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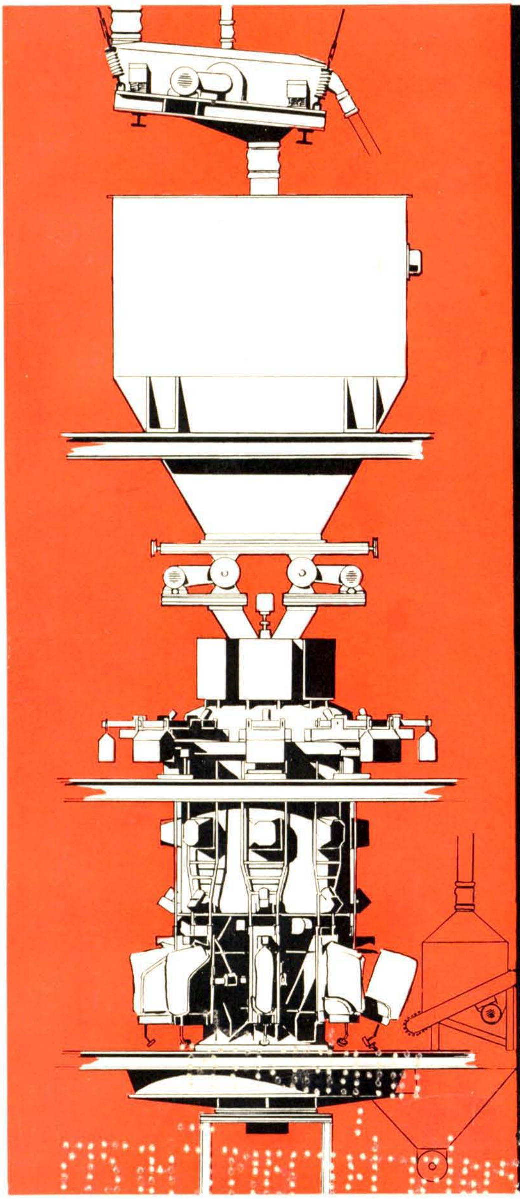

