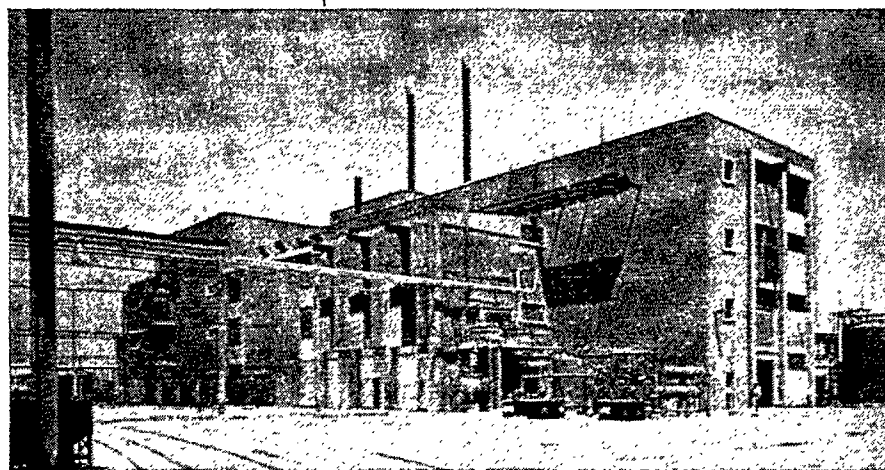
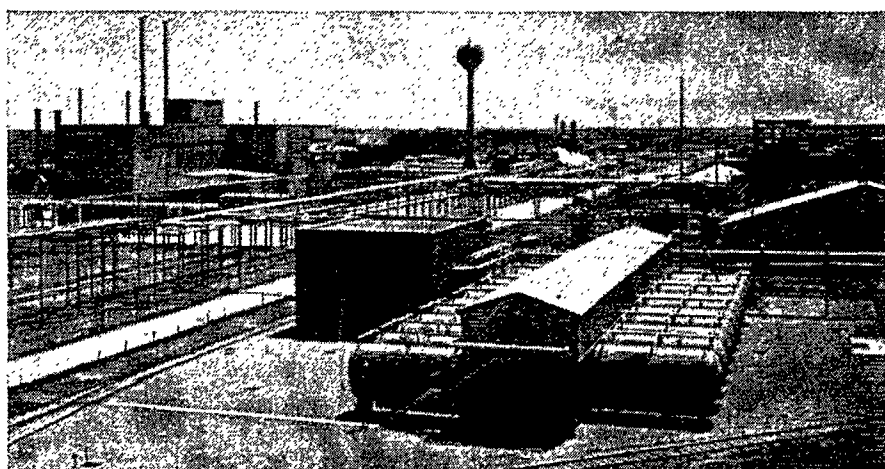
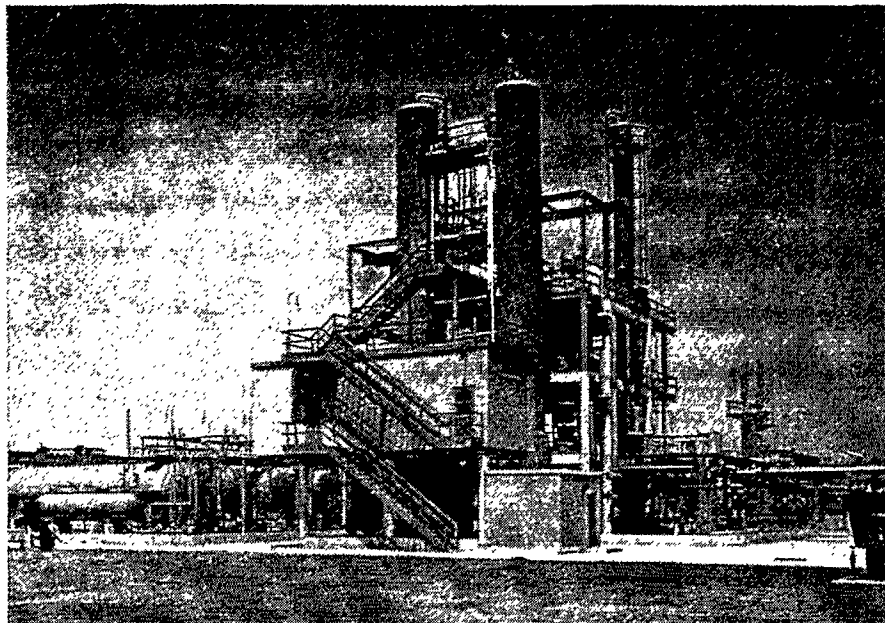


