CEMENT & LIME MANUFACTURE

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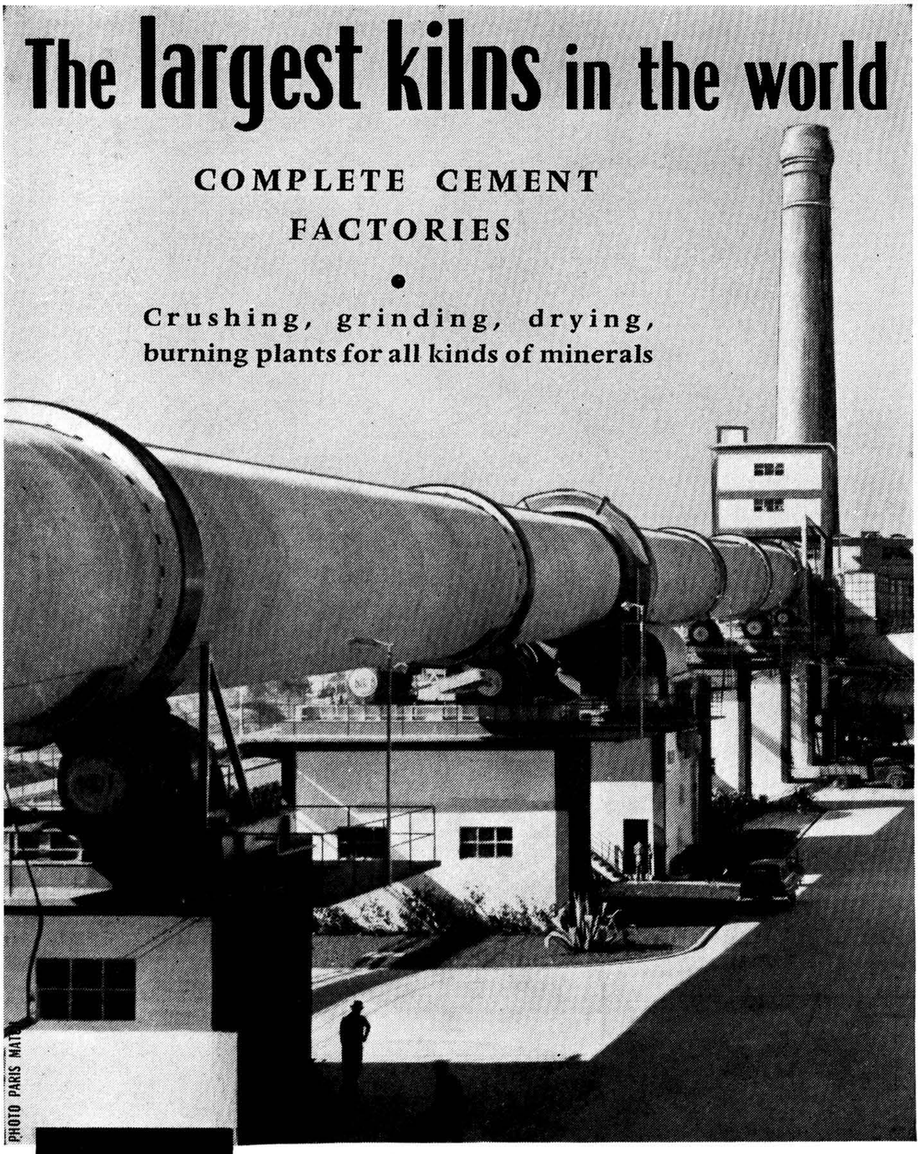

Alhandra cement factory (Portugal). View of the kiln (167.5 m x 4.8/5.3 m - 1600 T/day)

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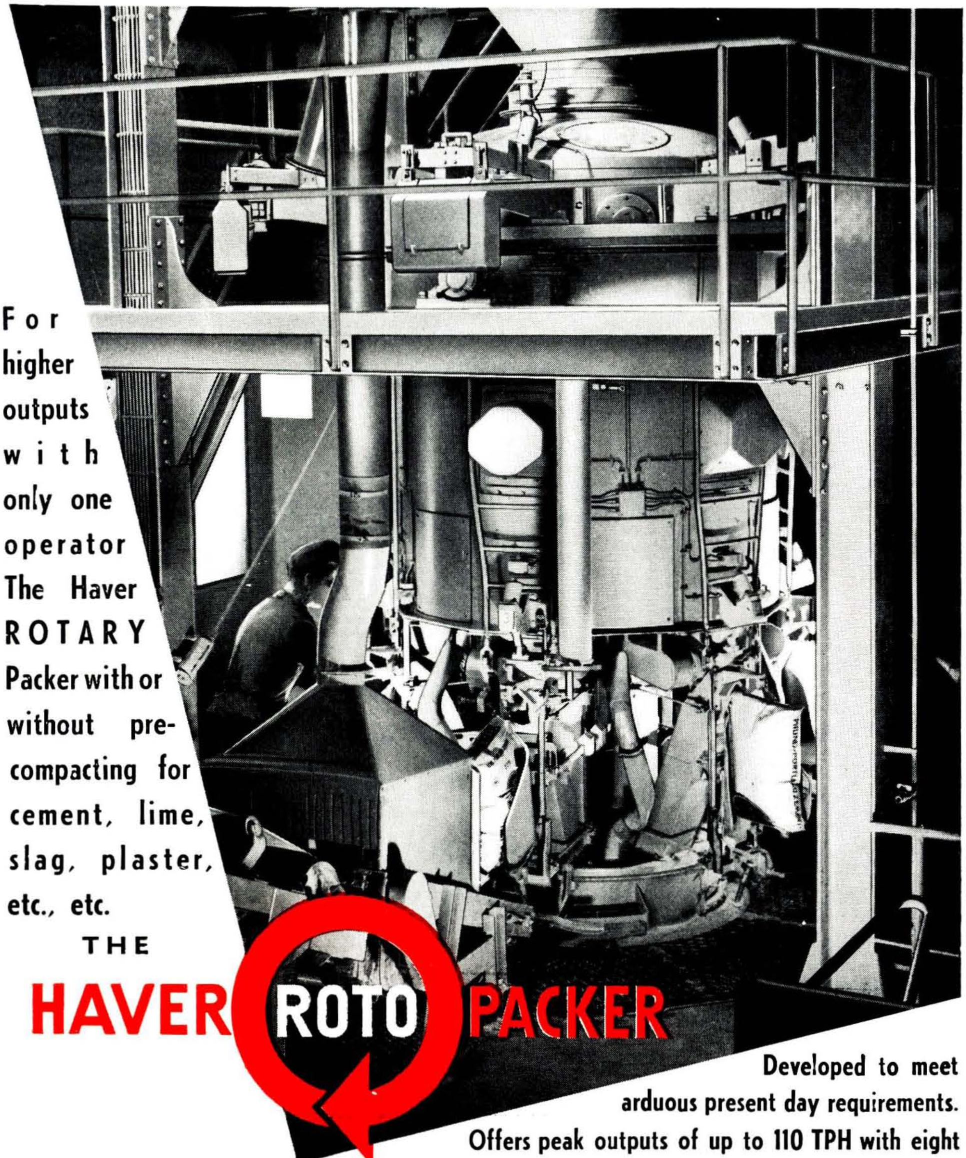

CEMENT AND LIME MANUFACTURE

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The New Cement Works at Westbury.—II*

IN the preceding article, the preparation of the raw materials and slurry, and the burning and cooling plant were described. An aerial view of the completed plant and the chalk quarry is given in *Fig.* 20 on page 70.

Instrumentation and Kiln Control.

The instruments for recording, indicating and controlling the 450-ft. kiln are grouped in the control panel partly seen in the view of the firing end of the kiln in *Fig.* 12. The instrumentation was supplied by Honeywell Controls Ltd., and designed in collaboration with The Associated Portland Cement Manufacturers Ltd.

