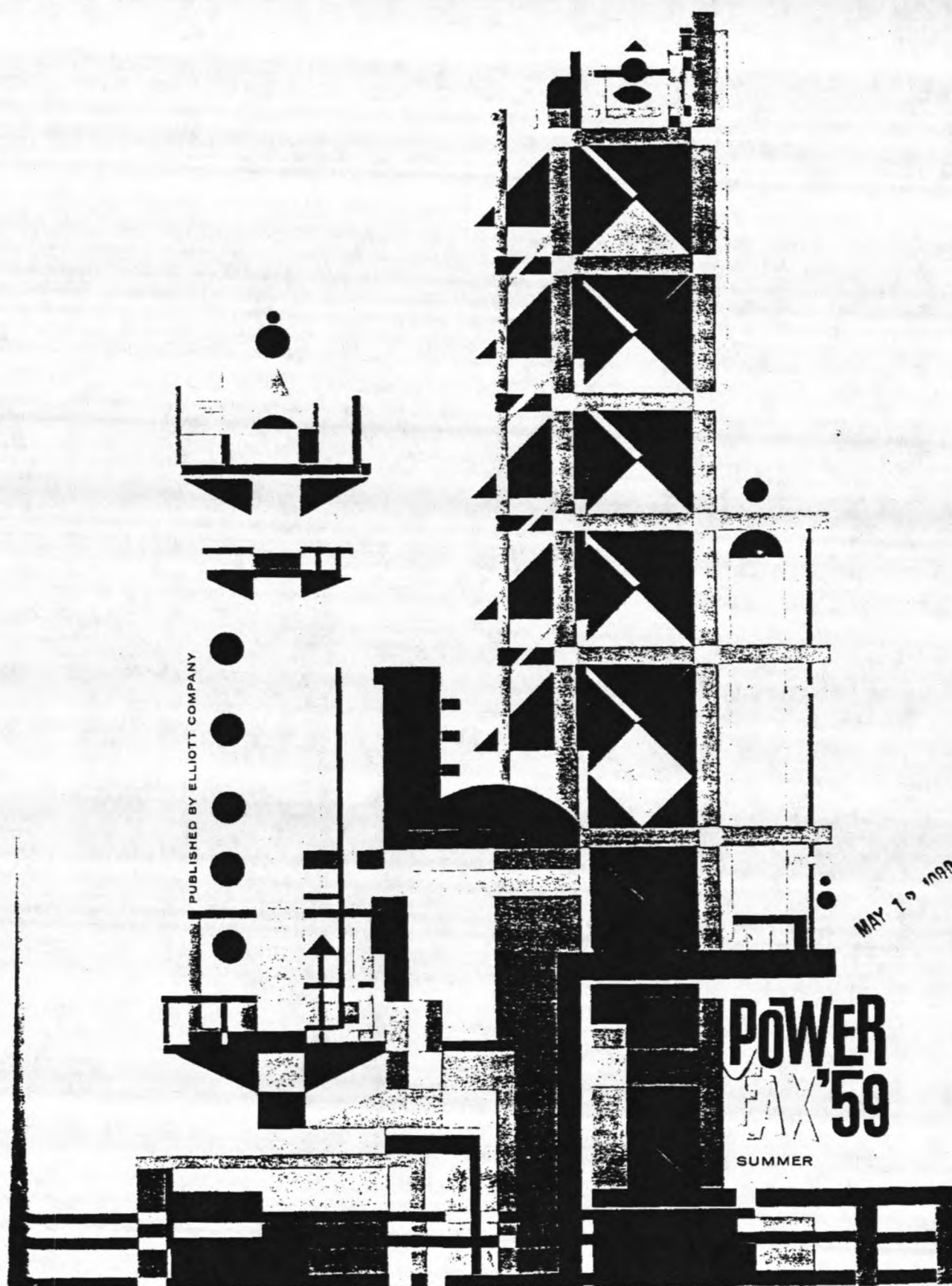




PUBLISHED BY ELLIOTT COMPANY

MAY 19 1959

POWER
EX '59
SUMMER

SC-ETM-2681

POWER FAX • E

POWERFAX • Summer 1959 • Vol. 37 • No. 2

Published by Elliott Company since 1923.

Distributed quarterly to more than 30,000

customers and friends in power plants

and industries using Elliott mechanical

and electrical equipment. See back cover.

Editor C. W. Kolbfus.

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Summer 1959

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DISCUSSING MOTOR DESIGN

Esso News, published by the Baton Rouge Refinery of Esso Standard Oil Company, recently ran a photograph showing C. F. McGinnis, assistant sales manager of Elliott Company's Ridgway plant, and G. C. Bayles, New Orleans district manager, talking before a group of Esso men. The discussion covered recent advances in the design and manufacture of large motors. The audience included a group of employees from the mechanical engineering and purchasing departments.

THE OIL SHOW

The International Petroleum Exposition, the "World's Fair of the Oil Industry," took over in Tulsa from May 14 to 23. Elliott Company has exhibited at this show practically since it started back in the 20's. Featured this year was a 100-hp, 900-rpm, 2300-volt drip-proof motor with top end bell, air baffle, and two louvers removed, on water torture test, demonstrating the effectiveness of Fabri-Seal insulation. Other equipment on display—the latest NEMA rerate explosion-proof motor, tube cleaners, expanders and control, tube accessories, a model of power-recovery gas turbine.



A MEDALLION FOR MCCLURE



At the Presidents' Luncheon of the Natural Gasoline Association of America, in convention at Dallas, Texas, April 23, J. N. McClure, Elliott Company Tulsa district manager for many years, was presented a medallion in recognition of his services as past president of the Natural Gasoline Supply Men's Association. He was one of three who were thus highly honored. The chairman of the meeting, eulogizing Mr. McClure, said, "This man was born in Norcross, Georgia, and received his engineering education in the deep South. On graduation in 1923, he went to work for the company for whom he still works today, 36 years later . . . With an exterior which leaves the impression that he is hard and tough, and with a vocabulary that is pure sulphur, he is really as generous and soft as an old lady. He has the instincts and ethics of a southern gentleman while trying to make you think he is a typical ramblin' wreck from Georgia Tech. As far as we are concerned, he is the Elliott Company, J. N. 'Mac' McClure."

STRAINERS FOR SOUTHERN CALIFORNIA EDISON

The leading article in the Spring Powerfax hooked-up the phenomenal growth of Southern California Edison Company's power plants with their use of Elliott deaerating heaters and evaporator feed pre-heaters. A paragraph at the end of the

article mentioned their use of Elliott motors. Our Accessories Department reminds us that Southern California plants also make use of the protection afforded by 88 Elliott strainers. These are divided roughly into 32 single strainers, sizes 2 to 12 in., 26 twin water strainers, sizes 6 to 20 in., 23 twin oil strainers, sizes 1½ to 8 in., and seven self-cleaning strainers, sizes 4 to 12 in.

POWER RECOVERY GAS TURBINES FOR FLUID BED PROCESSES

This was the subject of an article by J. C. Dygert, of Shell Development Company, Emeryville, California, which was published in *Oil and Gas Journal*, issue of April 20, 1959. This very complete article extended over six and a third pages, and was illustrated by five photographs and six line drawings which included a schematic of the test stand, the hook-up of the power recovery turbine-compressor and low-pressure CO-burning steam boiler. The article referred to tests made by Elliott Company in 1950, and to the fact that Elliott equipment was furnished for the exhaustive test described. Reprints of Mr. Dygert's paper are available.

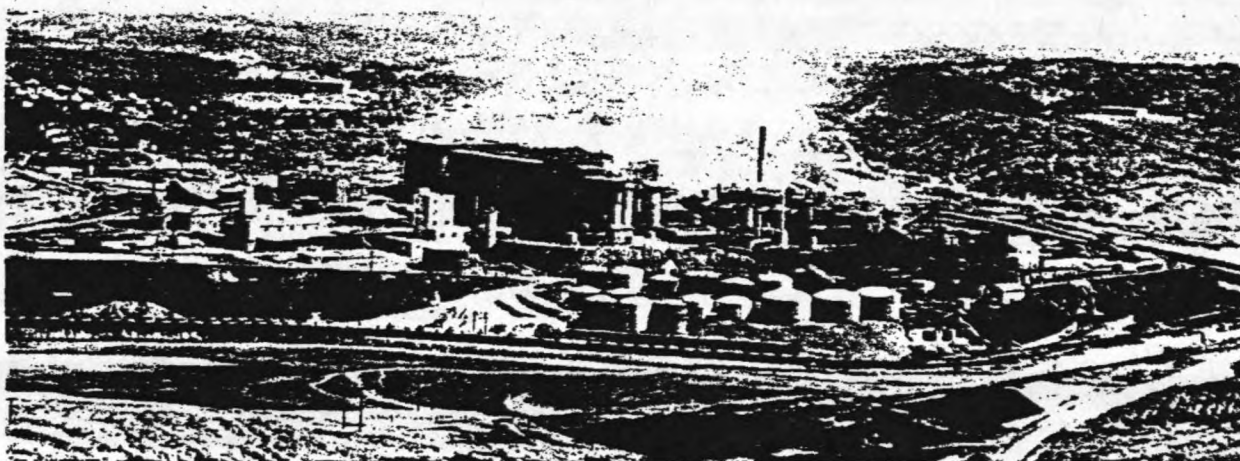
FONDRK AGAIN

V. V. Fondrk, division engineer, process engineering, won a prize in a contest conducted by *Chemical Engineering* with paper entitled, "Add a Jet to Raise Compressor Pressure." Illustrated by a hook diagram and a chart, it tells how a steam jet ejector may be used temporarily occasionally for operating a rotating compressor above design pressure.

SULFURIC ACID OUTRANKS COPPER IN COPPER VALLEY

●IN THE EXTREME southeastern corner of Tennessee is a famous mining district, embracing an area of about 100 square miles, known as Copper Basin. Actually, the region extends into North Carolina and Georgia. It is completely encircled by ranges of the southern Appalachian Mountains.

In contrast to the tree-covered mountains in the distance, the Basin presents a desolate appearance with barren eroded earth, few trees, no flowers. It has been called "Tennessee's wealthy wasteland". The reason goes back to the copper which was discovered here in 1843, and the copper mining and crude smelting which flourished wastefully for the next 50 years. The early operators exploited the area unbelievably. They were only interested in the copper content of the ore (about one percent). The sulfur was only an impurity. So they cut down the trees in the Basin and used them for fuel in crude smelting operations. The sulfur was wasted in the form of gases that billowed over the Basin, preventing the growth of new trees and shrubs. The heavy rainfall



Aerial view of acid area at Tennessee Copper Company's Copperhill plant.

of the area (about 60 in. per year) carried the topsoil and the shaly subsoil from the denuded hills. By 1900 the damage was complete and the gullies grew deeper every year.

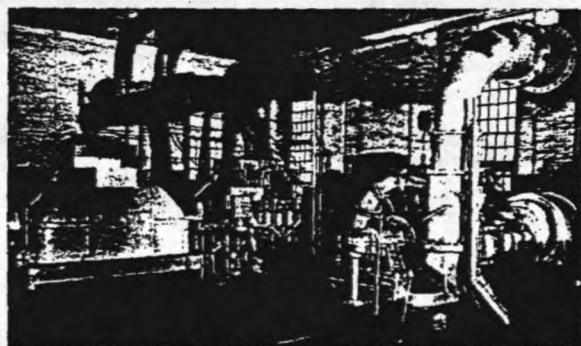
Tennessee Copper Company came upon the scene in 1899 and took steps to stop the wasteful open roast era. By 1908, the company's engineers and chemists had devised ways of trapping the sulfur dioxide smoke. Now the only mining and manufacturing industry operating in the Basin, the Tennessee Copper Company is widely known for its modern technical processes. The Copper Basin has ore enough for countless years of operation, and under the enlightened policies of Tennessee Copper



A view of the No. 2 acid plant. Railway tank cars loaded with sulfuric acid may be seen winding around the Ocoee River in the background.

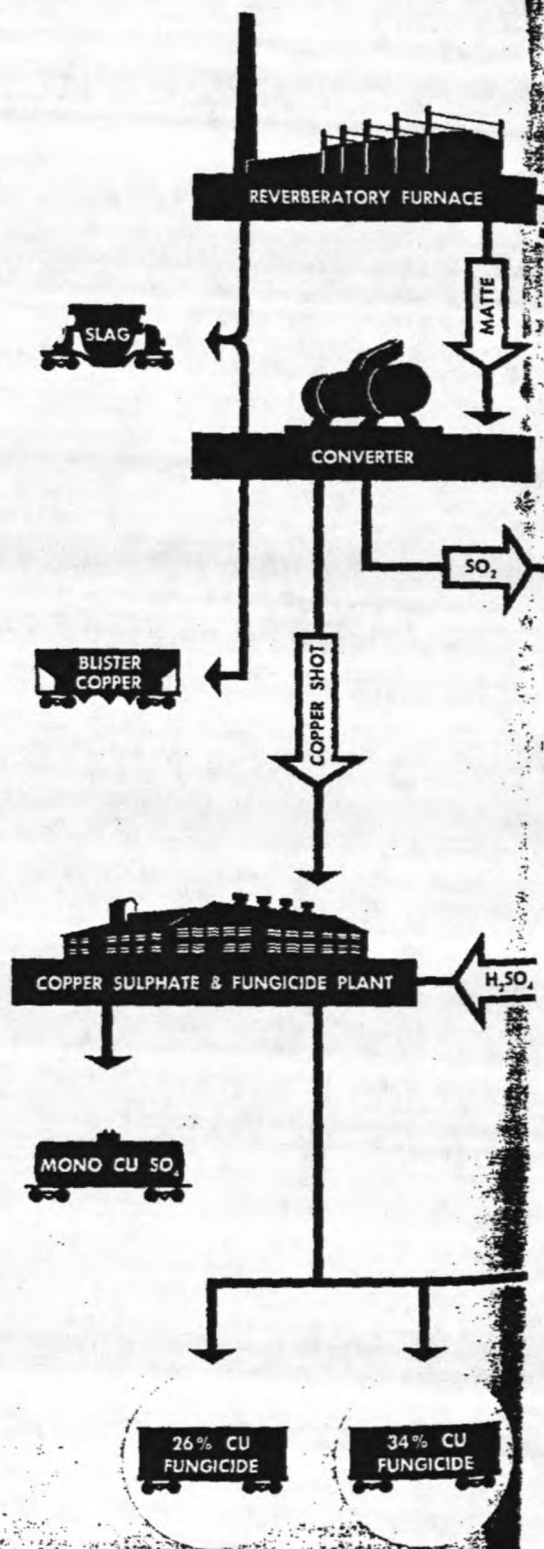
GENERALIZED FLOW SHEET OF TENNESSEE COPPER OPERATIONS

