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Published by the Kentucky Library / Winter 1955

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DESTE FIDELES"

Come all ye faithful. Once again
the singing of carols, the hurrying crowds,
and an air of happy anticipation herald the
Christmas Season. In this spirit, all of us at
Elliott Company extend holiday greetings and
best wishes for the New Year to you,
the readers of Powerfax.

HRISTMAS

1955

WINTER, 1955

Volume 33 • No. 4

powerfax

Front Cover

Our front covers this year have featured photographs of power and industrial scenes. For this winter issue, we present a traditional Christmas scene especially drawn for *Powerfax* by the talented Pittsburgh artist Tom Miller. It is portrayed in the feeling or style of the three previous covers plus, of course, the true Christmas spirit. We hope you like the picture which, you will note, carries over to our sincere greeting, opposite.

District Offices

Elliott Company's office in Charlotte, North Carolina, was recently moved from 1916 to 1707 Liberty Life Building. The telephone remains the same: Edison 3-9172. The district manager remains W. J. Lyons.

Large Mill Motor Standards

At the Association of Iron and Steel Engineers' meeting, held in the Hotel Sherman, Chicago, the latter part of September, C. R. Steen, chief d-c engineer, Crocker-Wheeler Division, Elliott Company, discussed a paper by M. B. Antrim, of Lukens Steel Company, who is chairman of the mill motor committee. The subject was the AISE proposed standards for three new higher-capacity mill motors—275 hp, 375 hp, and 500 hp. These new larger sizes of mill motors will use fabricated, instead of cast, frames and they will be for coupled drives only. Crocker-Wheeler made the first mill motor in 1904.

Turbine Movie Seems to be a Hit

Earlier this year, we announced in *Powerfax* the release of a new 16-mm sound-on-film moving picture.

The film describes in detail the proper procedure for the maintenance and repair of Elliott mechanical-drive turbines. It is a straightforward technical presentation—minus sales pitch or product plugs. Its sole purpose is to be helpful.

Apparently the movie serves its purpose. Bookings have been heavy and we had to prepare several additional prints to meet the demand. It has been shown to hundreds of turbine operators, maintenance men and trainees in this country, in Canada and in Mexico.

Your plant uses Elliott mechanical-drive turbines—in any quantity—this film will help your operators to keep them rolling with efficiency and minimum cost.

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Powerfax, published by Elliott Company since 1923, is primarily a record of the development of Elliott products and their application in industry. Over 35,000 copies are distributed quarterly to Elliott customers and friends. Address correspondence to C. W. Kalbfus, Editor, Elliott Company, Jeannette, Pa.

To schedule a showing in your plant, or to arrange to borrow the film for use in your training program, get in touch with your Elliott representative. Ask for the movie describing the "INSTALLATION,

OPERATION, AND CARE OF YOUR ELLIOTT MECHANICAL-DRIVE TURBINES." Copies of a leaflet describing the contents of the film (Bulletin H-24) are also available.

Big Boring Mill Gets Sure Footing

The installation of a 30-ft boring mill is quite a project. Such a machine was recently put into service in our Jeannette shops. One photograph shows the labyrinthine foundation which was prepared. This measures 40 ft by 40 ft, and is 13 ft, 6 in. deep. It required 32 tons of reinforcing rods and 210 yards of concrete. The new mill has a 16-ft clearance under the crossrail, and is equipped with two 9-ft travel rams and a 19-ft, 6-in. table. Special features such as electronic feed control, electrically operated set-up clamps, individual ram counterweights and ram-swing saddles will enable Elliott engineers to fit the mill with profiling equipment. The picture of the finished mill also includes, at the left, a 20-ft boring mill, which has been in service for many years. Shown on the new mill is a generator stator frame for a large hydro job.





The Greenwich station, at Gibbstown, houses a 10,000-kw noncondensing unit.

Around Atlantic City Electric Company's Deepwater and Greenwich Stations

SOUTHERN NEW JERSEY entertains many thousands of visitors along its excellent beaches each summer. This territory is also known for its farms (New Jersey is often referred to as the Garden State) and is growing industrially. The chemical industry, particularly, is showing large expansion.

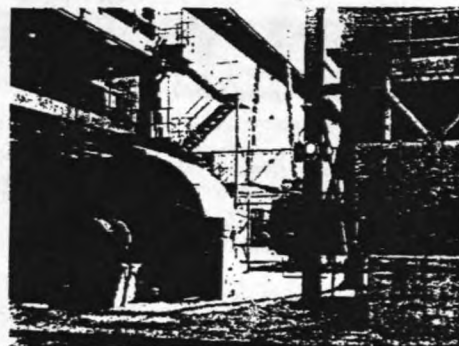
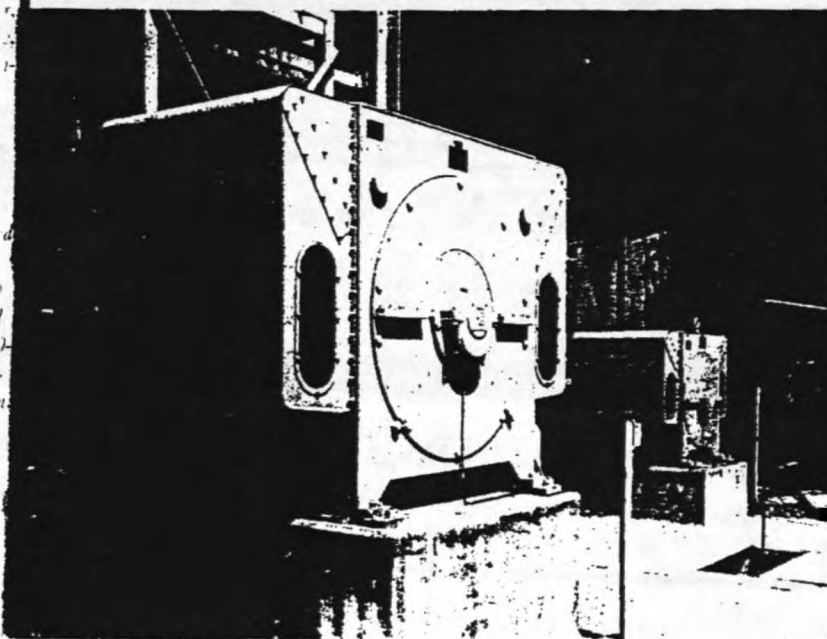
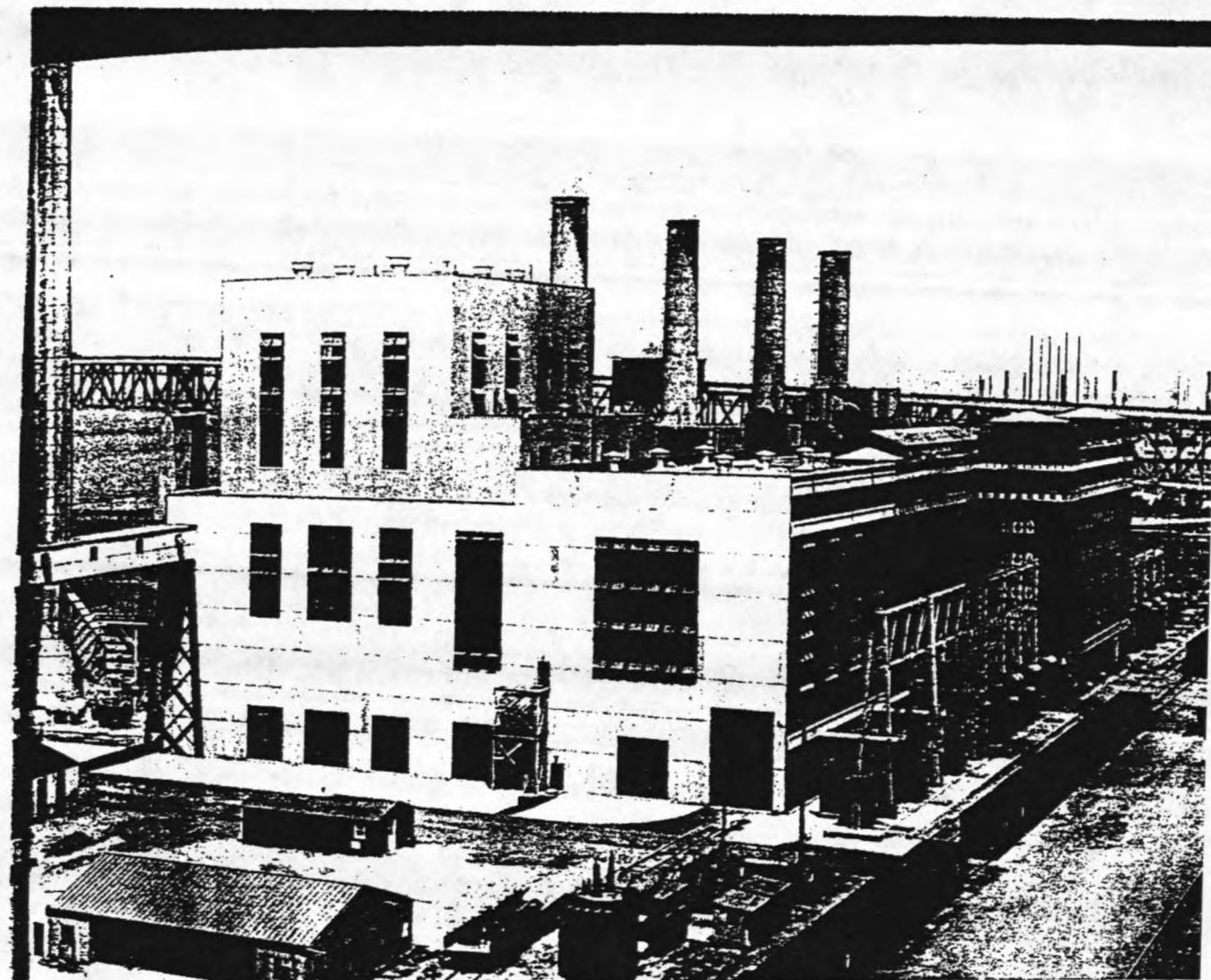
The Atlantic City Electric Company furnishes electric service in a 2700-sq mi area in southern New Jersey that comprises almost one-third of the state. It serves over 300 communities, a population of 492,000, and its list of customers currently totals 200,250. Its generating capacity of 318,000 kw is obtained from three stations, two located on the Delaware River on the western edge of the territory. The Deepwater Station, near Penns Grove, has a capacity of 213,500 kw; the Greenwich Station, at Gibbstown, has a capacity of 10,000 kw, and the Missouri Avenue Station in Atlantic City rates 94,500 kw.

The Missouri Avenue Station was featured in an article in the Autumn 1947 issue of *Powerfax*. It uses Elliott deaerating heaters, turbines, and motors. Pictures here show some of the Elliott equipment installed in the Deepwater and Greenwich Stations. These two stations are an interesting contrast in the use of steam-turbine-driven and electric-driven auxiliaries. Since the Greenwich Station operates a 10,000-kw, 175-psig back-pressure noncondensing unit, and furnishes



Deepwater station, near P. Grove, on the Delaware R. has a capacity of 213,500 kw of which is condensing, balance being supplied by back-pressure turbines.

Outdoor weather-protected motors drive the draft fan. At left, a 1500-hp, 720-rpm motor drives an i-d fan, at right is a 500-hp, 12 rpm motor driving a force draft fan. Deepwater Station.



Another view of the draft fans, from the other side, shows at left a 75-hp, 600-rpm motor on the forced-draft fan; and at right, a 250-hp, 150-rmp weather-protected motor on the induced-draft fan. This is Deepwater Station.

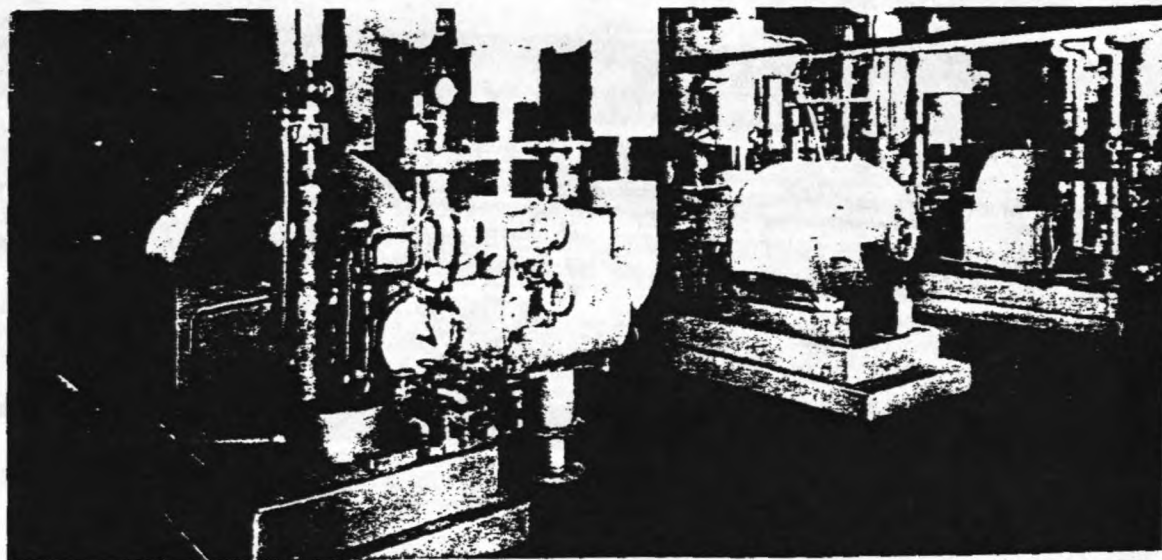
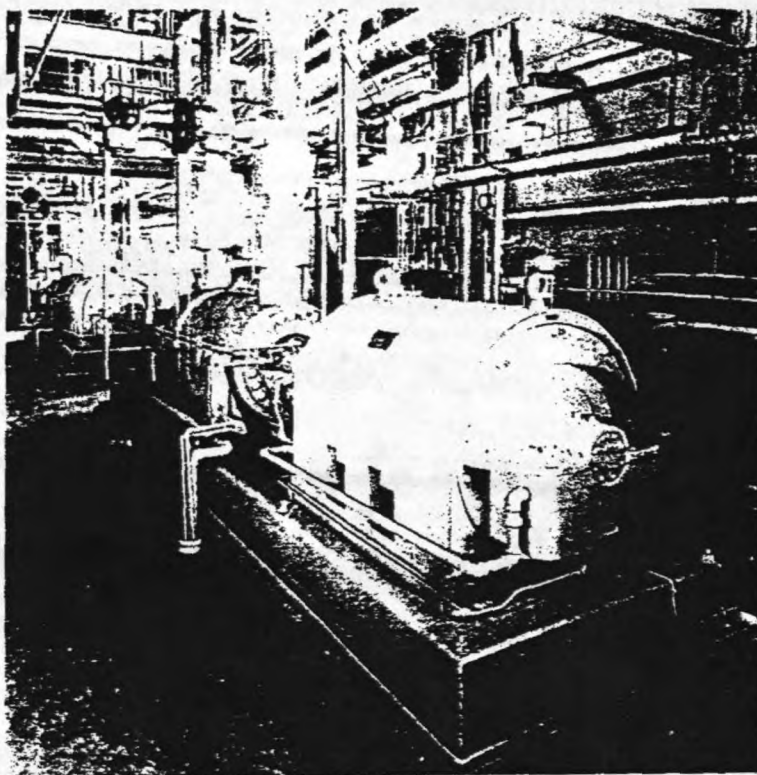
steam supply for industrial use, it makes use of steam auxiliary drives. The Deepwater Station, however, houses about 185,000 kw of capacity in condensing units in addition to back-pressure turbines for the supply of process steam for industrial use. This station uses the conventional electric motor drive for auxiliaries. Many of these motors are located outdoors.

The Elliott motors at Deepwater were installed in connection with a new 75,000-kw turbine-generator which went into service at the end of 1954.