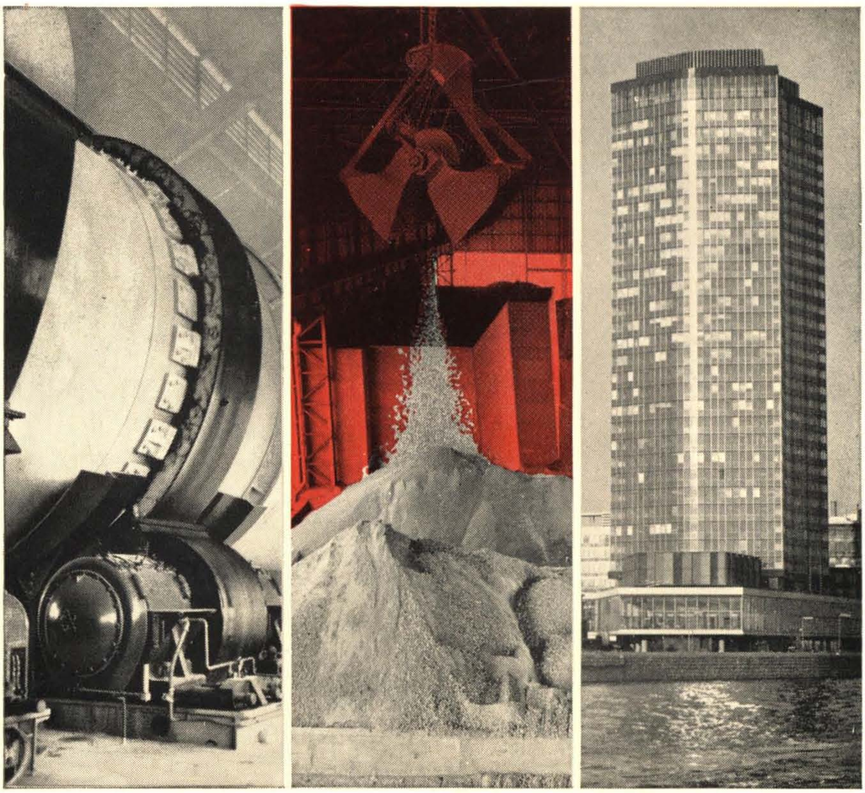

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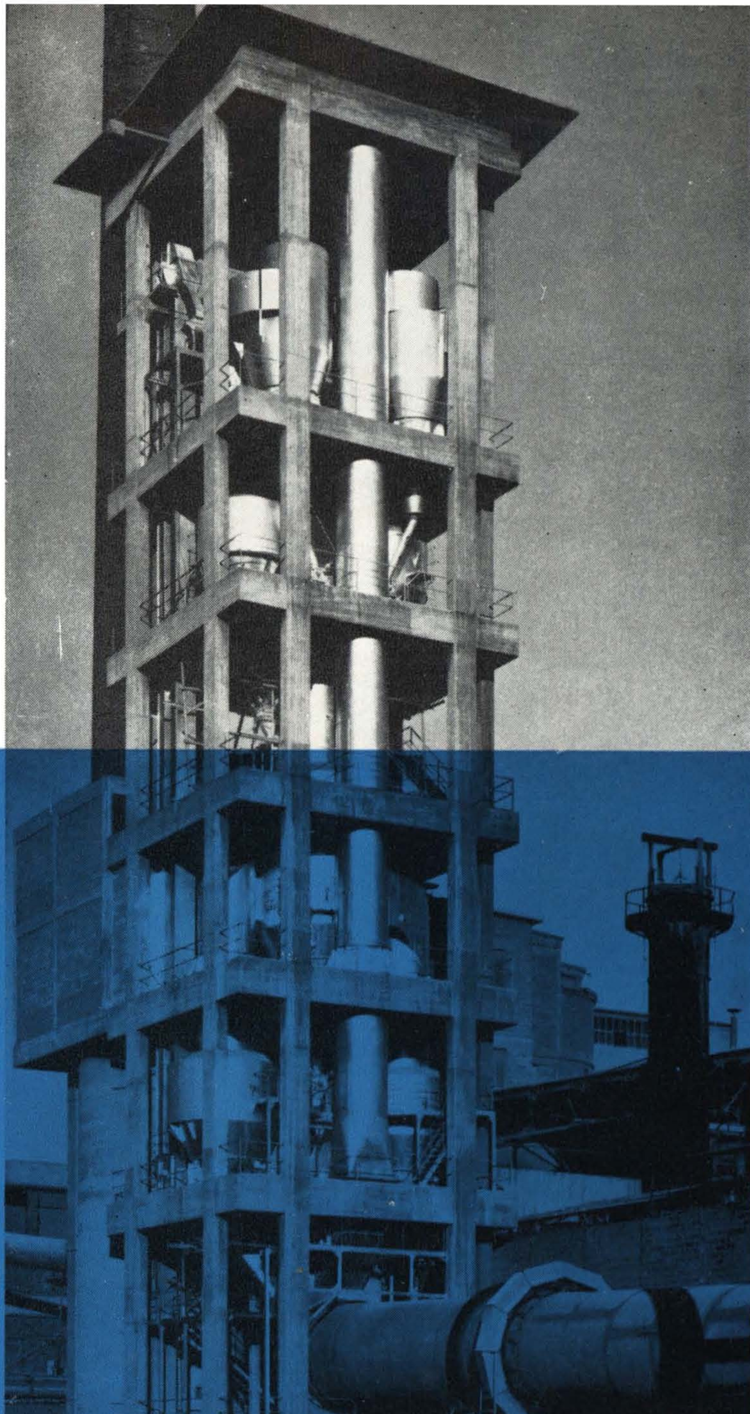