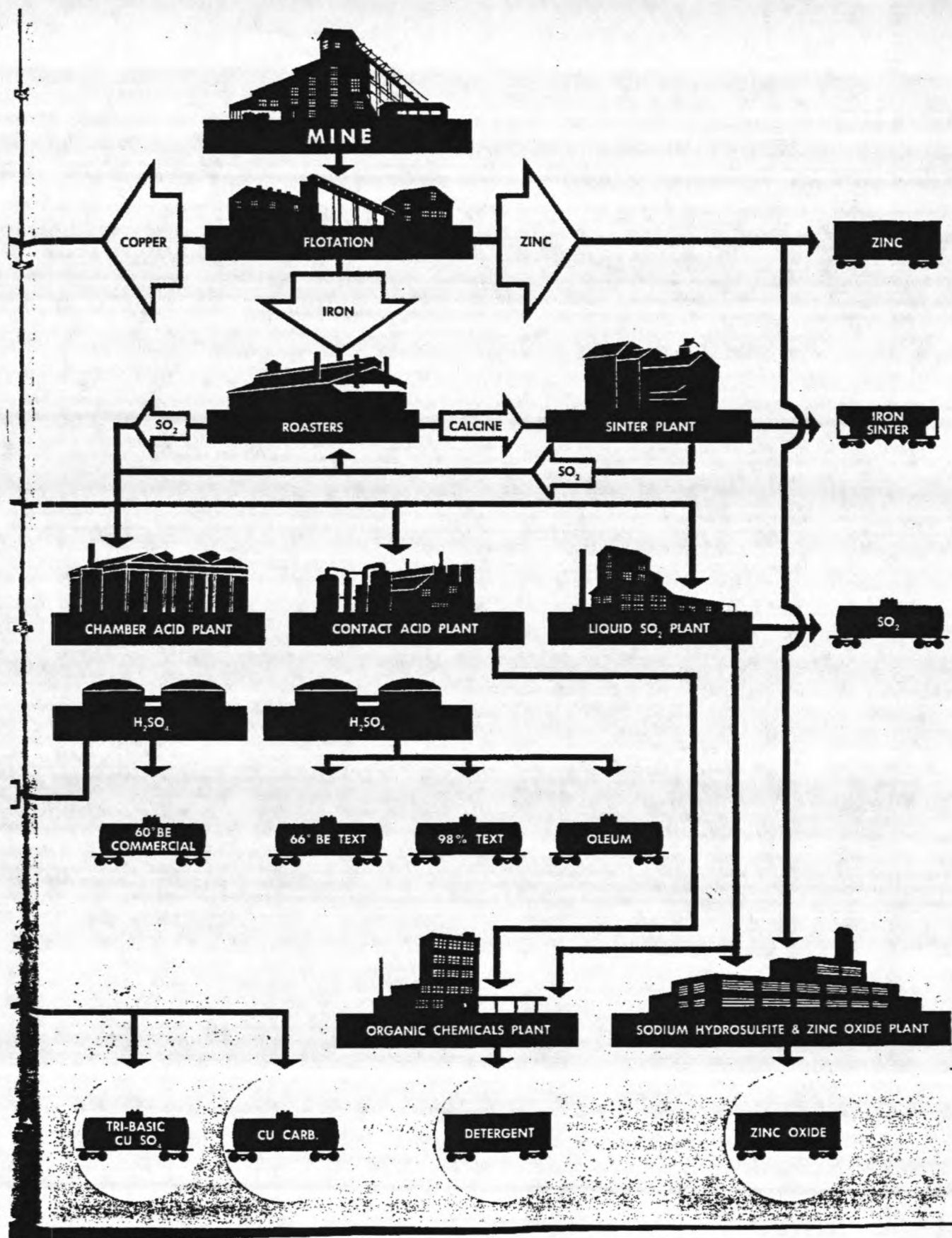
Ore from underground mines goes first to jaw and disc crushers and then into rod and ball mills where it is crushed and pulverized. It then goes into the flotation process. From the flotation plant, zinc concentrate is shipped directly, copper and iron concentrates are further processed. Copper concentrate goes to a reverberatory furnace for smelting and then, in the form of matte, to a converter and blown with air to produce blister copper, a part of which is cast into 375-lb "pigs" and shipped to a refinery. The balance is cast into "shot" for the production of copper sulfate and fungicides. Part of the iron concentrate goes into modern roasters and part directly to the sinter plant. Calcine from the roasters is sintered and shipped as a high-grade iron sinter. All SO_2 gases are piped into the chamber acid plant, contact acid plant, and liquid SO_2 plant. Acid is used in making various chemicals.



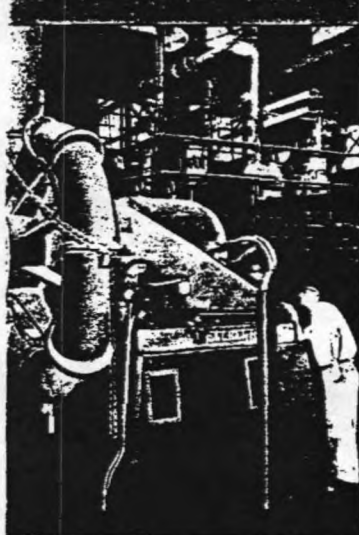
Here are two really old multistage centrifugal compressors which are still serving copper converters at Copperhill. The unit at left was installed in 1918. Its base plate reads "Ridgway Dynamo and Engine Company, Ridgway, Pa." This company was taken over by Elliott Company in 1926. Driven by a 1200-hp synchronous motor this unit furnishes about 12,000 cfm of air at 14 psi to the converter.

At right in the photograph is a motor-driven multistage centrifugal compressor which was originally put into operation at Isabella in the early 1920's and later moved to Copperhill. This compressor, rated at about 7500 cfm at 13 psi pressure, is driven by a 700-hp induction motor. Air goes to roasters in order to expedite oxidation process.





This Elliott motor-driven centrifugal compressor at No. 3 acid plant is rated 39,000 cfm and is driven by a 700-hp, 3550-rpm motor; operator is shown turning the handwheel to adjust the position of inlet guide vanes.



This is the Elliott motor-driven single-stage centrifugal compressor which was installed in the No. 1 acid plant in Isabella in 1930—the first contact acid plant built in the Copper Basin. Since that time, six more similar Elliott units have gone into service in the sulfuric acid plants of Tennessee Copper. Shown in photo H. A. Griffin, general foreman of Isabella acid plant.

Company, which has planted millions of trees, along with Kudzu vines and grasses, the valley's vegetation will certainly come back again, correcting the wasteful mistake which ruined the Basin for several decades.

The industrial property of TCC includes four operating mines, a flotation installation, a copper smelter, roasters, sintering plants, acid plants, a railroad, laboratories, two retail merchandise stores, an employee hotel, and 260 employee residences. The Company employs about 2000 persons, and turns out a variety of metallurgical and chemical products.

Today, ore bodies with no commercial value 30 years ago are being mined. From the ore is produced copper, copper sulfate, iron sinter, sulfuric acids, fungicides, zinc concentrate, slag, flue dust, liquid sulfur dioxide, sodium hydrosulfite, and organic chemicals.

Despite all the references to copper in the names still common in the area, sulfuric acid—not copper—is the big money-maker today, in the Tennessee Copper's widespread Basin operations.

Sulfuric acid is made at the Copperhill and Isabella acid plants from gases captured during the smelting, roasting, and sintering processes. It is industry's most important chemical, being necessary to the manufacture of fertilizers, iron and steel, petroleum products, textiles, automobile batteries, and hundreds of other articles for everyday living. One of the largest consumers is the Tennessee Corporation, which uses it principally in the acidulation of phosphate rock to produce fertilizers. Thus, the acid now goes to enrich the land, rather than to impoverish it.

It is interesting to observe the parallel between the rise in American prosperity since 1900, and the growth in the nation's use of sulfuric acid. In 1900, the entire sulfuric production in the United States was about one million tons. Just before World War II, it had risen to about five million tons. But from the war until the end of 1957, the latest year for which official national figures are available, the production chart line rises nearly vertically and 1957 United States output was over 16 million tons of sulfuric, as measured in terms of 100 percent-strength acid.

There are two kinds of plants making sulfuric acid. The lead chamber plant produces acid of about 78 percent strength, whereas, the contact plants produce acid of strength ranging from 78 percent to the oleums, or fuming acids, which are 100 percent acid with additional amounts of sulfur trioxide gas dissolved in the acid. Since the trend is to high-strength acid, recent increases in production capacity at Tennessee Copper have been in the form of new contact plants.

This Elliott centrifugal compressor rated 24,500 cfm at 2.7 psig pressure rise, and driven by a 500-hp motor, was installed at the Copperhill plant in 1941 and was moved to Isabella in 1947. This compressor pulls sulfur dioxide gas through the roasters and cleaning system into the acid plant, then pushes the gas through the converters and the absorbing towers. The Elliott motor-driven single-stage centrifugal compressor shown at far right was installed in the Copperhill acid plant in 1942 and then moved to Isabella in 1947.

An Elliott 16-in. twin strainer removes foreign matter from river water before it is pumped over trombone type sulfuric acid coolers in the contact process. The strainers prevent clogging of distribution pans.

An Elliott 450-hp synchronous motor drives a Harding Tricone ball mill. Treating 2450 tons of ore per day, the ball mill turns at 15 rpm. It reduces the size of the ore to 35 percent minus 200 mesh. The pulp-like material from this mill goes into the flotation process. Differential flotation produces four concentrates—copper sulfide, iron sulfide, magnetic iron, and zinc sulfide.





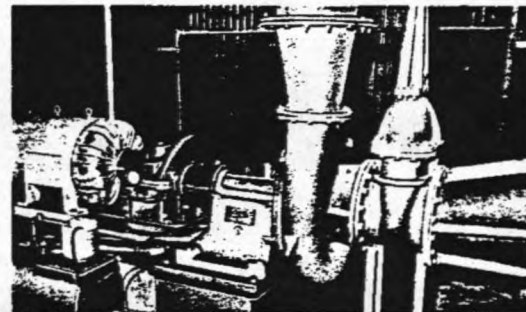
TCC's chamber plant (32 lead chambers) is said to be the largest of its kind in the world.

In 1949, production of liquid sulfur dioxide in a new plant was started. This product is made by compressing pure sulfur dioxide gas. It is shipped by tank truck, railroad tank cars, drums, and cylinders of various sizes.

Iron sinter is in second place as a revenue producer pushing copper—once the basic commodity—down to third place in importance.

The first Elliott centrifugal compressor for sulfuric acid plant service went to the Ducktown

Chemical and Iron Company, Isabella, Tennessee. This company was purchased by Tennessee Copper in 1936. The compressor mentioned went into service in 1931, and there was an article on the installation in the Winter 1932 *Powerfax* issue. Because of very satisfactory performance, three more of these Elliott single-stage open-impeller type centrifugal compressors were installed when a large contact sulfuric acid plant was built at

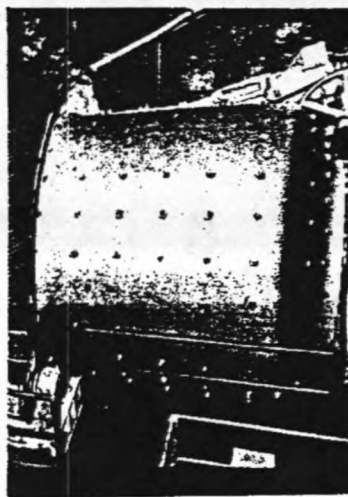


Copperhill in 1942. A few years later, two larger compressors were purchased, and in 1957 a larger unit, making a total of seven centrifugal compressors which have been installed here since 1931.

Our pictures show many of these single-stage centrifugal compressors. One picture shows some very old multi-stage units which were installed about 1918. It will be noted that the baseplate reads "Ridgway Dynamo and Engine Company, Ridgway, Pa." This Ridgway company was taken over by Elliott Company in 1926. Centrifugal compressors had been manufactured at Ridgway since about 1910, and many had been used in copper and nickel converter service.

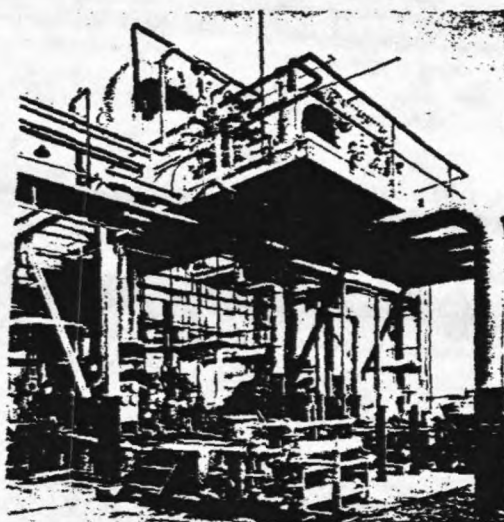
Other pictures show a big Elliott synchronous motor driving a ball mill and a 16-inch strainer in a water line to acid coolers.

This Elliott unit was installed in 1957 in the liquid sulfur dioxide plant at Copperhill. It pulls sulfur dioxide gas into the plant and then pumps the gas through an absorbing tower which extracts liquid sulfur dioxide from the gas stream. The compressor is rated 7840 inlet cfm and is driven at 6230 rpm through gears by the Elliott C-W 150-hp motor operating at 1770 rpm. Since this compressor handles wet sulfur dioxide it is made of duramet.



BIG SILVERY GASOLINE PLANT

A surprising sight in the midst of farm country in south central Louisiana is the glittering silver silhouette of a new gasoline absorption plant. It is visible in all directions, and well it might, for its two tallest towers soar 144 ft into the air.



Two Elliott 3450-hp, 8500-rpm multistage turbines driving Carrier six-stage horizontally-split compressors handling propane refrigerant—inlet capacity 9040 cfm, suction pressure 12.4 psia, suction temperature minus 50 F, discharge pressure 212 psia. The turbines take steam at 590 psig, 740 F, and exhaust upward to the Elliott 7500-sq ft, two-pass, divided water-box surface condenser mounted on the platform. Condenser is served by a twin two-stage ejector.

The new plant is owned jointly by Runnels Gas Products Corporation, a wholly-owned subsidiary of Union Oil and Gas Corp., of Louisiana and Texas Gas Exploration Corp. Runnels operates the plant, which was designed and built by The Flour Corporation, Ltd. As the result of an agreement signed between the two owners in January 1956, ground was broken near Eunice, La., on October 1, 1956, and construction was completed December, 1957.

The plant is one of the largest gas processing plants in the United States. It was designed to process 307,000,000 cu ft of gas per day, and to extract 96 percent of the propane, 99 percent of the butanes, and all of the natural gasoline contained in the gas received from the adjacent pipeline of Texas Gas Transmission Corporation. The Eunice plant was designed to recover each day approximately 103,600 gal of propane, 26,500 gal of isobutane, 28,100 gal of normal butane, and 44,800 gal of natural gasoline. The plant was recently expanded to process 440,000,000 cu ft of gas per day.

Normally, natural gasoline plants process gas from the larger fields before it enters a transmission system. Even though separation plants are being used more and more in the smaller fields, there are enough liquids left in the gas from these plants and from unprocessed wet gas streams to justify a large-volume plant on a big pipe line.

The plant was constructed within a 20-acre fenced plot, leaving ample space for enlargement,

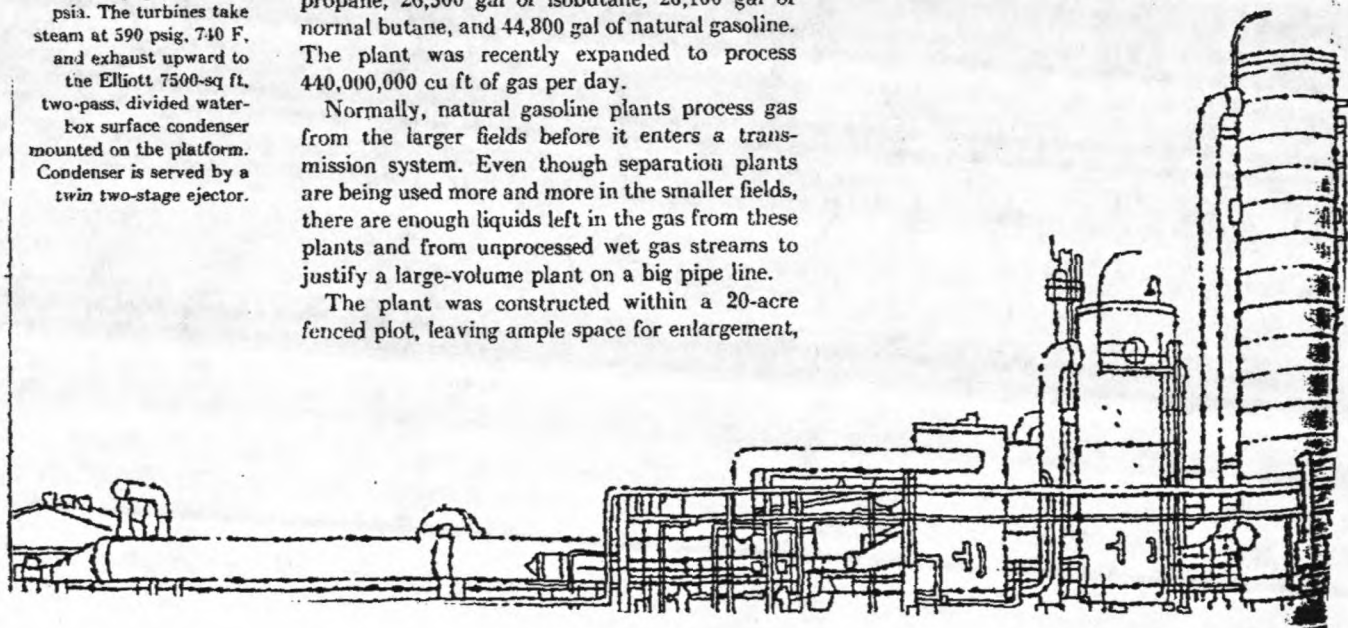
and all processing equipment and utilities were laid out with an eye toward increasing the throughput of the facility in the near future.