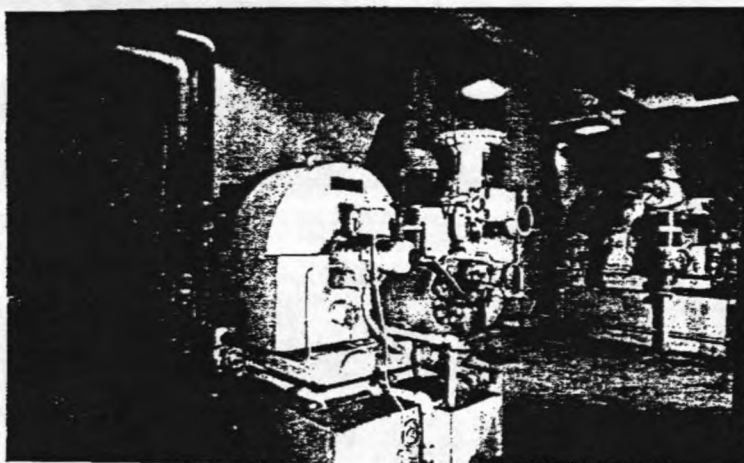
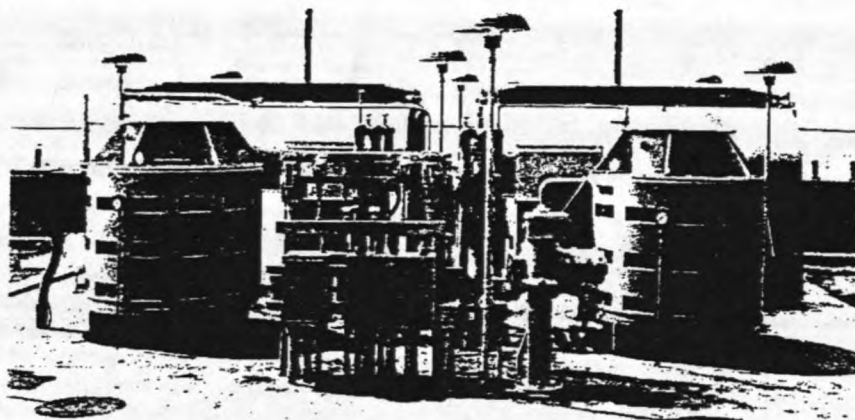
There is an Elliott 700,000-lb-per-hr deaerating feedwater heater in the Greenwich Station.

Three Elliott 900-hp, 3600-rpm squirrel-cage induction motors driving boiler-feed pumps in the Deepwater Station.

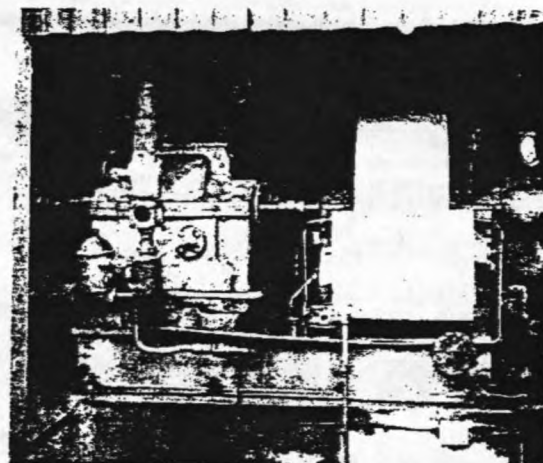
Two Elliott 406-hp, 3550-rpm turbines driving boiler-feed pumps in the Greenwich Station. Turbines take steam at 175 psig, 570 F, and exhaust at 35-psig back pressure. Turbines are suitable for future 700 F operation.



These two Elliott 200-hp, 511-rpm vertical outdoor weather-protected motors drive circulating pumps at Deepwater Station. There are also two Elliott 150-hp, 1200-rpm motors driving the condensate pumps.

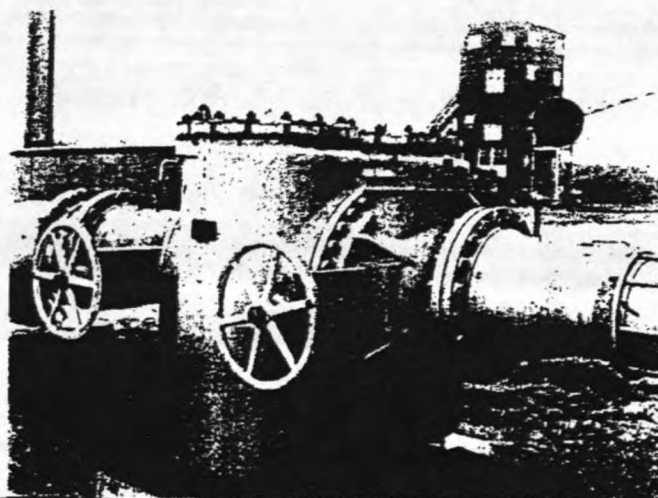


Two Elliott 203-hp, geared turbines driving forced-draft fans at Greenwich Station. Turbines operate at 3570 rpm, which speed is reduced to 1250 rpm on the fans. Steam conditions same as mentioned for boiler-feed pump drives.

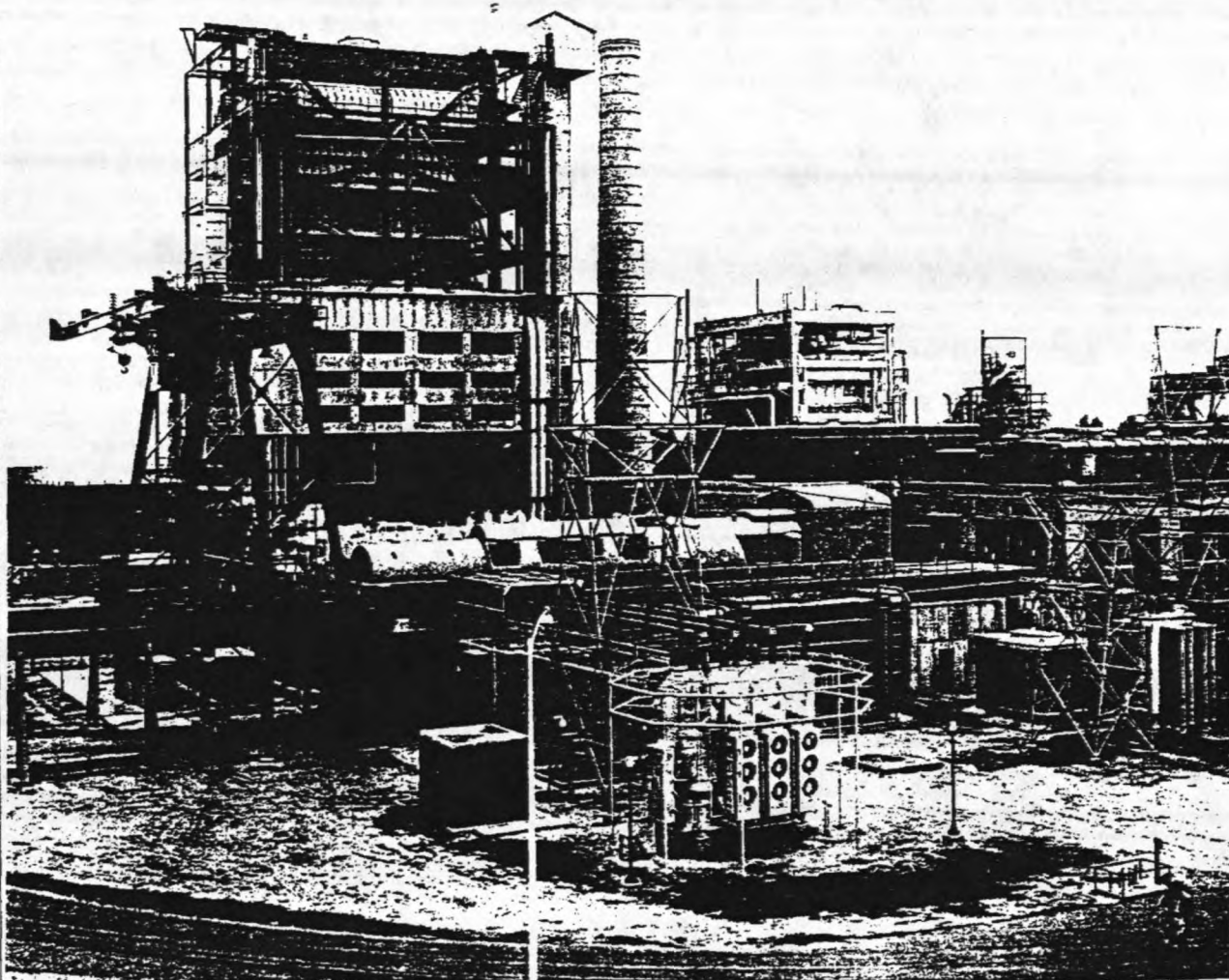


One of two Elliott 450-hp, 3570-rpm turbines driving induced-draft fans at Greenwich Station. Gears reduce speed to 850 rpm. Turbines exhaust at 35 psig.

This photograph shows an Elliott 20-in. twin strainer, one of several installed at Greenwich. The strainer handles cooling water and is installed outdoors.



Arkansas Power and Light keeps ahead of dema



The Harvey Couch Steam Electric Station near Stamps was one of two Arkansas Power and Light plants expanded by 135,000 kw in 1951. With a capability of 160,000 kw, it is the first of the major steam plants in the system, having been in operation since 1943. All major equipment operates in the open. The latest 135,000-kw turbine-generator unit is seen in the foreground with its boilers immediately behind. Older parts of the station are seen at right with an Elliott deaerating feedwater heater, installed in 1941, visible in its roof location

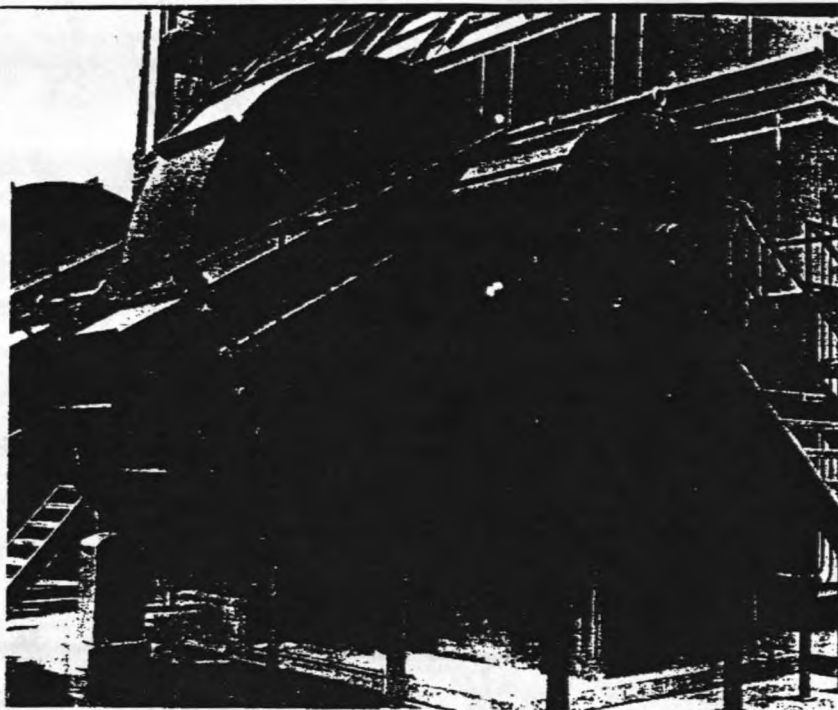
ARKANSAS POWER AND LIGHT CO. operates four major steam-electric stations totaling 768,000 kw capability. The Cecil Lynch Station (capability 242,000 kw) is located near North Little Rock. The Harvey Couch Station, at Stamps, (written up in Winter 1944 *Powerfax*) has a capability of 169,000 kw. Both stations were expanded in 1954 by 135,000 kw each. It is interesting to note that each of these generating units is capable of producing more power than the company's entire territory required prior to World War II. Other plants of the company include the Lake Catherine Station located near Malvern, with a capability of 211,000 kw, and the Hamilton Moses Station at Forrest City, with a capability of 146,000 kw. The company also operates two hydroelectric plants, located on the Ouachita River at Hot Springs, which total 69,000 kw capability.

The company is a part of the Middle South system, and this entire system is operated as an integrated unit, thus making available to each company the reserves of any of the other companies. Load forecasts are made at regular intervals, and additional generation is added from time to time as needed to take care of the Middle South area.

The Arkansas Power and Light Co. serves 735 communities in 61 counties, including 14 rural co-op systems. At the end of 1954, its rural lines totaled 17,989 miles. The company serves approximately two-thirds of the geographic area of Arkansas. It supplies electric power to more than 239,000 domestic consumers in addition to industrial and commercial users.

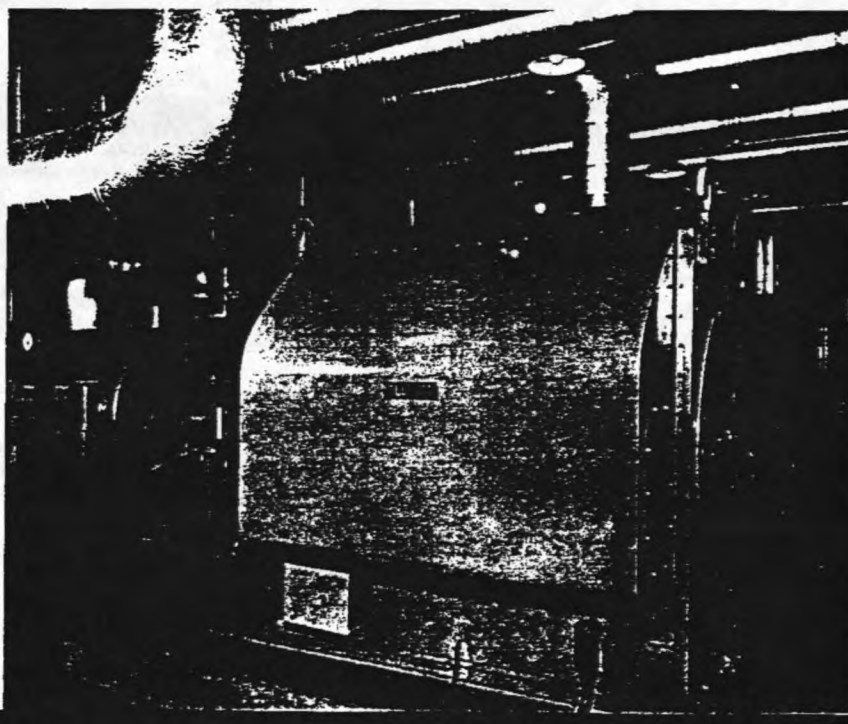
The company employs 2898 people and figures the investment per job to be \$80,211.