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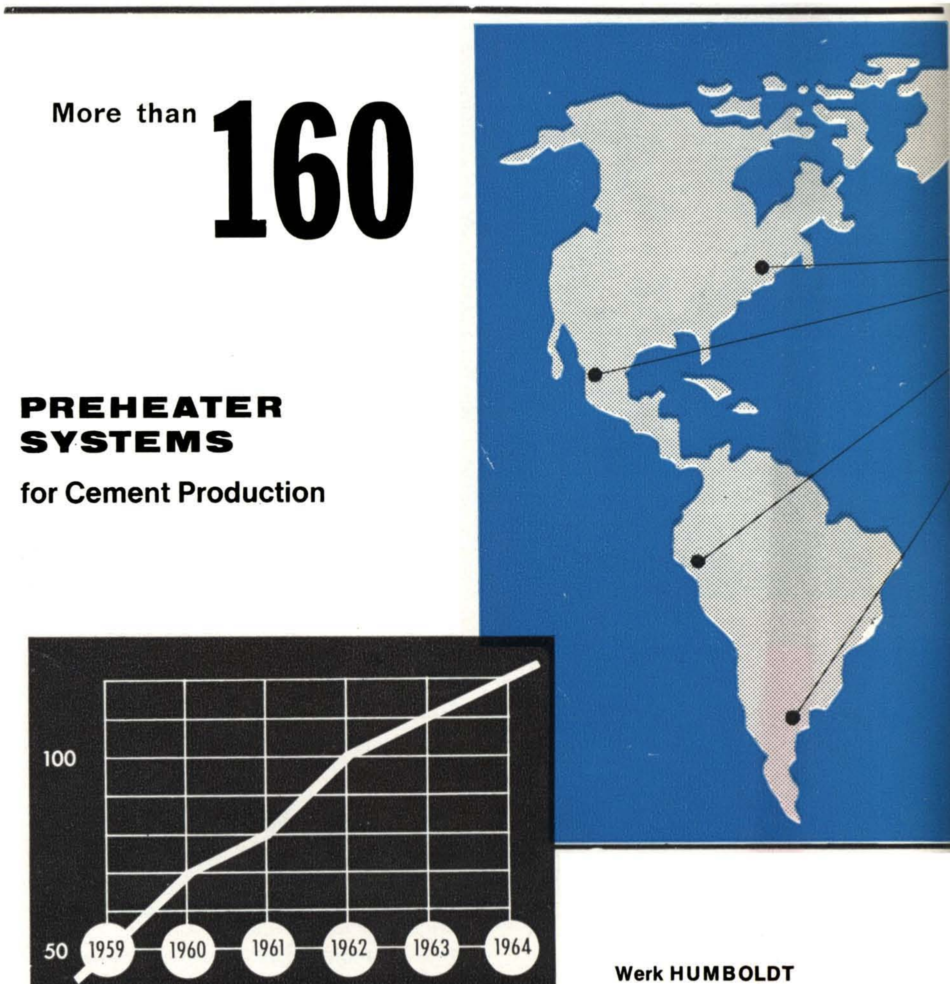
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Extensions to Westbury Cement Works.

