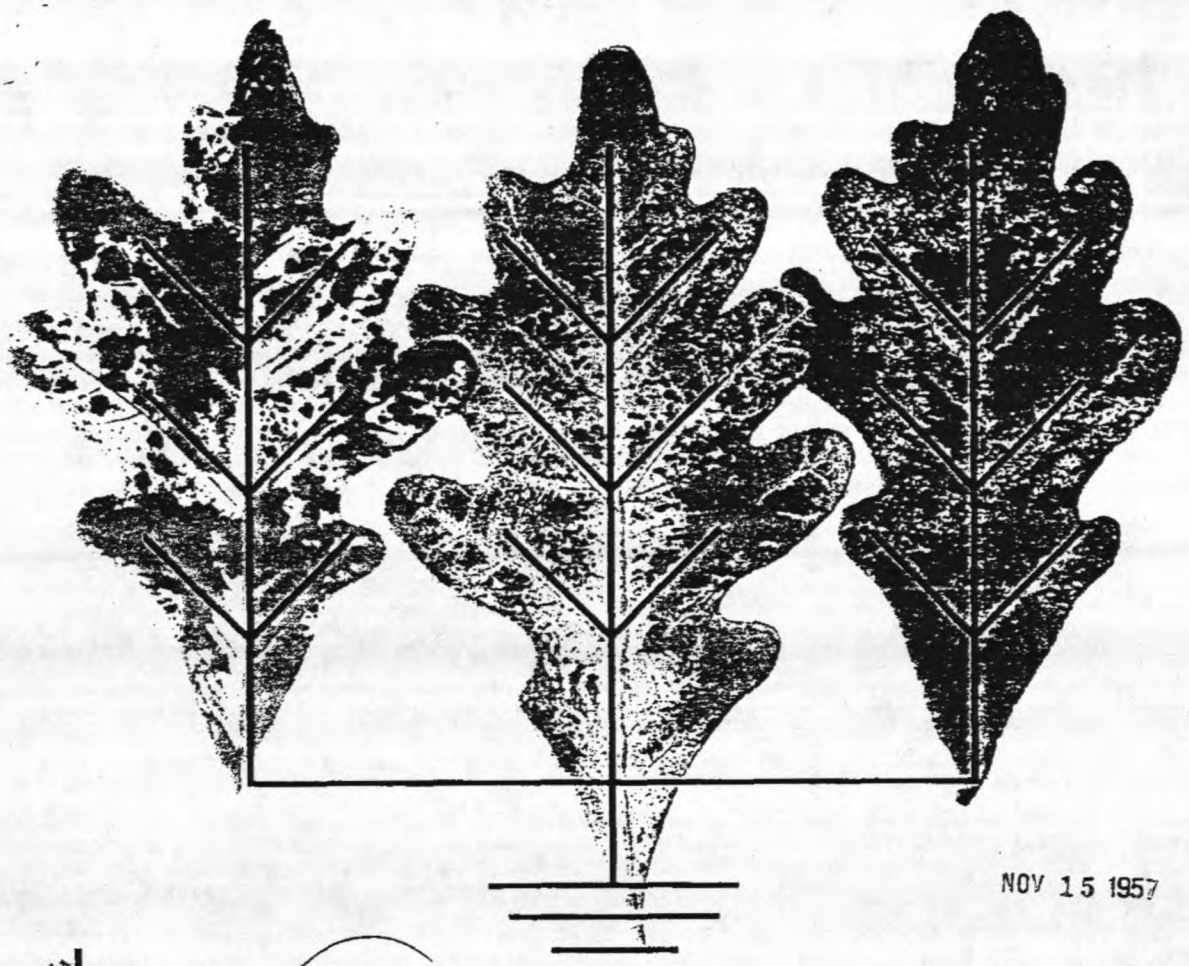
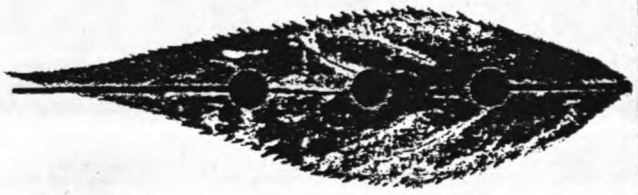


AUTUMN 1957

powerfax

PUBLISHED BY ELLIOTT COMPANY



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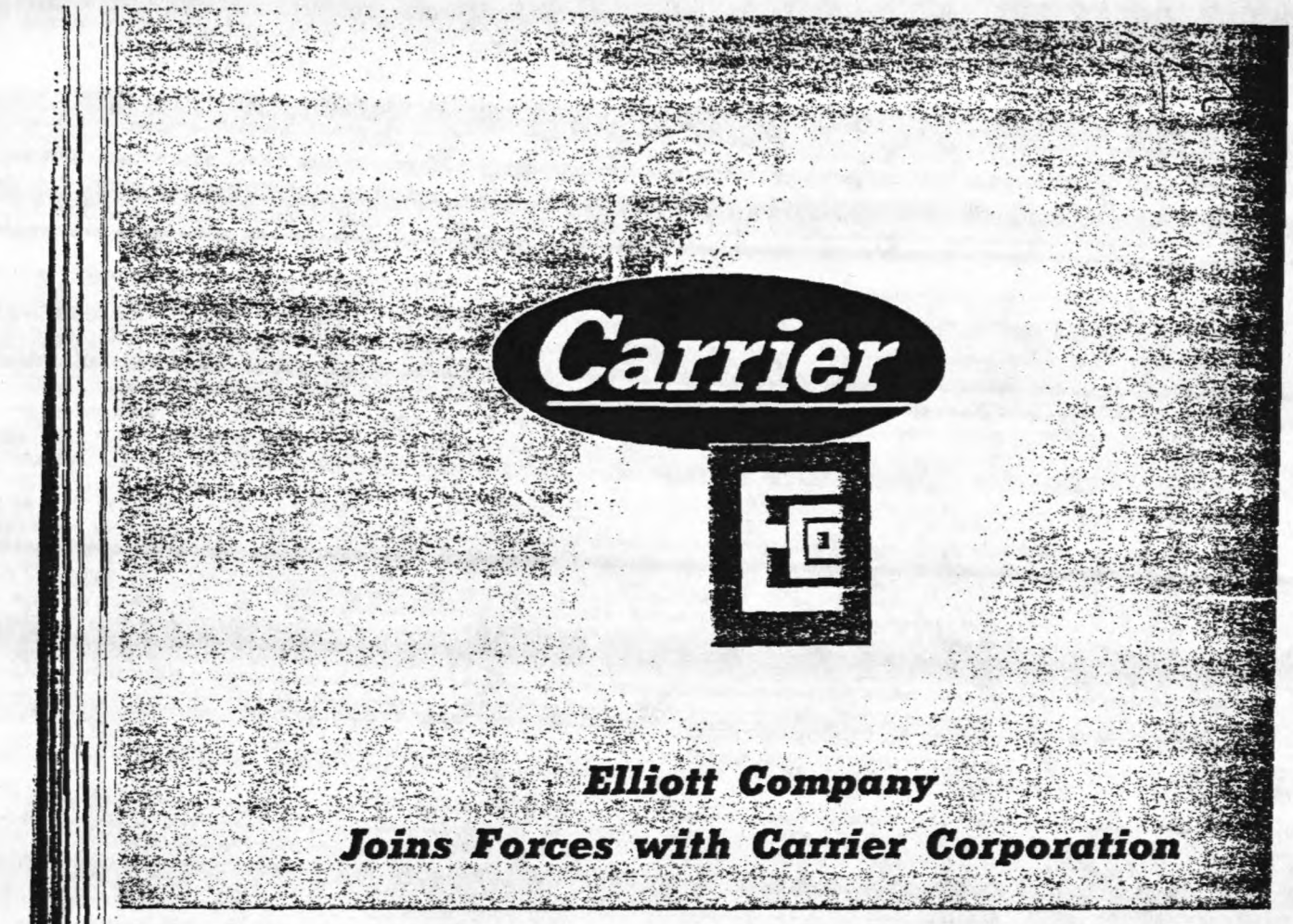


Elliott Company Joins Forces with Carrier Corporation

On July 31, Elliott Company became an operating division of Carrier Corporation. William A. Elliott continues as president, and he also serves as a vice president and director of Carrier Corporation. L. M. Forncrook, a prominent industrialist who had served on the Elliott board for many years, is also a Carrier director.

Elliott products and service will be continued unchanged; in fact, should be improved by this merger.

Readers of *Powerfax* perhaps have noticed the community of interest between Elliott and Carrier. Elliott turbines, condensers, and motors have been used in connection with Carrier air conditioning installations. Both Carrier and Elliott make centrifugal compressors; the merger will broaden the line. Carrier uses Elliott tube expanders and expander controls.

From small beginnings in 1902, Carrier Corporation has grown steadily and particularly in recent years has consolidated its position not only with new facilities but by acquiring subsidiary companies. Its business has grown to be international in scope. Its total assets are in excess of $161,000,000, and its net sales for fiscal 1956 were $193,200,000, with employment exceeding 10,0

Carrier continues to be the largest single factor in air conditioning and industrial refrigeration busin and its line of products is broader than that of any ot manufacturer in the field. It is believed the corporat still leads the industry in research and in the devel ment of new methods and new products. In fiscal 19 Carrier spent $4,500,000 on research and developm and has budgeted more than $6,000,000 for the sa purposes this year. Last December, a new engineer laboratory was formally opened for the development testing of unitary air conditioning equipment and sm systems. Another laboratory designed for developm work related to large air conditioning systems is b built. Under construction and scheduled for comple this year, is a research center which will be devote seeking new techniques, methods, and materials.

Elliott Company finds satisfaction in its affiliation Carrier Corporation and believes that the merger this pioneering and forward-looking organization wi of benefit to both organizations.

powerfax

Autumn • 1957

VOLUME 35 NUMBER 3

A QUARTERLY MAGAZINE FOR EXECUTIVES, ENGINEERS AND OPERATORS OF POWER AND INDUSTRIAL PROCESS PLANTS

CONTENTS

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.

Front Cover

Summer changes to autumn. Green turns to gold. For this issue's cover, our artist turns to the draftsman's symbols for lightning arresters. They become frost-tinted leaves. In oak leaf garb is the "electrolytic or aluminum cell type for 3 wire". Disguised as a maple leaf is the "valve or film type". And as a wild cherry leaf, the "multigap type".

Elliott Progress

The announcement on the opposite page marks a milestone in the development of Elliott Company. On this same page in past years have appeared these announcements.

In the December 1924 issue, announcement was made that Elliott Company had consolidated with the Kerr Turbine Company. In August 1926 it was the Ridgway Dynamo & Engine Company which became the Ridgway works of Elliott Company. In autumn 1949 this page carried the information that Crocker-Wheeler had become a part of Elliott Company. Now Elliott Company [illegible] operating division of Carrier Corporation, we feel sure the steady progress of Elliott will be continued and amplified.

New Publications

Bulletin Y-48—Lagonda Tube Cleaners. 32 pages. A complete showing of the Lagonda tube cleaner line. Tables show catalog numbers and dimensions for all tube cleaner motors, cutter heads, accessories. Special applications are covered.

Bulletin H-22C—Type YR Mechanical-Drive Turbines. 16 pages. A reprint and updating of the bulletin completely descriptive of these turbines.

Bulletin PB 6000-8—Elliott Crocker-Wheeler Sealedpower Chemical Motors. 4 pages. Describing a new line of motors for chemical service, protected against corrosive vapors and fumes. Includes a sectionalized view plus illustrations and brief description of distinctive features.

Bulletin PB 7000-5—Elliott Two-Pole Motors for Pipeline Service. 4 pages. Covering various types of large motors designed especially for pipeline service, including weather-protected, forced-ventilated, inert gas-cooled, etc.

Bulletin PB 9000-2—Elliott 620 Frame Mill Motor. 4 pages. Construction features of a new line of bigger, more powerful d-c mill motors for steel mill auxiliary drive.

Supercharger for Pressure-Fired Boiler

J. R. Shields, manager of the development engineering department, is co-author of a paper to be presented at the annual ASME meeting in New York on December 6, 1957. The paper, entitled, "Design and Development of a Supercharger for a Pressure-Fired Boiler", is prepared in cooperation with R. C. Reisweber, a member, and J. R. Glessner, formerly a member of the development engineering department.

Correction

Powerfax got the "facts" mixed-up last issue. Somehow or other, we mentioned in connection with our Atlanta office move that J. D. Willcox, Jr., was the district manager. It was a slip of the tongue, if there ever was one. We knew very well that Mr. Willcox is manager of the Houston office and has been since 1948. We also knew that F. L. Humphrey, Jr., was the Atlanta office district manager, as announced in the Spring 1955 *Powerfax*.

Perhaps we had Mr. Willcox in mind because he had just exhibited special activity in connection with *Powerfax* articles. In the Summer issue, he was behind the article on Eastern States Petroleum Company and in this issue, he is responsible for the article on South Texas Cotton Oil Company.

Pictures of the two men are shown here by way of apology. Also, Willcox somehow or other never had his "mug" in *Powerfax*.

F. L. HUMPHREY

J. D. WILLCOX, JR.

Denver

The Denver office, on October 1, will be at a new address, 220—655 Broadway Bldg., Denver. J. H. Petersen is district manager.