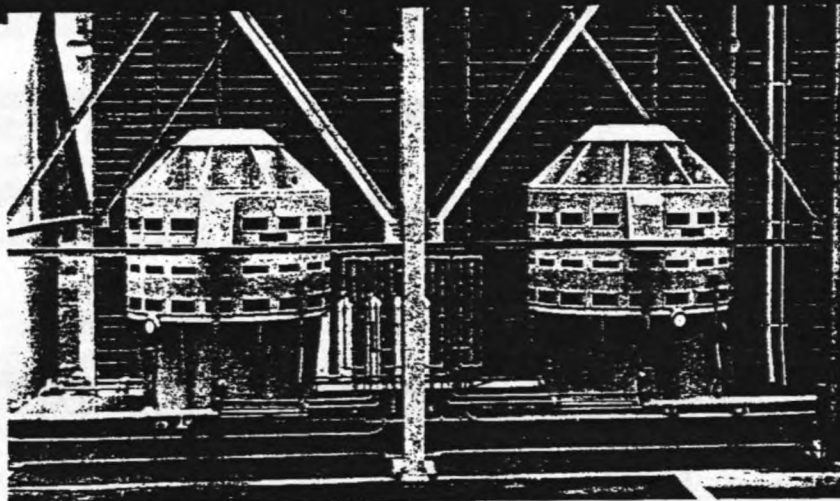
The new generating units at the



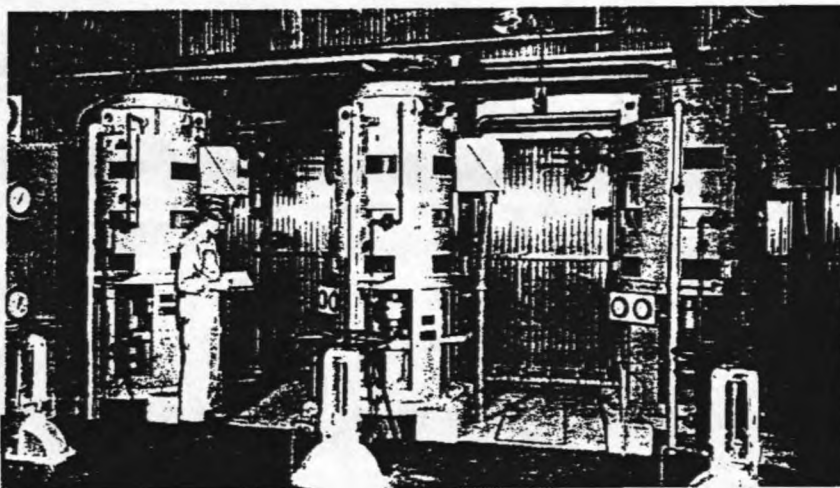
One of the two Elliott 1500-hp, 900-rpm weather-protected (outdoor splashproof) motors driving forced-draft fans in the Harvey Couch Station.

A view of the three Elliott 2000-hp, 3600-rpm induction motors driving the boiler-feed pumps for the latest unit in the Harvey Couch Station.





Cooling tower forms background for these two Elliott 1250-hp, 450-rpm vertical squirrel-cage induction motors driving the condenser circulating water pumps at the Harvey Couch Station.

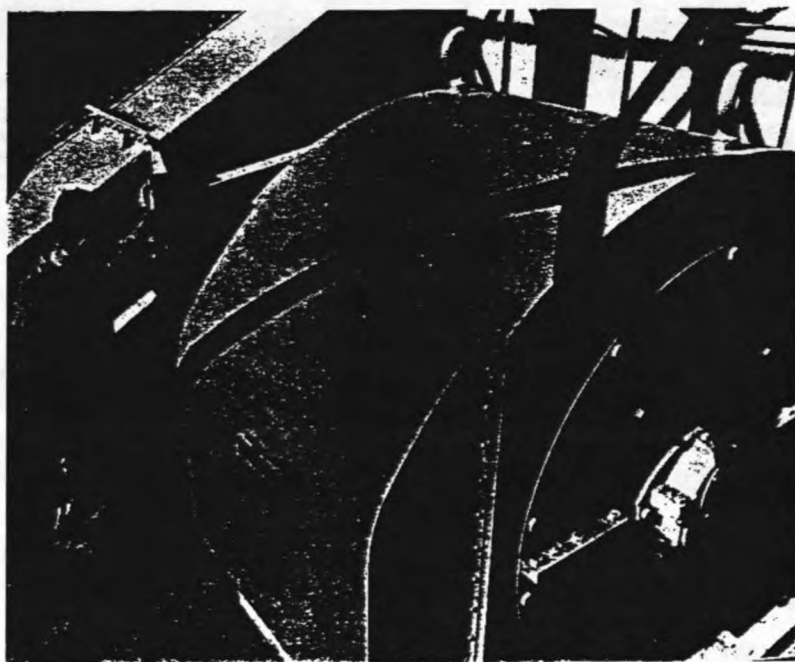


Cecil Lynch and Harvey Couch Stations have boilers equipped with burners which use either natural gas or fuel oil. Construction permits future addition of coal-handling equipment. Modern in every respect the generating units were built at a cost comparable to 10 years ago which points up the economies of expert engineering design and developments. Outdoor-type construction eliminated high cost buildings with all major equipment operating in the open.

The Cecil Lynch Station went into service with its first unit, 31,250 kw in May 1947. Its second unit, 66,000 kw, went on the line in July 1949; and its latest unit, 125,000

The three Elliott 350-hp, 1200-rpm vertical motors driving the condensate pumps for the new unit at the Harvey Couch Station are shown at the left.

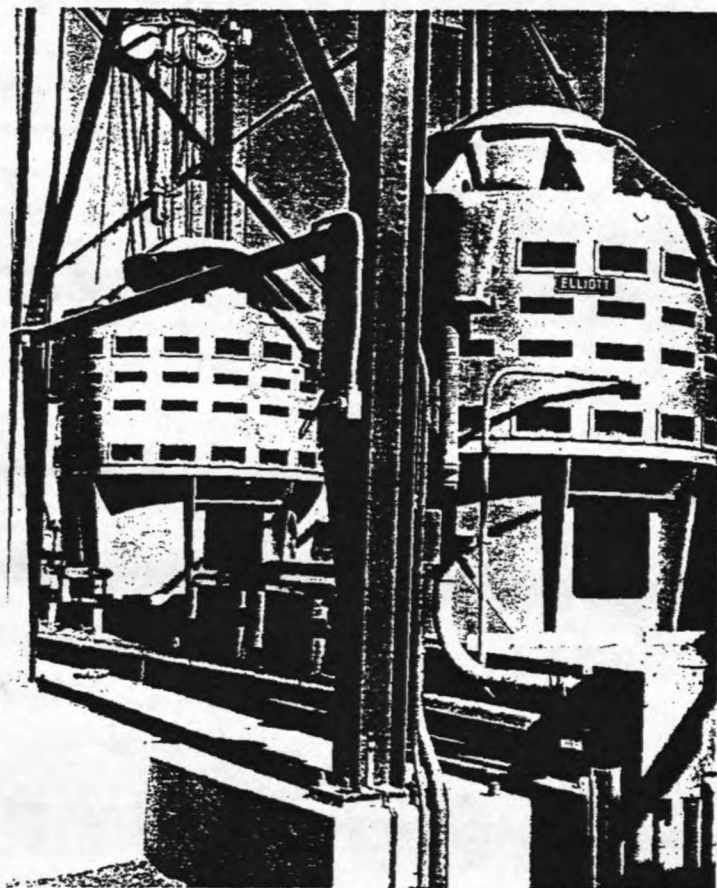
This Elliott 1500-hp, 900-rpm weather-protected squirrel-cage induction motor is one of two driving forced-draft fans for the latest addition at Cecil Lynch.



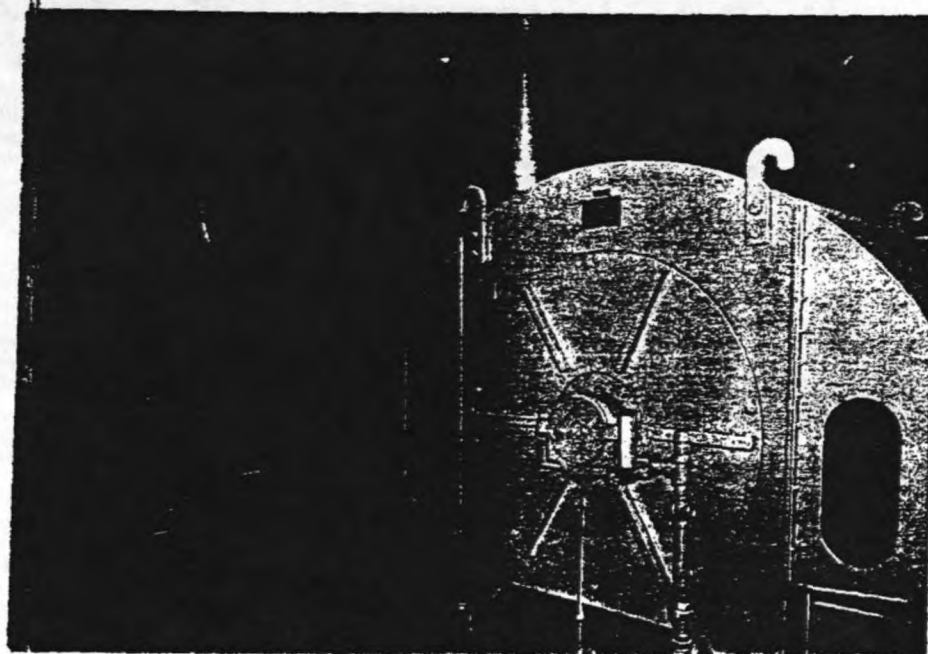
name-plate rating, went on the line in June 1954. Steam conditions for the first two units were 850 psig—900 F at the throttle. The No. 3 unit uses 1450 psig—1000 F. The two smaller units are located at main building roof level and are housed in a room whose roof may be removed for turbine maintenance work. The large unit is installed outdoors. Output of the station is fed into the Arkansas Power and Light Co. transmission system through power transformers at 110,000 and 161,000 volts.

The boilers are of the semi-outdoor type. With the exception of firing aisles, all parts of the boilers are outside. The principal fuel is natural gas, but equipment is installed to burn fuel oil in an emergency, and space has been allowed for future coal burning equipment. Boilers on the two smaller units are equipped with both forced- and induced-draft fans, while the large unit has only forced-draft fans.

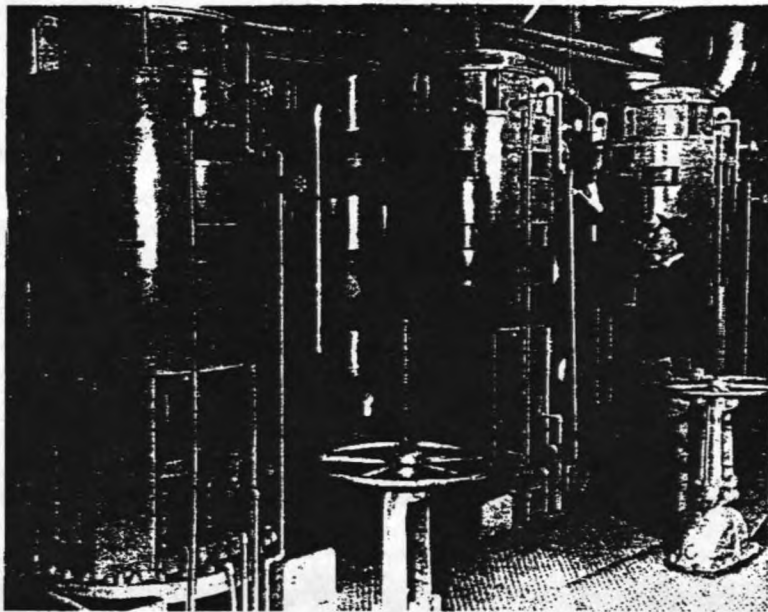
The station uses cooling towers, with water routed to and from them through underground concrete pipes. The condenser cooling water systems circulate 10,980,000 gph between condensers and cooling towers. Make-



These are the two Elliott 1250-hp, 150-rpm vertical weather-protected motors which drive the circulating water pumps at Cecil Lynch. They are installed outdoors alongside the cooling tower.



Three Elliott 2000-hp, 3600-rpm weather-protected squirrel-cage induction motors drive the boiler-feed pumps at the Cecil Lynch Station.



Three Elliott 350-hp, 1200-rpm vertical weather-protected induction motors drive the condensate pumps installed at Cecil Lynch Station.

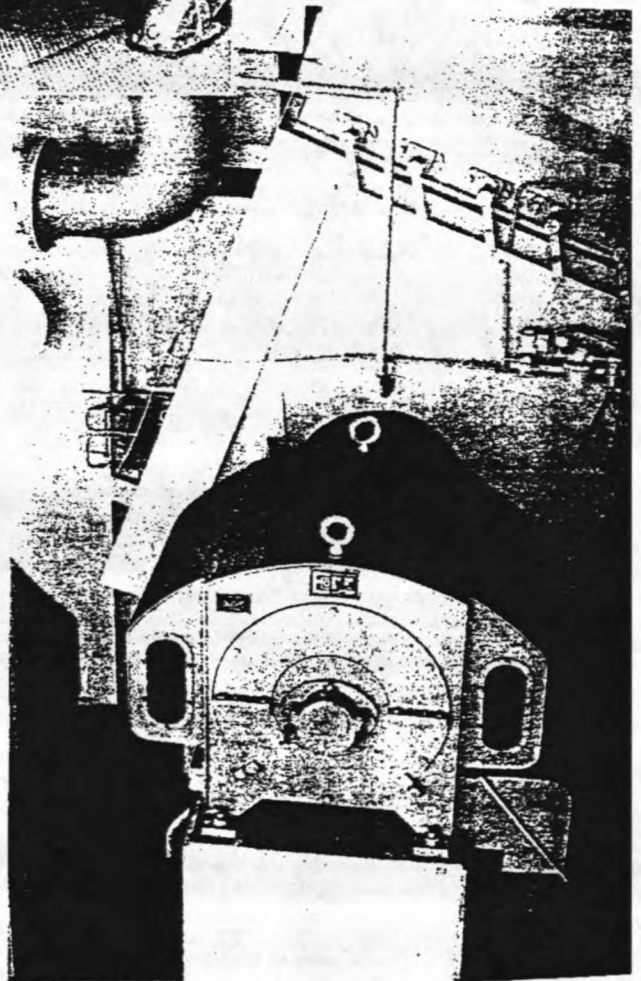
up to the system is about 1.7 percent, or 4,500,000 gpd. This make-up is pumped from 12 deep wells and is chemically treated for the removal of iron before entering the cooling-water cycle. Approximately 9000 lb of chemicals per day are required for this treatment. In addition, a railroad tank car of acid is used about every two months.

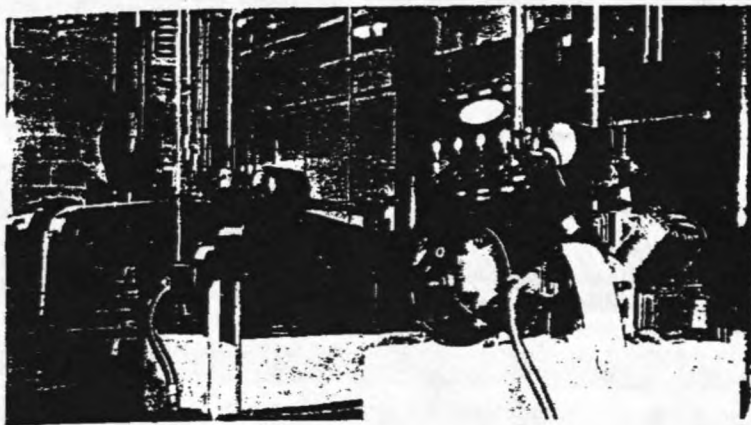
Some of the larger Elliott motors driving auxiliaries for the new units in the Harvey Couch and Cecil Lynch Stations are illustrated. In addition to these, Elliott C-W motors, in sizes from 1 hp to 100 hp, are driving cooling tower fans, compressors, lube oil transfer, and fuel oil recirculating pumps.

Engineers and constructors for these stations—Ebasco Services, Incorporated.

• • •

This Elliott 250-hp, 1200-rpm weather-protected squirrel-cage induction motor drives the gas recirculating fan at the Cecil Lynch Steam Electric Station.





Three Elliott motors drive the compressors for the refrigeration units in the plant. The Elliott 10-hp motor in right foreground is driving a compressor for the refrigerated storage space. Next in line is the Elliott 30-hp motor driving a reciprocating rotary compressor and, third, is an Elliott 25-hp motor driving another reciprocating multi-cylinder compressor. The last two compressors are part of the refrigeration equipment for the quick-freezing room.

