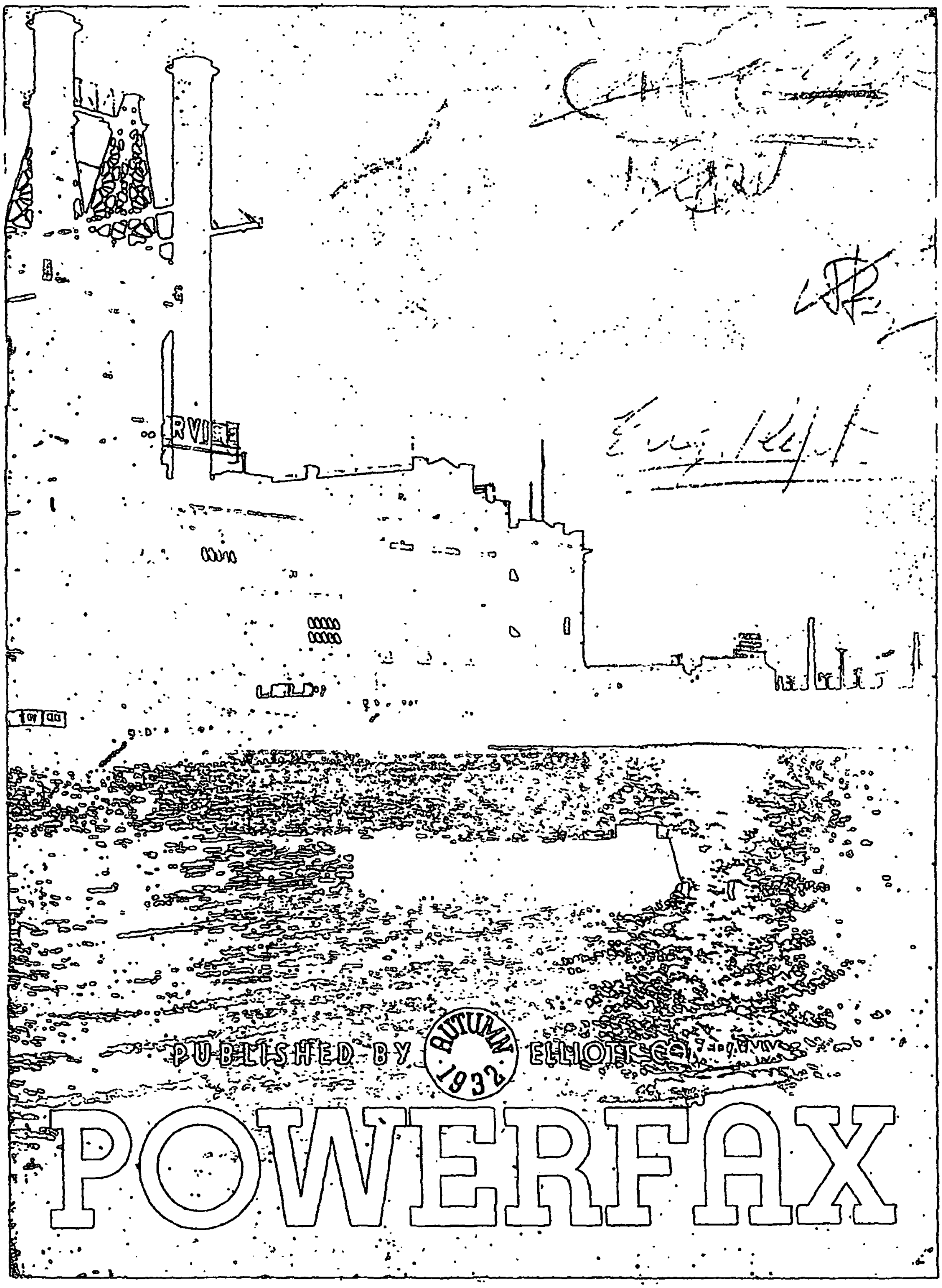
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ELLIOTT COMPANY

PITTSBURGH, PA.

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Manufacturers of Power and Industrial Plant Equipment. A complete list of products manufactured by Elliott Company is given on the back cover of this issue.

A list of District Offices and their addresses is also shown on the back cover. These offices maintain engineers, experienced in Power Plant operation and maintenance, who will be glad to co-operate with you.

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POWERFAX is a magazine of information for engineers and operators of steam and electric power plants, devoted mostly to the field covered by power equipment as manufactured by Elliott Company and its associates, The Lagonda Manufacturing Company, and Liberty Manufacturing Company.

POWERFAX

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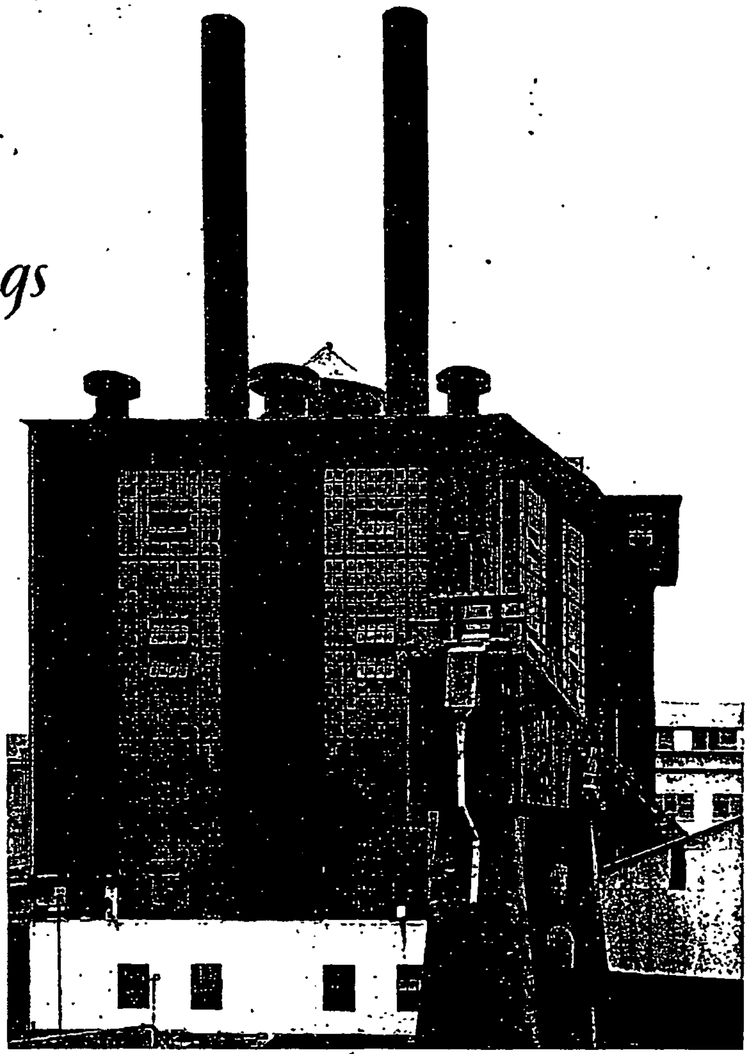
By D. L. BARBOUR
Turbine Engineering Department
Elliott Company, Jeannette, Pa.



Exterior of the new boiler house of the Philip Carey Mfg. Co., Plymouth Meeting, Pa.

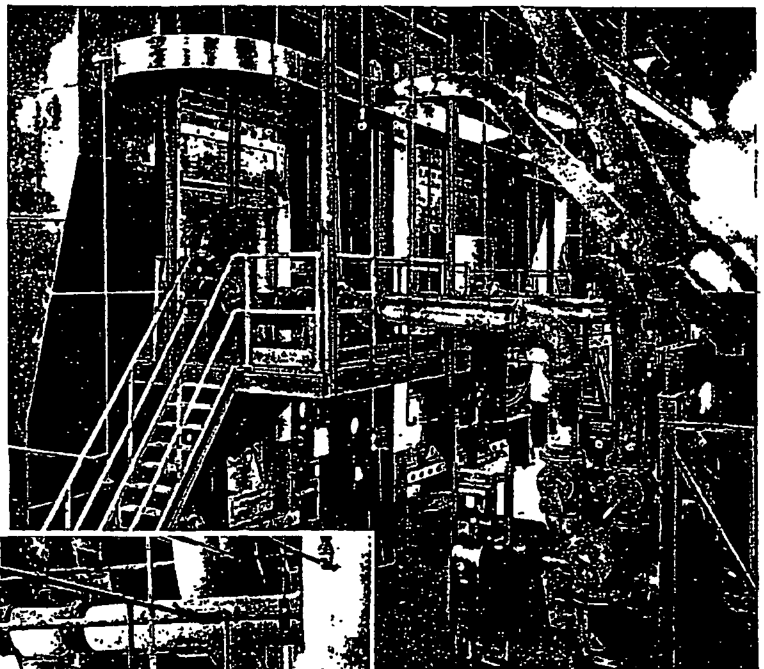
THE PHILIP CAREY MANUFACTURING COMPANY, PLYMOUTH MEETING, PA., REQUIRES UP-TO-DATE BOILER AND POWER PLANT

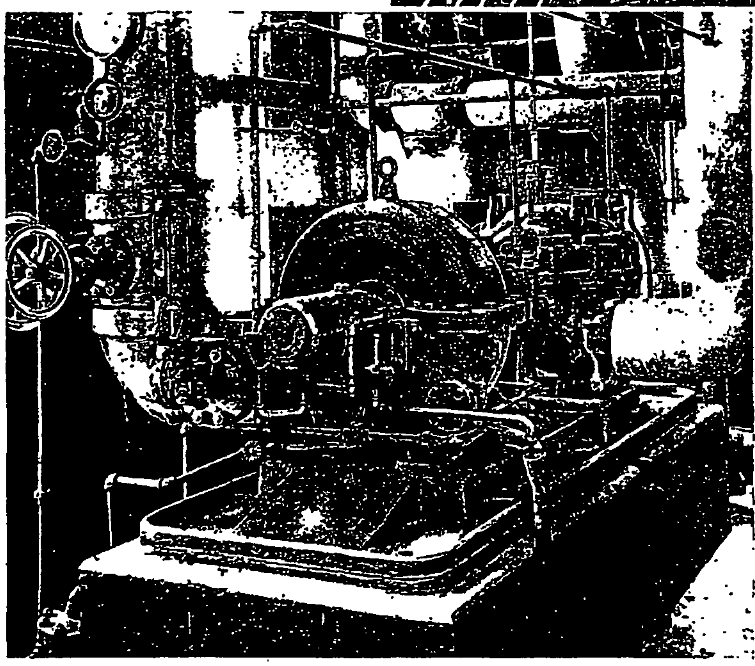
THE interrelation of industry is well illustrated in the case of the Philip Carey Manufacturing Company's plant at Plymouth Meeting, Pa. This plant makes pipe covering materials mainly for use in power plants. In turn, they require a considerable amount of power in their manufacturing processes and have recently installed a modern boiler plant and turbine-generator unit. Naturally, not many heat units are wasted in this plant due to any lack of proper heat insulation.

The utilization and production of power in the several Carey plants is unique and interesting. Their Canadian asbestos mining properties, which are among the world's largest producers of asbestos, are probably the only ones completely electrified. Not only is the mill itself operated by electric power, but all quarrying and mining is carried on by electric shovels and the ore is hauled by electric locomotives. The main plant of the Philip Carey Manufacturing Company is located at Lockland, Cincinnati, Ohio. Here they produce residential and commercial roofing materials, waterproofing felts and pitches, heat insulating products, asphalt industrial flooring, and asbestos products of all kinds, all of which have a wide use in the building industry. This plant has the most unique power plant ever installed by industry.

It has a steam boiler plant capable of operating at 1840 lbs. steam pressure and reciprocating engines operating at 1400 lbs. steam pressure.

While the Plymouth Meeting plant produces magnesia powders in the form of carbonates and oxides, both technical and pharmaceutical, the greatest part of its output consists of heat insulating materials—asbestos products for temperatures up to 300°F.; 85% magnesia products for temperatures up to 550°F.; Hi-Temp No. 12 products for temperatures up to 1200°F.





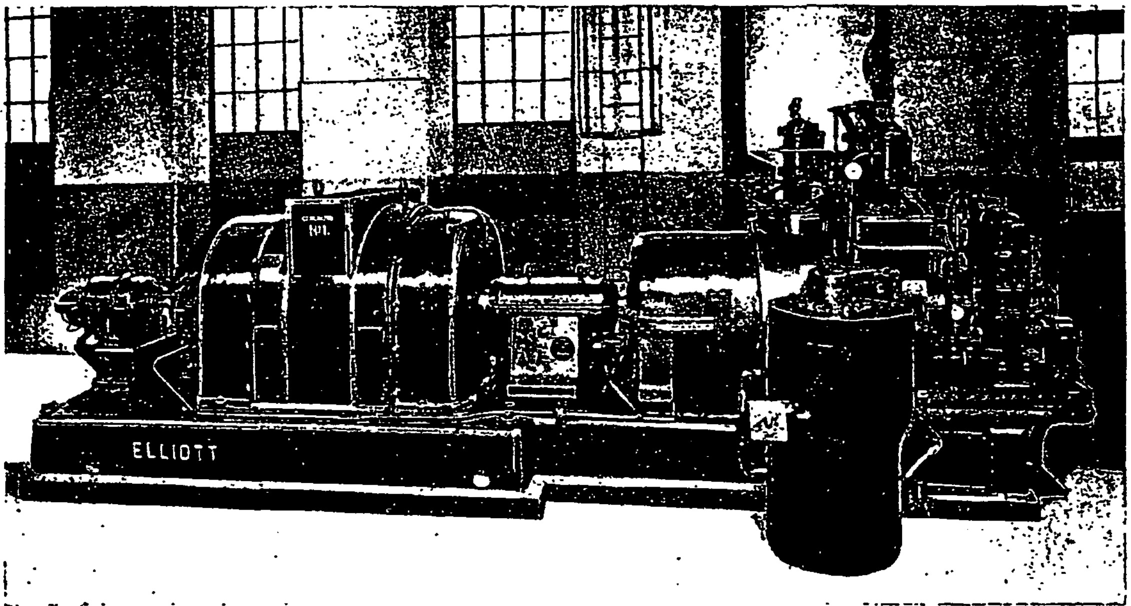
Interior view in the boiler house, showing coal pulverizers and burners.