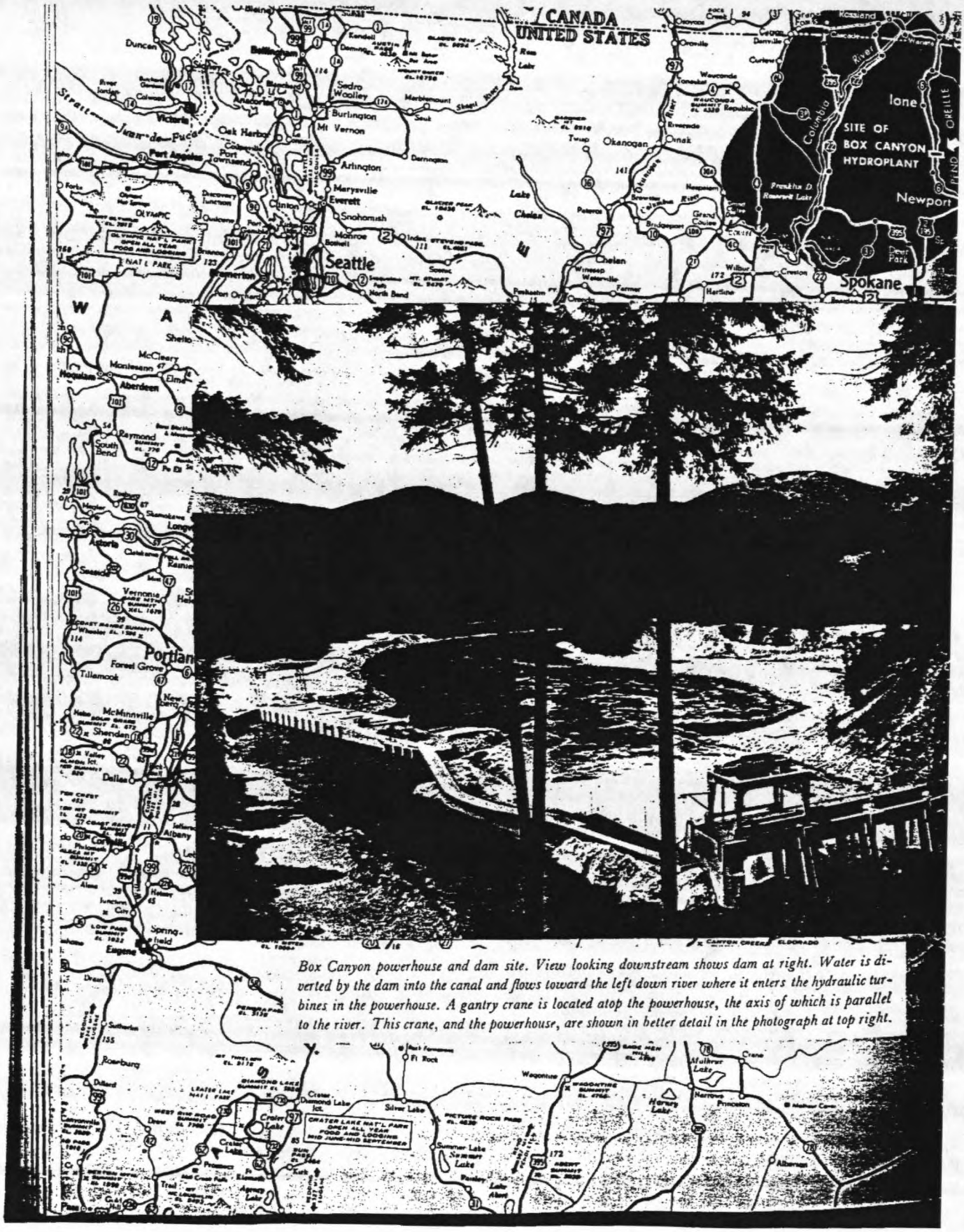
AIEE Appointment Announced

E. I. POLLARD

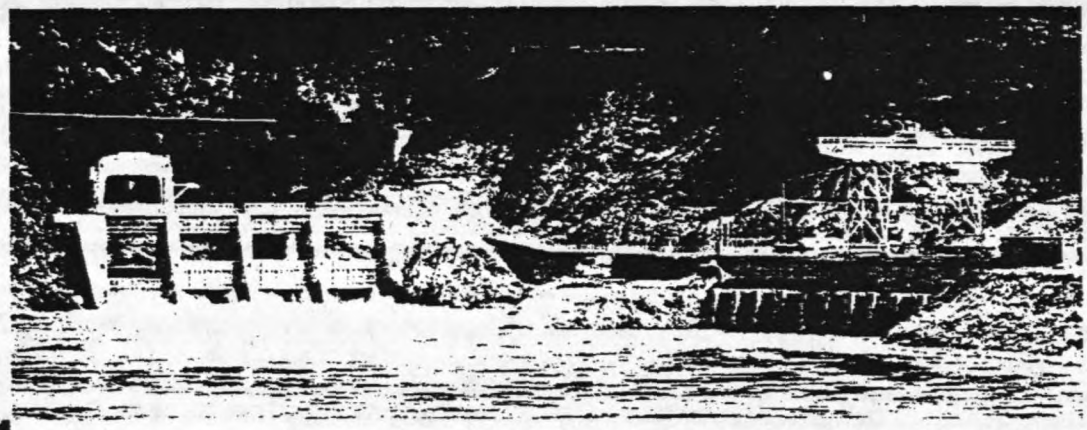
E. I. Pollard, chief electrical engineer of the Elliott Company, has been named chairman of the Power Division Committee of the American Institute of Electrical Engineers. The appointment, effective August 1, 1957, was made by AIEE president, W. J. Barrett.

Mr. Pollard, associated with Elliott Company since 1946, has been active in AIEE affairs for many years. He has headed the Synchronous Machine Sub-Committee of the Rotating Machinery Committee, and recently was chairman of the Rotating Machinery Committee.

The Committee of which he is presently chairman is in charge of the activities of eleven sub-committees covering power equipment.



Box Canyon powerhouse and dam site. View looking downstream shows dam at right. Water is diverted by the dam into the canal and flows toward the left down river where it enters the hydraulic turbines in the powerhouse. A gantry crane is located atop the powerhouse, the axis of which is parallel to the river. This crane, and the powerhouse, are shown in better detail in the photograph at top right.



View of Box Canyon dam and powerhouse looking upstream. Three spillway gates in the dam have been lifted to pass excess water. The dam bridges the narrow bed of this glacial stream which passes through mountainous terrain.

Box Canyon Hydro plant makes money for P.U.D.

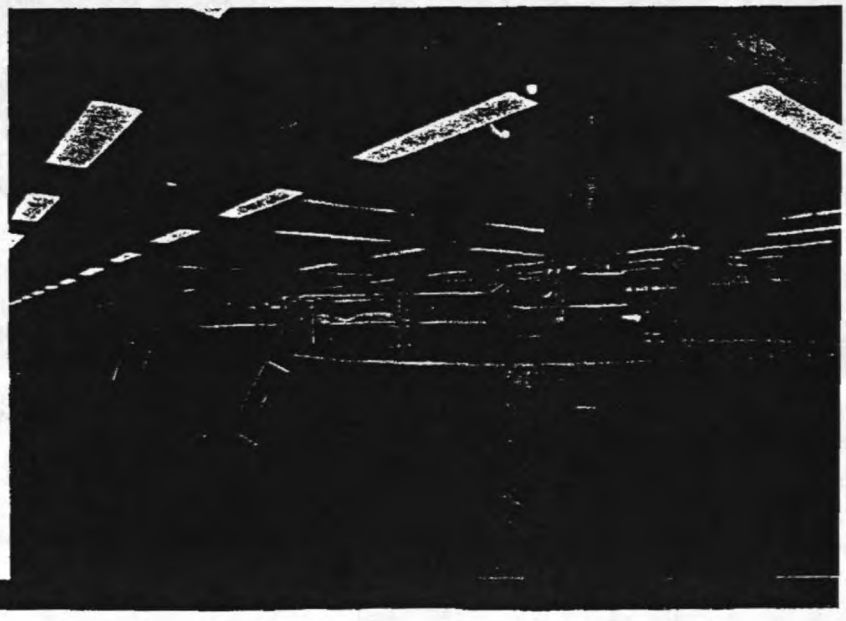
by **W. P. VanVranken,** *Elliott Company, Ridgway, Pennsylvania*

Most customers wouldn't expect to be picking up savings as soon as they put generating equipment into service—but that is what has been happening at Box Canyon Hydro. When four Elliott 15,000-kw vertical generators were put into service, late in 1955, the customer suddenly realized that he had a phenomenal bargain. The units were liberally designed and capable, actually, of putting out in excess of 75,000 kw. To Public Utility District No. 1 of Pend Oreille County, Washington, this was most welcome. With the extra capacity, the P.U.D. was able not only to supply its customers, but to create extra income with which to meet interest charges on the investment in the project, and actually to enter into a re-financing arrangement with the investors.

Let us go back into the history of power sales for the Box Canyon Hydro Project, which is named for the narrow gorge it blocks near Ione, Washington in the northeast corner of the state, 95 miles north of Spokane.

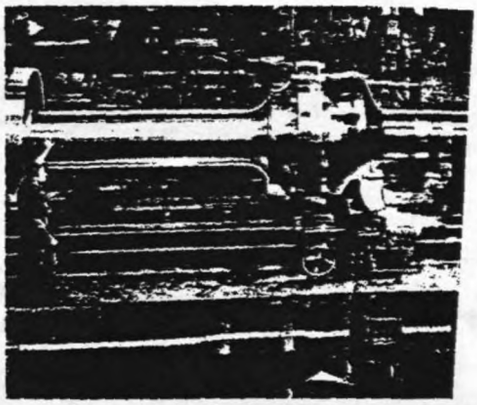
When Public Utility District No. 1 of Pend Oreille* County undertook this project, it

*French for "beautiful river".



Three of the four Elliott 16,667-kva, 100-rpm umbrella-type generators in the Box Canyon powerhouse. Just behind the generator in the foreground is the governor cabinet equipment for the Kaplan-type turbine. Above the exciter (atop generator) is located the oil head for the turbine and also governor magnet generator.

Umbrella-type generator lower bracket with integral oil pot and mounting for Kingsbury thrust bearing. Individual water cooling coils remove heat from the oil pot. Each of these coils is mounted on a door which can be removed for bearing inspection.

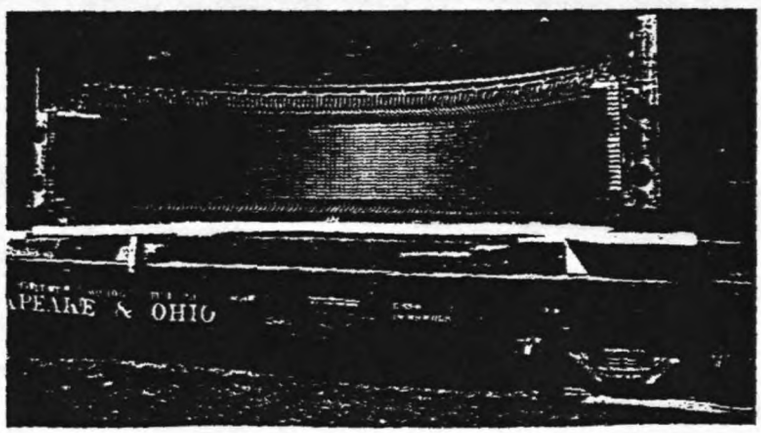


arranged to sell 48,000 kw of the power to be generated to "City of Seattle" Light Department, which in turn, was to resell much of the power to the Aluminum Company of America plants near Vancouver and Wenatchee, Washington. To get the power from Box Canyon to the Seattle area, the Public Utility District arranged with Bonneville Power Administration for a connection into their vast Northwest power grid. Under a 50-year contract, Seattle City Light is paying a wheeling charge to the Bonneville Power Administration, so that they will receive this peaking power from Box Canyon.

Another 8000 kw of the power from Box Canyon was sold to General Petroleum Corporation which has an oil refinery across the state in Whatcom county. By arranging with the Whatcom County Public Utility District to wheel this power over its system, the P.U.D. was able to deliver it to the refinery. Pend Oreille Public Utility District, is using ab 12,000 kw of the Box Canyon po in its own system within the cou taking care of its local needs enti The excess power which was foun be available because of favorable ter flow conditions in the river been delivered to the Bonneville As long as the extra power from Canyon is available to the Bonn grid it is possible to "store" an e alent amount of water at Grand lee, a major source of power fc Bonneville transmission system. then, builds up "credit" for P No. 1, putting it in the enviable tion of being able to meet ir charges on investment with ea

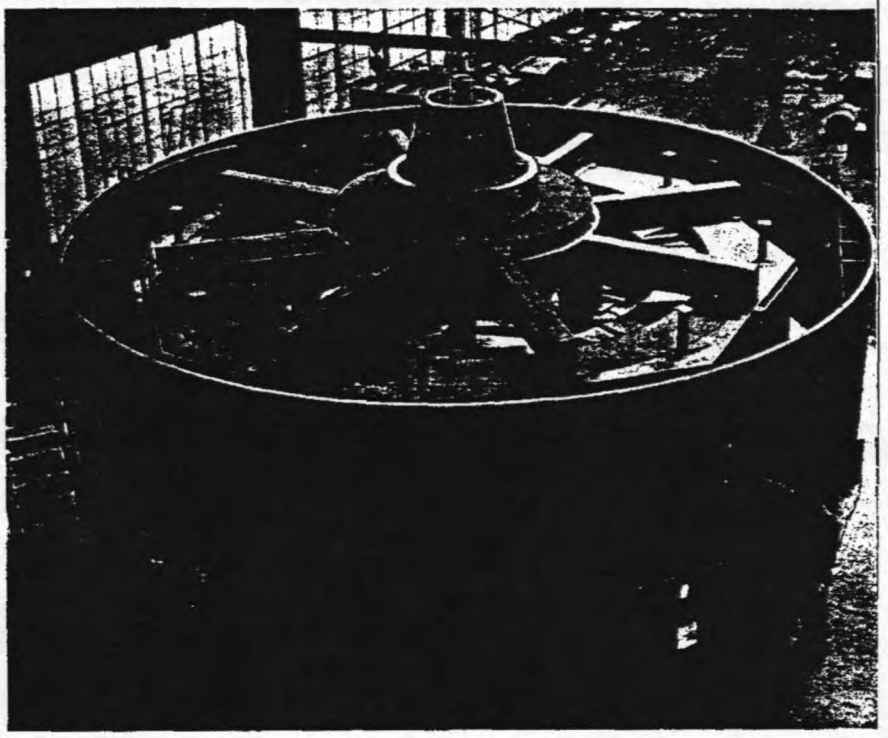
The Pend Oreille Public District's plans to alleviate the shortage in the Northwest sta bear fruit in July 1956, when t Canyon plant was officially ded It had been placed in operati in 1955 and the four generato rated 16,667 kva, at 100 rpm the time of dedication, prove selves. The machines are dr Kaplan adjustable-blade t manufactured by Allis Chaln these, too, because they are l

This is one of 65 carloads shipped from Ridgway to Box Canyon. It is half of stator frame, completely stacked and wound, except for coils adjacent to split, which are installed in field.



Photograph below shows alignment of turbine and generator shafts at our Ridgway plant. Total length of shaft assembly—45 ft. Combined weight—90,000 lb. All critical areas on the shafts, such as thrust bearing runner surfaces, were checked for runout.

Factory fit-up of air housing materially reduced the assembly time required at the dam site, insuring the fit of conduit, piping, internal parts, etc. Housing exceeds 30 ft in diameter.



design, lend themselves favorably to the picture of liberal generator design and resulting power delivery.

How did Pend Oreille come to select this rather unlikely location for a hydro plant? The first step was to employ Harza Engineering Company of Chicago to investigate various locations on the Pend Oreille River, on which the P.U.D. had site rights. Actually, the Corps of Engineers was already building a plant at Albeni Falls, up the river from the Box Canyon site, and over the state line in Idaho. With the possibility that, when Albeni went into service, there would be some stream control, the sites at Box Canyon and Boundary began to look favorable.

If you consult the map, you will find that the Pend Oreille rises in Montana, crosses Idaho, and runs nearly due north in Washington, crossing into Canada where it empties into the Columbia. The valley in which the river flows is quite wide near the county seat at Newport, Washington, but as it flows northward, it enters a narrow gorge lined on either side by high, forest-covered mountains. In Pend Oreille county, elevations range from 2100 ft in the southern part, to some 6000 ft in the Selkirk ranges, which are on the eastern and western boundaries of Pend Oreille County. This country, lying as it does between the Cascade mountain range and the Rocky Mountains, is semi-arid. Rainfall is only 25 in. annually.

In investigating the site at Box Canyon, Harza Engineering Company found it was dealing with a glacial-type river, flowing in a relatively narrow, deep channel eroded from the rock strata. Currents in the river are swift and it was problematical at first, whether it was feasible to place a dam across the river at this narrow location and then divert it downstream to the powerhouse site. After some investigation into the rock formation and of the foundation problem, Harza recommended that the site be developed, using a dam with lift gates to control the head of water. Since there could be no pondage behind the dam, it was necessary to take care of any excess water which could not be run through the turbines, by means of lift gates in the dam and diversion gates adjacent to the powerhouse.

The dam, which was built by construction forces of Morrison-Knudsen Company, Inc. of Boise, Idaho, extends 200 ft across the cramped gorge. Above an apron and arch section, are five 90-ft piers which support four

massive vertical-lift gates, 62 ft high, each in three sections. The dam is supported on a horizontal-arch structure that rests on a foundation of sand fill, thrusting downward into rock-supported abutment sections. A 240-ft diversion tunnel and forebay channel water into the powerhouse which Harza located on the edge of the river, with its main axis running parallel to the stream.

Since the cost of developing this site tended to be higher than conventional hydro developments, the consulting engineers dispensed with the usual building structure with built-in crane. They used a single-story plant structure with roof hatchways above each of the four generating units. A gantry crane on the roof is provided for maintenance purposes.

In designing the generators for this plant, Elliott engineers used umbrella-type construction for the rotor design with the idea of achieving a compact design, tending to cut down the vertical height of the machines and thus reducing the height of the building to a minimum. They utilized a Kingsbury-type adjustable thrust bearing which is mounted in the lower bracket of each generator. This thrust bearing assembly, together with a single guide bearing, is contained in a single oil pot below the rotor. The thrust bearing external loading is 650,000 lb under normal operating conditions.

To facilitate inspection of Kingsbury bearing shoes, the Elliott design incorporates removable doors in the sides of the oil pot. There are six such doors, each located between arms of the lower bracket. Each door also mounts a section of the water cooling coil which is located in the oil pot. The water circuit of these coils is divided into two parallel paths, so that under all conditions there will be even temperatures throughout the entire oil reservoir.