Freezing bread to keep it fresh

It is possible that many *Powerfax* readers have discovered that by putting a loaf of bread in the refrigerator it will retain its freshness over a long period of time. This simple household trick has now been put into full-scale commercial operation at the new bread freezing and storage plant of Arnold Bakers, Inc. in Port Chester, New York. The new plant covers nearly 9000 sq ft and is designed to provide 12,000 cu ft of refrigerated storage space in addition to a quick-freezing room, packing room, a truck bay, and compressor room. The entire "cold box" area, consisting of freezing, packing, and storage rooms, is entirely enclosed by insulated walls, ceiling, and floor.

After the loaves of bread are removed from the oven and allowed a normal cooling period to prepare for slicing, they are individually wrapped and placed on racks which are then wheeled into the freezing room. There the bread is quickly frozen at minus 20 F. The racks are then moved to the adjacent packing room where the frozen loaves are put into cartons. From the packing room, the cartons are taken to the storage room where the frozen bread is kept at zero F until ready for shipment. There are conveyors to handle the bread from the quick-freezing room to packing room, and the packed cartons from the packing room to storage.

Freezing capacity of the quick-freezing room is 1000 lb per hr at minus 20 F. Two compressors are required for refrigerating this room. The first-stage compressor is a rotary unit with a 206-cfm displacement, V-belt driven by an Elliott 30-hp motor. The second stage, a multicylinder reciprocating unit with 73-cfm displacement is driven by an Elliott 25-hp motor. One compressor only is required for the storage room refrigeration system, and this is driven by an Elliott 10-hp motor.

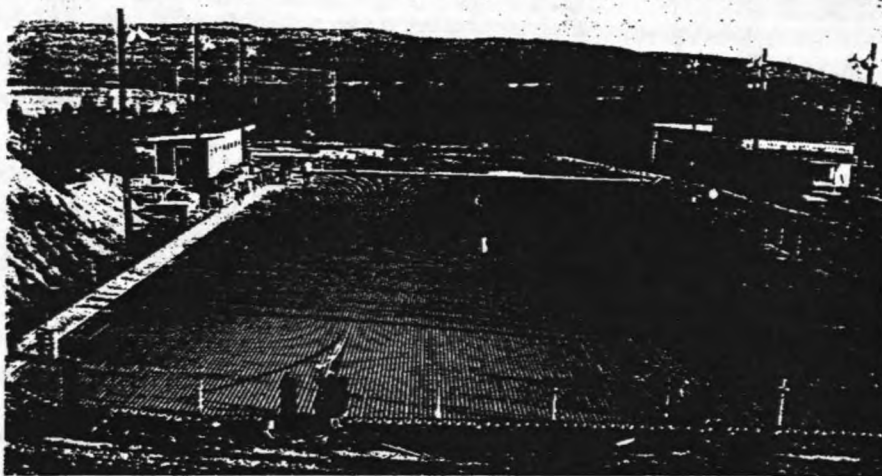
Arnold Bakers, Inc. pioneered the sale of quick-frozen bread on a commercial scale approximately two years ago, using public facilities in another city for storage of its frozen products. Now that Arnold has refrigerated storage space right at the bakery, bread can be frozen at the peak of its freshness and faster service can be given distributors, especially on those items where demand fluctuates widely. Frozen bread is shipped in refrigerated trucks to Arnold distributors in cities beyond a 400-mile radius of Port Chester. Within the 400-mile radius, Arnold distributors generally do not sell frozen products.

These racks of bread are being quick-frozen at 20 degrees below zero in the quick-freezing room of the new refrigeration and storage plant of Arnold Bakers, Inc., Port Chester, N.Y.



Information and photographs for this article were obtained from *Industrial Refrigeration*.

Ten miles of 1¼-in. galvanized steel pipe were installed to provide the base for the Amherst College rink at Amherst, Massachusetts.



Skating every winter day in New England

To get away from their dependency on the whims of the weatherman, schools, municipal authorities, and clubs in the New England area have been building artificial outdoor skating rinks that will give them dependable skating throughout the winter months. To date the rinks that have been built have had an average size of 85 by 200 ft. They contain approximately 10 miles of brine-carrying pipe which is welded together to form a return loop system as shown in the construction photographs of the Amherst College rink.

The Jarvis Engineering Company of South Boston has designed or built 12 such outdoor skating rinks in the last two years. Typical of these is the Metropolitan District Commission rink at Milton, Massachusetts, which is said to be the first municipal outdoor rink to be built in the country. On its opening day last November, the Milton rink drew a crowd of 3100 skaters, 2500 of whom were youngsters, and during the season it attracted over 45,000 skaters. The rink was closed only seven days during the season due to weather conditions. This record seems even more impressive when compared to the previous winter that had only six or eight days suitable for natural ice-skating.

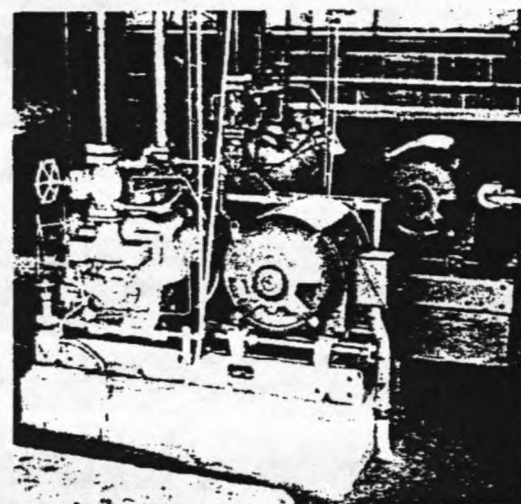
The rink that Jarvis put in at Massachusetts Institute of Technology is a little unusual in that its refrigeration equipment serves a dual purpose. Besides its ice-making duties in the winter, it doubles in air conditioning, keeping the new Kresge Auditorium cool during the summer months.

Some other installations made by Jarvis Engineering include rinks at Harvard University, Cambridge, Massachusetts; St. Paul's School, Concord, New Hampshire; St. George's School, Middletown, Rhode Island; and Phillips Academy at Andover, Massachusetts. All of these, and also the rinks mentioned above, use Elliott Crocker-Wheeler motors for driving refrigeration equipment. Motor sizes range from the 15- and 20-hp motors driving pumps to the 50-, 75-, and 100-hp motors used as compressor drives. The average skating rink requires about 100 tons of refrigeration, depending on the length of the operating season.





Milton, Massachusetts, now has a skating rink that can be enjoyed throughout the winter months, and no one has to watch for the weatherman's predictions of cold weather before they decide to go skating. The building at left houses the refrigeration equipment.



Two Elliott C-W open, drip-proof motors, a 75-hp and a 100-hp, drive the Worthington compressors in the refrigeration cycle at Milton.

Above left—The Worthington compressors at the Amherst rink are driven by two 75-hp Elliott C-W motors. In the foreground of the picture can be seen two Elliott Crocker-Wheeler 20-hp motors being used as pump drives.

At the St. George's School rink at Middletown, Rhode Island, are two more Elliott C-W 75-hp motors driving Worthington compressors.

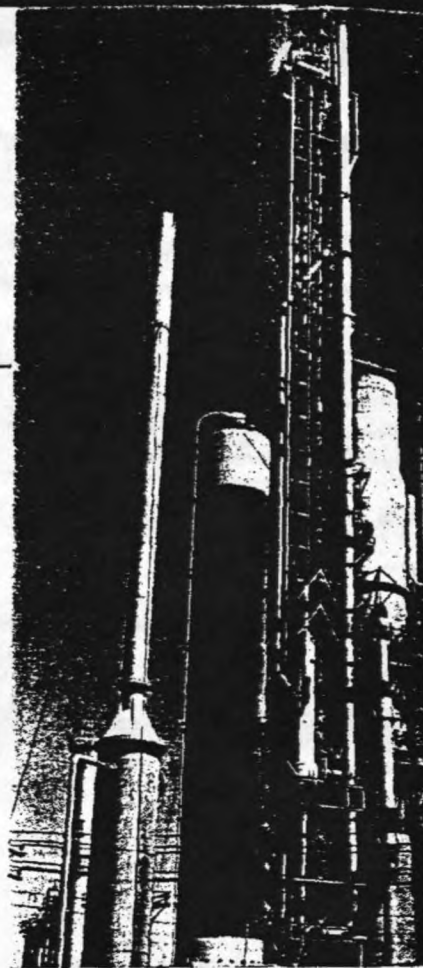
Texas City Refining's Houdriflow unit

A new 19,000-barrel-per-day Houdriflow catalytic cracker was placed in operation by Texas City Refining, Inc. at Texas City, Texas during September 1953. A charge consisting of vaporized gas oil from a flash tower, plus a liquid phase mixture of heavy vacuum gas oil and recycle, is being cracked into high octane gasoline.

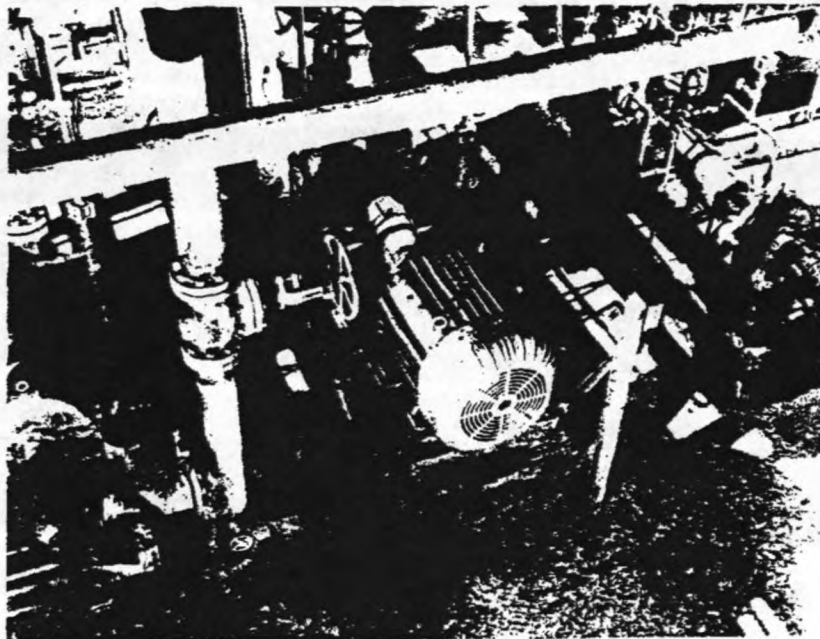
The new unit was designed by Houdry Process Corporation and engineered and erected by Kaiser Engineers, Inc. To the refinery this represents an expansion in capacity as well as a modernization of process. It is an indication of the fact that the people of Texas City Refining, Inc. are continuously striving to improve and modernize their facilities.

The cracking tower, being approximately 350 ft high, is a landmark for the surrounding territory.

As indicated by the photographs, an Elliott centrifugal compressor, steam turbines, motors, and steam jet ejectors serve the unit in various capacities.



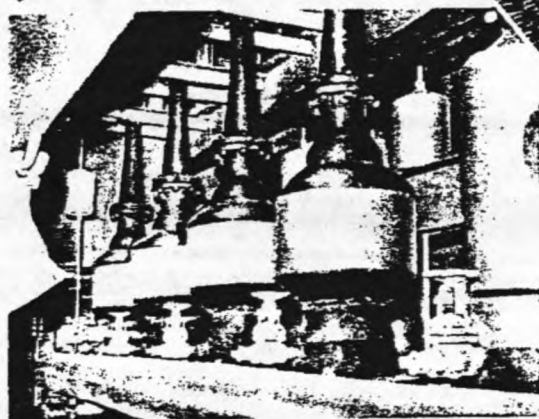
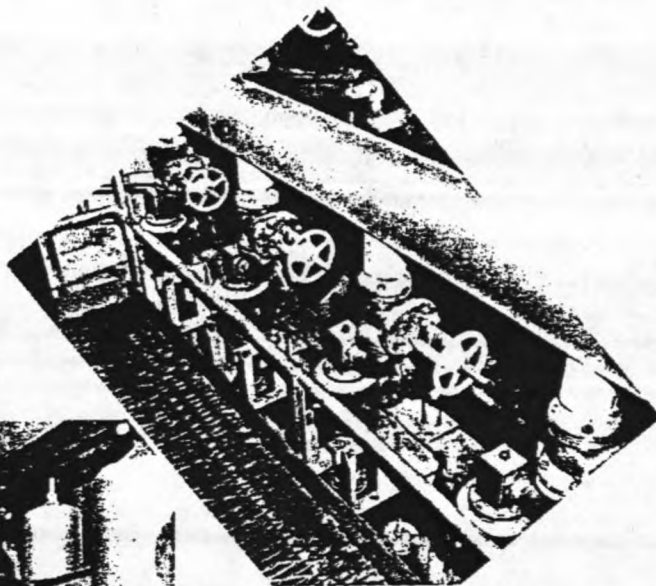
This is the Houdriflow unit, with 350-ft tower, at Texas City Refining, Inc., at Texas City, Texas. It is the principal element in an aggressive modernization and expansion program.



Elliott steam turbines and totally-enclosed fan-cooled motors drive various circulating water pumps. The drivers range in size from 25 to 113 hp.

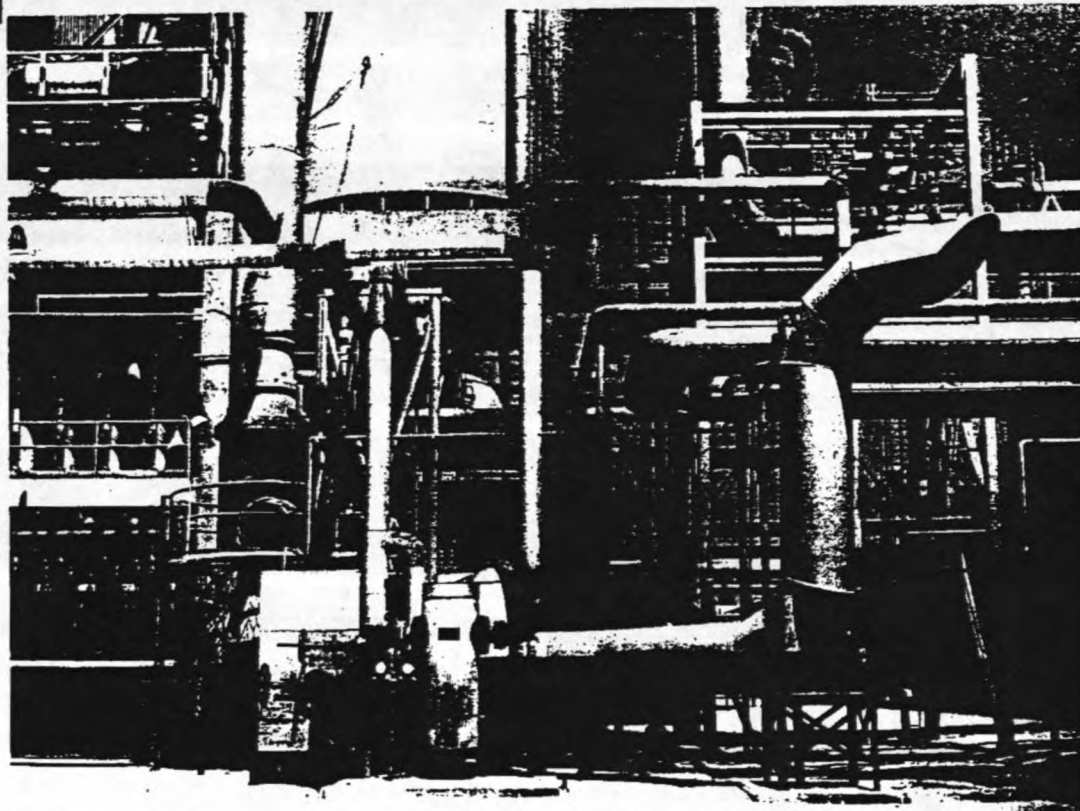
A little hard to make out is completely enclosed, is this centrifugal compressor which is used for inlet and lift. Compressor inlet pressure is rated 46,300 in 14.7 psia, discharge pressure is 1275 hp, taking steam at 43 against

