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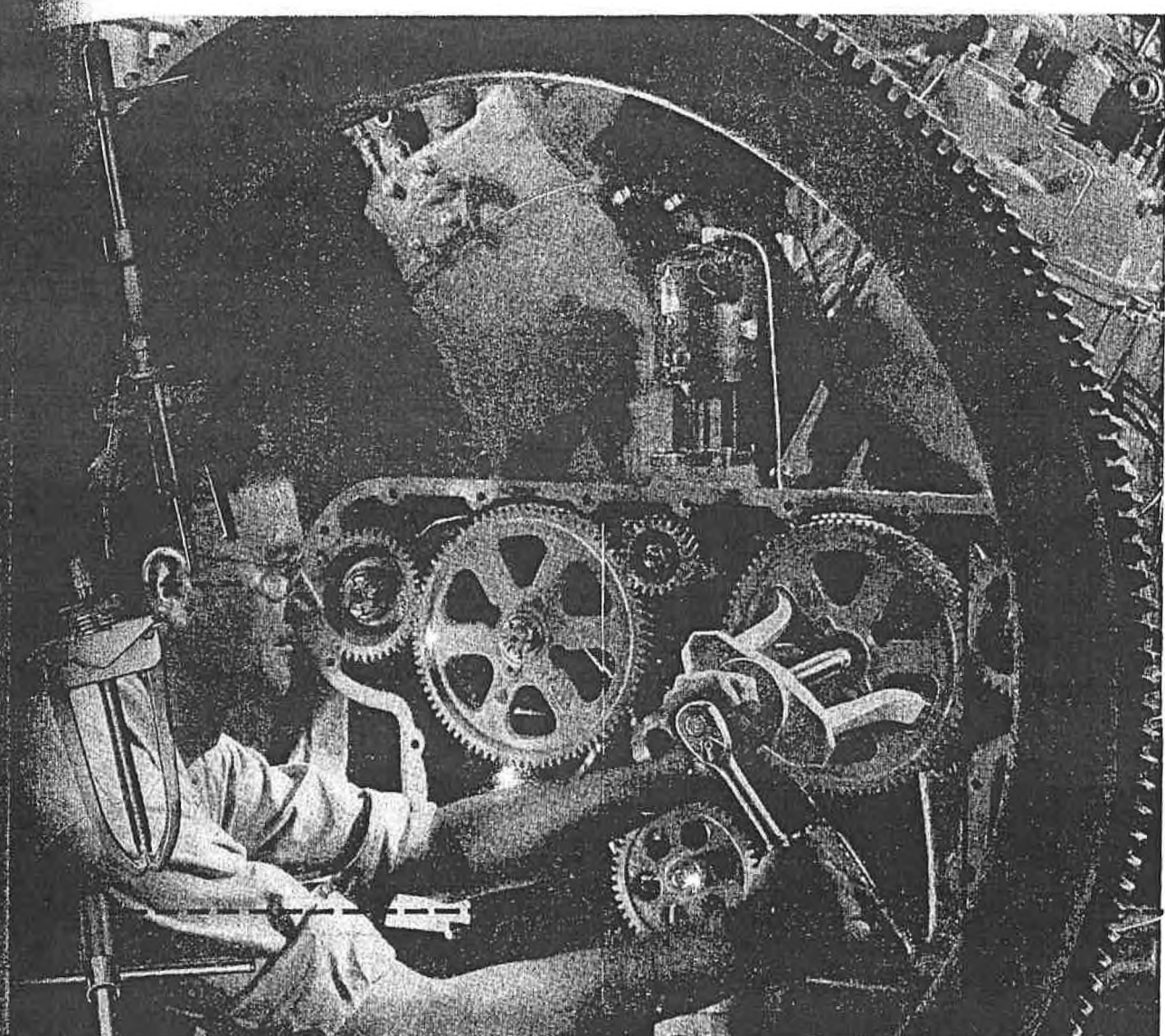
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Snap-on Gear Pullers

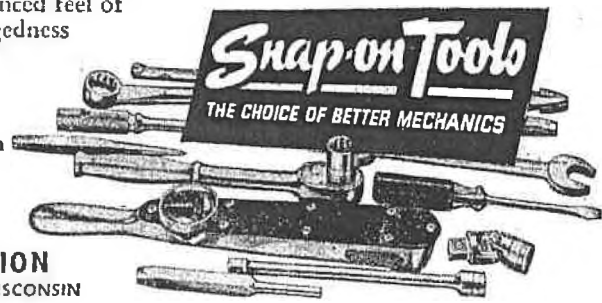
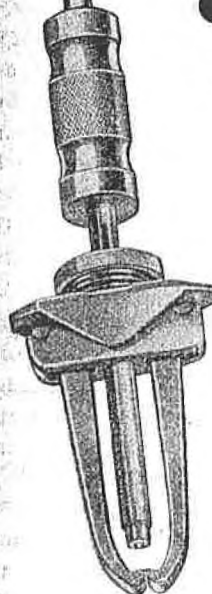
give you safe, uniform power over entire range

On the testing floor . . . in maintenance operations . . . wherever there is a need for gear pullers, Snap-ons are favored by men who know good tools. There are four definite reasons for this popularity: (1) Snap-ons have more "locking power" for added safety. (2) They give you a "tip-less" pull that prevents binding. (3) You enjoy smooth uniform power for easy pulling over the entire range. (4) Snap-on pullers are available in a wide range of types and sizes.

You'll like the comfortable, well-balanced feel of Snap-on pullers. They have the ruggedness and stamina that makes easy jobs out of the tough ones.

Ask the Snap-on man who calls at your plant for full details on Snap-on gear pullers or write for catalog of 3,000 Snap-on tools for industrial production and maintenance.

SNAP-ON TOOLS CORPORATION
8056-K 28th AVENUE KENOSHA, WISCONSIN



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

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

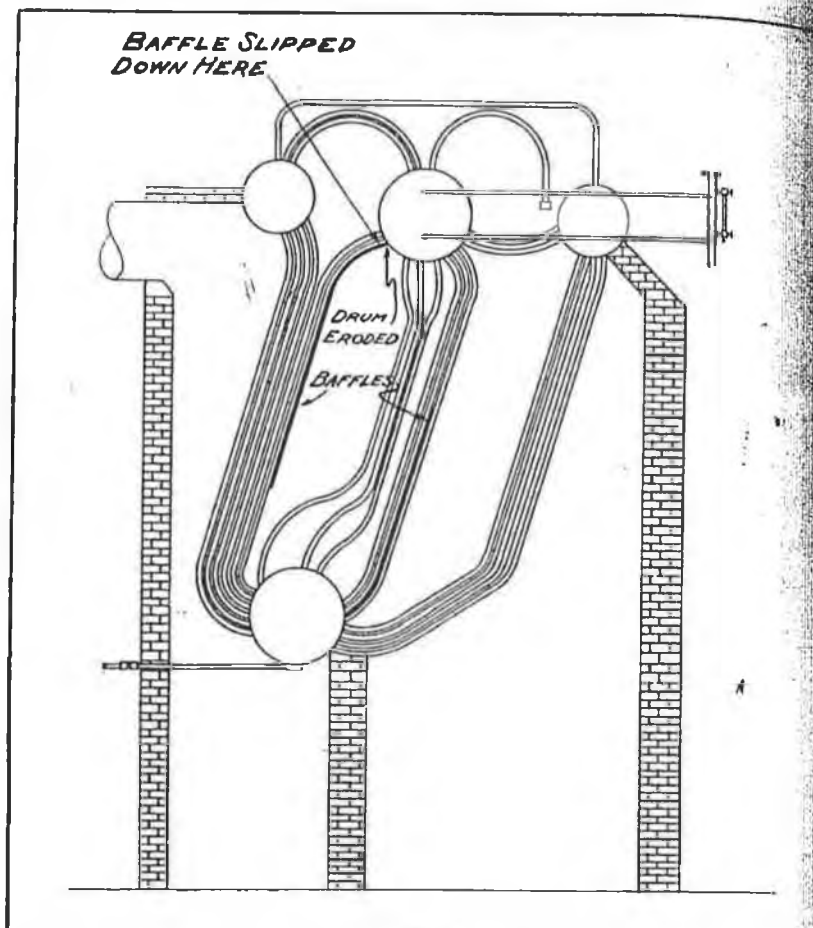
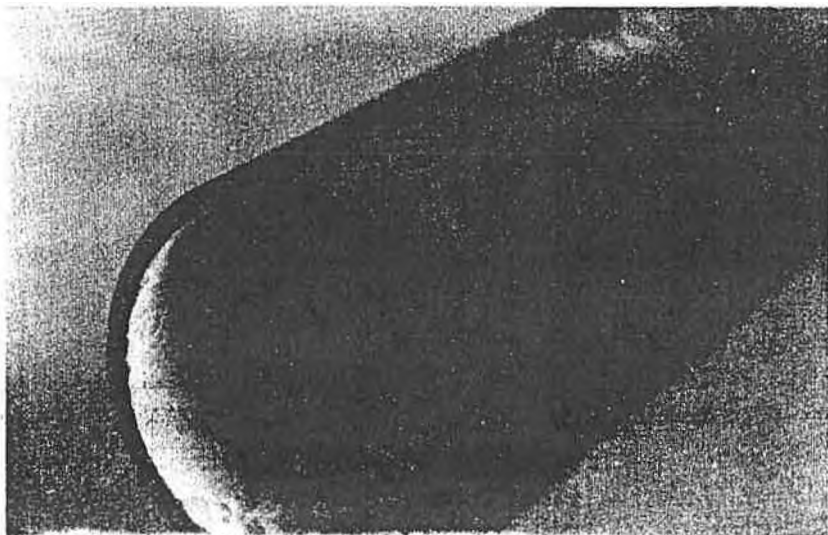


FIG. 1

FIG. 2



A
FOSTER WHEELER

FIRST

EXPANDED TUBE CONDENSERS

for purest feed water

Expanded tube condenser design, introduced 20 years ago by Foster Wheeler and considered a highlight of condenser development, is used by modern condenser manufacturers. The design completely eliminates leakage of circulating water into the condensate.

Condensate contamination became a major problem with the advent of higher pressure and temperature steam generators. Slight impurity of feed water, unnoticed for years in plants operating at 300 or 400 psi, quickly forms heavy scale at higher pressures and temperatures. Modern steam generators need almost chemically pure feed water — purer than drinking water.

Foster Wheeler anticipated this prob-

lem by designing the first expanded tube condenser for stationary power plants.

The condensers illustrated, first practical application of this design, were built in 1925 by Foster Wheeler for the Trinidad, Texas, station of the Texas Power & Light Company. Test data proved that expanded tube condensers provide feed water purer than all previous types.

Foster Wheeler offers industry practical engineering ability and experience plus foresight necessary for progress.

Foster Wheeler Corporation • 165 Broadway, N.Y. 6, N.Y.

FOSTER WHEELER

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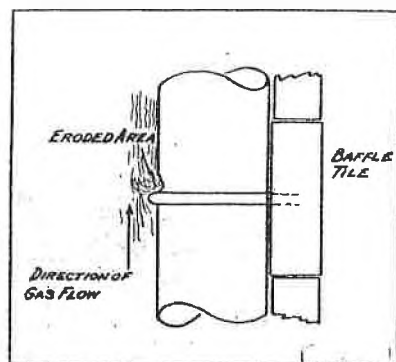


FIG. 3

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.

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 reoccurrence.

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

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 these days when consumer demand is greater than the supply of raw materials and because it has already inaugurated a program of control and research which will result in constant improvements.

Dust

(Continued from page 64)

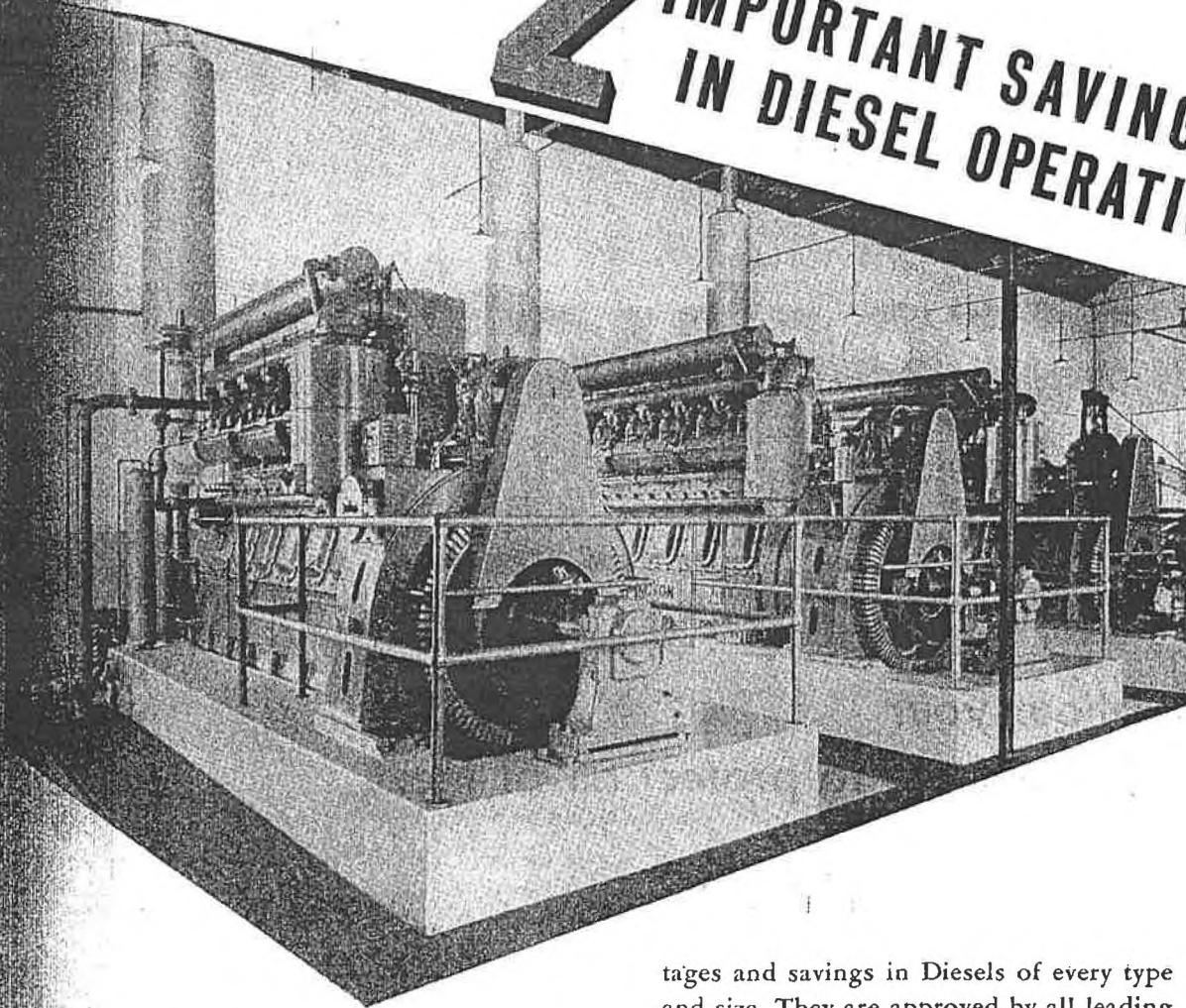
tion and dust arrestors as is shown in the photograph. Note that the dust collector is applied through the trunnion of the tumbler.

In foundry operations or any other industrial type processing, housekeeping is an important factor influencing the generation of dust. This foundry employs two five horsepower vacuum cleaners 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.

MAKE 2 IMPORTANT SAVINGS IN DIESEL OPERATION



FOR low operating cost, lubricate your Diesels with *Texaco Ursa Oils*. You'll *save on fuel, save on maintenance.*

Texaco Ursa Oils stand up in the severest service . . . keep engines clean . . . assure longer life for bearings, liners, rings and pistons. *Ursa Oils* promote maximum engine efficiency . . . dependable, full-power output . . . minimum expense for fuel and maintenance.

There are *Ursa Oils* to assure these advan-

tages and savings in Diesels of every type and size. They are approved by all leading Diesel manufacturers and used by operators the world over. In fact, because of their effectiveness—

More stationary Diesel hp. in the U.S. is lubricated with Texaco than with any other brand.

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SOUTHERN POWER & INDUSTRY for NOVEMBER, 1946

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 rewound 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 rewound 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

GET SMALL MOTOR PROTECTION Simply and Inexpensively

Burnout of motors from lack of oil, worn bearings, tight belt, overloading—or anything that causes a dangerous excess of current through the motor—can, on normal installations, be prevented by Fusetrons.

Just install a Fusetron of motor-running protection size, anywhere in the circuit to handle only the motor current. *That's All.*

If motor is on a separate circuit, install the Fusetron in the switch or panelboard. Then the motor as well as the circuit wiring is protected.

If the motor is on a general use circuit or a circuit feeding more than one motor, protect each motor individually by installing a switch or a fuse block with the proper size Fusetron. *It Is As Simple As That.*

Protect Against Cost of Replacing a Motor— and Against Production or Operating Losses

When pumps, fans, air compressors, blowers, conveyors, mixers, stokers, oil burners, grinders—or any of the hundreds of other circuits on which small motors are used—are out of service because of a motor burnout the losses incurred generally make the cost of Fusetron protection seem mighty small.

You not only have the cost and trouble of removing and replacing the destroyed motor—but all the time the motor is down, production or operating losses pile up.

It's guarding against these double losses that makes it pay you so well, to go to the little expense and trouble necessary to install Fusetrons for the protection of all small motors used throughout your plant or building.