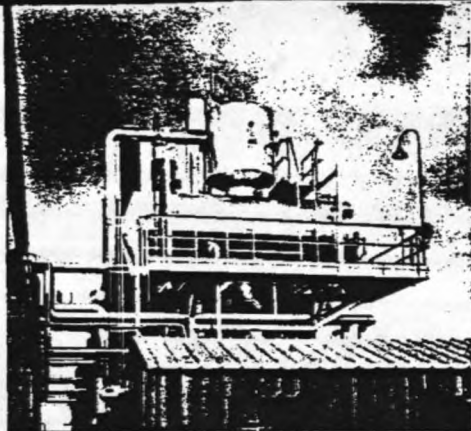
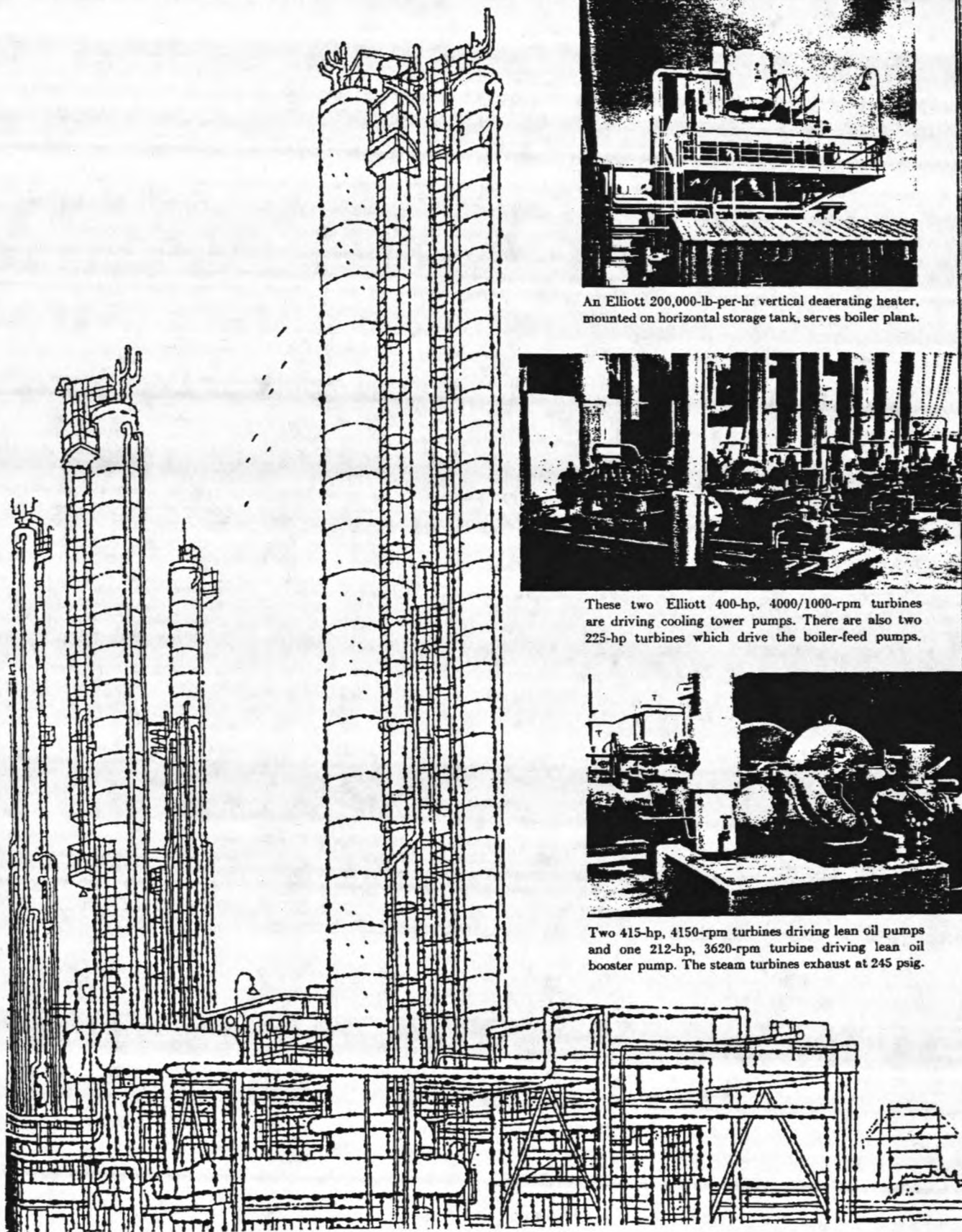
Among several unusual design features is the propane refrigeration system, which chills the incoming gas stream to very low temperatures. The desired products are extracted from the incoming gas stream by chilling it to minus 40 F, and flowing it through an absorption tower, where it is contacted with an unusually light absorption oil chilled to minus 45 F. Stripped gas leaving top of absorber is returned to the gas transmission line.

The absorption oil containing the extracted products flows from the bottom of the absorber through a series of heat exchangers and towers where the individual products are separated and sent to storage.

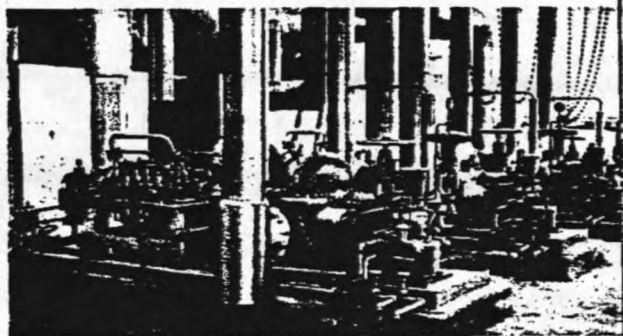
Besides the two high towers already mentioned, other major vessels are the 180-ton main absorber, the 77-ft dehexanizer, the 88-ft depropanizer, the 131-ft deisobutanizer, and the 88-ft debutanizer.

Salient process apparatus includes two Carrier refrigerating compressors driven by Elliott 3450-hp steam turbines, an Elliott deaerating feedwater heater serves the steam plant and Elliott turbines drive various pumps and boiler auxiliaries. Steam is supplied at 590 psig, 740 F by four 50,000-lb-per-hr package-type boilers, and a 114,000-lb-per-hr superheater. The turbines exhaust at 245 psig, and 60 psig to process.

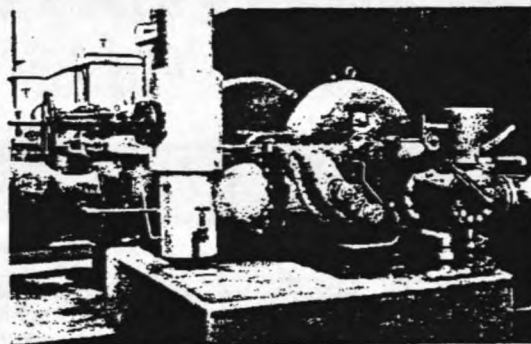




An Elliott 200,000-lb-per-hr vertical deaerating heater, mounted on horizontal storage tank, serves boiler plant.



These two Elliott 400-hp, 4000/1000-rpm turbines are driving cooling tower pumps. There are also two 225-hp turbines which drive the boiler-feed pumps.



Two 415-hp, 4150-rpm turbines driving lean oil pumps and one 212-hp, 3620-rpm turbine driving lean oil booster pump. The steam turbines exhaust at 245 psig.

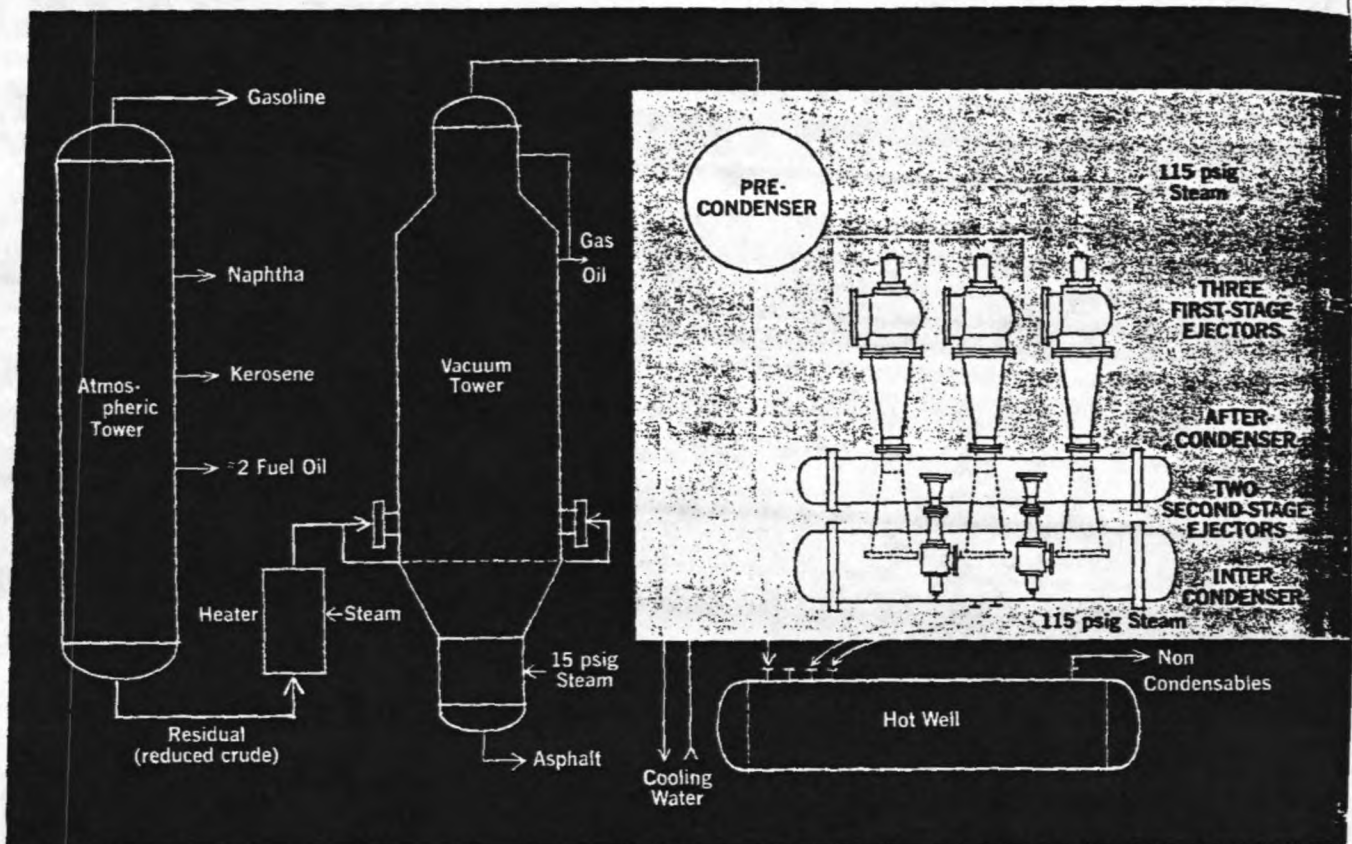
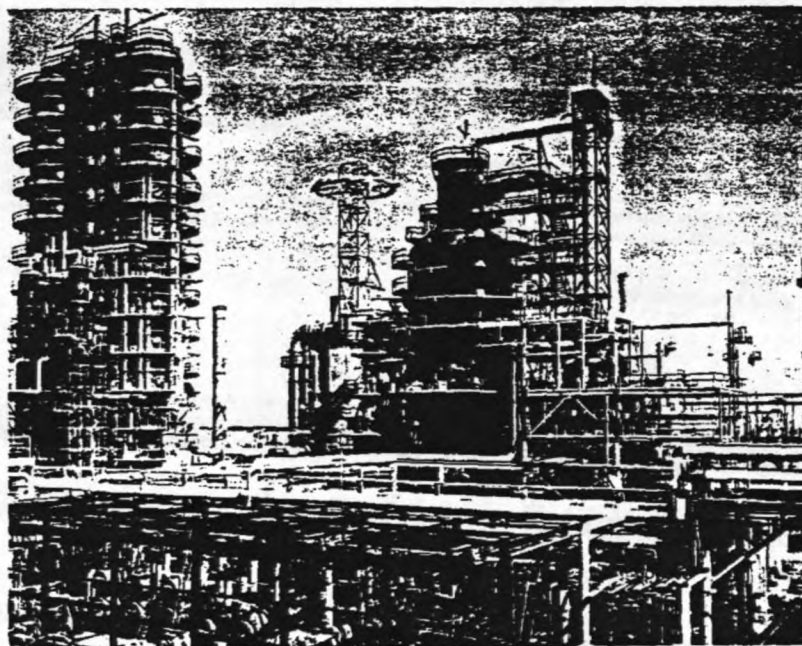


Diagram showing relation of atmospheric and vacuum towers and schematic arrangement of condenser and ejector equipment.



The recently-installed crude distillation unit at Sinclair's Marcus Hook refinery includes the tall atmospheric distillation tower and the vacuum tower, at right, which is served by the Elliott condenser and ejector equipment shown in other photographs and further explained by the line diagram. The equipment is located on a platform at right center.

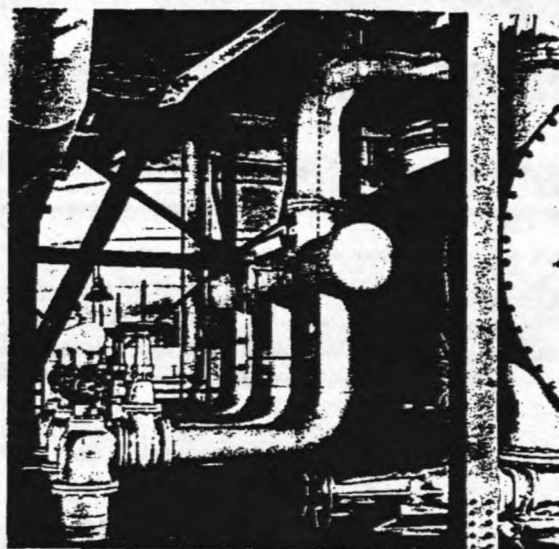
VACUUM EQUIPMENT SERVES SINCLAIR CRUDE UNIT

SINCLAIR REFINING COMPANY, in June 1956, placed in operation at the Marcus Hook refinery a crude oil distillation unit. This still was designed to process 60,000 barrels per day of North Texas crude.

Crude oil is fed to the atmospheric distillation tower where at atmospheric pressure, with the addition of heat to effect distillation, the lighter distillates, comprising approximately 60 percent of the original crude, are obtained. These lighter distillates are gasoline, naphtha, kerosene, and house-heating oil (No. 2 fuel oil). The residual, called reduced crude, which cannot be distilled at atmospheric pressure, is drawn off the bottom of the tower.

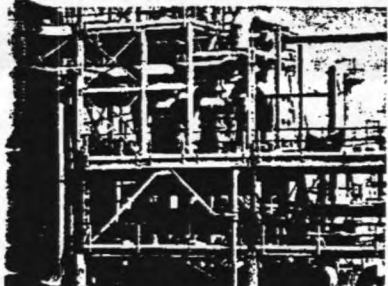
This reduced crude is then passed through a heater in which steam is added, and the reduced crude and steam are then introduced into the vacuum distillation tower at the midsection of the tower. Additional steam is introduced at the bottom of the tower, while Elliott vacuum equipment draws from the top of the tower, maintaining the required operating pressure of 75 to 100 mm Hg absolute. From this portion of the process, distillates of gas oil are obtained in the upper portion of the vacuum tower, while asphalt is removed from the bottom.

The residual crude can be reduced in the vacuum tower with various combinations of temperature, pressure, and steam flow. The versatile vacuum equipment, designed for the process, has given satisfactory performance under all operating conditions, thus permitting the required flexibility in over-all operation.



Top: The Elliott equipment consists of a 20,000-sq-ft precondenser, seen at right in this photograph, and a multi-element two-stage ejector with 3000-sq-ft intercondenser and 900-sq-ft aftercondenser. The air offtake from the precondenser goes to the header from which three 12-in. first-stage ejectors take suction. At lower left in this photograph may be seen the suction chambers and diffuser inlets of these three 12-in. first stages, further shown below.