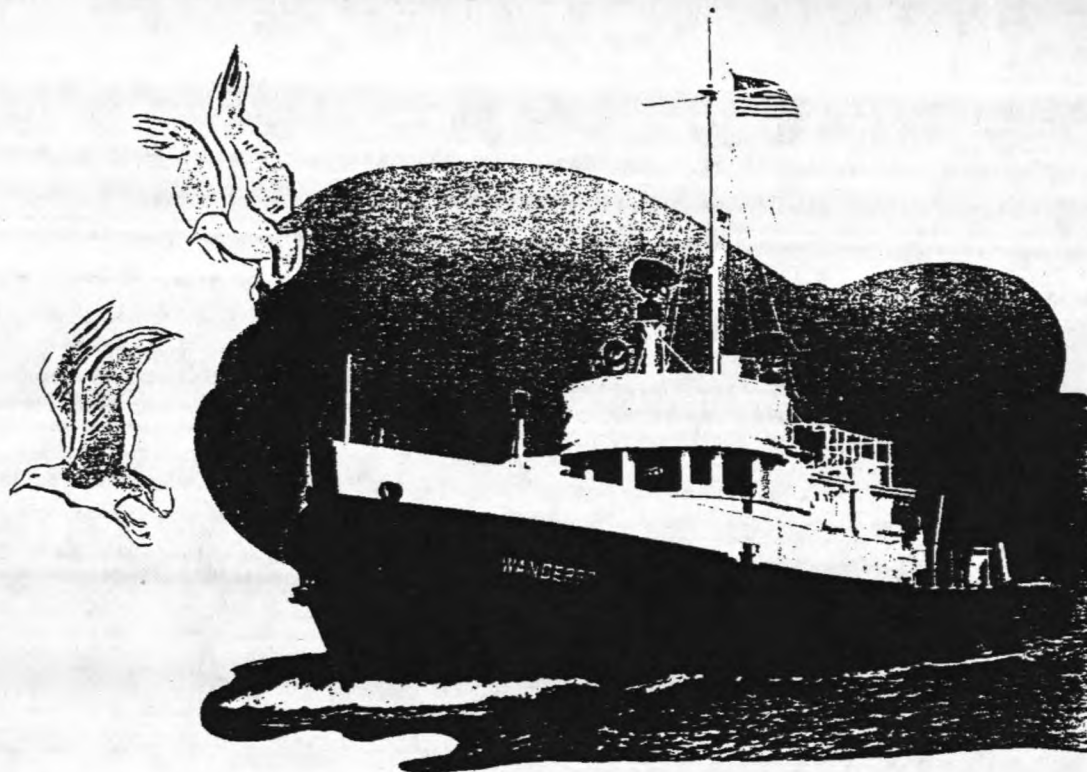
This photograph shows the bottom of four of the ten ejectors. These units act as steam jet compressors, compressing flue gas from the kiln and delivering motive gas at a constant rate to the lift system. The mixture of flue gas and steam from the thermocompressors lifts the catalyst to the top of the Houdriflow unit.



Ten large Elliott single-stage ejectors are used on the Houdriflow unit. They are installed about 100 ft above ground in two banks of five ejectors each. This photograph shows tops of four ejectors.

*...the turbine
...turbine-driven
...combustion air
...up at right.
...inlet pressure
...17 psia. Turbine
...and exhausting
...backpressure.*





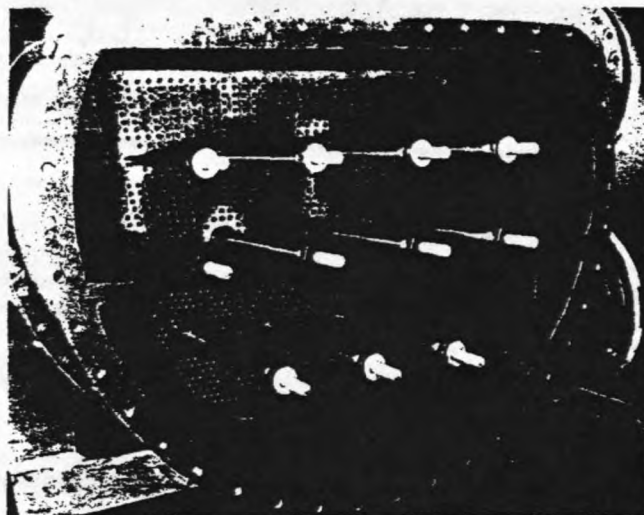
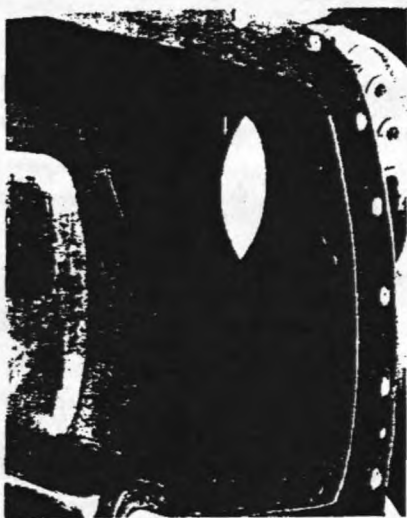
The saga of the "Wanderer"

THE lead article in the Winter 1931 issue of *Powerfax* was entitled "The Diesel Electric Yacht *Wanderer*." The article was written by two Elliott men, L. P. Brown, Ridgway plant, and H. W. Allsbrook of the New York district office, and described this unusual vessel, the first diesel-electric private yacht, which was distinctive in many ways. The electric propulsion equipment was worked out in detail by Elliott Company, which designed and built the propulsion motor, generators, controls and switchboard. The system provided variable voltage control for the armature of each propulsion motor.

A recent issue of *Mechanical Topics*, published by the International Nickel Company, Inc., brought this vessel into the limelight again.

After launching, the *Wanderer* became a familiar sight on the Great Lakes during summer months, around Florida and the Caribbean during winter. At every port she evoked interest. The statement was made at that time that "there wasn't any weather she couldn't ride out." With the advent of World War II, the *Wanderer* was mustered into the Coast Guard. She was on rescue and general patrol duty off the rugged Maine Coast. Mustered out of service in July 1945, the veteran went to work for new operators, The Sperry Gyroscope Company. She became a floating laboratory in which all sorts of new electronic devices were tried out. She put in at practically all Gulf ports, plowed the Mississippi, has been up and down the east coast, through the St. Lawrence waterway and into the Great Lakes.

We understand that the *Wanderer* now serves the U. S. Navy and is assigned to the Tenth Naval District.

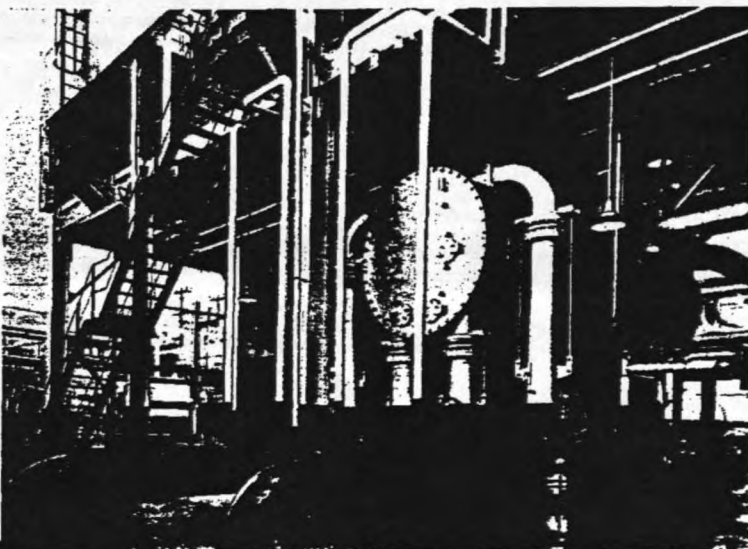


Neoprene lining overcomes salt water corrosion

THESE detailed views of the water box of an Elliott 7000-sq ft surface condenser show how it was equipped for use in a plant along the sea coast. To offset corrosion troubles the interior of the water box was coated $\frac{1}{16}$ in. thick with seamless Neoprene rubber coating. The faces of the flanges were also coated so that it was not necessary to use gaskets. The coating was sprayed on, and after each application, .005 in. thick, the material was cured by infrared heat. Before applying, all the surfaces were sandblasted to remove loose scale and dirt. In view of the use of salt water for cooling, aluminum brass tubes and Naval brass tube plates and water-box stays were used in the condenser.

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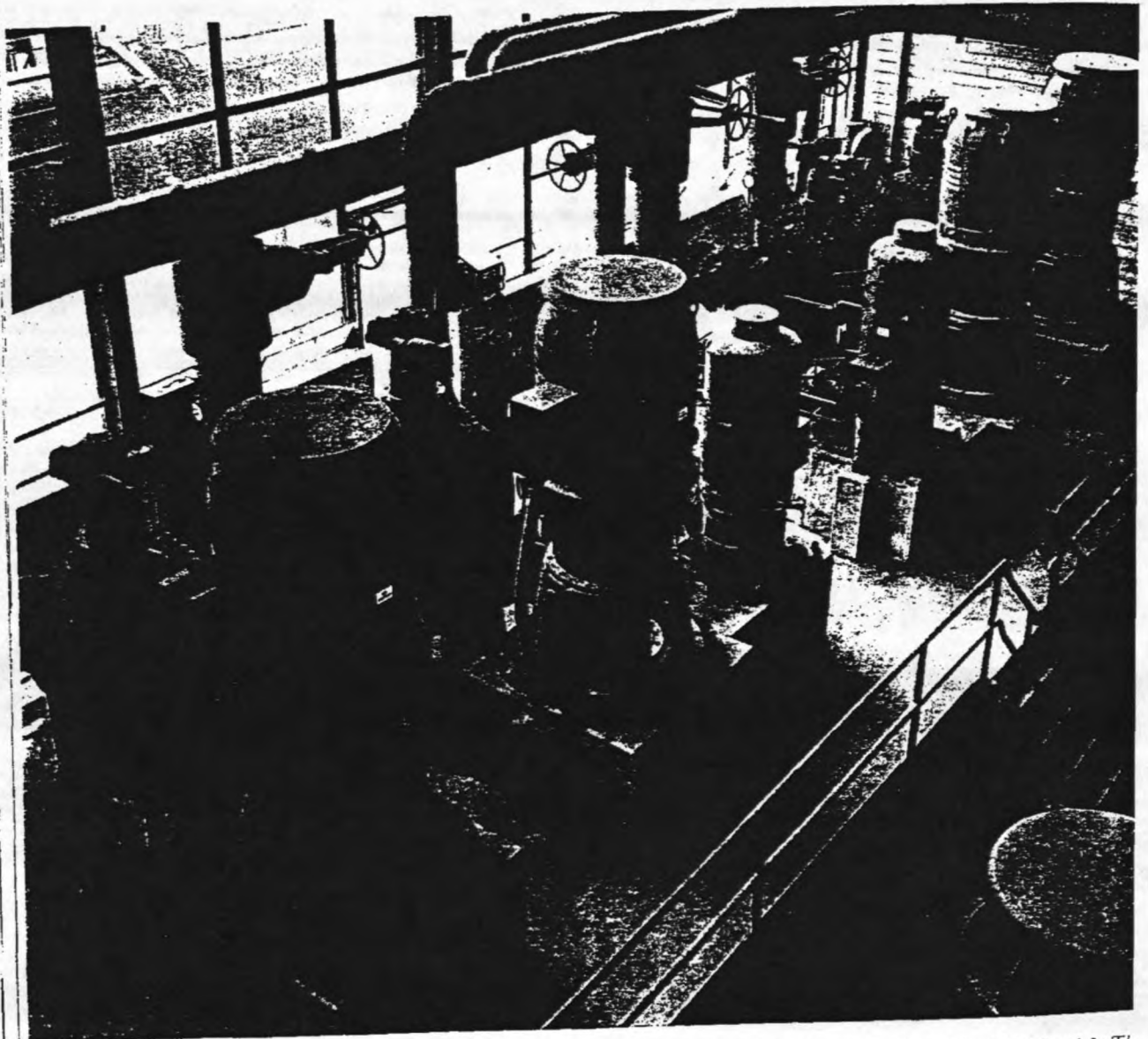
Condenser in a petrochemical plant



This good-looking Elliott condenser installation is in a southwest Gulf Coast petrochemical plant. The condenser serves a turbine driving a centrifugal compressor, which is mounted on the balcony above the condenser in outdoor location. It is one of a dozen divided water-box surface condensers ranging in size from 8800 to 11,000 sq ft furnished this large plant for similar service. At lower right may be made out a couple of Elliott mechanical-drive turbines driving condensate pumps.

“ “ “

In the Cromby Station



A view of the river-water pumps in the Cromby Station serving Units 1 and 2. The pumps, rated 6000 gpm, 86 psi, are driven by Elliott Crocker-Wheeler 350-hp 1200-rpm, 4000-volt vertical motors. Smaller units in center are fire pumps. In the discharge line of the river-water pumps are four Elliott 20-in. self-cleaning strainer.

of Philadelphia Electric Company

by W. S. Einwechter

Electrical Engineering Div., Philadelphia Electric Co.

and G. E. Klapper

Mechanical Engineering Div., Philadelphia Electric Co.

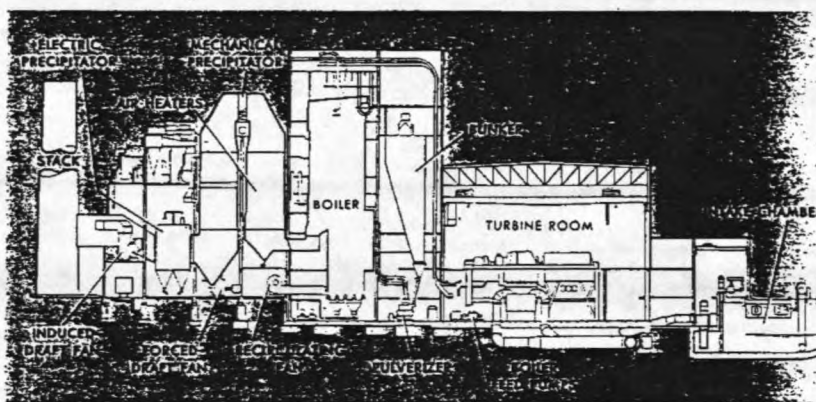
THE new Cromby Station of Philadelphia Electric Company, located on the West Bank of the Schuylkill River about 30 miles northwest of Philadelphia, near the borough of Phoenixville, is the third power station to be built at this location. The first, a hydro station which was placed in service in 1904, was retired and demolished in 1929. The second was a steam station, which was put into service in 1919, was shut down some ten years later, and recently was demolished to make way for the present station. It is interesting to note that the first Cromby plant had a capacity of 350 kw in two units. The present plant's capacity is 350,000 kw, also in two units. Thus the capacity has multiplied exactly 1000 times in the span of 50 years.

The No. 1 unit at Cromby, rated 150,000 kw, was placed in service in July 1954. The No. 2 unit, 200,000 kw, went into service about a year later, August 1955.

The plant is of semi-outdoor construction. A two-story section on the riverside housing the office, locker, storeroom, maintenance and construction facilities, as well as circulating and river-water pumps, features the use of large areas of glass and polished alberene stone. The turbine room has end-walls of glass block, the other walls being of spandrel construction using 8-in. structural tile. Miscellaneous enclosed areas and conveyors are covered with corrugated aluminum. Stacks for the main unit boilers are each 300 ft high. A cross section of the plant is shown above.

The daily burn requirement of 2800 tons is met entirely by rail delivery of Pennsylvania and West Virginia bituminous coal.