Manual and automatic controls for operating the kiln are on this panel (*Fig.* 13) on the firing floor. Combustion is controlled automatically from the air-flow

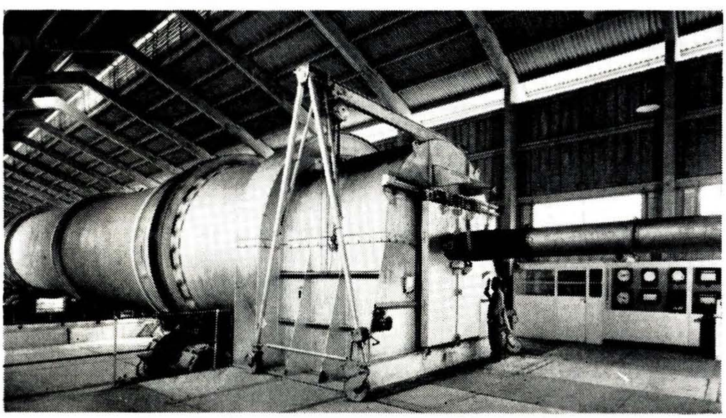


Fig. 12.—Firing End of 450-ft. Kiln.

* Continued from May, 1963.

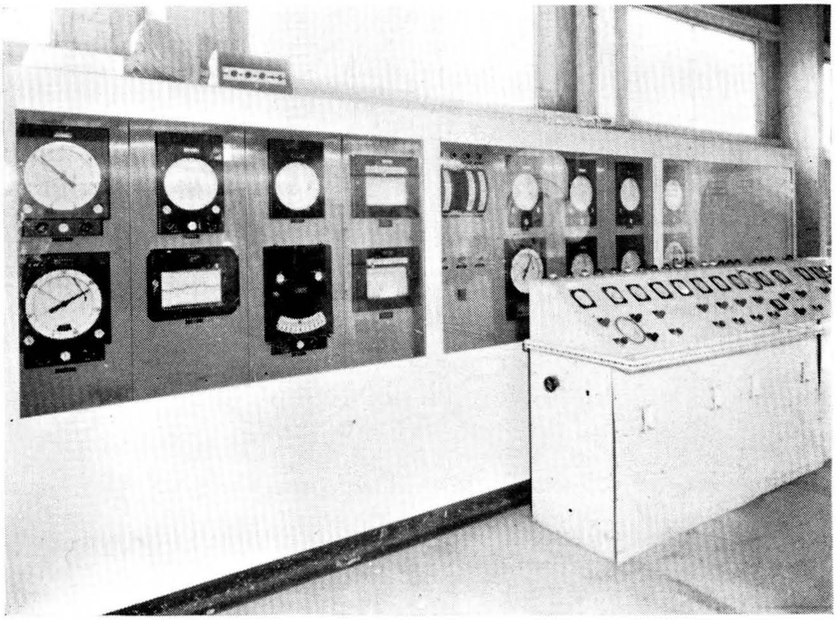


Fig. 13.—Kiln Control Panel.

to the kiln. Meters which summate the flows through the cooler fans, control the coal feeder to give the desired ratio of coal to air. The induced-draught damper is controlled to give constant pressure in the firing hood.

Some details of the instrumentation are as follows. Strip chart recorders measure the temperatures of the air at various positions. Also measured are the temperatures at the grate and kiln exit. The secondary air temperature is measured and controlled to modulate the grate speed, and the temperature of the combustion air is also measured and controlled. Effective control of the pressure is important to prevent the temperature gradient within the kiln shifting the burning zone to cause uneven heating of the product. The pressure is automatically maintained by operating the induced-draught louvre damper. Other pressures recorded or indicated include the back-end draught and the pressure within the cooler. The several air inputs are measured and controlled and relevant flows are transmitted to the summator. A master air-flow controller maintains the total of combustion air at a pre-determined value by remote adjustment of the main cold air-flow controller. This signal is also used to control the flow of pulverised fuel to the kiln-burner pipe. An additional refinement is that the fuel-air ratio is trimmed by reference to the oxygen content of the exit gases thus ensuring maximum efficiency of combustion.

When the burner desires to adjust the heat in the burning zone, so as to maintain proper burning of the clinker, he alters the air flow and the automatic

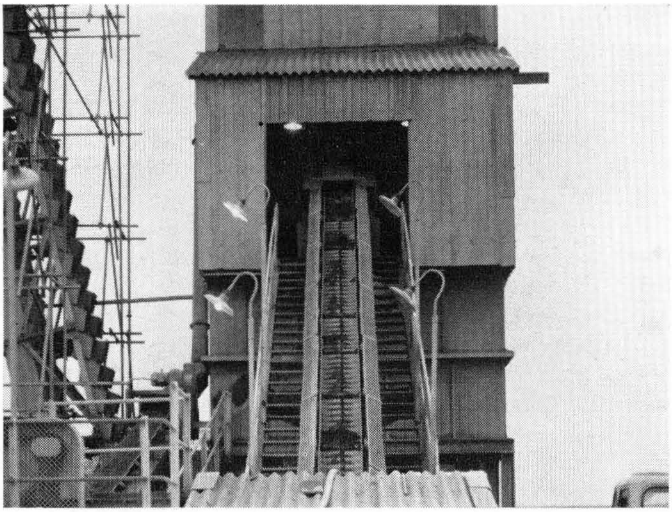


Fig. 14.—Clinker Elevator and Conveyor.

controllers make the appropriate alteration to the coal feed. The draught controller then alters the damper to keep the pressure in the hood unchanged.

Clinker Storage and Grinding.

The clinker is removed from the cooler by a drag-link conveyor which discharges into a Clarke-Chapman tray-conveyor (*Fig.* 14) 150 ft. long, in which the clinker is elevated and discharged into a transfer hopper at the base of the clinker storage silos. Two Locker vibrator feeders extract the clinker from this hopper; each feeds an inclined Bagshawe continuous bucket-elevator which discharges into a 15-in. Redler conveyor running along the top of the row of silos. The feeders and transfer points are ventilated through a Darnley-Taylor bag filter. Either of these conveyor systems can deal with the total output of the kiln.

There are four 1,000-ton welded steel silos arranged in a row. Each silo is 36 ft. in diameter and 64 ft. high. Three silos are provided for storage of clinker and one for gypsum.

Gypsum is delivered by road and tipped into a receiving hopper from which it can be removed at the rate of 40 tons per hour by conveyors discharging into the feed-chute of one of the clinker elevators for transference to the gypsum silo.

The main belts which take the clinker and gypsum from the silos to the cement mills are at ground level, one at each side of the row of silos. Each conveyor delivers directly into the feed chute of one of the two cement mills which are side by side (*Fig.* 17) at the western end of the silos. On both sides of each silo there is a variable-speed extractor-feeder of the belt type. The feeders on the three clinker silos discharge directly on to the main belts to the grinding mills.

At the gypsum silo, a Richardson belt weigher is interposed between each extractor and the main conveyor belts as shown in *Fig.* 16. Another Richardson belt weigher is provided in each conveyor just before it reaches the mill, and gives the combined weight of clinker and gypsum being fed into the mill. Each weigher is linked with the weigher-feeder at the gypsum silo by a Honeywell controller set to give the required ratio of clinker to gypsum. The mill feed is controlled manually by altering the speed of the clinker extractor-feeders, any change being followed up by the automatic control of the proportioning of the gypsum. The control panels are located in the mill control cabin seen in the background in *Fig.* 17 and in *Fig.* 15, which is a view of one mill looking towards the silos.

The two 1,200-h.p. cement mills and their drives are duplicates of the chalk wet-mill except that they have three chambers, with a lifting diaphragm between the first and second chambers, and are cooled by water spraying on the shell. They are equipped with drum feeders into which the chutes from the conveyors discharge. The mills work on open circuit. The discharge from the internal ventilation of each mill is purged through an electrostatic precipitator similar in design to, but smaller than, the units provided for the kiln gas.

