



View in the power plant showing units 3 and 4, Elliott 4000-kw condensing turbine-generator units. The Elliott 4750-sq ft surface condenser under one unit may be seen.

Elliott three-stage ejector using barometric type intercondensers maintains low absolute pressure on the second-stage tower of the two-stage crude distillation unit.

THE OHIO OIL COMPANY'S EXPANSION PROGRAM

by C. W. LYON, Ohio Oil Company, Robinson, Ill.

THE Ohio Oil Company recently completed a modernization and expansion program of its refinery at Robinson, Ill. for the refining of crude oil and other petroleum products. The main finished products are motor fuels, heating oils, kerosene, diesel oil, liquefied petroleum gas, residual fuel oils, and asphalts.

The major additions to the refinery consisted of a new 27,500-barrel-per-day, two-stage crude distillation unit, a fluid catalytic cracking unit of the latest Universal Oil Products Co. design, a catalytic polymerization unit, a gas recovery and stabilization unit, and a new treating section for the catalytic-cracked gasoline.

The refining equipment existing at Robinson previous to the expansion program consisted of a 15,000-barrel-per-day crude unit, four modified Holmes-Manley thermal cracking units, and a Kellogg combination distillation and cracking

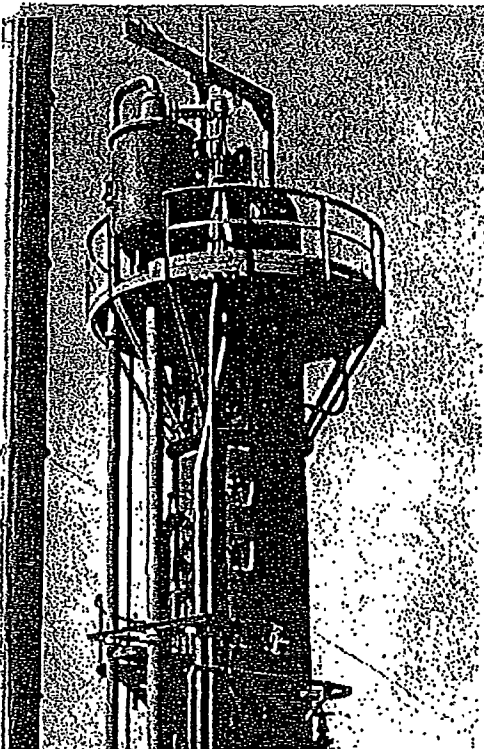
unit having a capacity of 2500 barrels per day.

The installation of the new refining equipment made it necessary to provide additional facilities for handling the new products and increased throughput. Major additions to the power plant were required, and a new water cooling tower with circulating water system was installed. New storage tanks totalling 1,150,000 barrels capacity were constructed to make a total of over 3,000,000 barrels capacity for crude oil and refined products storage. A new field piping system, consisting of approximately 40 miles of pipe, 8 in., 10 in., and 12 in., serves for transferring and blending the various products.

Two-Stage Crude Distillation Unit:

The crude oil is introduced into the unit through a series of heat exchangers and into a desalting process where a chemical destabilizer

Exhibit
Parcel 3



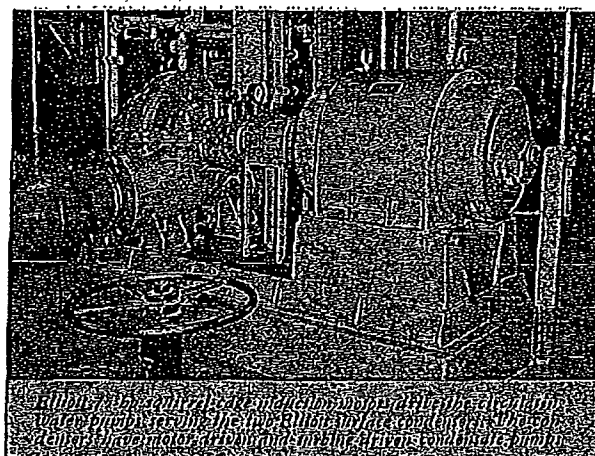
is injected into the system, together with fresh water to wash out the residual brine and soluble salts, and from there through another series of exchangers and into a heater or furnace. The hot oils, from the heater, flow into a fractionating tower operating at substantially atmospheric pressure, which is designed to separate the straight-run gasoline, kerosene, and gas oil fractions. The gas oil, or reduced crude, from the bottom of the atmospheric tower is then reheated and introduced into the second-stage tower, which is operated under a vacuum for the production of gas oil for charge to the catalytic cracking unit, and asphalt. The vacuum tower is equipped with an Elliott three-stage steam jet ejector maintaining 15 Hg absolute pressure when handling 2000 lb per hr of 250 F gas, consisting of 1000 lb per hr steam, plus 400 lb per hr condensable hydrocarbon vapor, plus 600 lb per hr of air or equivalent noncondensable gases.

