PORTLAND CEMENT ASSOCIATION
RESEARCH AND DEVELOPMENT LABORATORIES

RESEARCH DEPARTMENT
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April 1965

Presented at Fall Meeting of the General Technical Committee,
Portland Cement Association, at New York, N.Y.,
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5420 Old Orchard Road
Skokie, Illinois

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DESCRIPTION OF NEW ALPHA PLANT

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Alpha Portland Cement Company's new 3,000,000-bbl wet-process plant was designed to replace the Catskill dry-process plant and the Martins Creek, Pa., dry-process plant. It is located along the Hudson River, approximately 100 miles north of New York City, and is situated on a site adjacent to the Catskill plant. The only portion of the present plant still utilized is the Quarrying and Crushing Department and the cement storage silos. The cement storage silos at Martins Creek will also be retained for use as part of a distribution terminal.

All operations connected with raw material withdrawal from stockpiles, tertiary crushing, raw grinding, homogenizing, burning, finish grinding and cement conveying, are operated from a Central Control System. Additional control systems are utilized for stockpiling of limestone, cement handling, and packing and loading.

QUARRYING AND CRUSHING

New quarry faces have been developed to supply the added demand for raw material. The Becraft limestone and associated limestone formations without any shale or clay are used for the production of dark-colored cements. The Manlius limestone and associated formations are used for the production of light-colored cement with the addition of shale. Rock is selectively quarried, based on previous chemical information determined by the plant geologist and plant chemist.

The Becraft limestone is loaded by two 2-1/2 cubic yard Marion shovels and Manlius stone is loaded by a Caterpillar No. 988 front-end loader. Three Euclid 18-ton rear-

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dump trucks are used for hauling to the primary crusher. A 5x19-ft Pioneer apron feeder transfers the rock from the hopper to a 48x60-in. Traylor jaw crusher. Crushed rock is discharged onto a 42-in. belt conveyor which feeds a pair of 5x14-ft double-deck Ty-Rock screens. Over-sized rock from the screens is returned to the crusher building where it is fed to a 400-hp Williams reversible impactor. The impactor product joins the primary crusher discharge and is carried back to the screening plant. Minus-2 inch rock is conveyed to the main plant, approximately one mile away, by an overland Hewitt-Robins belt conveyor. At the plant site the rock is discharged to a reversible Link-Belt shuttle conveyor which stockpiles the material according to chemical composition, over a reclaiming tunnel. Coal and shale are stockpiled and use the same withdrawal system.

Limestone and shale are withdrawn from the stockpile by means of Syntron vibrating feeders and fed onto a 1,230-ft long belt conveyor which discharges onto a Hammermills reversible wobbler feeder. The over-size of the wobbler feeder is crushed in a 500-hp reversible impactor, and the minus-3/8 inch crushed material discharges onto an inclined belt conveyor which feeds a reversible shuttle belt located above the storage silos.

When the level in the selected silo reaches the upper Bin-Dicator, the feeder under the stockpile will shut off, and after an automatic time-controlled purge delay, all equipment interlocked in the programming sequence is shutdown automatically.

RAW GRINDING

The raw materials are withdrawn individually from the storage silos by a combination of five Jeffrey Waytrols. The feed rates required from the individual feeders are set by the operator in per cent of the total dry-material feed, as given by the mix control computer. The total feed rate to the raw mill is controlled by a Milltronics Sonic System.

The single 12x40-ft raw grinding mill was supplied by Allis-Chalmers with a 2,500-hp Twinducer drive. The mill has two compartments and is charged with 470,000 lb of forged steel balls. The mill discharge is pumped by either of two 800-gpm Wilfley pumps to three Tyler Ty-Rocket screens equipped with 50-mesh screen cloth. The over-size returns by gravity to the feed end of the mill and the (under-sized) slurry is pumped to storage.

Water feed control is achieved in three steps: (1) about 95 per cent of the total water needed is ratioed automatically to the total weight of solid materials; (2) an Ohmart density gauge in the mill discharge line keeps the moisture content within ±3 per cent of the required water; and (3) a second density gauge installed in the line to the slurry basin, controls the fine adjustment with "trim water" added ahead of the slurry pump.