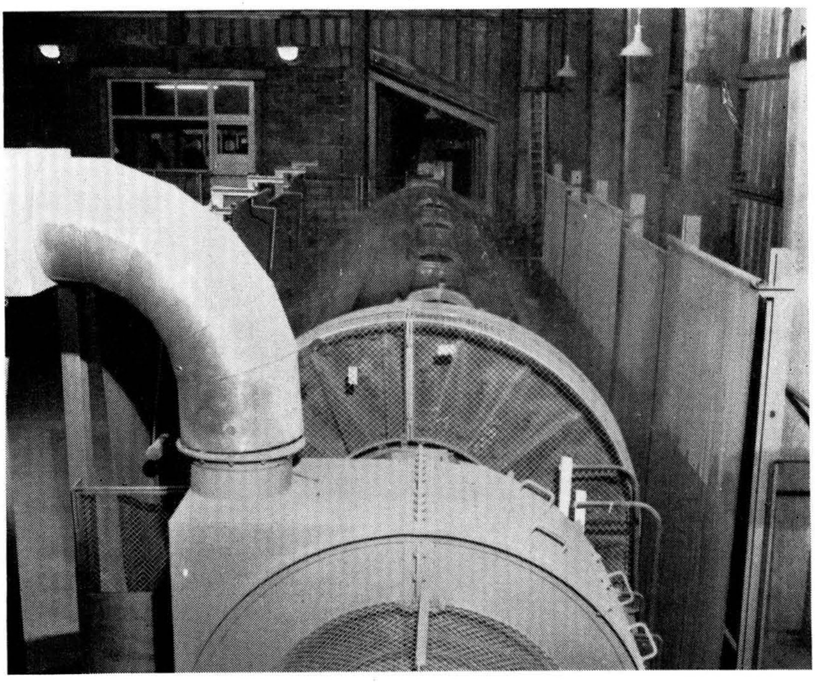


Fig. 15.—Discharge end of a Cement Mill.

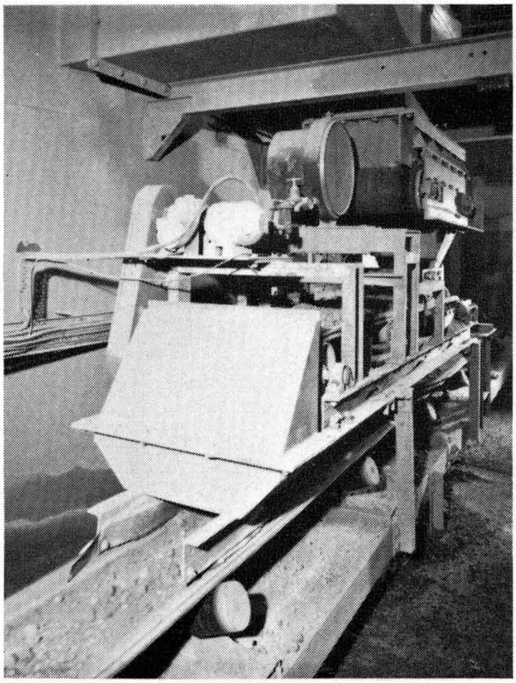


Fig. 16.

The cement from the outlet of each mill is passed through a Niagara screen to a Fuller-Kinyon pump, working on low-pressure air, which delivers it through a 6-in. pipe to the cement storage silos, where the air is released through hand-rapped bag filters on the top of the silos.

Cement Storage and Packing.

For the storage of the cement, there are four 2250-ton concrete silos, each 30 ft. in diameter and 90 ft. high, and arranged in pairs on each side of a 24-in. screw-conveyor into which cement is discharged by three " Airslides " in the flat bottom of each silo. The conveyor takes the cement to a Barry-Henry & Cook central discharge bucket-elevator from which a triple chute distributes it either directly to a twelve-spout Fluxo packer for filling paper bags or, by means of air conveyors, to two 250-ton hoppers for bulk loading for road transport or to two 40-ton hoppers for bulk loading for transport by rail. The filled bags are taken by conveyors from the packer to three retractable conveyors in the road-loading bay or to a turntable in the rail-loading bay, which is seen in *Fig.* 18. The bays beneath each of the 250-ton hoppers are equipped with platforms (*Fig.* 19)

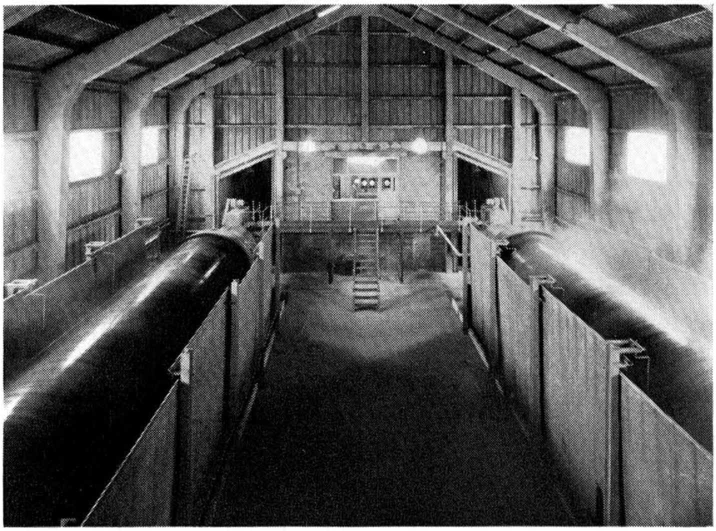


Fig. 17.—The Cement Mills.

mounted on load-cells which indicate sufficiently accurately, to prevent over-loading the vehicle, the weight of cement loaded. The packing plant is ventilated through a Darnley-Taylor automatic bag filter.

A 30-ton Avery road weighbridge and a 45-ton Avery rail weighbridge are provided.

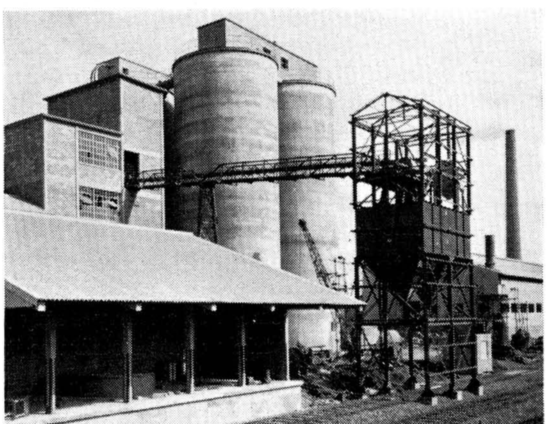
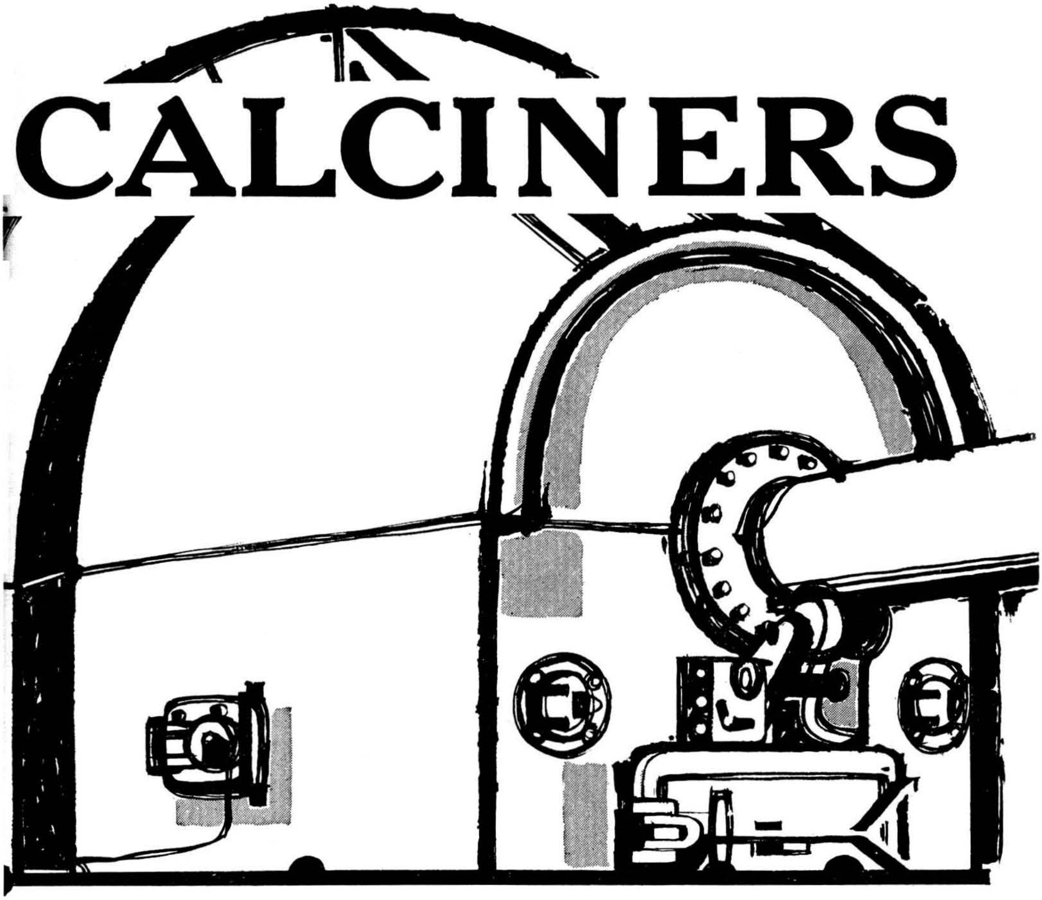
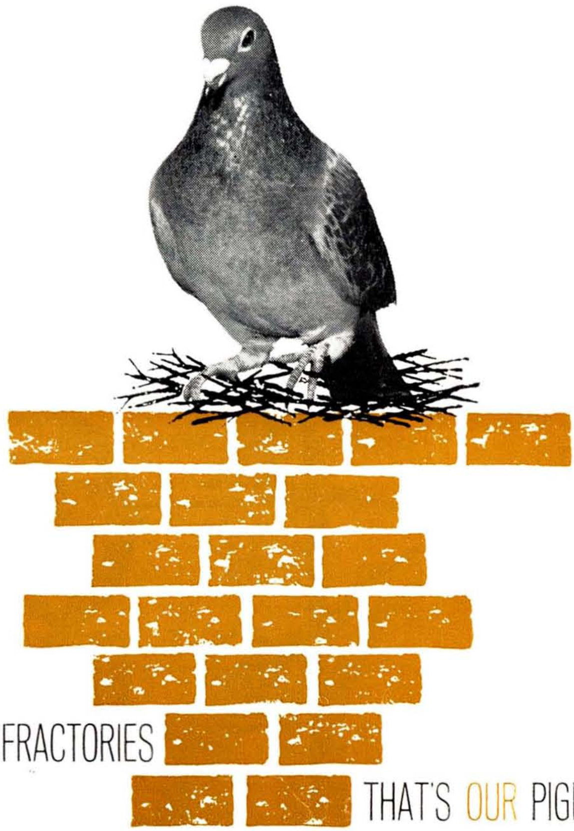