PLAINTIFF'S EXHIBIT

ETCO-591

# A NEW MANUFACTURING CENTER FOR ETHYL

BRAUN  
*Engineers and Constructors*

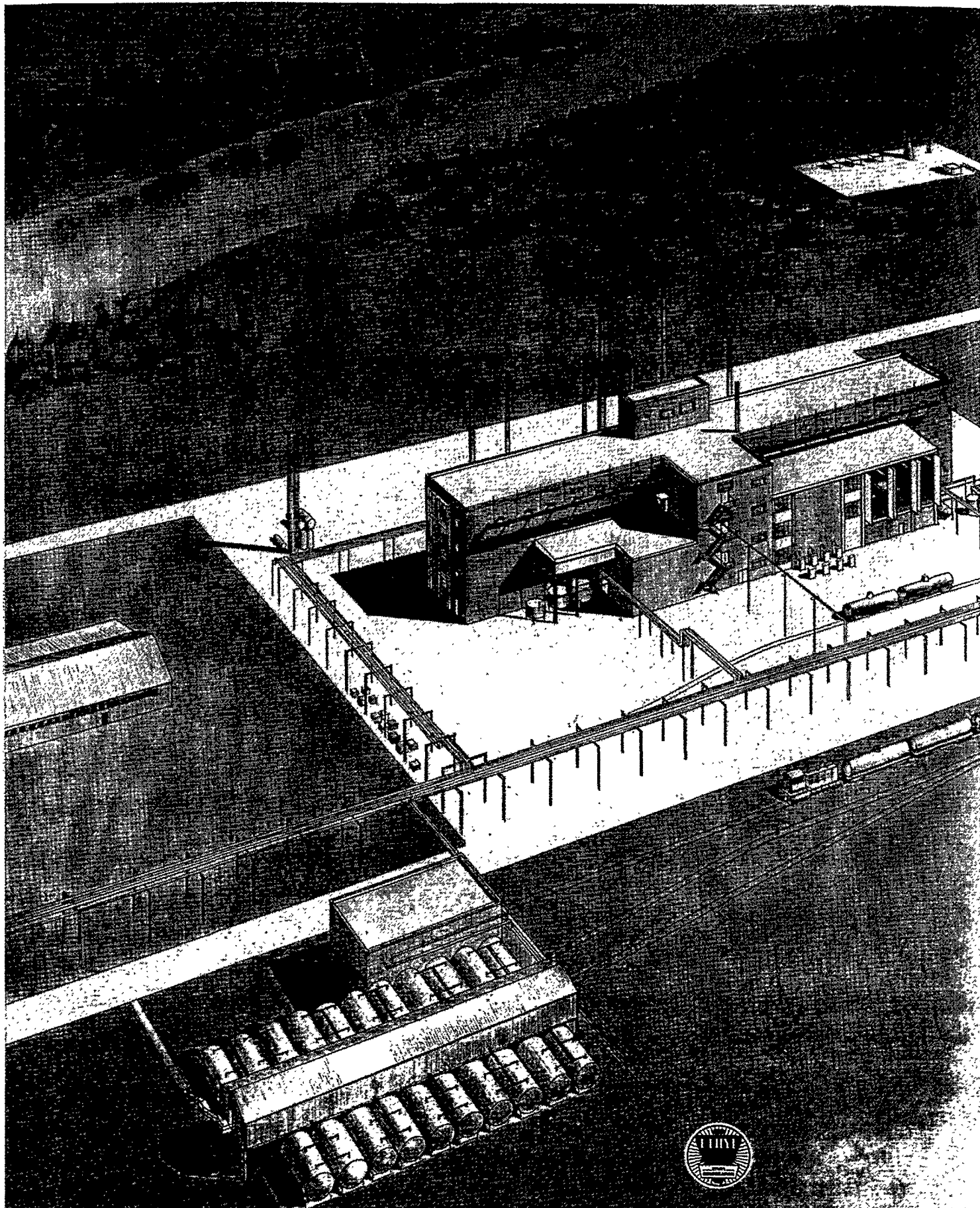


*A New —  
Manufacturing Center for Ethyl*

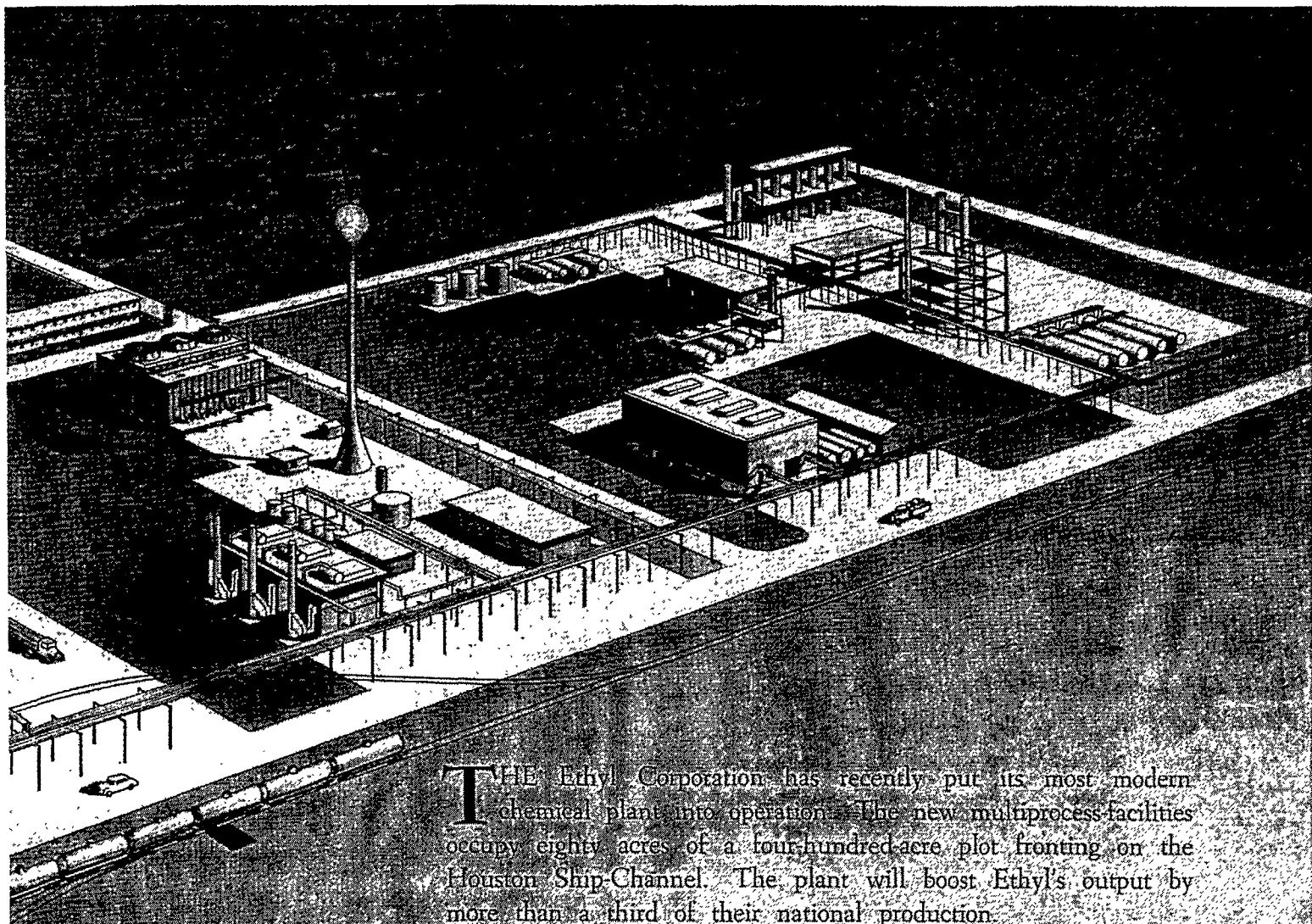
C F BRAUN & CO

*Alhambra California*

C O P Y R I G H T 1 9 5 2  
B Y C F B R A U N & C O



CHEMICAL MANUFACTURING PLANT HOUSTON TEXAS



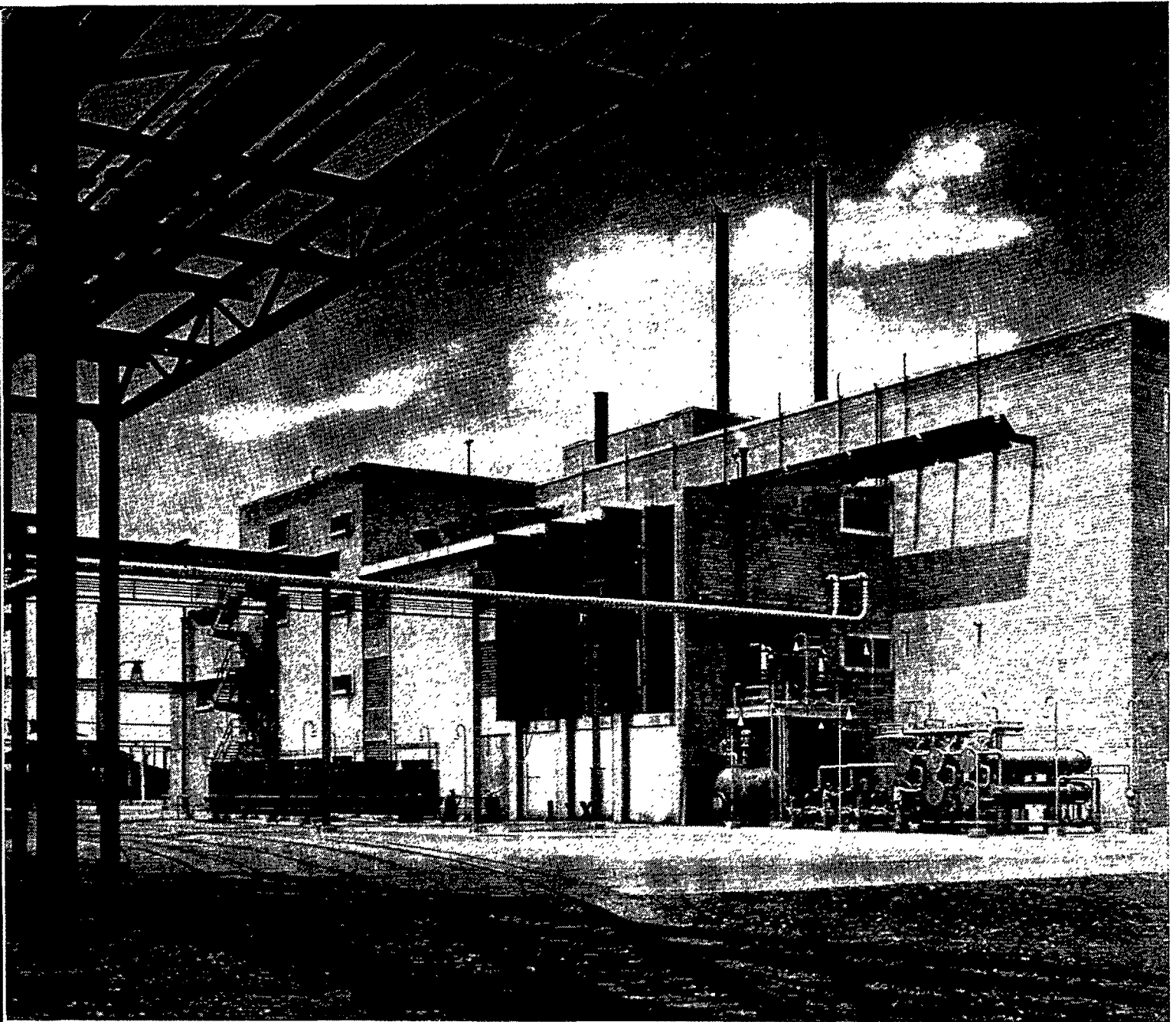
**T**HE Ethyl Corporation has recently put its most modern chemical plant into operation. The new multiprocess facilities occupy eighty acres of a four-hundred-acre plot fronting on the Houston Ship-Channel. The plant will boost Ethyl's output by more than a third of their national production.

There are seven main phases of processing which were assigned to Braun. Nitrogen production. Ethyl-chloride manufacture. Ethylene-dichloride synthesis. Lead-sodium alloying. Hydrogen-chloride synthesis. Tetraethyllead production. Product-compounding. The principal units are supported by a score of supplementary process-units and auxiliary systems. All facilities were built at the same time on the same site.

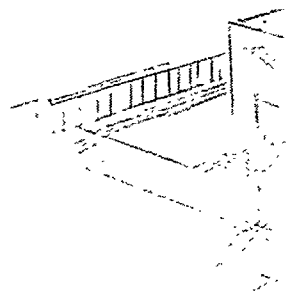
The complete development represents three decades of advances in chemical engineering. The plant itself is an outgrowth of extensive economic studies and engineering-preparation. Operation got under way eighteen months after ground-breaking.

First, Ethyl provided the fundamental process-information. Then C F Braun & Co did the engineering, designing, fabrication, and construction. Braun had undivided responsibility for the project, from the start with basic data, to the full completion.