Fluid Catalytic Cracking Unit:

The fluid catalytic cracking process has the ability to produce greater yields of gasoline of a high-octane rating than the thermal cracking process. In the fluid process, finely divided catalyst is suspended in gas, or vapor, or air, so



The Elliott multi-stage, turbine-driven centrifugal blower which was installed in connection with the fluid catalytic unit. It is rated 30,000 cfm, compressing air to a discharge pressure of 26 psig. It is operated 24 hours a day at 4750 rpm by the Elliott direct-connected 3140-hp steam turbine.

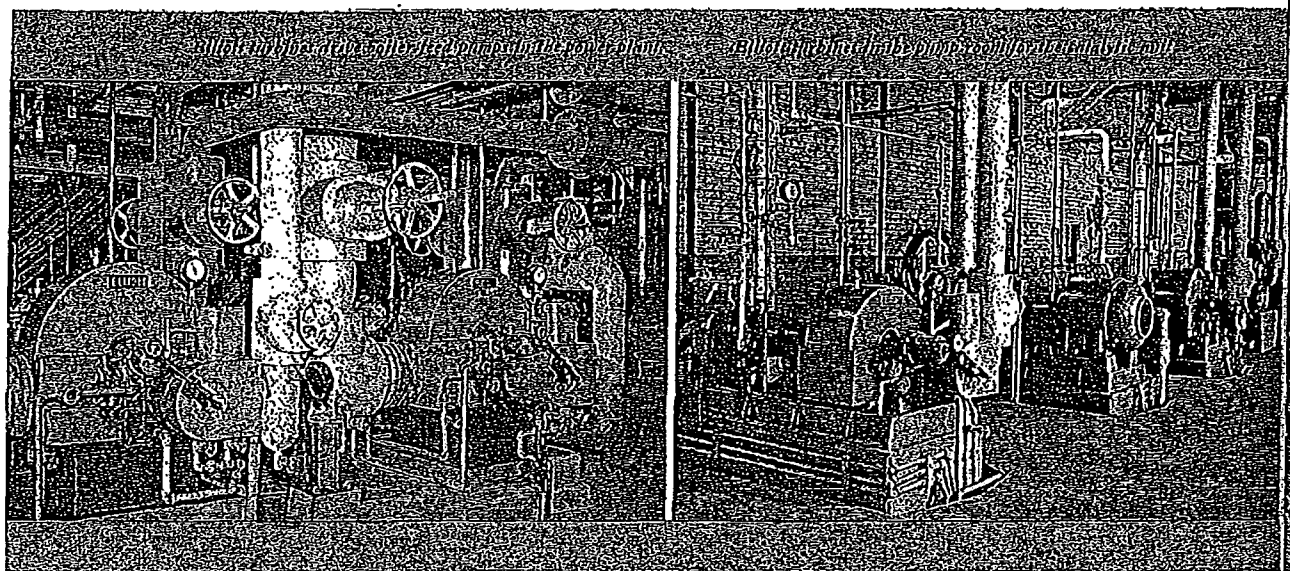


it flows through the equipment in a form resembling a liquid in many respects. The catalyst is circulated continuously between a reactor and a regenerator. The heat from the regenerator, (a vessel where the coke absorbed by the catalyst in its reaction with the oil vapors is burned) is transferred to the reactor. The oil feed is injected into the hot regenerated catalyst where the heat required for the reaction is obtained, the catalyst flow rate being controlled to maintain the required reactor temperature. The catalyst and oil

the motor gasoline, light hydrocarbons, and heavy gas oils are separated for processing and treating.

Light Ends Unit:

Within the light ends unit there are four operations, which are distinct but interdependent upon each other. The stabilization section removes from the gasoline lighter hydrocarbons and inert gas which would be objectionable in a finished motor fuel. These gases are separated through a series of fractionating towers into the



vapor mixture flow into the reactor where the catalyst reacts with the oil vapors and absorbs excess coke or carbon formed in the reaction. The oil vapors leaving the top of the reactor pass through separators which return most of the entrained catalyst back to the catalyst bed in the bottom. The spent catalyst is withdrawn continuously from the reactor, flows by gravity through an external stripper where hydrocarbons are stripped from the catalyst, and then goes into the regenerator. In the regenerator, the coke is burned off the catalyst by means of air furnished by an Elliott 30,000-cfm, turbine-driven blower. The regenerated catalyst then starts another cycle. After the cracked oil vapors leave the reactor they are introduced into a fractionating tower where

basic components of (a) gases lighter than propane, (b) propane-propylene and (c) butane-butylene. The lighter gases are introduced into the refinery fuel gas system and utilized for heating purposes. The propane-propylene and butane-butylene fractions are treated to remove hydrogen sulfide and mercaptan sulfur, and are then introduced into a catalyst chamber, or reactor, at 900 to 1000 psig, where a high octane polymer gasoline is formed. The propane fraction from the poly plant is then stored as liquid petroleum gas, which is used for domestic and commercial bottled gas.