Left—*An Elliott 110-hp. turbine drives one of the two boiler feed pumps. This turbine has a special excess pressure governor which regulates speed according to boiler requirements.*

The raw material from which this line of heat insulating materials is made is mostly dolomite rock, which is obtained from the company's quarries adjacent to the manufacturing plant. The rock is first hand-broken to uniform size. It then goes to kilns, where it is burned with coke, in which process it gives off large quantities of carbon dioxide gas which, in turn, is used in one of the next steps of the process for the precipitation and separation of the magnesia in the form of magnesium carbonate which constitutes 50 per cent of the mineral content of the rock.

All plant operation at Plymouth Meeting is under rigid chemical control, with the result that the quality of the product is uniformly maintained at the highest standard, and the company takes pride in the strength and insulating qualities of the finished products which go back to the high quality of fibre and method of manufacturing.

In the operation of the plant, considerable electric power and steam are required. The power load consists mainly of some 280 induction motors scattered throughout the plant. Fifty-six of these motors are used in driving drying-room fans, and there are various pumps, conveyors, blowers, mixers and power-house auxiliaries which require motors varying in size from fractional horsepower up to 100 hp. The connected load is 1000 kw., and peak loads



The Elliott 1000-kw. bleeder turbine-generator unit has been running 24 hours a day for more than two years.

of 950 kw. have been recorded. Plant power factor averages 88 per cent.

In manufacturing processes requiring considerable amounts of electrical power as well as process steam, it is frequently determined by means of an engineering analysis of operating costs, that very substantial savings can be made by installing a modern high-pressure boiler plant and turbine-generator units of the bleeder type. Naturally, the characteristics of the various necessary elements of the installation must be very carefully chosen, after considering alternate possible solutions of the problem, to fit the power and process steam requirements of the manufacturing plant.

In 1928, the Philip Carey Manufacturing Company commissioned W. E. S. Dyer, Consulting and Designing Engineer, Philadelphia, to make an engineering survey of the plant at Plymouth Meeting. Previous to this investigation, steam had been generated at 150 lbs. gauge pressure in seven obsolescent boilers for driving numerous CO_2 compressors, pumps and other equipment, the balance of the low-pressure steam required for process being obtained by means of reducing valves direct from the boilers. Electric power was purchased.

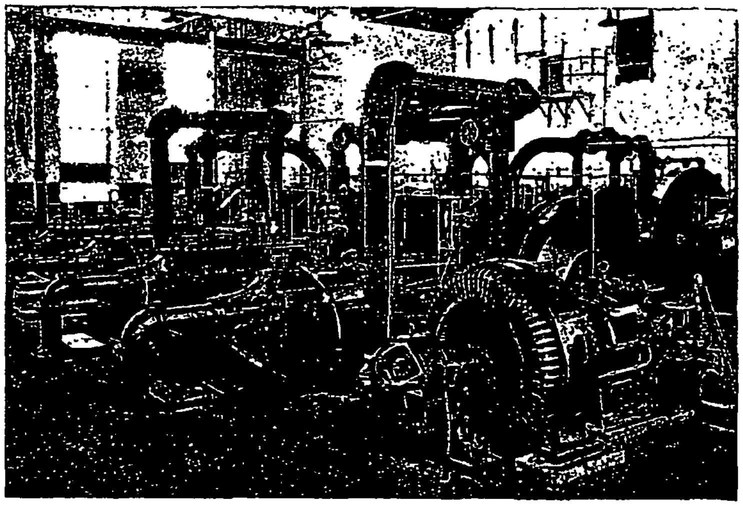
As a result of this survey, Mr. Dyer recommended the installation of a complete new high-pressure boiler plant, generating steam at 350 lbs. gauge, with a small amount of superheat, and a 1000-kw. non-condensing bleeder type turbine-generator unit, designed for 325 lbs. initial pressure, bleeding steam at 145 lbs. and exhausting at 5 lbs. gauge. The new equipment went into regular operation early in 1929.

The new boiler plant is located about 150 feet from the power house, and is thoroughly up-to-date in design and equipment. Screened bituminous coal is dumped from the cars to a conveyor leading to a covered storage yard equipped with a drag line, and passes through a hopper to the crusher and thence by conveyor to the 550-ton capacity bunker at the top of the boiler house, where it is distributed by a weigh larry. From the bunker, the coal flows to three motor-driven pulverizers on the operating floor. There are two 1000 b.h.p. steam generating units, only one of which is required for the maximum steam load. The boilers are equipped with air preheaters, integral economizers, water-cooled furnaces, steel-clad insulated settings, soot blowers, motor-driven forced and induced draft fans, automatic draft control and feed water regulators. There are two boiler feed pumps, one of which is motor-driven and is ordinarily used, while the other, driven by an Elliott 110-hp. turbine, is held in reserve.

About 55 per cent make-up feed water is required, since a considerable part of the process steam is not available as condensate. The raw water comes from springs located in a disused quarry, and is very hard. For this reason a rather elaborate hot process feed water treatment was installed. A continuous blow-down system is employed in connection with a heat exchanger, which raises the raw water temperature to about 80°F. Thence it passes to an open heater, where the temperature is raised to about 220°F. by the return condensate from the dryers, and drains by gravity to the sedimentation tank and then to the hot well. From there it is pumped through the filter tanks to the deaerator in the boiler room, and thence through the feed pump to the boilers, still at about 220°F. An overhead storage tank floats on the line.

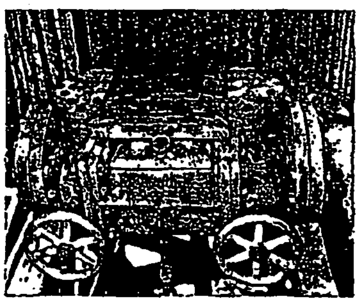
The piping between the boiler house and the power house is carried on overhead supports, and is provided with adequate heat insulation and expansion bends.

The power house contains the generator units, CO_2 compressors and an air compressor. The generating units are all alternating current, 3 phase, 60 cycles, 480 volts. A 400-kw. geared non-condensing turbo-alternator was purchased for additional emergency capacity, but it is practically never operated.



General view in the compressor room.

The Elliott 1000-kw. turbine-generator unit, with direct-connected exciter, takes steam from the high-pressure header at 325 lbs. gauge, and exhausts to the process steam line at 5 lbs. gauge. It is designed for automatic extraction, at 145 lbs. gauge, constant bleeder pressure, of a maximum of 70,000 lbs. per hour at full load. In order to obtain close speed regulation with fluctuating bled steam demand, and also to make it entirely suitable for future operation in parallel with other units, it is provided with a speed compensated valve gear, in which the bleeder pressure regulator is interconnected with the constant speed governor. Provision is also made against "over bleeding", to prevent the unit from losing its electrical load in case of a bled steam demand beyond the capacity of the unit. This unit has been in service 24 hours a day for over two years, and is shut down only for a few hours once each month for cleaning oil and water strainers, testing the emergency governor, and routine inspection. In addition, it is given a complete internal inspection once each year. The lubricating oil is changed completely every six months, and about 2 gallons make-up are added each week.



All water used in the plant passes through this Twin Strainer, located in a shed out in the quarry.

Seven recriprocating gas compressors and an air compressor in the power house, and also hoisting engines and various steam pumps in the manufacturing plant are operated on 145-lb. steam bled from the Elliott turbine. A reducing valve is provided for emergency use between the 325-lb. and 145-lb. headers. The main turbine as well as the compressors, standby generating units and steam pumps, exhaust at 5 lbs. gauge to the process line supplying the dryers and other manufacturing equipment. Under normal production conditions, the heat balance of the entire plant is excellent.

The decision to put in this new power plant equipment of course rested on the definite prediction that the savings realized would retire the whole investment in a favorably short period of years. The results of the first two years of regular operation of the new boiler plant and Elliott turbine-generator indicate that the predicted rate of investment retirement is being secured.

A New Power Plant for a Medical School

Baumes-McDevitt Company
Consulting Engineers
Saint Louis, Missouri

Exterior of Euclid Avenue Power and Service Station of Washington University School of Medicine, St. Louis, Mo. In the rear, the thirteen-story McMillan Hospital, one of a number of hospital buildings covering approximately eight blocks, served by the Station.

THE EUCLID AVENUE POWER AND SERVICE STATION OF THE WASHINGTON UNIVERSITY SCHOOL OF MEDICINE, SAINT LOUIS, MISSOURI

By C. L. DRAPER, *District Manager,*
Elliott Company, St. Louis, Mo.

FOUNDED about seventy-five years ago, the Washington University School of Medicine has grown to be one of the largest and best known institutions of its kind in this country. In addition to the School of Medicine, there are various hospital units, including a School for Nurses and the Shriners' Hospital for Crippled Children, in this group. The institution is ideally located where South Kingshighway and Euclid Avenue meet, directly across the boulevard from Forest Park.

Long ago the trustees recognized the importance of a reliable independent source of electrical energy and steam for heating. Consequently, there has been a steady increase of these facilities to keep up with the natural growth of the institutions. In 1930, with the addition of several new buildings and the demand for additional equipment for research work, it was decided to rebuild the power and service station and install new and up-to-date machinery, replacing the old equipment which had served since about 1912.

Baumes-McDevitt Company, Consulting Engineers, of Saint Louis, were retained to make a study of the situation and report on the best procedure. After making their recommendations, this firm was employed to draw up designs, write specifications, and supervise the installation of the new apparatus.

The principal additions included: four 550-hp. multi-drum boilers, with chain-grate stokers, forced draft fans, coal and ash handling equipment, boiler feed pumps and all auxiliary equipment; a 1250-kw. non-condensing turbo-alternator; switchboard; three 80,000-

gallon zeolite water softeners and other miscellaneous apparatus for domestic hot water service; two 50-ton and one 40-ton motor-driven ammonia compressors and condensers, brine coolers and pumps; one 260,000 lbs. per hour Elliott deaerating feed water heater.

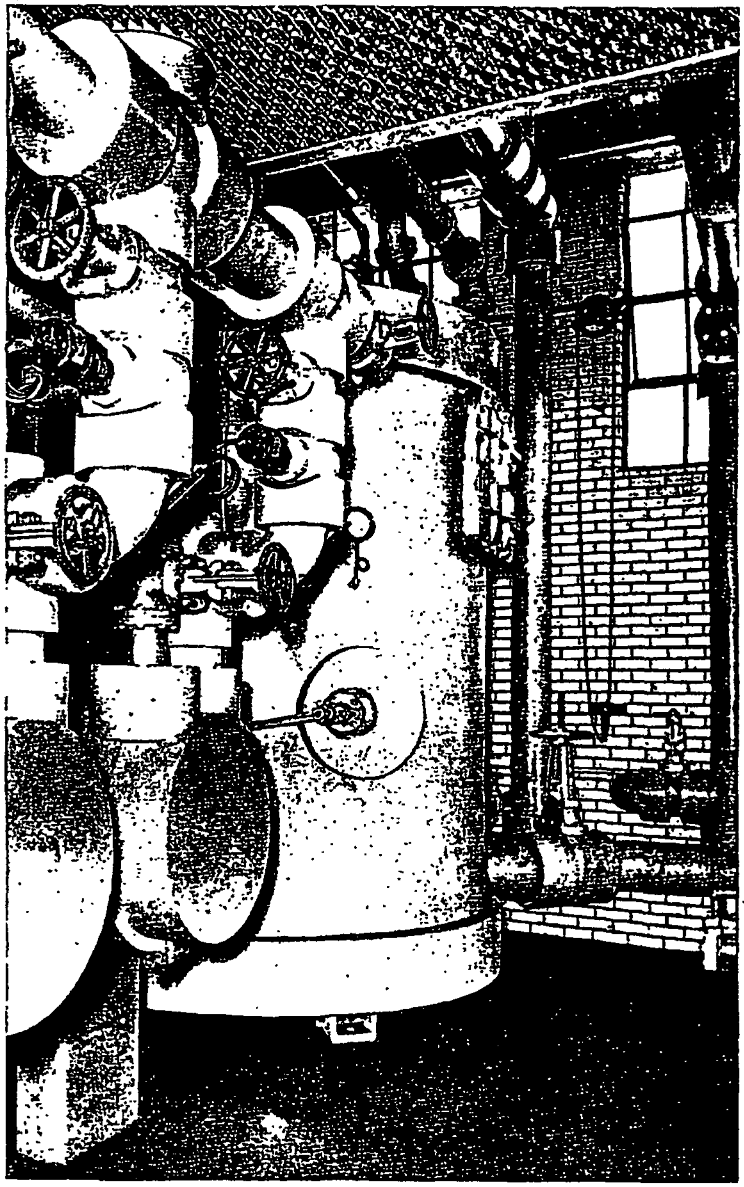
It was necessary, under the direction of the Engineers, to remove three old boilers and re-locate two existing 600-kw. non-condensing turbo - alternators. This was accomplished without interrupting the service at any time.