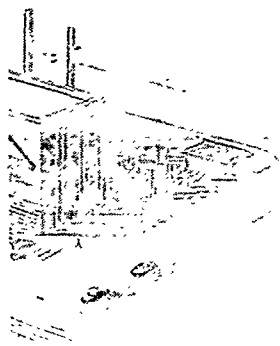
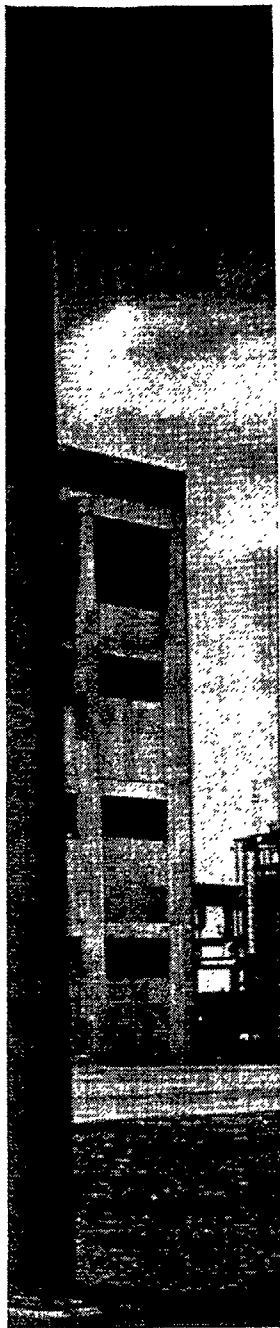
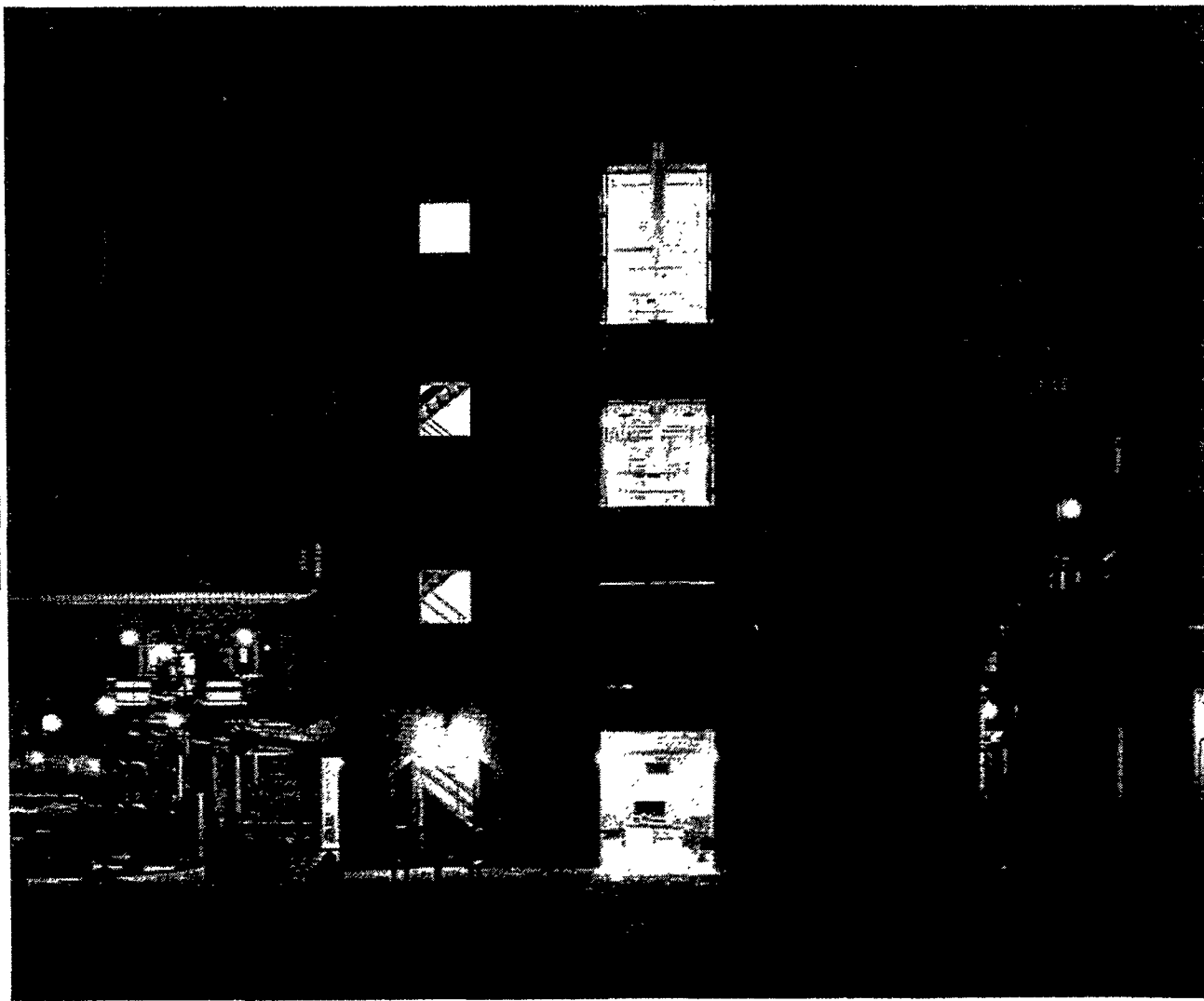


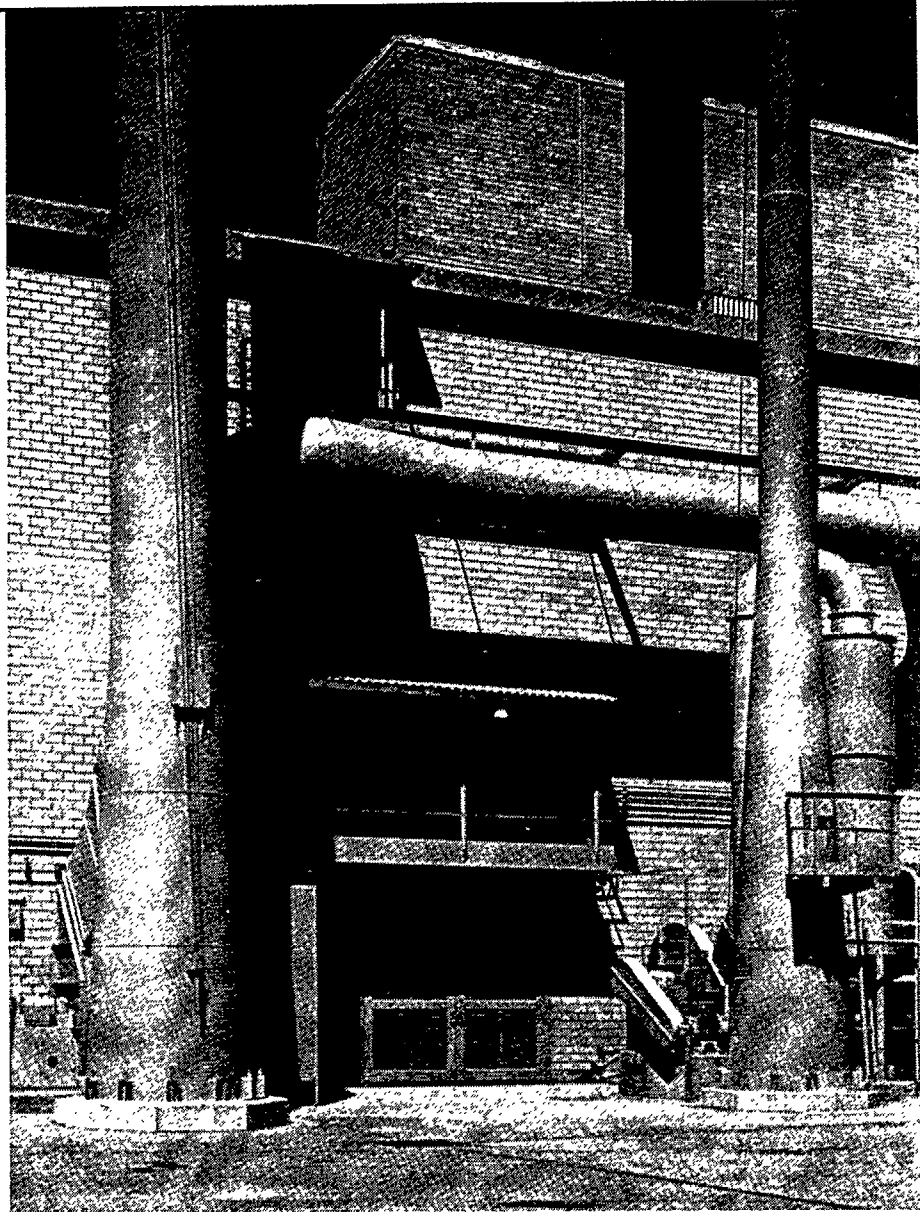
**MULTIPROCESS STAGES** This building accommodates four of the principal processing-stages. Lead-sodium alloying. Tetraethyl-lead production. Antiknock-fluid compounding. Lead-processing. Here in fact are both the initial stage and the final stages of the overall operation.



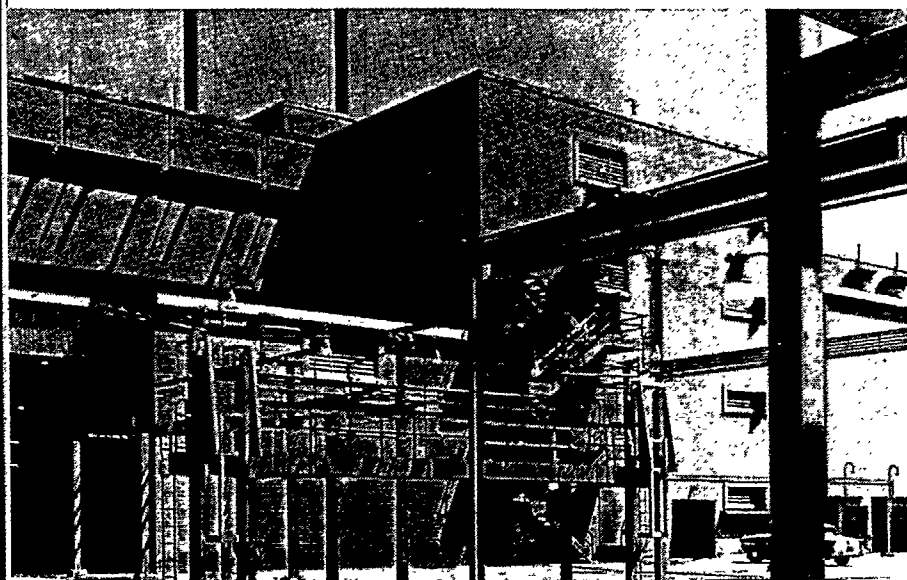
## *Lead-Sodium Alloying*

**ALLOYING** An early step in making tetraethyl lead is the alloying of molten lead with molten sodium. The resulting alloy reacts with ethyl chloride to produce crude tetraethyl-lead. The alloying-facilities include a series of weigh-tanks and alloy-mix pots, all induction-heated. Dowtherm-jacketing removes the heat of solution during the alloying-operation.