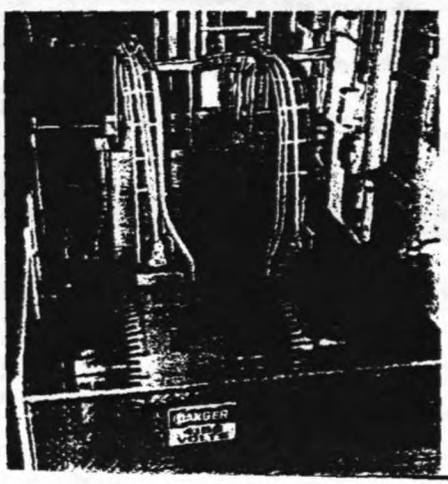
In addition to the doors in the sides of the oil pot, access may be gained to the thrust bearing by removal of the oil pot retainer at the bottom of the lower bracket. By means of a standard thrust-bearing lowering device, the entire Kingsbury bearing support can be lowered into the pit beneath the machine. Thus, a full measure of accessibility to thrust bearing parts is provided.

Since the generators at Box Canyon are connected to Kaplan turbines, hollow-bore shaft construction was required. The turbine manufacturer furnished an integral bell-shaped coupling at the upper end of his shaft, and this was matched by the generator flange, having an outside diameter at the coupling of 72 in. At the upper end of the generator shaft, is a flange for mounting the Kingsbury thrust bearing runner and for the connection of the rotor assembly.

Because of its large size, the stator would normally have been split in three sections. However, after a thorough check of railroad clearances, weights and handling facilities, it was determined by Elliott engineers that the stator could be built in two sections, if it were shaped octagonally. The resulting frame construction also simplified the mounting of air-to-water coolers, of which four were required for each generator. It also led to savings for the customer, reducing installation time, since the number of coils to be assembled into the stator frame across the splits at the time of installation was fewer. A greater percentage of factory completion of the stator winding was possible than would usually be the case.

To further reduce the installation time, all stationary parts on the Elliott generators were pre-fitted at the factory. Thus, no time was lost in the field in installing the coolers, air housings, air baffles, etc.

A significant part of the work in connection with this hydro installation was the coordination of shipment of the four generators and their related equipment. Of some 65 carload of equipment shipped, the only par damaged by handling enroute was rotor fan assembly. Since shipment totalled some 2,655,000 lb and th machines were at the site well in ac vance of the required installatio date, Elliott Company can be prou of its performance in cooperatir with the customer to enable him place the equipment in operation expeditiously as possible.



The Elliott motor-generator set converts 60-cycle to 300-cycle current for induced-voltage testing.

Transformer Testing at Wagner Electri

WAGNER ELECTRIC COMPANY, of St. Louis, Missouri, has been a manufactu of transformers since 1893.

In the induced voltage test section where all transformers are tested in accordance with commercial standards of ASA and NEMA, the Elliott motor-generator set, shown here, provides required test voltages. The un consists of a 300-cycle, 4000-volt generator with a five-minute rating of 1500 kva, three phase, and 1000 kva, single phase. The generator is drive by a 4160-volt, three-phase, 60-cycle synchronous motor with a five-minu rating of 2250 hp. Suitable control equipment provides voltage regulatio of 25 percent to 110 percent of normal voltage in increments of .5 perc

Adjustable-voltage system gives high accuracy on copper rod mill

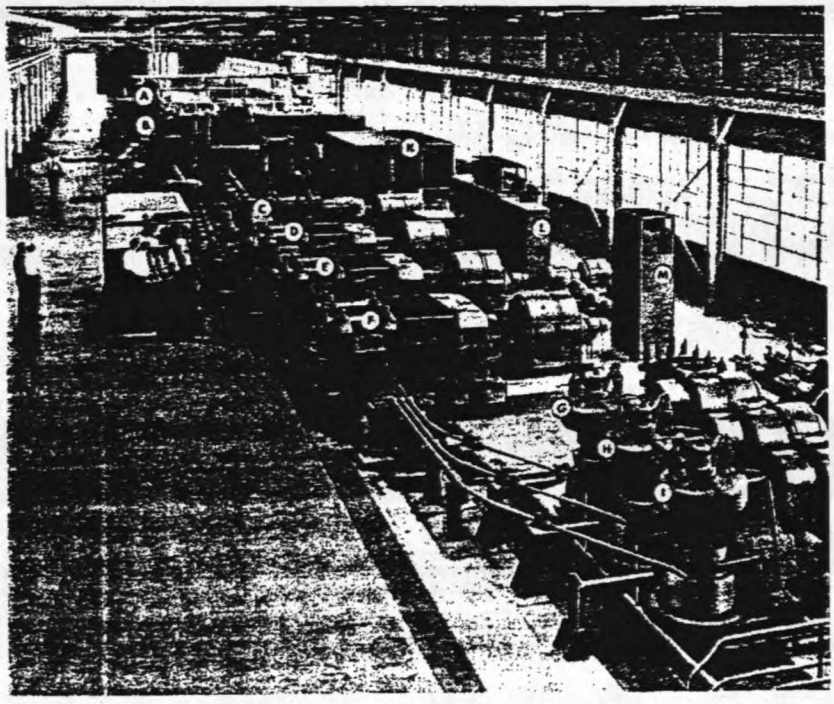
SHOWN below is a new and very modern copper rod mill in the plant of a leading manufacturer of electric cable. The installation has a capacity of 40,000 lb per hr for 2-strand rolling with finished coil delivery every 19 seconds. It rolls $\frac{5}{16}$-in. and $\frac{7}{16}$-in. copper rod from standard billets in a continuous, fully-automatic operation.

The entire electrical installation was engineered and coordinated by the Elliott Industry Engineering Department. The control, with the exception of the regulators, was furnished by Cutler Hammer and built to Elliott Company specifications.

Super-sensitive Elliott electronic regulators were developed to provide the extremely accurate performance required of this type of mill.

The mill consists of two 3-high roughing mill stands, seven continuous finishing stands, and three coilers. Copper wire bars are conveyor-fed into the furnace. After leaving the furnace, the ingots are rolled down in 14 passes to finished size. Leaving the last stand at a speed of 2400 fpm, the rod is coiled. The coils are tied and conveyed into a pickling line. The entire procedure is automatic and all operations are controlled from one operator pulpit.

Not shown in our picture, the heating furnace is at the far end of the building. Next to the furnace are two roughing stands (also not shown). There is first a 24-in., 3-high mill which is driven by an Elliott A 300-hp, 720-rpm, squirrel-cage motor. Three passes are normally taken in this mill. The No. 2 18-in., 3-high roughing stand is driven by an Elliott B 450-hp, 720-rpm squirrel-cage motor. Three passes are taken in this mill.



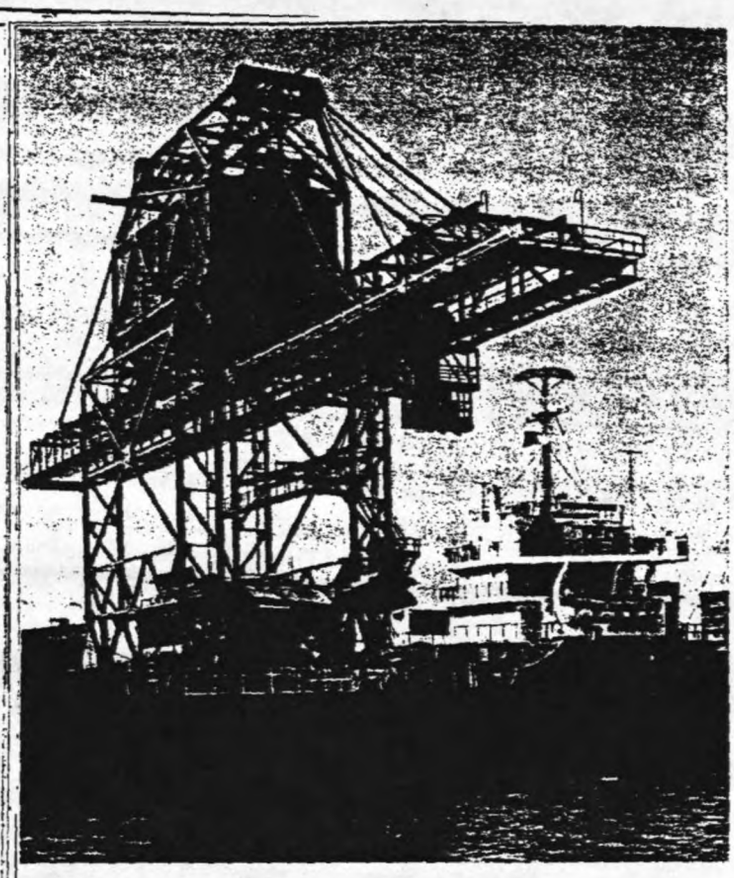
The rest of the motors are shown in the photograph. First, there is a 12-in., 2-high intermittent mill which is driven by a 200-hp, C 600-volt 690/825-rpm d-c motor. One pass is taken in this mill. This is followed by three D E F 10-in., 2-high finishing mills. Each of these consist of two stands and each is driven by an Elliott 350-hp, 600-volt, 500/1250-rpm motor. The Elliott 1000-kw, 600-volt motor-generator set which supplies the d-c power is not shown in the picture.

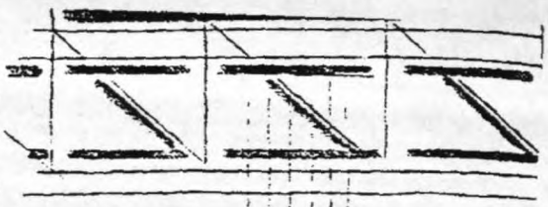
In right foreground, are the three G H I coilers which are driven by Elliott 20-hp motors.

There are three sets of controls shown; in the background opposite the roughing motors are the high-voltage control cabinets K. In about the same location, is the 440-volt control. In the right middle, opposite the finishing mill motors, are the cabinets containing the adjustable-voltage d-c control and electronic regulators J. The coiler control L is in the nearest cabinet. Ventilating equipment is in the middle background.

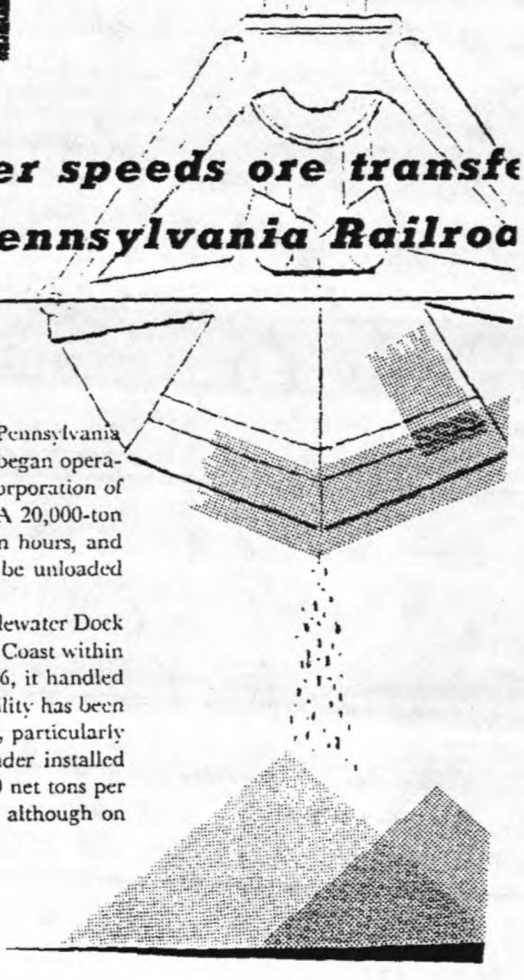
Also not shown in the photograph: an elaborate tying and conveyor system, furnace pushers, conveyor rolls, table-lift, and other auxiliaries that are powered by Elliott motors.

The main operator's control desk is shown at left.





The man trolley is shown, with the low hanging operator's cab overlooking the bucket, providing adequate visibility and control of the bucket while digging in the ship hold and while dumping into the hopper. The large machinery house at top of structure houses the Elliott motor-generator, motors and control shown in the photograph on opposite page.



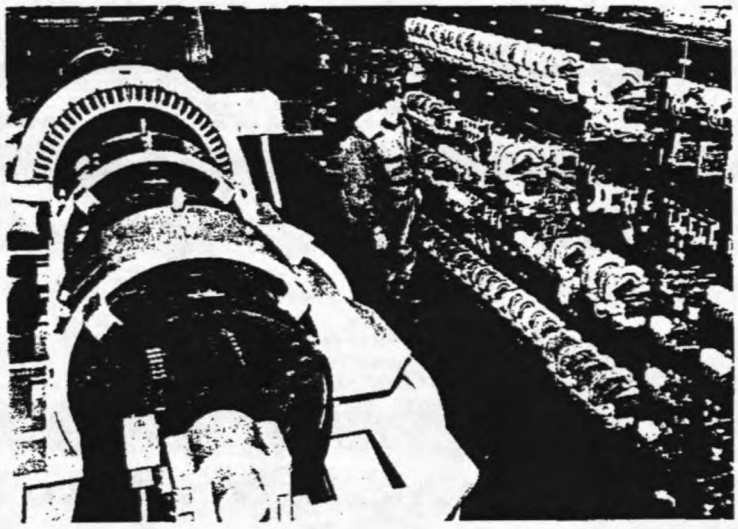
New Dravo Unloader speeds ore transfe for Pennsylvania Railroa

THE fourth and newest man trolley unloader for the Pennsylvania Railroad's giant ore pier at Greenwich Point, Philadelphia, began operation last winter. It is the second unloader that the Dravo Corporation of Pittsburgh has installed at this pier in less than two years. A 20,000-ton ore ship can now be unloaded at the pier in less than seven hours, and with the addition of the new machine two such ships can be unloaded simultaneously.

The pier, operated for the railroad by the Pennsylvania Tidewater Dock Company, has grown to be the largest of its type on the East Coast within two and one half years after its dedication. During July 1956, it handled nearly a million tons of iron ore. Rapid expansion of the facility has been necessary to handle the ever-increasing flow of imported ore, particularly from Labrador and South America. Like the Dravo unloader installed earlier, the new machine has a free-digging capacity of 1800 net tons per hour. The bucket capacity is rated by Dravo at 22½ tons, although on

The trolley turntable drive motor is in the foreground, an Elliott 603 frame mill motor rated 13½ hp, and in the background one of the 616 frame, 187½-hp trolley drive motors is visible. The turntable is rotated through its limited travel by the sprocket and chain drive shown, the chain simply being anchored to the periphery of the turntable.

View inside the machinery house showing the five-unit, 800-hp, 1200-rpm a-c to d-c motor-generator set, and the d-c control panel. In background one of two apron-hoist drives can be partially seen.



occasion the bucket can be overloaded to 25 tons. With the other unloaders on the 850-ft pier, the new machine operates on the same 64-ft gage runway.

Elliott Company supplied the electrical drive on the unloader. It is powered by Elliott a-c and d-c motors, ranging in size from 10 to 800 hp and having a total rating of 2137 hp. The use of d-c adjustable voltage control on the bucket and the trolley travel assures superior performance and smooth operation.

Among the notable electrical equipment items are the five-unit adjustable-voltage motor-generator set consisting of an 800-hp, 4160-volt, synchronous motor driving two 250-kw, one 300-kw and one 150-kw d-c generators. Each of the 250-kw generators supplies adjustable-voltage d-c power to one of the 618 frame shunt-wound hoist-drive mill type motors, and the 300-kw generator supplies adjustable-voltage d-c power to the two 616 frame shunt-wound trolley-drive mill type motors. The 150-kw, 250-volt, d-c generator supplies power at constant potential for auxiliary drive power, and for control and excitation purposes.