Steam is generated at 250 lbs. gauge pressure for operation of the main generating units and high-pressure steam auxiliaries which exhaust against a back pressure of 1.5 lbs. gauge. Exhaust steam has many uses, as it is used for heating the buildings, for heating domestic hot water and water for the laundries. High-pressure steam is used for cooking, sterilizing and making up any deficiency in the low-pressure system. All hot water for the laundries, of which there are several, is softened and heated in the main service station in order to utilize the exhaust from the main generating units to the fullest advantage. The heat balance, as estimated before the plant was built, has been very effectively maintained, especially during the non-heating season.

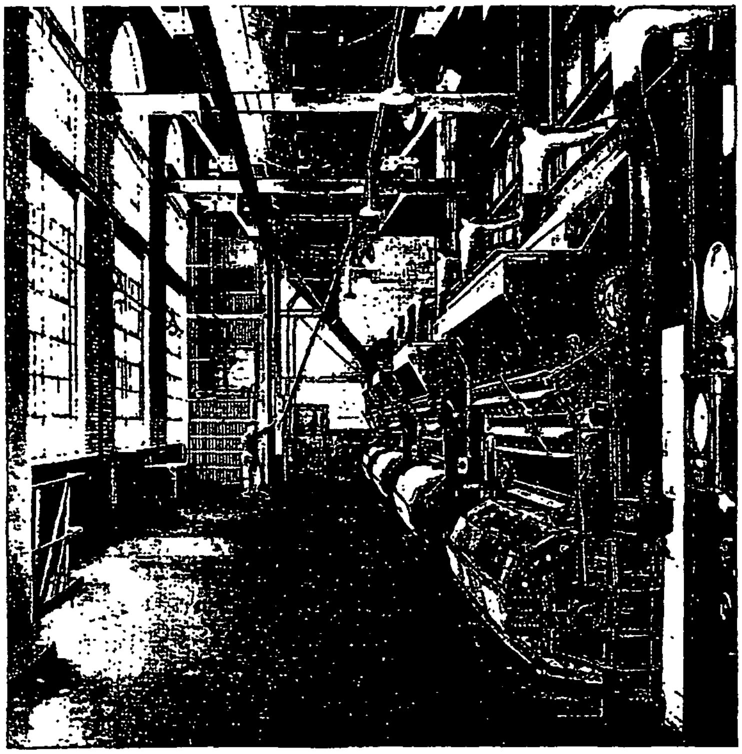
Condensate returns provide approximately 85 per cent of the water going to the boiler feed water heater. Condensate from the heating systems and hot water generators is returned to a large sump in the plant, and from this point is pumped to a surge tank located about 15 feet above the Elliott deaerating feed water heater. The surge tank is provided with a metered make - up connection from the zeolite softeners. The water from the surge tank flows by gravity into the heater under the control of the regular float-operated heater inlet valve.

All water is metered between heater and boiler feed pumps, and each boiler has a steam flow meter. All distribution steam lines are completely equipped to measure steam supplied to station auxiliaries, to the main generating units, make-up steam to heating system and steam distribution to various buildings and laundries.

Production records are obtained



This Elliott 260,000 lbs. per hour vertical deaerating heater gives most efficient feed water heating, and guarantees the Euclid Avenue Station against corrosion troubles due to oxygen and other gases.



Firing aisle in the boiler room.

daily from meters, which record the service supplied each building, in order that each institution can be charged with its proportional share of the plant operating costs. Complete daily records are kept and an analysis made each month on operation and costs.

Requirements of this station are: steam—approximately 120,000 lbs. per hour: electrical energy—about 1250 kw., and the equivalent of 100 tons refrigeration to serve the cold storage space throughout the various buildings (at present a little more than 25,000 cubic feet), as well as cold drinking water service for the entire group. The present peak requirement for domestic hot water service amounts to about 25,000 gallons per hour.

We are indebted to the Baumes-McDevitt Company for the information here given and for the photographs reproduced.

It might further be stated that in addition to the Euclid Avenue plant, described above, the Washington University also operates a Campus plant, located several miles away, where an Elliott 300-kw. turbine-generator has been in service for a number of years.

Savings were 51% instead of 22%

The leading article in the June, 1932 POWERFAX told the story back of the power and heat supply of an unnamed industrial plant. In analyzing the cost of a new plant and balancing this cost against savings, the statement was made that the existing steam plant was inadequate and that $80,000 would have been required for steam plant changes and additions in any event. Then it was stated that the additional investment to install a more economical plant was $140,000. It should have been pointed out that this $140,000 was the total new investment to cover both steam and power generation equipment. This would mean, therefore, that the difference between $140,000 and $80,000, or $60,000, would be the actual investment chargeable against power generation.

Therefore, on an estimated saving of $30,665, the saving to be expected was 51.2%, rather than 22%, as stated in the article. After the first year's operation, as stated at the end of the article, the actual savings were $31,200, or a little better than anticipated, and if normal plant operation had been possible, the saving would surely have been $40,000, or a saving of 66% on the capital investment of $60,000, which shows the profitable nature of the revamped power plant.

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FRONT COVER

Our Photographer gives us this time a pleasing composition of a big power plant looming up across the water. If there is anything that seems appropriately to set off the awe-inspiring lines of a typical modern central station, it is the view with a foreground of water. A strategic location from the standpoint of economics, waterside also seems appropriate to the casual eye.

• • •

PERSONNEL CHANGES

Mr. H. D. Storer, who for many years has been manager of the Marine Department of Elliott Company and located in New York, has now assumed also the management of the New York District Sales Territory. Mr. Storer's office location remains at 2905 Transportation Building, 225 Broadway.

At the Ridgway Works, the following personnel changes have been announced. Mr. M. E. Thompson, consulting engineer, Mr. A. B. Owen, engineer, and Mr. W. H. Johns, shop superintendent have been retired from active service. Mr. R. C. Kase, formerly manager of the Service Department becomes shop superintendent and Mr. H. A. Erb, formerly of the Blower Department assumes the duties of Service Department manager.

BRAIN TEASERS

Naturally, we had worked out the little problem presented in the Summer issue of Powerfax before publishing it, but Mr. R. C. Cox, 9821 South Leavitt Street, Chicago, Illinois, worked up and sent in the solution of this problem in a most compact form. It is so neatly done that we give it below. You remember the problem. A courier started from the rear of a 20-mile infantry column, delivered a message to the head, returned to the rear. When he reached the rear, it was at the point occupied by the head of the column when he started his trip. The question was how far did the courier travel. Here's Mr. Cox's solution:

> "By the time the courier reaches the head of the column, it has moved up some distance, x. The courier has now traveled 20 + x miles. He returns, retracing the distance x to the point where the head of the file formerly was. He has now covered 20 + 2x miles in the same time that the infantry has covered 20 miles, or a ratio $\frac{20+2x}{20}$.
>
> "While returning over the distance x, the column has moved up 20 − x miles, or a ratio $\frac{x}{20-x}$. These two ratios are necessarily equal, so the equation is $\frac{20+2x}{20} = \frac{x}{20-x}$. Solving, $x = 14.14$; and $20 + 2x = 48.28$, the distance in miles which the courier traveled."

Here's an intriguing little problem which is not so tough, if you go at it right:

> A number ends in the figure 2. Move the figure 2 from the end to the beginning of the number. The number is now just twice as great as the original number. What was the original number?

After you have worked this out, try the same thing with the number ending in something else, say, the figure 9. You will discover something.

IN THIS ISSUE

Two Deaerator installations are mentioned. The one at Washington University is a power plant deaerating heater. It serves as an efficient feed water heater and also prevents corrosion in the boilers. The unit at Indiana University Hospitals is a domestic hot water deaerator, and it solves the corrosion problem in a hot water piping system. The two deaerators are considerably different, being designed for different types of service.

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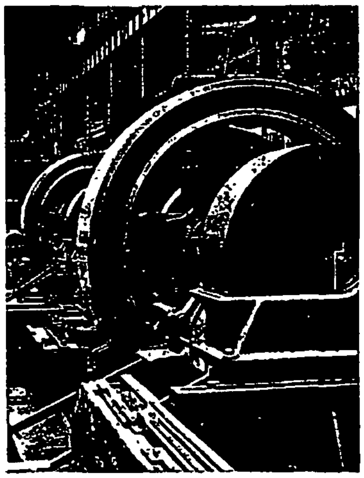
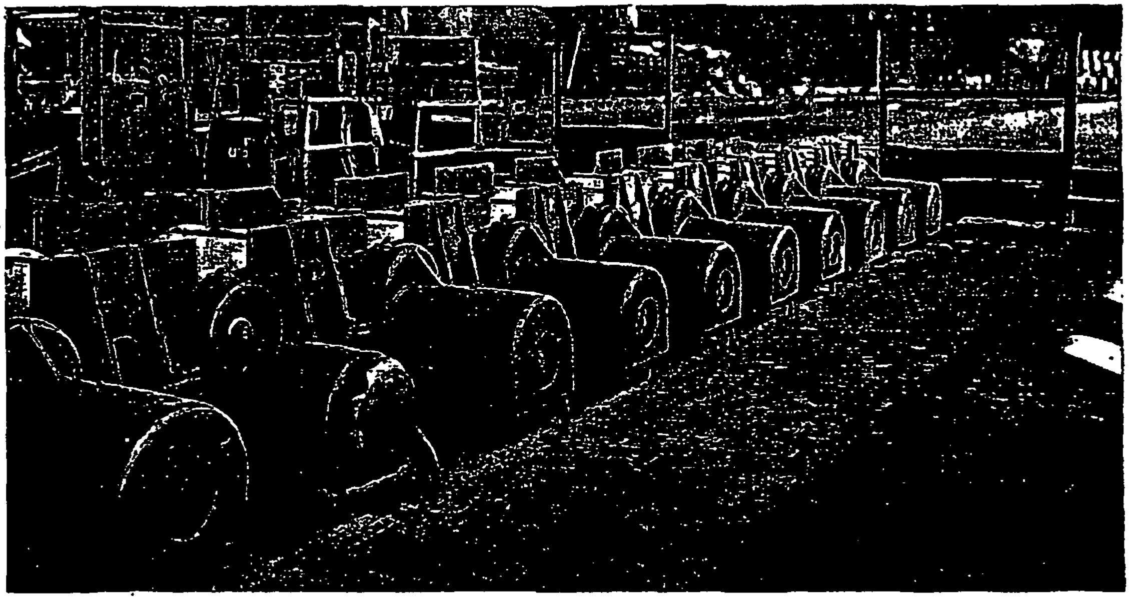


ON THE TEST BLOCK

Two Elliott engine-generator units. Every such unit is completely erected and fully tested in the shop. Often these tests are run for several days under full and overload conditions, which are often more severe than any that will ever be encountered when the unit is in actual service.



A view of the individual roll drives on runout tables, taken from the finishing stand. 87 motors and 87 rolls comprise this installation.

Powering Motors on Hot Strip Mill

INDIVIDUAL ELECTRIC DRIVE AFFORDS RELIABILITY AND FLEXIBILITY FOR RUNOUT TABLES

By V. M. BEELER, *Sales Engineer*,
Elliott Company, Cleveland, Ohio

IN the steel industry the modern hot strip mill has imposed upon it a demand for a considerable variety of sheet. In a 16″ mill for instance, thickness specification in different runs may range from .050″ to .250″—with length and width of strip likewise varying between wide limits depending upon the exact requirements of the individual order. In a continuous mill of this sort, operating at a selection of relatively high speeds, electric drives having considerable flexibility are most essential. Frequent stopping and starting, with minimum time loss, and close speed regulation are fundamental for economical production.

From the drive standpoint a typical 16″ hot strip mill may be considered in three sections.

(1) *The Main Rolls*—In these rolls or stands, of which there may be eight to ten in succession, the steel is shaped from the billet to the strip of a specified gauge thickness and width. The speed of these rolls differs one from the other, the rolls running faster as the strip gets thinner. The main roll driving motors range in horsepower from approximately 1500 to 5000 each and may be direct-current adjustable speed or alternating current with adjustable frequency through modified secondary control to get speed change. All rolls in this set have a speed range of approximately 1.75:1, the last roll running fastest at a speed range generally of 150 to 250 r.p.m. with a lineal speed of the strip from 635 to 1060 feet per minute. The strip upon leaving the last finishing roll is traveling just about ten times as fast as it was when it entered the first roughing roll as a billet. Close speed regulation between the successive rolls is essential to maintain the proper tension on the strip when passing from one roll to the other.