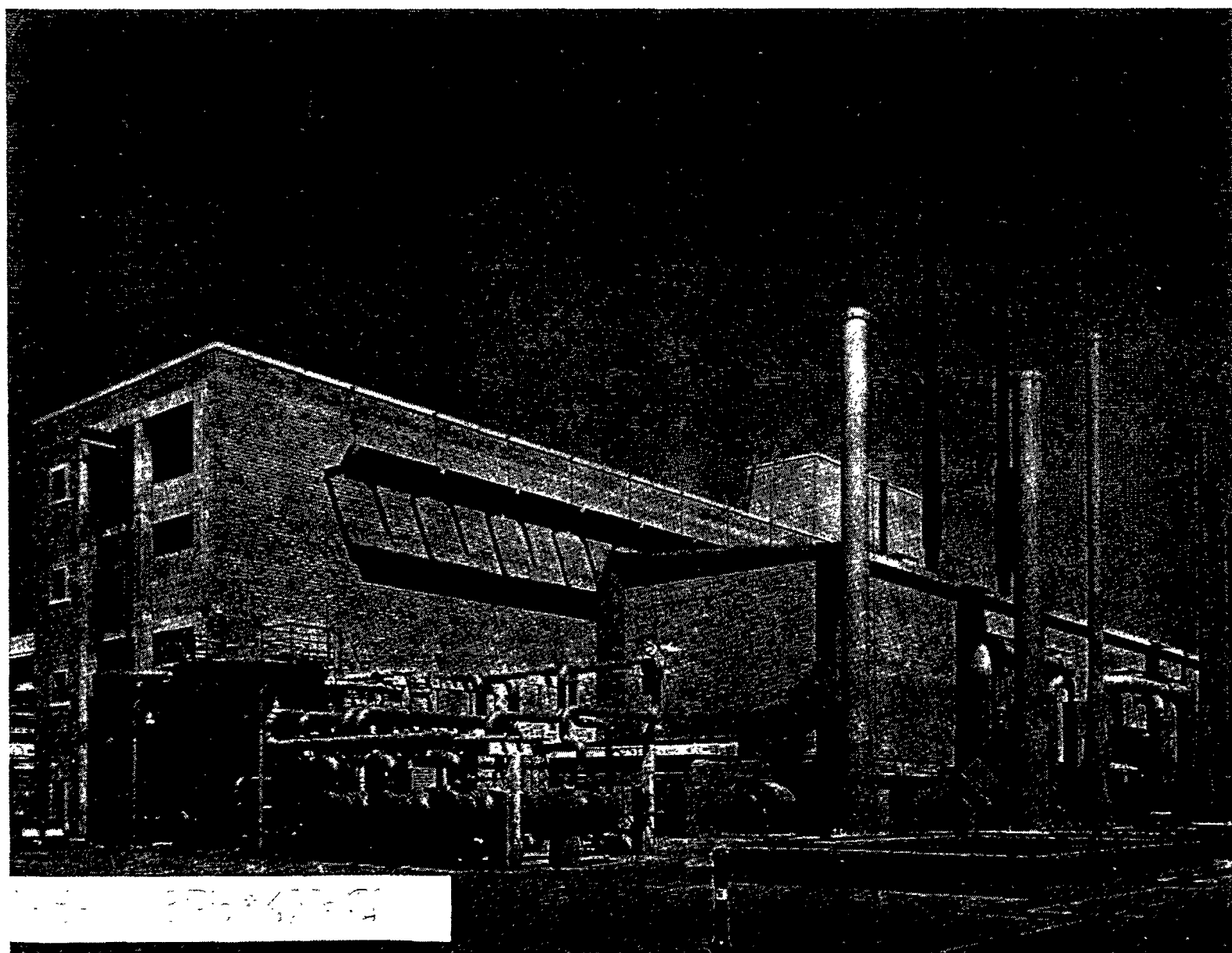
**THE LEAD-WING** Metallic lead is handled in four forms — pig lead, molten lead, lead in solution, and lead in suspension. Auxiliary scrubbers remove minute particles of lead before flue-gases go to atmosphere.



**CARLOADING** At this loading-rack, finished antiknock-compound is loaded in Ethyl's own cars for shipment to consumers the world over.

# *Tetraethyl-Lead Production*

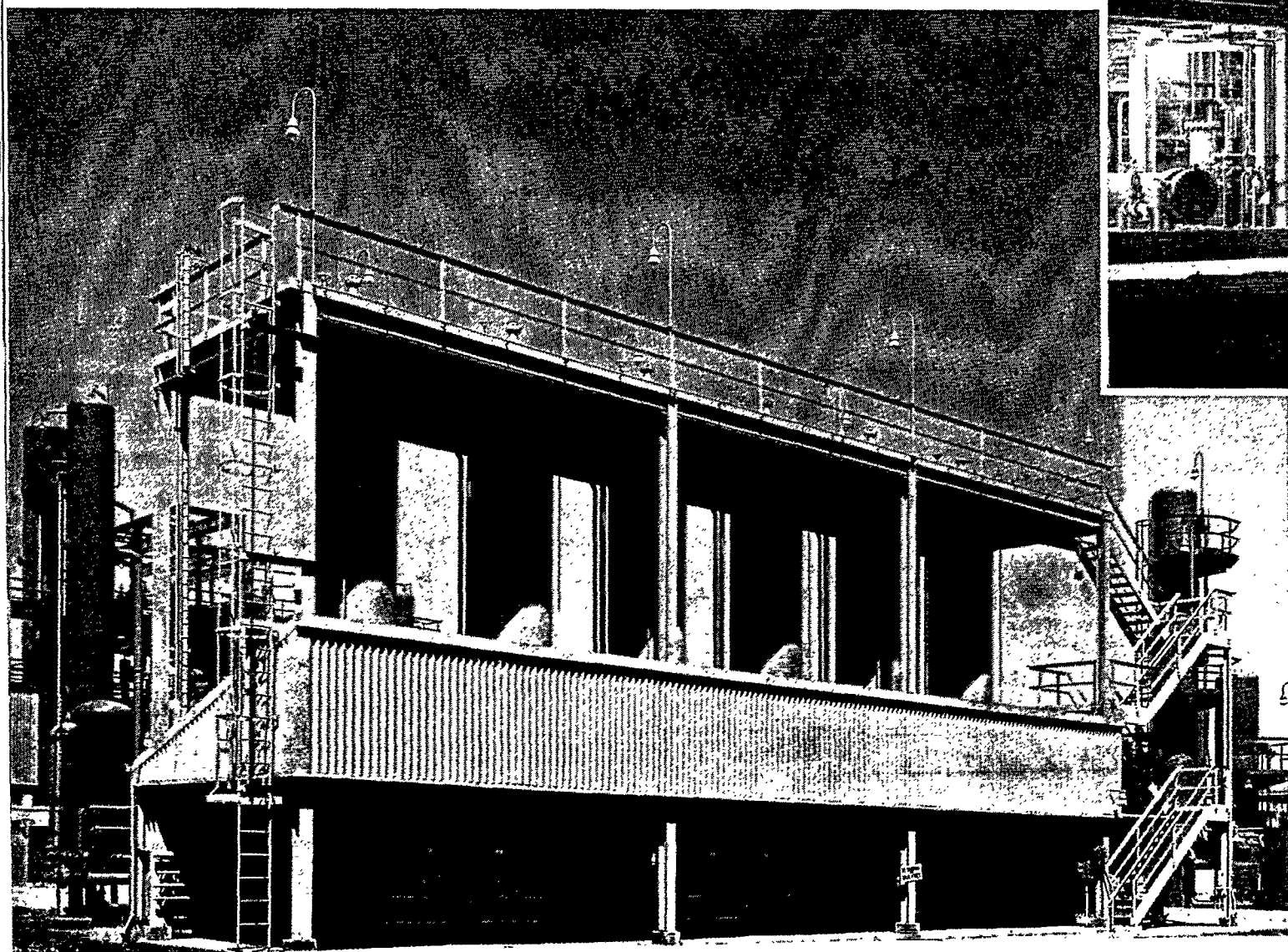
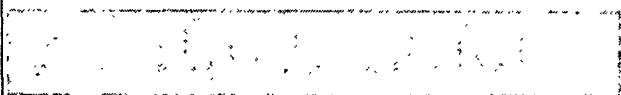
**TEL REACTION** Special Braun-built autoclaves are charged with lead-sodium alloy and ethyl chloride. The products of the exothermic reaction are distilled to separate crude tetraethyl-lead from the lead-salt residue. The TEL is then purified by washing and filtering.