The straight-run, thermal-cracked, catalytic-cracked, polymerized, and natural gasoline are blended together in a continuous automatic

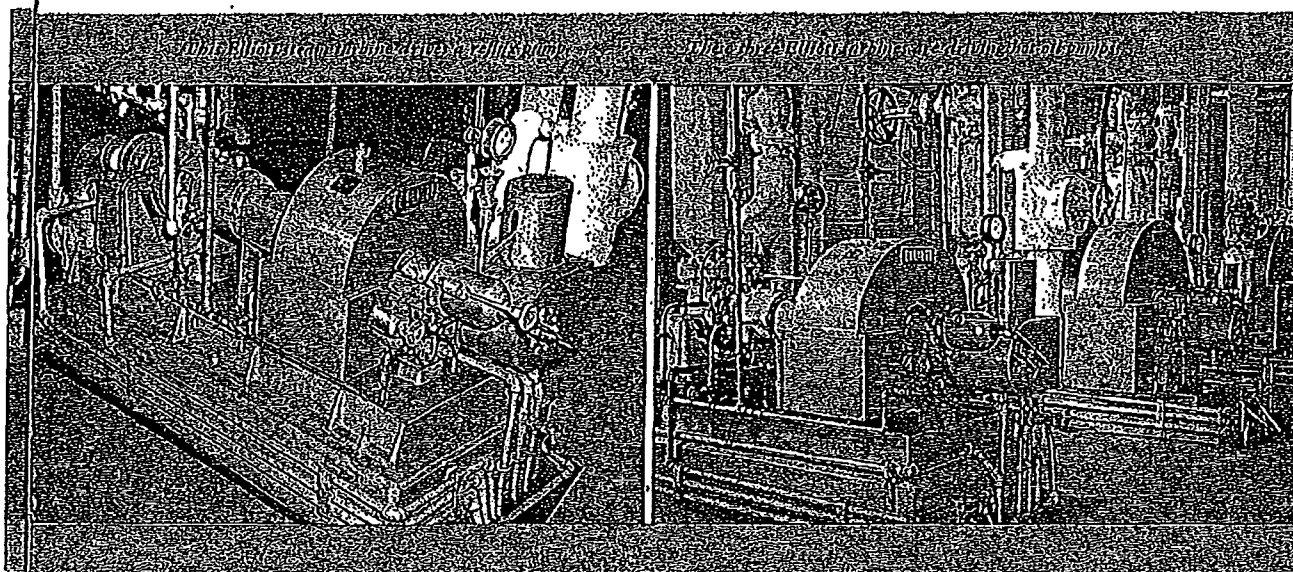
blending system where tetra-ethyl lead is added to give a finished motor fuel, meeting vapor pressure, distillation, and octane specifications.

The new water-circulating pump house and cooling tower provide a closed system to furnish water to the unit for condensing and cooling service. There are nine cells in the induced-draft type cooling tower, which has a total circulating water capacity of 49,500 gpm. Each processing unit has its own water supply pumps and cooling tower cells. Approximately 65 per cent of the

condensate pumps, and the boiler-feed pumps.

An oil refinery requires the movement of oils, water, and other fluids in great quantities and consequently many hundreds of pumps are used. Electric motors are commonly used for drivers but where loss of electric power may create hazards, steam turbines are usually installed. This plant has 52 Elliott mechanical drive turbines (6 to 310 hp) in operation, providing dependable power.

The Ohio Oil Company purchased the site



total circulating water is supplied by electric-driven pumps and the remainder by pumps driven by Elliott steam turbines. This arrangement insures an ample water supply to the process units in the event of an electric power failure.

To provide the necessary additional processing steam and electric power required by the new facilities, two 100,000-lb-per-hr steam generators, producing 650 psig steam at 750 F total temperature and two Elliott 5000-kva condensing turbine-generators were added to the existing power plant. Steam at 650 psig from the steam generator is reduced to 150 psig for distribution to the processing units. Elliott motors drive the forced- and induced-draft fans, condenser circulating water pumps (see illustration on page 9),

of the present refinery in 1924 from the Lincoln Oil & Refining Co., at which time the refining capacity was about 1000 barrels per day. The crude at this time was processed in small horizontal shell stills. In 1926 the capacity of the refinery was increased to 5000 barrels per day by the addition of a pipe still and thermal cracking facilities. The crude capacity was then gradually increased over the intervening years to 15,000 barrels per day by alterations and modifications of the equipment. The recent expansion and modernization program represents the second major expansion for the Robinson refinery and results in a completely modern plant, capable of producing petroleum products of the highest quality.