FUSETRONS GIVE MANY OTHER KINDS OF PROTECTION HERETOFORE NOT AVAILABLE

*Fusetrons do everything fuses do, as is confirmed by the
Underwriters' Laboratories' Label, and in addition...*

- ★ Provide simplest way to stop burnouts from single phasing.
- ★ Entirely wipe out needless blows caused by motor starting currents or other harmless overloads.
- ★ Give thermal protection to panelboards and switches.
- ★ Prevent needless blows caused by heating in panels and switches.
- ★ Permit use of larger motor or adding more motors on circuit without installing larger switch or panel.
- ★ On new installations proper size switches and panels can be used instead of oversize.
- ★ Protect motors against burnout.
- ★ Give double burnout protection to large motors.

What is the FUSETRON?

The Fusetron is a DUAL element device—a Fuse to which is added a Thermal cutout.

The result is a fuse with tremendous time-lag and much less electrical resistance.

Fusetrons have the same degree of Underwriter's Laboratory approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses, Fusetrons fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere in both 250 and 600 volt types. Also in tamper-resisting type (Fustats) for 125 volt circuits.

Their cost is surprisingly low.

Sold through Wholesalers

Get All the Facts

Get Better Protection—Send the Coupon Now

Even one lost, hard-to-replace motor, or one needless shutdown or destroyed panel may cost you far more than replacing every fuse with a FUSETRON.

Don't risk such losses—protect your production schedules by changing over your entire electrical system to FUSETRONS.

BUSSMANN MFG. COMPANY
University at Jefferson • St. Louis 7, Mo.
(Division McGraw Electric Co.)

BUSSMANN MFG. CO., University at Jefferson 1146
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about BUSS Fusetrons.

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Title _____
Company _____
Address _____
City _____ State _____

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 "defective" 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.

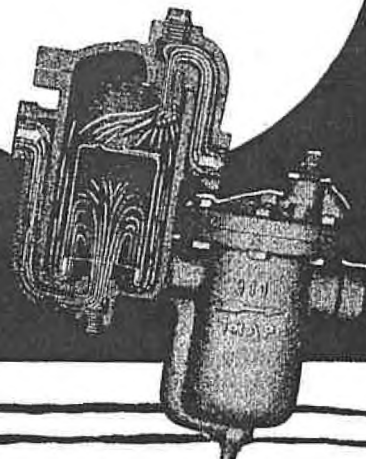
A similar instance occurred when an air conditioning fan failed to start. A checkup was made, splices on the motor opened, still no current indication was obtained. Finally it was discovered that an unnoticed mercury switch intended to shut down the system in the event of fire, had been knocked from 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 the number and the words "Series

One of a series of advertisements, each discussing trapping practice on a different class of equipment.

HOW TO TRAP

UNIT HEATERS



.. for better heating

Advantages Offered by Armstrong Traps

Whether you use *low pressure* or *high pressure* unit heaters, application of Armstrong traps gives you these important advantages:

1. **FULL HEATER CAPACITY.** Heaters drained by Armstrong traps are kept dry! No waiting for condensate to cool before trap opens. No cooling leg is necessary.
2. **AUTOMATIC AIR VENTING.** No separate air vent is required. Both air and condensate pass out through same valve. Minimum maintenance, minimum repair cost.
3. **PROTECTION AGAINST CORROSION.** Prompt removal of air and condensate from heater minimizes danger of CO₂ or oxygen causing corrosion.
4. **LONG VALVE LIFE.** All internal mechanism is stainless steel. Valves are same quality as used for 2400 p.s.i.

For complete information on Armstrong traps for heating service, see your local Armstrong representative or write **ARMSTRONG MACHINE WORKS**, 806 Maple Street, Three Rivers, Michigan, U. S. A.

TRAPPING TIPS*

- Install trap below and close to unit heater.
- If trap discharges to overhead return, use a check valve.
- Use a separate trap for each unit heater.
- Use a trap Safety Factor of 3 to 1.
- If heater operates on variable pressures, order trap for highest pressure.
- Use ample size supply and drain pipe lines. Keep supply mains drained with proper traps.
- ★ Complete data, diagrams, tables, capacities in 36-page CATALOG H, available on request.

See our exhibit at the 17th National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York, December 2 to 7, 1946



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STEAM TRAPS

Over a Million in Use... For Power... Process... Heating

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"Series A"

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 presented two of his ideas. One of them 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

FOR TODAY'S TOUGHER JOBS, HERE'S A NEW TOUGHER MOTOR



WHERE IT'S WET Wet weather doesn't bother the new totally-enclosed Tri-Clad motor. Neither do frequent "washdowns" in food plants.



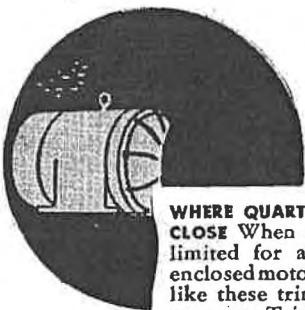
WHERE IT'S CORROSIVE Acids, alkalis, and fumes are kept out of these new Tri-Clads. Cast-iron enclosures are corrosion-resistant, extra strong.



WHERE IT'S DIRTY Dirt and dust can't get into these Tri-Clads to shorten their life. Smooth surfaces are convenient to clean.



WHERE IRON DUST FLIES Harmful iron dust and metal filings can't get past the inner wall. Bearings are protected from dust.



WHERE QUARTERS ARE CLOSE When space is limited for a totally enclosed motor, you'll like these trim, compact new Tri-Clads.



WHERE EXPLOSION HAZARDS EXIST The new Tri-Clad motors are available in explosion-proof constructions where needed.

THE G-E TRI-CLAD TOTALLY ENCLOSED MOTOR (1 TO 1000 HP)

service; in position in or himself a glass face. However, his was not of his plant in t de Laval ed that he seek work- ness enter- d the em- Iron Work- pacity of is creative ssert itself ice he pat- ne of the- more satis- in Besse- d invention- galvanizing s work in- centrifuga- much le- le Germ- ne into the his spe- e of equip- manner in a more

In 1940 you welcomed the Tri-Clad open motor with its extra protection features. More Tri-Clads have since gone into service than any other integral-horsepower motor. Now G-E is ready with a new line of tough, totally enclosed Tri-Clad motors for use in adverse atmospheres. *We believe they are industry's most dependable motors.* Their longer life and lower maintenance will make them a sound investment in almost every job. Apparatus Dept., General Electric Co., Schenectady 5, N. Y.

POINT PROTECTION

1. Cast-iron, double-wall frame completely encloses and protects the motor and windings.

2. Corrosion-resistant cast-iron and steel are machined to provide a tight seal and protect the motor from dust, dirt and moisture. Primer and finish coat of "Vitreous" enamel affords high resistance.

3. Pressure-relief grooving system which can be packed with long-life lubricant protects the bearings.

4. Die-cast iron conduit box is diagonally split for easy wiring. Boxes are inherently explosion-proof on Class I locations.

5. Shock-absorbing compound around base protects motor foundation from

dust and moisture of the plant where leads pass through the frame.

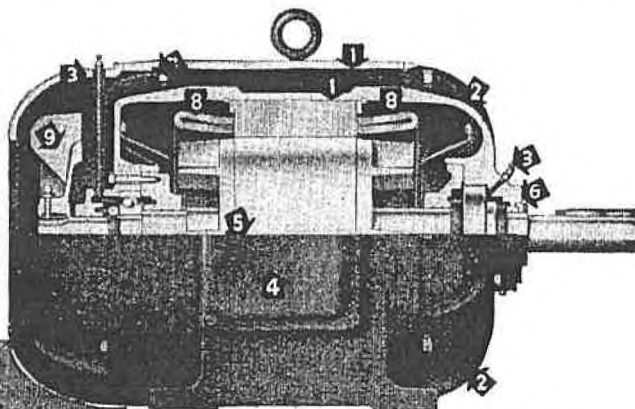
6. Rotating labyrinth seal further protects motor interior from damage by foreign matter.

7. Large air passages provide adequate protection from overheating. They're easy to keep clean and open, too.

8. Modern "apogee" insulation treatment includes windings of "Formex" magnet wire.

9. The powerful external fan is removable to simplify maintenance; nonsparking type in explosion-proof motors.

10. Individual dynamic balance of rotors and external fans protects against vibration hazards, even under severe operating conditions.



FOR THE COMPLETE STORY

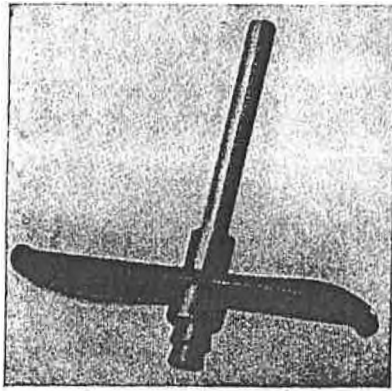
Apparatus Department, Section G-750-278C
General Electric Company
Schenectady 5, N. Y.

- ☐ Please send me GEA-4400, which describes the new Tri-Clad totally enclosed motors.
- ☐ Please send me GEA-4131, "Motors and Controls for Hazardous Locations."

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GENERAL ELECTRIC



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.

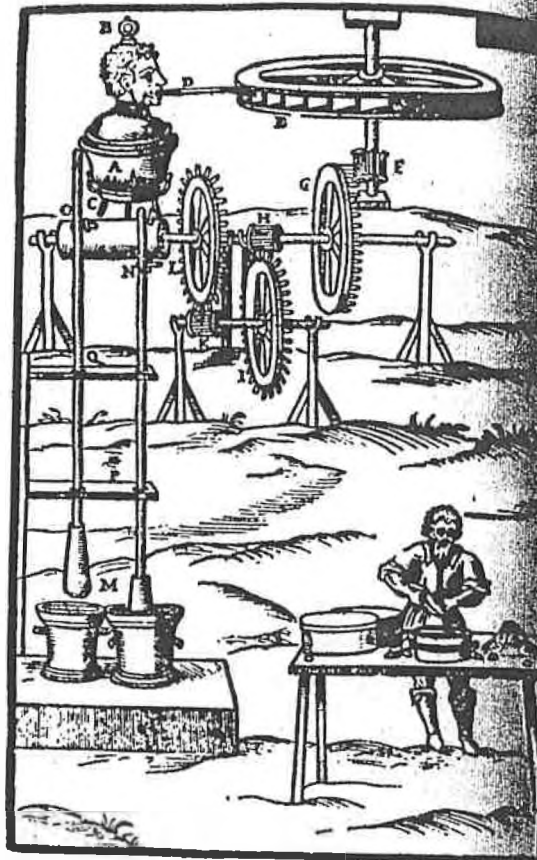
He began in 1877 to try to raise a sufficient sum of money to construct a factory in which his separating device might be manufactured. Success did not at once attend his efforts. The indifference with which de Laval's predecessors had been plagued likewise harassed him. His lasting qualities were, however, substantial. His faith in the usefulness of the device which he had refined before leaving the employ of the Klosterverken 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 100 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.

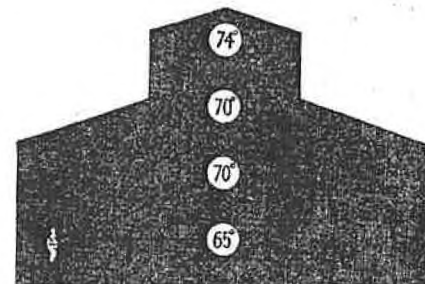
High rotative speeds in turbine rotors introduced lubrication problems. He sought to eliminate these troubles by resorting to the use of oil introduced into the bearings and centrifugal force. Although the separating devices needed high rotative speeds, they could not be operated at speeds as high as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

Some New Angles on INDUSTRIAL and COMMERCIAL HEATING

Angle #1 . . . working level recirculation

The Dravo Heater offers today's highest possible efficiency for open space heating. It recirculates warm air in the working level, thus minimizing the tendency of the heated air to rise and cause excessive heat losses through the roof. Under the Dravo method warm air is discharged above the heads of the workers and cool air is taken off the floor. This provides a thermostatically controlled comfort zone in the working level with no annoyance to workers.

In addition to saving fuel through low roof heat loss, the Dravo Heater is extremely economical in these respects . . . **Sustained efficiency of 80 to 85% by constantly getting more Btus from each gallon of oil or cubic foot of gas burned.** — **Lower initial cost compared with indirect heating systems.** — **Ease of installation . . . It is necessary only to provide power**



Actual tests with balloon-suspended thermometers in a building with 200,000 square feet of roof showed temperature differential between roof and working area to be only 9 degrees with Dravo Heaters. This is a big fuel-saving advantage when compared with other methods in which roof area temperatures are often 35 degrees higher than those at the working level.

line, fuel line and stack. —No stand-by heat or specialized attendant is necessary. Heater operates only when thermostat dictates your requirements.

Dravo Heaters are available in capacities ranging from 400,000 to 2,000,000 BTUs per hour output. The money-saving angles for Industrial and Commercial Heating with DRAVO COUNTERFLO DIRECT FIRED HEATERS are more fully described in Bulletin NF 516. Write Heating Section, DRAVO CORPORATION, 300 Penn Avenue, Pittsburgh 22, Pa.

Dravo Counterflo Direct Fired Heaters are products of the Machinery Division.

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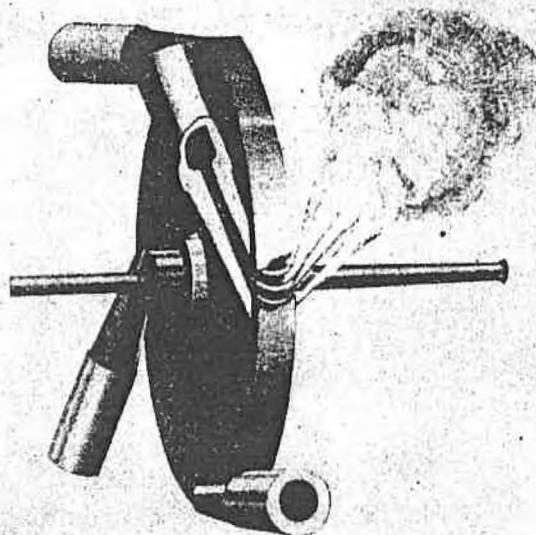


were, therefore, introduced into de Laval's power transmitting system.

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 rotating 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 gainful 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)

LARGE DIAMETERS FOR EXTRA YEARS OF MAXIMUM *Dust recovery*

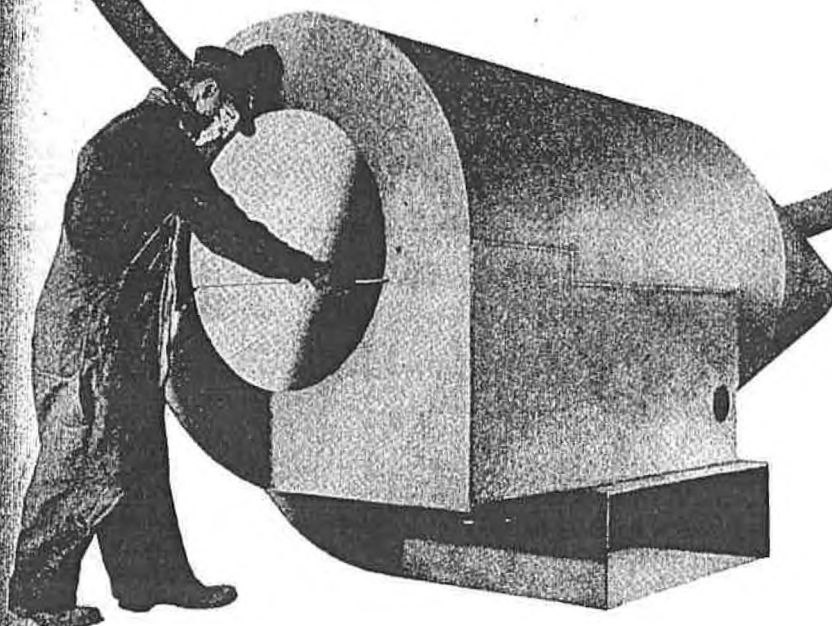
Because of Buell's exclusive feature—the patented van Tongeren "shave-off"—the cyclones in Buell Dust Recovery Systems do not have to be made with small diameters in order to achieve high recovery efficiency. On the contrary, diameters of Buell cyclones can be in excess of four feet without loss in efficiency.

These large diameters make possible operation with low centrifugal force and consequent reduction in abrasive wear; and permit one-piece construction of extra-thick steel, with large duct outlets,

that makes clogging virtually impossible.

All these are prime factors in the trouble-free operation, low maintenance cost, and high efficiency of custom built Buell Dust Recovery Systems—as established from actual records of installations in service for three, four, five or more years.

Buell's book—"The van Tongeren System of Industrial Dust Recovery"—illustrates and explains the patented van Tongeren principle and its many applications to industry. We will be pleased to send you a copy without charge. Write for it today.



Six Exclusive Buell Features

- 1 THE "SHAVE-OFF"
- ✓ 2 LARGE DIAMETERS
- 3 EXTRA-STURDY CONSTRUCTION
- 4 CORRECT HOPPER DESIGN
- 5 SPLIT-DUCT MANIFOLDING
- 6 INNER WELDS GROUND SMOOTH

BUELL ENGINEERING COMPANY, INC.

4 Cedar Street, New York 5, N. Y.

Sales Representatives in Principal Cities

buell

DUST RECOVERY
SYSTEM

SOUTHERN POWER & INDUSTRY for NOVEMBER, 1946



Helping the MAN-IN-THE-PLANT

A Section of Practical 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 portable DC generator anywhere, 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 back. 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 the small amount of additional gasoline the welding engine burns.