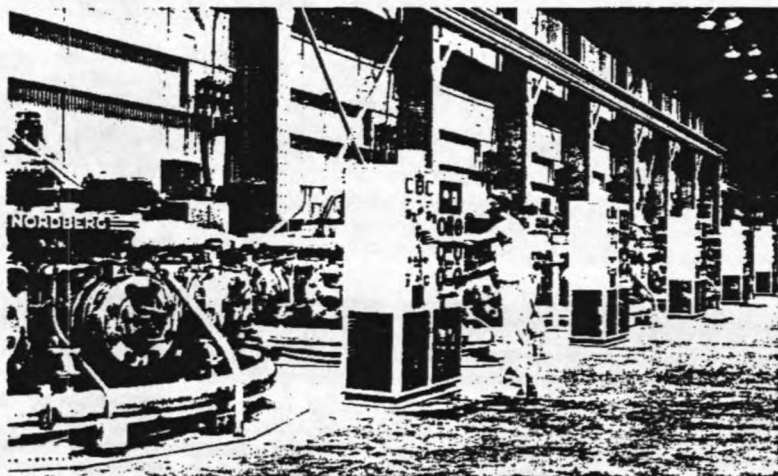
Bottom: Below the floor, the diffusers of the three 12-in. first-stage ejectors are seen coming in vertically and exhausting into the 3000-sq-ft intercondenser. At right of the intercondenser are two 6-in. second stages which discharge upward and to the left into a 900-sq-ft aftercondenser, mounted above intercondenser.



TURBOCHARGERS ON VERTICAL RADIAL GAS ENGINES AT POINT COMFORT

A PAPER DISCUSSING the turbocharging of vertical radial engines for Point Comfort was presented before the ASME Oil and Gas Power conference in Houston, Texas, April 19-23 by Robert Cramer, Jr., of Nordberg Manufacturing Co. and Howard Keefer, Chief Engineer, Point Comfort operations, Aluminum Company of America. We here abridge and condense this interesting paper.

The Nordberg radial engine was developed at the end of World War II especially for large scale production of direct-current power from natural gas. Three power plant buildings, utilizing 120 of these 11-cylinder engines were constructed and



An interior view of one of the Point Comfort power buildings of which there are now seven. The appearance on the operating floor is practically the same for all engines, including turbocharged units. Incidentally, 162 Elliott generators are serving Nordberg vertical gas engines in this works, including the 22 latest turbocharged 2000-kw units.

placed into operation at Alcoa's Point Comfort works during 1949 and 1950. The rated capacity of each unit was 1150 kw.

A 12-cylinder form of this engine was later developed, and between 1951 and 1955, 100 of these improved engines rated at 1330 kw each were installed in additional power plant buildings.

One of the last of these latter engines was selected for turbocharging development early in 1956. As a result of the experimental work on this engine the latest addition to the Point Comfort power plant comprises 22 turbocharged 12-cylinder engines which are rated at 2000 kw each.

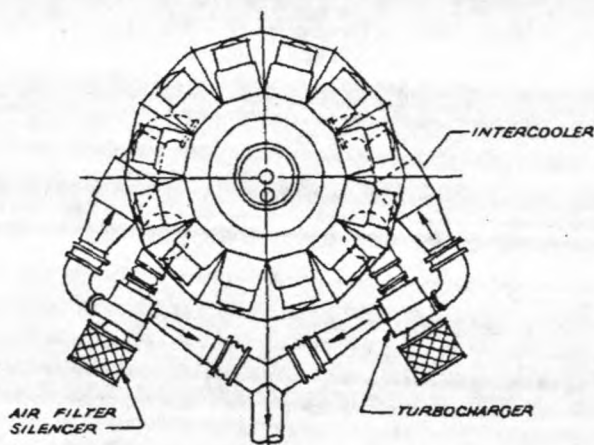
In this power plant each engine, together with its generator, cooling equipment, pumps, etc., forms an independent unit. The generator output is direct current for the aluminum pot line, plus about 5 percent a-c power removed from slip rings on the rotor and used for driving auxiliaries.

The increase in unit rating has substantially reduced the investment required per kilowatt of output. While the cost of an engine has increased somewhat, the increase is only nominal compared to increased output. Building requirements, foundations, exhaust stacks, piping, control panels, etc., have not increased in cost. Cooling radiators are somewhat larger for the turbocharged engines and an intercooler water system has been added.

It was recognized in the beginning that self-sustained turbocharging for these port-scavenged engines was doubtful, and that it might be necessary to use a motor-driven fan or blower as a supplement. However, because of the complicated piping involved, it was decided to make an attempt to achieve self-sustained operation. This was successful because the operating conditions require only that the engine run at either no-load or rated-load. As finally developed, an engine can sustain the turbocharger and itself without outside aid in a load range from its rated 2000 kw down to about half of rated load. Once started an engine can be idled without assistance, but the operation is so borderline that it is not possible to pick up load.

To overcome the starting and load pickup condition an "air assist" system was developed to increase the turbocharger speed when required during starting, idling, and load application.

The arrangement of the turbochargers and exhaust and air ducting was severely limited because the essential arrangement of the engines in the building could not be changed and piping had to be short and well streamlined to avoid flow losses. An attempt to design multiduct piping resulted in a hopeless snarl of pipes. Hence it was decided to use a constant-pressure exhaust system.



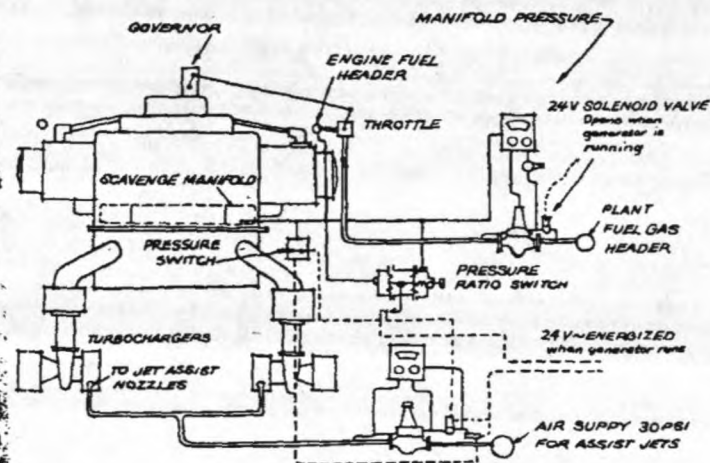
This plan view shows location of the two turbochargers on a unit.

View in basement looking upward at a turbocharger on one engine, with turbocharger and intercooler for adjacent engine in the background. The centerline between the two engines lies between the two discharge elbows leading to the intercoolers. A stainless steel expansion joint is used at the turbine inlet and a corrugated rubber expansion joint between the compressor outlet and intercooler.

Two turbochargers for each engine were selected because they made possible short streamlined piping and delivered air into the two normal inlet manifold openings in the engine sub-base.

On the first attempt to start a turbocharged engine, smoke appeared at the turbocharger air inlets and the rotors did not turn. It was immediately realized that the net energy available was too feeble to start the rotor turning, but it was felt that if once started the turbochargers would sustain themselves.

The turbocharger air assist system finally worked out is shown in a diagram below. Air is obtained from two sources. The plant supply system at 90 psi is reduced to 40 psi and is carried in a central header running the length of the building. A second supply comes from a motor-driven centrifugal compressor. This supply is sufficient for all 22 engines at no-load condition, as when starting the powerhouse or during a potline interruption. The compressor control is arranged so that it will automatically come into service whenever the



Showing the turbocharger air assist system. The control admits air to jets when scavenge pressure is below set point. It admits full assist air to jets during load increase when gas pressure is high relative to the scavenge pressure.

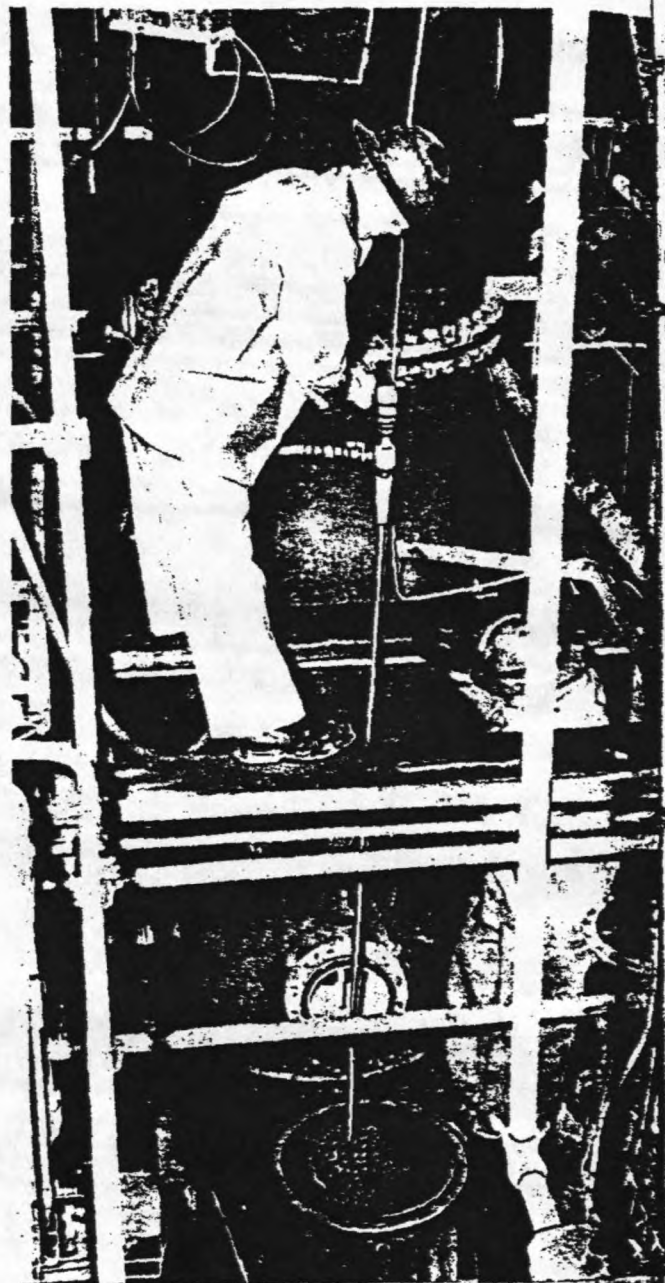
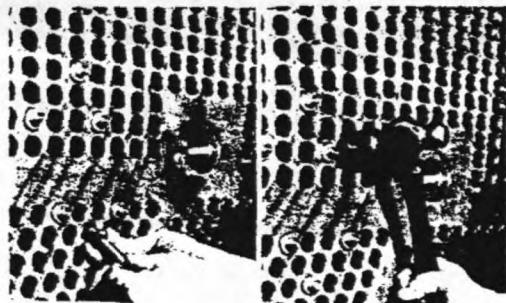
current breaker is open; approximately 5 to 10 seconds are required to bring this compressor up to speed and in a position to supply air. The inertia of turbochargers and engines is sufficient to allow engines to ride through this start-up period.

Automatic valves in the air assist system are arranged so that a greater than normal speed is developed in the turbochargers while idling at no load, thus enabling engines to readily pick up load when the potline circuit breaker is re-closed. As the load on each engine increases and the scavenging manifold pressure increases, the system automatically reduces the air assist jet pressure so that the mixture in the engines does not become too lean. Thus, the operation of the air assist system is completely automatic when the entire powerhouse load is reduced to idling and also when it is again raised to normal full load.

The constant pressure turbocharging system, as applied to the Point Comfort engines, demonstrates that loop scavenged engines can be successfully turbocharged by designing the supercharged conditions to give equal effective fuel-air ratio within the cylinder to that obtained under satisfactory non-supercharged conditions.

HERE'S THE WAY TO SEAL OFF TUBES

THE ELLIOTT TWO-PIECE TUBE plug is becoming more and more popular as an easy and effective method of sealing-off leaky condenser and heat exchanger tubes without damage to the tube sheets. Some refineries order them in quantities of 1000 or more. The advantages of this two-piece plug are obvious. The ring is cylindrical on the outside but bored with a slight taper, the same as the pin. This construction gives even expansion to the ring and long contact to the seal. Above all, it prevents bell-mouthing of the tube sheet. Both pin and ring are available in a choice of materials and to fit various tube sizes. As shown by the pictures, the ring is first placed in the tube end. Then the tapered pin is inserted. A few sharp blows with a hammer make a tight seal. The plug is not hard to remove.



In cleaning the 12-ft tubes in the vertical heat exchangers, two men cooperate. The lower man guides the drill end of the shafting into the tube and completes the pass through the tube; then he passes the cleaner back to the man above to start the next tube.

UNFOULING HEAT EXCHANGER TUBES

TWO PLANTS of a big midwestern chemical company were experiencing severe tube fouling conditions on certain process boilers or heat exchangers. Tough gummy accumulations, hard encrustations, and light rubbery material were all found coating tubes in the same bundle. Cleaning these small vertical tubes with a minimum of off-stream time was a challenge both to cleaning equipment and to the operators.

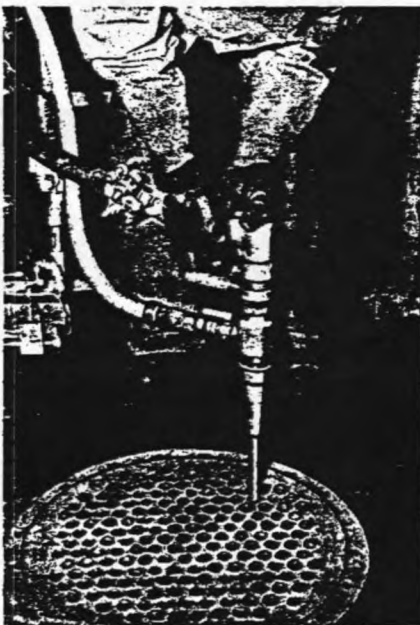
With the assistance of Elliott field engineers, an effective team of cleaning equipment was established. This involved the use of both the lightweight pistol grip type of air rotor, and the rugged heavy-duty suspension type motor to handle the toughest cleaning jobs. Both types of cleaners use drills and shafting. Both cleaners have built-in water feed control which sends a stream of cooling and flushing water through the hollow chrome-

moly steel shafting. Liberal water flushing action keeps drill and brush attachments free to penetrate the deposit, and drill tips remain cool for sustained cutting efficiency.

To make the cleaning problem worse, an improvement in process technology resulted in increased difficulty when it came to cleaning certain tube bundles. The amount of hard granular encrustations increased to the point that tool steel drill tips would become dull after cleaning a single tube. The nature of the process would not allow the use of silicone carbide steel-tipped drills. A large amount of flushing water was required to prevent the shaft and drill from plugging in the tough gummy accumulation.

Elliott Company engineers altered the standard drill construction to provide increased water flow and equipped the drill with a stellite cutting tip.

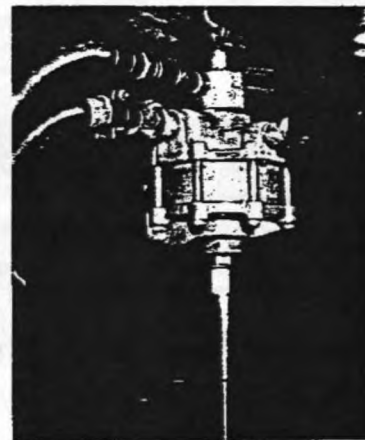
The Elliott light weight pistol grip type condenser cleaner motor is shown in use, the 12-ft shaft being practically through the tube. The small hose brings flushing and cooling water, larger hose the compressed air which powers cleaner.

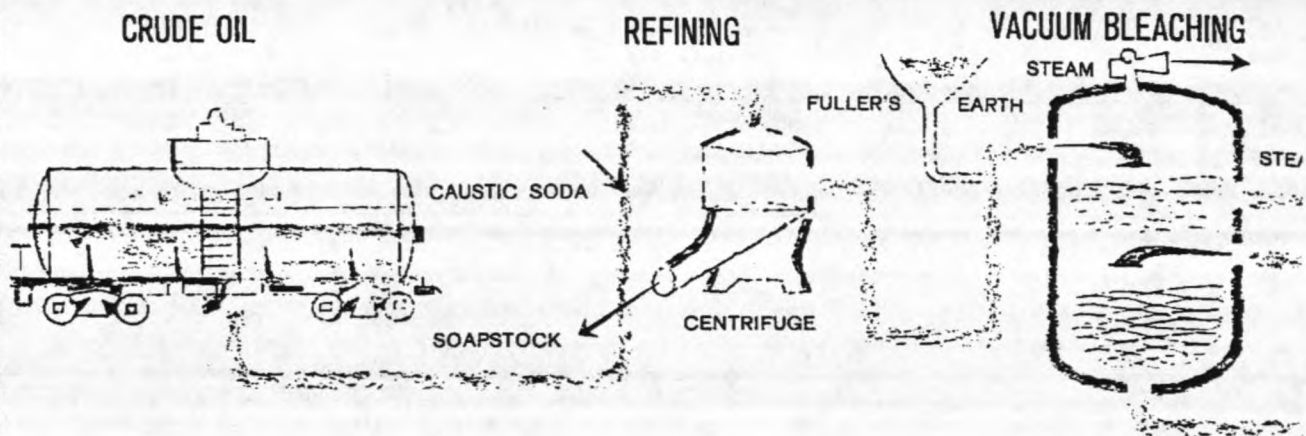


The Elliott heavy-duty suspension type cleaner is used when there are especially hard deposits to clean. The weight of this heavier and more powerful motor is taken by a rope block. It uses same shaft and drill heads as the light weight cleaner.