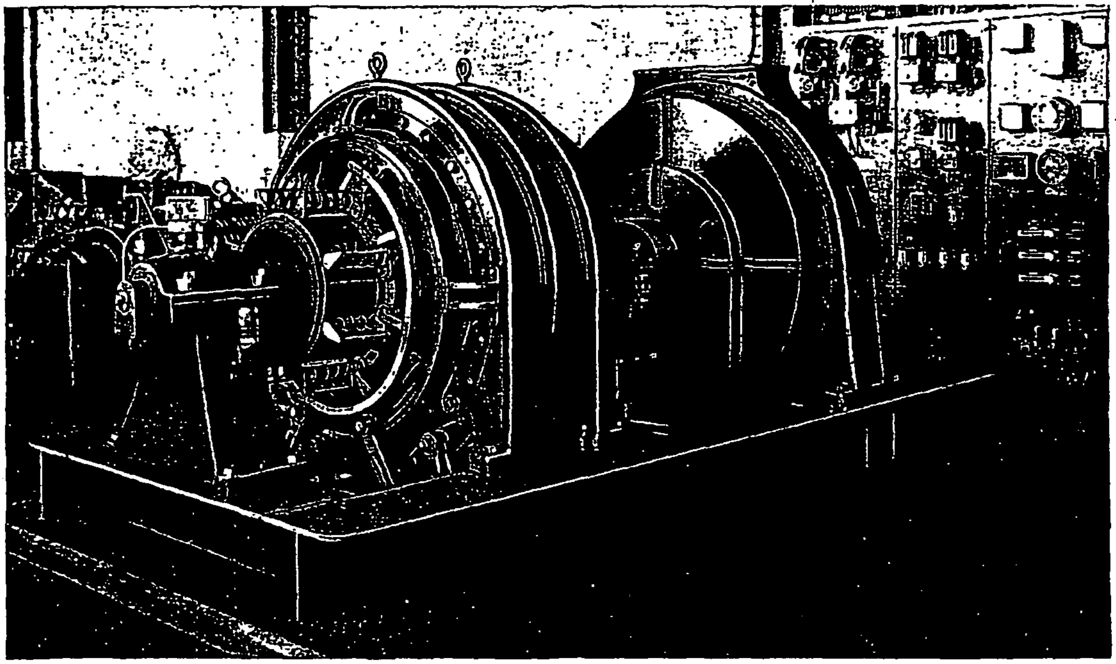
(2) *Runout Tables*—These tables

comprise a series of propelling rolls, either group or individually driven, which carry the finished hot strip away from the last finishing roll to the shears and coiling machine. Speed control here must be independent of the main roll motors and also permit of fine adjustment to keep the strip under slight tension to prevent buckling. Frequent as well as quick starting and stopping are necessary in this drive as the runout tables control the strip to the shears for cutting into a variety of specified lengths. Drives for the runout tables have been "group" by adjustable speed geared direct-current motors or by individual drive from geared alternating-current motors. Some a.c. individual drives are "direct" driven by slow-speed squirrel cage motors in which case the motor is "inverted", mounted inside the roll; the stationary element carrying the winding is pressed onto the roll shaft which is stationary. In the case of a.c. drives, the speed selection is generally obtained by adjustable frequency from an inverted motor-generator set.

(3) *Shears and Coiling Machine*—From the runout tables the strip passes through the shears for cutting into specified lengths and then to the coiling machine where it is coiled for shipment. Motor drive and control are individual for these two machines, the coiler being adjustable speed so as to keep pace in coiling the strip as fast as it is fed off the runout tables.

From the above it is apparent that for continuous production the various sections of the mill must be properly correlated, with a wide range of speed adjustment, and drives selected which will cause a minimum of shutdowns from electrical and mechanical troubles in any section. The drives for the runout tables have been given special attention by steel mill engineers in recent years as it was felt that flexibility and reliability could both be improved for that particular part of the mill.

At Warren, Ohio, The Republic Steel Corporation has, in addition to other mills, a 16" hot strip mill in which the runout table drives have recently been improved. It is desired to describe the electrical part of this runout drive briefly, not because it represents anything especially new in application principle, but because it illustrates the fact that cooperation and understanding between steel mill engineers and electrical design engineers is producing many successful major steel mill drives with greatly improved flexibility and lowered maintenance and produc-



Elliott 600-kv.-a., 480- to 960-r.p.m. inverted motor-generator set supplying power to 87 induction motors for runout table on hot strip mill at The Republic Steel Corporation plant at Warren, Ohio. The direct-current end of the unit is a compensated motor.

CRIMDEBN00000309

tion costs. On the runout tables at Warren, Republic engineers have taken a unique advantage of the desirable characteristics of both alternating and direct current and have harnessed these two different types of power to the one drive with excellent results.

Previous to the recent change the rolls on the runout tables were arranged in three successive groups, each group driven by a geared 40-hp. adjustable speed d.c. motor with a gear at each roll. This method had some disadvantages as follows:

1—Large number of gears made excessive noise with high lubricant and maintenance costs.

2—Motor or gear trouble at any roll necessitated a shutdown of the entire group, causing delayed production.

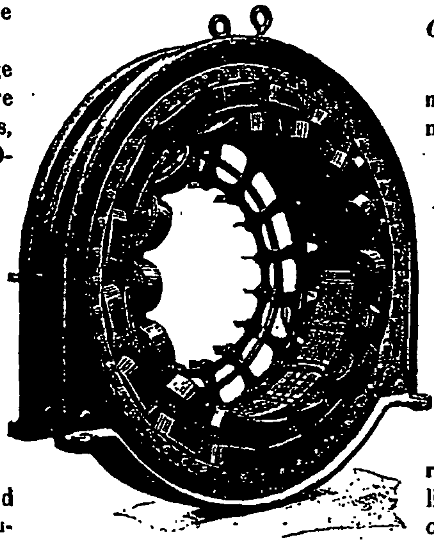
3—Large number of gears did not conform to latest safety regulations.

It was felt the above disadvantages could be eliminated and improvement in flexibility of both drive and control could be obtained by individually motorizing each roll with a geared squirrel cage a.c. motor of special design, speed control to be obtained by adjustable frequency from an inverted motor-generator set. With this done the present drive now consists of:

Individual A. C. Motor Drive for Each Roll

Each of the 87 rolls of the runout table is individually driven by a nominally rated geared 3-hp., 3-phase enclosed squirrel cage motor 570/1140 r.p.m., 147/293 volts, 40/80 cycles. The 87 motors are arranged in three groups, each group subject to starting and stopping independently of the other two groups. Further flexibility is obtained by providing three motor circuits in each group and then equipping each individual motor with a thermally protected line switch. From the flexibility standpoint this means:

1—If trouble develops in any motor circuit only one-third of the motors in that group are down, and the mill continues to run. The remaining eight circuits and driving motors are unaffected.



Stator of the Elliott compensated direct-current driving motor of the inverted motor-generator set. Laminated sheet steel yoke and the distribution of the strap copper compensating winding are shown.

2—If trouble develops with an individual roll or motor that one member may be isolated by its line switch and the mill continues to run.

3—Each group of motors and rolls is under separate control of the operators and can be handled independently of the other two groups.

4—All motors in all groups operate at the same constant speed as determined by the frequency setting of the a.c. generator which powers the drive.

5—The squirrel cage motors are subject to full voltage for quick starting of the rolls and to reverse plugging for quick stop at all speeds and frequencies. This has meant increase in mill output and a dependable drive due to the high reliability factor of the squirrel cage motor.

Control

The control is essentially full magnetic with remote manual master switches located in the pulpit and at the tables in the mill room. The six-panel switchboard in the generator room provides d.c. motor and a.c. generator panels with three motor distribution panels. The pulpit operator, through a remote-controlled motor-operated motor field rheostat, sets the frequency of the d.c.-a.c. motor-generator set powering the runout table roll motors, to give the desired lineal feet per minute of the runout which he reads on a tachometer. The shear operators, through line start and reverse plug stop, control the feed of the strip from the last two tables or hot-bed, to the shears for cutting into proper lengths and then to the coiling machine. The speed of the rolls on all three runout tables is, however, set by the pulpit operator.

Motor-Generator Set—Powering A.C. Runout Table Motors

The d.c.-a.c. motor-generator furnishing power to the 87 three-hp. motors on the runout table rolls must have some unusual characteristics to meet the service conditions imposed upon it. Two-thirds of these 87 motors driving the hot-bed rolls may be line-started or plug-stopped at frequent intervals independently of line starting of the remaining one-third of the motors on the runout tables, from the finishing stand. This operating cycle imposes severe cumulative current peaks on the a.c. generator, at frequent intervals. Under these extreme load conditions the d.c. motor driving the motor-generator set must hold constant speed to maintain the frequency setting and the a.c. generator must hold up in voltage to produce the torque necessary for quick stopping and starting of the strip on the tables.

The Elliott 500-kv.-a. d.c.-a.c. motor-generator set, illustrated here, was selected for this service since it embodied inherent electrical design features which made it most adaptable to the fluctuating load conditions.

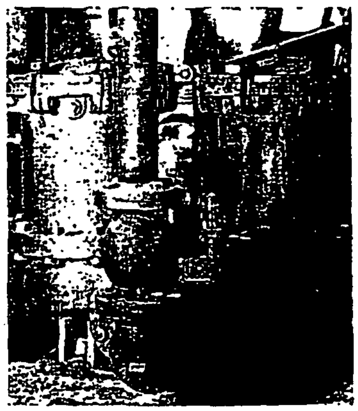
The d.c. driving motor is fully compensated with the compensating winding of insulated strap copper completely distributed around the entire magnetic area of the armature in close proximity to the armature conductors. This prevents field distortion even at extreme peak loads and affords sparkless commutation and close speed regulation, both important features in an adjustable-speed d.c. motor for this service. Another unusual characteristic of this Elliott motor is the use of laminated sheet steel in both the pole and yoke structure. This forms a quick-response magnetic circuit so that any change in motor field current imposed by the operator in the mill room pulpit, is followed instantly by the proper motor speed to give the frequency, and hence the speed setting of the runout table induction motors to correspond to the desired lineal feet per minute of the strip from the mill. It is important that very little time lag occur between the setting of the master switch in the pulpit and the actual speed response on the runout table.

The 3-phase adjustable frequency 500-kv.-a. alternator of the motor-generator set encounters some extreme peaks due to the plugging and line starting of the 87 three-hp. squirrel cage motors on the tables. Since these peaks follow at frequent intervals, the alternator must have a liberal thermal capacity. For quick starting and stopping of the motors, the voltage should hold up fairly close to normal under the low power factor peaks. This alternator is provided with a special field strengthening winding, auxiliary to the conventional field winding, so that field strengthening is automatic and proportional to the load. The proper a.c. voltage is thus available for quick starting and plug stopping of the squirrel cage motors under normal operation of the mill. Field forcing by means of field forcing relays may be cut in to function automatically to assist the special field strengthening winding and maintain the speed of starting and stopping at high operating speeds and forced mill output.

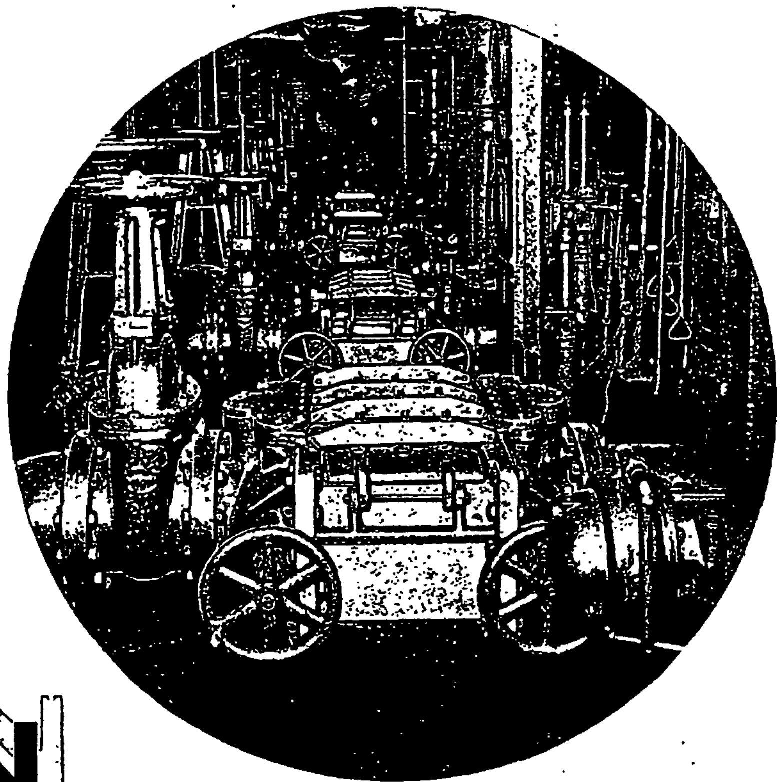
The motor-generator set is especially rugged mechanically and is enclosed to draw washed air from the ducts below and exhaust out the top half of both the motor and alternator. The laminated field yokes in both motor and alternator provide ventilating channels for air passage which gives low operating temperatures.

The operation of this entire mill has more than met the expectation of its designers. The flexibility of the electric drive utilizes the mill most advantageously for economy in production and uniformity of product regardless of the output demands and regardless of the variety of strip to be handled.

Continuous Filtering of Brine



In the refining of salt, every precaution must be taken to produce a product of absolute purity. Elaborate methods of filtering are therefore required. The photograph reproduced at the right shows an Elliott twin filter in the plant of the Worcester Salt Company, Silver Springs, New York. It is used as a final element in a carefully selected series or steps of filtering. The twin construction of this filter allows continuous service, as one side is always in use while the other side is available for changing the filter cloth. Such careful filtering is one of the many means taken to insure 100 per cent purity of the salt, bearing out the slogan of the Worcester Salt Company, "It takes the best to make the best".



TWIN STRAINERS in the world's largest station

A solid rank of these trouble-savers demonstrates forcibly the confidence with which they were selected for the Hudson Avenue Station. In this famous plant, as in hundreds of others, large and small, Twin Strainers are giving absolutely non-stop service, providing complete protection.