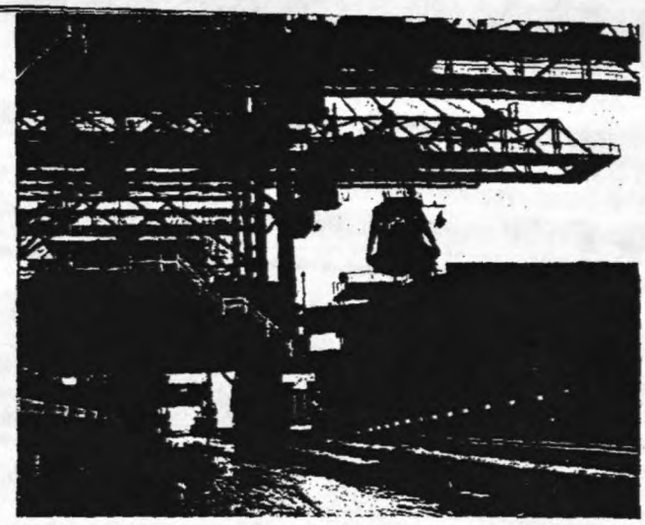
The d-c auxiliary, constant-potential drives (with mill-type motor frame numbers in parentheses) are: apron hoist (612), tower travel (608), rail

The Dravo Elliott-driven unloader is shown at left in the photograph reproduced below. Conveyor belts carry the ore from the hoppers of all four unloaders to the waiting weigh house and gondola cars for immediate movement to the nation's steel mills.

clamp release (602), and trolley turntable (603). These Elliott C-W mill type motors, developed initially for use in steel mills, have been almost universally adopted for use on the adjustable-voltage d-c driven, bulk material handling equipments, of which this Dravo Pennsylvania Railroad man trolley unloader is a typical example.

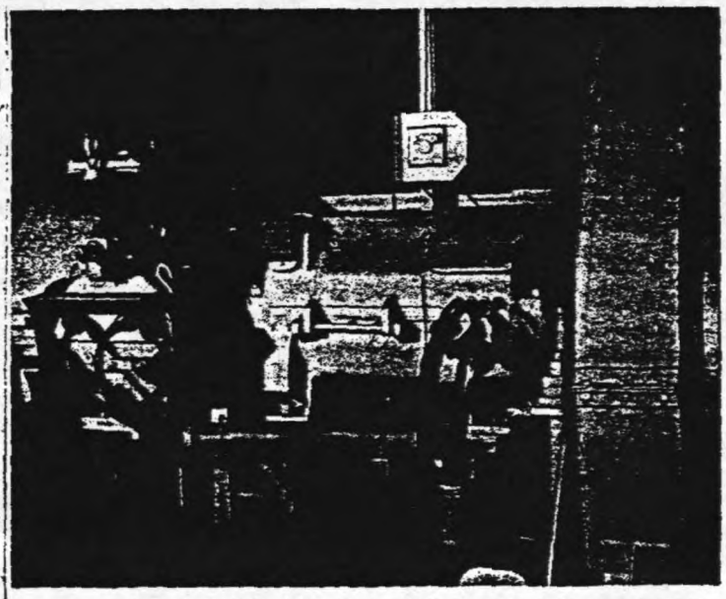
The control equipment includes a high-voltage starter for the 800-hp synchronous motor, adjustable-voltage and constant-potential d-c control, as well as a 4160/440-volt transformer for a-c auxiliary power, a distribution panel board, and a power supply for 110-volt lighting.

A bucket of ore can be removed from a ship's hold on an average of once every 45 seconds, and Pennsylvania Tidewater's skilled operators frequently have driven the Dravo unloaders to handle bucket loads in as little as 36 seconds. Because the bucket can reach 73 ft from the dock face and be lowered nearly 30 ft below the normal water level, the unloader can remove ore from the largest carriers afloat. The turntable on the trolley permits rotation of the bucket, which facilitates the removal of the ore from the holds of all types of ships, particularly during clean-up operations.



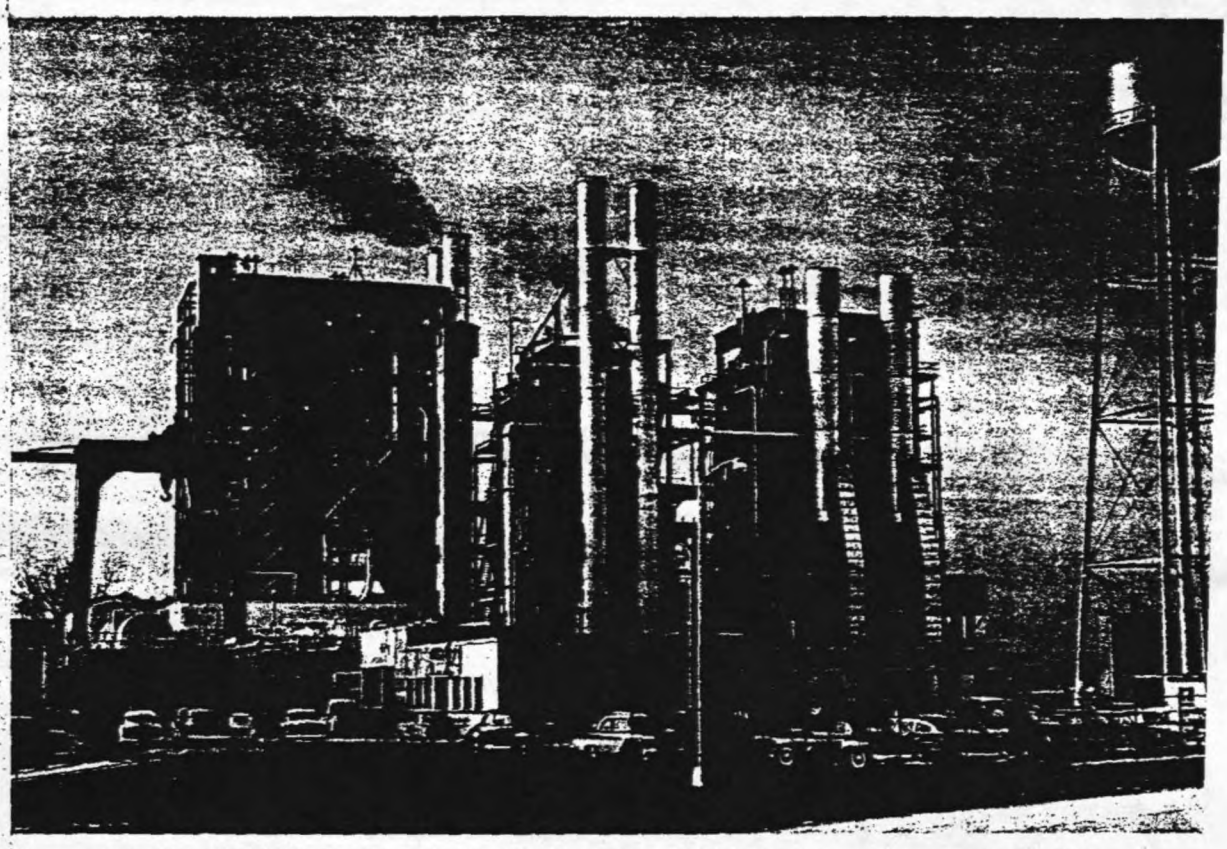
The first bucket of foreign ore is unloaded by the new unloader. The bucket takes up to 25-ton bites to help unload modern ore vessels such as shown here in less than seven hours. For size comparison note man walking.

The bucket empties the ore into a 2200-cu ft hopper, which can be racked (traveled) so that it can serve either of two conveyor belts. The belts are 1600 ft long and run between the trucks of all the unloaders to carry the ore to the weigh house and railroad car loading station.



One of the Elliott 612 frame, 94-hp series-wound apron hoist drive motors. Each apron hoist machine consists of two large cable drums, two speed-reducers and one of these husky, mill type adjustable-voltage motors.

In the foreground is one of the 616 frame, 187½-hp trolley drive motors. It drives a pair of trolley wheels, on the shaft visible behind and to the right of the motor, through the speed-reducer next to the brake on the left end of the motor. In the background above trolley motor, may be seen one of the bucket hoist motors, atop the turntable which mounts both hoist motors and the two hoist machines. Bucket hoist motors are 250-hp mill type motors



The Ninemile Point Steam Electric Station of Louisiana Power & Light Company, at Westwego, near New Orleans, has been called the most fully automatic utility power plant in the United States. In the picture, the No. 1 unit is in the middle, No. 2 at right, and No. 3 at left, No. 3 turbine-generator, extreme left. Each unit preserves its individuality.

Louisiana Power & Light Company plant is distinctive

LOUISIANA POWER & LIGHT COMPANY is proud of its Ninemile Point Steam Electric Station. It has been called the nearest thing to a completely automatic power station. Only five men per shift are required to operate this three-unit totally outdoor station with a generating capacity of 319,000 kw. Television scans fires and monitors the main gate.

The location of the station on a peninsula in the Mississippi River, near Westwego, La., (about nine miles above New Orleans) was selected on the basis of load requirements in the area, future load growth, availability of fuel and cooling water.

All three turbine-generators are hydrogen-cooled, tandem-compound, double-flow units.

No. 1, a 66,000-kw preferred standard unit, went on the line in April 1951. Its steam generator is rated 650,000 lb per hr, 1350 psi, 955 F, burning

gas at a maximum pressure of 35 psi, but equipped to burn medium diesel oil as emergency fuel.

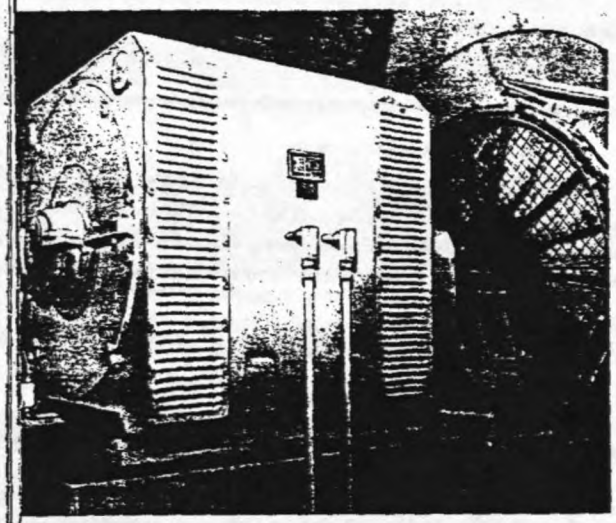
The No. 2 unit, a 99,000-kw preferred standard unit, was installed in 1953. Its boiler is rated 950,000 lb per hr, 1550 psig, 1005 F, and is equipped with furnace television so that the control room operator can constantly check fires.

No. 3 unit features a 135,000-kw turbine-generator and a boiler rated 1,000,000 lb per hr, 1550 psig, 1005 F with reheat to 1005 F. Its auxiliaries are driven by Elliott motors, some of which are pictured here.

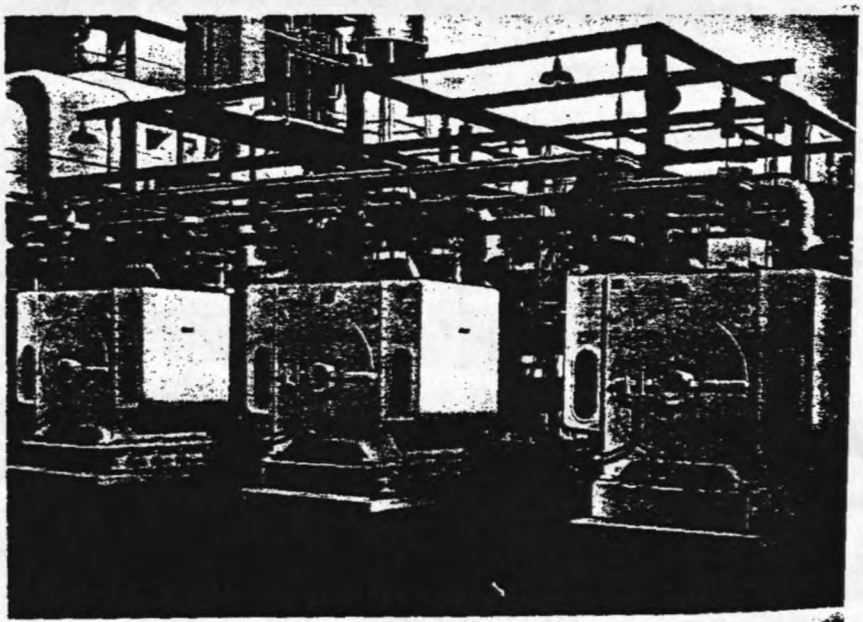
Each of the three units maintains its individuality by differences in design and each is painted a different color. Unit 3 uses a colored porcelainized metal boiler skin.

All three boilers are set at about a 30-ft elevation and are arranged for future conversion to coal firing, should it ever be required.

Ebasco Services Incorporated was responsible for the engineering design, construction and start-up of all units.



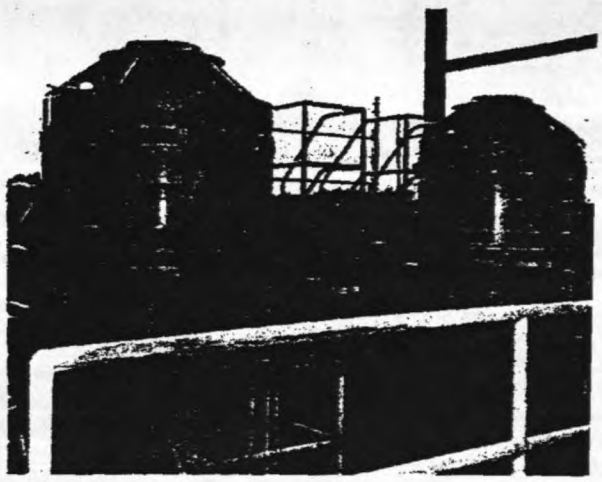
One of two Elliott 1000-hp, 900-rpm, weather-protected motors driving the forced-draft fans.



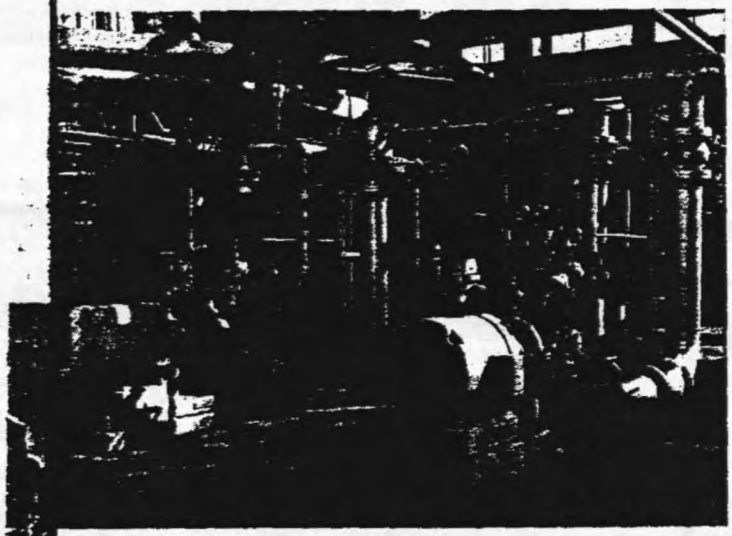
Right out in the open are three Elliott 1500-hp, 3600-rpm weather-protected induction motors driving the boiler-feed pumps. A portion of the Unit 3 turbine-generator unit is seen at top left.

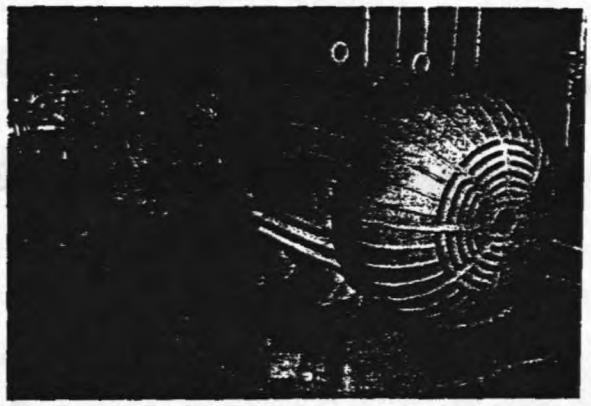
At left are seen two Elliott C-W 100-hp 3600-rpm, vertical, solid shaft, squirrel-cage induction motors which are driving low-pressure heater drip pumps.