Close-up of the suspension type motor in use. Top hose introduces cooling and flushing water which flows through the hollow shaft, flushes the tube and cools the drill head. Bottom hose brings compressed air to the motor.





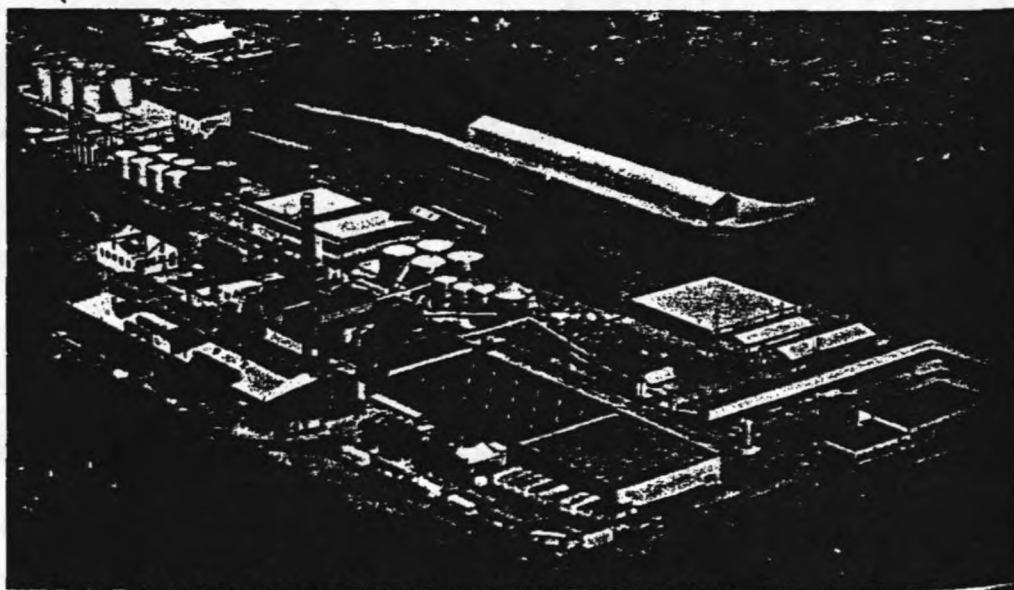
ELLIOTT EJECTORS HELP PUT EDIBLE OIL

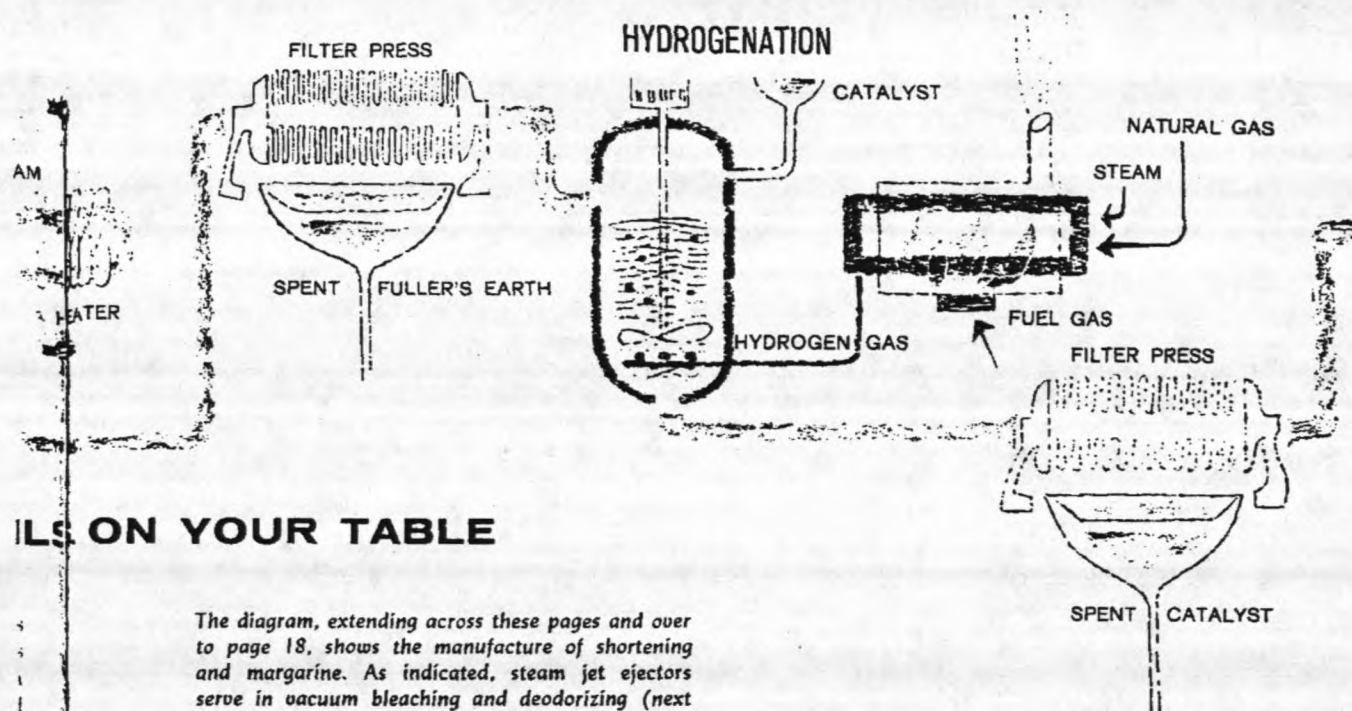


THE PENS OF HISTORIANS record that an ancient cottonseed oil mill, located in what is now Persian Asia, furnished food for the armies of Alexander the Great. Future writers will relate that 2300 years later American technology took up the thread of this idea and laid the groundwork for a giant of industry that helps provide the earth's two and one-half billion with those essential elements of diet—fats and oils.

The edible oil industry produces essential food products such as shortening, margarine, and salad oil. Annual consumption in the United States alone exceeds 3,000,000,000 lb, or a per-capita average approximating 20 lb per year.

Edible oil foods got their commercial impetus with the development of the process of hydrogenation, by which liquid oils are converted into solid fat by adding hydrogen in the presence of a catalyst. Cottonseed obtained from cotton which Columbus found in America, and the soybean, with its origin in an Asiatic legume, are the principal sources of raw materials for the industry. Numerous vegetable oils, such as peanut, sesame, palm and coconut, are available in lesser quantities.

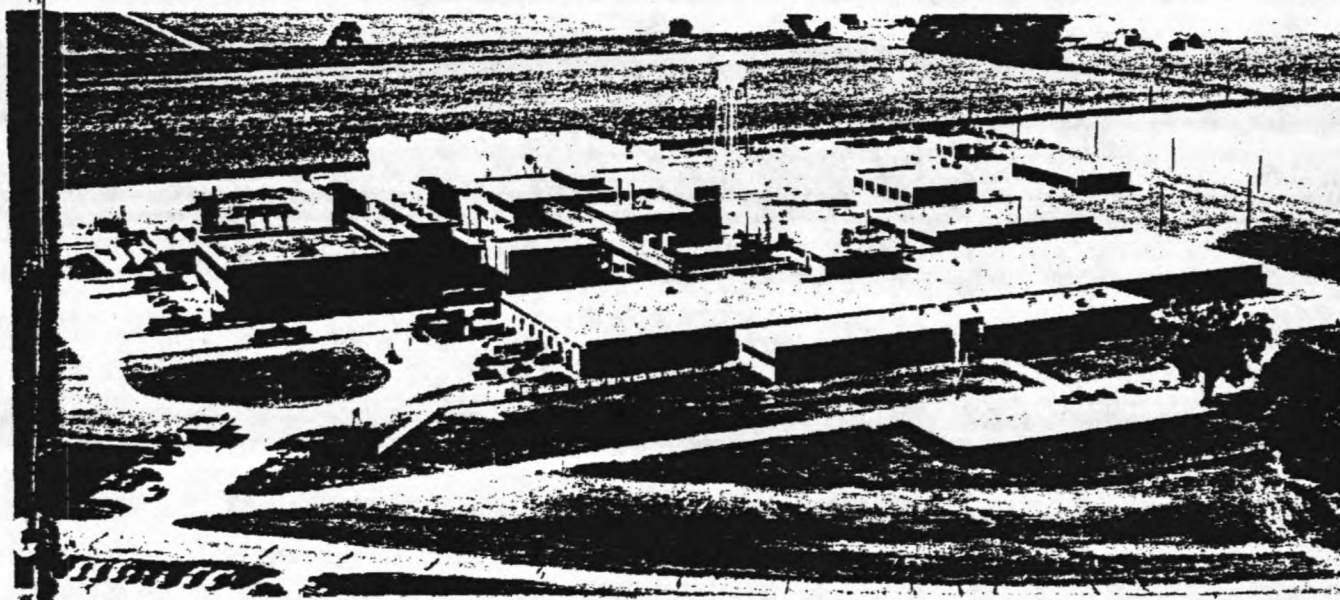


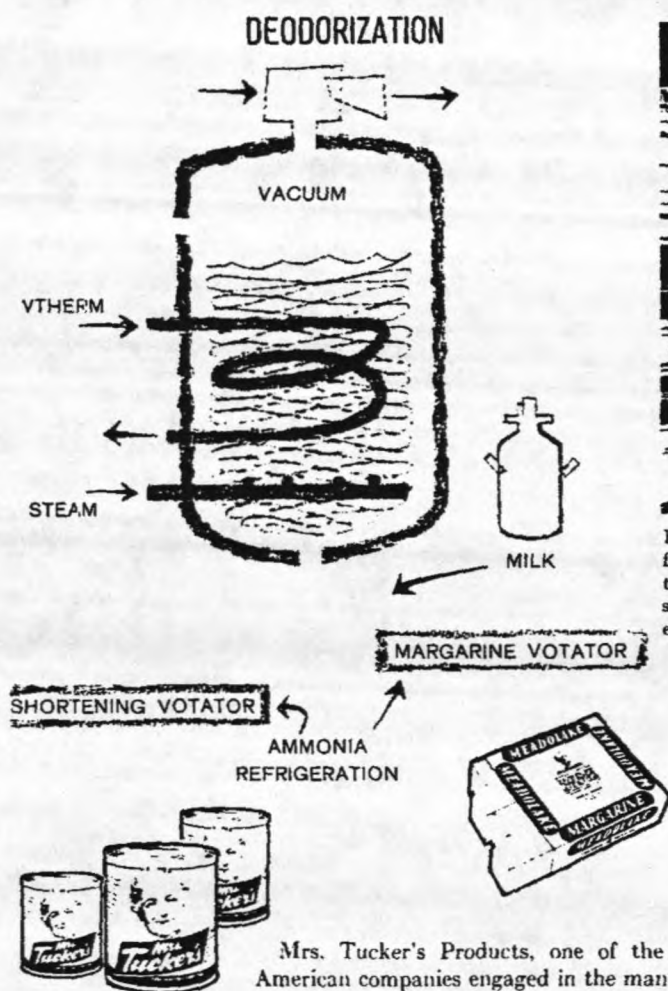


ILS ON YOUR TABLE

The diagram, extending across these pages and over to page 18, shows the manufacture of shortening and margarine. As indicated, steam jet ejectors serve in vacuum bleaching and deodorizing (next page). Oil arriving in tank cars is first treated with an alkali to neutralize any undesirable natural acids, which are removed in the form of soap. Color of oil is then lightened by contact with fuller's earth. Vacuum bleaching follows, after which hydrogenation changes the liquid oil to a semi-solid. Deodorizing is the final step before packaging. Both margarine and shortening are quickly chilled with refrigerating devices and then packaged. Margarine is at least 80 percent fat and about 20 percent milk solids, salt and other ingredients. Shortening is actually 100 percent fat.

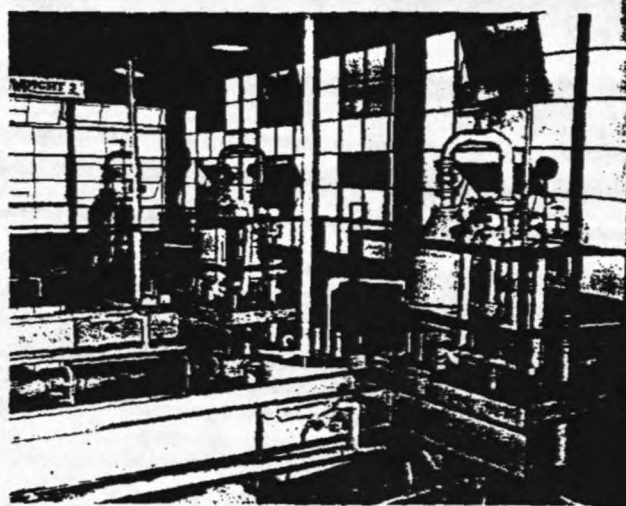
Aerial views of Anderson, Clayton & Co. Foods Division plants are shown below. At left is the older enlarged plant in Sherman, Texas and at right the new facility at Jacksonville, Illinois.





Mrs. Tucker's Products, one of the pioneer American companies engaged in the manufacture and distribution of edible oil food products, was merged in 1952 with Anderson, Clayton & Co., itself one of the world's largest cotton firms. The Food Division now handles the processing of fats and oils in the original Mrs. Tucker's plant at Sherman, Texas, and in new facilities in Jacksonville, Illinois. Mrs. Tucker's name and the trademark picture of a kindly old lady are well-known, particularly in the southwest and midwest.

Production of cooking oil, manufactured by the time-worn batch "kettle" method, commenced in 1913, at Sherman, Texas, with a capacity of one tank car of oil per day. Twenty-one years later, one of the first centrifugal refining units in the southern vegetable oil industry was installed. Soon, initial units of a hydrogen gas plant and a hardening plant were completed, eliminating the need of supplements from other manufacturers. The following years saw the addition of a continuous vacuum deodorization system, a continuous soda ash refining system, and the continuous vacuum bleaching system. The original factory at Sherman has been enlarged many times. It is



Here are three Elliott three-stage ejectors serving deodorizers. Two of the first or booster stage ejectors are seen under the I-beams at the bottom of the picture. They discharge to large barometric intercondensers which are served by two-stage ejectors. The second- and third-stage ejectors are easily seen in the first two units. Photo from Jacksonville, Illinois plant.

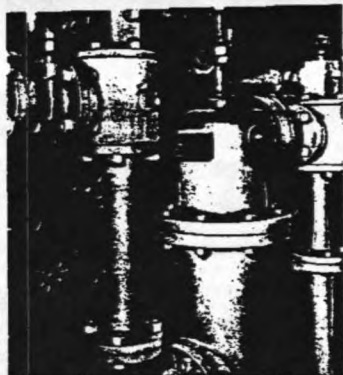
equipped with modern machinery, laboratories, and technical staff.

A completely new and modern factory has recently been constructed at Jacksonville, Illinois.

The modern plant for processing edible vegetable oils into food products is a complex one. The starting raw materials may be cottonseed, soybean, peanut oil, or any combination of these three. Whatever the oil, it must be subjected, as a raw material, to a number of treatments before it can be considered a finished product or made into a finished product. Any one of a variety of products may be made from each type of treated oil.

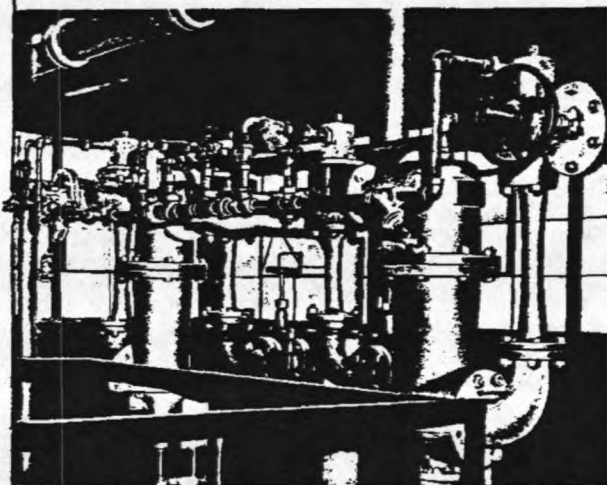
Manufacturing operations begin with crude vegetable oils as received from the cottonseed and soybean crushing mills. First, these oils are refined and passed through bleaching, hydrogenation, and deodorization processes, concluding with the packaging of products in cartons, cans, pails, and/or drums for shipment to the markets.