When a Twin Strainer basket becomes fouled, a few turns of a handwheel diverts the flow through the alternate basket. Then, when convenient, a few minutes suffice to remove the cover, lift out the fouled basket, dump it and replace. Meanwhile the alternate basket is in service and there is no interruption to the flow.

Twin Strainers can be installed anywhere in the line, in almost any position. They are invaluable for water, oil—lubricating or fuel, or any liquid sufficiently fluid to pass the basket mesh. They are made in all types and sizes.

We also make Single Strainers, for use where constant flow is not essential. Write for the bulletin.

ELLIOTT COMPANY
PITTSBURGH, PA.

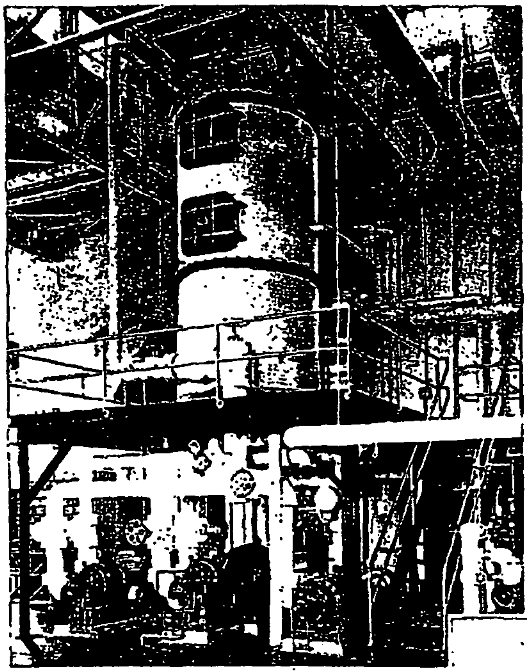
Accessories Department
Jeannette, Pa.

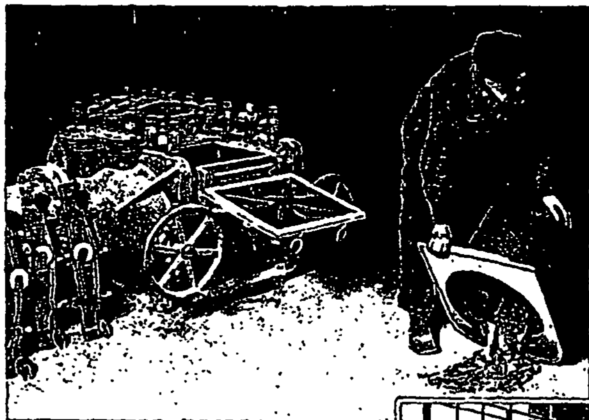
District Offices in Principal Cities

BIG SAVINGS

in putting the RIGHT POWER PLANT

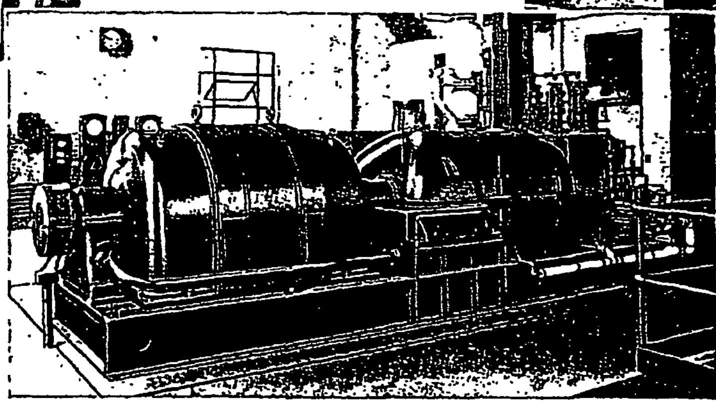
Deaerating heaters not only pay for themselves in preventing corrosion in boilers, economizers and piping, but they also give the most efficient possible feed water heating. Elliott deaerating heaters heat up to steam temperature and deaerate down to zero oxygen. They are made in all sizes, and designs are so flexible that they may be adapted for any condition.





An engine-generator unit can be furnished to suit your heat balance and your requirements for exhaust steam. Elliott builds all types of steam engines—single-valve, four-valve and unaflow. Steam consumption and first cost among these three types give a range of choice. Elliott gives unbiased recommendations between these types of engines and also in comparison with turbine-generators. Elliott builds the generator with the engine or turbine in all cases.

A turbine-generator can pay for itself in many an industrial plant in a short while—sometimes by superseding older equipment with modern, more efficient units, sometimes by making power from steam before it is used in process or heating, sometimes by using high-pressure steam from new boilers and exhausting at fairly high back-pressure to an old system. In any case, the reliability of Elliott turbines is an extra economy.



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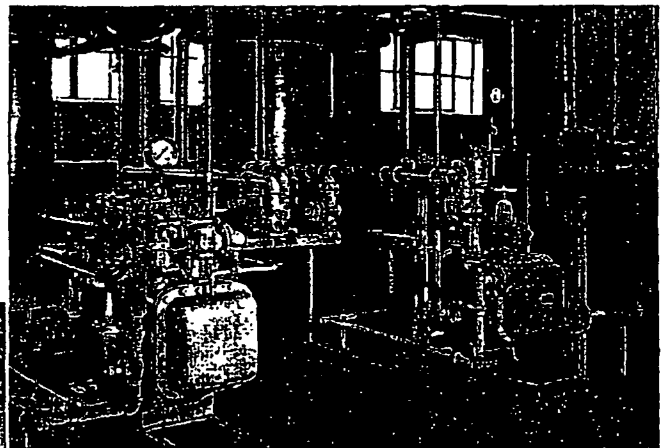
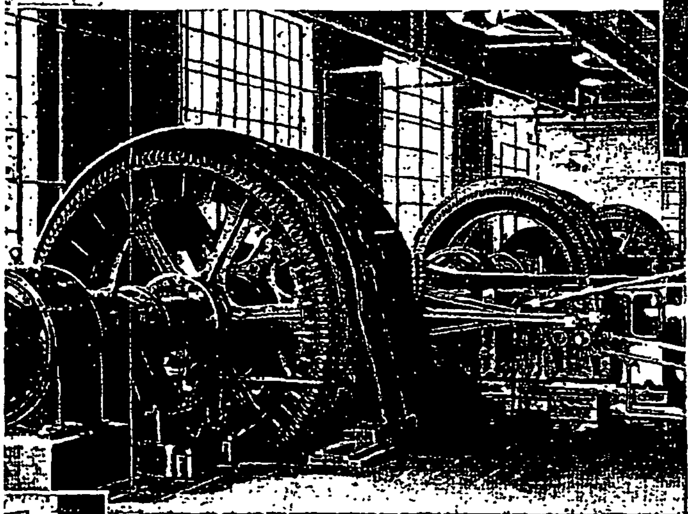
S

NT EQUIPMENT in the RIGHT PLACE

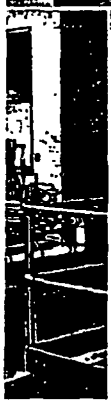
Elliott Engineers can help you do it

The cheap protection of reliable strainers saves costly repairs. It is wise economy to install a Twin Strainer and save a pump from very probable damage. Twin Strainers give continuous, uninterrupted protection. You clean one side of the strainer while the other is in operation. Elliott also builds Single Strainers of solid construction equaling that of Twin Strainers.

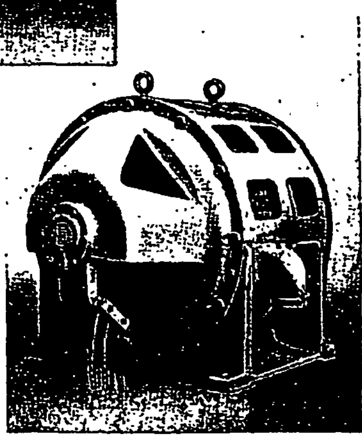


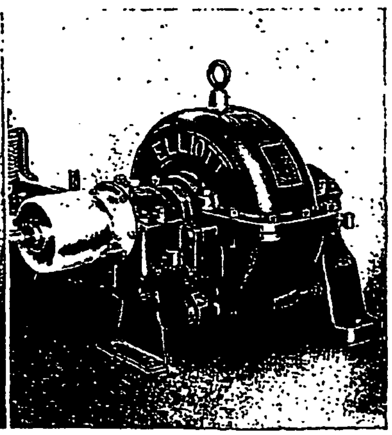


For producing and maintaining vacuum either in connection with condensers in power plants or in various industrial process applications, Elliott steam jet ejectors are big money savers. Not only in initial cost, but almost always in steam consumption and most surely in reduced maintenance, repairs and supervision. Elliott ejectors get high vacuum economically, and there is a type for every application.



Heat balance requirements determine whether auxiliaries should be driven by motors or turbines. Elliott builds both, is therefore unprejudiced, can help you decide which you require if need be. The uniform reliability of Elliott mechanical drive turbines and motors, and their unvarying high standard of construction adds to the natural economy of the drive and also to the dependability of your auxiliaries.





Timber Preservers, Ltd., Boiler and Retort House.

The Treatment of Timber

AN ACCOUNT OF THE METHODS USED BY TIMBER PRESERVERS LTD., VANCOUVER, B.C.

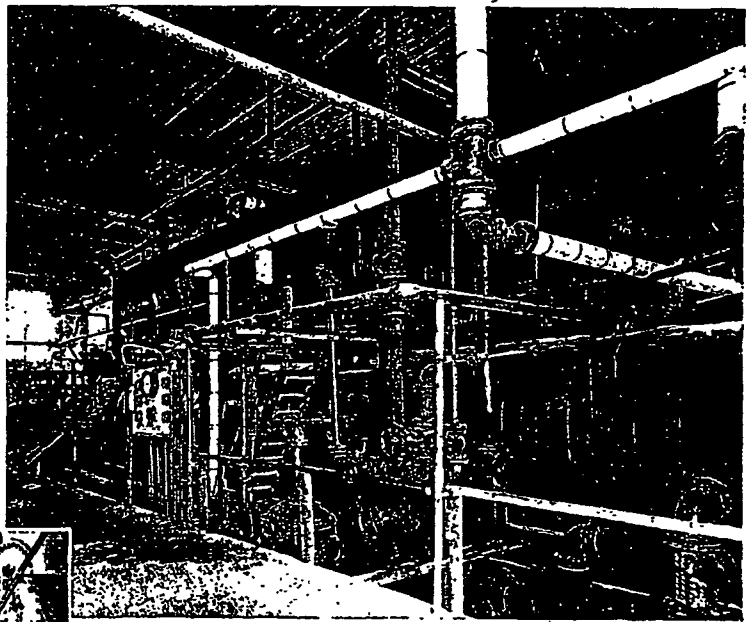
By R. H. RAWSON, *Consulting Timber Engineer,*
Portland, Oregon

IN THE CONSTRUCTION of the new timber treating plant of the Timber Preservers Limited, on the north arm of the Fraser River, near New Westminster, B. C., an endeavor has been made to develop a plant that was capable of treating all of our West Coast forest products with the various timber treating processes in commercial use.

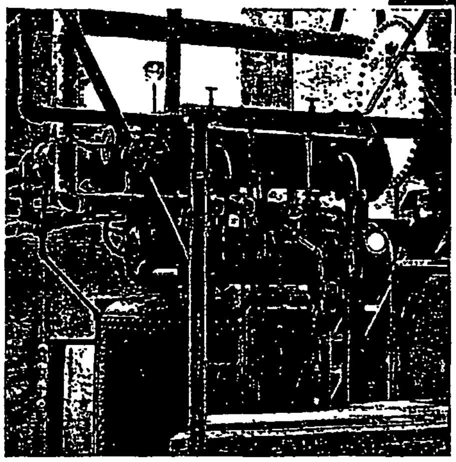
Before giving a description of this plant, the reader may be interested in a few historical facts showing the developments of timber treating, here and abroad.

The foundation of our modern timber treating practice was laid exactly 100 years ago, in Great Britain, when Mr. John Howard Kyan took out his first patent in September, 1832, in which he used corrosive sublimate for treating timber. In July 1838, Mr. John Bethel took out patents for preserving timber, and other substances, this process being in reality the forerunner of the present creosoting process. In July 1838, Sir William Burnett also took out patents on timber preservation, this process using zinc chloride as a preservative. Later on Mr. S. B. Boulton took out a series of patents, starting in March 1865, and still later, in 1879, 1882 and 1883, he patented the process that was the forerunner of the one now used by practically all of the commercial timber treating plants on the West Coast of the North American Continent. These early pioneers in the timber treating industry found that it was necessary either to air dry the material before treatment or to use some artificial means of seasoning. Frequently it was not possible to wait a long period of time for the wood to air dry and, as a result, they literally baked it in a huge oven, carrying a sufficient amount of heat to dry the wood. This process of subjecting the timber to dry heat was sometimes called "stoving", but invariably it was found that the timbers were injured; undoubtedly this fact caused Mr. Boulton to develop his process wherein he boils the timber in oil under a vacuum.

On this side of the Atlantic, experiments were conducted in 1838, using the Kyanizing process, when a few chestnut railway ties were treated and used in Maryland. Later, various experiments were conducted with this process in small plants built in the Eastern portion of the United States, but the process never seemed to prove popular.



A view in the retort room, Timber Preservers, Ltd., Vancouver, B.C.