E. A. ROBERTS

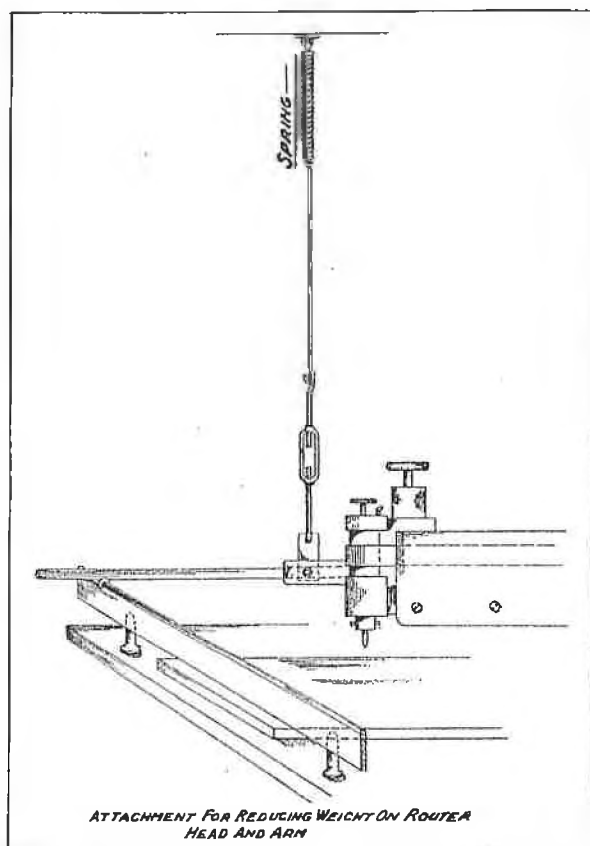
City Clerk, Carlsbad, N.M.

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 repairs but applicable to many similar operations.

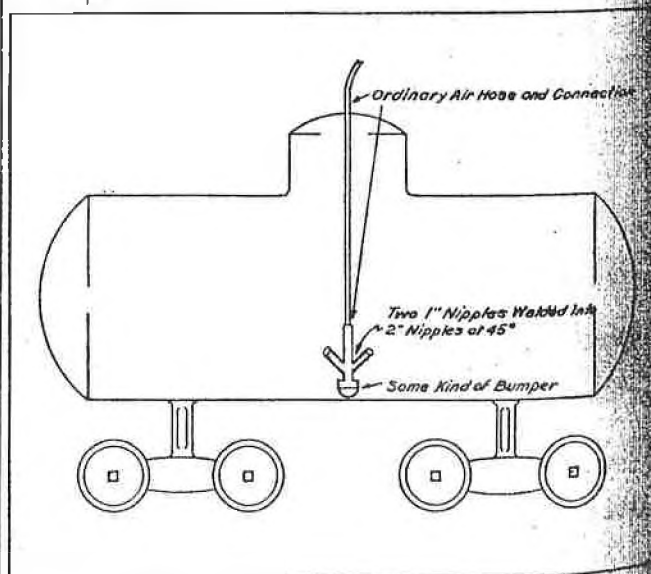
Two 3/4" nipples were welded into a 2" x 6" nipple at a 45 degree angle. A short 3/4" nipple was welded into the top of a 2" nipple for the air hose connection and the unit welded to a 4" x 1 1/2" beam which serves as a base. A rope is attached to the beam and halter can be used to raise and lower the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

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

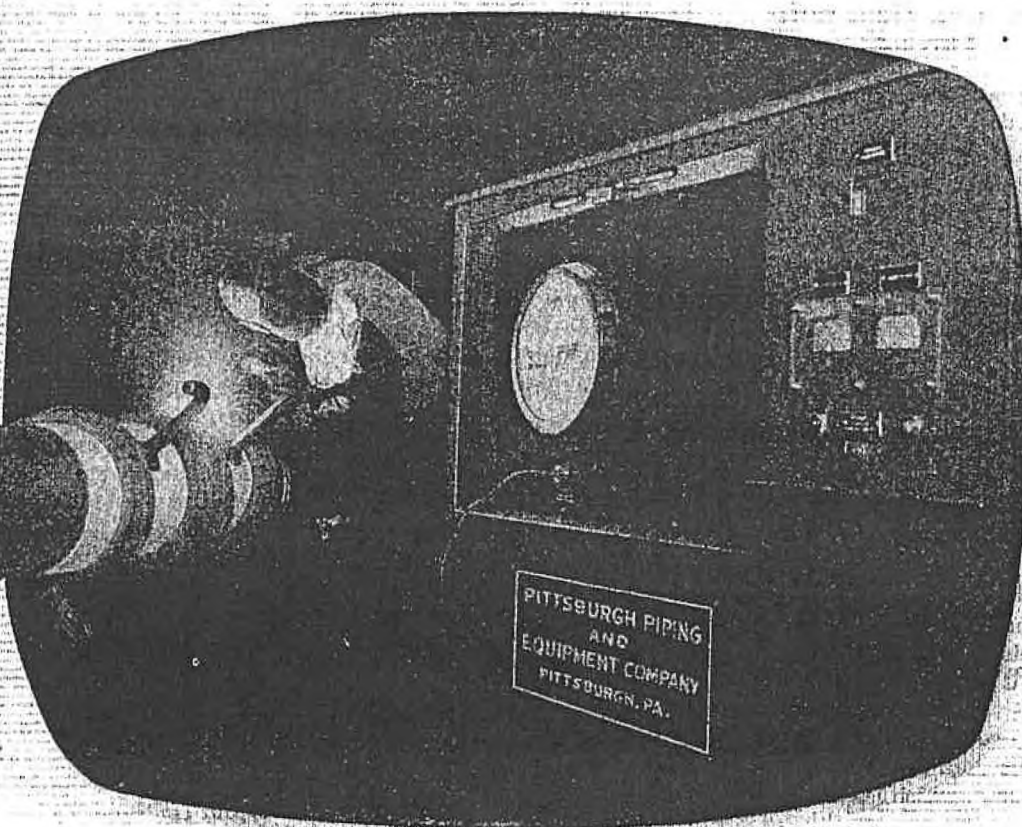


ATTACHMENT FOR REDUCING WEIGHT ON ROUTER HEAD AND ARM

ROUTING AID
←
AIR MANIFOLD
↓



PRECISE CONTROL OF WELDING PROCEDURES



AVAILABLE ONLY THROUGH MODERN SHOP FABRICATION

PRECISE welding control is a major reason why shop fabrication by Pittsburgh Piping and Equipment Company results in a thoroughly dependable piping installation.

The illustration shows how a welding operation on 14" high pressure, high temperature piping is performed. The area adjacent to the weld is induction preheated to a temperature of 500°F. min. This temperature is accurately maintained during the entire electric arc-welding operation by means of indicating and control instruments. When the weld is finished, stress-relieving is ac-

complished by similar procedure.

Better welding contributes to the safer, more satisfactory prefabricated piping installations produced by Pittsburgh Piping and Equipment Company.

Pittsburgh Piping

AND EQUIPMENT COMPANY

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525 Market Street, San Francisco

634 S. Gramercy Place, Los Angeles

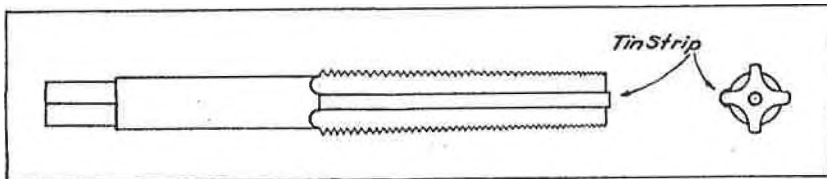
Peoples Gas Building, Chicago

Public Square Building, Cleveland

10 High Street, Boston

Heights State Bank Bldg., Houston

Whitehead Building, Atlanta



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.)

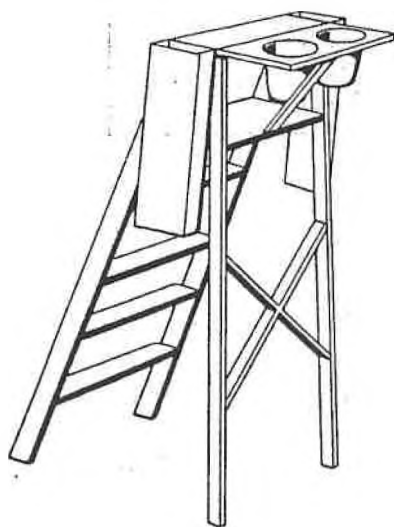
Special Ladder Aids Maintenance

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-

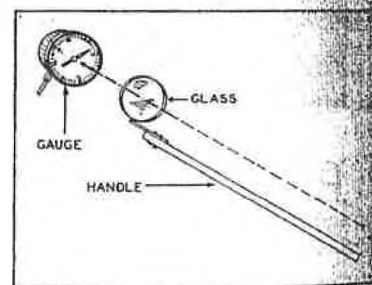
Freezing Facilitates Water System Repairs

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.)

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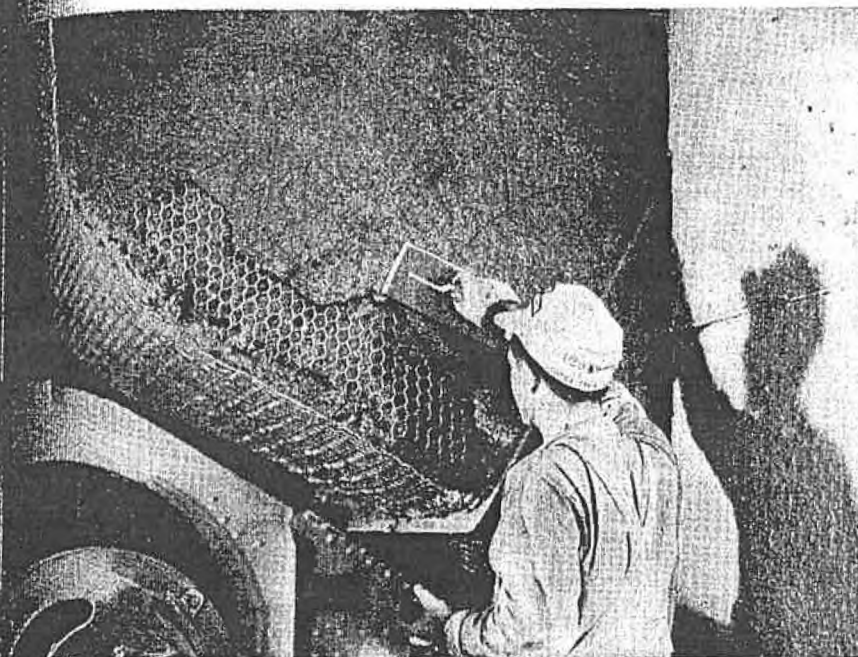
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Users applaud the high Rust-Inhibition of Eagle Super "66" Insulating Cement

Men who have used Eagle Super "66" Insulating Cement are enthusiastic not only about its great fuel-saving ability — they applaud the way Super "66" actually inhibits rust on heated metal equipment!

This unique rust-inhibitive quality has been conclusively proved by laboratory tests, and in actual use. It's an important factor in prolonging the life of boilers, ovens, tanks, towers, heat exchangers, etc.



"Springy Ball" structure gives remarkable efficiency

The tremendous insulating efficiency of Super "66" comes from its "Springy Ball" pellets of Eagle Mineral

Wool. Each pellet is a maze of dead air cells — one of Nature's most effective barriers against passage of heat. "Springy Ball" structure is permanent — lasts as long as the insulation.

Eagle Super "66" withstands a full range of temperatures up to 1800° F. If not subjected to temperatures above 1200° F., it can be *removed, remixed and re-used!* An all-purpose insulation, it can be troweled with little effort on almost any size or shape surface. Wet coverage is as high as 65 sq. ft. per 100 lbs., 1 in. thick . . . and shrinkage is less than 15%.

Send for data sheets. They contain complete technical information about Eagle Super "66". Available on request.

Other Eagle Industrial Products include:

Eagle Insulseal. A protective coating for insulation. Trowels on — dries to a hard finish. Withstands temperatures up to 450° F.

Eagle Swetchek (black). A prepared, asphaltic base, rust-inhibitive anti-condensation compound.

Eagle "43" Finishing Cement. A hard white finish coating for all types of indoor insulation within a range from 70° F. to 800° F.

EAGLE-PICHER INSULATIONS High and Low Temperature



THE EAGLE-PICHER COMPANY • CINCINNATI (1), OHIO

Eagle Super "66" Insulating Cement • Eagle L-T and M-2 Felt • Eagle Supertemp Black • Eagle Blankets • Eagle Pipe Covering

Eagle Insulseal • Eagle Loose Wool • Eagle Insulstic • Eagle Swetchek

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 80th

New York, N. Y.

Nov. 17-22—Annual Meeting, Atlantic City, N. J.

National Metal Congress, Wm. H. R. Managing Dir., 7301 Euclid, Chicago, Ill.

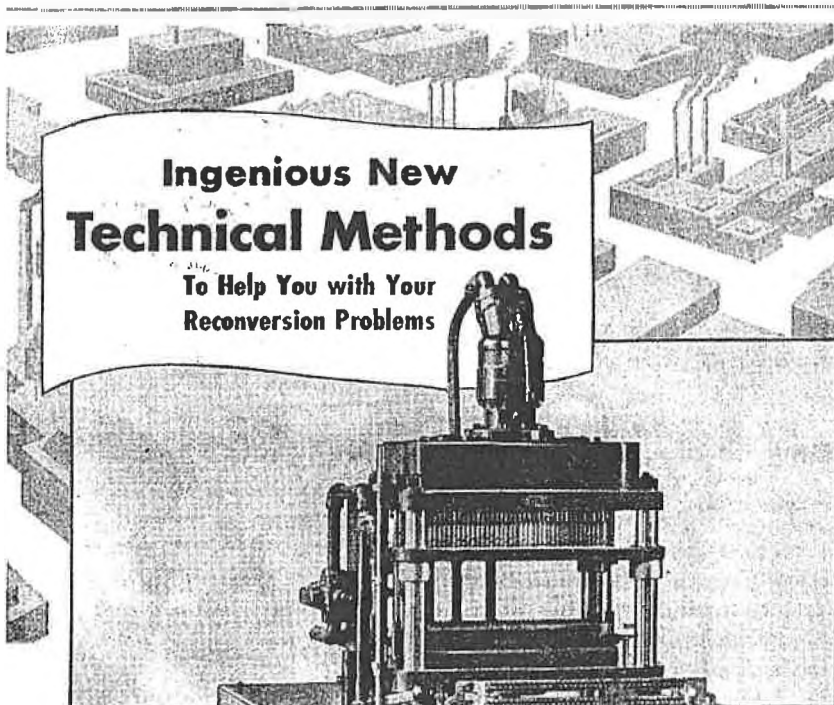
Nov. 18-22—Exhibition, Atlantic City, N. J.

American Society of Mechanical Engineers, E. Davies, Secretary, 29 W. 30th St., New York 18, N. Y.

Dec. 2-6—Annual Meeting, Hotel Pennsylvania, New York, N. Y.

American Institute of Electrical Engineers, E. E. Honline, Secretary, 29 West St., New York, N. Y.

Jan. 27-31—Winter Convention, New York, N. Y.



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.

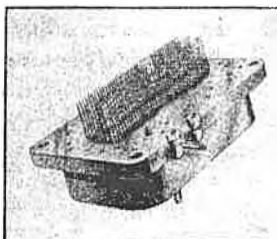
With this unit all holes are drilled at one pass, and valuable time is saved by the elimination of indexing and extra handling. It may be used on standard drill presses, or furnished as a complete hydraulic machine by the factory.

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

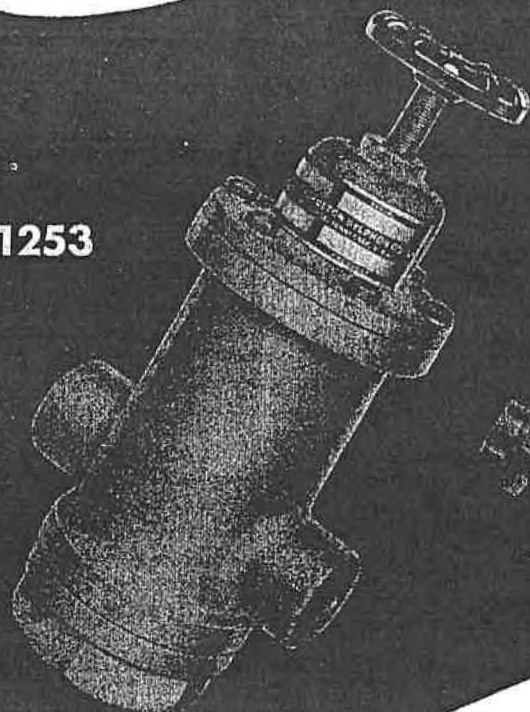
ers, and therefore preparation for the Exposition clearly indicate the attitude and purposes of industrial planners as interpreted by those whom they must rely for machinery and manufacturing equipment. Requirement starts with the plant and various means to get power to production and come through to numerous productive applications. Lists of exhibits are compiled constitute an extensive catalog covering all kinds of industries from the standpoint of power needs and also such process services as fuel, heat, steam, and water supplies, materials handling and others. A great majority of exhibitors have participated in former 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 by 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 with 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 to be handled and the temperature and pressure requirements involved.

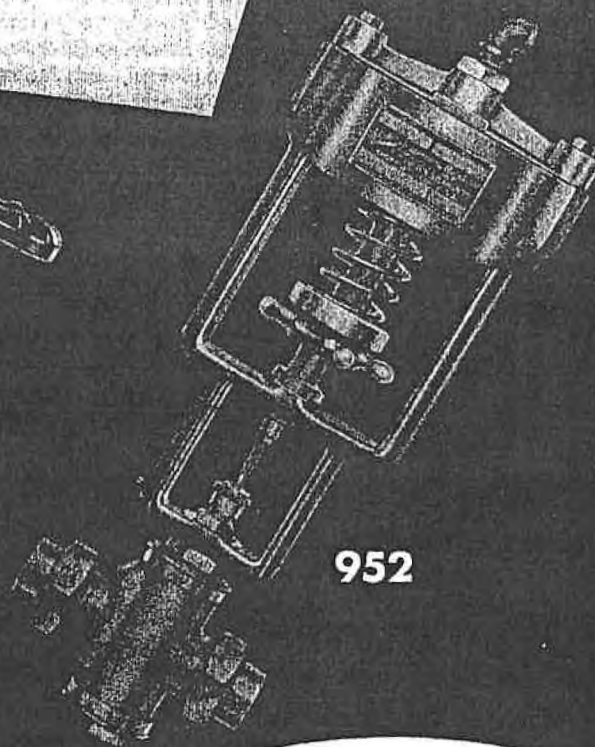
Though highly diversified, the principal influence of the Exposition is in developing a wider knowledge of the economical transformation of energy in fuel into power, and the key classifications of exhibits with pumps and conveyors for handling

A simple twist of the wrist...