The deodorization process has become increasingly important as consumers demand more and more quality refinements in the products they buy. One reason for the deodorizing of vegetable oils is that people are generally unfamiliar with the natural odors and flavors of oils. Raw cottonseed oil, at least, has a strong unpleasant flavor, and it must be processed for flavor removal before it is considered edible in this country. Not only odor and flavor important, but the problem is complicated in that different materials bear various flavors and odors depending upon the state of

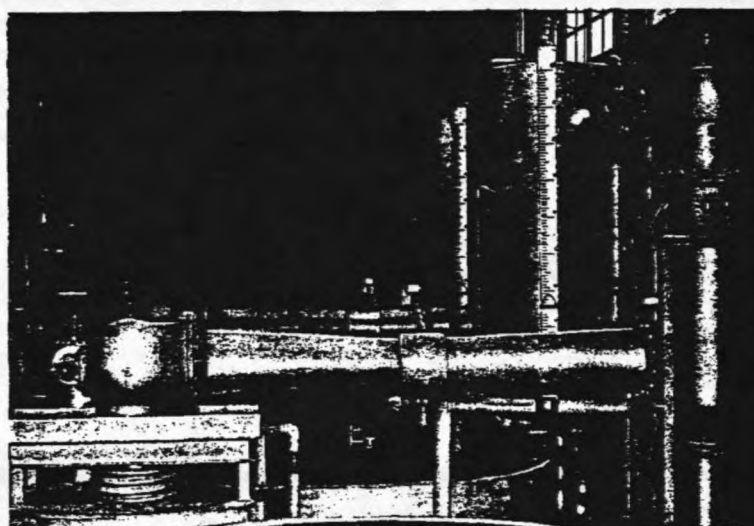


This is a close-up of second- and third-stage ejectors in deodorizer service. Both three-stage and two-stage ejectors serve various processes in Anderson, Clayton & Co. Foods Division plants.

These two Elliott two-stage ejectors are installed on bleaching towers in the Jacksonville, Illinois vegetable oil plant.



oil—raw, refined, or finished product. These odors must be removed regardless of their source and nature, and this is accomplished by what is essentially steam distillation at reduced pressure. Deodorization is made possible by the fact that neutral fat cannot be vaporized to any appreciable extent, but components of oil, which impart flavor and odor, can be changed into vapors under high temperature and low absolute pressure, and can be removed from the oils as gases. Steam flowing through the oil acts as a carrier to sweep vapors from the oil; it also absorbs part of the low absolute pressure, so that the absolute pressure of the oil vapor is lowered, preventing vapors returning to the liquid phase.



Paired like identical twins, two Elliott three-stage steam jet ejectors serve a deodorizer for the preparation of palatable vegetable oils at the Sherman, Texas, plant. In the foreground is the 18-in. first ejector stage which discharges into the first barometric intercondenser, at right. Behind the intercondenser the smaller second barometric intercondenser and the third-stage ejector may barely be seen.

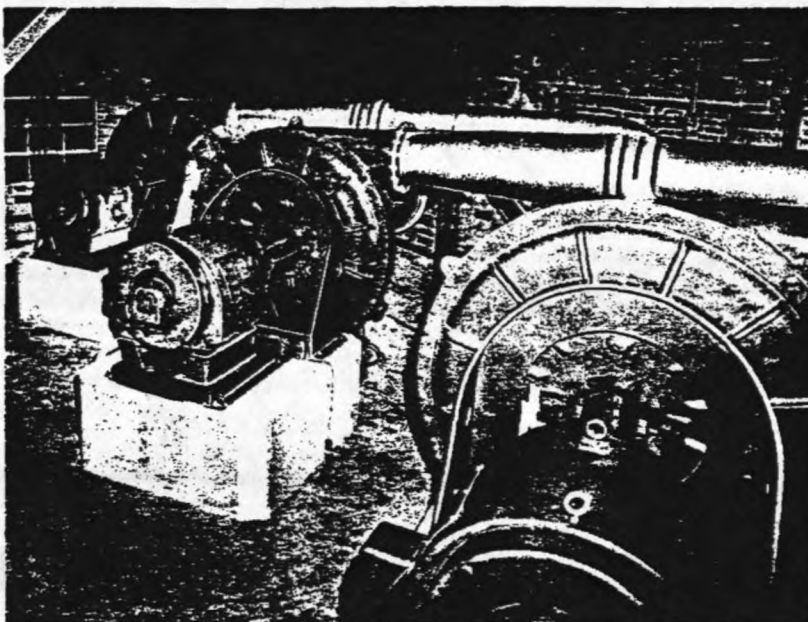
Elliott three-stage ejectors have been used at the Foods Division of Anderson, Clayton & Co. for many years to maintain the low absolute pressure required in the deodorization process.

An article in the Winter 1948 *Powerfax* spoke briefly of this application with a photograph of Elliott ejectors at the Sherman plant. It mentioned that

the ejectors handle both the undesirable oil vapors flashed from the oil and the steam admitted to the deodorizer, at temperatures around 450 F, without the slightest difficulty.

Oil must be processed at a high temperature for efficient deodorization, and a high vacuum must be maintained to assist stripping and to prevent hydrolysis of the oil by the stripping stream. Color, stability, good flavor, and pleasing odor are protected by rigorous exclusion of air from the hot oil.

Besides steam jet ejectors, some of which are illustrated here, Elliott motors, strainers and tube cleaning equipment serve the Anderson, Clayton & Co. Foods Division's plants.



Three Elliott 9000-icfm centrifugal compressors, serving the lead blast furnaces, are seen in this close-up. Each is driven by an Elliott C-W 200-hp, 3600-rpm motor. Compressor intakes enter from the back, opposite the motor shafts; discharges exit horizontally to the right.

BLOWERS FORCE AIR THROUGH LEAD BLAST FURNACES

PEOPLE living before the birth of Christ were not surprised to find lead piping in the Roman plumbing system; in fact, the word *plumbing* is derived from the Latin word for lead, *plumbum*. The Chinese lined their tea chests with it, statuettes were made of it before 3800 B.C., and the Phoenicians carried the metal around the Mediterranean nearly 4000 years ago.

Lead is a member of the family known as white metals, well known for their low melting points, and many of the uses of lead depend upon its ease of melting. Most commercial solders are lead-rich alloys, and even the popular pewterware, fast returning to vogue, contains some 20 percent lead. Common battery plates contain 94 percent lead, and the monotype from which this article is printed is approximately three-quarters lead.

The great majority of native lead ores is reduced in the lead blast furnace. Similar in operation to the iron blast furnace, its construction differs in size and shape—the lead blast furnace is much smaller and has a rectangular cross-section. As the ore is reduced in the furnace shaft, lead collects in the crucible beneath the slag and matte. The pressure of the blast and weight of the charge, slag, and matte force the bullion out through the furnace well into collecting troughs. The analysis of the lead as it comes from a furnace is quite variable and uncertain, depending on furnace operation and the material charged. The many uses of lead require many alloys varying from material of 99.99+ purity on down. The refining of the crude bullion is a rather complicated and complex operation. This is indeed a far cry from the first lead smelter, probably a campfire built over an outcropping of lead oxide.

Air for the blast furnace, at this large midwestern lead smelter, is furnished by a trio of Elliott motor-driven compressors. The Elliott C-W motors deliver 200 hp at 3600 rpm, and the compressors are rated 9000 icfm, with a differential pressure of 83.3 in. water. All three units went into service in 1957, replacing older positive displacement blowers serving the lead blast furnaces.



By R. S. Healey
Field Engineer, Elliott Company
Atlanta, Ga.

NITROGEN goes SOUTHERN

THE SOUTHERN NITROGEN COMPANY, located near Savannah, Georgia, is the first basic nitrogen manufacturing plant located on the southern Atlantic seaboard.

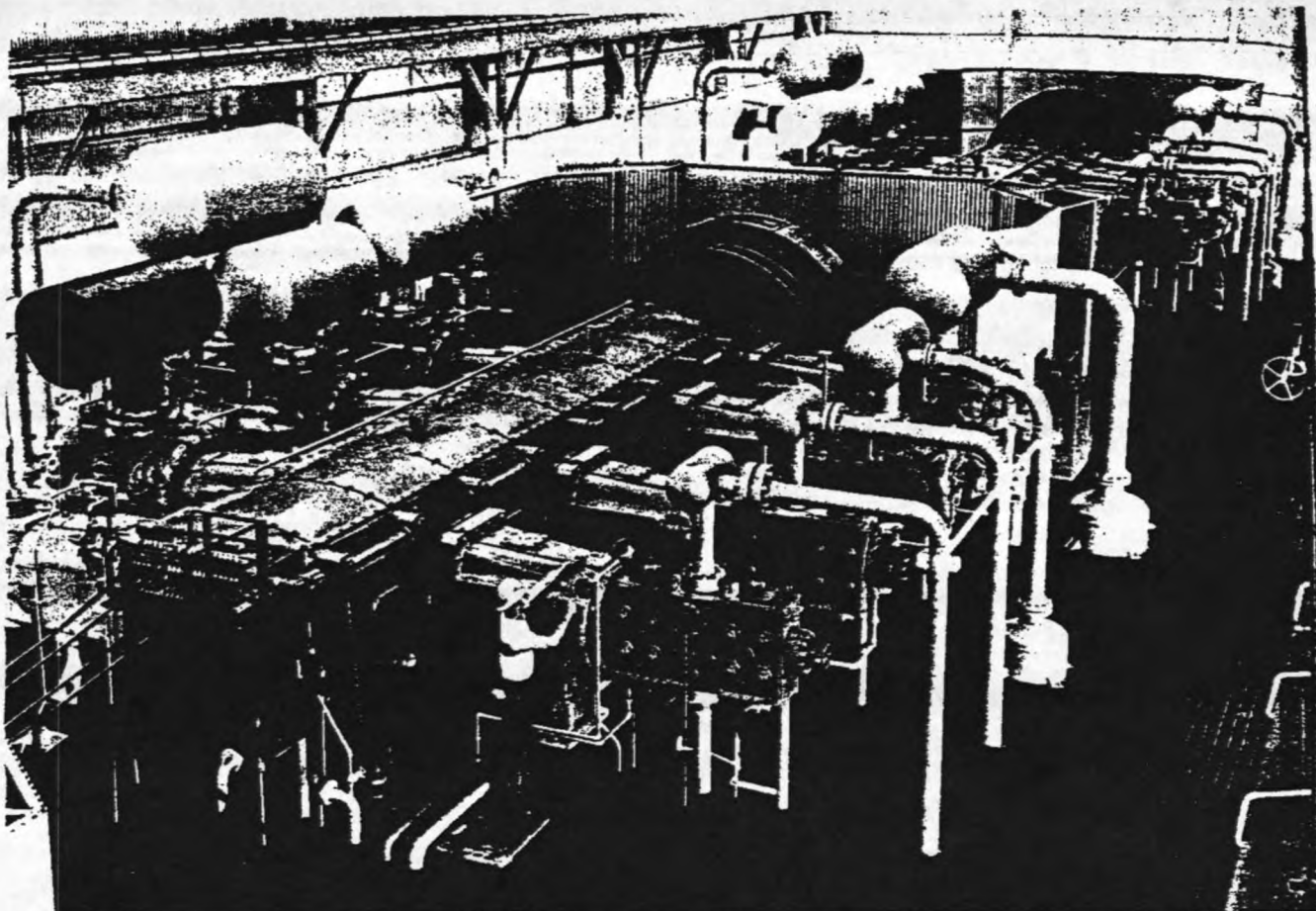
The plant produces anhydrous ammonia, aqua ammonia, ammonium nitrate, urea, various solutions combining ammonia, ammonium nitrate and urea, and solid DIXIE ammonium nitrate fertilizer. Approximately 450 tons of the latter can be produced daily.

The basic raw materials are natural gas and air. Natural gas is burned to obtain hydrogen which is mixed with air and steam to form a gas containing hydrogen, nitrogen, carbon monoxide, and carbon dioxide.

The carbon dioxide and carbon monoxide are removed, and the purified gas containing nitrogen and hydrogen is com-

Night view of the synthetic nitrogen plant of Southern Nitrogen Company, near Savannah, Georgia.





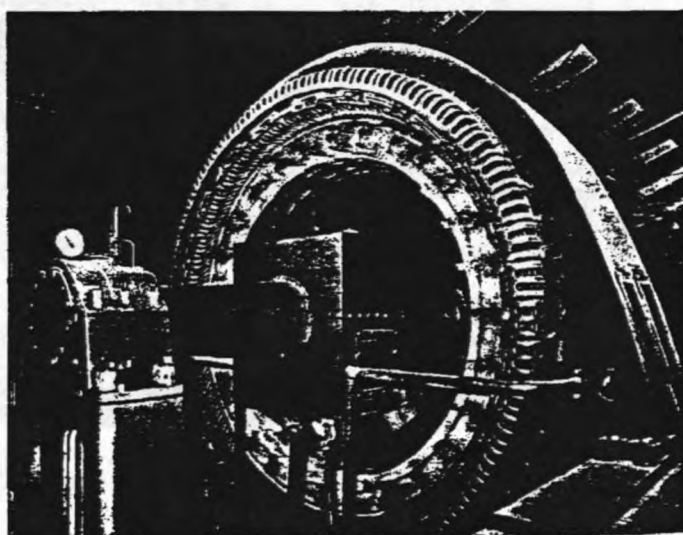
Two Elliott 5000-hp, 257-rpm synchronous motors drive these big multi-cylinder reciprocating compressors which handle several different gases. In the above view, the two motors are seen to the rear of the compressors. A closeup of one of the motors is shown in the photograph below. The collector ring enclosure is pressurized with inert gas to protect the collector rings from damaging corrosion.

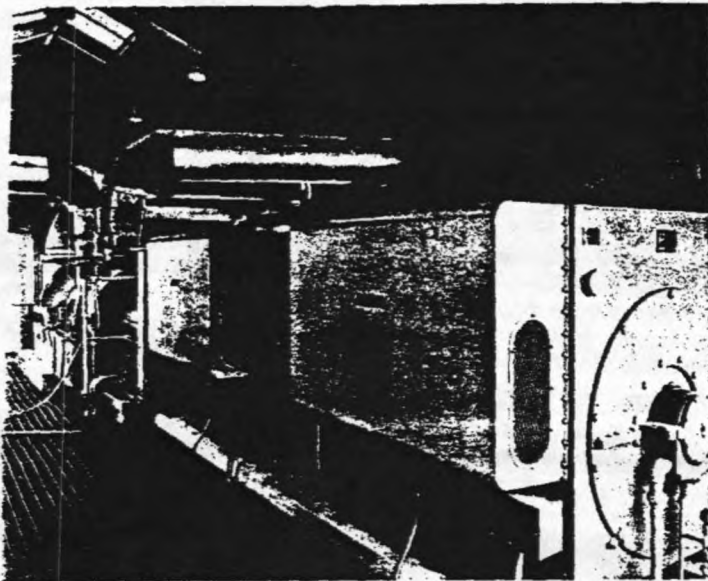
pressed to 5000 psig by two reciprocating compressors driven by two Elliott 5000-hp synchronous motors. This installation is illustrated here.

The gas is made into ammonia by an ammonia synthesis converter, is liquefied, and sent to storage for shipment or for use in the manufacturing processes described later.