Fig. 18.—Rail-loading Bay and Bulk-loading Hoppers.

(*Continued on page 69.*)




david bryant



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Services and Structures.

The supply of water, except that for drinking and domestic purposes, is the effluent from the local authority sewage farm which is about 1 mile from the works. Up to 250,000 gallons are pumped to the works every 24 hours by two centrifugal pumps through a 5-in. pipe-line to the 30,000-gallon water tower seen in *Fig.* 6 (see page 44 of the May number), from which 10,000 gallons per hour are pumped by two pumps through a 4-in. pipe-line to the chalk quarry. The clay mill and all services at the works are fed by gravity. There is a 140,000-gallon storage pond to which water from the works services is returned together with storm water and the effluent from a small sewage plant at the works.

Two pumps, with floating suctions, pump 14,000 gallons per hour from the pond to the water tower. The pumps at the local authority sewage farm are controlled by the level of the water in the tank on the water tower.

The Southern Electricity Board have provided a substation at the western end of the approach road to the works, from which a supply is taken at 33 Kv. by underground cable to the works substation, in which there are two 4-m.v.a. 33/3·3 Kv. transformers. These provide a supply to the chalk excavator and the three mill motors. There are three 1000-k.v.a. 415-v. transformers for the remainder of the power requirements of the works. Electricity supply for lighting is fed at 110 v. from transformers situated in various sections of the works. The three mill motors

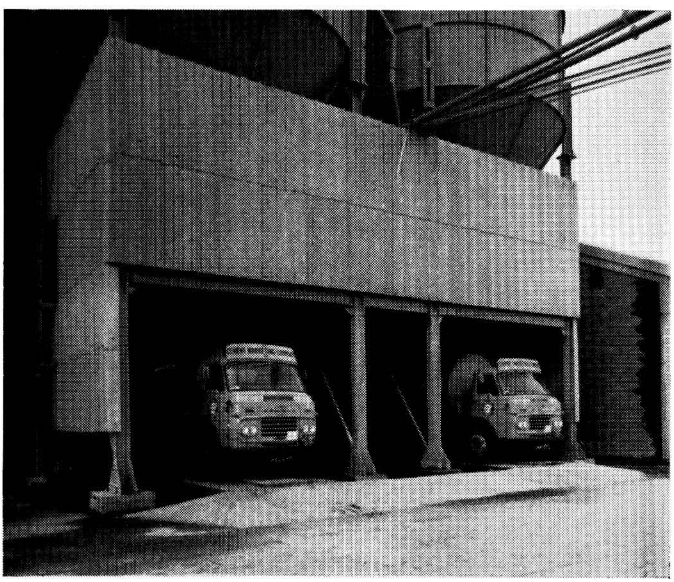


Fig. 19.—Road Bulk-loading Bay.

Fig. 20.—Aerial View of Works and Chalk Quarry.

work at a power-factor of 0·95 leading, which enables the works load-power-factor to be maintained as near unity as possible.

The garage, fitting shop, stores, cement mill building (*Fig.* 17) and the kiln building (*Fig.* 12) are constructed of precast concrete frames with corrugated asbestos-cement sheeted roofs. The walls are either corrugated asbestos-cement sheeting or lightweight concrete blocks. The main office, canteen and laboratory are of concrete block construction, with corrugated asbestos-cement sheeted roofs. The small auxiliary buildings, such as pump houses, are of concrete block construction with flat concrete roofs.

The works were designed, and the erection was supervised, by The Associated Portland Cement Manufacturers Ltd. The chimney was designed by Messrs. Oscar Faber & Partners.

The main civil engineering contractors were Messrs. A. E. Farr Ltd. The chimney was constructed by Messrs. Bierrum & Partners Ltd. The precast concrete components for the kiln building were supplied by Tarmac-Vinculum Ltd., those for the mill house by Concrete Development Co., Ltd., and those for the store and fitting shop by Messrs. F. & D. Hewitt & Co., Ltd. The offices, laboratory and other small buildings were erected by Messrs. J. T. Parsons & Co., Ltd.

The various items of plant were supplied by the firms named in the descriptions in the foregoing. Additionally, the high-tension switch-gear in the substation was supplied by The English Electric Co., Ltd., and the main transformers by

Messrs. Crompton Parkinson & Co., Ltd. The MPS coal mill and the drag-link feeder were supplied by P.H.I. Engineering Ltd., which firm is the exclusive licensee in the U.K. for the MPS mill system. Electric motors, except where specified otherwise in the foregoing, were supplied by Messrs. Crompton Parkinson & Co., Ltd., and The English Electric Co., Ltd. The motor control equipment was supplied by Messrs. George Ellison Ltd., Messrs. Allen West & Co., Ltd., and Messrs. Dewhurst & Partners Ltd.

Data Required.

Admixtures.

It was announced by the Reinforced Concrete Association, last summer, that the Association was collating data on admixtures and that most of the principal producers had agreed to publish information on the contents of their products. Specifications indicate that engineers should establish the values of admixtures before agreeing to their use. Accordingly the Association had suggested to firms manufacturing or selling admixtures that they should give information in their literature and/or on their packages regarding the contents of their products, or at least that they should make the information available on demand.

The Association now announces that other producers of admixtures have subsequently agreed to publish data or make it available on demand for some or all of their products. Where they are not able to do so, it is generally because they manufacture or sell the product under licence. An up-to-date list of the firms collaborating in this way is given in "Structural Concrete," May 1963.

The standard data given for an admixture includes the main active ingredient, whether the admixture contains calcium chloride or not and, if so, the percentage by weight expressed as anhydrous calcium chloride; and whether or not the admixture entrains air when normally used in concrete.

Firms who supply special cements with admixtures and who have agreed to publish data or make it available on demand are according to the Association's list:

The Cement Marketing Co., Ltd.
I.C.I. Ltd. (Billingham Division.)
Ketton Portland Cement Co., Ltd.
The Rugby Portland Cement Co., Ltd.
Tunnel Portland Cement Co., Ltd.

High-Alumina Cement.