1253



952



...and pressure is under control

● Here are two Fulton Sylphon regulators . . . job-proved by engineers and contractors in your industry . . . for solving pressure problems in steam, air, water or oil lines.

On the left is the No. 1253 with packless, all-metal construction. Single-seated valve for dead-end service—may be held in wide open position. Requires no "feeler" pipe. Reduced pressure ranges—20 to 100 lbs. and 30 to 150 lbs.

Shown with it is the No. 952 which is used as an automatic pressure regulator for reduc-

ing from high to low pressure—or to insure a constant delivery pressure when supply fluctuates. Equipped with direct-acting type valve (closes with rising pressure). Maximum initial pressure—150 lbs.; maximum controlled pressure—100 lbs.

Both are handwheel, spring adjusted . . . equipped with Sylphon metal bellows . . . rugged, reliable, long-lasting. Both are backed by 45 years of specialized experience. For complete information, write today for Catalog VL-100.

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FIRST WITH BELLOWS

THE FULTON SYLPHON CO. KNOXVILLE 4, TENN.
FULTON SYLPHON
Temperature Controls Bellows Bellows Assemblies

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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; home new and converted; retail stores and service establishments. This general movement involves changes in character of demand, especially power and appliances; expansion of works; new installations. Meantime shortages and strikes have held production, creating confusion, many dislocations at present, demanding projections and planning. Many of the engineering aspects will be clarified by the first of the when the Exposition is held, when a great deal of material now available will be placed in view, a considerable number of it being exclusive to this display.

A qualified audience is assured the method which has been adopted of admitting visitors by invitation and registration only, excluding general public. The pattern provided 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

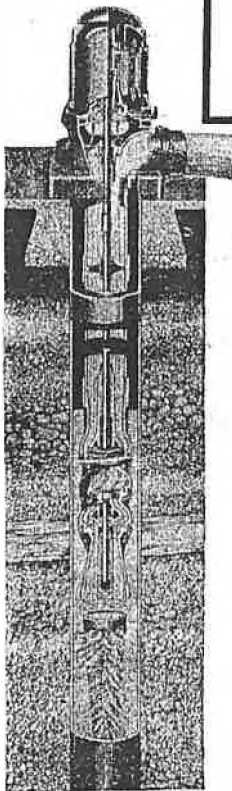
Vertical and Horizontal Types

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.

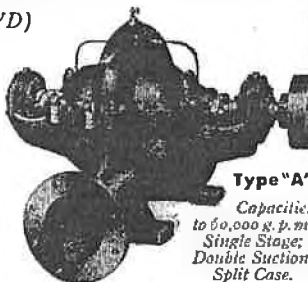


Peerless HORIZONTAL CENTRIFUGAL PUMPS

(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

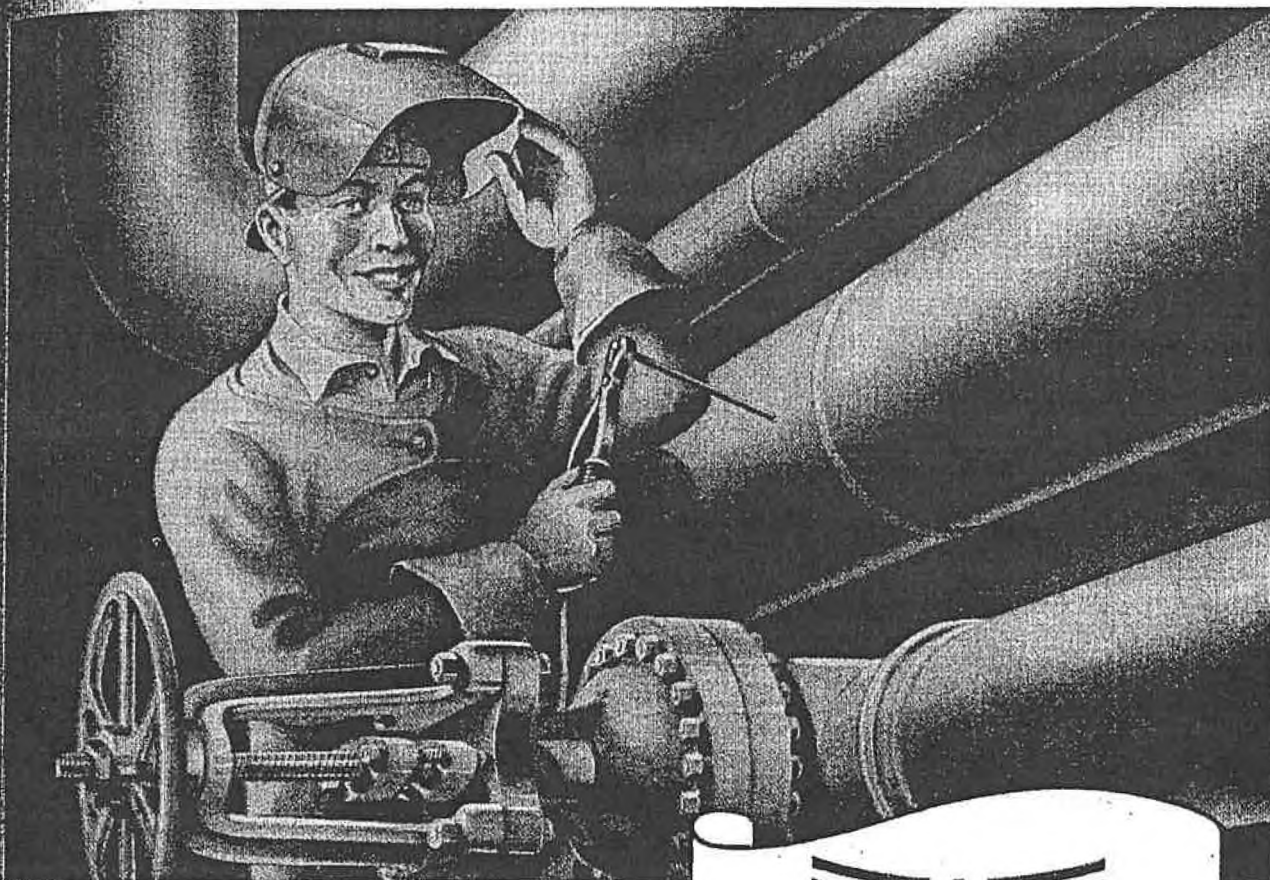
FOOD MACHINERY CORPORATION

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

Distributors in all Principal Cities



The Man in the Field **KNOWS** when Pre-Fabricated Piping is Right



MIDWEST
CONTRACTING DEPARTMENT
Checks
MIDWEST PIPING QUALITY



MIDWEST

PIPING & SUPPLY CO., INC.
MAIN OFFICE: 1450 SOUTH SECOND ST., ST. LOUIS 4, MO.
Plant: St. Louis, Passaic, Los Angeles and South Boston • Sales Office: New York 7—30 Church St.
• Chicago 3—645 Marquette Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg.
• Tulsa 3—533 Mayo Bldg. • Atlanta 3—Red Rock Bldg. • South Boston 27—426 First St.

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Men in the field who erect piping know when shop fabrication is well done . . . they know if the sub-semblies fit correctly, line up easily and have all field joints or flanged joints in accessible positions. When this is the case, the erecting job is easier . . . saves both time and money.

Midwest has a Construction Department which has erected piping of all kinds for 46 years. The critical attitude of this department is the best stimulant to our four pipe-fabricating plants. The Construction Department also frequently contributes useful and practical suggestions for improving pipe fabrication.

This situation has a powerful effect in keeping the whole organization alert . . . and in encouraging continuous improvement. It is one of many reasons why you get the best when you buy Midwest Pre-Fabricated piping . . . either as materials furnished or piping completely installed.

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-Clean allied slasher room equipment, introducing it to the industry. He so worked with mills in the installation of complete automatic treatment 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 expect to 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 retail department of the Philadelphia office. Since that time, he has served 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 as Superintendent of Erection and Service Engineer. Mr. Lequin will supervise 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 types of equipment.

This company represents the Canton 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 SUPERVISOR, RALEIGH, N. C., as sales representative in central North Carolina for large heavy-duty industrial and commercial stokers. The Dillon company is one of the oldest and most experienced equipment representatives in this area.

SOUTHERN POWER & INDUSTRY for NOVEMBER

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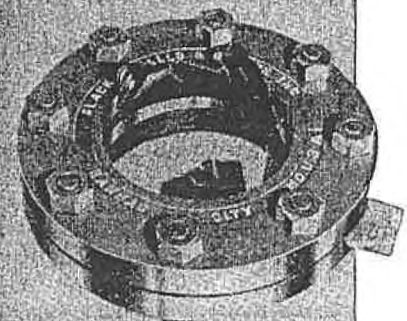
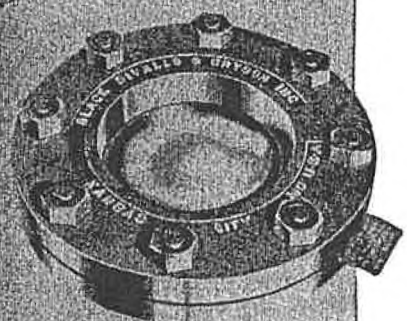
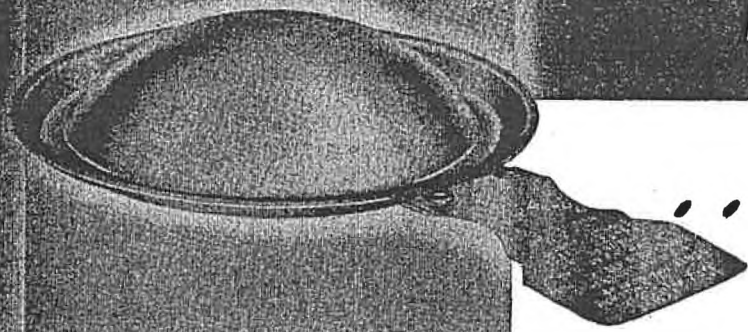
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*Just a
Piece of
METAL*

...But

**IT MAY
SAVE YOUR LIFE**

The rupture diaphragm of the B. S. & B. SAFETY HEAD is the "pressure fuse" which will prevent your pressure vessels from blowing up.

It starts life as a flat blank of almost any metal—Aluminum, copper, silver, stainless steel, platinum and a dozen others are used. Then it is given the spherical form which in great measure accounts for its ability to withstand fatigue in service and to burst at the right pressure in time of need.

Specimen discs are regularly burst to assure consistent performance. The specified bursting pressure of each SAFETY HEAD diaphragm is the average of bursting pressures of two or more specimen discs from an adjacent section of the same sheet of metal. The bursting pressure of the SAFETY HEAD Diaphragm is marked on a permanently attached metal tab.

A lot of care goes into turning this little piece of metal into a "life preserver" for your life and property. We believe this function deserves the full measure of our fifteen years of research and know-how—and the success of our efforts is proven by the fact that no pressure vessel equipped with a SAFETY HEAD has ever burst from over pressure.

**BOOTH 564—NATIONAL POWER SHOW
NEW YORK CITY, DEC. 2-7**

...WRITE FOR CATALOG

BLACK, SIVALLS & BRYSON, Inc.

• SALES OFFICES-- 24th FLOOR POWER AND LIGHT BUILDING, KANSAS CITY 6, MO.
• PLANT-- 7500 EAST 12th STREET, KANSAS CITY 3, MISSOURI



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.



NEWS—Continued

T. C. I. Expansion

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

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

The construction program was 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 producing such material.

Included in this modernization program are the installation of a 48-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. plans to 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"

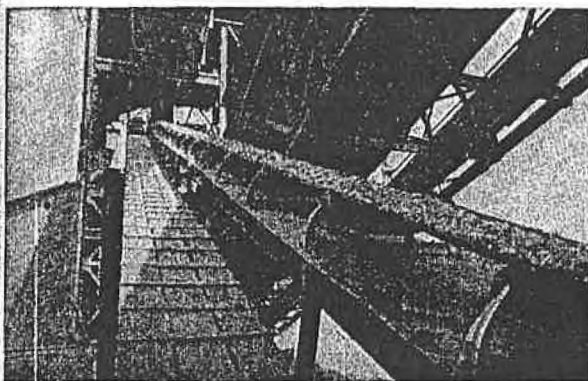
Specify Continental



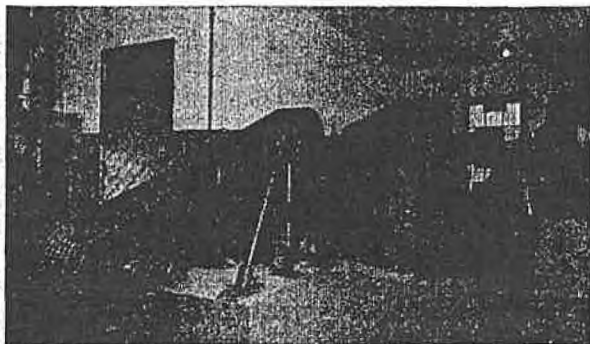
Materials Handling and Power Transmission Equipment

SERVING — Coal Mines — Steel Mills — Paper Mills — Textile Mills — Cement Mills — Chemical Plants — Sand and Gravel Plants — Quarries — Power Plants — Public Utilities — Railroads — Grain Elevators — Cottonseed Oil Mills — Cotton Gins — Aluminum and Magnesium Plants — Canneries — Phosphate and Potash Mines — Fertilizer Plants — Ship Yards.

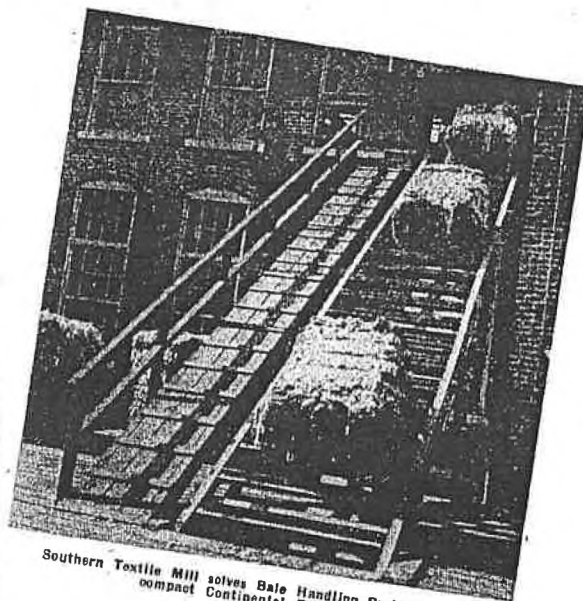
PRODUCTS — Belt Conveyors — Screw Conveyors — Bucket and Screw Elevators — V-Belt Drives — Pulleys — Bearings — Sprockets — Chain — Gears — Buckets — Clutches — Reducers — Hoists — Apron, Vane and Reciprocating Feeders.



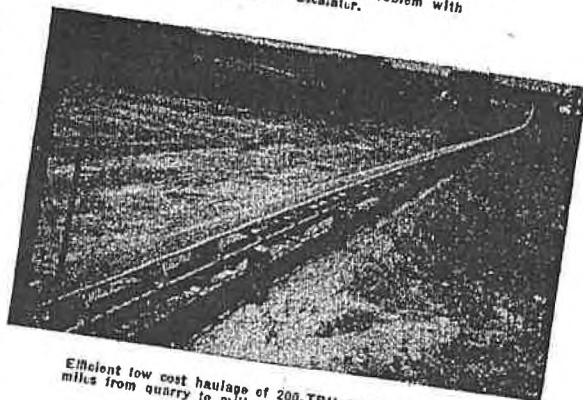
The efficiency and low maintenance cost of Continental rollers have fully justified the many REPEAT orders from satisfied operators.



Mine Fan V-Belt Drive from Electric Motor with Auxiliary Drive from Diesel Motor for emergency. Designed and manufactured by Continental.



Southern Textile Mill solves Bale Handling Problem with compact Continental Escalator.



Efficient low cost haulage of 200.TPH Crushed Stone 1 1/4 miles from quarry to mill via Continental Belt Conveyors.

Continental is equipped to handle any mechanical power transmission or materials handling problem. Send your inquiries to our nearest sales office.

INDUSTRIAL DIVISION CONTINENTAL GIN COMPANY

BIRMINGHAM, ALABAMA

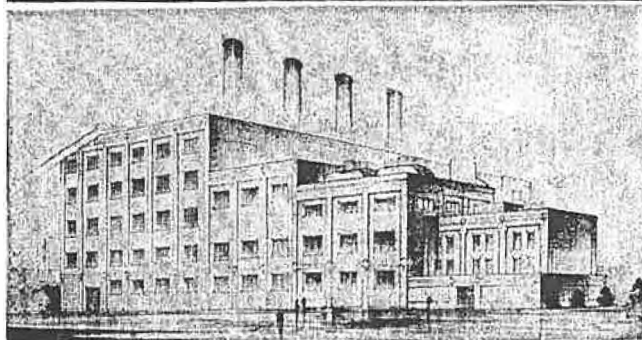


ATLANTA • DALLAS • MEMPHIS



COCHRANE

SINCE 1863



DEAERATORS

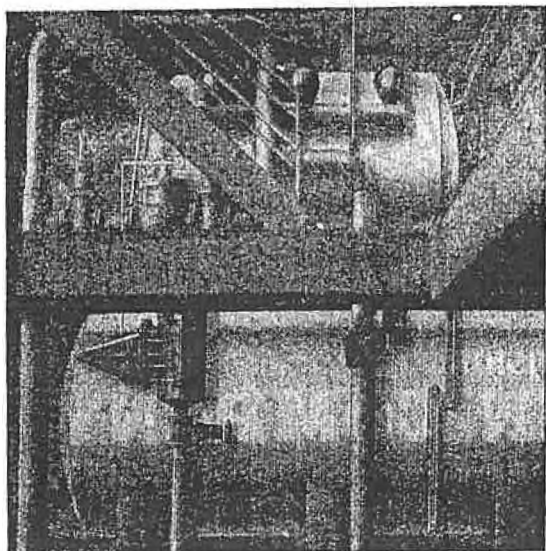
AT *Indianapolis*
Power & Light

ONE of the most progressive utilities in the country is the Indianapolis Power & Light Company of Indianapolis, Indiana. Ten years ago, in 1936, the Cochrane Corporation furnished a 650,000 lb./hr. Deaerator, for Section "K" of the C. C. Perry plant. This Cochrane Deaerator heated the entire boiler feed in Section "K" and completely removed dissolved oxygen. Again in 1940 a 400,000 lb./hr. Deaerator was installed in the Harding Street Plant for Unit No. 3.