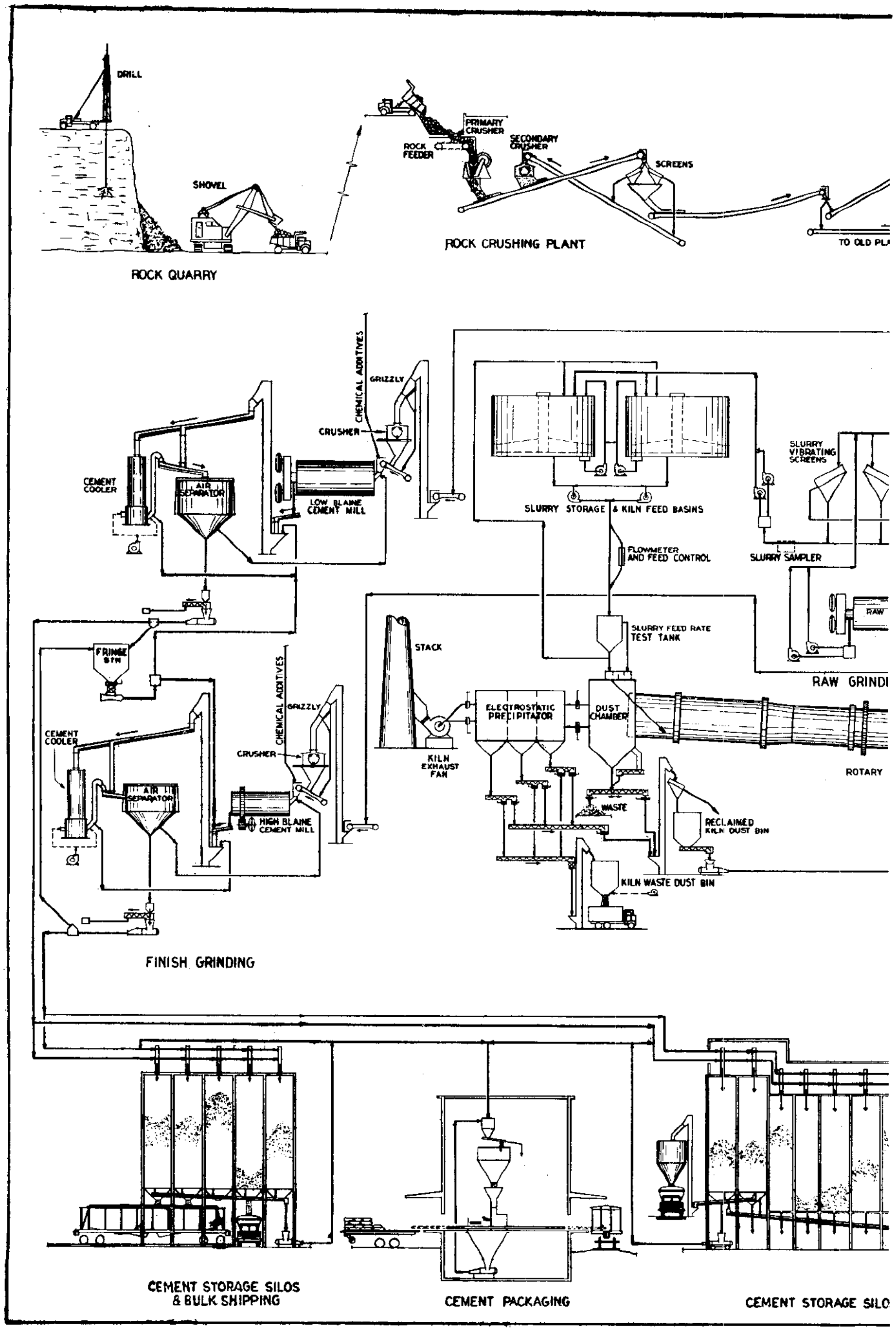
Finished slurry is stored in two slurry homogenizing basins each having a diameter of 85 ft and a height of 44 ft. Either of the basins, each holding a supply of approximately three days' kiln feed, can be used to feed the kiln.