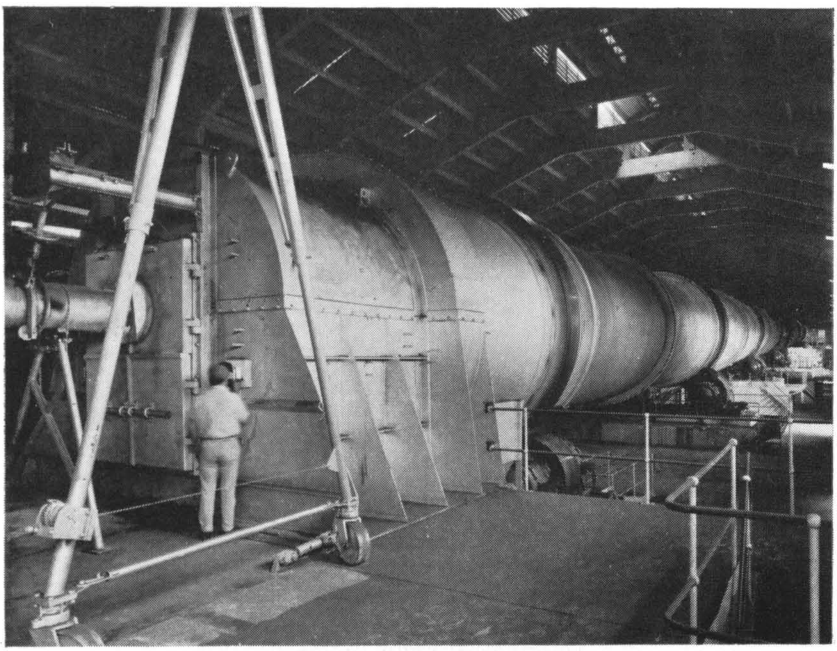


Fig. 1.—New 500-ft. Kiln viewed from Firing End.

EXTENSIONS TO WESTBURY CEMENT WORKS.

IN the numbers of this journal for May and July, 1963, a description was given of the then new works of The Associated Portland Cement Manufacturers Ltd. at Westbury, Wiltshire. The works commenced to operate in 1963 with an annual productive capacity of 30,000 tons. By the installation of another rotary kiln, production has now been increased to an annual capacity of 600,000 tons of Portland cement. The new kiln (*Fig.* 1) operates on the wet process and is 500 ft., long. The extension includes the necessary additional ancillary equipment for the preparation of the raw materials, grinding the clinker, and packing and despatch. The arrangement of the plant and buildings of the extended works is given in *Fig.* 13 (pages 30 and 31). The extensions were completed without interrupting the operation of the original installation. Work commenced on the site in August 1964, and the kiln, some preliminary particulars of which were given in this journal for November 1965, was started up in June 1965.

Winning the Raw Materials.

For digging the chalk, a second 54 RB. electric face-shovel has been provided. Two more 15-ton Foden six-wheel dumpers have been provided to take the chalk to the wash-mill in the quarry. The washing plant has been augmented by the addition a 35-ft. rough mill, with an apron-feeder and kibbling rolls. Between the existing pair of 24-ft. screening mills and 1,200-h.p. finishing grinding mill, which have sufficient capacity to accommodate the product from the two rough mills, another Dorr-Oliver Sieve-bend has been installed. The capacity of the grit elevators from the screening mills has been increased.

A second Oil Well Engineering horizontal slush pump has been installed to

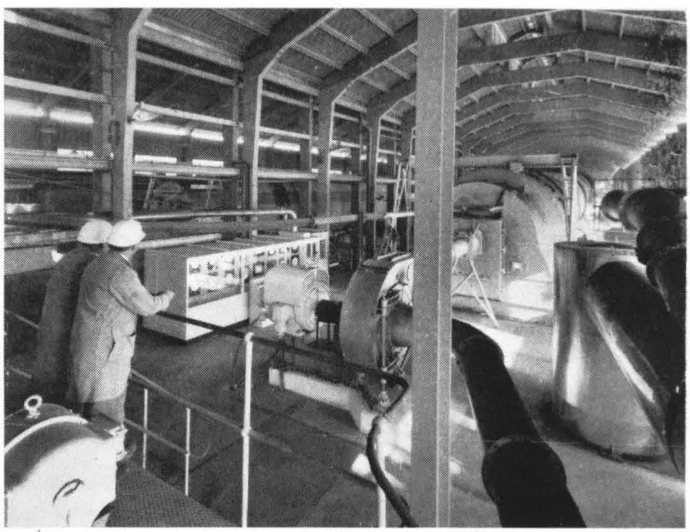


Fig. 2. Extended Kiln House Viewed from Firing End.

Fig. 3.—Excavating at Clay Pit.

pump the chalk slurry to the works, which is about $1\frac{1}{4}$ miles distant. To provide additional storage capacity for chalk slurry at the works, two of the 66-ft. diameter storage tanks originally provided for finished slurry are now used for chalk slurry.

In the clay pit (*Fig.* 3), the 38-RB diesel dragline has been replaced by a 54-RB diesel dragline. The 42-in. field belt-conveyor to the clay wash-mill and its feed hopper and belt have been discarded. The 54-RB dragline loads two 15-ton Foden dumpers, which transport the clay to a stockpile at the clay wash-mill. The 38-RB dragline released from the pit is used to feed the clay direct from the stockpile into clay rough-mill.