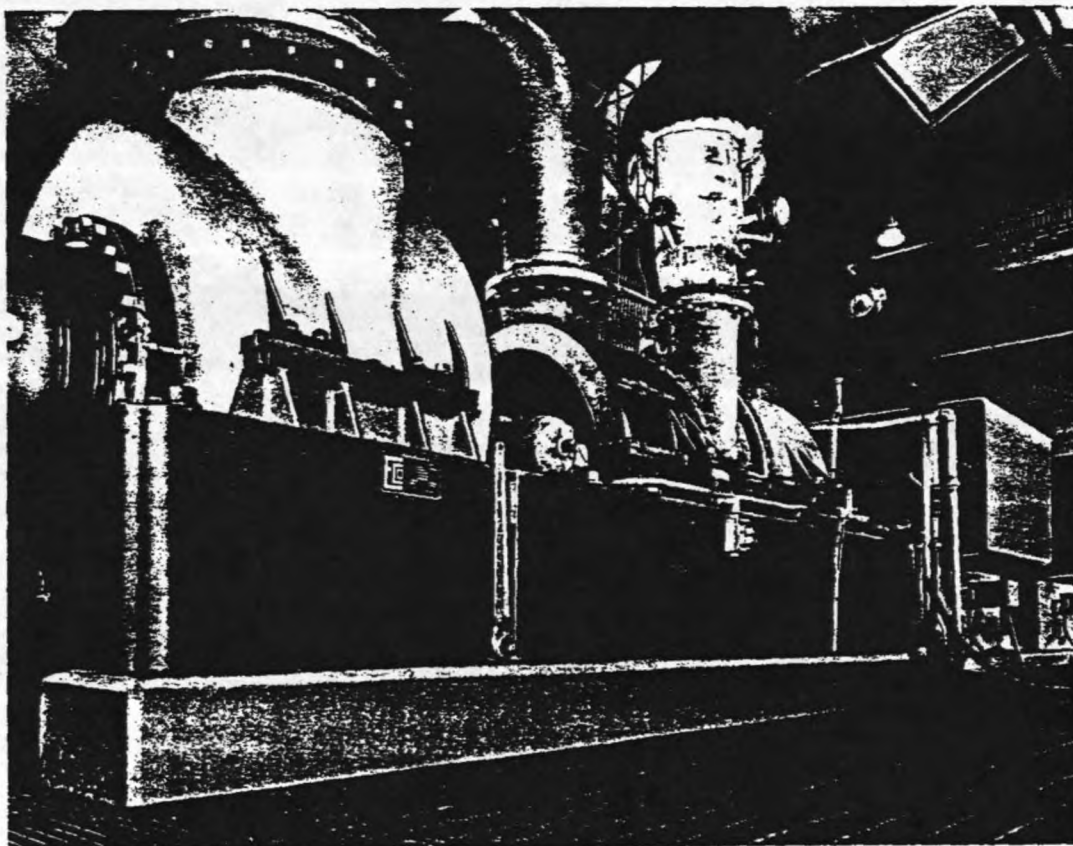
A portion of the carbon dioxide which is removed, is liquefied, mixed with ammonia, and converted into urea.

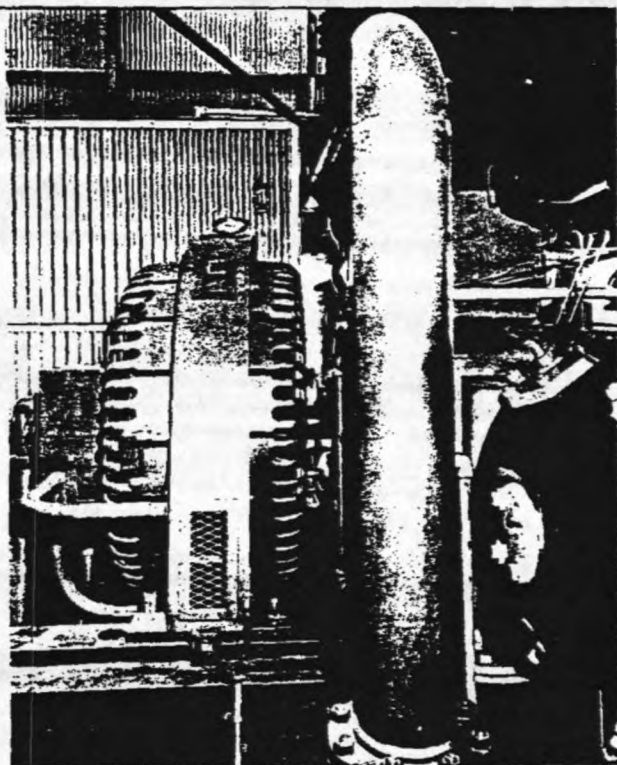
Ammonia is vaporized with steam and passed over a platinum catalyst in the presence of air in an oxidizing reaction which is highly exothermic. The oxides of nitrogen produced are cooled and passed to an absorber tower where they are absorbed in condensate. The nitric acid thus produced goes to storage where it is





Two views of the geared motor-driven centrifugal air compressor with power-recovery turbine. In the photograph below, left to right—the first unit is the first, or low-pressure compressor. At left is the air inlet from atmosphere. The discharge at top goes to the intercooler. Next is the second, or high-pressure compressor with integral power-recovery turbine. The vertical piping is the return line from the intercooler. The line with the lagging loose is the high-pressure air discharge to process. Hidden behind this line is the hot gas inlet to the power-recovery turbine. The turbine exhausts through the bottom of the baseplate. The power-recovery turbine is designed to expand the waste gas from the process at inlet temperatures to the turbine up to 1200 F. There is a reduction gear barely visible, followed by two Elliott 3000-hp induction motors coupled together (see photo at left). A separately-mounted motor-driven turning gear is provided between the compressors. It is common practice on high-temperature rotating equipment to provide means of turning the rotor immediately after shut-down. In case of electrical failure, this turning gear motor can be manually engaged and turned by use of a wrench on the side of the baseplate.





Elliott 225-hp, 360-rpm synchronous motor driving another compressor.

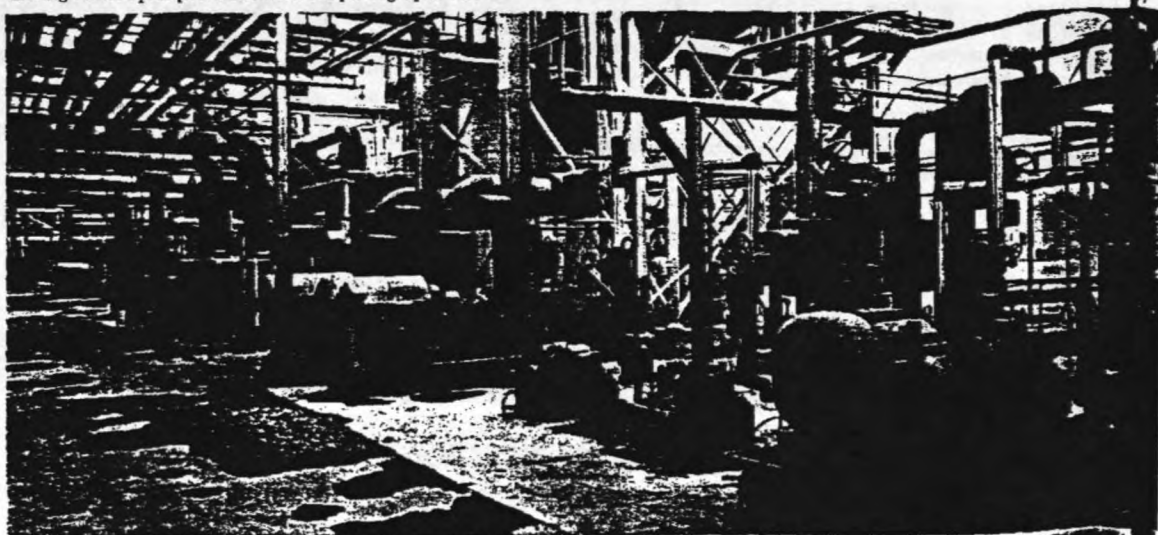
later reacted with ammonia to form ammonium nitrate solutions.

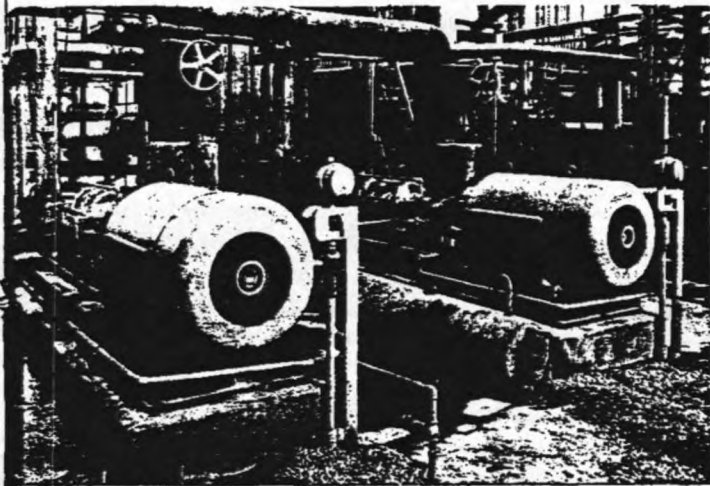
The tail gas from the absorber tower is further heated by an exchange with hot gases from the ammonia oxidation converters, and passed through an Elliott power recovery turbine which drives Elliott compressors to supply air to the oxidation process. The expansion turbine produces 6050 hp, and the make-up power is supplied by two Elliott 3000-hp squirrel-cage induction motors coupled to the same shaft. Only on start-up is the entire horsepower of the motors used. After running conditions are established, the motors supply only about 1700 hp, and the balance of the power required is obtained through the power recovery turbine. The low horsepower required during normal operation is achieved by operating the power recovery turbine at inlet temperatures up to 1200 F.

In addition to the power obtained from the waste gas, the advantage of clear stack gas is obtained when the tail gas is passed through a catalytic combustion chamber and burned with natural gas before it is used in the power recovery turbine.

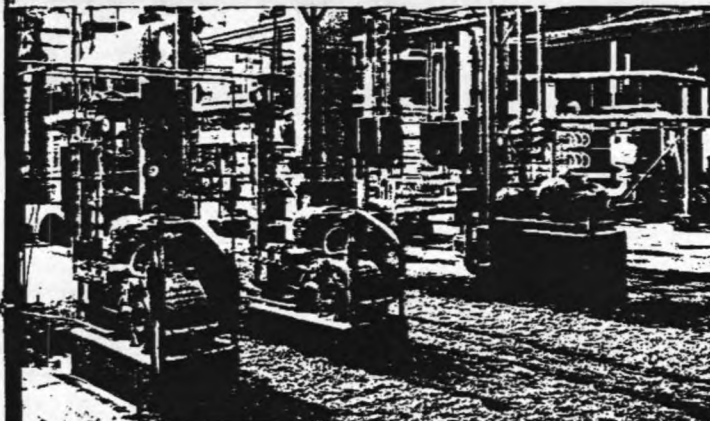
An article on power-recovery gas turbines in the Summer 1958 *Powerfax* carried a flow diagram which is practically the same as the one used at Southern Nitrogen Company.

Two lines of Elliott weather-protected and TEFC motors driving various pumps are shown in the photographs below.

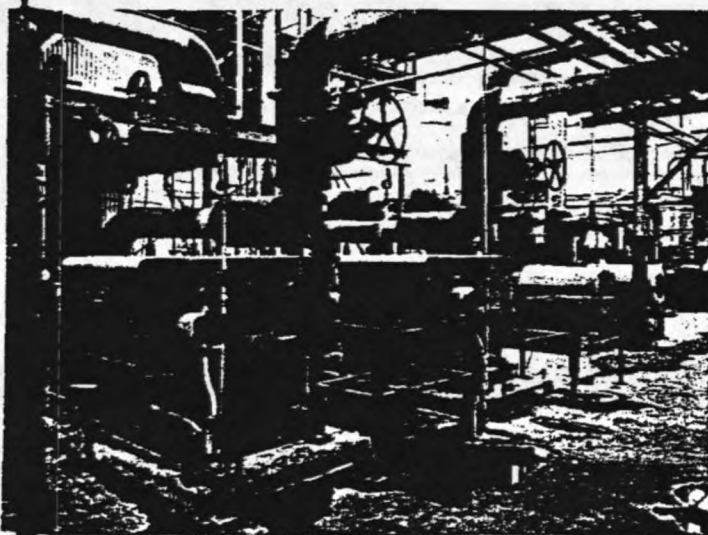




Two Elliott C-W 200-hp, 3600-rpm motors driving hot carbonate pumps.



Elliott C-W totally-enclosed fan-cooled motors driving pumps. Approximately 72 Elliott C-W motors, ranging in size from $1\frac{1}{2}$ to 200 hp, are driving all sorts of pumps, blowers and compressors in this plant.



These are the motor-generator sets that supply synchronous motor excitation.

COMPUTERS TAKE OVER

by R. E. Hansen
Assistant Chief
Development Engineer
Elliott Company
Jeannette, Pa.

IT'S THE MACHINE AGE. Machines and motors do our work. But to design a machine, engineers used to figure their pencils to the stub and heat their slide rules to the danger point. Now they let electrons do the figuring just as other machines do the digging, the sawing, the dishwashing, and other distasteful jobs.

Since computers have come to the rescue of the accountant and the engineer among others, everybody that is anybody these days uses such machines.

Elliott Company became actively interested in electronic computers several years ago. Investigations were made as to whether machine computation would be advantageous in our work, and to determine the best type of computer available for our requirements. Within the next year Elliott engineers were travelling to Pittsburgh once or twice a week checking out new programs and solving

problems on those already checked.

The results were indeed surprising. Tedious calculations, formerly postponed as long as feasible, or not done at all if there seemed a good chance the answer would be favorable, were now breezed through in a few minutes, and results obtained to an accuracy never before possible.

As an example, the calculation for finding "critical," or resonant speeds of turbine or compressor rotors, takes an experienced engineer two or three days. If the first result is unsatisfactory, the design must be changed, and the calculation repeated. Often, if the first answer is not too far out, and the changes made seem adequate, the repeat calculation is not made; there are always too many other things to do.

With machine calculation, not one but several critical speeds (the fundamental and one or more

harmonics) can be obtained in an hour or less. If the first result is unsatisfactory, several different remedies can be tried out in a short time, and the most satisfactory selected.

Last October, the small desk-size digital computer illustrated was rented for Jeannette engineering use.

Other divisions of Carrier Corporation are using electronic computing. An IBM-650 is in use in Syracuse mainly for accounting but with an increasing use for engineering. The Research and Development Division is installing an analog computer, made by another Carrier Division, the Colorado Research Corp.

Several plants of Elliott Company are represented on Carrier's Engineering Task Committee on Computing Equipment. Through this group, information and experience are pooled, and it is expected that the inevitably rapid expansion of electronic computing will be channeled into the most productive lines of development.

It has already been decided that we will depart from the customary procedure of setting up a centralized computing group to which engineers will turn over their problems, and get their answers second-hand. At Jeannette, most of our engineers will become sufficiently familiar with computer operations to write their own programs and get answers in the form most suitable for the problem. This may not always result in the most efficient computation, but we feel that the overall result is more satisfactory. Computation is an integral part of engineering; in the very near future the electronic computer may replace the slide rule as the "symbol" of the engineer.

When the man who needs answers knows how the computer functions, he can devise solutions to problems he would not otherwise consider "suitable" for machine calculation. The full significance of this factor may, we feel, become increasingly evident as experience builds up.

In line with this policy, ten engineers have attended four programming schools operated by two manufacturers. In addition, three groups totalling 48 engineers have voluntarily attended four-session evening seminars at the plant. Fifteen programs have been written by ten different engineers.



The Royal McBee Company's LGP-30 digital computer now serves the needs of the Elliott Jeannette engineering department.

This line of Elliott C-W 2-hp, 1750-rpm, 440-volt induction motors is driving bar conveyor table rolls between roughing stands of a new mill at Connors Steel Division, H. K. Porter Company.



MOTORS

SERVE STEEL MILL MODERNIZATION PROGRAM

CONNORS STEEL DIVISION, H. K. Porter Company, Inc., recently completed an extensive modernization program at its works in Huntington, West Virginia. Designed to increase the steel-finishing capacity of the mill by more than 50 percent, the modernization program provided for a new billet-rail reheating furnace and four roughing stands set in-line to give increased production with a wide range of products.

Connors Steel called upon the Crocker-Wheeler plant of Elliott Company to supply the motors needed to power the new bar conveyor tables. The fine service of the Elliott Crocker-Wheeler motors used throughout the Connors Works in Birmingham, Alabama, was a deciding factor in selecting the motors for the West Virginia Works.