The Institution of Structural Engineers set up a committee recently to revise and bring up to date the Institution Report, "The Use of High-Alumina Cement in Structural Engineering." This Report was published in 1937 and has been withdrawn for some time. Members and others who have experience in the use of high-alumina cement are invited to communicate with the Secretary at 11 Upper Belgrave St., London, S.W.1. The Committee would like to have information on the extent of use of high-alumina cement, the reasons for its choice, the advantages and disadvantages which have attended its use, and other relevant facts. Information so supplied will be treated as confidential.

Developments in the Russian Cement Industry.

SOME of the several and interesting developments in the cement industry in the U.S.S.R. are described in the following. Some account of the new Russian high-alumina cements and super-high-strength Portland cement was given in this journal for November, 1962.

Setting of Magnesium Cement.

There is no general consensus of opinion on the process and products of the setting or hardening of magnesium. Some conflicting views from the literature of the subject are cited in a report of a new investigation of magnesium cements by O. B. Adomavichyute and co-workers in "Zh. prikladn. Khim.," 1962, No. 11. Hitherto there has been little experimental data on $MgSO_4$ solution that is often used as substitute for the chloride.

The initial materials used in this investigation for the preparation of samples of magnesium cement were chemically pure MgO, $MgCl_2.6H_2O$, and $MgSO_4.7H_2O$. The cement was made in the form of a viscous paste of normal thickness in given weight-ratios of Mg salts and MgO, namely 0·6, 0·4, and 0·2. The oxychloride $MgCl_2.3Mg(OH)_2.5H_2O$, was obtained by dissolving MgO in 15 to 20 per cent. $MgCl_2$ solution, and the corresponding sulphate in a similar manner in which the sulphate concentration was 17·5 per cent. The latter preparation has been described previously by the authors in "Trans. Lithuanian. Acad. Sci.", Series B, 1961.

The kinetics of hardening and products thereof have been studied by both thermographic and X-ray methods, the former by means of the Russian thermograph TP-k, and the latter with X-ray camera PKD (d = 57·3 mm. for 10 hours using Co-K_a radiation). Thermographic curves for an $MgCl_2$ cement after three months, show the existence therein of an endothermic effect at temperatures of 490 and 580 deg., 490 and 575 deg., and 530 deg., indicating the presence of oxychlorides in this cement. Such endothermic effect is also seen in the region of about 400 deg. but this must be attributed to dehydration $Mg(OH)_2$.

Further X-radiograms show that, with a $MgCl_2$:MgO ratio of 0·6 or 0·4, there are oxychloride lines. There is marked change in structure with the ratio at 0·2 with evidence only of $Mg(OH)_2$. The composition of products does not depend on prolonged hardening times (1 or 7 days and 8 months), both in the case of high (0·6) and low (0·2) ratios of chloride to oxide. With a ratio of 0·4, there is evidence of hydroxide in the initial periods of setting, but the presence of oxychloride is indicated after further setting. It therefore follows that crystallisation of the oxychloride at a given concentration of $MgCl_2$ proceeds more slowly than hydration of the oxide, that is, with reduced chloride concentration the rate of formation of the oxychlorides is reduced, and in the initial period of setting there is preferential hydration of the oxide.

Similar tests with samples of sulphate-based magnesium cements showed the formation therein of hydroxide. The thermograms indicated clearly an endothermic effect starting at about 400 deg. Only with a sulphate-to-oxide ratio of

0·6 is there an endothermic effect at 680 deg., indicating the presence of oxysulphate. Thermal effects between 100 deg. and 200 deg. must be due to $MgSO_4.7H_2O$. The X-ray curves confirm the thermographic results.

Other samples submitted to X-ray investigation included those with ferric sulphate in a ratio to MgO of 0·6, with hardening times of 1 hour, 7 hours and 3 months. There was evidence only of hydroxide, showing that the setting of such cement proceeds in the same way as with $MgSO_4$. From these experiments it follows therefore that the main factor in the setting of cements based on magnesium sulphate is hydration of the oxide with formation of $Mg(OH)_2$. For formation of oxysulphate a higher ratio of the $MgSO_4$ than 0·6 is required. The action of the salt is associated with its adsorption-dispersing effect, accelerating the formation of a colloido-disperse phase, together with its crystallising and cementation effects.

From the predominance of magnesium hydroxide in a cement based on magnesium sulphate may be explained its lower hygroscopicity as compared with chloride cement, due to the absence of the oxysulphate that is unstable to water. The strength of a magnesium cement thus depends on the hardening salt, on the ratio of this to the MgO, and on the time factor. It acquires high strength after seven or more days. The setting of such a cement is higher or stronger with the chloride than with the sulphate basis, due to the positive effect of the oxychloride, the crystallisation of which through the hydroxide particles is the more effective from the point of view of structural strength.

Calcium Aluminates.

Another paper in the same Russian journal as the foregoing deals with the formation of calcium aluminates (CA, CA_2, C_5A_3 and C_3A). The authors are S. D. OKOROKOV and others who make a further contribution to the important subject of the ternary system CaO, Al_2O_3, $CaSO_4$. and illustrate the results of their investigations by numerous X-radiograms.

In the synthesis of calcium aluminates of ratios 3·1, 5·3, 1·1, and 1·2 from charges including gypsum, the process of mineralising proceeds very differently from that which occurs in the roasting of similar charges without gypsum. In heating a charge with gypsum up to 1,300 deg., the most stable phase is in the composition $3CA.CaSO_4$. Therefore in the synthesis of these aluminates with high CaO content (C_3A and C_5A_3), any calcium oxide in excess, as compared with the $CaO.Al_2O_3$ ratio, remains free. Similarly with the aluminate $CaO.2Al_2O_3$ with excess of gypsum as compared with $CaO.Al_2O_3$ = 1·1, excess alumina remains free.

Hitherto it has been supposed that gypsum is a mineraliser, accelerating the formation of both silicates and aluminates in cement materials, but the foregoing considerations show that gypsum is not merely a mineraliser but a constituent of the charge with formation of the compound $3CA.CaSO_4$. When present in sufficient amounts, the formation of calcium aluminates as such becomes impossible. Important also is the fact that, in the presence of gypsum the union of CaO with alumina proceeds always in the 1·1 ratio. Excess of CaO or Al_2O_3 present in the charge above this ratio cannot combine to form $3CA.CaSO_4$.

A New Method of Cement Manufacture.

WHAT is claimed to be a basically new method of manufacturing cement by employing counter-currents has been developed in the U.S.S.R., the first installation having been due to Isaac Elperin at the Power Institute of the Byelorussian Academy of Sciences. In principle, the method is as follows:

Finely-crushed particles of the raw material are injected in a strong current of gas, in which they travel in a state of suspension. The current is diverted into two pipes and the ensuing streams are directed towards each other. The hard particles, due to their momentum, begin to enter the opposite pipe, but this movement does not last long, since the counter-current from the opposite pipe slows down the speed of the particles, and then sweeps them along into the pipe they have just left. Thus both currents of hot gas bombard each other with particles, so that when the particles in the clashing vortices start losing their speed and pass out of the active zone, they are caught up in another which carries them into a third pipe ending in another vortex zone.

The aerodynamic principles of the installation are complex, and the slightest deviation from the calculated velocity of the gases or from the form of the pipes or the vortex zones causing the deceleration of the particles, may lead to the raw material dropping out of the stream and settling at the bottom, thus clogging up the system. Excessive velocity of the currents of gas results in the product being insufficiently calcined by the hot gases. The timing of the processes within the system are calculated exactly so that the particles gradually turn into cement, the fineness being such that grinding is not required.

At the end of the plant, there is a large cylindrical reservoir, or cyclone. As soon as the gas gets into the cyclone, and rotates around the walls, it rapidly loses speed and cools. The particles of cement drop into the lower conical part of the cyclone, while the hot gases pass out through an upper vent and can be recirculated in the installation while still possessing an appreciable amount of heat.

New Russian Standards for Cement.

The new standards for cements (GOST 10178-62) issued recently in the U.S.S.R. are of interest because of the wide range of cements dealt with and because the strength tests seem to comply with the international requirements of Cembureau-Rilem. The standards deal with ordinary Portland, rapid-hardening Portland, sulphate-resisting Portland, low-heat Portland, pozzolanic, hydrophobic, plasticised, slag-magnesium, Portland-blastfurnace (ordinary and rapid-hardening) and sulphate-resisting pozzolanic cements. White Portland cement, oil-well cement and Portland cement for making asbestos-cement products are covered by other standards.