# *Hydrogen-Chloride Production*

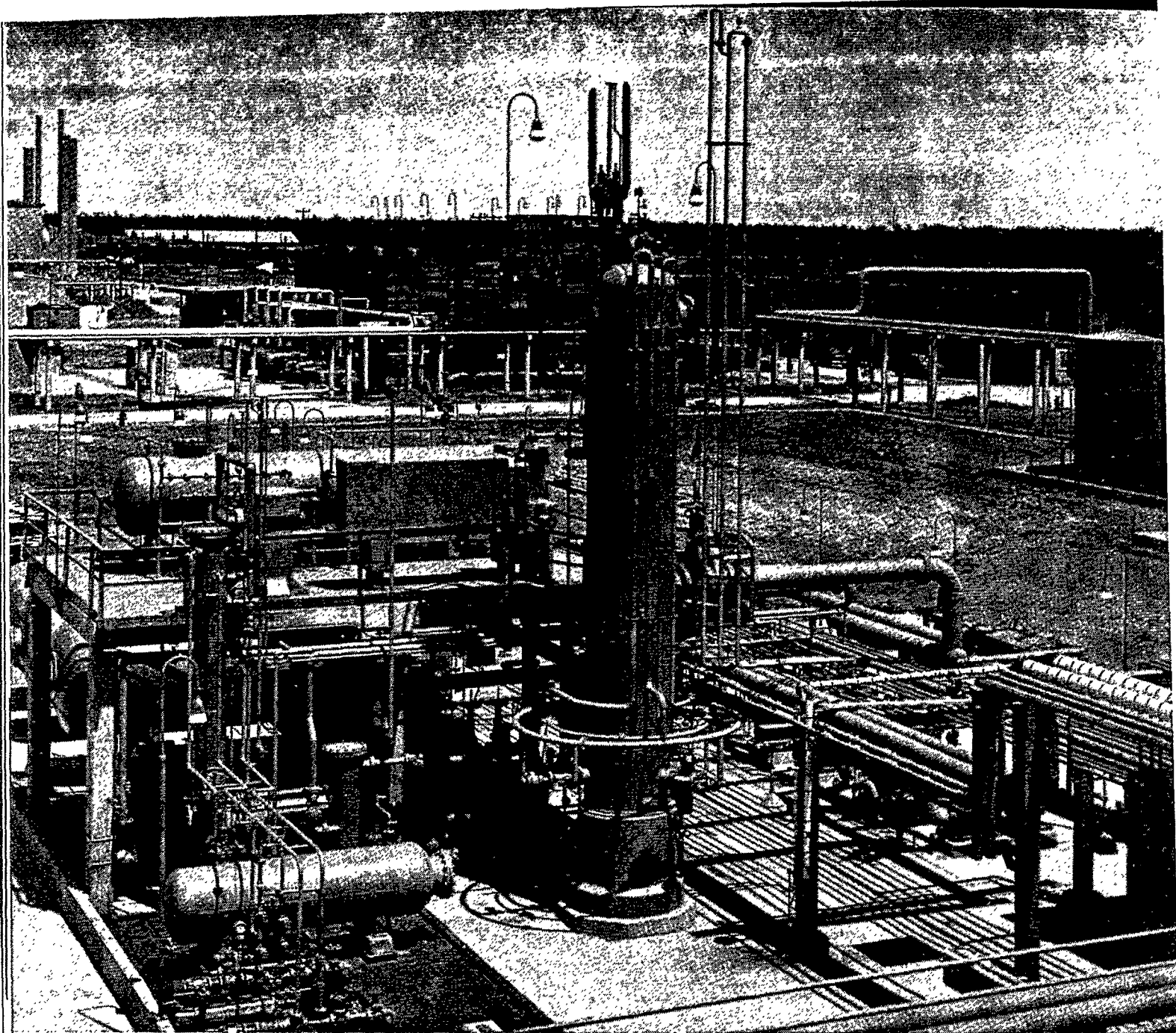
**REACTION PRODUCT** Hydrogen chloride is produced by the combustion-reaction of hydrogen and chlorine. The product is cooled and is dried with concentrated sulphuric acid. It is then compressed for use in the synthesis of ethyl chloride.





## *Ethyl-Chloride Synthesis*

**CATALYTIC REACTION** Ethyl chloride is produced by the addition-reaction of ethylene and hydrogen chloride. The reaction is brought about in the presence of a catalyst. The ethyl-chloride vapors are condensed at temperatures down to minus 80 F and are purified by two-stage fractional distillation.

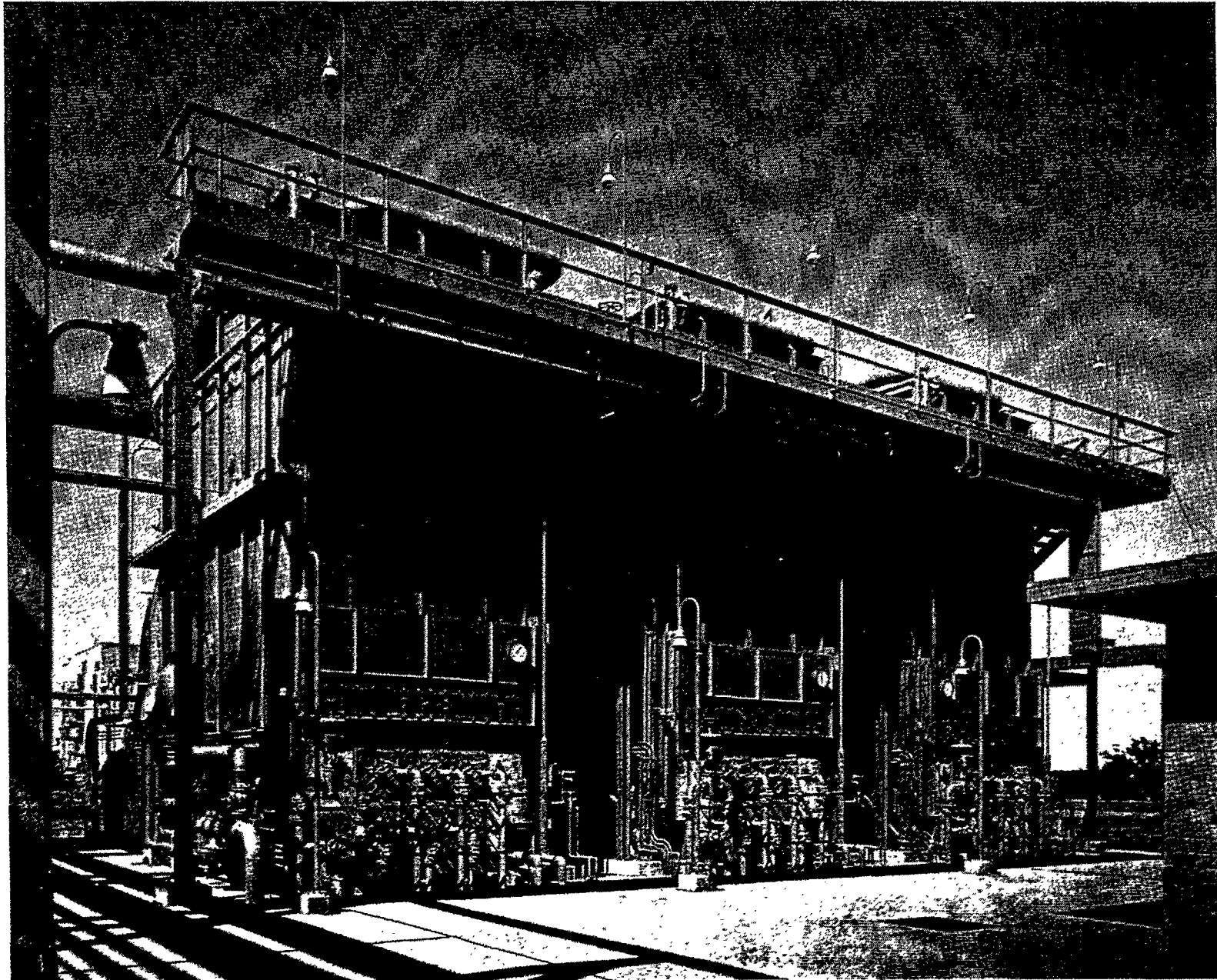


## *Ethylene-Dichloride Synthesis*

**ANOTHER REACTION** Here, two intermediates react to produce ethylene dichloride. Compressed chlorine and ethylene are fed to a reactor. The raw liquid product is processed and purified. Ethylene dichloride is one of the ingredients added as a scavenger in the blending of "Ethyl" antiknock-compound.

## *Steam-Generation*

**UTILITY STEAM** This battery of modern waterwall-boilers delivers a quarter-million pounds of steam per hour. The steam serves for various processing, for heat-exchange, and for driving turbines and compressors.