The bar conveyor table rolls which convey the hot bars from one mill stand to another are now individually driven by the Elliott motors, through reduction gears, whereas formerly they were

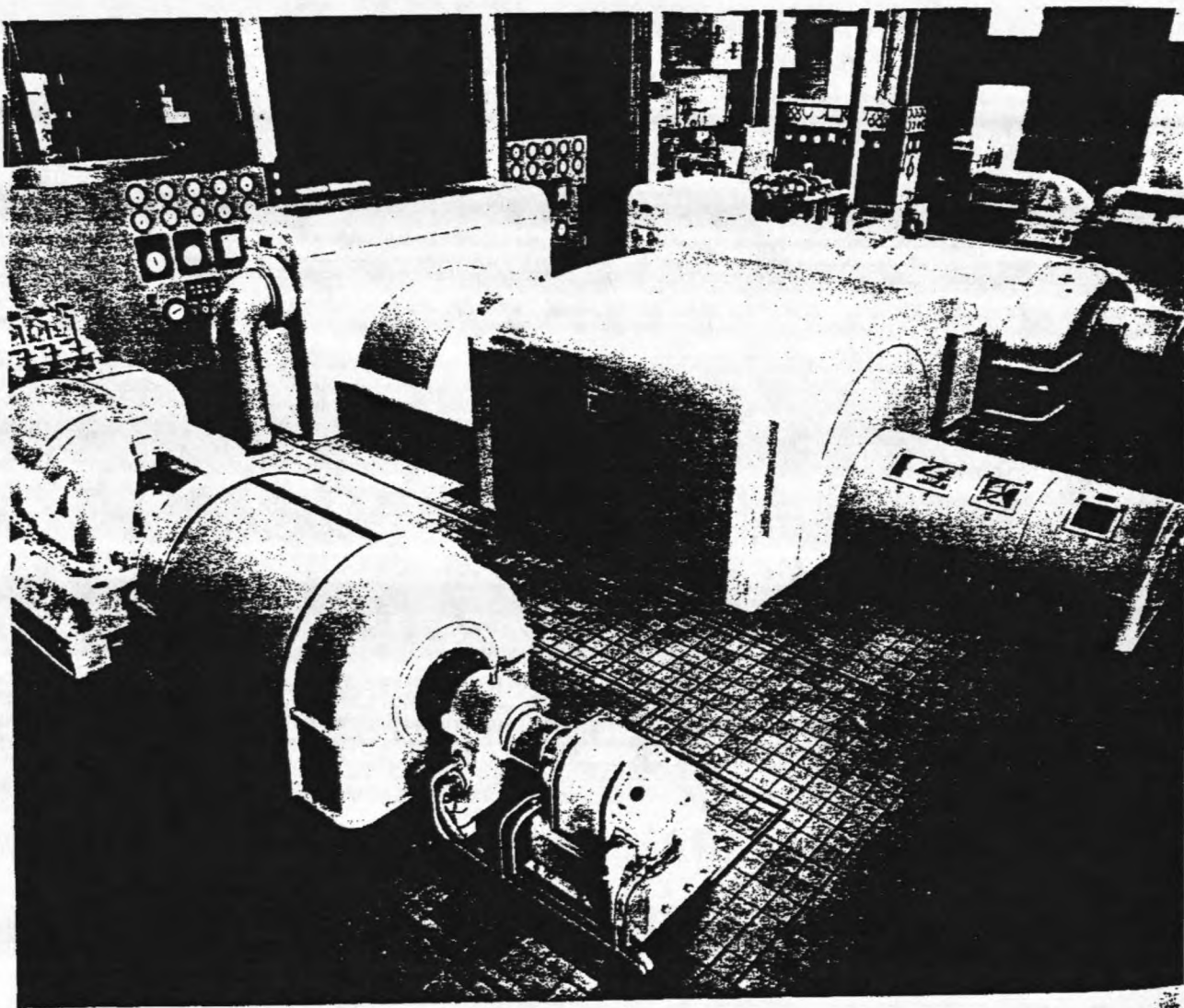
driven by a gear line shaft. The improved drive requires less maintenance. The motors are individually fused for overload and short circuit protection and they are started by one line contactor.

Other improvements included the redesigning of the finishing mill to give improved housing adjustment, and the addition of semi-automatic bar conveyors for improved bar handling of shaped products. Repeater guides are used to increase production speeds in the rolling of rounds and concrete reinforcing bars. A new cooling bed was added to the delivery end to assure straighter bars, better shearing, and improved handling conditions. The new mill provides a better product produced at higher speeds.

In addition to the 30-odd Elliott motors used on the bar conveyor tables, there are also six 3-hp motors driving roughing table rolls and several 25-hp d-c mill motors driving a billet ejector and tilt tables on the roughing mill.

20

YEARS OF TURBINE-GENERATOR IMPROVEMENTS



THE TURBINE ROOM of the public utility station of McPherson, Kansas, shown here, constitutes a comment on improvements in turbine-generator design and appearance over the past 20 years or more. The four Elliott turbine-generator units were installed as follows: The 3000-kw turbine-generator unit in the foreground was installed in 1934. In the background is a 5000-kw unit which went into service in 1939. Next from the rear is a 7500-kw unit installed in 1947, and the largest unit, second front in the photograph, is the latest 7500/10,000-kw turbine-generator unit which has been serving since 1955.

Over the years many significant design and structural changes have been made. The trend is toward improved appearance, enclosing the units in sheet steel to give a streamlined appearance, covering-up governor valves and exciters. The four units progressively become better looking.

The latest generator has side-mounted coolers, with removable covers over the cooler water-boxes, which are sealed into the frame with neoprene diaphragms. The split water-boxes on the air coolers of the latest installation permit accessibility for replacement of tubes.

To facilitate accessibility to generator windings on the two latest generators, end brackets are split horizontally and are removable. An inner baffle, adjacent to the fan, is removed after the outer bracket is taken away, and the ends of stator winding are then fully exposed at either end of the machine.

The exciter enclosure features full visibility of collector rings and commutator, with lights inside the exciter enclosure. The enclosure itself can be removed quickly. Ventilation is maintained by a shaft-mounted fan.

It is not necessary to have the collector rings ventilated from the room, hence no louvers or openings are provided in the exciter enclosure for this purpose. Radial holes on one side of each ring circulate cooling air past rings and brushes. Cooling air inside the collector enclosure comes in contact with large surfaces on the generator housing, and with the aluminum covers over the exciter.

Turbine valve gear and oil piping, which were exposed in the original unit, were partly enclosed in the second, and completely enclosed and streamlined in the last two units.

The governing systems show marked improvement. The original two machines utilized large eccentrics and heavy governing springs. The third unit employed a servo-motor connected to a valve operating cam shaft with each valve being operated by its own cam. Valve closing was obtained by preloaded compression springs. In the latest unit, the speed changer acts on linkage instead of the governor rotating element, giving improved

performance. The governor is considerably smaller, using lighter governor weights and governor spring, a major reduction in centrifugal force resulting. Governor weights are pivoted on torsion neoprene bushings and are connected to a rotating pilot so that friction is virtually eliminated in the basic speed sensing assembly. The governor admits a full range of control signal with a change in position of less than .010 in. vertical motion of the rotating pilot. The hydraulic signal, amplified at the valve servo-motor, is transferred to mechanical motion for positioning the admission valves.

A change in bearing design concept over the years is noted. In the first machine, the bearing length is greater than the bearing diameter. The second machine used a "square" bearing, where length and diameter are equal. The third unit used a liner type bearing design at the steam end position, permitting easier bearing replacement. In the latest machine, liner type bearings have the additional improvement of a cooled sleeve at the steam-end bearing position which circulates oil beneath the journal surface for additional cooling effect. By utilizing a three-bearing construction, the over-all length of the latest unit was decreased; one large bearing in the turbine exhaust end supports the downstream position of the turbine shaft and the inboard end of the generator rotor.

Shaft packing has changed from axial-type labyrinth seals to radial labyrinth seals with spring-backed packing at the main packing cases to allow seal strip push-back in case of contact. The gradual change has been from semi-labyrinth, labyrinth and carbon rings, to 100 percent labyrinth construction, giving maximum reliability.

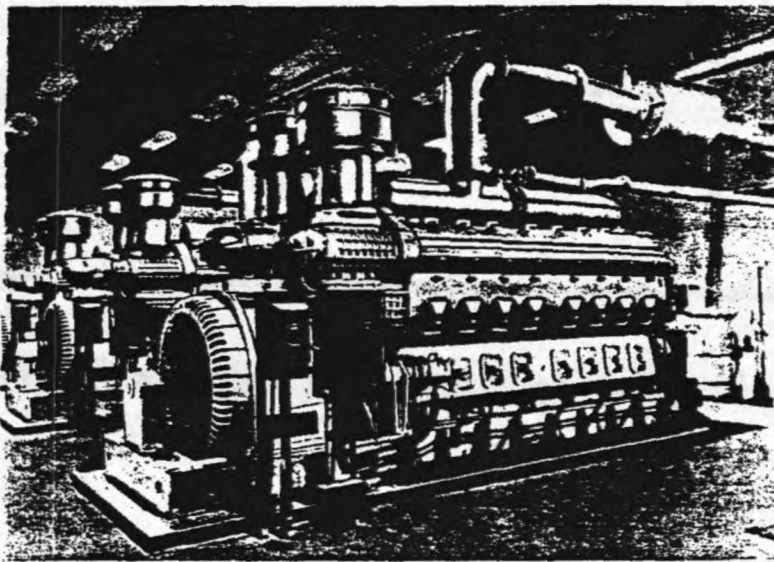
The increase in unit sizes dictated larger oil systems with the tanks ranging from a minimum of 275-gal to an 800-gal capacity for the largest machine. The first machines used gear-type pumps driven through worm and wheel in the main turbine shaft, the latest machine a centrifugal pump mounted on the turbine shaft.

The turbine shaft sealing systems were first manually controlled, then became a combination of manual and automatic; the last machine is fully automatically controlled with an Elliott-built double-purpose valve which controls the admission of sealing steam at start-up, automatically shuts off the sealing steam and controls the leak-off flow from the steam end under load conditions.

Couplings for the first three units are of flexible design, whereas, the latest three-bearing unit utilizes an integrally forged solid coupling, eliminating wear and replacement problems.

The first two machines used all soft packing for valve stem sealing and the last two machines used nitrided labyrinth rings, plus a short outer section of soft packing for improved operation.

BRAZILIAN DIESEL GENERATING PLANT OPERATES IN SILENCE



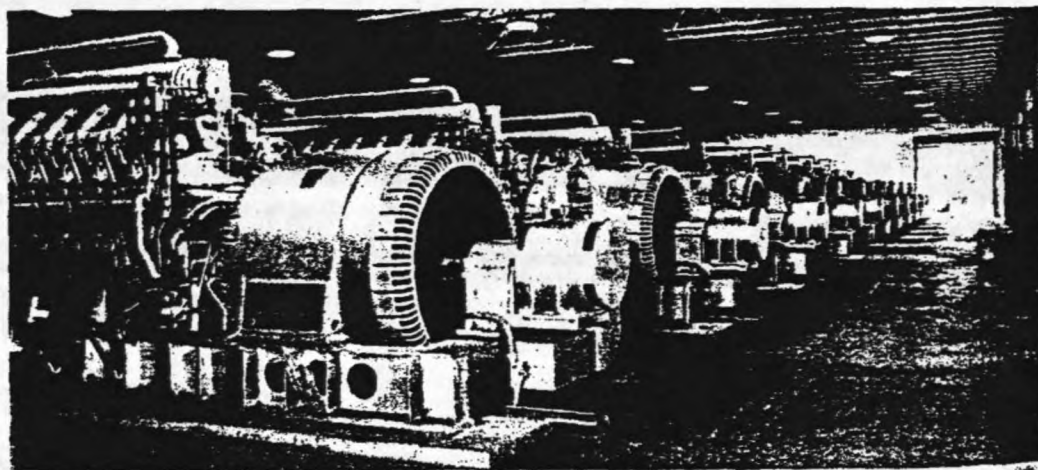
These three diesel-driven Elliott 1000-kw generators are producing electricity at Sao Caetano, Brazil, with minimum neighborhood noise nuisance.

DIESEL-GENERATOR SETS have long been regarded as efficient noisemakers, but engineers can now turn these decibel-raisers into quiet neighbors. The new Sao Caetano, Brazil, generating plant boasts this silent service (see *POWER*, October 1958). Located in a suburb of Sao Paulo, about 200 miles down coast from Rio de Janeiro, it was so designed that noise from the generating units would be inaudible 50 ft from the building walls.

To bar escape routes for sound, acoustical engineers decided upon a windowless, soundproofed structure. The roof is fabricated from four-inch precast concrete slabs, dictated by acoustics rather than load. Even the entrances and exits are of special soundproof construction, with vestibules and double doors.

Electricity is generated by three Elliott 1000-kw, 0.80 power factor, 4160-volt generators driven by a trio of 1440-hp diesel engines. Space for a fourth unit provides room for growth potential. To lower the sound level, engine foundations were designed to prevent sound transmission by conduction through the base material. Basically, the foundation is a solid concrete block, thrice the mass of the set itself and resting upon three-inch cork mats, surrounded by a waterproof concrete cradle.

The maximum silencing effect was realized because all details were given attention, from door sealings to pipe and conduit openings. Soundproofing the entire structure proved admittedly expensive, but not a single complaint has been filed by residents or workers in the area!



CUBAN POWER PLANT This line of ten diesel engine-generator units, featuring Elliott 2000-kw generators with direct-connected exciters, is in the "Rincon de Melones Diesel Plant" of the Compañia Cubana de Electricidad system in Cuba. The plant implements a local industrial expansion and also serves as emergency generating capacity for the main station at Regla. This plant was constructed in record time.

A sheep rancher suddenly struck it rich. His first purchase was a Cadillac limousine. On his next trip into town, the dealer meeting him on the street inquired how he liked the car.

"Say, fella," said the sheepman, "that there is a real nice automobile. Sure do like that winder back of the front seat."

"How's that?" said the salesman. "You don't have a chauffeur!"

"Don't need no chauffeur, sonny," said the sheepman, "but that winder keeps the sheep from licking my neck when I'm taking 'em to market."

During the recent heat wave some farmers down here in Texas were feeding chopped ice to their hens to keep them from laying hard boiled eggs.

"I don't want to see any callers this afternoon," said an executive to his secretary. "If they say their business is important, just tell them that's what they all say."

During the afternoon a woman called and insisted on seeing him.

"I am his wife," she explained.

And the secretary replied:

"That's what they all say."

"The weather here in Florida is so wonderful," said the old lady, "how do you tell summer from winter?"

Replied the hotel clerk, "In winter we get Cadillacs, Lincolns and stuffed shirts. In summer we get Chevrolets, Fords and stuffed shorts."

Millions of men welcome a little depression that doesn't hurt too much for it gives them a chance to scare heck out of their wives.

When Jimmy returned from summer camp, his parents asked him if he had been homesick.

"Not me," replied the youngster.

"Some of the kids were, though—the ones that had dogs."

The Spring *Powercrax* carried the following ditty:

Beneath the spreading chestnut tree

The village smithy snoozes.

No nag since 1923

Has been to him for shoes.

A *Powerfar* reader contributes an alternate or second verse:

The chestnut tree succumbed to blight;

The smithy fell to rot.

The former smith, still strong of arm,

Now runs a parking lot.

A vacation usually consists of 2 weeks, which are 2 short. Then you are 2 tired 2 return 2 work, and 2 broke not 2. 2 bad!

POWERCRAX

There is just as much authority in the family today as there ever was—only now the children exercise it.

Every baseball team could use a man who plays every position superbly, never makes an error . . . but there's no way to make him lay down his hot dog and come down out of the grandstand.

Women are to blame for most of the lying which men do. They insist on asking questions!

In the parlor, Mrs. Tucker and Mrs. Fremont were reliving the good old days, while their husbands sat smoking on the porch.

"Remember when women started wearing short skirts," Mrs. Tucker remarked, "even up to the knee?"

"Can't name the year it started," Mrs. Fremont replied, "but I can find out. Hey, Charlie," she called out to her husband, "what year was it you started wearing glasses?"

Doctor (after a thorough examination): Well son, you have a little chest trouble.

Cowboy: Whaddya suggest?

Doctor: Can you arrange to sleep out-of-doors?

Cowboy: Well, I been sleepin' under the old chuck wagon all summer, but I reckon I could kick a couple spokes outta the wheels.



She asked him, "Why did you park here when there are nicer places farther on?" His answer was: "Love at first site."

The young minister was a bit upset over his wife's purchase of a new dress.

"Darling," he said, "what made you do it—you promised me you wouldn't buy a new dress."

"I guess it was the devil tempted me," she replied.

"Then why didn't you say, 'Get thee behind me, Satan'?"

"I did," she replied, "But then he whispered over my shoulder, 'It fits you just beautifully in back, too!'"

A normal person is one who thinks 2 and 2 are four and accepts it.

A psychotic person is one who thinks 2 and 2 are five and believes it.

A neurotic person is one who thinks 2 and 2 are four and it bothers him.

A dyed-in-the-wool baseball fan was persuaded by friends to go to the horse races. Being a beginner, he picked a 50-1 long shot and put \$2 on the nose. Coming into the stretch the longshot horse was neck and neck with the favorite. As they neared the wire for a photo finish, the baseball man hollered, "Slide, you bum! Slide!"

After several visits to his ailing friend in the hospital, the man called the nurse into the hall and asked:

"Tell me, is he making any progress?"

"None at all," she answered, "he's not even my type."



As your new superintendent you'll find me a man of few words . . . "Get back to work"

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Printed in U.S.