(Left)—*A closer view, showing the Elliott Twin Type "C" Ejector. At the left behind the pipe is the Type "AL" Ejector and air meter.*

The Burnetizing process was introduced in the United States about 1850, and possibly the first real timber plant was built by the Vermont Central Railroad Company in 1856 to treat ties and bridge timbers with zinc chloride. In some portions of the United States and Canada this process of treatment, using zinc chloride, is still considered standard, and very good results are being obtained in prolonging the life of crossties and construction material.

About the first record we have of using the creosoting process on this side of the Atlantic is an account of experiments conducted by the Philadelphia and Reading Railroad in 1854.

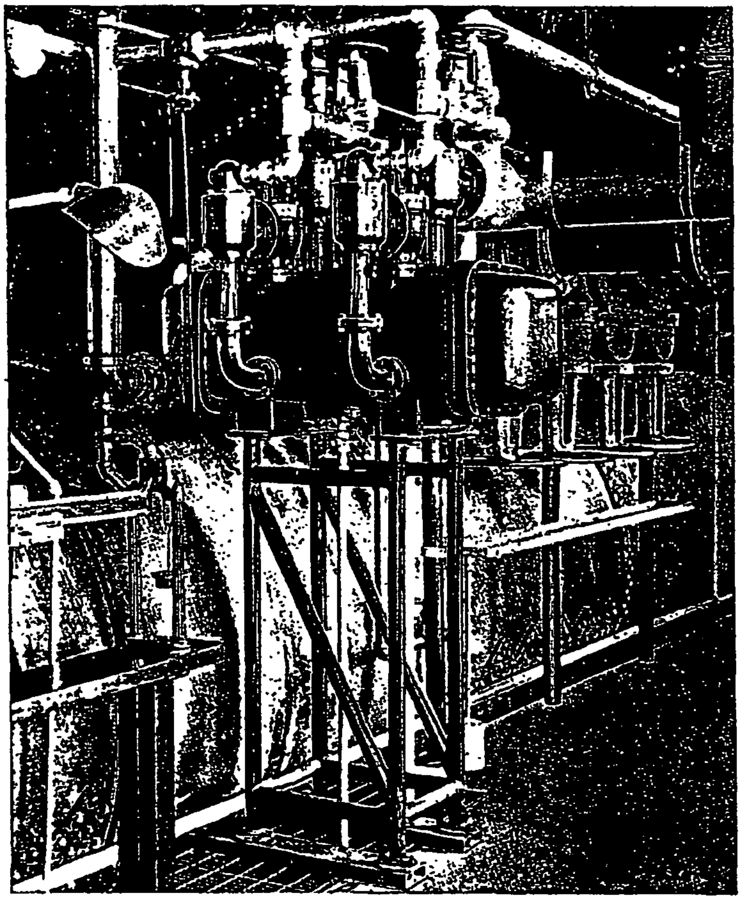
Later on various timber treating plants were built in the United States and Canada, one of some notable interest at West Pascagoula, Mississippi, in 1875, in order to treat timbers for the L & N Railway. About the same time, another plant was built at Slidell, La., to treat the timbers in the bridge over Lake Ponchartrain, the timbers in this bridge being still sound and in use after a period of over 40 years of service, while the plant that was built to treat these timbers has long since been discarded. Many of these early plants were built, not because of the high cost of untreated material, but because of the high cost of renewals.

Less than 30 years ago there were only 30 timber treating plants on the North American Continent, while today there are over 200 plants in the United States, 12 plants in Canada, 3 in Central America and 3 in Mexico.

Boulton Process

Since the largest percentage of material to be treated by this new plant will be Coast Fir, a brief description of the procedure used will be given herewith. As pointed out previously, it was necessary either to air dry or artificially season material to be treated. On the Pacific Coast some material has been air dried successfully, but there are locations where material either drys too fast or, as in the case of the Pacific Northwest, the air drying season is very short. Some of the commercial plants in the Pacific Northwest started about 17 or 18 years ago to apply the Boulton process to seasoning Douglas Fir. Railroad companies, being able to anticipate their demands for crossties annually, in advance, were able to purchase their requirements and stack them in the yard for air seasoning. Commercial treating plants frequently have orders with delivery stipulated that will not permit sufficient time for air seasoning. Therefore, the success of the Boulton process is of tremendous importance to commercial treating plants for the reason that they can accomplish, in a matter of days or hours what would require months by natural seasoning.

About the same time that the commercial plants were conducting experiments with the Boulton process, investigations were being made, using the present method of incising timber before treatment. This method of incising consists of slitting the surface of timbers or lumber, and in some cases even poles and piling, by running the material through rolls having teeth spaced at regular intervals. The teeth are forced into the wood to permit the preservative to be absorbed in all directions from the incisions.



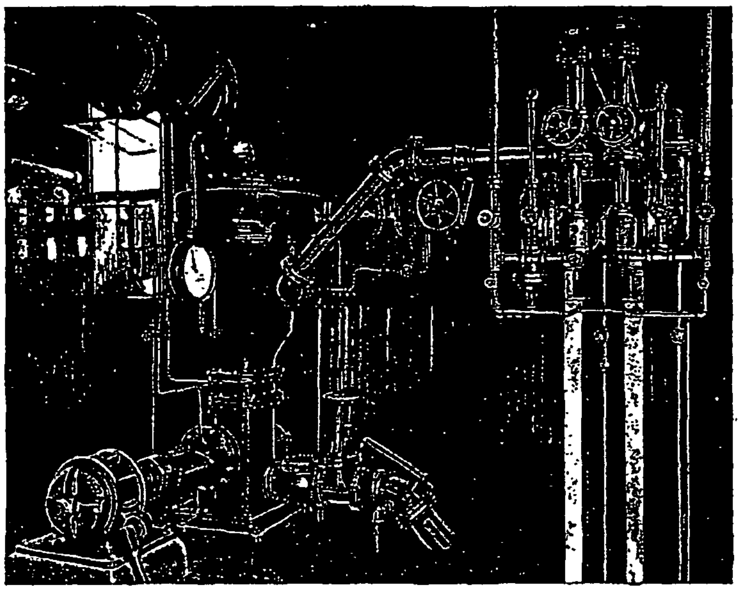
Elliott combination type ejector serving creosoting cylinder at W. P. Brown & Sons Lumber Company, Louisville, Ky. This ejector serves a cylinder 8 ft. in diameter by 132 ft. long. It establishes a 26" vacuum in 15 minutes and the air handling capacity is 220 lbs. per hour at 26" vacuum. It uses stainless steel nozzles and nozzle plates and aluminum alloy tubes in the inter- and after-condensers thus handling the corrosive creosote vapors without difficulty.

In the use of the Boulton process today, material is first loaded on the trams and run into the treating cylinder or retort and then the retort is sealed up by closing the doors and bolting them fast. The creosote is next admitted to the cylinder and heated to a temperature considerably above the boiling point of water for the condition of vacuum later carried. The entire retort, with this load of timber, is next placed under a vacuum and the vapors drawn off through the condenser, where they are trapped out and measured. The rate at which the moisture is removed from the wood gives the operator the information from which he determines whether the wood is dry enough to have the pressure applied. When the material has been dried to the proper point, additional preservative, to give the required absorption, is forced into the wood. After the pressure period is completed, the preservative is removed from the cylinder. In order to remove any excess surface preservative a final vacuum is carried. The doors are opened and the charge removed.

"FULL CELL" AND "EMPTY CELL" TREATMENTS

In connection with the above described process there are two types of treatment, one called the "full cell", and the other called the "empty cell". With the "full cell" process, the cell structure of the wood is supposed to be completely filled with the preservative. With the "empty cell" process, before applying the oil pressure, a preliminary air pressure is built up in the retort and in the wood itself and then the oil pressure applied. After the required amount of preservative has been forced into the wood, the pressure is released and the air confined in the wood expands to its original volume, thus expelling a portion of the preservative, leaving the cell structure only partly filled with preservative instead of being entirely filled.

During the seasoning process, prior to injecting the preservative into the wood, it is necessary to supply heat to the oil surrounding the wood. In developing the plans for the Timber Preservers' plant, the writer has endeavored to eliminate the necessity of using heating coils in the retort and also to overcome the difficulty experienced in the earlier experiments with the Boulton process of having the preservative boil over into the condenser. These difficulties were overcome by using a closed heater outside of the retort and by circulating the oil first from the bottom of the working tank, which is located above the retort, through an Elliott twin strainer, thence through the heater and into the bottom of the retort at three points. This heated oil is circulated at a rate of 1500 gallons per minute and passes out of the top of the retort and back into the working tank, the oil carrying with it the vapors from the wood. These vapors pass out of the top of the working tank and then down into the condenser where the condensate is trapped out in the hot well and measured. Using the working tank for a separating chamber prevents oil being carried over into the condenser. When this process of circulating heated oil through the retort is being carried out the entire system is under a vacuum.



An installation of Elliott jet condenser and ejector equipment which has been in operation for several years in a large tie treating plant.

Vacuum Equipment

In selecting equipment for producing the vacuum, the writer decided on a type "AL" Elliott ejector which is used at the beginning and end of the run to bring the vacuum up as quickly as possible. When this is accomplished, at the beginning of the run, an Elliott twin type "C" air ejector is used, for what is called the running vacuum, the type "AL" ejector being shut off as soon as the twin type "C" has taken the load. After several trials with this apparatus it was soon found that the vacuum can be applied as soon as the retort is filled and no difficulty has been experienced in reaching a vacuum of 24" to 25" in 15 minutes after starting. After the rate at which the moisture is removed from the wood decreases and comes to a fairly constant point, it has been found that 27" to 28" of vacuum can be maintained on the entire system with one-half of the twin type "C" in operation. The photograph on page 19 shows the type "AL" and "C" ejectors used for this plant.

In order to control the supply of heat to the retort an air operated Foxboro controller has been used, with a thermostatic bulb placed in the thermometer well on the side of the retort, which operates the control valve on the steam supply to the heater. With this apparatus, no difficulty has been experienced in holding the temperature within one degree of that required.

The piping hook-up has been laid out so that when the oil is in the working tank above the retort it can be circulated through the heater and brought to any desired

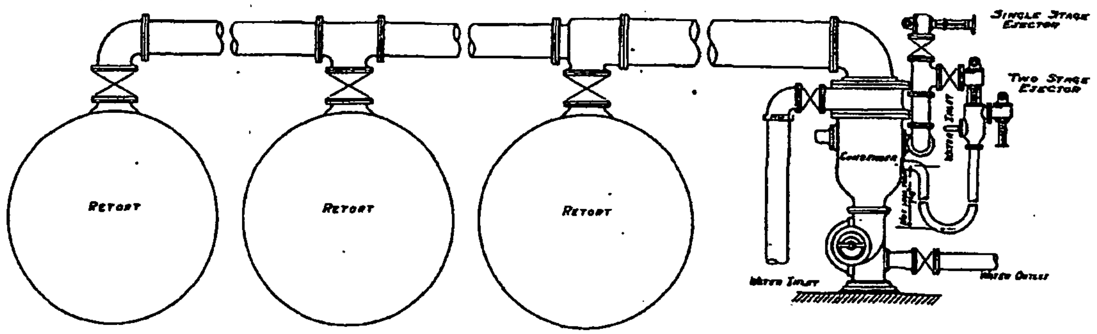


Fig. 1—*Layout of typical installation of vacuum equipment to serve three creosoting retorts. The condenser and two-stage ejector are used for the initial run; the single-stage ejector, operating alone, creates the final vacuum.*

temperature and pumped back to the working tank. Also, the circulating pump can be used for emptying the cylinder, the oil being forced through the Elliott strainer and either direct through the heater or by-passed around the heater to the working tank or storage tank.

The Use of Ejectors In Creosoting Work

As MENTIONED BY MR. RAWSON in the above article, steam jet ejectors are readily adapted for creating vacuum in connection with creosoting work. The advantages of this type of vacuum producing equipment have been apparent for some time, and suitable ejector equipment is available for use in conjunction with any of the processes outlined in Mr. Rawson's article.

The simple construction of the ejector, the absence of moving parts, and a great reduction in maintenance costs make the ejector particularly applicable in the creosoting field. Reciprocating pumps have a handicap in that the creosote vapors handled are not only corrosive, but when cooled they condense and form gummy deposits which hamper the action of pistons and valves. All this trouble is eliminated by the use of the ejector. The ability of ejectors to establish vacuum quickly and maintain it for long periods of time, regardless of the age of the ejector, aids in keeping production up to schedule with the minimum cost of operation.