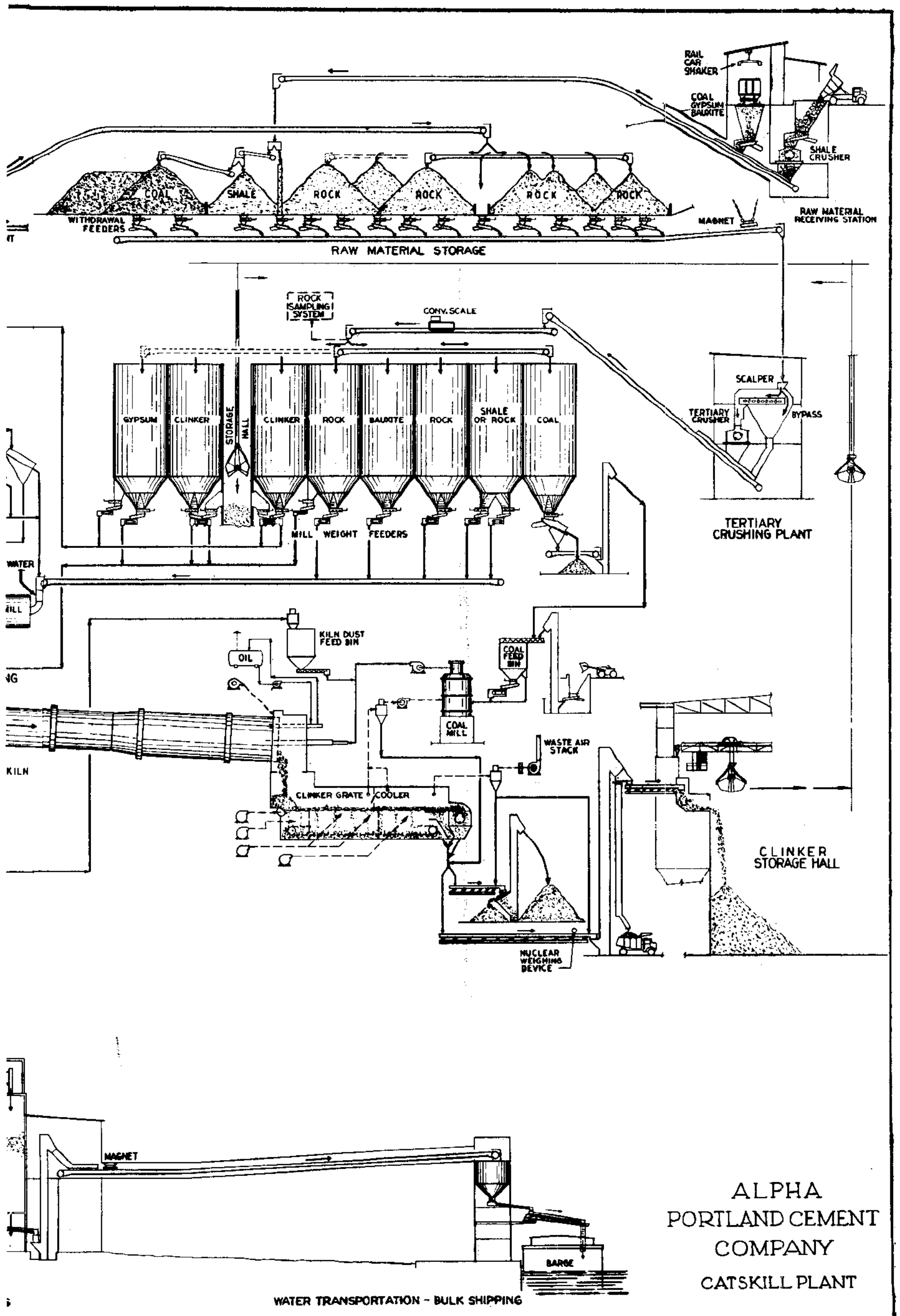
CLINKER BURNING

The 510-ft long rotary kiln was manufactured by Allis-Chalmers, is dumb-bell shaped, measures 17 ft 6 in. by 15 ft 6 in. by 17 ft 0 in., and is driven by two 300-hp motors. The kiln is equipped with a 91-ft long high-density chain section, consisting of an intricate combination of garland and curtain patterns. The chain is circular link and each of five zones are metallurgically designed for varying conditions of temperature and abrasion. The chain measures approximately 55,000 ft and weighs 214 tons.