The main difference between the new and previous standards is the introduction of a strength test for the cements using a plastic mortar moulded into 4-cm. by

4-cm. by 16-cm. prisms. The strength of cement is determined by breaking by bending the mortar prisms and by compression tests on the two pieces. The minimum strengths are shown in *Table* I. At three days, rapid-hardening Portland and rapid hardening slag cements should have compressive strengths respectively of 200 and 150 kg. per sq. cm. (2,800 and 2,100 lb. per sq. in.). At twenty-eight days, the specified minimum is 350 kg. per sq. cm. (5,000 lb. per sq. in.) for both cements. Cement is classified in six different qualities according to the strength of the mortar at twenty-eight days; for example ' type 400 ' signifies that 1 : 3 mortar made with this cement under standard conditions will attain in twenty-eight days a crushing strength of at least 400 kg. per sq. cm. (5,700 lb. per sq. in.).

The specified initial and final setting times of all cements are 45 min. (minimum) and 12 hours (maximum) respectively. The sulphuric anhydride (SO_3) content of any cement must not exceed 3·5 per cent., but for Portland cements it must be not less than 1·5 per cent. The magnesium content (MgO) of the clinker must not exceed 5 per cent., except in the case of magnesium-cement clinker when the upper limit is 10 per cent. The fineness of the cements must be such that 85 per cent. passes a sieve having approximately 170 meshes per inch.

Plasticisers and hydrophobic agents may be added to most of the cements if so agreed between the supplier and the customer, but standard requirements regarding admixtures are given in the following. Portland cements can contain up to 15 per cent. of active mineral admixture such as volcanic ash. Plasticised cement is made by adding 0·15 to 0·25 per cent. of sulphite-lye concentrate (calcium lignosulphonate) to ordinary Portland cement while grinding the clinker. This addition increases the workability of wet concrete and improves the resistance

TABLE I.—MINIMUM STRENGTHS AT TWENTY-EIGHT DAYS. (kg. per sq. cm.)

Type of Cement	Compressive Strength						Bending Strength					
	Quality						Quality					
	200	250	300	400	450	500	200	250	300	400	450	500
Portland, plasticised and hydrophobic cements	—	250	300	400	450	500	—	40	50	60	65	70
Sulphate—resisting and low-heat cements	—	250	300	—	—	—	—	40	50	—	—	—
Slag and pozzolanic cements	200	250	300	400	450	—	35	40	50	60	65	—
Slag-magnesium cements	200	250	300	400	—	—	35	40	50	60	—	—
Sulphate pozzolanic cements	200	250	300	—	—	—	35	40	50	—	—	—

to frost of the hardened concrete. Mortar made from plasticised cement with a water-cement ratio of 0·4 and placed in the form of a cone on a jolting table should have a spread of at least 125 mm.

Hydrophobic cement is made by adding a suitable plasticising agent to ordinary Portland cement during grinding; acidols, acidol-naphtha soap, naphtha soap, oleic acid, and oxidised petrolatum can be used as the agent. Hydrophobic cement must not take up water for a period of 5 minutes.

Rapid-hardening properties of Portland cement are attained by finer grinding and control of the chemical and mineralogical composition of the cement. The addition, during grinding, of active minerals and blastfurnace slag in amounts not exceeding 10 and 15 per cent. respectively, is permitted.

Sulphate-resisting cement is made from clinker similar to that for ordinary Portland cement, but no additives are permitted. Compared with ordinary Portland cement it has as lower a rate of generating heat and a slower rate of hardening at early ages. Low-heat Portland cement is also made from a clinker similar to that for ordinary Portland cement, but no active or inert mineral admixture is permitted. Compared with ordinary Portland cement, the sulphate resistance is somewhat better but the rate of hardening at early ages is slower. The content of active mineral admixture in pozzolanic cement must be from 25 to 40 per cent. of volcanic tuff, or 20 to 30 per cent. of material originating from sedimentary deposits.

The clinker for either sulphate-resisting cement, sulphate-resisting pozzolanic cement, or low-heat Portland cement must comply with the limits given in *Table* II.

Portland-blastfurnace cement must contain not less than 30 and not more than 60 per cent. of granulated slag by weight of cement, but up to 15 per cent. of the cement can be replaced by a mineral admixture. When required for mass concrete, the slag content can be decided by agreement between the supplier and the customer. Rapid-hardening Portland-blastfurnace cement must contain 30 to 50 per cent. of granulated slag.

Slag-magnesium cement is made by finely grinding granulated slag with magnesium-cement clinker. The slag content should be not less than 30 per cent. and not more than 50 per cent. by weight of cement. The clinker is made by sintering

TABLE II.—COMPOSITION OF CLINKER: MAXIMUM PERCENTAGES.

Constituent	Sulphate-resisting cement	Sulphate-resisting pozzolanic cement	Low-heat Portland cement
Tricalcium silicate (C_3S)	50	Not limited	50
Tricalcium aluminate (C_3A)	5	8	8
Tricalcium aluminate plus tetracalcium aluminoferrite ($C_3A + C_4AF$)	22	Not limited	Not limited

an iron oxide concentrate with a synthetic mixture of calcareous magnesium and argillaceous rock. Slag-magnesium cement is used for the same purposes as Portland-blastfurnace cement. (Some account of research on the setting of magnesium cement is given in a preceding section of this article.)

For concrete used in road construction, Portland cement of type 300, or of higher quality, should be used, and up to 15 per cent. of granulated slag can be added. The C_3A-content of the clinker must not exceed 10 per cent. and the setting time must be at least two hours after gauging.

Tests on cement are to be made on each 500 tons made at a works, but if the annual output is less than 200,000 tons, tests are made on each 300 tons.

The foregoing notes on the new standards are abstracted from " Byulleten Stroitel noi Tekhniki ", No. 9, 1962.

Cement Production in U.S.S.R.

THE production of cement in the U.S.S.R. during 1962 exceeded 57,000,000 tons, compared with 16,000,000 tons in 1953. The estimated production in 1963 is 63,000,000 tons, 60 per cent. of which will be high-quality Portland cement.

The Associated Portland Cement Manufacturers Ltd.

THE following are abstracts from the Statement for 1962 made by the Chairman, MR. J. A. E. REISS, of The Associated Portland Cement Manufacturers Ltd.

Although home deliveries were slightly higher than in 1961, new delivery and production records were not established owing to the continuing decline in exports, which fell by another 250,000 tons as a direct result of the hydrocarbon-oil duty. Exports are about a third of that before the imposition of the duty and, even with the removal of the duty, there is now little expectation of improvement.

The three years' expansion programme ended in April last when the Dunbar Works[1] went into full operation; the Westbury Works[2] began operation in September last. Further increases in productive capacity are being considered to keep pace with the large volume of constructional work that is expected in the next decade. Twenty-six per cent. of the issued ordinary capital of the Aberthaw & Bristol Channel Portland Cement Co., Ltd. has been acquired.

In common with most other concerns in the building industry, due to the bad weather in the first quarter of 1963, home deliveries during this period were more than halved compared with 1962 and it is optimistic to expect that the loss can be made up during the last nine months of this year. Much depends on the weather at the end of this year and the ability of the building trade to absorb the lost tonnage in the limited time. The making of clinker was continued during the bad weather and this material can be ground and despatched quickly when

1. The Dunbar Works, which has an annual productive capacity of 400,000 tons, is to be officially opened on September 17, 1963.

2. The Westbury Works is described in an article commencing in the number of this journal for May last and concluded in the present number.

required. The previous record week's delivery at home was recently beaten by a large margin and any peak demand that may arise can be met.

The overseas companies in which A.P.C.M. are interested established a new record of sales amounting to 2,767,000 tons, in spite of the unsettled political position and uncertain trading conditions in some areas.