Now, as indicated by the architect's drawing shown at the top of the page, the Perry "K" Station is being expanded and another Cochrane Deaerator of 700,000 lb./hr. shown in the illustration below, is being installed. At the same time another 400,000 lb./hr. Cochrane Deaerator is being installed in the Harding Street station for Unit No. 4.

Cochrane Water Conditioning Apparatus has been a part of Indianapolis Power & Light Company equipment since 1917.

COCHRANE CORPORATION
3110 N. 17th Street Philadelphia 32, Pa.



THE RECORD

C. C. PERRY STATION SECTION "K"

One 650,000 lb./hr.
Cochrane Deaerator
Two 400,000 lb./hr.
Cochrane Open
Heaters

MILL STREET STATION

Two 300,000 lb./hr.
Cochrane Open
Heaters
One 500,000 lb./hr.
Cochrane Open
Heater

HARDING STREET STATION

Two 350,000 lb./hr.
Cochrane Open
Type Heaters
One 400,000 lb./hr.
Cochrane Deaerating
Heater

NEWS—Continued

has been established for the ELECTRIC COMPANY, St. Louis, which combines the functions of the Power Plants, Electric Steam, Steam Operation Engineering, Mound and Granite City Plant departments.

"This move," said Geo. Gamble, Superintendent, Power Production, "was made in recognition of the larger administrative complex which increased size and more complex personnel relation matters necessary. The larger number of supervisory jobs make it possible to better carry on simultaneous aspects of operating large plants safely, efficiently and with regard to the rights and feelings of the people who run them."

Under the new set-up, E. H. Ney, Chief Engineer—Steam Electric Generation, will be consultant in matters relating to steam operation, construction and maintenance, with special emphasis on current and contemplated major construction at Ice, Ashley Street, and Cahokia major turbine overhaul. E. H. Luxemburg, Assistant to Chief Engineer—Steam Electric Generation, will continue to report to Mr. Tenney, who specializes in turbine overhauls.

H. O. Duetscher, Electric Engineering Superintendent, and G. V. Williamson, Steam Engineering Superintendent, will have charge, respectively, of all technical matters relating to electrical and mechanical operation, construction and maintenance of steam-electric plants and will have technical direction of other and general matters as assigned.

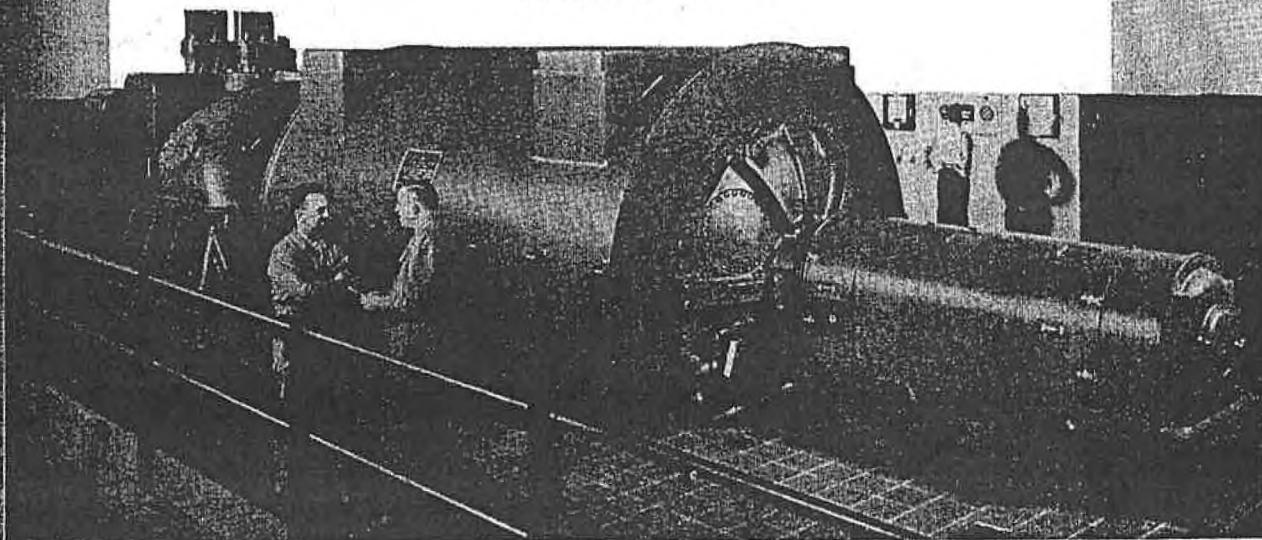
The following General Superintendents will be responsible directly to the Superintendent Power Production for all matters of personnel, general administration in their respective plants, and to him through the Engineering Superintendent for all matters delegated to these Superintendents: J. B. Wheeler, Cahokia; L. L. Kraft, Venice; M. D. Davis, Ashley Street; and H. W. Bull, Mound and Granite City Plants. Wheeler will also act as coordinator of personnel policy matters for the four general superintendents named.

G. E. Purchases Plant

Fractional-horsepower motor production facilities at GENERAL ELECTRIC have been increased with the

*"We started our new turbine
out **right** -
with **GULFCREST OIL**"*

says this Superintendent



The power plant Superintendent (left) consults with a Gulf Lubrication Engineer on the lubrication of this 30,000 kw. unit just installed in the new station of a prominent utility in New York State.

REPORTS by associated stations on the outstanding performance of Gulfcrest Oil made our choice of the lubricant for this new turbine an easy one," says this Superintendent. "We feel that Gulfcrest Oil is the best insurance we can provide for our big investment."

Extra refining makes the difference! Gulfcrest Oil is not only refined by conventional methods, but is super-refined by the Alchlor Process, which weeds out the sludge formers—the undesirable

hydrocarbons—in oil. The Alchlor Process also imparts to Gulfcrest Oil greater ability to benefit from the addition of special inhibitors which control oxidation, lengthen the induction period of the oil, and maintain low neutralization number.

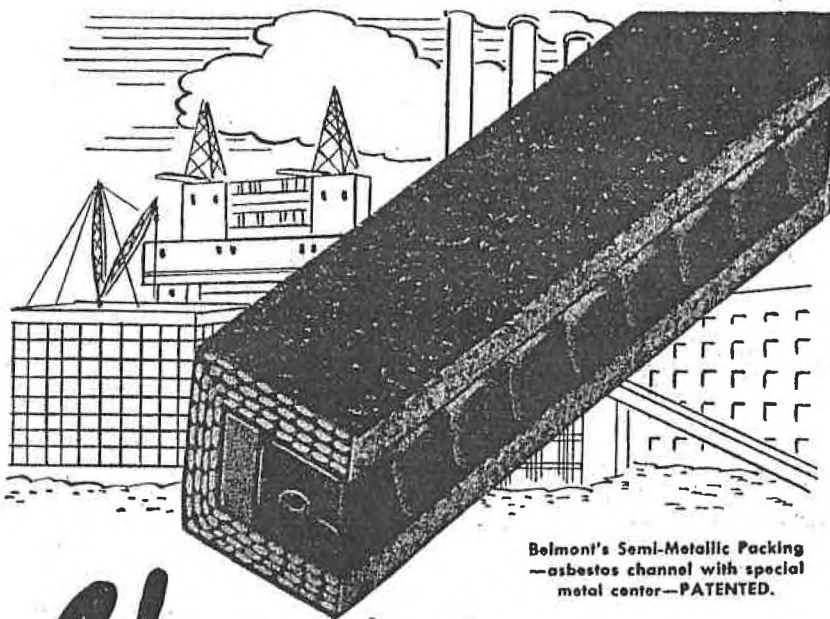
Call in a Gulf Lubrication Engineer today and ask him to recommend the proper grade of Gulfcrest Oil to provide the best lubrication for your turbines. Write, wire, or phone your nearest Gulf office today.

Gulf Oil Corporation • Gulf Refining Company

Division Sales Offices:

Boston • New York • Philadelphia • Pittsburgh • Atlanta
New Orleans • Houston • Louisville • Toledo





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. G. \$5,000,000 for the plant, according to the Company's announcement.

It is expected that more than 700 persons will be employed at the plant as soon as installation and 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 vote 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, Alpha Delta Phi fraternity. He was educated at Prospect Elementary School in East Cleveland, Shaw School, and Western Reserve University.

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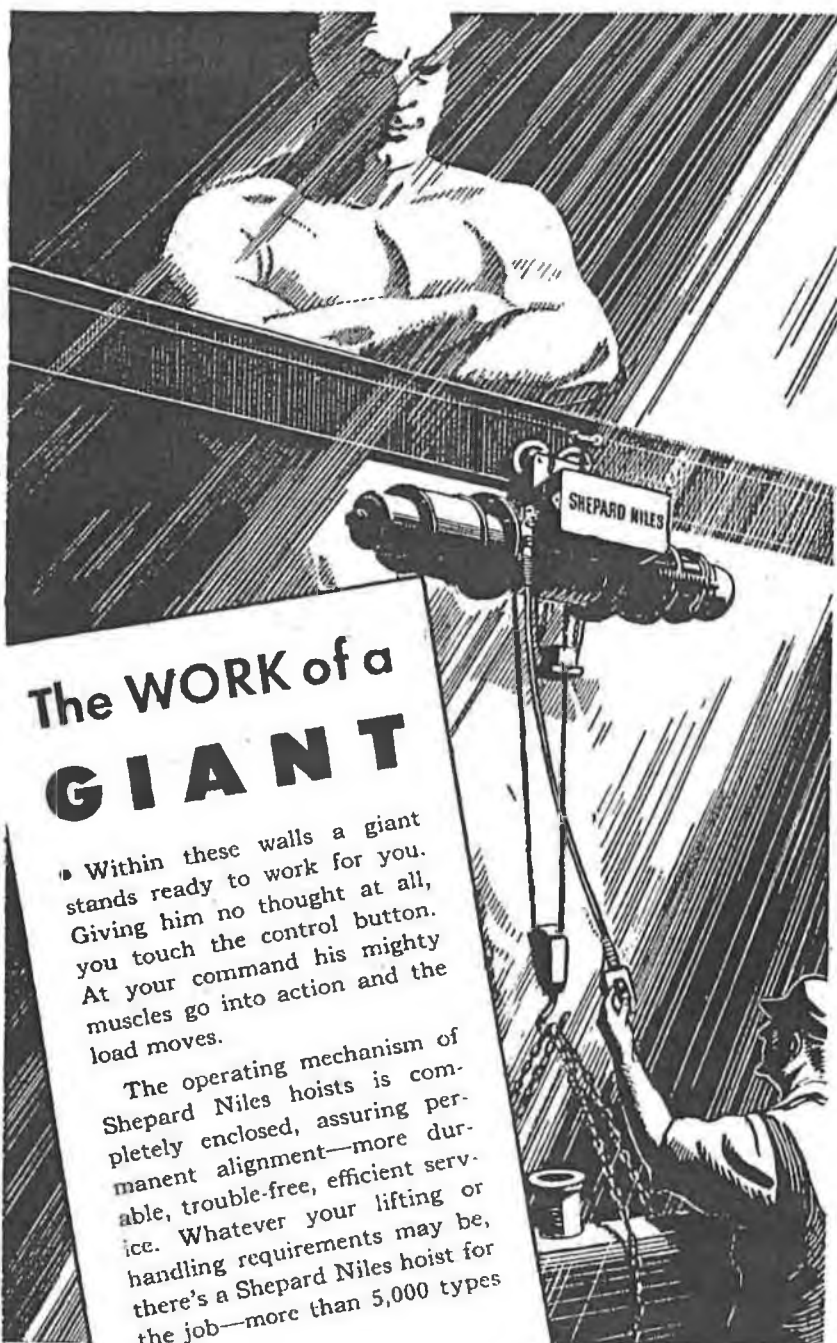
WATCHEMOKET

eye
SAVERS

with new, stronger molded frame,



Stronger than ever, improved Model I-N Eye Savers are now made with a new, all-molded plastic frame that resists breakage at all points. More than that, they're better looking, better fitting... plenty roomy and comfortable for wear directly over many types of prescription glasses. All Eye Savers give extra protection against injury from top, sides and bottom. The Impax methacrylate lens is tough: stops flying chips, splinters, and hot metal... will not splinter even under heavy impact. And it's free of distortion as finest optical glass! Eye Savers exceed all Federal specifications for impact resisting goggles. And they're so light in weight your workers will keep them on. See your Eye Savers dealer today, or write us.



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

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.

455 SCHUYLER AVENUE • MONTAUR FALLS, N. Y.

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

Thermix Products at the 1946 POWER SHOW

GRAND CENTRAL PALACE, NEW YORK CITY



For the first time since the war, Thermix Products will be on display at the New York Power Show.

Many new developments are to be seen and you are cordially invited to drop in at booths 50 and 51.

High on the list of attractions will be a full scale working model of a Thermix Duplex Dust Collector using alternately an Aerotec tube and Aerotec electrical secondary. Heacon Dampers will control flow and a Thermix Fan Stack will furnish the draft. Sides of the equipment will be transparent for observation.

Our engineers will be on hand to welcome you and answer any inquiries.

THERMIX ENGINEERING CO.

GREENWICH, CONN.

Project and Sales Engineers for

**PRATT-DANIEL CORPORATION • AEROTEC COMPANY
HEACON, INC. • ROCKWELL BLAST GATES**

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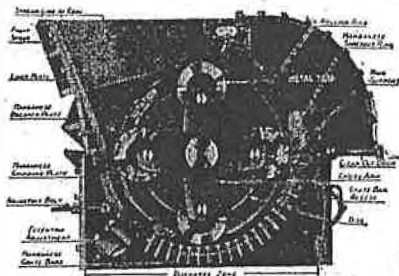
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CRUSHERS

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.

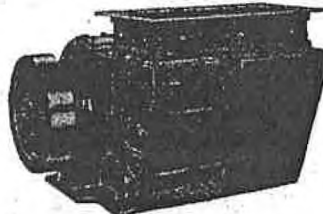
American
*Originators and Manufacturers of
Ring Crushers and Pulverizers*



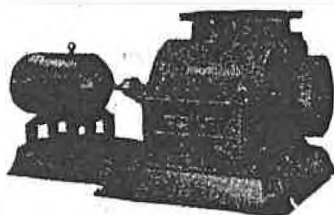
AC SHREDDER RING CRUSHER



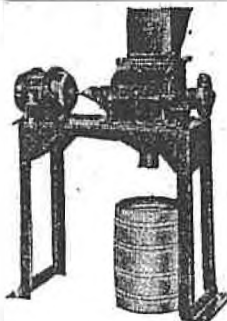
TYPE S CRUSHER



HAMMERMILL and HOG



24 SERIES RING OR HAMMER TYPE



LABORATORY MILL

PULVERIZER COMPANY

1243 MACKLIND AVE.
ST. LOUIS 10, MO.

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 Oak Products, Inc., New York, of the appointment of J. C. LEONARD as Sales Manager of its Industrial Market Division. Associated with the Oak 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 Chief Division, Mr. Leonard assumed new duties on September 1, 1946, will direct the marketing and servicing 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 that 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.

"When you want this valve to work . . . it works"

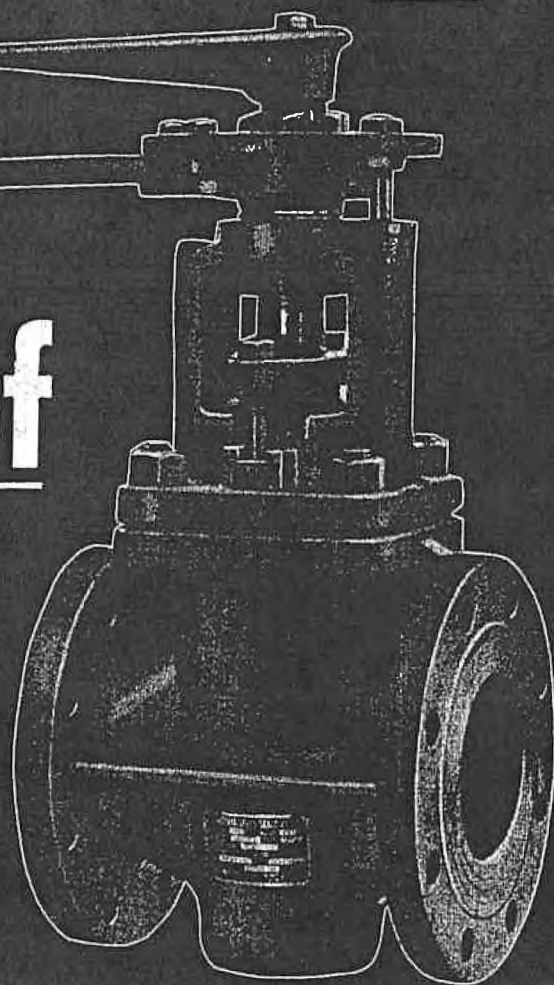


Stick-Proof

because

it's

LEVER-SEALD



CHECK THESE OUTSTANDING LEVER-SEALD VALVE FEATURES

1. Instant stick-proof operation.
2. Quarter-turn fully opens or closes.
3. Positive mechanical seal.
4. Seating surfaces always protected in both open and closed positions. Corrosion practically eliminated.
5. Unobstructed straight-line fluid flow.
6. All operating parts protected from damaging effects of service conditions and weather.