The kiln is equipped with an electrostatic precipitator supplied by Western Precipitation Corporation. Most collected dust is pumped to a bin at the discharge end of the kiln, where it is metered into the burner pipe by a variable-speed screw for insufflation into the kiln. The dust feed rate is automatically adjusted by the burning-zone temperature.

Slurry feed rate to the kiln is controlled by a magnetic flow meter, which regulates a Clarkson valve on the discharge side of the kiln-feed slurry pump. A measuring tank ahead of the slurry inlet to the kiln permits a check of the actual feed rate at any time to within one-tenth of one per cent accuracy.


DRILL
SHOVEL
ROCK QUARRY
PRIMARY CRUSHER
ROCK FEEDER
SECONDARY CRUSHER
SCREENS
ROCK CRUSHING PLANT
TO OLD PL
CHEMICAL ADDITIVES
GRIZZLY
CRUSHER
CEMENT COOLER
AIR SEPARATOR
LOW BLAINE CEMENT MILL
SLURRY STORAGE & KILN FEED BASINS
SLURRY VIBRATING SCREENS
FLOWMETER AND FEED CONTROL
SLURRY SAMPLER
FRINGE BIN
STACK
SLURRY FEED RATE TEST TANK
RAW
RAW GRINDI
CHEMICAL ADDITIVES
GRIZZLY
CRUSHER
CEMENT COOLER
AIR SEPARATOR
HIGH BLAINE CEMENT MILL
KILN EXHAUST FAN
ELECTROSTATIC PRECIPITATOR
DUST CHAMBER
ROTARY
WASTE
RECLAIMED KILN DUST BIN
KILN WASTE DUST BIN
FINISH GRINDING
CEMENT STORAGE SILOS & BULK SHIPPING
CEMENT PACKAGING
CEMENT STORAGE SILO



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A Raymond bowl mill coal pulverizer with a 250-hp variable-speed primary air fan is used to fire the kiln. Primary air is withdrawn partly from the first and mainly from the second clinker cooler overgrate compartments. A Jeffrey Waytrol unit is used to feed the coal mill, and the feed rate is controlled automatically by the gas temperature in the calcining zone of the kiln. Pulverized fuel is blown into the kiln through a telescopic burner pipe, which has motorized control of pipe rotation and axial movement in order to permit even wear and to control flame-shape and position.

CLINKER COOLING

The kiln discharges clinker into an 11-ft 2-in. by 64-ft F. L. Smidth Folax cooler. The area underneath the cooler grate is split into seven compartments. A high-pressure fan supplies air to the "quench" undergrate compartment to assure fast initial cooling. A second fan supplies air to the first full-sized compartment. The pressure in this compartment controls the cooler bed speed. The next two compartments are supplied with air by a third fan through two separate ducts. The inlet damper to this fan is automatically adjusted by the draft in the kiln hood in order to keep it at a given set point. The remaining three compartments are supplied by a fourth fan. The area above the cooler grate is divided into two compartments. Clinker leaving the cooler is conveyed by a series of vibrating conveyors, and elevators to the clinker storage hall, where it is handled by a P & H overhead crane with a four-yard bucket.

FINISH GRINDING

The Finish Grinding Department is divided into two separate systems: (1) for grinding cement at normal Type I fineness; and (2) for primarily grinding cements of higher fineness, such as Masonry and Hi-Early Strength cements.