The photograph at the right shows two Elliott 600-hp, 450-rpm, vertical, weather-protected, solid shaft, squirrel-cage induction motors driving the main condenser circulating water pumps, which are located across a levee from the station. A syphon pumping system is located out on the levee.

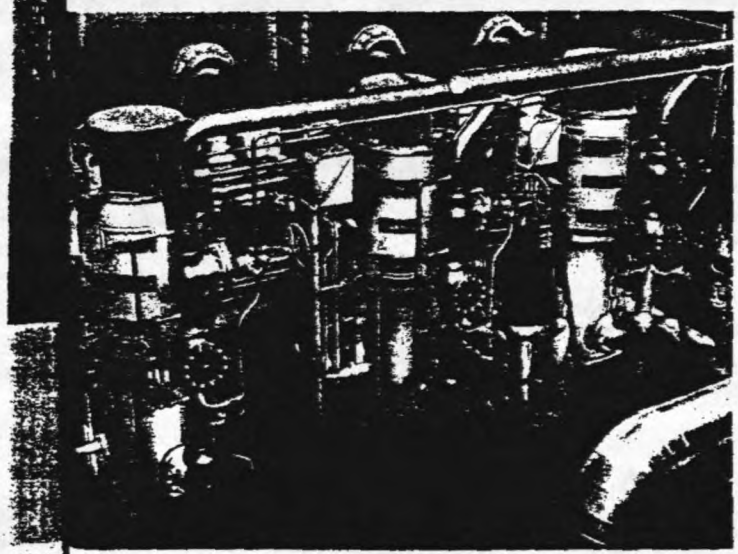


Shown below are two Elliott C-W 100-hp, 1800-rpm, splashproof motors driving service water booster pumps. Back of the unit on the right may be seen two Elliott strainers—a single strainer and a self-cleaning strainer. They strain the river water before it is handled by the booster pumps.

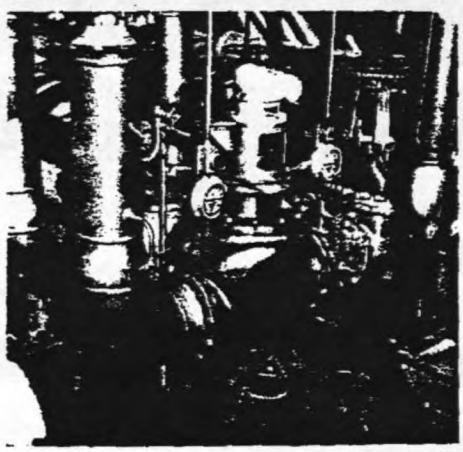




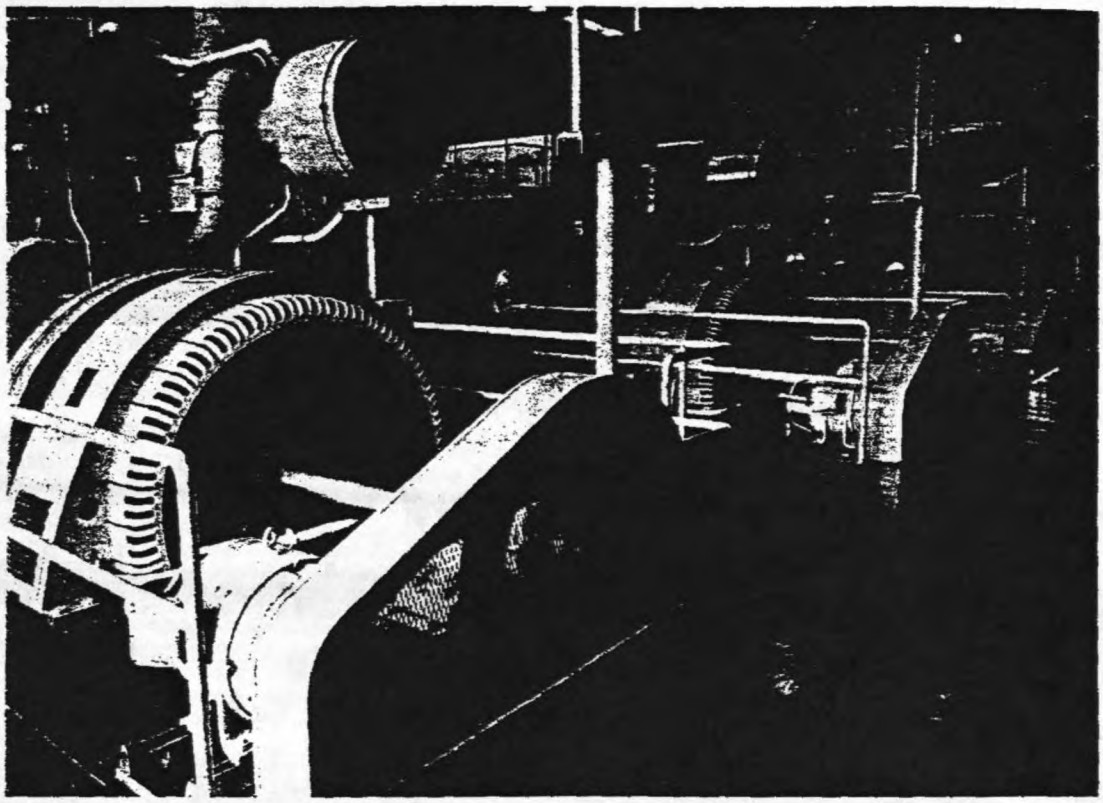
An Elliott C-W 50-hp, 1800-rpm TEFC induction motor is here driving an instrument air compressor.



Here are two Elliott strainers. In the foreground is a 12-in. self-cleaning strainer, and immediately to the left, a 10-in. single strainer in a by-pass line.



The three condensate pumps are driven by Elliott 350-hp, 1800-rpm, vertical weather-protected induction motors. They are located immediately adjacent to the condenser, which may be seen here in the left background.



Here are the four Elliott 1583-kva, 327-rpm generators driven by Nordberg Duafuel engines which are equipped with Elliott turbochargers.

Minnesota REA plant

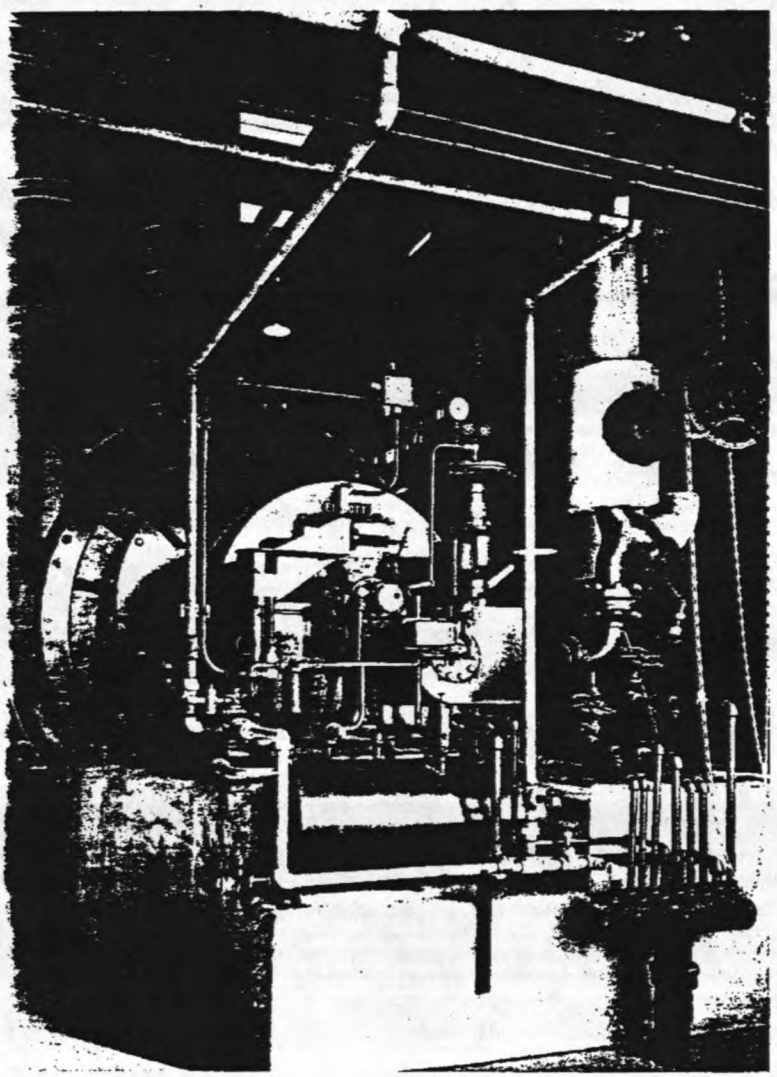
THE FEDERATED RURAL ELECTRIC ASSOCIATION at Jackson, Minnesota has been in existence since 1936. For 13 years it was a distribution cooperative. Then when power demand exceeded the possible supply it was necessary to build a suitable power plant. A building was erected and three Nordberg 4-cycle, 8-cylinder, 16 in. by 22 in. Duafuel diesel engines were installed. The engines, developing 1750 hp at 327 rpm, were fitted with Elliott turbochargers and Elliott 1230-kw generators. The engines operate on either natural gas or diesel oil and can be switched over from one fuel to the other while operating.

Original plans provided for a fourth engine-generator to be installed at a later date. Less than a year after the first three went into service, the order was placed for the fourth unit, identical to the other three.

This is a unitized plant in that each engine with its auxiliaries forms a complete entity. Power is generated at 4160 volts and transformed to 34,500 volts in the sub-station to supply the transmission line and the stepdown sub-station.

Diesel fuel oil is stored in four 20,000-gal tanks and is filtered and metered before going to the engines. A five-ton overhead travelling crane, together with shop facilities, provides for the maintenance of the equipment.

Hot acid in a cold country



The Elliott centrifugal compressor is rated 29,600 inlet cfm, handling air at minus 5 in. water gage and discharging at 75 in. water gage. The 482-hp turbine drives the compressor at 3200 rpm, using steam at 445 psig, 600 F, and exhausting at 35 psig.

SULPHURIC ACID is just about the handiest chemical there is. So it's not surprising to find acid plants all over. And when you find them, you'll usually see Elliott single-stage centrifugal compressors pumping the air for oxidation and the sulphur dioxide through the various coolers, filters, catalyst holders, absorbers, etc. These compressors keep the whole process moving and furnish the control regulation. Thus, they operate continuously as the heart of the plant. We naturally think it's a fine recommendation for Elliott compressors that hundreds of them have served so well in this industry for the past quarter century.

The photograph shown here was snapped as an Elliott turbine-driven, single-stage centrifugal compressor was just being hooked-up in a new fertilizer plant in Canada. The 22-million-dollar plant is to produce ammonium nitrate and ammonium phosphate for Canadian and northwest U. S. markets. Raw material requirements are about 410 tons per day of phosphate rock, and about 530 tons per day of sulphuric acid. Because of extremely cold winters, special building construction and raw material practices are used. Mines are inaccessible in winter so raw materials must be stockpiled. All equipment is indoors and buildings are designed for comfort at −40 F with 60-mph winds whistling outside.

Lead...

Metal of many virtues

LEAD has been called "the precious metal" not because of its price but because of its worth. Throughout the centuries, lead has proved its value in numerous ways, yet comparatively few people realize how much they depend upon it.

People who work with lead do not regard it as a dull, unromantic base metal. Having first-hand knowledge of lead, those who use the metal value it for one or more of its many unique properties.

For example, in the chemical processing field, lead is relied on to prevent the corrosion of equipmen needed in handling sulphuric acid and other metal destroying chemicals.

In chemical plants, lead is used either by itself i all-lead piping, valves, vessels or other equipment, c in combination with stronger, harder metals such a steel, iron or copper. In these "combinations", th lead may be intimately joined to its sister metal b bonding or it may be applied as a so-called "loos lining or cladding. In any case, lead's job is to prote the acid-handling system from corrosion which wou have disastrous consequences upon the production whatever commodity—petroleum, synthetic fibe fertilizers, chemicals, for example,—is manufactu in the plant. Furthermore, should the lead lining jacketing be damaged, repairs are quickly and ea made because lead is so "mendable".

In the plumbing field, lead has long been prefer by men who ply a trade which actually gets its na from the Latin word for lead—"plumbum". W and waste systems consisting of lead pipe and fitti not to mention sheet lead shower pans, owe t trouble-free nature to several of lead's properti pliability, corrosion resistance, low-friction sur and ease of joining. Where joints or connection required, the lead elements are readily joined solder which itself is mostly lead.

In the field of what may be termed either preve medicine or health promotion, lead shows anoth

National Lead Company owns this of old Roman lead pipe, unearthed i in 1907. It was made about 75 A.D., the reign of Emperor Vespasian. Afte 1900 years, this lead pipe is as s sound, as the day it was made. Inter the lead, studied via spectrographic is as pure as present-day commerc

Rolls of sheet lead ready for shipment.

its many valuable "faces". Here the very "heft" or density of lead dictates its use as a shielding material in connection with x-ray examinations and treatment with radioactive substances such as radium or cobalt-60. Moreover, lead containers are commonly employed to protect x-ray or other film from fogging by radiation.

In the field of atomic energy lead is playing a highly important role since the metal stands practically alone, in its price range, as a shielding material against gamma radiation. Lead, in proper thickness, not only provides adequate shielding for personnel but the metal itself does not become radioactive.

In the field of transportation, it is hard to imagine how automotive vehicles would operate without the familiar lead-acid storage battery. In this application, the lead plates or "grids" of the battery, coated as they are with certain lead oxides, have, in the presence of sulphuric acid, the valuable properties of "storing up" electrical energy and then, when called on by starter-button, light switch, servo motor, etc., of releasing the energy. This cycle is repeated again and again for the life of the battery; and that's not all! When the battery is junked, the lead plates go back to a smelter where the lead is freed of impurities and is returned to battery service, good as new.

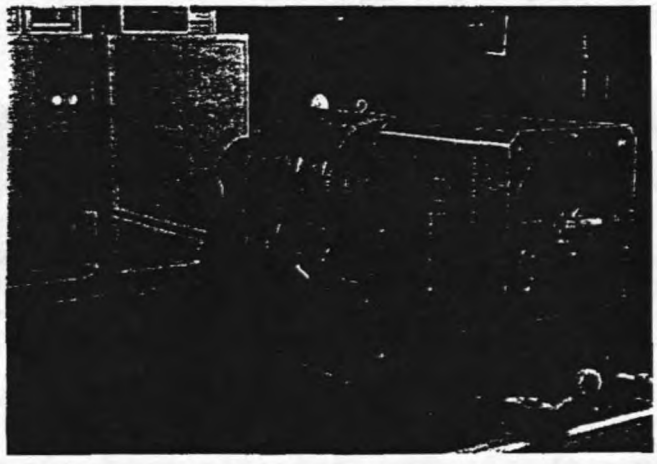
In the field of communication, lead's largest use, of course, is as a covering for cables.

The message-carrying or functional part of the cable is protected against moisture or other damaging element by a seamless, continuous jacket of lead.

The foregoing has outlined in brief some of the principal uses of lead. The listing of other uses—as an alloying element in solders, in bearing metals, in printing metals, for example; and in modified form as paint pigments, in pottery and enamel glazes, in chemicals and numerous other applications—would require many pages. We have not even mentioned the role of lead in anti-knock gasoline—a market that consumes thousands of tons weekly.

Except where lead is converted into a chemical compound—as in pigments, glazes, tetraethyl, and so on—the metal is almost completely recoverable. Old piping, tank linings, trimmings, cable sheathing, stor-

Mill motor drive at Hoyt plant, National Lead Company. An Elliott mill motor, nominally rated 250 hp 1 hour, 200 hp continuous, 420 rpm, with peak loadings of 750 hp, drives the rolls through a speed reducer. Input speed of 775 rpm is reduced to 50 rpm or a ratio of 15.5 to 1. The mill has motor-driven screw-down and the tables are driven by the main drive motor.