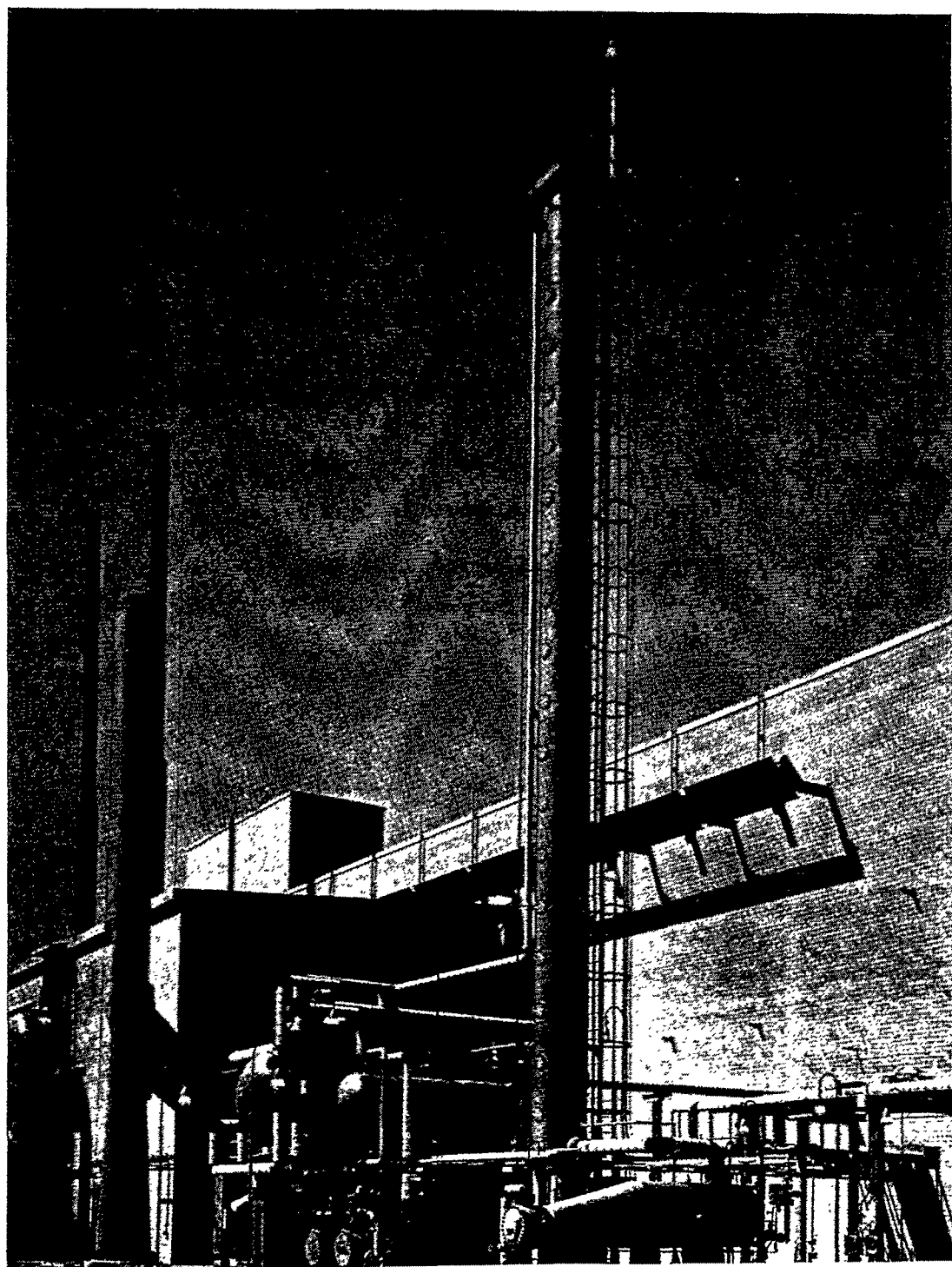
## *Antiknock-Fluid Compounding*

"ETHYL" ANTIKNOCK-COMPOUND The compounding-wing accommodates the final stages of the multiprocess-operation. Here, tetraethyl lead is proportioned, mixed, and agitated with secondary ingredients including ethylene dichloride, ethylene dibromide, and dye. All are introduced by careful measurement from a series of weigh-tanks.