HOMESTEAD LEVER-SEALD VALVES operate instantly with only a Quarter-Turn . . . at all times and under all conditions . . . in services where extremes of temperature, pressure, or the corrosive action of line fluids would cause ordinary valves to stick or "seize."

That's why they have been favorites with industry for more than 15 years in all sorts of difficult applications.

They're stick-proof, because built right into each valve is a powerful lever and screw device that relieves seating pressure between plug and body just enough to overcome friction and permit easy turning.

This stick-proof construction is only one of many HOMESTEAD LEVER-SEALD VALVE features assuring long, economical, trouble-free service.

You may order HOMESTEAD LEVER-SEALD VALVES in metals and alloys to meet service requirements, in sizes from 1½" to 12" with regular or wedge gate valve face to face dimensions, for pressures from vacuum to 1500 pounds. Complete technical details and Valve Reference Book No. 38 are yours for the asking.

HOMESTEAD VALVE MANUFACTURING COMPANY

P. O. BOX 70

CORAOPOLIS, PA.

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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 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. Shanklin has been associated with the company since his graduation from the University of Kentucky in 1927. During this period he has served in sales and executive capacities. 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., January 1, 1946.

State of Georgia, County of Fulton. Before me, a Notary Public, in and for the State and County aforesaid, personally appeared E. W. O'Brien, who having sworn according to law, deposes and says that he is the Managing Director of SOUTHERN POWER AND INDUSTRY, and 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 above required by the Act of August 24, 1912, amended by the Act of March 3, 1907, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this to-wit:

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

2. That the owners are W. R. Smith Publishing Co.; Estate of W. R. Smith, 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.; Myra E. O'Brien, Atlanta, Ga.; Richard P. O'Brien, Atlanta, Ga.

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

4. That the two paragraphs next 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, or any other fiduciary relation, the name of the person or corporation for whom such person is acting is given; also that the two paragraphs contain statements embracing the full knowledge and belief of the declarant as to the circumstances and conditions under which stockholders and security holders appear upon the books of the company, as trustees, 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, My Sworn to and subscribed before me this 25th day of October, 1946.
SEBA J. JONES, Notary Public
My commission expires Feb. 19, 1947.

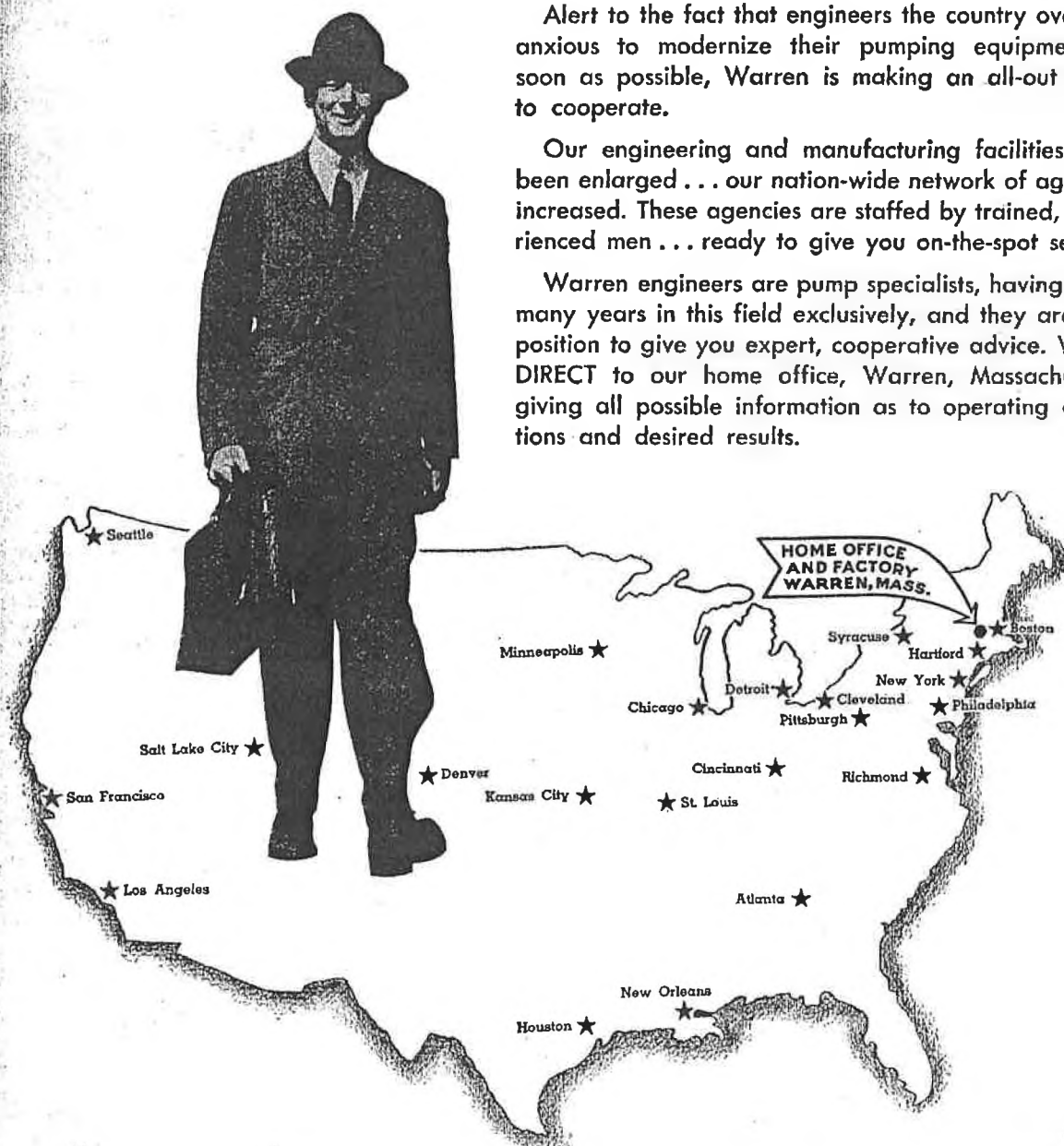
PUMPING *Service* TO YOU

on a Nation-wide Basis

Alert to the fact that engineers the country over are anxious to modernize their pumping equipment as soon as possible, Warren is making an all-out effort to cooperate.

Our engineering and manufacturing facilities have been enlarged . . . our nation-wide network of agencies increased. These agencies are staffed by trained, experienced men . . . ready to give you on-the-spot service.

Warren engineers are pump specialists, having spent many years in this field exclusively, and they are in a position to give you expert, cooperative advice. WRITE DIRECT to our home office, Warren, Massachusetts, giving all possible information as to operating conditions and desired results.



WARREN STEAM PUMP COMPANY, INC. • WARREN, MASSACHUSETTS

Warren Pumps

CENTRIFUGAL AND RECIPROCATING

For: Power Plants — Chemical Plants — Paper Mills — Food Industries — Metal Working — Oil and Mining Services

SOUTHERN POWER & INDUSTRY for NOVEMBER, 1946

113

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.

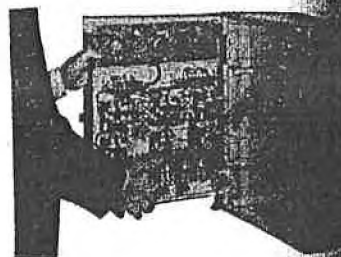
The first of these is suitable for use in hydraulic equipment in sub-zero temperatures, and the latter two are developed for use in mills where rust and oxidation inhibited oils of corresponding viscosity are needed. These oils are rust and oxidation inhibited oils which prevent clogging of oil lines, 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 GENERAL 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

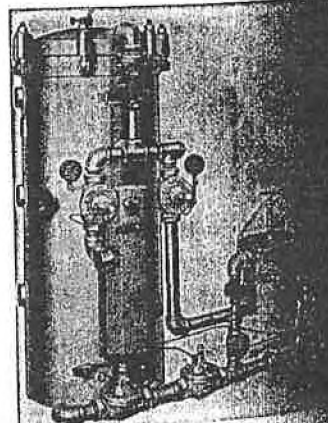


tenance, and remote operation. It includes an improved electronic timing circuit which makes possible the consistent welding speed essential for high-production speed welding with timing intervals.

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 pre-weld timer. For less exacting applications, the sequence-weld timer provides the necessary control of mechanical sequence of operation 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. 611 series, Bowser filters range in capacity from 15 to 500 gpm with 7





fedders

NEW Series 12

Downflow UNIT HEATERS

FOR installations 15 to 45 ft. above working zone. Circular and square types. Copper tubes and copper fins. Write for Catalog 12C-2.

FEDDERS-QUIGAN CORPORATION

BUFFALO 7, N. Y.

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Production, Prosperity and POWELL VALVES

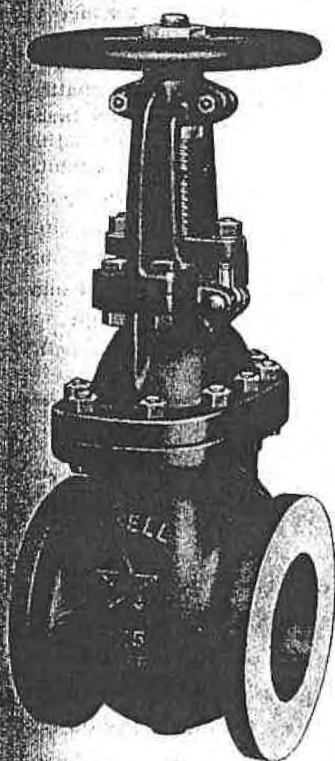


Fig. 1793—125-pound Iron Body Bronze Mounted Gate Valve for 125 pounds W.P. In sizes 2" to 30", incl. Has flanged ends, bolted flanged yoke, outside screw rising stem and taper wedge solid disc. Taper wedge double discs can be provided in sizes 2" to 12", incl. Seat rings and stem are in bronze. Disc is bronze in 2 1/4" and smaller size valves; bronze in the larger sizes. Also available in All Iron.

Fig. 241—125-pound Iron Body Bronze Mounted Globe Valve. Made in sizes 2" to 16", incl. Has flanged ends, outside screw rising stem, bolted flanged yoke and regrindable, renewable bronze seat and disc. Also available in All Iron.



Fig. 376—200-pound Bronze Gate Valve with screwed ends, inside screw rising stem, union bonnet and renewable, wear-resisting "Powellium" nickel-bronze taper wedge solid disc in sizes 1/2" to 3/4", inclusive; taper wedge double disc in sizes 1" to 3", inclusive.

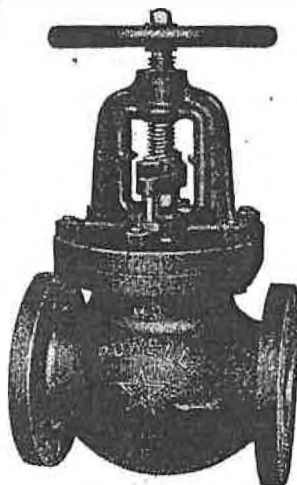


Fig. 3003 W.E.—Class 300-pound Cast Steel Gate Valve with welding ends, outside screw rising stem and bolted flanged yoke.

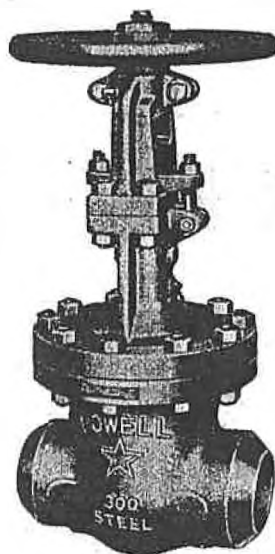


Fig. 559—125-pound Iron Body Bronze Mounted Swing Check Valve. Made in sizes 2" to 16", incl. Has flanged ends bolted flanged cap and regrindable, renewable bronze seat and disc. Disc, when wide open permits full unobstructed flow through the valve body. Also available in All Iron.

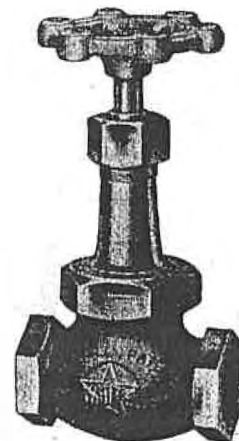
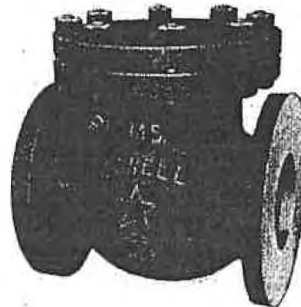


Fig. 1708—200-pound Bronze Globe Valve with screwed ends, union bonnet, renewable stainless steel seat and regrindable, renewable, wear-resisting "Powellium" nickel-bronze semi-cone plug type disc. Made in sizes 1/2" to 3", inclusive.



The real wealth of a nation lies in its power to produce. And the greater the production, the greater the prosperity of its people.

Production depends on many things. Not the least of these is the efficiency of the equipment that controls the flow of the innumerable media that constitute the lifeblood of Industry.

Powell's contribution to national prosperity is a line of valves that is so complete that today there are Powell Valves adapted to every service in every branch of modern industry.

The Powell Line of Valves for Power Plants includes Bronze and Iron Valves of all required types, sizes, and designs and all types of Cast Steel Valves (including an outstanding line of Non-returns) available in pressure classes from 150 to 2500 pounds. Where quick, positive operation by remote control is desirable, electric motor operators can be furnished.

The Wm. Powell Co., Cincinnati 22, Ohio
DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

Catalogs furnished on request. Kindly state whether you are chiefly interested in Bronze, Iron, or Cast Steel Valves.

POWELL VALVES

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

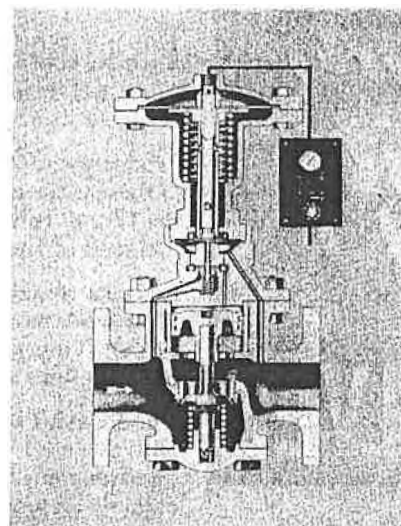
Filter elements are tubular, plastic impregnated cartridges which support the filtering medium. Diatomaceous earth is deposited evenly on these cartridges from the pre-coat pot and removes particles as small as $\frac{1}{2}$ micron.

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.

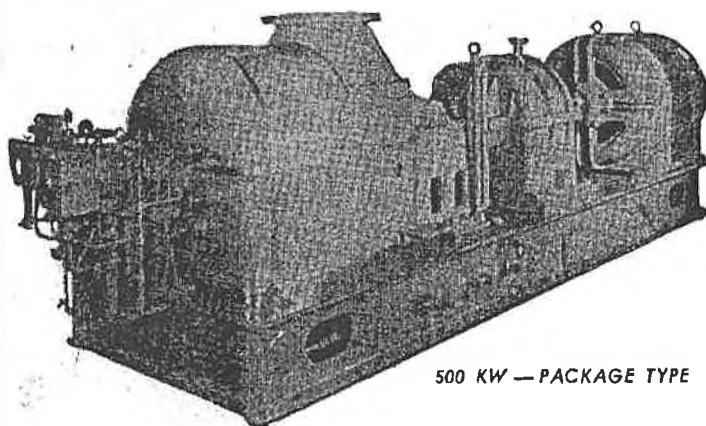
Automatic Water Feed Control

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, sounding an alarm at a dangerous low water level. The equipment contains no moving parts, no floats, 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

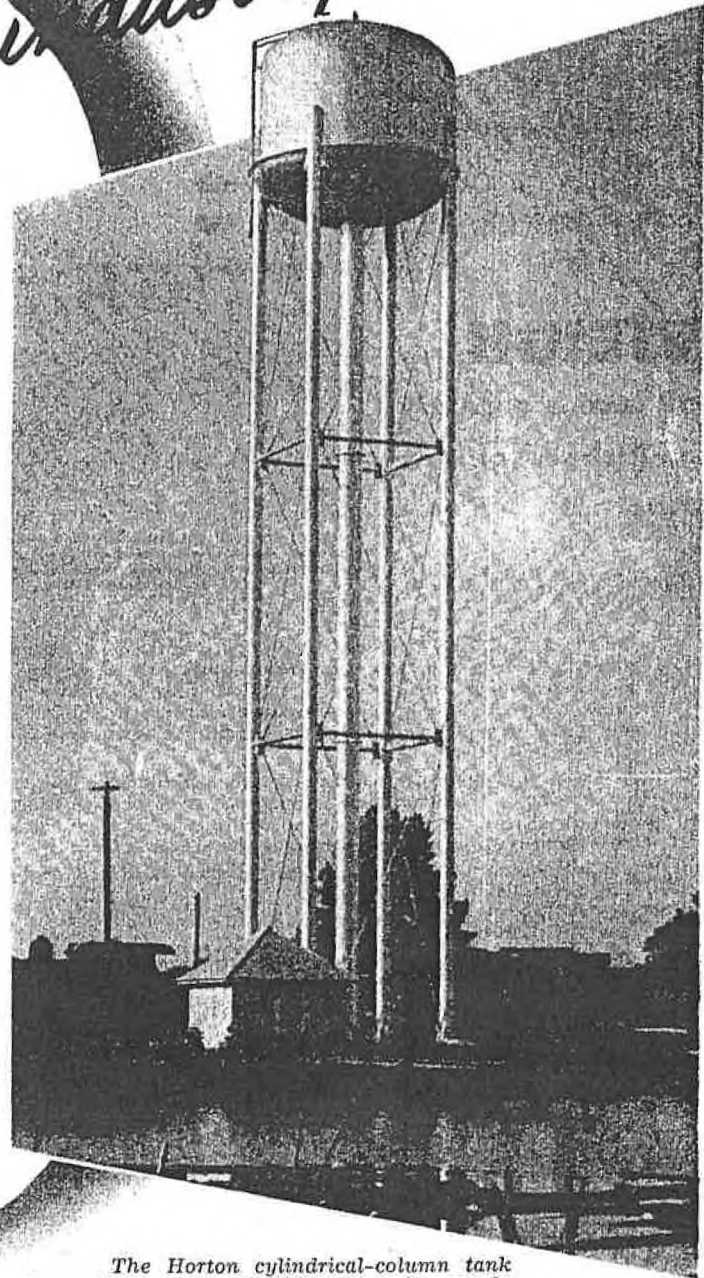
GRAVITY WATER PRESSURE

for all industry's needs!