In Australia, The Commonwealth Portland Cement Co., Ltd., and Metropolitan Portland Cement Proprietary Ltd., maintained their predominant position in the cement industry in New South Wales. During the year, the Australian economy showed a marked improvement and the long term outlook for the building industry is encouraging. Work on the 300,000 tons works near Geelong, Victoria, by The Victoria Portland Cement Co., Proprietary Ltd., is proceeding according to plan and it is anticipated that the works will be commissioned towards the latter part of this year. In New Zealand, The Golden Bay Cement Co., Ltd , and its subsidiary, Waitomo Portland Cement, Ltd., made record sales, and prospects of further growth are encouraging.

In Canada, the associate company, Ocean Cement & Supplies, Ltd., increased its share of the market. An extensive modernisation programme is in progress. The cement industry in Canada still suffers from over-capacity but Canada Cement Co., Ltd., the largest producer and one in which a substantial minority is held, recorded improved results.

Malayan Cement, Ltd., again attained record results. Further economic expansion is expected to follow the establishment of the Malaysian Federation this year.

The anticipated improvement in trade in Mexico did not materialise but, following the stabilisation of the political situation in Cuba, the Mexican economy has shown more encouraging signs and an improvement in the demand for cement is expected during the year.

South Africa has emerged from the initial economic strains following the creation of the Republic. Sales by the subsidiary, White's South African Portland Cement Co., Ltd., were slightly lower, but trading conditions have since improved and prospects are promising. Kenya is still affected by political uncertainties, and little improvement can be expected until conditions are more settled. Trade in Southern Rhodesia was again at a low ebb. The Salisbury Portland Cement Co., Ltd., in common with other members of the industry, has had to operate at a restricted output. Until the uncertain political situation is clarified, there is no prospect of an improvement in the building industry. The West African Portland Cement Co., Ltd., in Nigeria had a successful year's trading and, with a growing demand for cement, the annual productive capacity of the works is to be increased from 200,000 tons to 450,000 tons per annum by the installation of a second kiln, which should be in operation by the middle of 1964.

Modern Vertical Kilns for Cement Manufacture.

IN connection with the article entitled "Modern Vertical Kilns for Cement Manufacture," by S. R. Devlin, in the number of this journal for January 1963, a correspondent writes:

"In the very interesting article on modern vertical kilns in your January number, the author makes the somewhat sweeping assertion that the fuel consumption of 860 k.-cals. per kg. is considerably less than that of a typical rotary kiln. While the word 'typical' can cover a multitude of variations, in this context it appears only reasonable to compare the performance of the latest type of vertical kiln with that of an up-to-date rotary kiln. Typical of this practice is the short kiln with a preheater fed with either dry raw meal or semi-dry nodules (pellets). The author does not say whether the 860 k.-cals. per kg. is a test or an annual figure, or whether it includes the oil fuel for the Loma drier furnaces, or what is the amount of moisture in the fuel and raw material. However, giving the benefit of the doubt on both counts, it is certainly no better than a dry raw meal rotary kiln utilising waste heat for drying or a semi-dry process including the drying of raw material of medium moisture content. In fact, figures published recently in Germany claim substantially better performance than this.

The vertical kiln is also at a disadvantage in having a typical product of the quality admitted on page 7 of the article."

The author replies:

"The stated consumption of 860 k.-cal. per kg. of clinker is not a test figure but an annual average figure obtained in the plant described in the article. The consumption is higher than usual with our process because of the difficult raw materials at Peggau. The figure stated does not include the oil for the Loma mill furnace. Where the alkali removed from the mix is low, the waste gases from a vertical kiln can be utilised for drying in the mill, thus saving the furnace.

An additional improvement, which can be combined with the 'black-meal' process, is the so-called 'coating' process which results in another substantial reduction in fuel consumption. By a fuel-free raw mix coating around the pellets, the fuel is protected against the hot flue gases in the pre-heating zone. So the reaction $CO_2 + C = 2\,CO$ will not occur in that zone as usually happens in vertical kilns. The coal in the pellets passes through the pre-heating zone and reaches the burning zone in a gas-proof envelope, thus delaying reaction. The fuel consumption in full-scale operation is less than 800 k.-cal. per kg. of clinker, as stated in the last paragraph of the article.

In the statement on the comparative fuel consumption in vertical and rotary kilns, it would have been better to have said 'wet-process rotary kiln' rather than 'typical rotary kiln.' It is believed that, so far as this country is concerned, only the Lepol kiln and the Humboldt plant at certain new works have a heat efficiency equivalent to that of a vertical kiln operating on the 'black meal' process.

The 'typical product' mentioned on page 7, is the product usually obtained in a conventional vertical kiln, that is a vertical kiln without the improvements mentioned in the article. This disadvantage of a conventional vertical kiln was mentioned to emphasise the improvement in quality obtained in the improved design of vertical kilns and by use of the ' black meal ' process."

The Cement Industry in America.

North America.

U.S.A.—The works of the Alpha Portland Cement Co., at Catskill, New York, is to be developed to have an annual capacity 500,000 tons. This Company's works at Ironton, Ohio, is to be completely rebuilt, and will have an annual productive capacity of 333,000 tons.

The despatch of cement from Ideal Cement Co.'s new works at Castle Hayne, North Carolina commenced in July last. Storage, packing, and bulk despatch facilities are now in use. The manufacturing plant, the first in this State, was expected to be completed in June 1963. The works, it is claimed, is one of the most highly instrumented and mechanised in the world. The principal plant includes two rotary coal-fired kilns, 450 ft. long and 12 ft in diameter; a raw mill, 11 ft. in diameter and 32 ft. long, driven by a 2000-h.p. motor; two finishing mills, 11 ft. by 32 ft., also driven by 2000-h.p. motors; two grate-type clinker coolers, 10 ft. by 50 ft.; and eight cement silos, 40 ft. in diameter, 141 ft. high and having a total capacity of 37,500 tons. The equipment for bulk loading is described as the fastest and most efficient available; more than 4,700 tons of cement can be despatched per 8-hour shift.

At the Portland, Colorado, works of Ideal Cement Co., an 18-ft. vertical kiln with a new type of discharge gate is to be installed. It will be an experimental plant, which will be operated to establish the economics, and quality control of a vertical kiln for cement production.

(The foregoing reports are abstracted from " Pit & Quarry ".)

A new rotary 425-ft. kiln was fired at the new works of the Calveros Cement Co., near Redding, California, in December last. The diameter at the feed end is 13 ft. 6 in. and 12 ft. at the discharge point. The rate of rotation is one turn in 51 seconds.

A new kiln, 460 ft. in length and 15 ft. and 13 ft. in diameter commenced production recently at the works of the Huron Portland Cement Co., at Alpena, Michigan. The kiln has a daily capacity of 866 tons.

A kiln 450 ft. long has been installed at the works of Permanente Cement Co., near Helena, Montana.

The first phase of the extensive development of the Crestmore division of the Riverside Cement Co., is now in operation. The new installation includes a raw material ball mill, dust collectors, silos and a control centre. New rotary kilns are included in a later phase.

A new kiln, 600 ft. long and of 16 ft. 6 in. internal diameter has been installed at the works of the Florida Portland Cement division of General Portland Cement Co., at Hooker's Point.

Canada.—A new cement works is to be built by Inland Cement Co., Ltd., in the Winnipeg area. This Company is affiliated to Sogemines and with Cimenteries et Briqueteries Reunies both of the Societé Generale de Belgique Group. An option has been taken on a site for the works, and a licence on a large deposit of suitable limestone in the Steep Rock Area has been granted to the Company. This will be the Company's third works, the other being in the Provinces of Alberta and Saskatchewan.

Mexico.—The plant to be supplied by Allis-Chalmers International to Cementos de Mixcoac of Mexico, D.F., Mexico, includes a 213-ft. kiln, a travelling grate 84 ft. in length, and other equipment. The rated capacity of the kiln is 700 metric tons per day. This is the first A.C.I. cement processing system which includes pelletisation and preheating to be installed in Mexico. The pelletising plant will include two rotating pans each 12 ft. in diameter. The travelling grate will carry the pellets through two preheating stages. The kiln is claimed to be 40 per cent. shorter than an equivalent kiln for the conventional process.

Central America.

Panama.—The demand for cement varies from month to month. In August last, the importation of 50,000 bags of cement was authorised, but later it was reported that Panama would shortly become one of the biggest exporters of cement in Central America.