In plants where a steaming process is used for artificially drying green timber prior to the creosoting process, the vacuum equipment required consists of a condenser and two-stage ejector. Fig. 1 shows a diagrammatic sketch of a creosoting installation using a jet type condenser and a two-stage ejector, equipped with a barometric inter-condenser. The vapors which are given off from the retorts are condensed in the jet condenser and are discharged, together with the cooling water, by the removal pump. The two-stage ejector removes the non-condensable gases which consist mainly of air leakage into the system. Where it is desirable to eliminate pumping expense, the jet condenser can be replaced by a barometric condenser by elevating the vacuum equipment to a sufficient height to permit draining the water through a barometric leg. The photograph, page 21, shows an installation using a jet type condenser and a

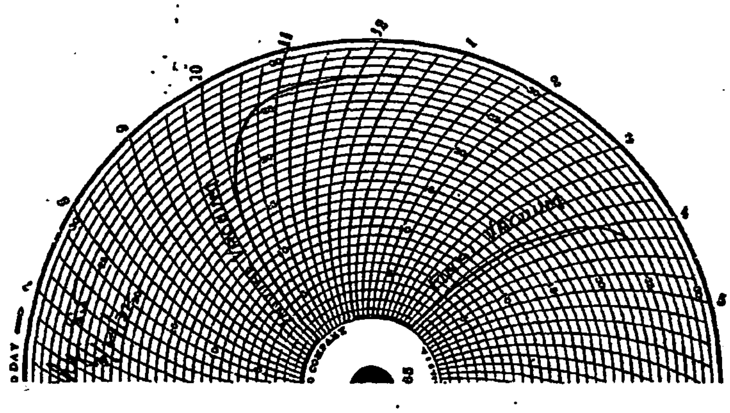


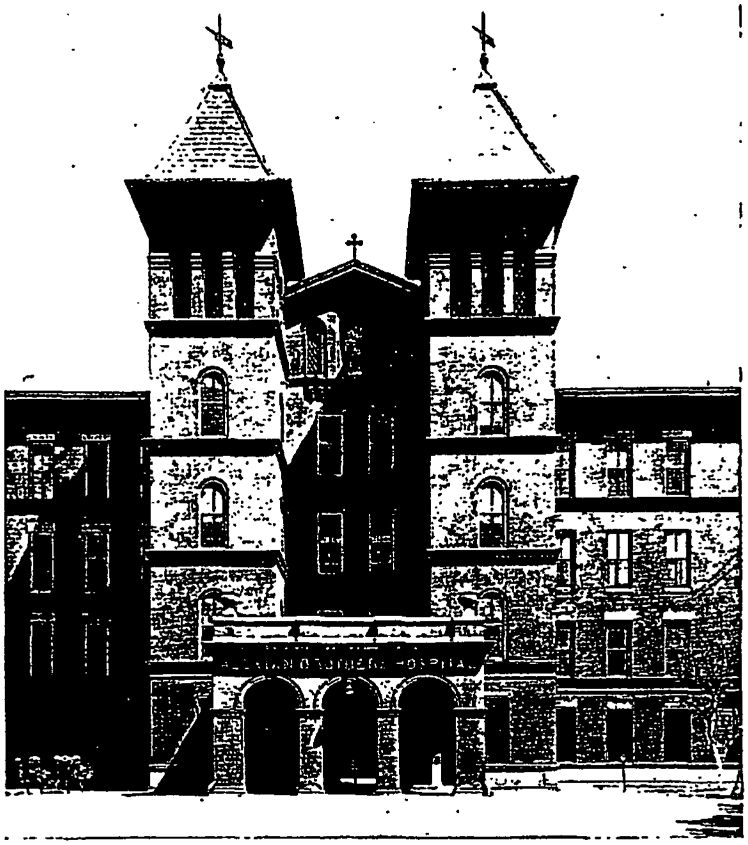
Fig. 2—*Vacuum chart indicating the time in which initial and final vacuum are established in a creosoting cylinder. One of a number of rather typical charts on file.*

two-stage ejector with a surface type inter- and after-condenser.

After the steaming process, it is desirable to establish high vacuum as quickly and efficiently as possible. Fig. 2 shows a vacuum chart indicating the amount of vacuum created in a definite period of time. It will be noted that during the initial run a vacuum of 24" is established in 15 minutes, 26" is reached in 35 minutes, and towards the end of the run the vacuum increases to 27". The maximum vacuum obtainable depends, of course, on the tightness of the system, and vacuums of 28", referred, are frequently reported.

During the final or dry vacuum run, the gases which must be removed are largely non-condensable and, therefore, the water to the main condenser can be turned off. Some companies find it worth while to reclaim the small amount of condensable vapors which come over during this run, and therefore install a surface condenser instead of a jet or barometric unit. The ejector used during this run is usually a single-stage unit which is shown in Fig. 1 above the two-stage ejector, which during this run is isolated from the system. The chart also indicates the time required for establishing the vacuum during this run and it will be noted that a vacuum of 22" is easily established within 15 minutes' time. As the length of the run increases, the vacuum will, of course, increase, the maximum vacuum being in most cases approximately 26".

Companies engaged in the commercial creosoting of wood products are using ejector vacuum equipment on practically all new installations, and are replacing reciprocating pumps wherever possible. A large percentage of these installations are Elliott ejectors.



CHICAGO HOSPITAL INSTALLS

New Power Units

ALEXIAN BROTHERS' HOSPITAL REPLACES 36-YEAR-OLD EQUIPMENT WITH ELLIOTT ENGINE-GENERATORS

By J. M. MAAG, *Sales Engineer,*
Elliott Company, Chicago, Ill.

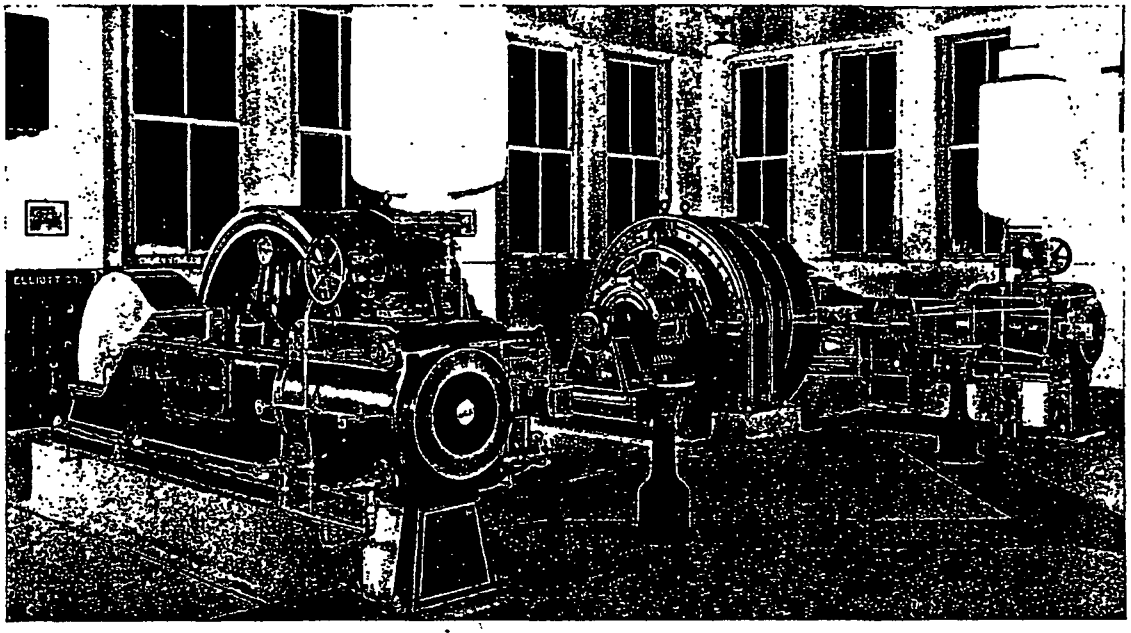
ALEXIAN BROTHERS' HOSPITAL of Chicago, is one of an international chain of similar institutions owned and operated by "The Congregation of the Cellites or Alexian Brothers", a Catholic Order, having its origin dating back to the middle ages. The first institution of record, was founded in Mechlin, Germany, in 1300 A. D. The Brothers were at first called "Cellites" from the Latin word "Cella" or "Grave" because they used to bury the dead. They played an important part in assisting the people of Germany and Northern France during the plague of the Black Death when everyone else was afraid to approach the sufferers or bury the dead.

The growth since the inception of the Order has been steady. A Mother House was established at Aachen (Aix-la-Chapelle), Germany, and many institutions were built in Germany, France and Belgium.

It was not until 1865, however, that the Brothers came to the United States and built their first hospital in the City of Chicago. This building, a 75-bed hospital, was destroyed in the memorable Chicago fire of 1870. A new 225-bed hospital was immediately built, which lasted until 1885, when the construction of an elevated railway made it necessary to abandon this building.

In the meantime, hospitals had been built in St. Louis, Missouri (1869), Oshkosh, Wisconsin (1880), and Newark, New Jersey (1893).

The Brothers opened the present Chicago hospital building to the public in 1896. In spite of its early construction, it still ranks as one of the best built, best arranged and best preserved of Chicago hospitals. It accommodates 286 patients (male only) and has equipment to handle any case committed to a general hospital. Treatment is given to over 4000 patients annually. The entire institution, including such service departments as the power plant, laundry, kitch-



The engine room of the Alexian Brothers' Hospital presents a pleasing appearance, with the two Elliott 150-kw. four-valve engines driving compensated d.c. generators. The engine-generators, one left- and one right-hand, are placed with out-board bearings opposite each other. and a convenient walking space between. The units are particularly quiet in operation.

en and bakery, are under the care of the 107 Brothers now stationed at this House.

The most recently improved and most modern department in the hospital is the power plant. At the time the building was constructed in 1896, two 60-kw. Siemans-Halski "revolving stator" type generators, driven by two slow-speed releasing Corliss engines were installed. These units gave good service until last year when the increased power load and the worn-out condition of the equipment made a change necessary.

For such a change, two courses were available; either contract for purchased power or install new and larger generator units. Careful consideration was given to both plans and the decision made in favor of purchasing two 150-kw. engine-generator units.

The only available source of purchased power supplied alternating current. The cost of changing over entirely to an a.c. system, including the purchase of a.c. motors for laundry, elevators and other purposes, was considered prohibitive. To convert the a.c. supply into d.c. meant the purchase of at least two motor-generator sets and an average loss of approximately 15% in conversion. Any plan that could be considered involved a sizable cash investment. Estimates indicated that new generator units could be purchased for little more than motor-generators, with their control, and for considerably less than the cost of changing entirely to an a.c. system. It was evident, therefore, that interest and depreciation on the investment—one of the largest items usually charged against the private plant—could, for all practical purposes, be ignored.

In most hospitals high-pressure steam is needed for sterilizing. In this institution it is needed, also, for the presses and flat-work ironers in the laundry. Considerable quantities of low-pressure steam are needed the year around for hot water for the laundry, hospital and residential quarters, and, during six to eight months of the year, for heating the building. Past experience had proven that all available exhaust steam could be used during the six to eight months' heating season and very little wasted to the atmosphere during the remainder of the year. The heat balance, therefore, distinctly favored the private plant. When considered together with the unusually low fixed charges and low labor costs (all supervision and most of the maintenance being taken care of by the Brothers) the decision to purchase new generating equipment was not difficult to make.

This decision having been made, the next step was the selection of the type of equipment to be installed. The demand for exhaust steam, the lack of available cooling water, and size of the proposed new unit made it impractical to consider condensing or condensing - bleeder equipment. On the other hand, the few months of the year when some of the exhaust steam would be wasted made it advisable to consider only the more economical types of prime movers. Turbines and single-valve engines were automatically ruled out because of high steam consumption. The choice, therefore, was between the four-valve Corliss, either non-releasing or releasing, and the poppet valve unaflow engine.

Bids were received on all three types. Two Elliott non-releasing four-valve engines direct-connected to Elliott compensated generators were selected. It is interesting to review briefly the reason for this selection.

The steam consumption guarantees of the Elliott four-valve engine were materially better than the releasing Corliss units and were on an average within less than 2 lbs. per kilowatt-hour of the guarantees of the poppet valve unaflows. The releasing Corliss engine was eliminated both because of steam consumption and because of the need for as quiet-running equipment as possible.

As far as the poppet valve unaflow was concerned, it was felt that the difference in steam consumption guarantees did not tell the whole story. It was recognized that in order to obtain the guaranteed economy of a unaflow engine, it would be necessary to keep the poppet valves adjusted and seating perfectly. To do this would require frequent inspections and occasional adjustments, adjustments that ordinarily can best be performed only by factory service men. Wear or erosion of the valve seats, or poor adjustments of the valves, would destroy the slightly better economy which is the only justification for unaflow engines.

The Corliss valves on the other hand, in combination with the non-releasing gear, would permit economies very close to those of the unaflow engine, with none of the disadvantages of the poppet valve. No adjustment between the valve and seat is possible. The valves are made steam-tight at the factory and any wear tends to make them tighter. This is easily understood when the construction and operation of the valves are known. The valve chambers are lapped on the inside by means of a lead lapping mandrel, an expensive operation, but insuring steam-tightness from the first start-up. The accelerating gear provides a quick opening and closing and a period of rest during the period of greatest unbalanced pressure. The steam valves are double-ported in order to secure large steam openings with small movements of the valves. The shortest possible arcs are spanned, the steam pressure and force of gravity hold the valves against their seats, and any wear tends to make them even more steam-tight.

The Brothers believed that over a period of years the Elliott four-valve engine would be more economical than the poppet valve unaflow.

The operators of this power plant are members of the Order and, primarily, are not power plant operators. It is conceivable that at some future date the Brothers in charge may not be as skilled as those now operating the plant. It was, therefore, most desirable that equipment simple in design and requiring a minimum of attention be obtained. It was felt that the Elliott four-valve engine met these requirements to a desirable degree.

Another highly important requisite, was that constant voltage be maintained at all times. Steady, non-flickering lights were, in some respects, as important in the operating rooms as were the steady hands of the surgeons. Elevator motors, motors driving washers, driers, and extractors in the laundry, and an occasional compressor or pump motor thrown on the lines in the power plant, would cause comparatively heavy load swings. Voltage fluctuation and light flickering would result if regulation was not good.