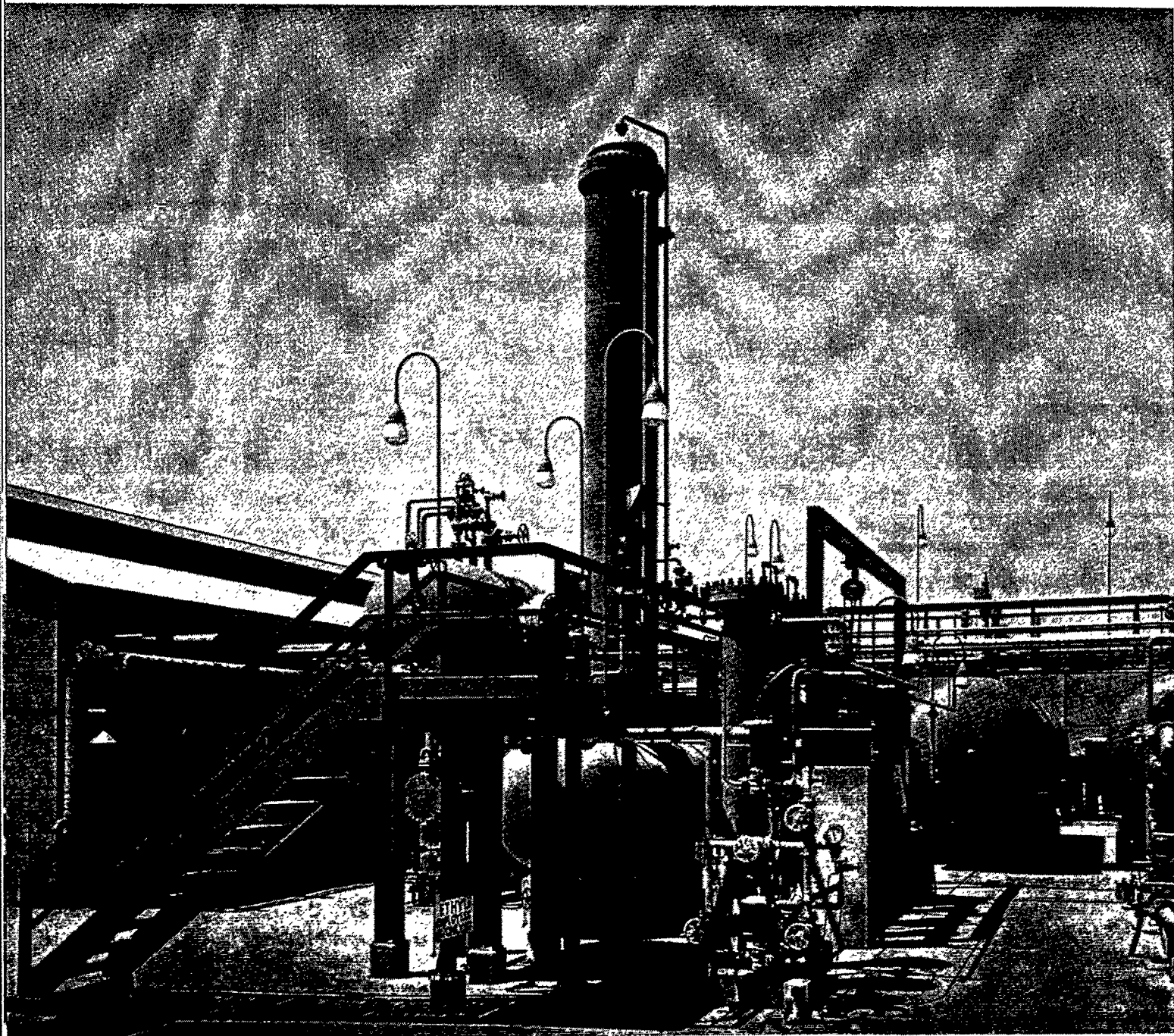
# *Ethyl-Chloride Recovery*

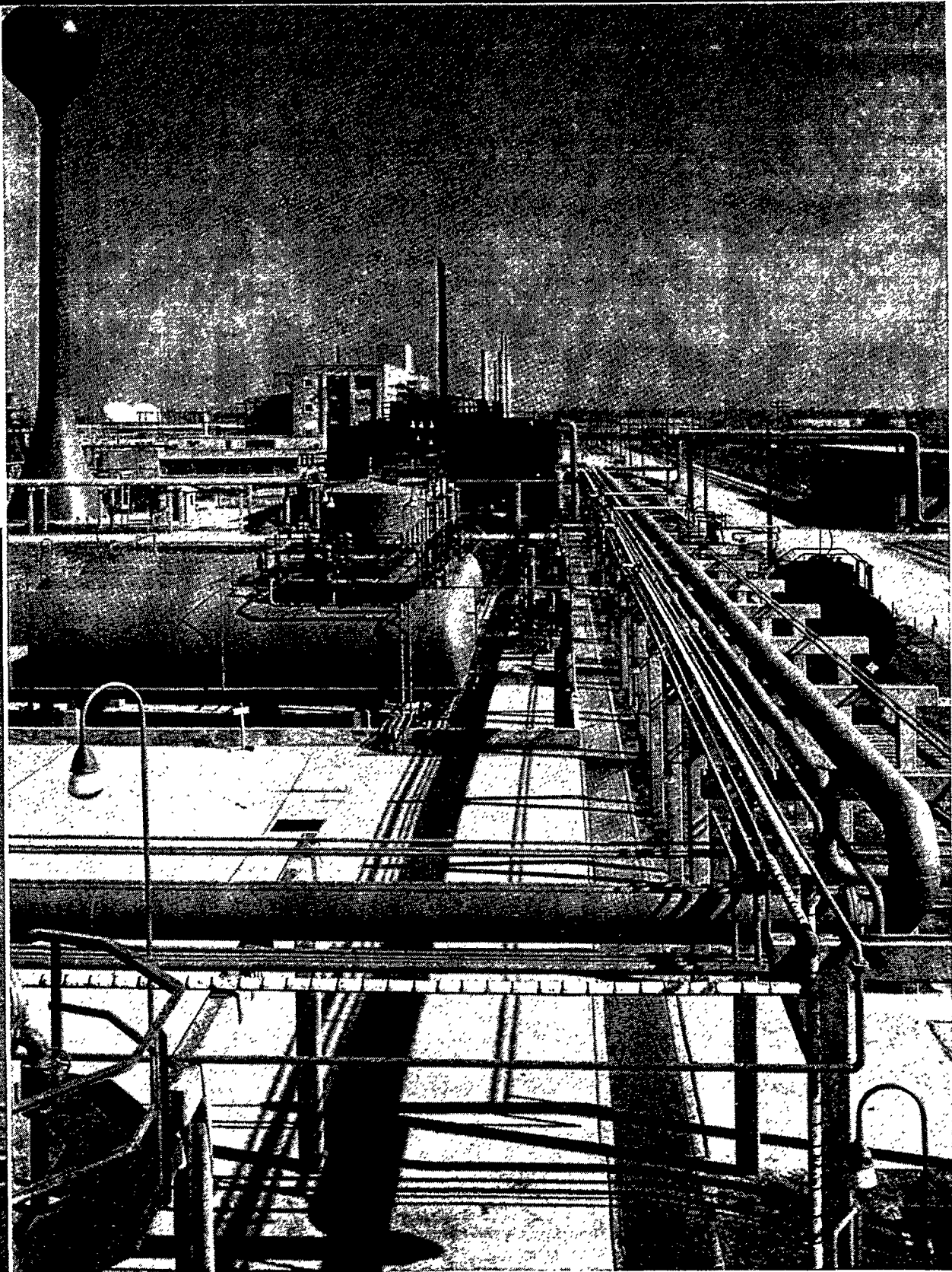
**RECOVERY AND PURIFICATION** During the processing of tetraethyl lead, some of the ethyl chloride remains unreacted. The residue is recovered by separation and condensation. The condensers are cooled by refrigeration. Purification follows by fractionation.



# *Nitrogen Production*

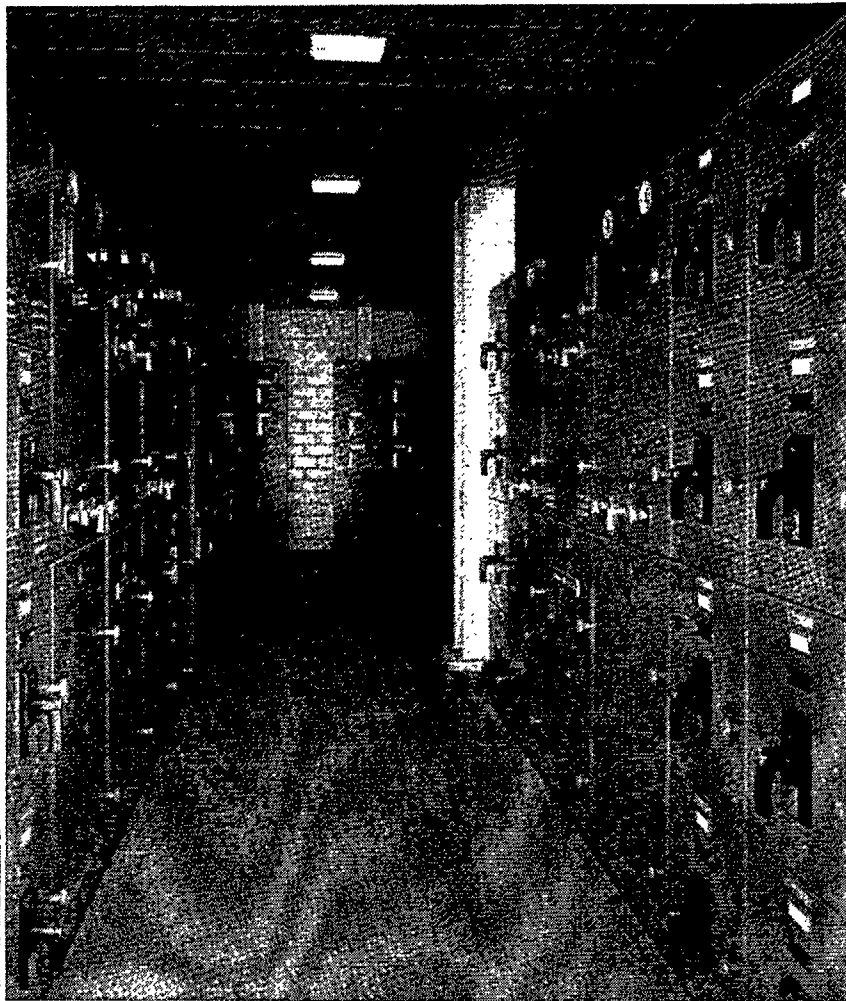
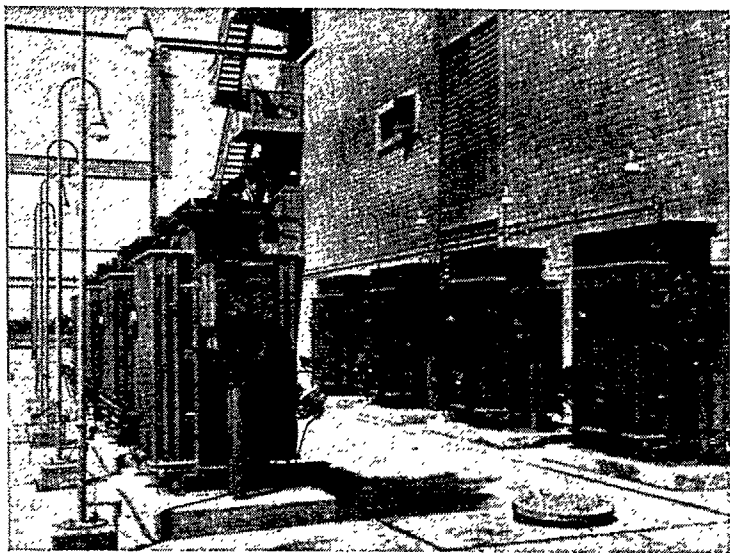
**GAS RECOVERY** Nitrogen is recovered from the resulting gases after the combustion of controlled amounts of hydrogen and air. The facilities for the purification and storage of nitrogen are shown below. The nitrogen is used in the alloying-operations for blanketing and for displacement.



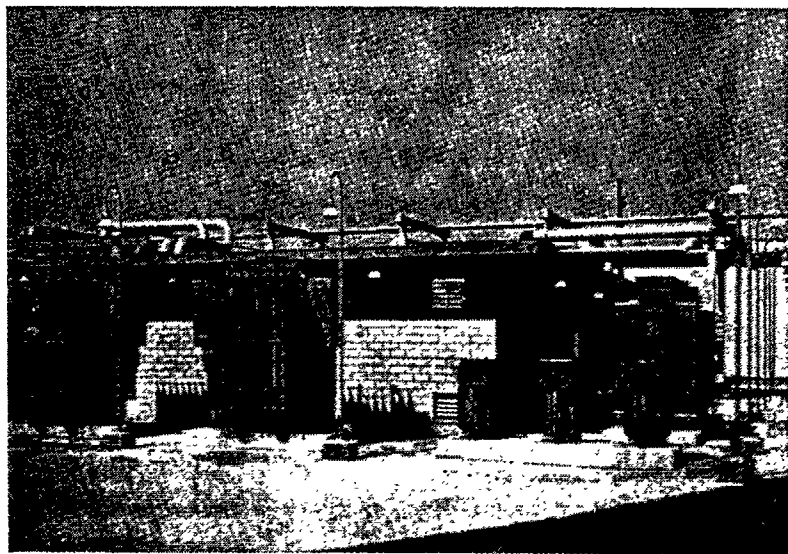


**ACCESSIBILITY** The various units are well-spaced and are arranged for convenient maintenance. Roadways and access-areas are carefully laid out with suitable clearances for upkeep-work within the units.

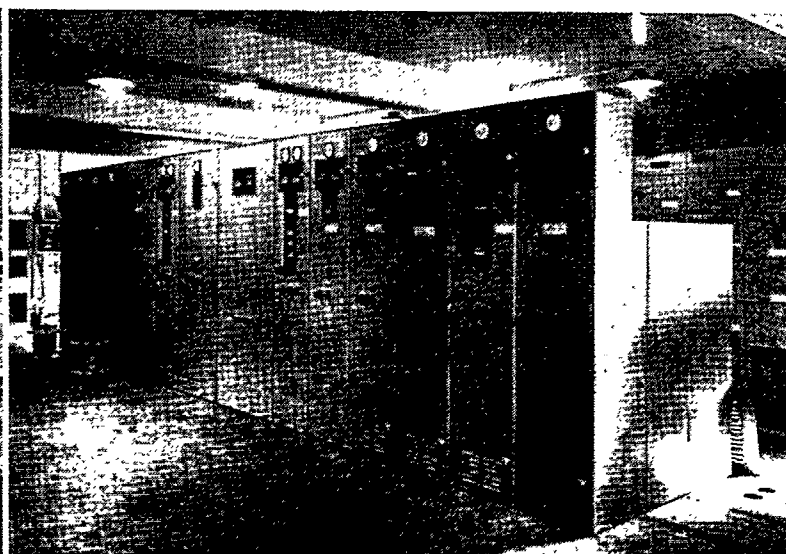
Four double-end transformer-banks



One of four switchrooms in TEL Building



Substation 2, with vault below grade



Switchgear inside Substation 2



# *Electrical Systems*

**THE HIGHLIGHTS** Eight substations, located at load-centers, serve the various process- and utility-areas. Primary energy is delivered at 13,800 volts. The substations deliver secondary power at three levels, 2400 volts, 480 volts, 120 volts. Switchgear is drawout-type, totally enclosed. Distribution is largely underground with suitable tunnels and access-vaults at substations.