The Elliott motor-generator set consists of a 250-kw d-c generator, a 300-hp synchronous motor, and a 7½-kw exciter, all operating at 1200 rpm. The unit is of rugged metal mill construction. Bearing thermostats and overspeed device are included. In background are seen the adjustable voltage control cabinets.

age battery plates, in fact, almost all forms of metallic lead, eventually go back to the smelter for refining and recovery and eventual re-use.

Sheet Lead

One of the oldest forms of metallic lead is sheet. And it is one of the commonest fabrications today. The plumbing systems of ancient Rome consisted largely of lead pipe which was formed from lead sheet. By some obscure method the sheets were bent around mandrels and the overlapping sheet edges were joined by a "burning" process. These oval-shaped pipes, necessarily in short lengths, were joined, section by section, until a water conduit of the proper length was obtained.

Sheet lead today is rolled in powerful mills, in sheet sizes ranging downward from 12 ft by 48 ft, in some gages. Very thick sheet (1 in.) is obtainable as large as 12 ft by 12 ft. Thin sheet ($\frac{1}{64}$ in.) is obtainable 8 ft by 20 ft, or smaller. There are, of course, many variations.

Whatever the ultimate thickness or size, the sheet usually starts in the mill as a six- or seven-ton slab, size about 10 ft by 4½ ft by 4½ in. This huge lead casting, either warm or cold, is placed on the mill bed and moved back and forth between heavy steel rolls. With each forward or backward pass of the lead slab, the rolls are moved a little closer together, the slab becoming thinner and longer as it moves to and fro. When the desired dimensions are reached, the sheet is trimmed square, rolled like a rug and prepared for shipment.

Since there is a fairly close mathematical relationship between sheet thickness and weight per square foot, sheet lead may be specified as such-and-such fractional inch thickness or as so many pounds per foot. That is to say, it can be $\frac{1}{16}$ in. thick or 4 lb, which is the same thing, since the sheet weighs about one pound per square foot for each sixty-fourth inch thickness.

Besides the usual specifications as to length, width, and thickness, sheet lead may be had in several so-called "grades". There is common lead, chemical lead, antimonial lead, tellurium lead, and tellurium-antimonial lead. Each has its own characteristics as to stiffness, strength, creep, and corrosion resistance. Sheet lead finds its greatest usefulness, perhaps, as a lining for tanks and vessels in which sulphuric acid solutions are employed for chemical processing.

The lead sheet may be a "free-hanging" lining, supported in a cage-like structure; it may be fastened to the steel, concrete or wooden tank with strapping and bolts or studs fired from a cartridge; or it may be permanently, and virtually inseparably, joined to a steel sheet by a special bonding process. In all cases, the sheet edges are "burned" or welded together to produce an acid-tight structure.

Hoyt Plant Mill Modernized

At the Hoyt Plant of National Lead Company at Granite City, Illinois, recently a 28-in. by 110-in. single-stand, two-high reversing lead rolling mill was modernized and speeded up by replacing the original steam engine drive by an Elliott adjustable-voltage d-c electric drive. The installation, which is said to be the only lead mill drive of its kind in this country, has resulted in great savings in rolling costs.

The electrical equipment replaced a 350-hp, 250-rpm, two-cylinder steam engine and a 5-to-1 gear unit driving the main rolls of the hot mill. In making the conversion, the existing steam line was used as a conduit for a power line from sub-station to mill. The change-over to electric drive required a shutdown of only a week and a half.

The Elliott electrical equipment was sized and designed after a study of the existing operation, plus detailed calculations from test data. As shown by installation photographs on the previous page, the mill is now powered by an Elliott Crocker-Wheeler adjustable-voltage mill motor, nominally rated 250 hp, together with a 250-kw motor-generator set and adjustable-voltage control equipment. A synchronous motor was used in the motor-generator set since maintaining good power factor was desirable.

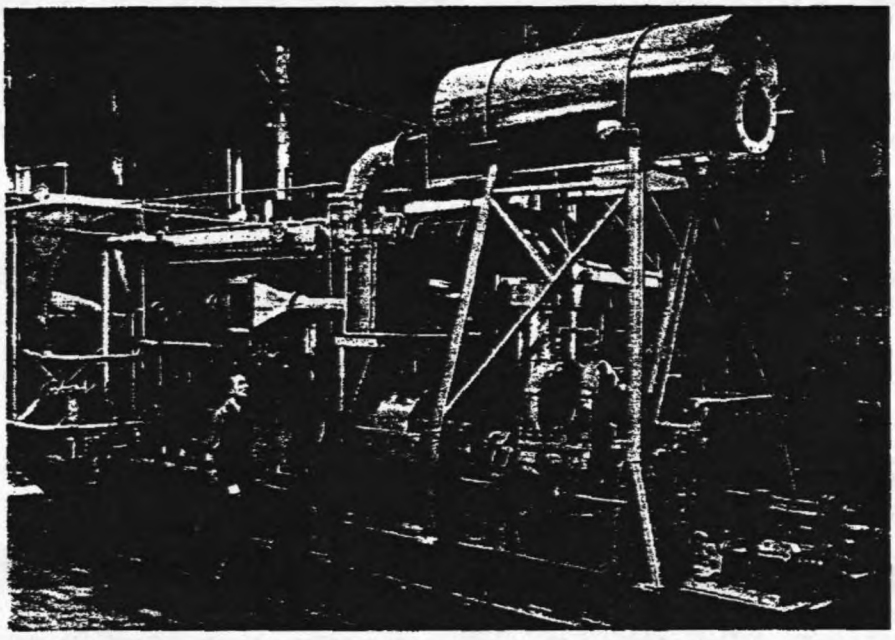
It was noted that antimonial lead slabs 8 ft by 4 ft by 4½ in. and weighing 4 tons were reduced to ½ in. thickness in 38 passes, requiring 5 minutes rolling time. The slab was then sheared into four parts and each part further reduced to 0.130 in. in 13 more passes, requiring approximately 1 minute, 30 seconds rolling time for each part.

Chemical lead slabs 5 ft by 5 ft by 5 in. are also reduced to ½ in. thickness.

The new drive arrangement provides continuous uniform speed control from rest or from any speed in the reverse direction to any of the desired running speed points selected by the operator. The control, which is housed in a sheet steel cabinet with hinged doors on front and back, provides five speed points forward and reverse for the main drive motor and field neutralizing of the generator in the off-position of the master switch. The rate of acceleration and deceleration, together with the accuracy of the speed points up to base speed is obtained by a sensitive, powerful, rotating voltage regulator with a current limiting feature. This keeps uniform current and consequently torque on the motor during acceleration and deceleration and yet protects the motor from any excessive currents.

The gear ratio and control make possible for the motor to start and accelerate up to 32.5 rpm of the mill with maximum torque and to develop the maximum horsepower all speeds above 32.5 rpm.

The increased available horsepower results in increased production many schedules.



The 1000-hp Enterprise engines operate at 600 rpm driving United centrifugal pumps at 3550 rpm through Western Gear Works speed-increasing gears. The engines are equipped with Elliott turbochargers (top middle in photo).

Portable units pump Middle East oil

THIS diesel pumping rig (one of four) is on its way to Arabia, where The American Independent Oil Company will use these portable rigs to pump oil from their rich new Wafra Field wells to the Persian Gulf coast. (Wafra Field lies in the Neutral Zone of the tiny sheikdom of Kuwait.)

The 1000-hp Enterprise engines are equipped with Elliott turbochargers. The engines can burn both the crude oil which they pump and natural gas emanating from wells.

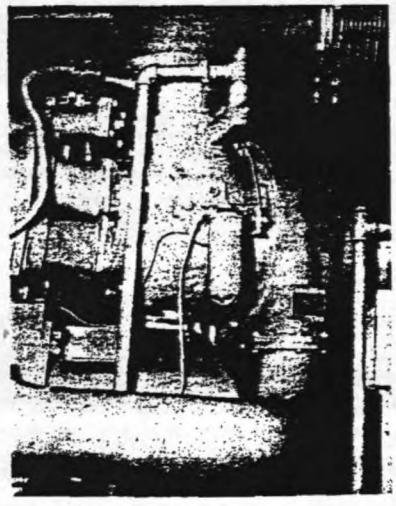
The Neutral Zone is a 2500 sq mi coastal strip lying along the Persian Gulf between its sponsors, Kuwait and Saudi Arabia. Production from its Wafra Field Oil reserves is equally shared by The American Independent Oil Company and Getty Oil Company, both U. S. concerns. In 1956, Wafra's oil was produced at the rate of 39,000 bbl daily. With an estimated 650,000,000 bbl in reserve, production is expected to increase sharply this year.

Oil is pumped from the wells overland 35 miles through a pipeline called the Wafra Shipping System, to a terminal on the coast called Mina Abdulla. It is along this pipeline that the portable pumping units will be used.

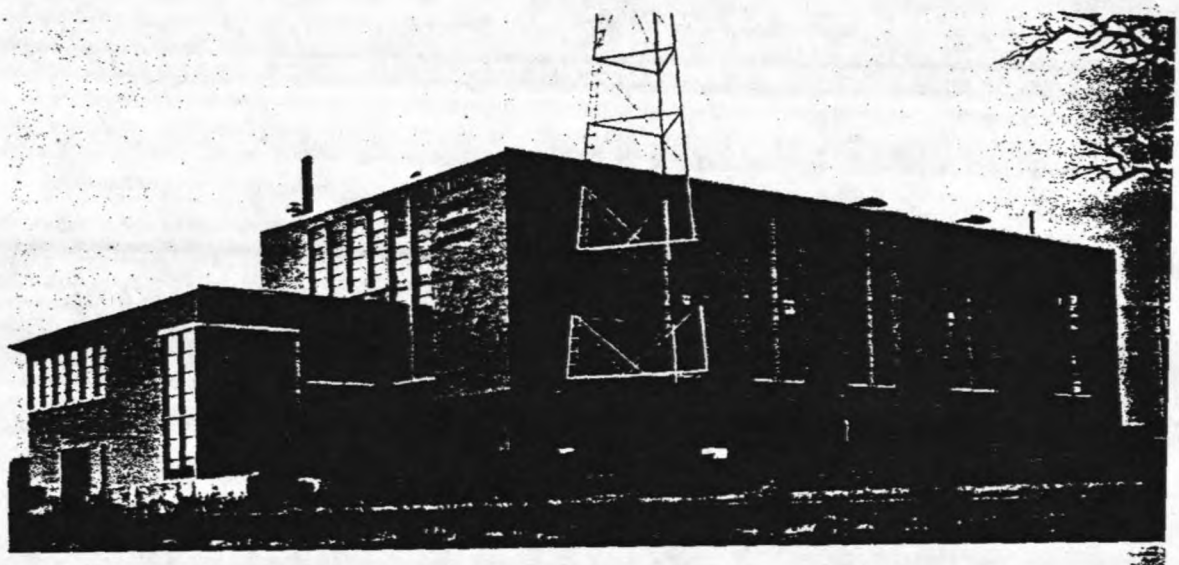
The marine terminal at Mina Abdulla is actually the shore-anchor for a 12,000-ft submarine line connecting the pipeline system with the sea berth. Tankers tie up and load the oil directly from this terminus.

Pumping oil from the hot, desolate field outpost to waiting tankers puts ever-changing demands upon the power source. Burning-hot 130F temperatures—fierce, sudden sand storms—bleak, inaccessible locations—changing production loads—all these were factors to be considered part of "normal" operating conditions for these units.

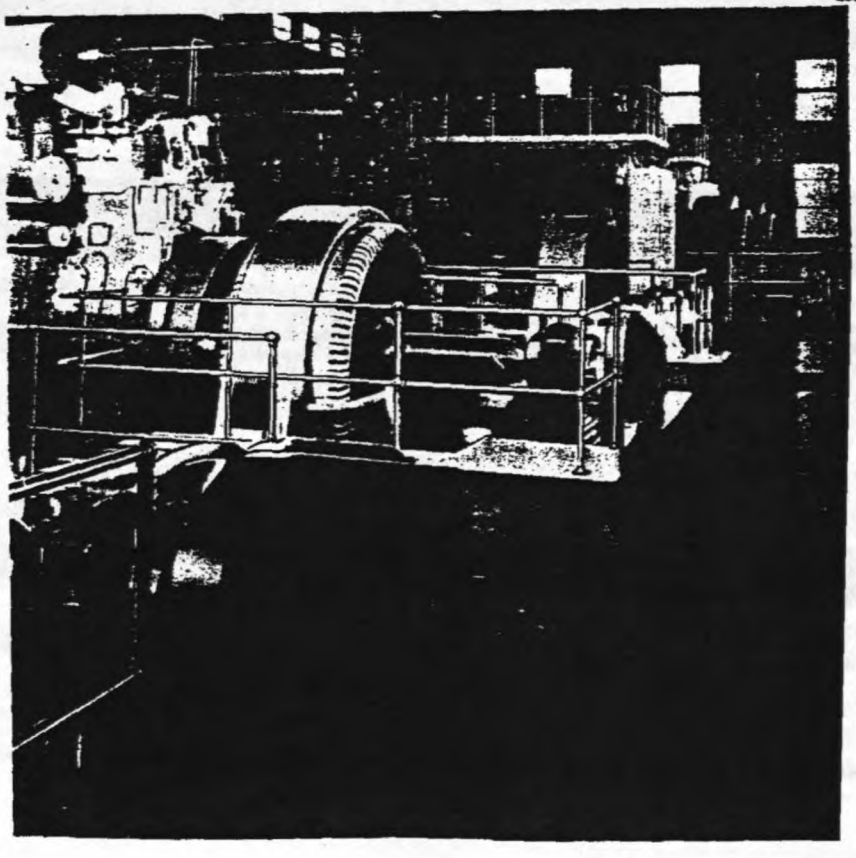
Photograph below shows a close-up of the Elliott turbocharger on one of the engines.



Two more Elliott generators adde



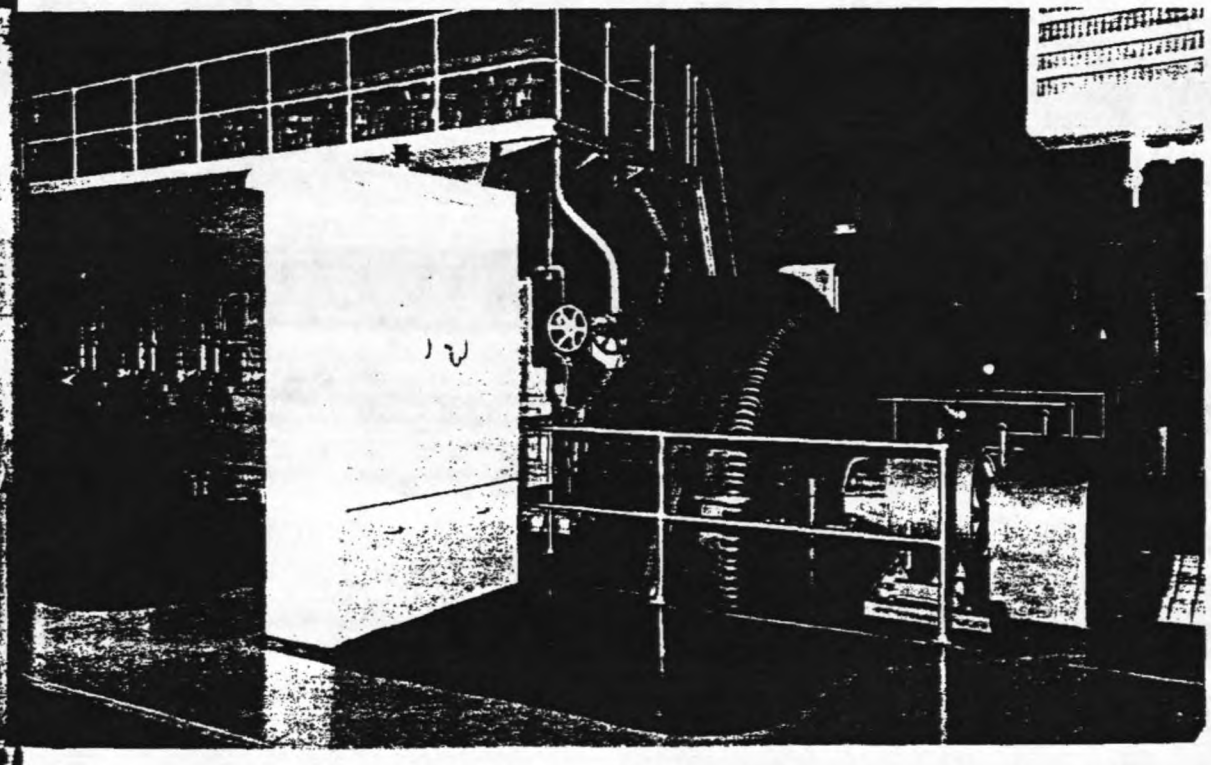
This modern Pittsfield plant was built in 1950. It was constructed to permit expansion of generating capacity with minimum expense.



dy Illinois Rural Electric Company

Two Elliott 3000-kw diesel-driven generators installed at its Pittsfield, Illinois, plant are Illinois Rural Electric Company's latest addition to its generating capacity to keep pace with ever-increasing demands for electric power. Illinois Rural Electric serves rural consumers of electricity in seven counties in west central Illinois and has a total generating capacity of 12,680 kw at its two plants at Pittsfield and Winchester. In addition to these latest units at the Pittsfield plant, are three Elliott 1160-kw generators installed in 1950. At the company's Winchester plant are three 400-kw and two 1000-kw Elliott diesel-driven generators.