Four vertical circulating water pumps, two per unit, provide a total of 225,000 gpm to the condensers. This water is returned to the river about 1000 ft downstream from the intake to minimize recirculation at periods of low river flow. Water may be diverted from discharge conduits through a 36-in. concrete pipe to a nozzle cham-



Cross section drawing of No. 1 unit in Philadelphia Electric's new Cromby Station.

ber in the apron of the intake tunnels in order to minimize ice formation on the trash racks and screens.

The boiler used with the 150,000-kw unit is of the pressurized dry-bottom type with a capacity of 1,050,000 lb of steam per hour. It is provided with four mills, each with a capacity of 18.2 tons per hour to provide for a coal burn at rated load of 48.5 tons per hour. The furnace is operated normally with two forced-draft fans under a positive pressure of 20 in. of water. Two induced-draft fans have been installed to operate only for brief periods during maintenance operations when negative furnace pressure is required.

The boiler used with the 200,000-kw unit is of the twin-furnace, controlled-circulation type, with a capacity of 1,450,000 lb of steam per hour. For the controlled circulation, four boiler-feed pumps are available, any three of which can supply the required 5,800,000 lb per hour of water circulation. Full boiler load may be maintained for a limited time with only two pumps.

Both main turbines are of the tandem-compound, triple-exhaust type, operating at 3600 rpm with throttle steam conditions of 1800 psi, 1000 F, leaving the high-pressure element at 415 psi and 630 F to be reheated to 1000 F before returning to the intermediate-pressure

element. Heaters for the six-stage regeneration cycle are located in the turbine room. Final feedwater temperature is 500 F.

The hydrogen-cooled generators generate at 20 kv. Each generator feeds its power to a separate outdoor substation through its own unit step-up transformers. Excitation is from separate motor-driven exciters of the flywheel type, three being provided for the two generators.

Since all boiler and turbine auxiliaries are motor driven, a sizable auxiliary power installation is required. Motors rated 200 hp and above are supplied from a 4-kv system, and smaller integral horsepower motors from a 440-volt system.

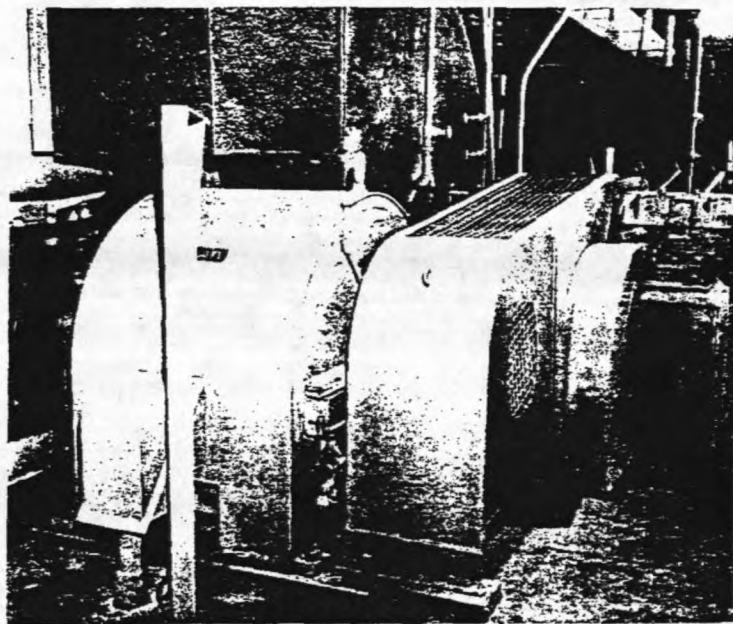
Indoor motors are splashproof except where near oil or inflammable materials. Outdoor motors above 200 hp operate at 4 kv and are of the weather-protected, air-cooled design, while smaller outdoor motors are fed at 440 volts and are totally-enclosed, fan-cooled.

Boiler, turbine, generator, auxiliary power, and substation controls are concentrated in one central con-

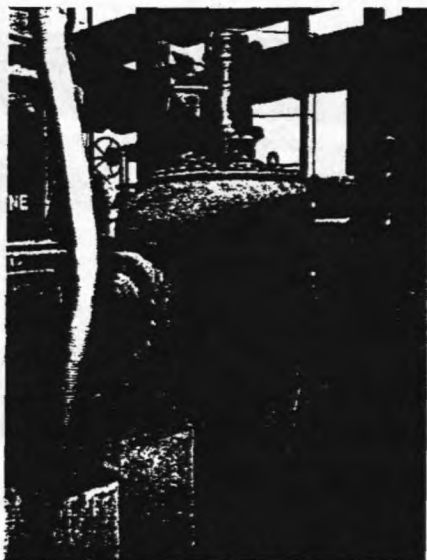
trol room which is completely enclosed except for two small windows facing the boilers which allow a mirrored view of the furnace fire through observation doors on the boilers. These windows allow a line of sight for the conventional water-level mirror system. The water columns for

the two boilers are televised to the control room.

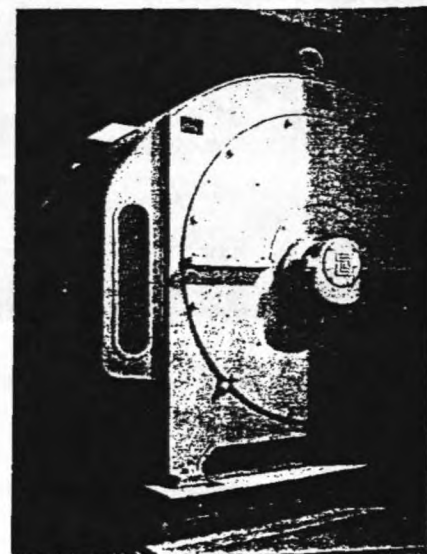
Both the mechanical and electrical installation were designed by the engineering department of the Philadelphia Electric Company. The general contractor was United Engineers & Constructors, Inc.

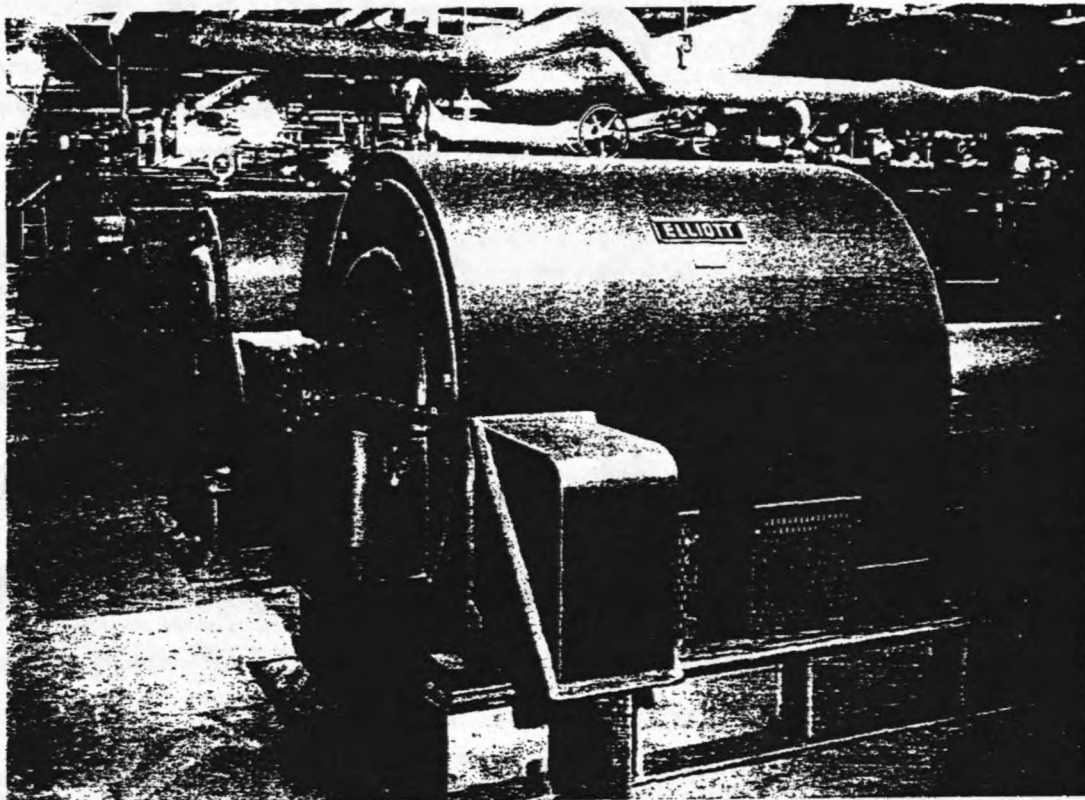


This is one of two Elliott 1500-hp, 710-rpm, 4000-volt motors driving induced-draft fans serving Units 7 and 8 in the Delaware Station.



A close-up of one of the four Elliott 20-in. self-cleaning strainers which are located on the discharge side of the vertical river-water pumps. These strainers clean themselves constantly, the motor on top slowly turning a rotating element, thus permitting backflushing of the straining elements. Dirt and debris are discharged through a drain at the bottom.



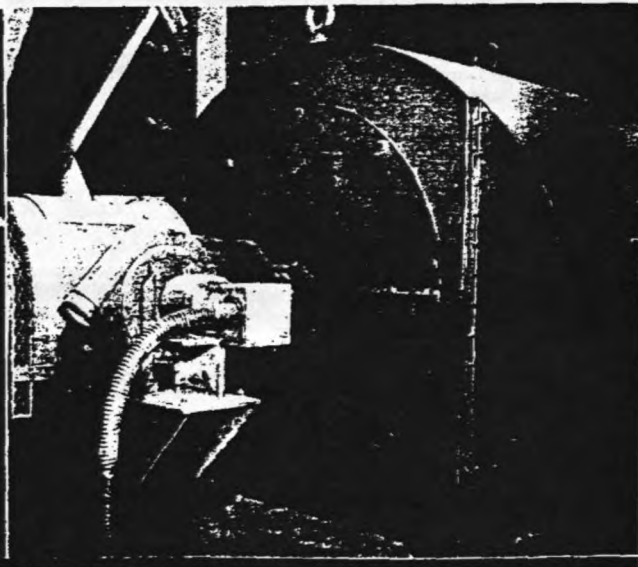
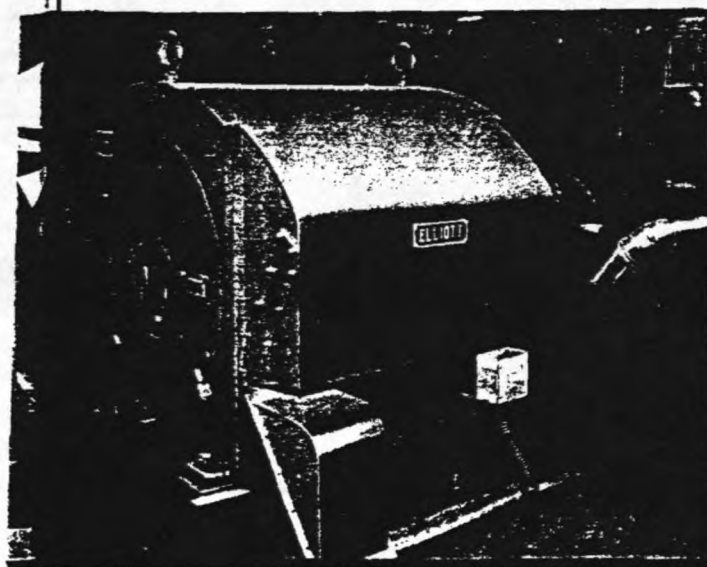


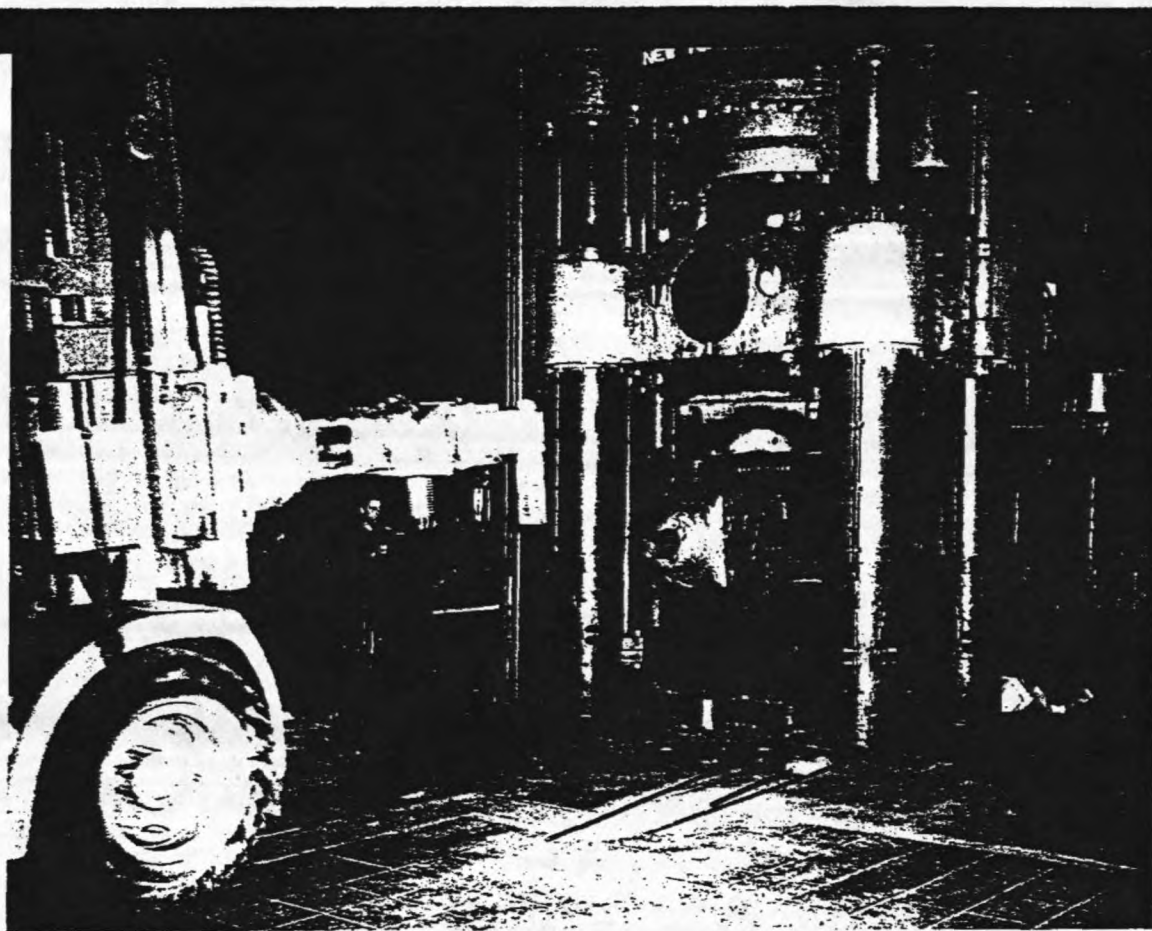
Four Elliott 350-hp, 600-rpm, induction motors drive pulverizers for No. 1 unit, Cromby Station. The drive is through V-belts. Coal pulverizers are rated 18 tons per hour. Each mill supplies four burners.

This line of six Elliott 2000-hp, 5000-rpm, 1000-volt motors is driving the boiler-feed pumps for Units 1 and 2 at the Cromby Station. Two boiler-feed pumps are assigned to No. 1 unit and three to No. 2 unit with an additional pump being available as a common spare. All pumps are of the horizontal, centrifugal, barrel casting type. Each pump has a capacity of 575,000 lb per hr against a discharge head of 2215 psig when handling 340 F water.

This particular Elliott 250-hp, 1200-rpm, weather-protected induction motor drives a dust collector fan serving Unit No. 2.

One of two Elliott 1000-hp, 900-rpm, weather-protected motors driving induced-draft fans serving No. 1 unit at Cromby Station.