Considerable time was spent by the Brothers investigating direct-current generators. They learned through inquiry and personal visits to a number of installations, that the inherent regulation of the fully-compensated generator is superior to that of the inter - pole type. They were convinced of this to the extent that all engine bidders were requested to bid on the "fully compensated" generators as built by Elliott Company. This type of generator in combination with the ruggedly built but highly sensitive inertia type flywheel governor, which is standard equipment on the four-valve engines, gives a degree of regulation unequaled by any other engine-generator unit.

In installing this equipment, special attention was given to the foundation. The sub-soil was of a sandy nature and it was necessary to make sure that the foundations were not only made firm, but that no vibration would be transmitted through the walls. The engine room was built below the sleeping quarters of some of the Brothers and any building vibration would be highly objectionable. The engine-generators, one left- and one right-hand, were to be placed with out-board bearings opposite one another, and a short walking space between. One excavation was made for both units, and a solid mat of concrete, 8″ to 12″ thick, placed at the bottom of the foundation. Forms were built and the concrete poured so that the two foundations were actually one continuous mass of concrete, being joined at the outboard bearing. Insulation, ½″ thick, was then placed between the floor and foundations and between the foundations and the trenches, serving the exhaust steam lines and electrical conduits.

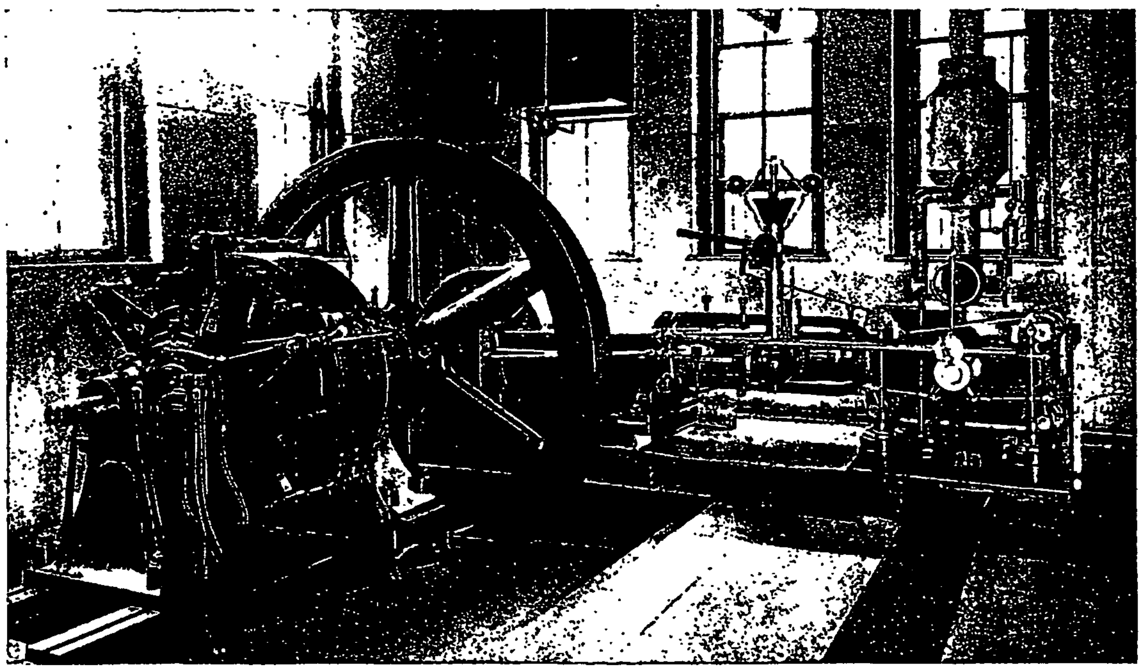
These extra precautions were justified by the results. Not a trace of vibration can be felt in the floor or walls. All who have seen these units operating have commented on their quiet, smooth and apparently effortless operation. The Brothers have expressed themselves as being well satisfied with their purchase.

The large receiver type separators on each engine are Elliott Welderon separators. Elliott type "P" oil separators serve each of the exhaust lines from the engine.

The new engine-generators are housed in a new engine room built for the purpose. Other changes and improvements were made at the same time, including the installation of a complete new switchboard, consisting of two generator panels and three distribution panels. The pump room was practically rebuilt. A new feed water heater was installed and the feed water pumps lowered to a new pit, giving sufficient additional head to permit efficient removal of the feed water which is being heated to the temperature of the exhaust steam. The softener and the hot water heaters serving the laundry and general purpose requirements were moved to a new tank room.

All of this work was accomplished without any interruption of services to the institution. That this could be done successfully was due to the very careful planning of Brother Julius, who, with the assistance of Brother Alphonse, had complete charge of this modernizing program.

One of the old releasing Corliss units which were replaced by the new equipment will be preserved for posterity and is to be placed on permanent exhibition in the Museum of Science and Industry now being built in Chicago. It is considered typical of what was best practice 35 to 40 years ago. And it is not entirely coincidence that, by its side, will be placed an Elliott four-valve engine representing the best that is offered in modern engine construction.



One of the two old 60-kw. engine-generator units which were replaced by the Elliott sets shown on page 25. The generator of the above unit is a Siemens-Halske, built 36 years ago. The rotor is on the outside of the generator and the exterior surface of the rotor serves as the commutator. These units were typical of best practice 35 to 40 years ago.

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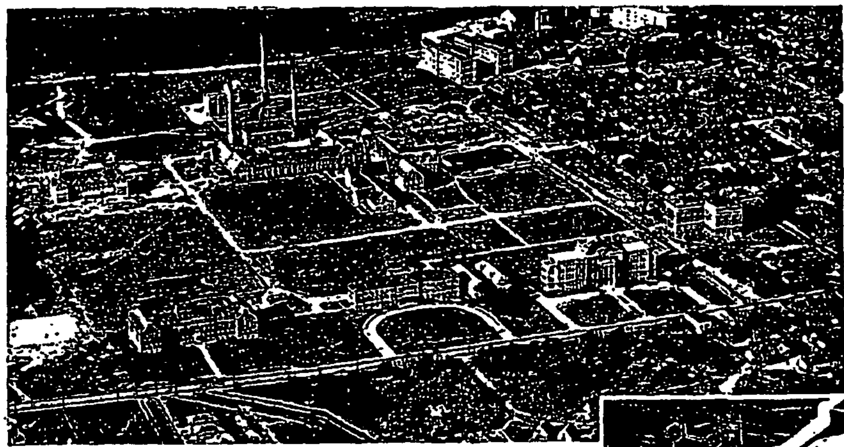
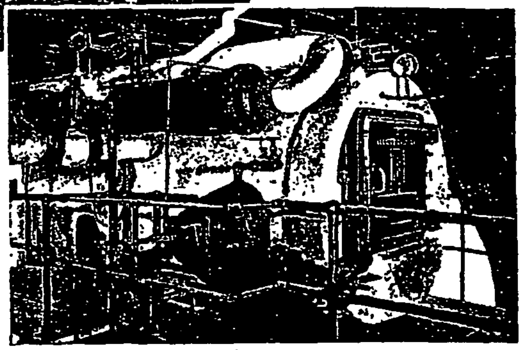


Aerial view of group of hospitals. At the extreme left in the distance is the Indiana Rotary Club unit of the James Whitcomb Riley Hospital for Children. At its right is the Riley Hospital. Buildings in the foreground, left to right are: Nurses' Home, Wm. H. Coleman Hospital for Women, Robert W. Long Hospital, and the Indiana University School of Medicine and Hospital. In the distance is the City Hospital.

Deaerator Eliminates Corrosion



Elliott domestic hot water deaerator installation, which assures corrosionless hot water and freedom from pipe renewals for Indiana University Hospital.

INDIANA UNIVERSITY HOSPITAL GROUP OVERCOMES PIPE PITTING TROUBLES

By J. A. GERLACH, *Sales Engineer,*
Elliott Company, Indianapolis, Ind.

INDIANA UNIVERSITY, Bloomington, Ind., maintains its medical center, including medical college and attendant hospitals in Indianapolis, Ind. This group of buildings, shown in the aerial view, consists of the James Whitcomb Riley Memorial Hospital for Children, Rotary Convalescent Ward, Medical School, Robert W. Long Hospital, Coleman Maternity Hospital and the Ball Nurses' Home.

The requirement of softened hot and cold water for this group of buildings has constantly increased from an average consumption, in 1928, of 50,000 g.p.d., to 105,000 g.p.d. in 1932, with a peak condition in early 1932 of 146,000 g.p.d. Undoubtedly, new buildings and hospital units will be erected in the future which will impose still heavier duty on the hot and cold water supply system.

The hot and cold water service lines are of galvanized wrought iron pipe. A short time ago, evidences of pitting and corrosion appeared in the domestic hot water lines, which trouble was traced to the presence of dissolved oxygen and other non-condensable gases.

Mr. Charles R. Ammerman, Consulting Engineer, Indianapolis, Ind., was retained to investigate what could be done to eliminate the continual trouble of bursting hot water service lines, due to corrosion pitting. After a thorough study, a 20,000-g.p.h. Elliott low-temperature vacuum type deaerator was installed. The size was such as to take care of the expected load demands on the hot water system and to assure the medical center of proper protection for the future.

The deaerator unit included the horizontal gas separator, vapor condenser, motor-driven air removal pump and auxiliary steam

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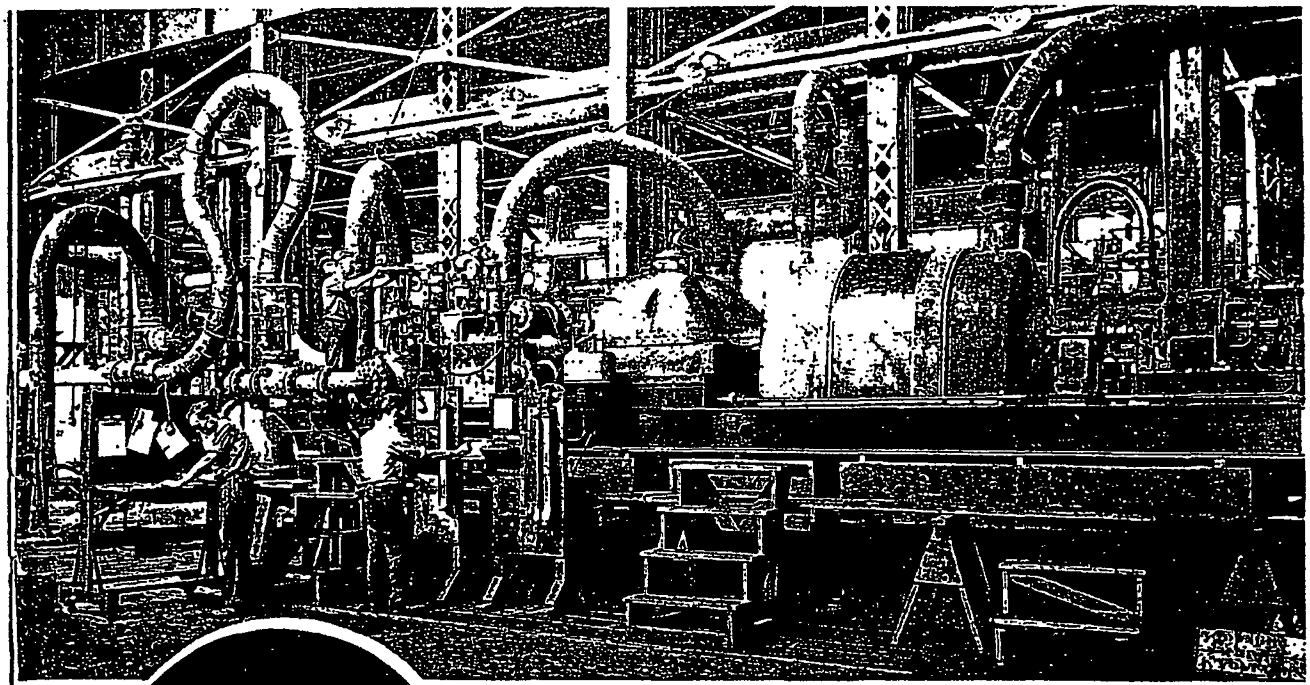

COMPLETE TESTS*

ELLIOTT TURBINE-GENERATORS ARE SO WELL PROVED IN THE SHOP, THEY ARE SURE TO MAKE GOOD ON THE JOB

It is important for the purchaser of a turbine-generator to know that the manufacturer has adequate testing facilities. You want the unit you buy to be shop-tested under conditions duplicating those in your plant. And you want the engineers who design your unit to be backed up by the knowledge of what the turbine will do, which can only be had from complete testing of many units.

Many turbine test plants are limited so that complete tests cannot be run on equipment offered,—limitations in steam pressure and temperature, condensing capacity or electrical loading facilities for running overall tests.

There are no such limitations on the Elliott modern and up-to-date test floor. Complete tests of machines within our size range can be made. Pressure, superheat, capacity as to boilers, condensers and electric loading are adequate in every respect.

Drop in at our Jeannette Works sometime, look over the test floor, see a turbine being carefully and fully tested. You'll realize one reason why Elliott turbines have a reputation for smooth-running efficiency and dependability.

★ Elliott turbines are always given a real honest-to-goodness test. Commercial tests include power output tests and running the turbine to check balance; adjust governor and control mechanisms, including the emergency overspeed trip; check the adequacy of the lubrication system; prove the entire job oil and steam-tight at all points. A high percentage of all Elliott turbines built are also subjected to accurate water-rate efficiency tests either as a matter of routine or by arrangement with the purchaser.

ELLIOTT COMPANY, *Steam Turbine Department, Jeannette, Pa.*

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