The photograph below shows the latest Elliott 3000-kw, 225-rpm generators installed at Illinois Rural Electric's Pittsfield plant. These generators show as the last two in the row of five in the photograph at the left. In this latter photo, the three generators in the foreground are the 1140-kw units installed in 1950. Note that the stator frame of the third unit has been shifted out of place for routine inspection.



This view features the three first-stage ejectors of the Elliott triple element two-stage ejector serving the residuum stripper. Suction chambers are connected to a manifold and they exhaust to the intercondenser shown in photograph at right.

Oil in California and the El Segundo Refinery

by **R. L. Ridgway**, *Field Engineer, Elliott Company, Los Angeles*

Gross crude oil production for the Standard Oil Company of California and its subsidiaries of the Western hemisphere totaled up to 144,931,628 barrels in 1956, making it one of the leading oil companies in the United States.

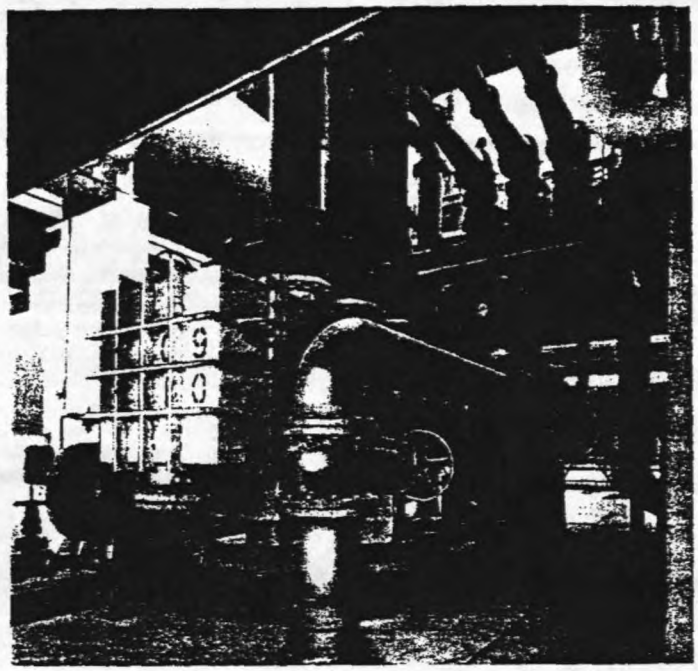
The most extensive refinery operations are at Richmond, near San Francisco; at El Segundo, near Los Angeles; and a smaller unit located near Bakersfield.

Even before 1866 when the first serious attempt to drill for oil was made in California, it was well known that there was oil beneath California soil. Surface indications and seepages had been recovered, treated, and used for illuminating and lubricating purposes.

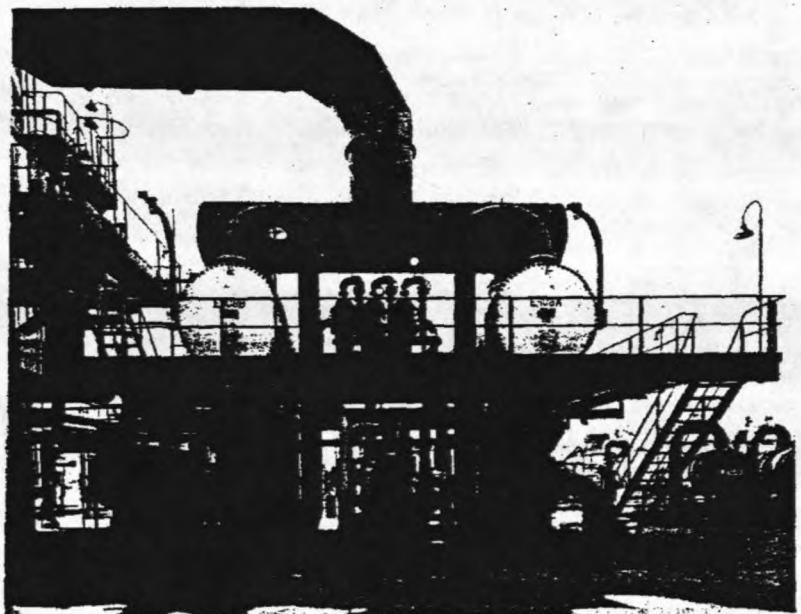
According to old records, in 1865 there were 62 petroleum companies incorporated in the State of California. This was six years after the Drake discovery well which was drilled in 1859.

The rapidly growing population of California provided a good market for kerosene, which for many years was brought mainly around the Horn from the East. As a result of the enterprise of some ex-Pennsylvanians, three wells were drilled in Pico Canyon, northwest of Los Angeles late in 1875. The next year the California Star Oil Works Company was formed to develop the Pico, a company in which D. G. Scofield, later the first president of the independent Standard Oil Company (California) played a key role. In 1879 the California Star Oil Works Company passed into the control of a new organization, the Pacific Coast Oil Company. For many years Pacific Coast Oil was the dominant company in the western industry.

In 1878 the Standard Oil Company came West. Standard brought its wide range of products from its eastern refineries into the West, where



This photograph features a closeup of the combined inter- and aftercondenser. In the one shell are a 2000-sq ft intercondenser and a 1000-sq ft aftercondenser. The three first-stage ejectors are again seen, top right.



This photograph shows the vacuum equipment for the residuum stripper. Two Elliott 11,000-sq ft surface condensers are mounted on the platform. The downcomer from the tower is seen at the top coming into a manifold distributing the vapors to both condensers. Between the condensers on the platform may be seen the suction chambers of the three first-stage ejectors. Below these is the square head of the combined inter- and aftercondenser. The intercondenser is served by three second-stage ejectors, the foremost of which can be made out at the right of the square condenser. Details of ejectors and condensers above.

they encountered a certain degree of competition from the products of the Pacific Coast Oil refinery at Alameda. During this period the Alameda works manufactured gasoline, naphtha, gas oil, fuel oil, lubricants, and a poor grade of kerosene.

Pacific Coast Oil soon became an integrated oil enterprise with producing, transporting, and refining facilities. Meanwhile Standard Oil had developed a very strong marketing organization in the West. In 1895 came the alliance between Standard and Pacific Coast Oil Company. As a first step Standard contracted to sell Pacific Coast's entire output of kerosene and the naphthas. Five years later, in 1900, Standard took over Pacific Coast Oil Company by stock purchase.

Around 1900, with the introduction of new fields such as Kern River and Brea Canyon, it was apparent that the old Alameda Refinery would not be able to keep pace with opportunity. Standard Oil built the Richmond refinery. In July, 1902, the first oil flowed into that refinery. When the last of the eighteen crude stills was completed in the following year, the refinery charged about 3000 barrels a day. However, expansion began almost immediately. In 1904 about 9000 barrels a day were being charged. Richmond had become one of the largest processing refineries in

the world. It was charging nearly 80 per cent of the runs to stills in California. The prior year, 1903, California's crude production had increased to more than 24,000,000 barrels, making it the first state in crude production in the nation.

This was about the time, around 1904, when people were tinkering with something called a "horseless carriage". Records show that 22,000 automobiles were manufactured in 1904. This is a far cry from the production of today but it soon made the former waste product, gasoline, the most important end product.

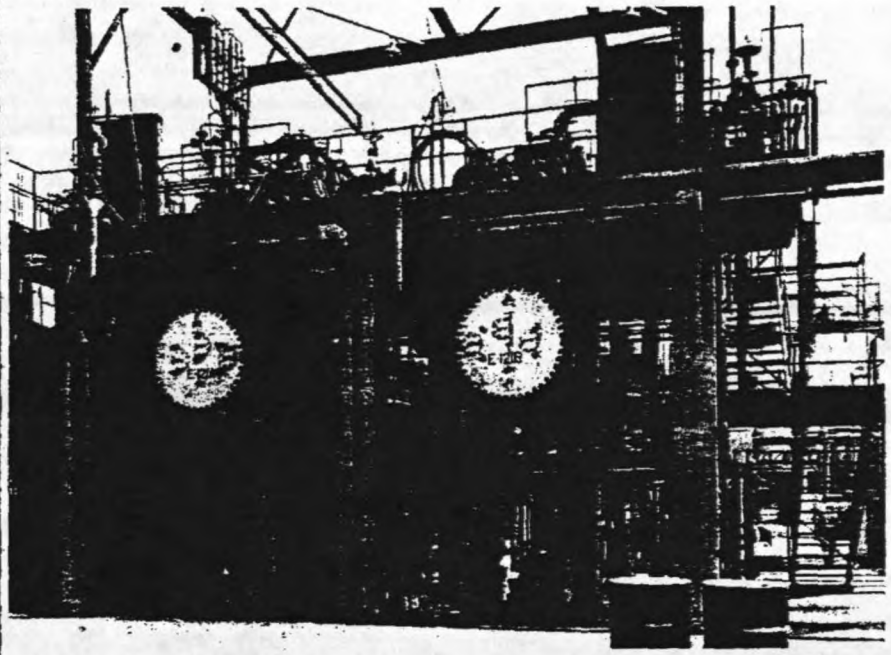
In 1907 Standard created a production department, began to buy lands, to lease land, and to begin active drilling for producing wells. Since 1907 there has been a continuing expansion of this program.

In 1911 on Santa Monica Bay, 17 miles from the center of Los Angeles, ground was broken for the El Segundo Refinery (El Segundo means second in Spanish). The site was a barren waste consisting of 843 acres, but within 139 days the first battery of five stills was operating.

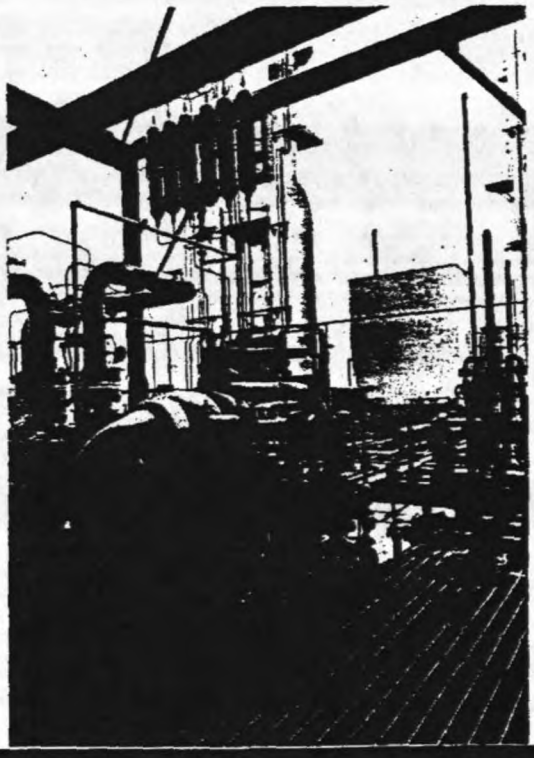
The first modified Dubbs thermal cracking plant was constructed at El Segundo in 1928 to meet the increasing demand for gasoline. At this time the thermal cracking process had been brought to a high degree of perfection and enabled the refiner to recover more gasoline from a given amount of crude oil.

In 1941, as the need for higher octanes increased, a Houdry fixed bed catalytic cracking unit was constructed at El Segundo. In 1953 a Model Four fluid catalytic cracking unit, perfected in 1951 by the Standard Oil Development Company, was installed at El Segundo.

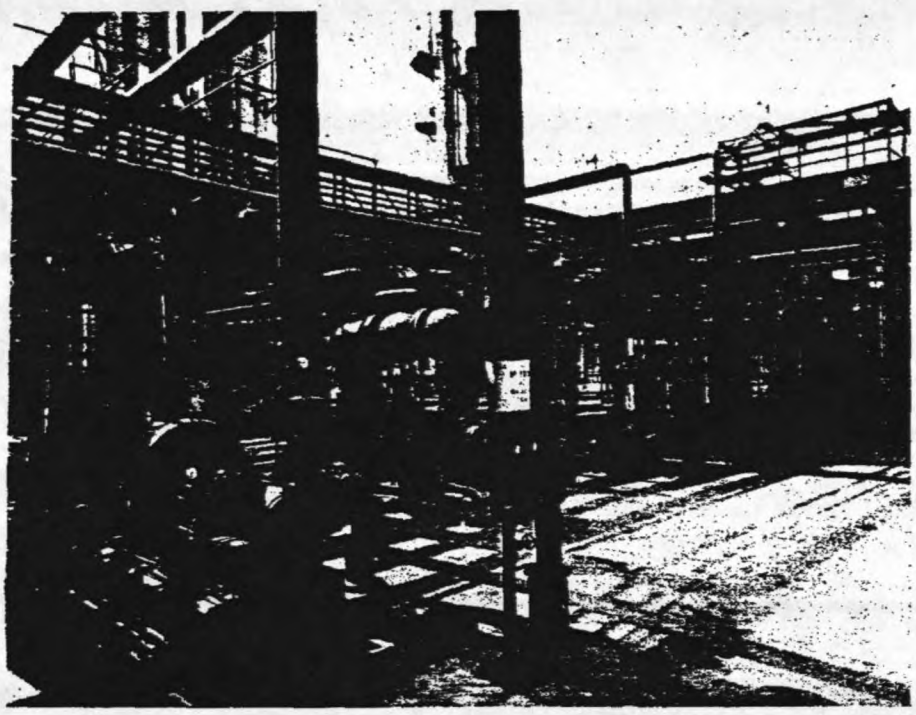
This unit, which processes 40,000 bpd gas oil, required approximately 18,000 hp to handle the flow of feed



The two Elliott 5000-sq ft single-pass surface condensers which serve the high-speed turbines are featured in this view.



One of the two Elliott 2494-hp, 10,400-rpm, multi-stage turbines which drive centrifugal compressors serving the platformer unit, installed on a platform in an outdoor location. The turbine sheet steel jacketing had not been installed when this photograph was made. The turbines exhaust to Elliott 5000-sq ft surface condensers, which are shown in the above photograph. At right is one of the Elliott two-stage ejectors which serve the condensers below.



This photograph shows a line of Elliott steam turbines driving pumps serving the catalytic reformer unit. Serving at El Segundo are many Elliott turbines ranging in size from 5 to 2500 hp (opposite).

and products (gas oil, gasoline, LPG and fuel gases). Numerous Elliott steam turbines are used on this unit as pump drives. These turbines range in size from 5 to 500 hp, most of them operating at either two-pole or four-pole motor speeds. Motive steam is in the neighborhood of 150 psig.