Elliott motors power new hydraulic forging press

A new 2000-ton forging press built by Loewy Hydropress, Inc., is now busy making smaller billets out of bigger ingots at the Universal Cyclops Steel Company plant at Titusville, Pennsylvania. This new press, which will deliver over 100 blows per minute, is the only modern forging press in the United States designed primarily for forging tool steel and high temperature alloys. It rests on steel pilings filled with concrete which were driven to a depth of 50 feet, its base requiring 400 cubic yards of concrete.

The care and feeding of this huge mechanism requires four heating furnaces, an annealing furnace, a charger, a manipulator, a 40-ton overhead crane with a seven and one-half ton auxiliary hook, high lifts and a unit

for pumping water to a pressure of 4200 psi. All of this is inside a new building measuring 200 ft by 90 ft and 50 ft high, especially constructed to house the monster. However, for all the considerable amount of equipment involved, a crew of only six men is required for the operation of the forging press.

The water unit is housed in its own room next to the press, where the main pieces of equipment are two hydraulic pumps driven by Elliott 600-hp, 1200-rpm synchronous motors. Water is pumped at a pressure of 4200 psi into a "bottle" having steel walls eight inches thick. The cushioning air at the top of the bottle is supplied by a horizontal V-belt-driven air compressor. The compres-

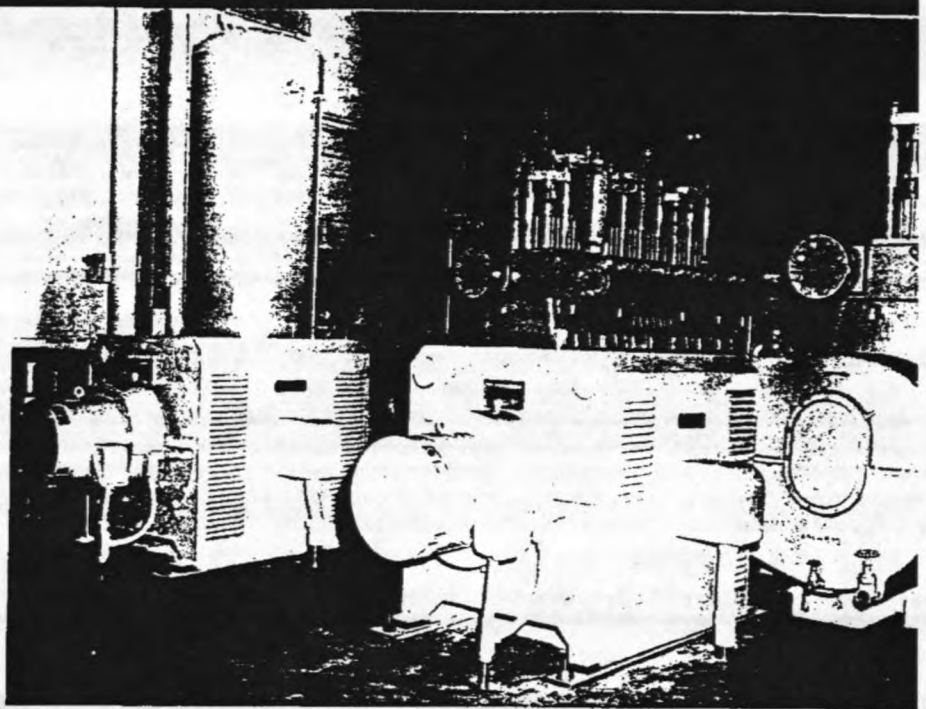
sor drive is an Elliott C-W 40-hp motor.

The press has enabled Universal Cyclops to handle larger-sized ingots and billets which it could not process before. These ingots, cast at the company's Bridgeville, Pennsylvania division and alloyed to the customers exact specifications, arrive at Titusville either by rail or truck. After the ingots are ground to remove scale, they are delivered to the building which houses the forging press. Here each ingot is placed in an automatic controlled gas-fired furnace for about 24 hours and heated to proper forging temperature.

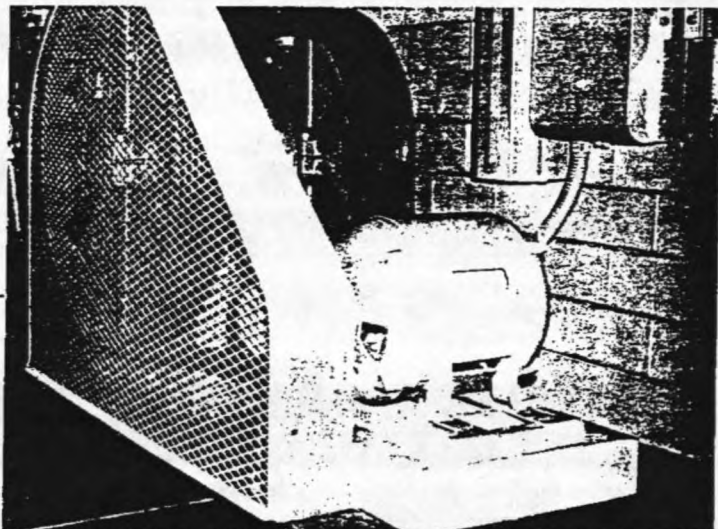
After the right temperature is reached, the charging machine removes the ingot from the furnace and

A billet has just been placed in Universal-Cyclops' new 2000-ton hydraulic forging press by the charger at left. The single operator, sitting at the control panel, controls the stroke of the press. The manipulator, on the opposite side of the press from the charger, is controlled by a second operator in its own cab.

These two Elliott 600-hp, 1200-rpm synchronous motors drive the hydraulic pumps which provide power to the forging press. Water is pumped at a pressure of 4200 psi into the steel bottle which can be seen standing in the corner of the room behind the pumps.

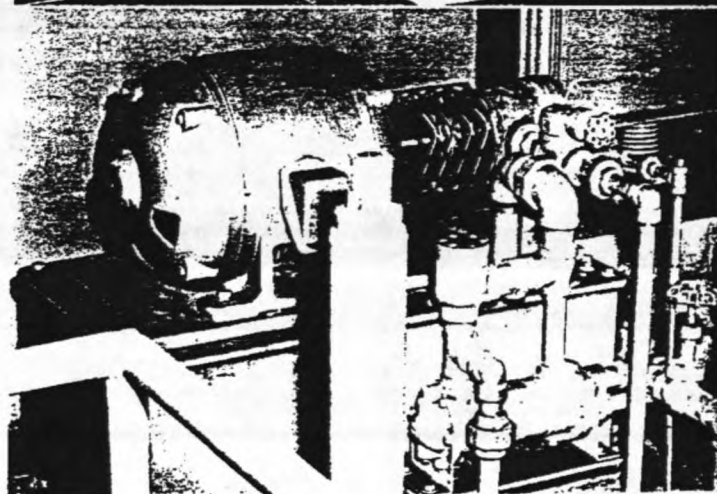


A horizontal air compressor, also located in the pump room, is used to maintain the air cushion at the top of the bottle. The drive for this is an Elliott C-W 40-hp motor.

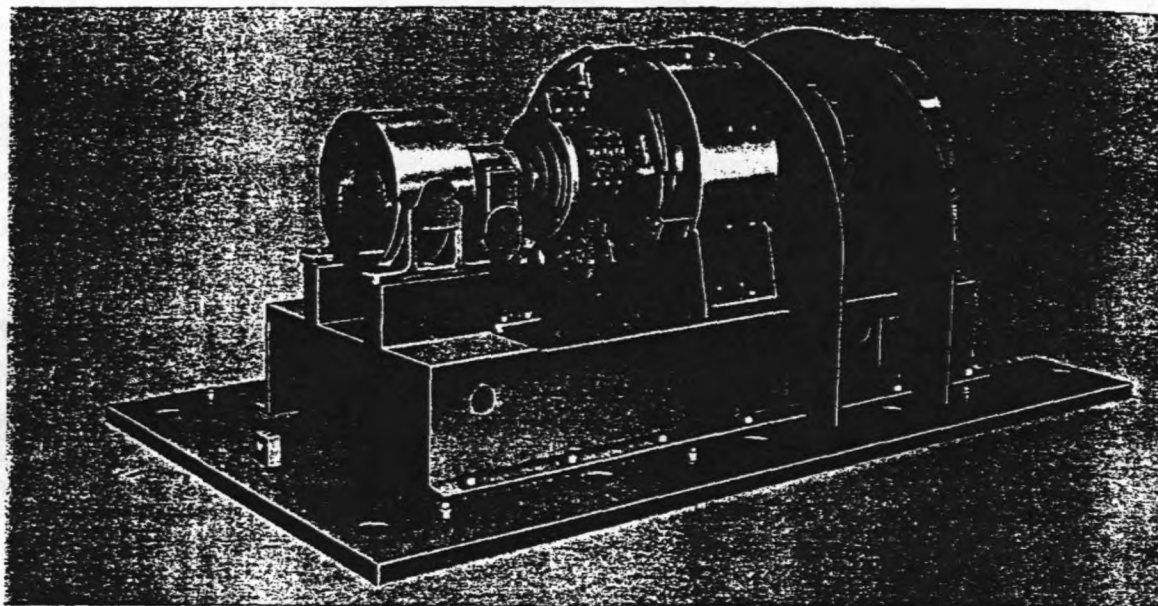


places it on the die of the press. Now the manipulator takes over, its jaws able to make every movement required in the forging process. The press, actuated by controls located on an operating panel beside it, then begins pounding away with blows equal to 2000 tons each. A billet 10½ in. square or larger may be pounded down to 6 in. square or smaller. After forging, the billet goes on to the annealing furnace and the new forging press has done its job on another piece of steel. * * *

The oil servo pump for press controls is driven by an Elliott C-W 5-hp, 1160-rpm motor.



A pilot exciter without a commutator



An Elliott permanent-magnet type pilot exciter, mounted on a common base with a conventional main exciter. Pilot exciter, of course, needs no commutator or brushes.

ONE of the principal causes of turbo-generator outages over the years has been the failure of pilot exciters. The usual compound-wound d-c pilot exciter has been a machine of small physical size with a commutator prone to give poor performance and subject to excessive brush wear and commutator maintenance. This is because, first, the brushes used must, for mechanical reasons, be large in size. Secondly, at least two brushes per polarity must be used to permit brush-changing under load. Finally, since pilot exciter current output is low, the current density in the brushes is also low. And especially at low current density, the numerous large brushes wear out quickly and groove the commutator rapidly. A permanent magnet exciter by eliminating these problems, can improve overall unit reliability.

Elliott Company is supplying with

its larger turbine-generators an excitation system in which the conventional pilot exciter has been replaced by a permanent-magnet type a-c generator. At 3600 rpm, it delivers 120-cycle, 3-phase current at approximately 110 volts. This voltage is rectified by a selenium rectifier assembly and introduced into the field of the main exciter. Voltage is controlled by a standard indirect-acting, rheostatic-type regulator.

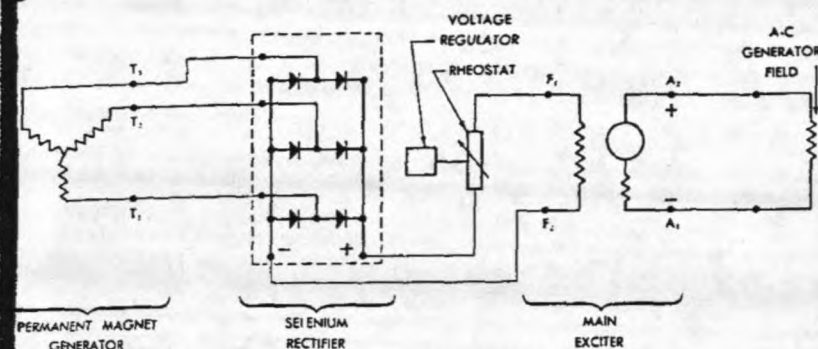
The voltage characteristics of the permanent-magnet generator and rectifier approximate those of a compound-wound, d-c pilot exciter as outlined in industry specifications (AIEE Numbers 601 and 602, page 55). Actually, the change in voltage with speed is better than required, since, at 90 percent rated speed, voltage

drops only to 90 percent. From full-load to no-load, voltage will increase approximately 15 percent, but this has no effect on performance since a rheostat or voltage regulator controls current flow into the main exciter field.

The rotor of this new pilot exciter consists of a steel hub, four Alnico permanent magnets, four steel pole shoes, and 24 nonmagnetic capscrews. (Magnetic cap screws would short-circuit the permanent magnets.) The rotor is designed for overhung mounting on an extension of the main exciter shaft, hence requires no coupling or bearing.

All other parts of the pilot exciter are static. The stator frame contains a core and winding of conventional three-phase design. The rectifier

by J. H. Schneider, Section Engineer, Ridgway Division, Elliott Company



The pilot exciter rotor consists of four Alnico permanent magnets, no field windings being necessary.

Schematic sketch of circuit employing the permanent-magnet type a-c generator as a pilot exciter. Generated a-c is rectified by rectifier, fed into main exciter field.

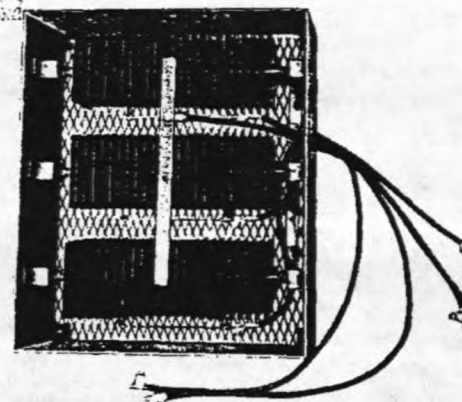
assembly provides three-phase, full-wave rectification. For mechanical protection it is mounted in an enclosure with a removable screened top. This cover gives easy access to the internal connections and permits adequate ventilation. In order to assure long rectifier life and to minimize the increase in voltage with decreasing load, the rectifier is large and conservatively designed for this service. It need not be located near the exciter, although it is usually mounted in the excitation cubicle.

Aside from its low maintenance cost, another feature of this a-c pilot is that it cannot be damaged by overloading or short-circuit. The stator windings are liberally designed to withstand overcurrents and, of course, no field windings are required. The

only result of overloading or short-circuit is to partially demagnetize the rotor magnets. Magnetism is readily restored, at standstill, by "flashing" one phase of the stator winding from a storage battery, the rotor poles having been lined up with respect to a designated point on the stator.

The first installation of the Elliott permanent-magnet pilot was made in 1953 as part of an excitation system in a municipal plant. Since then, four other units have been put into operation in connection with Elliott hydrogen-cooled turbine-generator installations. Excellent results have been reported in each instance.

The pilot, with conventional main exciter, will give an ASA nominal exciter response of 0.5 or higher. « « «



Three-phase, full-wave selenium rectifier assembly converts 120-cycle pilot exciter voltage to direct current for the main exciter field.

Coal barge unloaders use adjustable voltage system

SOMETIME shortly after the New Year, the Ohio Valley Electric Corporation will complete construction of the two largest power plants ever built by private enterprise.

These two stations, Clifty Creek plant at Madison, Indiana, and Kyger Creek plant at Cheshire, Ohio, actually started delivering power to the U. S. Atomic Energy Commission's gigantic new uranium diffusion plant near Portsmouth, Ohio, early in 1955. The first 215,000-kw generating unit at each plant was placed in operation last January—ahead of schedule—and subsequent units since have gone into service, also ahead of schedule. Upon completion, Clifty Creek will have six units totaling 1,290,000 kw, and Kyger Creek will have five units totaling 1,075,000 kw.

The two power plants, which are 175 miles apart, as the crow flies, and the A.E.C. Project, which is located between the two plants, are interconnected by a double-circuit system of 330,000-volt transmission lines—the highest voltage lines now in service in this country.

OVEC was organized in 1952 by 15 private electric utility companies of the Ohio Valley region for the single, specific purpose of supplying the full and tremendous electric requirements of the then-proposed Portsmouth Project. Clifty Creek, Kyger Creek, the transmission system, and other OVEC facilities will cost approximately \$400,000,000.