A new works is being built on an island in Las Mibas Bay, near Colon, by Cemento Atlantica S.A. Cement will be made from coral deposits. Since the entire requirements of cement in Panama are provided by the Cemento Panama works, all the products of the new works are expected to be exported.

South America.

Brazil.—A comprehensive review of the cement industry in Brazil was issued recently by the Associação Brasileira de Cimento Portland (Bulletin No. 65). Data of capacity, production, and consumption for each year from 1950 are given. The annual consumption in a ten-year period has increased from 1,800,000 tons (of which 200,000 tons were imported) to 4,500,000 tons (all of which is produced in the country).

The 200-ton-per-day cement works at Capanema in the northern part of the country commenced production recently.

Pires, Carneiro, S.A., of Brazil, has opened a new cement works, Fabrica de Cimento Portland Carneiro, at Capanema, Paraná. The plant includes a 311-ft. rotary kiln, which is expected to have an initial annual production of 72,000 tons which is about half the estimated maximum capacity.

Peru.—Plant has been ordered for the first of a three-stage centralisation and modernisation programme now in progress at the works of Compania Peruana de Cemento Portland at Atocongo, near Lima. Upon completion of the project, the capacity of the works will be increased by about 38 per cent. The present capacity is 1725 tons per day.

It is proposed to establish a cement works at Arequipa.

Accidents in the Cement Industry.

THE annual report by the Accident Prevention Advisory Committee of The Cement Makers' Federation for the year 1962 contains the following statements.

The year 1962 was one of notable achievement, there being 161 accidents compared with 198 in 1961, and the resulting frequency rate was 0·59, the lowest on record. Twelve out of a total of forty-four works were completely free of accidents, and nineteen other works each had a frequency rate below 1·0. The Blue Circle Group again had only thirty-one accidents, and therefore a frequency rate of 0·18; two of the months in 1962 were completely free of accidents. The total number of accidents in the works of other companies were reduced from 144 in 1961 to 130 in 1962, and the frequency rate from 1·53 to 1·34.

About one third of the accidents were caused by persons falling, and about one fifth due to persons striking against objects. Each of the other principal causes accounted for about 10 per cent. or less of the total number of accidents.

New Lime Works In Hungary.

THE new lime plant, which is part of the Tatabánya Cement and Lime Works in north-western Hungary (see this journal for May 1963), was opened in June last and has an annual productive capacity of 72,000 tons. The limestone is delivered direct from the quarries by a belt conveyor and automatic equipment. The kilns are semi-automatic in operation, but the finished product is transported without manual aid. Modern ventilators and large-capacity dust extractors are installed to ensure healthy working conditions. The cost of the new plant was about £2,100,000.

A Long Cement Slurry Pipe-line.

CONSTRUCTION has commenced on part of the pipe-line which, as announced by the Ministry of Power in May last, is the first cross-country pipe-line authorised by the Minister under the Pipelines Act 1962. Chalk slurry will be conveyed from the cement quarries of the Rugby Portland Cement Co., Ltd., to the works in Warwickshire. This first section, which is being laid by Taylor Woodrow Construction Ltd., will extend for thirty-six miles from Newport Pagnell to Rugby. The pipe, the external diameter of which is 10¾ in., is of welded steel construction.

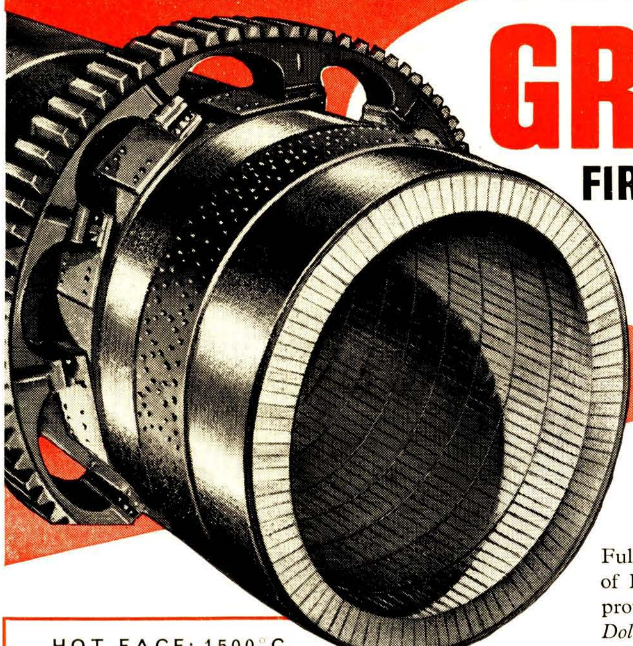
Cement Production in Great Britain in 1962

ACCORDING to statistics published by the Ministry of Public Buildings and Works, the production of cement in the United Kingdom was 14,000,000 tons in 1962. This amount is about 1 per cent. less than in 1961, but deliveries to the home market were slightly higher.

In the first eleven months of 1962, the amount of cement imported was 100,000 tons which is less than half the amount imported in the corresponding months last year. Exports in the first eleven months amounted to 285,000 tons, which is slightly less than half of the amount in the same period in 1961.

New Approach to Hot Zone Linings

FIRED DOLOMITE BRICK LININGS PROVED SUCCESSFUL



GR '341'

FIRED DOLOMITE BRICKS

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HOT FACE: 1500° C

	°C COOL FACE (THEORETICAL)			
	GR '341'		MAGNESITE	
Lining Thickness	Uncoated	Coated	Uncoated	Coated
6″	365	265	395	295
7″	355	255	380	280
9″	330	230	375	275

We shall be pleased to provide specialist advice and supervision of the installation of linings if required.

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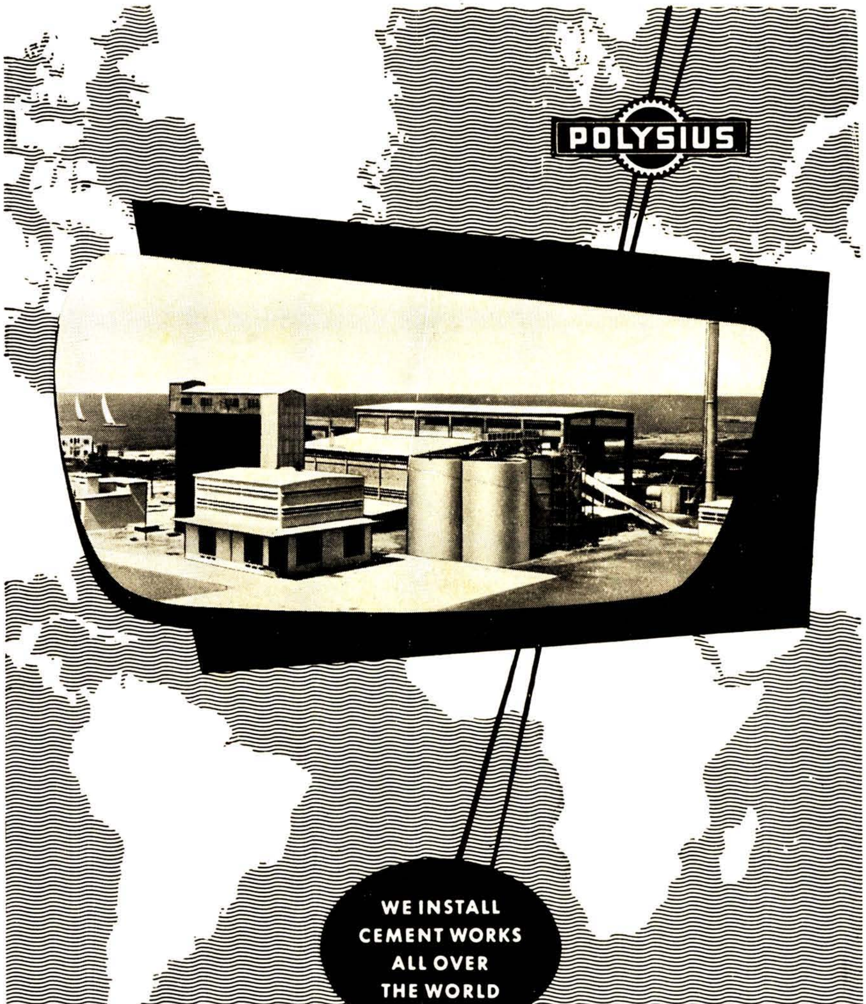

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