Clinker and gypsum are withdrawn separately from storage by means of Jeffrey Waytrols and conveyed by separate belt conveyors and elevators to preliminary Hammermills impactors. The impactor discharge is fed to the mills by a belt conveyor.

The feed rates required from the separate feeders are set by the operator in per cent of the total of all materials equalling 100 per cent. The total feed rate is controlled by a Milltronics Sonic System.

The Lo-Blaine mill is the larger of the two mills. It is an Allis-Chalmers, two compartment, 12x36-ft mill driven by a 2,500-hp Twinducer drive and is charged with 425,000 lb of forged steel grinding balls. The Hi-Blaine mill is an Allis-Chalmers, two compartment, 10x35-ft mill driven by a conventional gear and pinion connected to a 1,500-hp motor. This mill is charged with 263,500 lb of grinding balls.

The discharge from each mill is conveyed by means of Fuller-Huron Airslides and Chain-Belt elevators to two Fuller-McEntee cement coolers. The larger cooler is 8 ft in diameter and 16 ft high, and the cooler for the smaller mill is 6 ft 6 in. in diameter and 14 ft high. An automatic control system adjusts the water flow through the cement coolers in order to keep the temperature of material leaving the cooler close to the adjustable temperature set point. After cooling, the material is transported by Airslides to the air separators.

The Lo-Blaine System has an 18-ft, 300-hp, Sturtevant separator and a remotely-operated hydraulic adjustment of the valves to control fineness. The Hi-Blaine System has an 18-ft Fuller-Heyd separator. The main fan is driven by a 150-hp motor, and the auxiliary fan is driven by a 50-hp remote rheostat-controlled variable-speed drive. Varying the speed of the auxiliary fan on the Fuller-Heyd separator permits a fineness adjustment from 2,000 to 5,500 Blaine, while the separator is in operation. This Fuller-Heyd separator is the first separator of its type to be installed in the United States of America.

Separator tailings are returned to the feed end of the mill and the finished cement is returned directly to individual Fuller pumps. Each pump has a cement line to the silos or to a common fringe bin, which is used to receive cement when changing types in order to prevent contamination.

CEMENT STORAGE

As previously mentioned, the cement storage silos in the old Catskill plant have been retained for the new plant. The inlet lines and valves and the withdrawal systems were remodeled to accommodate the demands of increased production and remote-controlled operation.

BARGE LOADING

A new barge loading installation enables the plant to withdraw and load cement at a rate of 2,500 bbl per hour. A new pack house was also constructed and incorporates three four-tube St. Regis packing machines, one of which is used exclusively for Masonry cement. The pack house has a storage area for palletized sacks of cement.

QUALITY CONTROL

Some special features of this plant are the facilities available to perform routine quality control. These include automatic sampling systems, an X-ray analyzer, and an analog mix control computer.

When limestone or shale is fed to a mill-feed silo, a sample is automatically and continuously collected and prepared for analysis. The system dries and grinds the sample, divides it and automatically delivers a small portion to the sample room in the Control Laboratory.

The control operator's assistant prepares a pellet for analysis for five chemical elements by a Norelco simultaneous X-ray spectrograph. In approximately six minutes, the five-element analysis of the sample is available, as determined from the total number of impulses counted for each element in 100 seconds. By using these values in terms of counts per second, the oxide analysis is obtained from previously established curves (eventually to be used as tables). This five-oxide analysis on the raw mix (unignited) is manually inserted into the Electronics analog computer. At the same time, the desired potential compound composition is inserted into the computer, along with acceptable limits of error. The computer then supplies the settings required for the raw material feeders.

Another automatic sampling system continuously collects a sample of slurry being pumped to the kiln feed basin. The sample is dried, prepared in a pellet form, and then presented to the X-ray spectrograph for analysis of five elements. The analytical results converted to the usual oxide forms are inserted into the computer. The potential clinker compounds which would have resulted from burning the slurry are calculated. The computer then displays any adjustment required in the feed rate settings for the raw materials.

The X-ray spectrograph can also be used for the analysis of quarry samples and clinker or cement samples by using an auxiliary analytical channel which is provided in the instrument.

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