For general water service or for fire protection, you can depend on gravity water pressure, as provided by Horton elevated storage tanks, to furnish water at a moment's notice! Horton all-welded elevated tanks are widely used throughout the South for this purpose.

The 75,000-gal. cylindrical-column tank at the right is a typical elevated water tank installation. It was erected at the T. R. Miller Mill Company, Inc. at Brewton, Alabama, and is used to supply water to the saw mill, planing mill, shop, veneer mill and box factory. The tank is filled twice each day, early in the morning and again in the late afternoon, with a 1,000-gal. per min. electrically-driven pump. About 150,000 gals. of water are used per day for boiler feed and other uses. According to the T. R. Miller Mill Company, the water supply from the tank is "as near 100% perfect as we could expect."

Investigate Horton all-welded elevated storage tanks when considering a gravity water supply for general service or fire protection.



The Horton cylindrical-column tank shown above provides a gravity supply of water for general service. It holds 75,000 gals. and is 100 ft. to bottom.

CHICAGO BRIDGE & IRON COMPANY

Atlanta, 3 2180 Healey Bldg.
Birmingham, 1 1500 N. Fifth St.
Chicago, 4 McCormick Bldg.
San Francisco, 11 22 Battery St. Bldg.
Cleveland, 15 Guildhall Bldg.
Tulsa, 3 Hunt Bldg.

Los Angeles, 14 Wm. Fox Bldg.
New York, 6 165 Broadway Bldg.
Philadelphia, 3 1700 Walnut St. Bldg.
Washington, 4 703 Atlantic Bldg.
Houston, 1 5600 Clinton Drive
Detroit, 26 Lafayette Bldg.

Plants at BIRMINGHAM, CHICAGO and GREENVILLE, PENNSYLVANIA

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NEW EQUIPMENT—Continued

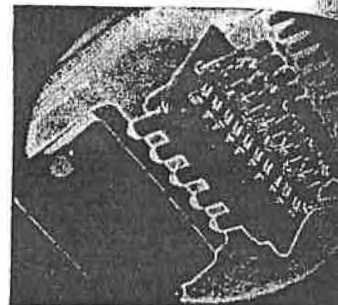
feedwater pump is turned off and on to maintain constant water level. The lowest probe defines the danger point below which water must not fall.

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.

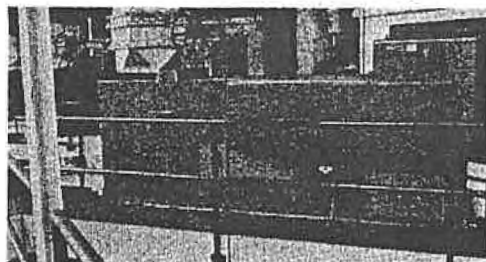
Individual switches are of the knife blade type and are separated



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.

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.

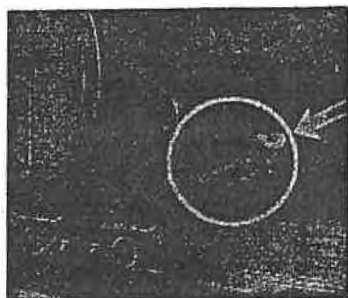
RICHARDSON SCALE COMPANY, Clifton, N. J.
ATLANTA • BOSTON • BUFFALO • CHICAGO • MINNEAPOLIS • WICHITA
NEW YORK • OMAHA • PHILADELPHIA • SAN FRANCISCO • DETROIT • PITTSBURGH • MONTREAL • TORONTO

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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)

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*are pleased to announce that
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BENJAMIN F. SHAW COMPANY

Piping Contractors & Fabricators
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INCREASE PRODUCTION

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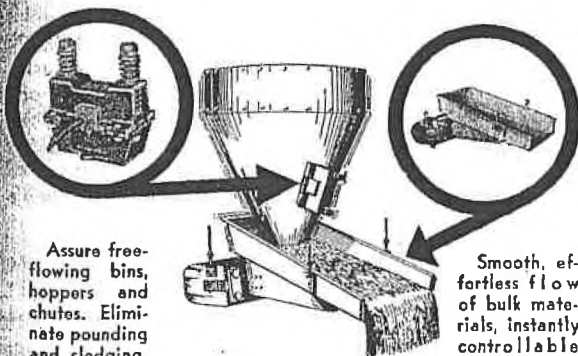
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"Pulsating Magnet"

**ELECTRIC
VIBRATORS**

"Vibra-Flow"

**VIBRATING
FEEDERS**



Assure free-flowing bins, hoppers and chutes. Eliminate pounding and slodging.

Smooth, effortless flow of bulk materials, instantly controllable by turning the rheostat.

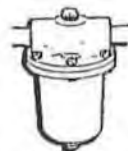
NO MOVING, WEARING MECHANICAL PARTS

Write for free, illustrated folders

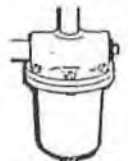
SYNTRON CO., 118 Lexington, Homer City, Pa.



**LET
SUPER-SILVERTOP**
pull the plug on loggy unit heaters



In-Line



Elbow

Water-logged unit heaters pour on the heat when you get the water out and keep it out. Super-Silvertops pull the plug and throw it away! How? By operating on the presence of water instead of its temperature. Presence of water, hot or cold, causes the Anderson Super-Silvertop to discharge.

Super-Silvertop is the inverted bucket trap that gives simplified piping without cored passages or split (pierced) gaskets. It's the trap with guided bucket, easy-to-remove valve and seat, increased capacity per dollar and a proved record of trouble-free operation.

A copy of the 40-page book, "How To Choose A Steam Trap", is yours for the asking. Would you like to have a copy?

THE V. D. ANDERSON COMPANY
1936 West 96th Street • Cleveland 2, Ohio

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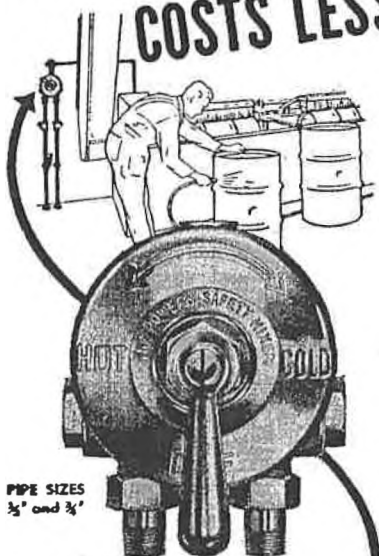
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BEST KNOWN NAME IN
WATER TEMPERATURE CONTROL

**HOT WATER
COSTS LESS**



PIPE SIZES
1/2" and 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

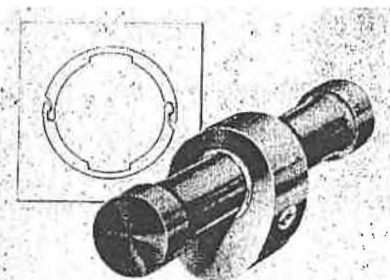
Atlanta, 135 Luckie St. N.W.
Birmingham, Box 27, Homewood
Station
Greensboro, 1034 Jefferson Stand-
ard Bldg.
New Orleans, 309 Vincent Bldg.

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

NEW EQUIPMENT—Continued

Interlocking Retaining Rings

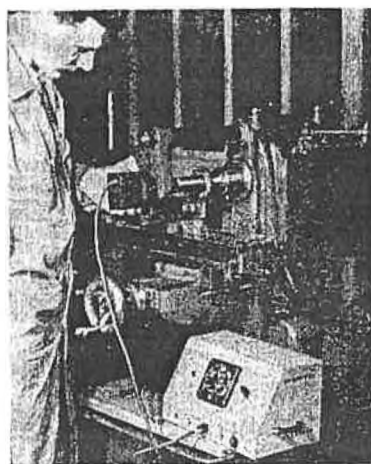
WALDES KOHINOOR, INC., Long Island City 1, N. Y., announces the Truarc Interlocking Ring, Type 5107, which may be fitted over a shaft in a radial direction so that the ring forms a complete annular shoulder of uniform section height around the circumference of the shaft. This eliminates the wide gap 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 100 to 50,000 rpm. Weighing only 18 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, automotive and aircraft engines, pumps, fans, 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, 60 North Willow Street, Montclair, N. J., has developed a self-contained filtering system designed to remove

**659,000
Now in Service**

**HERCULES
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
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EQUIPMENT—Continued

metallic particles in suspension
liquid coolants used on machine

The system consists of a seven gal-
rectangular steel tank in which
strainer unit is mounted.
Inject-A-Flow pump unit is
mounted on the lid of the tank with
pump operating inside the strain-
unit. The pump unit consists of a
precision cast, non-corrosive, centri-
pump connected to the motor
through an extended shaft. Provision
made for recirculating coolant
liquid.

The system is equipped with a
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and a bronze flow control cock,
together with necessary wiring and
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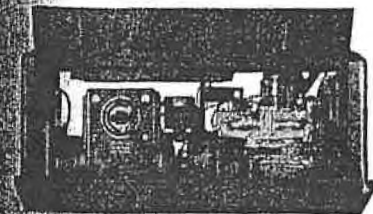
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Electric Arc Welder

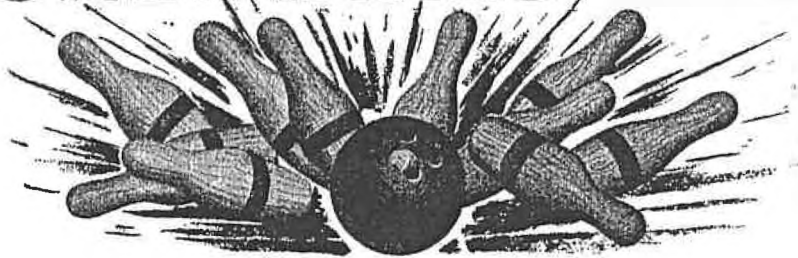
The HOBART BROTHERS COMPANY,
Hobart Square, Troy, Ohio, announces
new, combination drive Hobart
welding machine which consists of
the standard 300 amp generator and
20 hp induction motor mounted on
heavy, solid shaft coupled to a
Chrysler, 6-cylinder industrial en-
gine through an over-running clutch
coupling. This coupling allows the
gasoline engine to drive the welding
generator. However, should the gaso-
line engine be stopped and the gen-
erator be driven by the electric in-
duction motor, the clutch will over-
ride or free wheel. This action is en-
tirely automatic.



The induction motor is wound for
dual 220/440 voltage. The gasoline
engine is furnished with an idling
device and all other features that are
carried by the Standard Hobart, 300
amp gas drive.

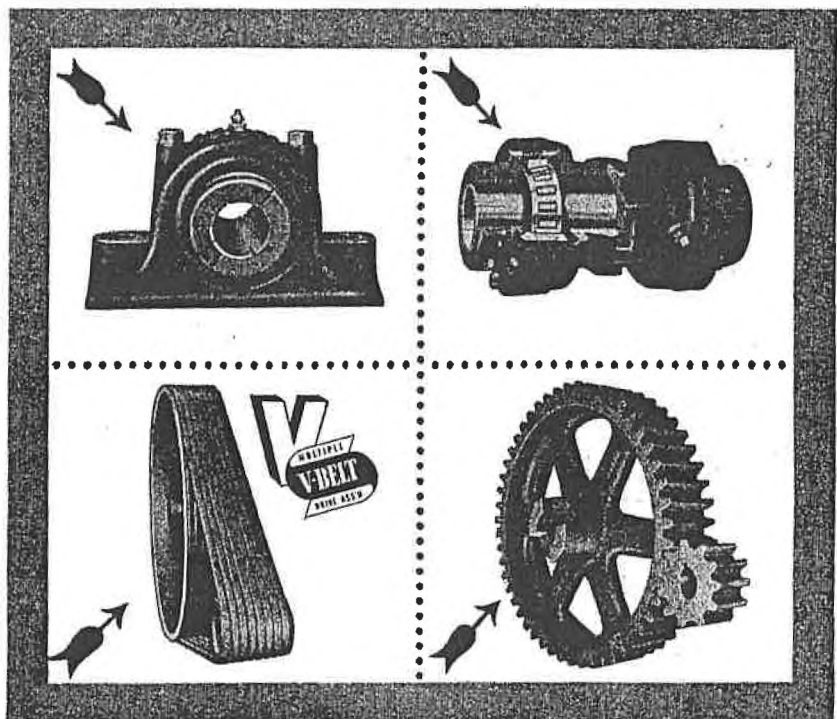
This welder is ideal for locations
where power may fail and the con-
tractor or job welding shop operator
with such a unit is able to take ad-
vantage of the cheapest power avail-
able.

ONLY TAKES ONE!



COMPLETE POWER TRANSMISSION EQUIPMENT FROM
ONE SOURCE SCORES *High* . . . IN EFFICIENCY!

Let Medart's 60 years' engineering experience help you on your transmis-
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neers can choose from the entire field of power transmission equipment.



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- Wire Rope Sheaves
- Cut Tooth Gearing
- Molded Tooth Gearing

MEDART



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
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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 1904, the vicissitude left de Laval with few financial resources. At this time The Separator Company, Ltd., in which de Laval was now no longer an executive, was a thriving concern. The board of its directors realized that de Laval could have lived a life of ease after having developed the patent which it now manufactures, but that he had not felt the virtuous course of action. The company felt the urge to reward de 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 gain, but his failure 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 on intensive development work, de Laval 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 de Laval "lived far ahead of his time." In 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.

A World Standard for Efficiency

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Southern Representatives:

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Boiler Feed Pumps

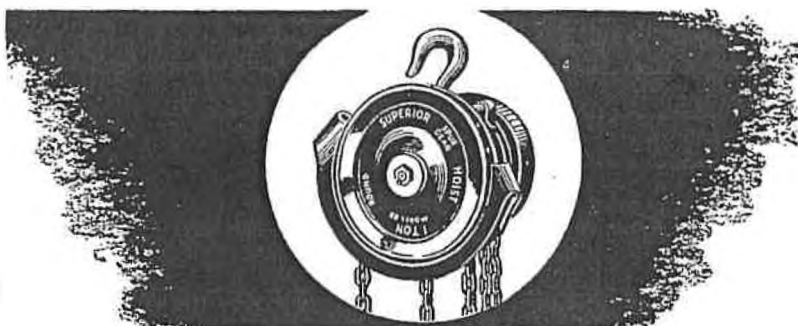
(Continued from page 72)

steam plant. In addition, it is necessary to credit the boiler feed pump with the heat generated in the by-pass orifice through the dissipation of pressure energy.

In all, it can be stated that the losses incidental to the operation of a boiler feed pump with by-pass are almost negligible and are incurred in order to avoid possible damage to the installed equipment and serious interruption of the service provided by the steam power plant. When considered in this light, these losses become a most reasonable premium to pay for the assurance of continuity of service of the boiler feeding equipment.

Such an evaluation of the by-pass losses leads to the recommendation that should the size of the installation dictate against the use of automatic by-pass controls the by-pass should be left open at all flows. It will become necessary to close the by-pass valve only when the full load capacity of the feed pump less the by-pass capacity no longer suffices to fill the demand from the boiler. As a matter of fact, in very small installations and with low pressure operating conditions, the by-pass requirements are so low that they can be added to the required capacity when establishing the design capacity of the feed pump, and no occasion ever arises to close the by-pass. For example, if the boiler feed pump is originally selected to handle 100,000 lbs per hour of 212°F water against a net pressure of 300 psi, the required by-pass capacity is approximately 5,000 lbs per hour, and if the pump is designed for 105,000 lbs per hour, the by-pass may be left open under all conditions.

It is readily recognized that in small installations, this additional design capacity will add little to the cost of the installation, and is well worth the investment. Larger pumps should have automatic controls if possible, and, in any event, should have by-passes arranged in accordance with the good practices indicated in this article.



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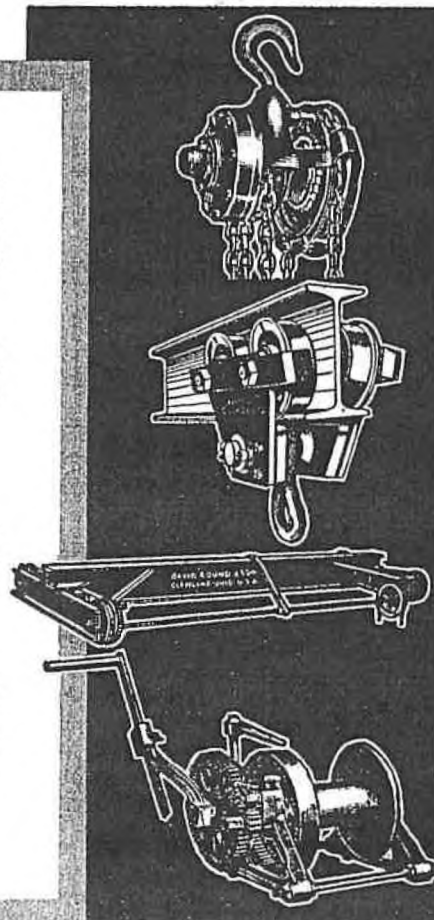
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**WELL WATER SYSTEMS
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CATALOGS AND BULLETINS

(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 A.C. 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 Cellor 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. **CELLOR TOOLS**, division of Clark Equipment Company, Buchanan, Michigan.