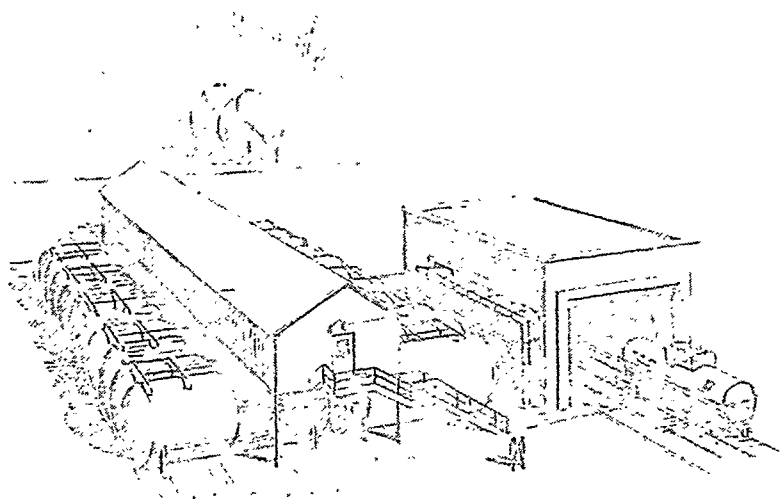


Electrical distribution, fifty miles of conduit and three hundred miles of conductor





Sodium-storage facilities. Molten sodium is moved by vacuum-eduction and nitrogen-displacement.

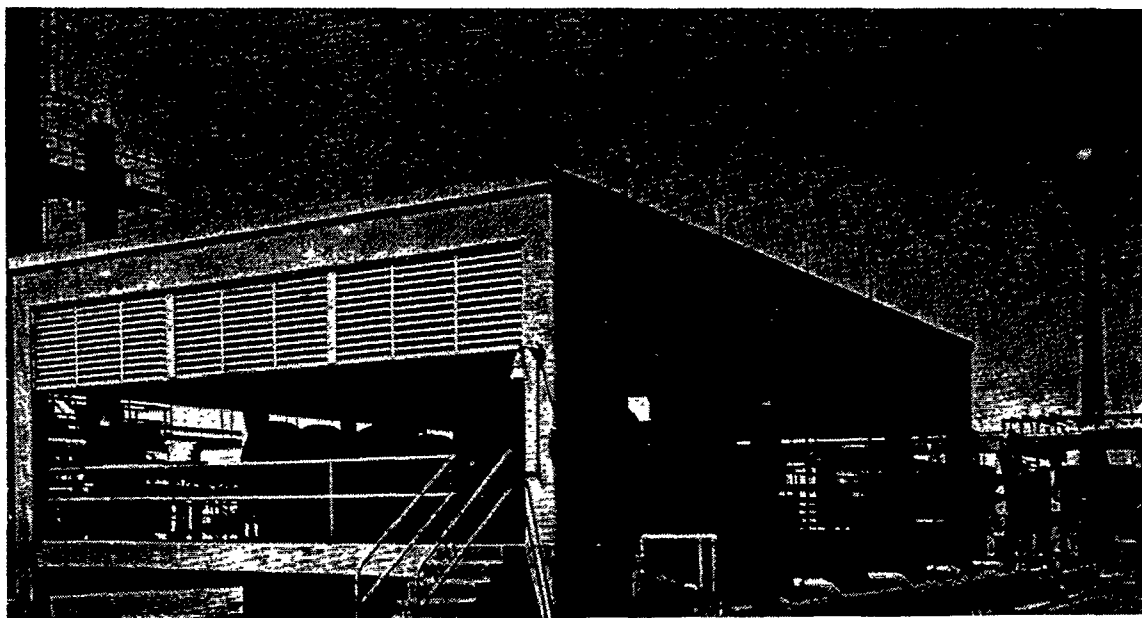


# *Auxiliaries*

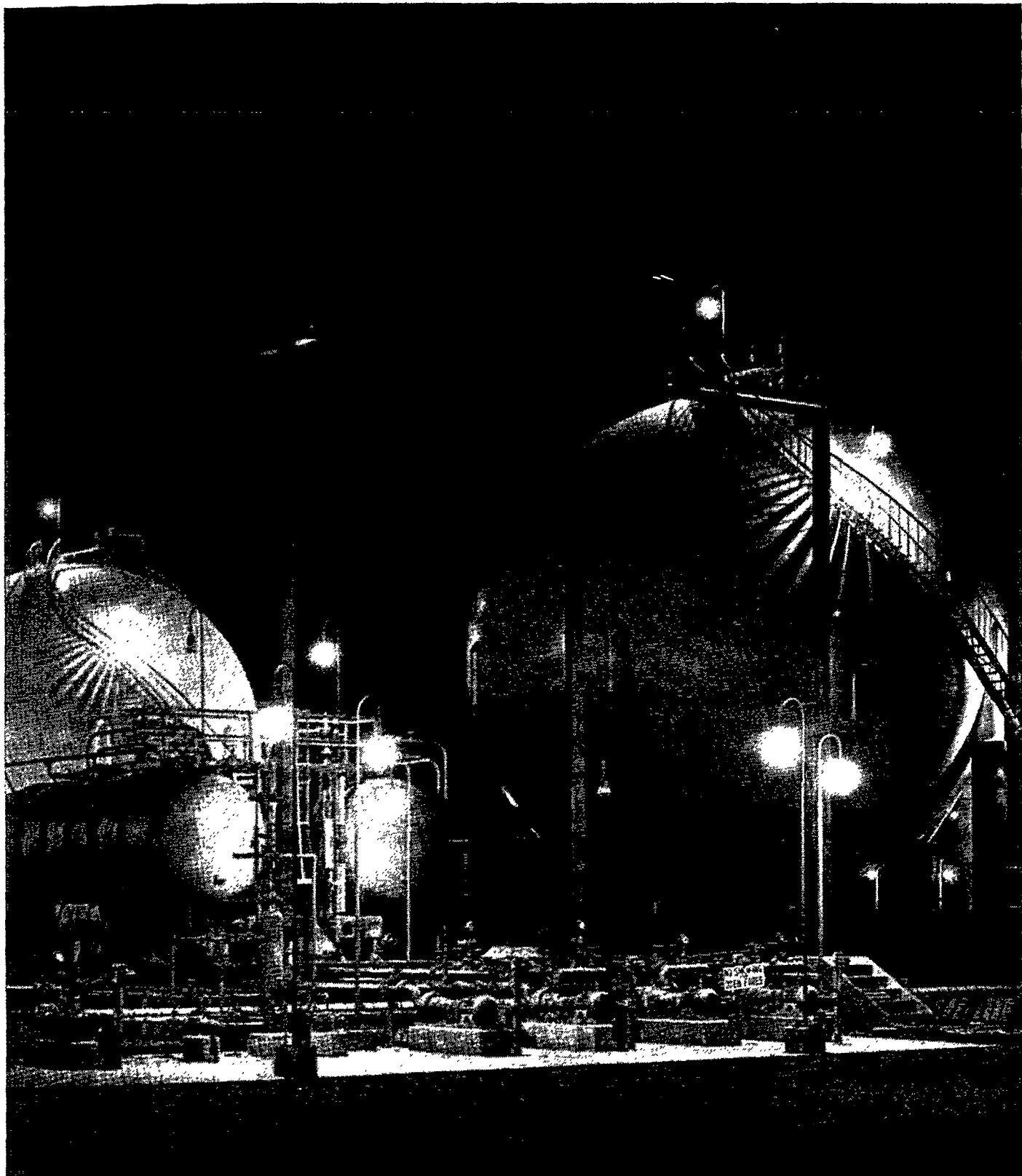
**STAR PERFORMERS** The starring roles in the production of "Ethyl" fluid are carried by the seven main process-units introduced in the preceding pages. But the success of the whole performance depends inseparably on the supporting cast. There are literally scores of supplementary process-units and auxiliary systems.

**SUPPORTING CAST** There are process-units for polymer-hydrolysis, for carbon-dioxide removal, for Dowtherm-heating, for dehydration, refrigeration, decontamination, for sludge-treatment. There are scores of systems for distribution, collection, protection, storage, and disposal. All of these facilities — primaries and secondaries like — were designed and built by Braun, all on the same construction-program.

**STAGING** To prepare the plantsite, six hundred thousand yards of earth were moved and compacted in 60 days — all done by Braun forces. Over two hundred carloads of custom-built equipment and accessories were built by Braun at Alhambra. Hardly any subcontracting was involved — the work was done almost entirely by Braun's Construction Division.



Four steam-driven compressors for hydrogen chloride



ONE RESPONSIBILITY ... The engineering, the design, and the construction, were done by Braun with undivided responsibility. Full completion was accomplished two months ahead of schedule. Final cost was substantially lower than the project-budget.