M-138

Sugar Creek Plant of Missouri Portland Cement Company

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December 1955

PORTLAND CEMENT ASSOCIATION
Research and Development Division

33 West Grand Ave. Chicago 10, Ill.

Presented at Regional Fall Meeting

GENERAL TECHNICAL COMMITTEE

PORTLAND CEMENT ASSOCIATION

Sept. 26-28, 1955, Kansas City
and St. Louis, Missouri

SUGAR CREEK PLANT OF MISSOURI PORTLAND CEMENT COMPANY

By

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The design of a new cement plant usually combines new models of equipment with the latest thoughts and practices. The success of the design depends in a large measure on how well these new things are applied to the local situation. It is my purpose to show how the new things are applied to the Sugar Creek situation.

Our old dry-process plant is located on a narrow shelf, half way up a bluff, overlooking the Missouri River. The packing department is located below the plant, across the main line of the Santa Fe Railroad, with the river a few hundred yards beyond. Directly behind the plant are entrances to a mine which supplies limestone and shale.

Following World War II, the old plant was of such an age and state of repair that operating and maintenance costs were increasing and production efficiency was declining. Since sufficient raw material reserves were available, it was decided to build a new plant at the same location which would:

1. Have low operating and maintenance costs resulting from the use of modem equipment.

2. Reduce man power requirements by means of an efficient plant layout and labor saving devices.

3. Improve the uniformity and quality of cement by means of instrumentation and modem controls.

A long narrow construction site was obtained by removing a portion of the high bluff behind the old plant. The plant layout which suited this site can best be described as a straight line from start to finish, folded in half, so that start and finish are side by side.

The dry process was adopted for the new plant for three reasons:

1. Fuel economy.

2. Our raw materials are uniform in composition and low in moisture.

3. Modem proportioning and blending equipment can produce a satisfactory feed for a long kiln.

The crushing system consists of a jaw crusher and impactor in closed circuit with a vibrating screen. Our mine-run rock is much finer than

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most quarried rock; however, the shale has a tendency to break in relatively large slabs only a few inches thick. To prevent these slabs from falling thru the jaw crusher and plugging the conveying system, the jaw crusher is equipped with deep corrugated breaker plates. All units of the crushing system are adjusted to obtain a fine, sized raw mill feed. Belt conveyors move the rock between crushing units and to the raw storage.

The raw storage consists of two rows of silos, one row for rock and iron ore; the other row for limestone, clinker, and gypsum. All silos are filled by belt conveyor and materials are withdrawn from the bottom.

Silo storage was selected because:

1. The crushed rock is relatively free flowing, making it possible to remove the rock from the bottom of the silos and eliminate expensive handling equipment such as an overhead crane.

2. The capacity of the silos was sufficient for our purpose.

It was decided that a capacity sufficient to last through a long weekend would suffice because:

1. Weather does not interfere with our rock production. Inside the mine we have perpetual fall. It is cool and dry. There are no icy winters, no wet springs, no hot summers.

2. The short outdoor haul from mine portal to crusher is level, solid rock which is easily maintained during adverse weather conditions.

3. Mined-out areas in the mine provide excellent storage for crushed rock stockpile for use in case of crusher breakdown. These mined-out areas are also excellent for clinker storage.

Below each raw silo is a weighing feeder which discharges to a belt conveyor which feeds two raw grinding systems. The feed is delivered alternately to each system by means of a timer and motorized flap gate arrangement.

A combined dry and grind system was selected because:

1. The cost of a dryer and its operation can be eliminated.

2. The moisture content of our rock is so low that removal does not require too much heat, making such a system practical.

3. The intimate contact of solids and gases in the dry and grind process make it very efficient.

Each raw grinding system consists of a single compartment mill in closed circuit with an air separator. Furnaces provide hot drying air which is passed through the separator and then through a dust collector. The new feed is mixed with the mill product ahead of the air separator. The separator rejects enter the mill through a chute and the separator fines from each system are combined and pumped to blending silos.

The blending silos are located near the feed end of the kiln. Silos of mix are homogenized with air agitation and tested. Corrections are prepared by the raw mills as required. Facilities are available for transferring from one silo to another and for blending, so as to insure a satisfactory kiln feed.

Kiln feed is transferred to a kiln feed tank equipped with high and low level indicators which automatically control the rate of transfer. An excess of material is withdrawn from the kiln feed tank and delivered to a feed screw which controls the kiln feed rate. The excess material returns to the kiln feed tank.

The kiln is 11 ft 3 in. in diameter by 350 ft long straight section, lined with basic hot zone followed by alumina brick. The last half is lined with insulating brick. It is equipped with various instruments and controllers mounted in a panel on the burner floor. Gas is burned except for about four months winter interruption of gas service, when coal is burned. The coal is prepared in a unit bowl mill fed by a weighing feeder, the speed of which is controlled from the instrument panel. Except for a slightly longer delay in response to a change, coal firing is as flexible as gas firing.

The flue-gas duct at the feed end of the kiln is equipped with automatic tempering air dampers to protect a multicone dust collector and a draft fan from high temperatures. We have recently been experimenting with the addition of water sprays in the flue gases to reduce the quantity of tempering air, so that the draft fan can draw more air through the kiln for increased combustion and production.

Hot clinkers discharge into an inclined-grate cooler, equipped with a hammer mill for breaking chunks and throwing hot pieces back up the cooler for additional cooling.

The cooled clinker is sized by a roll crusher and carried by belt conveyor to the clinker storage silos.

Weighing feeders under the clinker and gypsum silos proportion onto a belt which feeds the finish grind system.

A combined cool and grind system was adopted because:

1. Cool cement can be obtained without the expense of special equipment.

2. Since cool clinker is fed to the system the amount of heat removal required is not excessive.

3. The intimate solids-cool air contact obtained with this system makes it very efficient.

The finish system consists of a two-compartment mill in closed circuit with an air separator. Cooling air is drawn through the air separator, then through a dust collector. The proportioned clinker and gypsum are combined with the separator rejects and enter the mill through a chute. The separator fines, or finished cement, are pumped to cement storage silos.