3097 ELECTRICAL EQUIPMENT—Catalog No. 40-1, 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 the inherent stability of organo-silicon compounds. **DOW CORNING CORPORATION**, Midland, Michigan.

3099 PIPE AND FITTING MATERIALS—Chart, 4 pages—'Chart of Pipe and Fitting Materials', deals with carbon, intermediate alloy, stainless and special analysis steels, and covers A.S.T.M. specifications, chemistry, service limitations, and welding procedure. **TUBE TURNS**, Louisville 1, Ky.

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

4001 CONTROLLER—Bulletin 331—Describes Model 40 Controller, latest addition to Foxboro line of instruments for process control. Large illustrations explain many features of design which make this model a wholly new instrument. **FOXBORO COMPANY**, Foxboro, Mass.

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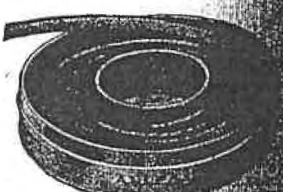
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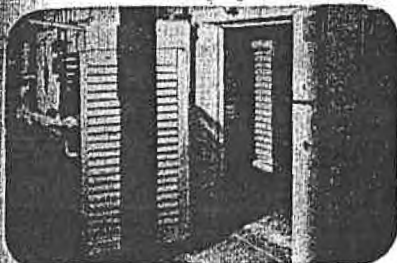
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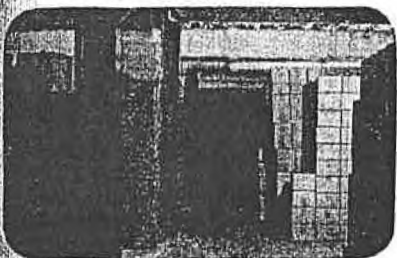
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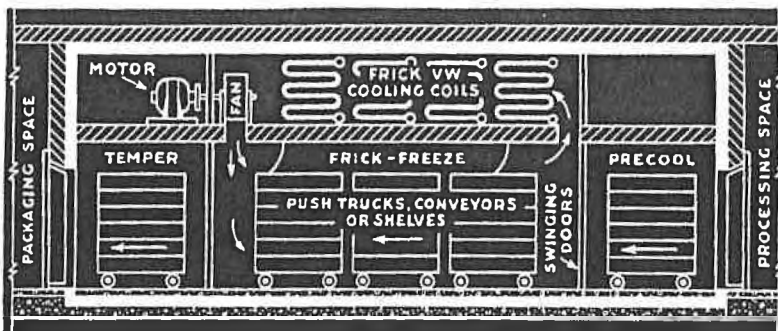
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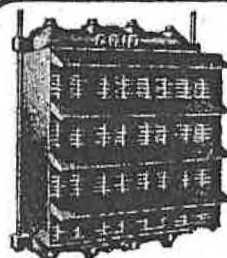
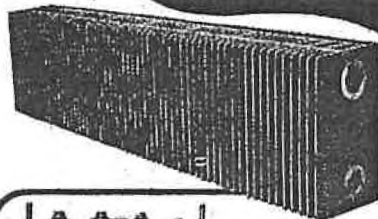
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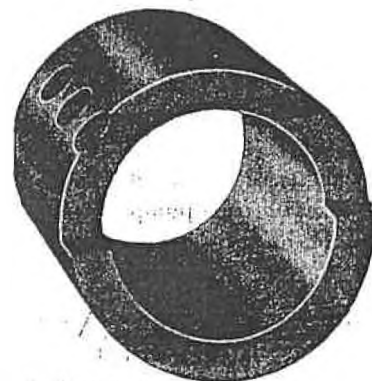
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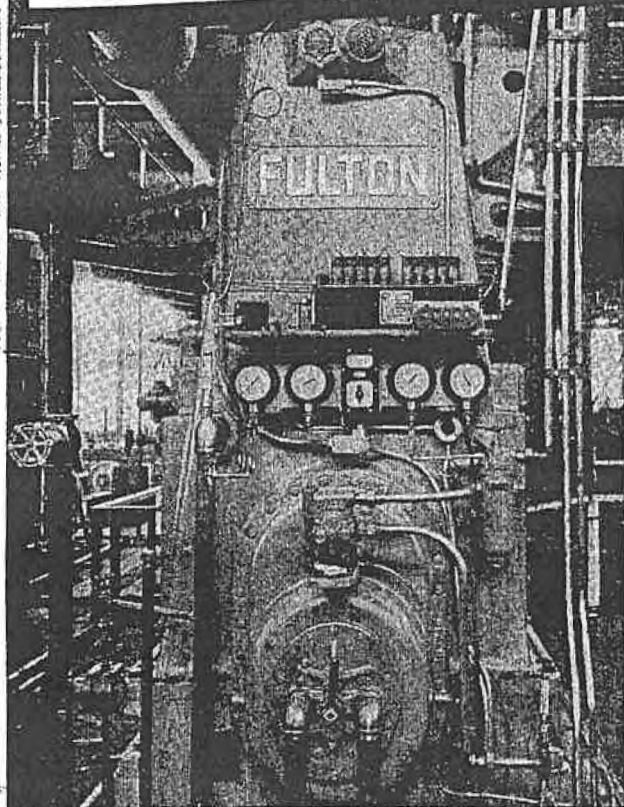


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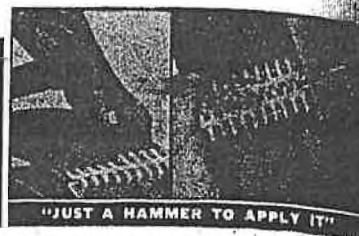
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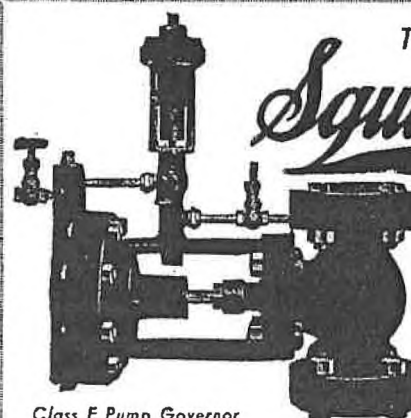
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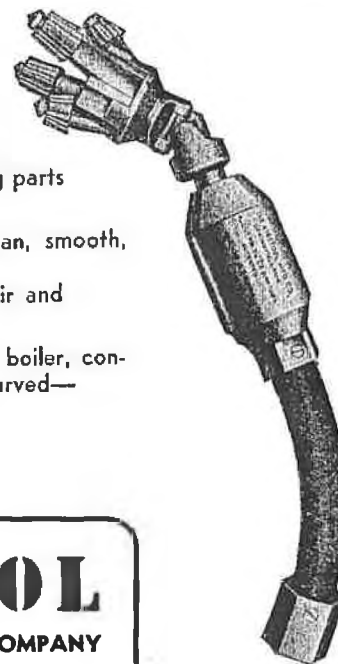
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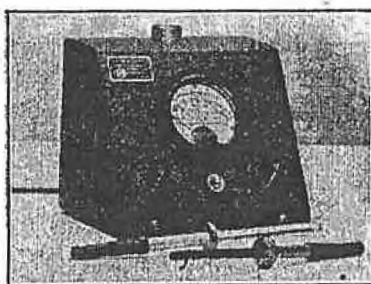
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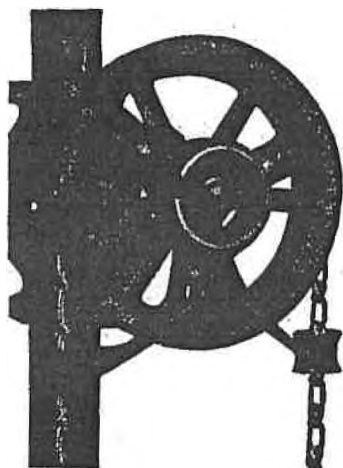
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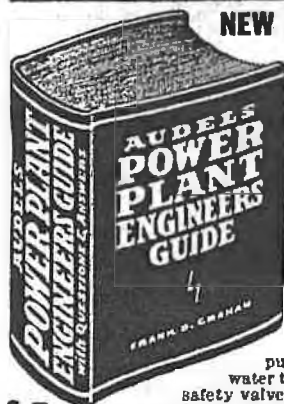


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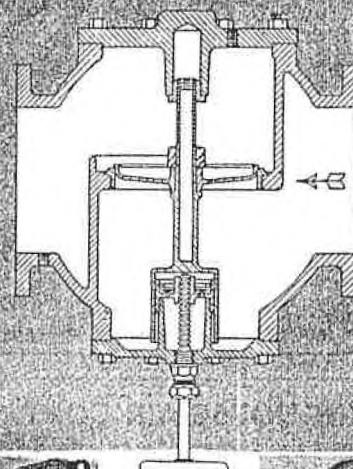


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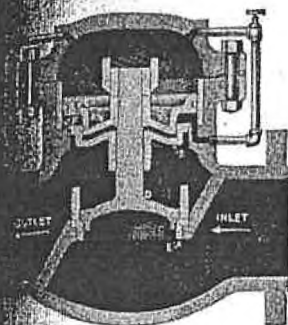
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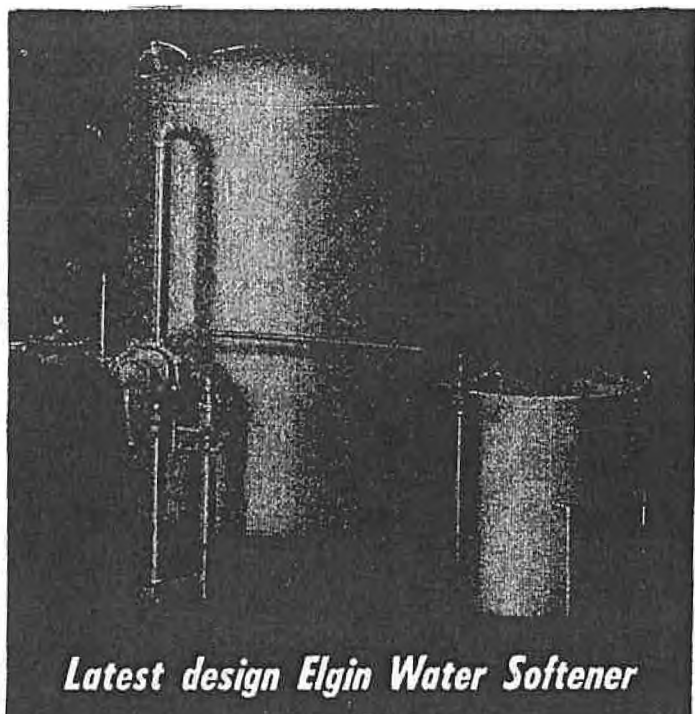
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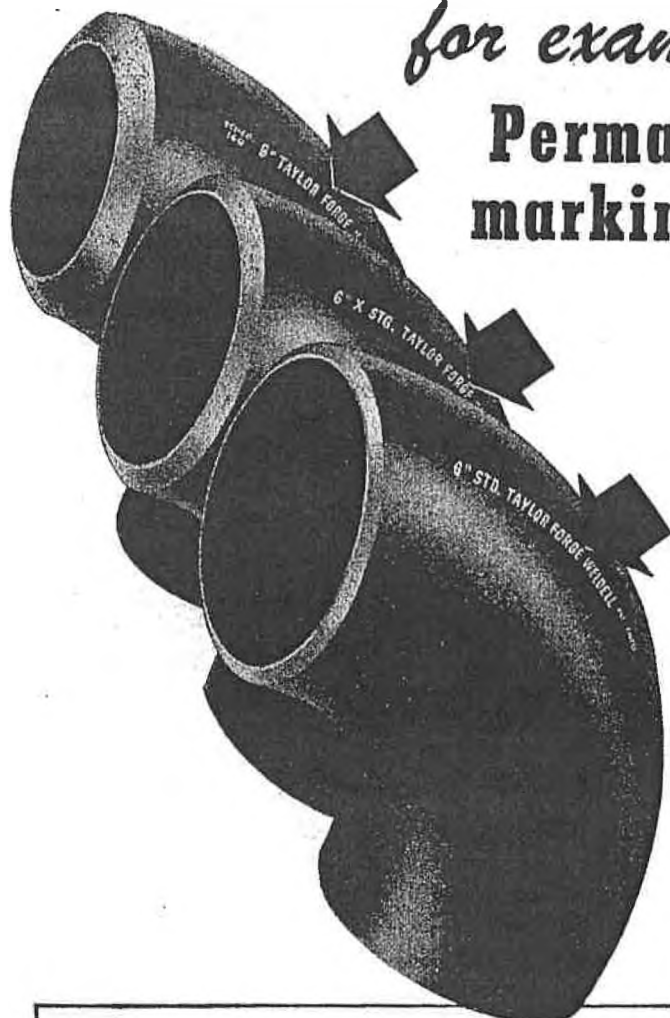
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Jenkins PRACTICAL PIPING LAYOUTS 16

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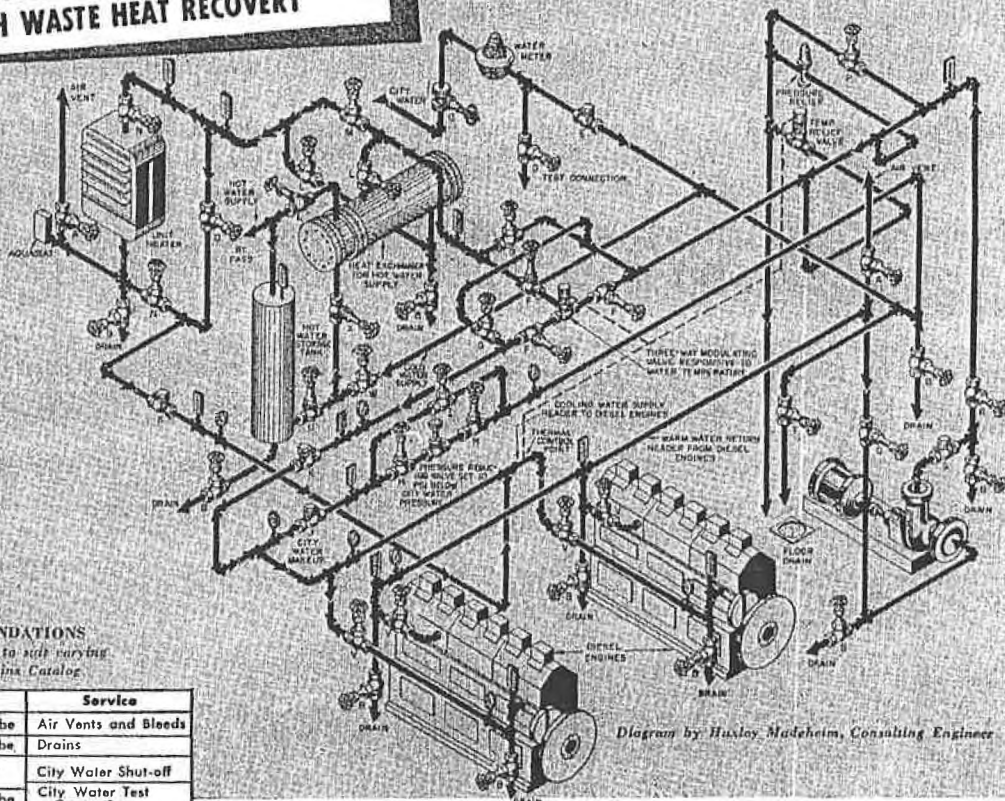


Diagram by Huxley Madheim, Consulting Engineer

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Quan.	Jenkins Valves	Service
2	Fig. 106-A Bronze Globe	Air Vents and Bleds
9	Fig. 106-A Bronze Globe	Drains
1	Fig. 677-A O. S. & Y. Bronze Gate	City Water Shut-off
1	Fig. 106-A Bronze Globe	City Water Test Connection
1	Fig. 92 Bronze Swing Check	City Water Backflow Prevention
3	Fig. 47 Bronze Gate	3-way Mod. Valves Shut-off
2	Fig. 106-A Bronze Globe	3-way Mod. Valves By-pass
2	Fig. 47 Bronze Gate	P.R.V. Shut-off
1	Fig. 106-A Bronze Globe	P.R.V. By-pass
1	Fig. 92 Br. Swing Check	Prevention of back-flow into City Water
2	Fig. 92 Br. Swing Check	City Water Check-off
2	Fig. 106-A Bronze Globe	Heat Exchanger Shut-off Control
1	Fig. 106-A Bronze Globe	Heat Exchanger By-pass
2	Fig. 106-A Bronze Globe	Unit Air Shut-off and Control
1	Fig. 106-A Bronze Globe	Unit Air By-pass
1	Fig. 106-A Bronze Globe	System Manual Bleed
1	Fig. 47 Bronze Gate	Pump Suction Shut-off
1	Fig. 106-A Bronze Globe	Pump Discharge Shut-off
1	Fig. 92 Br. Swing Check	Pump Discharge Check
1	Fig. 106-A Bronze Globe	Floor Drain Trap Fill
1	Fig. 47 Bronze Gate	Hot Water Tank Shut-off
4	Fig. 106-A Bronze Globe	Engine Cooling Water Control
1	Fig. 106-A Bronze Globe	Cold Water Supply
1	Fig. 47 Bronze Gate	Cold Water to Heat Exchanger

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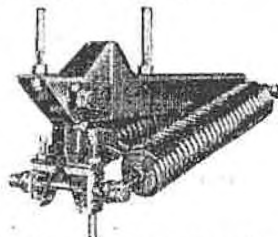
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