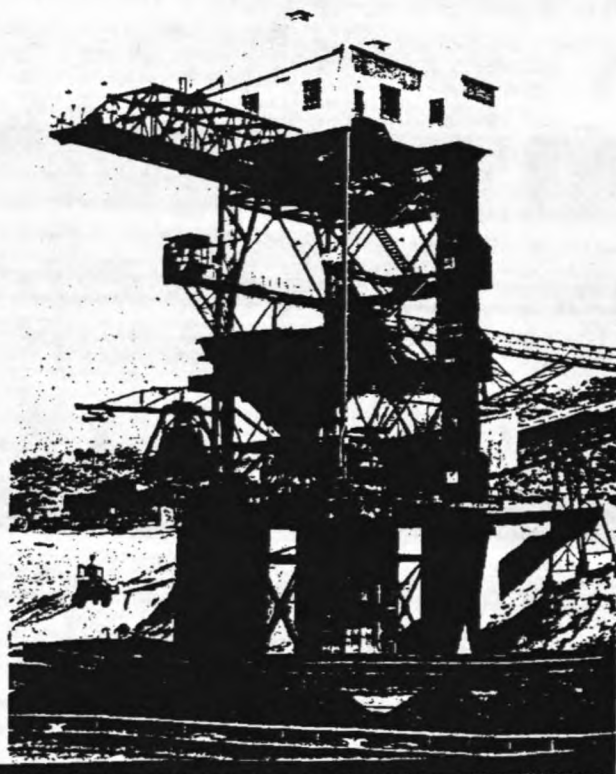
The two completed plants together will burn an estimated 7½ million tons of coal a year, all of

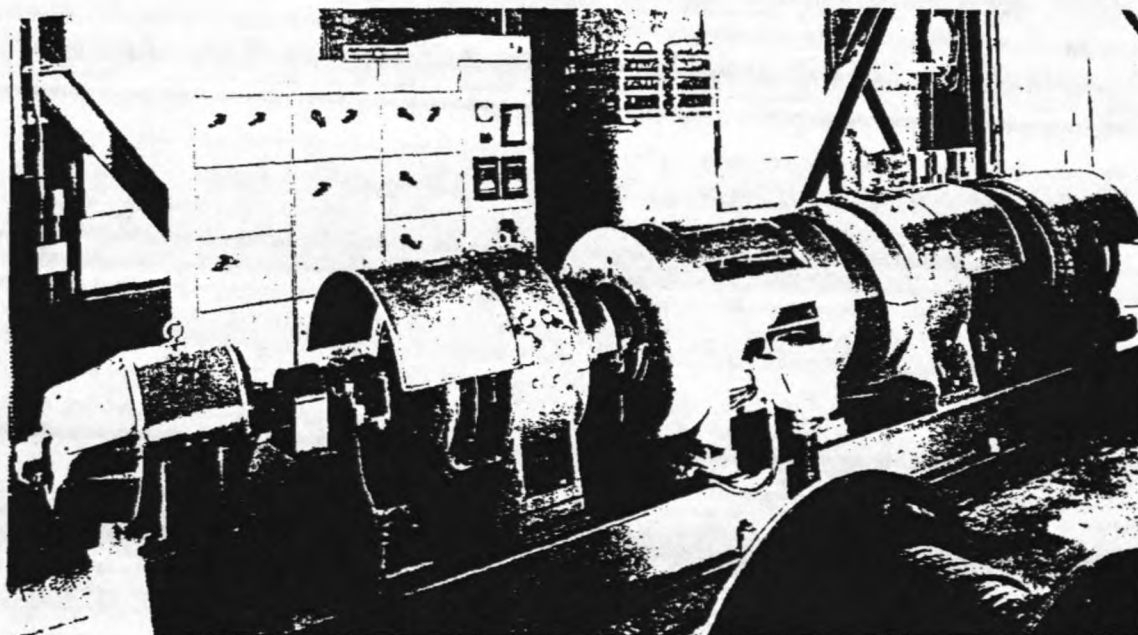
which is to be delivered via barges upon the Ohio River.

Elliott Company is furnishing many motors for driving powerhouse auxiliaries, ten deaerating heaters, each rated 1,000,000 lb per hr, and self-cleaning strainers for use in these outstanding stations. This article will deal only with the coal barge unloaders—two for each station—which were designed, built, and erected by Heyl & Patterson with Elliott Company furnishing the adjustable-voltage motors, generators, and control. This equipment insures high-speed precise operation of the coal unloading and handling operation.

These coal barge unloaders remove coal from river barges to a 200-ton capacity receiving hopper built in-

One of the two coal barge unloaders at Clifty Creek station. Designed, built, and erected by Heyl & Patterson, Inc., Pittsburgh, it is rated 1100 tons per hour and uses an 11-ton grab bucket. Motors, motor-generators, and control are in the house at top. Operator's cab may be seen below and to the left of this, with a walkway extending off to the right.





This is the five-unit, adjustable-voltage, motor-generator set which consists of a 400-hp, 1150-rpm, 2300-volt squirrel-cage induction motor driving two 200-kva, 345-volt d-c motors for the hold and close drives, one 75-kva special variable-voltage auxiliary generator for trolley drive, and a 15-kva, 250-volt d-c exciter to supply power for the motor fields. Set is located adjacent to motors and control cabinets.

tegrally in the unloader. The coal flows from the hopper by gravity to a 54-in. belt feeder, then to a 48-in. belt conveyor which delivers it to the power-plant bunkers.

The trolley in the stationary tower is rope-operated and the 12-ton grab bucket operates from two drums with a counterweight on the hold drum. The equipment is designed for a 37-second cycle for a free digging rate of 1100 tons per hour with a trolley travel of 36 ft and a lift of 73 ft.

The barge unloader is operated from an operating cab by means of master switches which actuate electrical equipment in the house on top of the tower. Elliott Company furnished the motors, generators, and adjustable-voltage control equipment.

In this system, the motor-generator set might be called the heart of the equipment. It is a five-unit set including individual generators for the close, hold, and trolley drives, plus a con-

stant-potential exciter which provides the necessary excitation for the regulators, motor fields, brakes, and control circuits.

All driving motors are 600 series, heavy-duty mill motors, and the generators of the m-g set have special characteristics suitable for regulator control and the peak capacity of these motors.

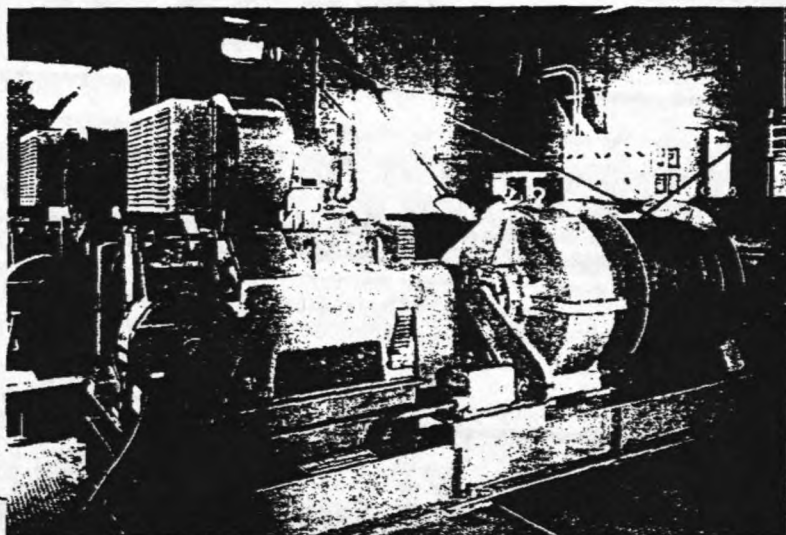
The generator fields are controlled by rotating regulators. These control the rate of acceleration and deceleration, limit the current peaks, and regulate the generator voltage. The system provides smooth operation, simplifies the control, and reduces maintenance.

D-c-operated, floor-mounted, shunt-wound brakes are provided for all motions. The trolley travel motor has a continuously rated shunt brake, and the closing and holding line brakes, which are duplicate, have sufficient capacity for the close line

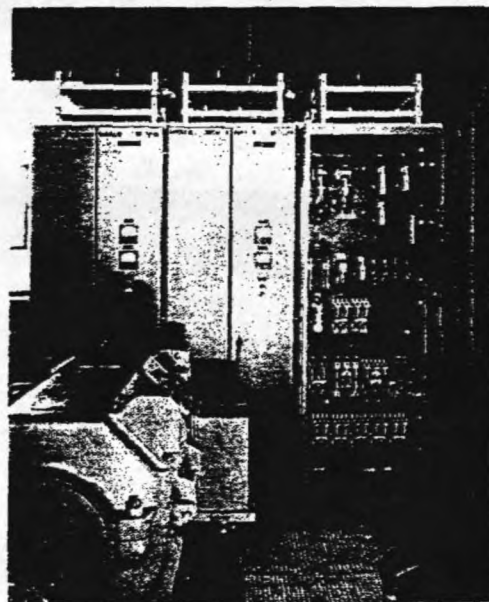
brake to hold the loaded bucket if the other brake fails.

The hold and close drives provide five speed-control points in each direction with protection against motor field loss, overload, overspeed, loss of power, and hoist overtravel.

Regenerative braking is provided for overhauling loads in the lowering direction. The master switch contacts directly control the pattern excitation of the regulators, which in turn control the generator fields to provide the functions previously outlined. Adjustments of speed can be readily made by adjusting small control resistors located with the master switches. The regulators are adjusted for load division so that 50 percent of the load is taken by the closing line motor and 50 percent is on the holding line motor. The same ratio of load division is maintained when lowering a loaded bucket, provided the master switches are on the same



This view inside the house on top of the coal barge unloader shows the two Elliott 187 1/2-hp. forced-ventilated, separately-excited hold and close drive mill-type d-c motors. These motors are operated at approximately 345 volts and 685 rpm. They drive the drum through gears. Brakes are shown at left and a hoist-limit switch may be seen on base plate between motor and gear. A little of the motor-generator may be seen in the background.



In left foreground is the Elliott 94-hp, 230-volt self-ventilated, separately-excited mill-type d-c trolley motor, which is operated at approximately 317 volts and 710 rpm. Control cabinets in background (doors of one are open).

point, and the bucket remains closed. A load-sensitive relay insures that both the hold and close line drives operate at the same speed when lowering a light open bucket. When lowering an empty bucket, it is possible to open or close the bucket by setting the hold and close master switches on different points.

The trolley drive is controlled by regulators similar to those on the hoist drives and is arranged for normal stopping by regenerative braking. Automatic deceleration and stop circuits are established at each end of the trolley travel when the trolley enters these zones at speeds above predetermined values.

The hold line and the close line are each driven by a 187 1/2-hp mill-type motor which receives its power from a separate 200-kw, 345-volt adjustable-voltage generator. Each generator's excitation is controlled by a rotating-type voltage regulator. These regulators receive reference voltage signals from five-point speed hold and close line masterswitches.

The regulators compare these reference voltages with the actual voltages across the two power loop circuits and excite the fields of the generators so as to maintain the loop voltages at the desired value as dictated by the position of the master switches.

Normal braking torque on the hoist drives is provided by regenerative action in the hold and close d-c motor-generator power loop circuits. Individual dynamic braking for each motor provides emergency stopping.

Limit switches in the hoist controls are used for slowdown and final limit of upward travel of the bucket. Dynamic braking is applied to the hoist motors when the limit switches operate for final stop. Voltage relays protect each motor against overvoltage and consequent overspeed. Motor field loss, overcurrent, and undervoltage protection are also provided.

The trolley is powered by a 94-hp mill-type motor supported by a 75-kw, 320-volt generator. A rotating-type voltage regulator controls the generator field circuit and operates in the same manner as described for the hoist generators. Normal braking torque is by regenerative action in the power loop. Dynamic braking with excitation of the trolley motor field from the trolley motor armature is provided for emergency braking. Overspeed, overcurrent, and undervoltage protection are provided.

The salesclerk tried to be helpful when the lady was looking for a suitable Christmas gift for her grandfather:

"How about a tie, madam?" he asked.

"No, he has a beard."

"A pullover might be the thing."

"No, it's a very long beard."

"I see, madam," said the salesman wearily. "Do you think a pair of spats would show?"

A Russian named Rudolph looked out the window one morning and said, "It's raining."

"No, it's sleeting," said his wife.

"It's raining, doggone it," he answered, "and Rudolph the Red knows rain, dear."

Christmas Philosopher: "You know, there are bigger things in life than money."

Cynic: "Oh, yeah, what?"

Philosopher: "Bills."

It's the little things that bother
And keep us on the rack;
We can sit upon a mountain
But not upon a tack.

An Australian trying to impress a visiting Texan with the wonders of his country wasn't having much success until the Texan saw a kangaroo.

"Ah'll grant you one thing, anyhow," said the impressed Texan, "your grasshoppers are a mite bigger than ours."

Real estate salesman: "Would you like to see a model home?"

Prospect: "Glad to. What time does she get off work?"

Speaker: "Is there any man in the house who would let his wife be slandered and say nothing? If so, please stand up."

A meek little man rose to his feet.

Speaker: "Do you mean that you would let your wife be slandered and not do anything about it?"

Meek Little Man: "Oh, pardon me, I thought you said slaughtered."

The bride, white of hair, is stooped over her cane;

Her footsteps, uncertain, need guiding,
While down the church aisle, with a wan,
toothless smile,

The groom in a wheel chair comes riding.
And who is this elderly couple just wed?

You'll find when you've closely explored it,

That here is that fare, most conservative pair

Who waited till they could afford it.

When the lady who was making out the application came to the little square headed "Age" she didn't hesitate. She simply wrote "Atomic."

Wife: A woman who braves wintry blasts in nylons but who requires 85% of the bedclothes.

As one of our friends said: "If we hadn't expanded, we'd think we were really going to town with today's business."

The hardest job modern children face is learning good manners without seeing any.

Life is like that. You usually hear about the man who hits the jackpot, but the fellows who built up the pot are unknown.

A friend reports he learned all about relative humidity when he held his infant daughter on his lap.

"He says I don't know how to dress, huh? Tonight I'll wear my low-cut dress and show him a thing or two."

A young lady down our street slipped on the ice yesterday. It bruised her somewhat, and slightly injured her otherwise.



Passing a run-down store in a distant city, a well-known artist noticed a mangy little kitten lapping up milk from a saucer. The saucer, he realized with a start, was a rare and precious piece of pottery.

He sauntered into the store and offered two dollars for the cat. "It's not for sale," said the proprietor.

"Look," said the collector, "that cat is dirty and undesirable, but I'm eccentric. I like cats that way. I'll raise my offer to five dollars."

"It's a deal," said the proprietor as he pocketed the five-spot.

"For that sum I'm sure you won't mind throwing in the saucer," said the connoisseur. "The kitten seems so happy drinking from it."

"Nothing doing," said the proprietor firmly. "That's my lucky saucer. From that saucer, so far this week, I've sold thirty-four cats."

First Boarder: "This cheese is so strong, it could walk over and say 'Hello' to the coffee."

Second Boarder: "Yes, but the coffee is too weak to answer back."

The little man was pushing his cart through the crowded market.

"Coming through," he called merrily. No one moved.

"Gangway!" he shouted. A few men stepped aside.

Ruefully he surveyed the situation and then smiled as a bright idea struck him.

"Watch your nylons!" he warned. The women scattered like chaff in the wind.

Miami: A land flowing with silk and money.

A lot of brainy women earn their living, but the sensible ones let men do it for them.

The modern idea of roughing it is to sleep without an electric blanket.

A couple of young boys walked into the dentist's office and one faced boldly up to the dentist and said, "Doc, I want a tooth took out and I don't want no gas 'cause I'm in a hurry."

"My," said the doc, "I must say you're a brave boy. Which tooth is it?"

The little boy turned to his silent friend and said, "Show him your tooth, Albert."

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* Descriptive bulletins of any of these products will gladly be sent upon request.

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Printed in U.S.A.