The feed for the catalytic cracker comes primarily from the residuum stripper. The major purpose of this unit (vacuum flash) is the recovery of virgin or uncracked stock from reduced crudes and heavy residues of the refinery. The reduced crudes enter the residuum stripper first, through heat exchangers, absorbing heat from the asphalt bottoms and heavy gas oil product streams and are thus preheated before entering the direct-fired heater. The vapor-liquid mixture leaving the direct-fired heater enters the vacuum column which separates a light vacuum gas oil which comes off the top of the tower. A heavy vacuum gas oil comes off the tower about midway up and this is the feed for the fluid cat cracker. The asphalt residue comes off the bottom of the tower.

The vapor load removed from the top of the tower consists of approximately 30,000 lb per hr of steam, plus approximately 25,000 lb per hr of condensable hydrocarbon vapor, plus approximately 2000 lb per hr of noncondensable gas. To handle this load and maintain approximately 2 in. Hg absolute pressure, two Elliott 11,000-sq ft surface condensers are used, arranged in parallel. Serving these two condensers is an Elliott triple element two-stage ejector having the intercondenser and aftercondenser combined in a common shell. Condensate from the inter- and aftercondensers is collected in pots and pumped to storage. The aftercondenser in this vacuum system is vented to the furnace where the noncondensable hydrocarbons add to the other fuels used for firing.

Elliott equipment serving this residuum stripper consists of two 11,000-sq ft surface condensers arranged for four water passes and two vapor passes. Due to the presence of ammonia, hydrochloric acid, naphthenic acid, and hydrogen sulfide in the overhead vapors being condensed, it was necessary to use special metals in the condensing equipment. The residuum charging stocks are from California crudes and contain about 1 to 2 per cent of sulphur. They also contain an appreciable amount of naphthenic acids and hydrochloric acid formers. The ammonia comes from being injected into the vacuum column at a rate of about 5 lb per hr for control of the corrosive effects of these acids on carbon steel.

The latest major construction at El Segundo was a catalytic reformer constructed in 1953. This unit, using a platinum type catalyst, has a capacity of 26,000 barrels per day of naphtha feed. The two multi-stage centrifugal compressors on the platformer are driven by Elliott multi-stage, multi-valve turbines rated 2494 hp at 10,400 rpm. The turbines exhaust at an absolute pressure of 2 in. Hg to two Elliott 5000-sq ft surface condensers.

The expansion plans of Standard Oil of California for the immediate future include another residuum stripper at El Segundo and new refineries in Honolulu and Washington state.

Pictured here is the 30-in. booster ejector serving the deodorizer vacuum header and discharging into the 42-in. barometric-type booster condenser.

Ejectors serve South Texas Cotton Oil Compa

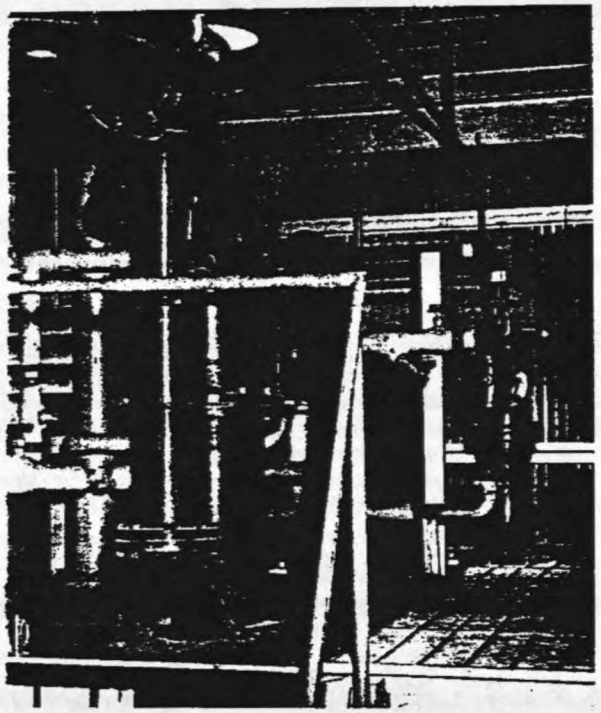
THE NEW, modern and efficient vegetable oil processing plant of South Texas Cotton Oil Company, Houston, Texas, division of Southern Cotton Oil Company, is exemplified by the photographs shown here. Design and construction were supervised by the owner's engineering department.

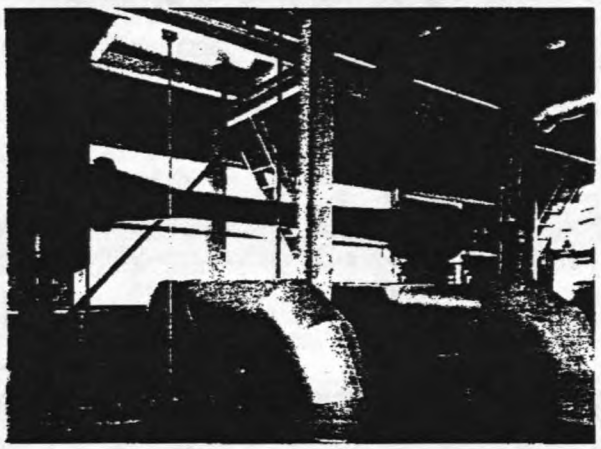
The building uses glazed tile walls at the ground level with upper siding of transite and corrulux. The result is natural lighting which emphasizes the pleasing appearance of the brightly color coded process lines, vessels, and other equipment.

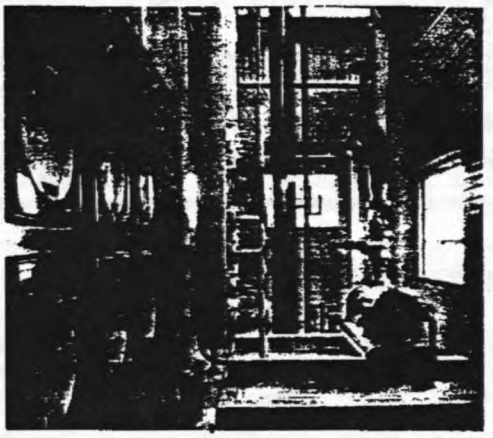
Elliott steam jet ejector and barometric condenser equipment serves all vacuum requirements. These include deaerating and deodorizing esses, the latter employing a three-kettle ca gravity flow design.

The deaerator kettle employs a two-stage with barometric type intercondenser mair approximately 1.5 in. Hg absolute pressure

The three deodorizing kettles are serve common vacuum header in which appro 9.5 mm absolute pressure is maintaine three-stage ejector. This ejector consists of diameter suction first or booster stage, mately 20 ft. long, discharging into a 4 ameter barometric condenser, which in







At lower right is the excellently arranged condenser hotwell with an Elliott motor driving the condensate removal pump. At left is seen the control panel.

Left above—Close-up of two-stage deaerator ejector with two-stage ejector serving the booster condenser in right background.

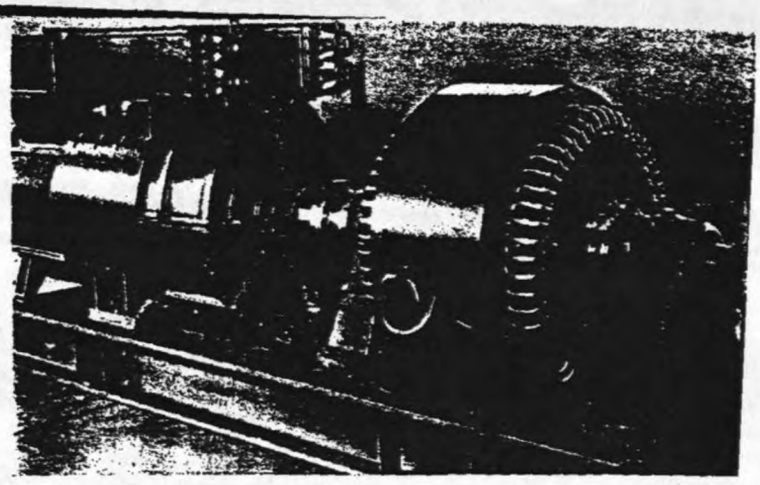
A side view of the booster ejector in the background with deodorizer kettle vacuum lines in the foreground and upper right.

Elliott dripproof and TEFC motors drive the pumps handling the condenser water at the cooling tower.

'ved by a small two-stage ejector with baro-·tric type intercondenser.

The last stages of the three-stage deodorizer :ctor and the two-stage deaerator ejector are anifolded, with an additional single-stage ejector provide adequate "hogging" capacity for rapid acuation of the system at start-up.

In addition to the ejector equipment, Elliott ipproof and TEFC (totally-enclosed, fan-cooled) otors drive Ingersoll-Rand pumps in the handling condenser water to and from the Fluor cooling wer; the induced-draft fan serving the tower is lso Elliott TEFC-motor-driven.



This Elliott submarine propulsion motor, driven by an Elliott synchronous motor, serves as a generator. The generator furnishes current for a wind tunnel motor. Note the unusual totally-enclosed, water-cooled enclosure. These motors had to be water-tight below the frame joint and water-proof above.

"Beached" submarine motors still on the job

If these motors could talk, they could tell some interesting stories. Both powered U. S. submarines during World War II. Both were retired, toward the end of the war, when improved enemy sound-detection made *geared* submarine propulsion obsolete.

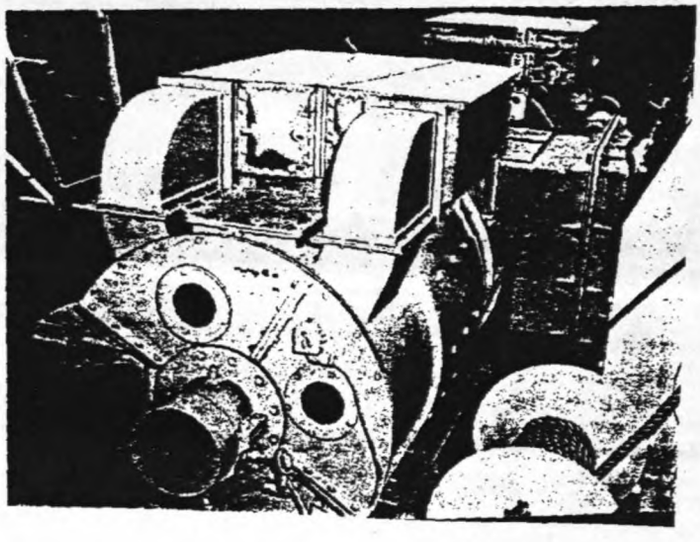
However, these motors (and nearly 200 others made by Elliott) were simply too useful to stay "retired". Declared surplus by the Navy, motors of this type are now doing many jobs throughout the United States.

The two shown below, arranged back-to-back, power the draw-works of a giant electric drilling rig capable of drilling to 25,000 ft. The rig is operated by Circle Drilling Co., Eunice, Louisiana. Other identical Elliott submarine propulsion motors are employed in drilling service by Loffland Brothers, New Iberia, Louisiana. These, however, are used as main generators, being driven by 1100-hp diesel engines.

Another Elliott veteran of submarine service, above, serves an entirely different purpose. Coupled with an Elliott synchronous motor, it operates as a generator, feeding another sub-type motor. This motor in turn drives a blower in a Massachusetts Institute of Technology wind tunnel.

During World War II, motors of this type became the standard propulsion machine of our submarine fleet. Four motors comprised a "shipsworth". Operating in pairs, two motors drove each of two reduct gears which powered the twin scre A diesel-powered generator furnis current for each pair of motors. Ell production reached its peak in 1 when Ridgway built 39 vessels-w of propulsion motors, main ge ators, and auxiliary generators.

Toward the close of the war, en sonic detection improved. The noise of the standard propulsion tem became intolerable. An imm ate program was undertaken which Elliott played a major pa develop a low-speed propulsion tem, eliminating the reduction By war's end, the original high-s geared motors, as shown on this were retired and became "surp



Two Elliott submarine propulsion motors, back-to-back, drive the draw-works of an electric drilling rig. In the original sub service, each motor was rated at 1362.5 hp, 1200 rpm, 400 volts.

Powercrax

Two duck hunters were sitting behind their blind, one drinking from a thermos of coffee, the other from a jug of whiskey. After some hours of sipping they spotted a lone duck winging through the sky. Taking quick aim, the coffee drinker rose, let fire, and missed. The whiskey drinker rose, let fire and brought the bird down. His companion, properly amazed, complimented him on the shot. He replied, "Aw, it's nothing. I usually get five or six in a flock like that."

◆

The way of the transgressor may be hard—but it isn't lonely.

◆

The football coach, dejected because his team is losing, looks down his bench of substitutes and yells:

"All right, Jones, go in there and get ferocious."

Jones jumps up with a start and says:

"Sure, coach, but what's his number?"

◆

Quiet people aren't the only ones who don't say much.

◆

A woman reported the disappearance of her husband to the police. "Is there any message you wish to give your husband if we find him?" asked the officer in charge of the investigation.

"Yes," she replied, "tell him mother didn't come after all."

◆

There is no wholly satisfactory substitute for brains, but silence does pretty well.

◆

The lovely secretary announced that she was quitting her job and shortly thereafter one of the men told her they were striking for a raise because she was leaving.

"What's my going got to do with your salary?" she asked.

"Well," he explained, "We've always considered you one of our fringe benefits."

A man ran for sheriff in a small western town and after the ballots were counted found that he had been defeated 100 to 1. The day following the election he walked down the center of the main street carrying two guns.

"See here," said an indignant citizen, "You have no right to carry guns. You weren't elected sheriff."

"Listen," he remonstrated, "A man with no more friends than I've got needs these two guns."

◆

Farmer (pulling with one mule):

"Giddap Pete! Giddap Barney! Giddap Johnny! Giddap Ralph!"

Stranger: "How many names does that mule have?"

Farmer: "His name's Pete, but he don't know his own strength so I put blinders on him, yell a lot of names and he thinks other mules are helping him."

◆

"Listen," said one cute young thing to another, concerning a rival, "All a sweater does for her is make her itch!"

◆

Sam was not as good a hunter as he pictured himself in telling accounts of his adventures, but what he lacked in ability he had in confidence. Duck hunting with some friends early one morning he sighted his game within easy shooting distance. As his double blast broke the stillness of the morning the bird went squawking away.

"Fly on, you fool bird," shouted Sam. "Fly on with your stubborn heart shot out!"

●

The road to success is crowded with wives pushing their husbands ahead.

◆

Census Taker: How many bushels of corn did you raise last year?

Backwoodsman: Didn't bushel it—bottled it.

In these days of low-cut gowns, tight-fitting waists and sheer stockings, it takes will power for a man to look a woman in the eye.

◆

The dentist told the millionaire Texas oil man that his teeth were in perfect condition. "But I feel lucky today," pleaded the Texan, "drill anyway."

◆

"He was nervous as a long-tailed cat in a roomful of rocking chairs."

◆

Said the hesitant young sheik upon inheriting his father's harem:

"It's not that I don't know what to do; I just don't know where to begin."

◆

"I've sacrificed everything I had in order that you could study medicine," the irate father told his son, "and now that you are a doctor, you tell me I have to give up smoking."

◆

Young man to draft board: "But you can't turn me down. I've proposed to three girls, told my boss what I think of him, and sold my car."

◆

A man who had imbibed too freely and was late getting home was berated by his wife for keeping her up. His alibi was that he'd taken the wrong bus.

"That I can understand," said his spouse, considering the shape you're in, but how did you find out you were on the wrong bus?"

"Well, I kind of thought I was," replied the confused man, "when it stood at one corner for a couple of hours, but what finally tipped me off was the fact that people kept coming in and ordering hamburgers."

◆

A doctor had just finished checking over a middle aged patient. "Well, old man," he said with a laugh, "I can't seem to find a thing wrong with you, but I do recommend you give up half your love life." After a long pause and deep thought the patient replied, "Doctor, which half do you recommend I give up, thinking about it—or talking about it?"

◆

Socrates was a Greek philosopher who went around giving good advice. They poisoned him.

●

The two women were discussing a third. Said one, "Well, you have to admit she's awfully kind to her inferiors."

After a pause, the other retorted, "But where does she find them?"

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