Preparation of Slurry.

The original clay wash-mill plant comprises a 35-ft. rough mill and two 24-ft. screening mills, which are duplicates of those in the chalk quarry, and which have sufficient capacity to deal with additional output. The clay deposited in the

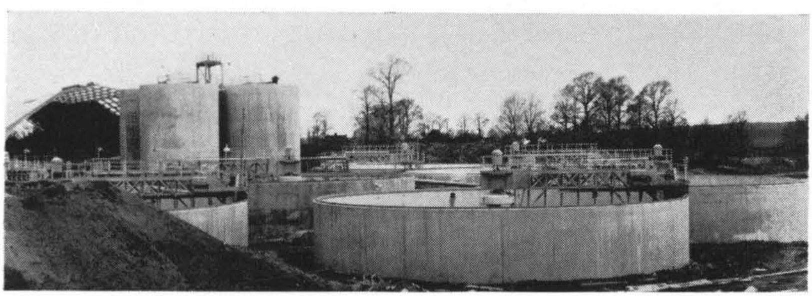


Fig. 4.—Slurry Tanks.

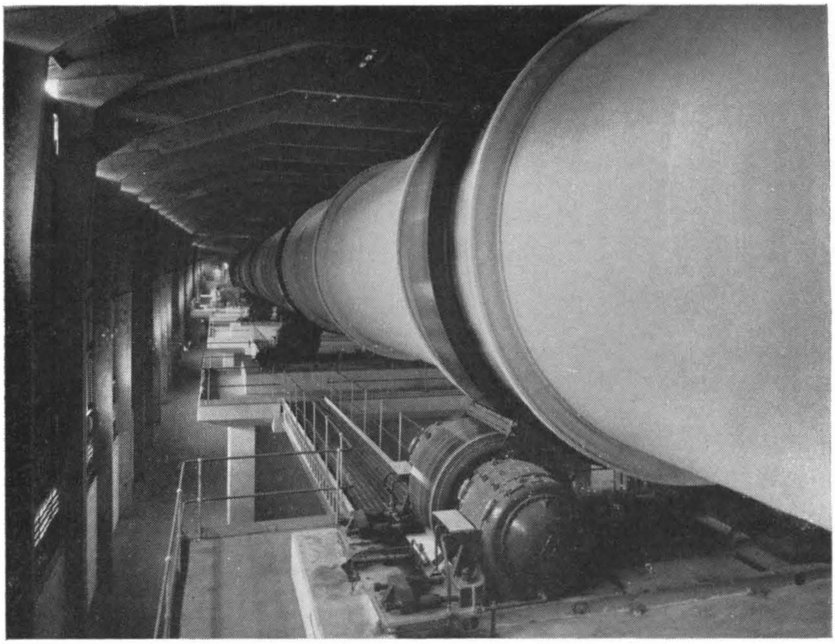


Fig. 5.—New Kiln from Feed End.

rough mill by the 38-RB dragline is washed with chalk slurry from the storage tank fed in the proportions required to give a combined slurry of the desired composition and moisture content.

No addition has been made to the four existing concrete doctor-tanks for blending the slurry, but four new 66-ft. diameter storage tanks have been provided. Thus, after deducting the tanks now used for the storage of the chalk slurry, there is a total of seven tanks for storage of the combined slurry. It is interesting to note that the concrete walls for the new tanks (*Fig.* 4) were built with the aid of continuously-sliding forms which has resulted in an excellent finish. Three of the new tanks are located alongside those originally installed, but one has been placed near the feed-end of the kiln, thereby requiring only a short final pumping stage. It is desirable to place one tank near the kiln because the small head-tank, used for the first kiln installed, has been removed and the slurry is now pumped directly through the slurry flow-meters and control valves to the kilns and there is no overflow to be returned. Additional Allis-Chalmers centrifugal pumps permit slurry to be drawn selectively from the six tanks and pumped to the tank near the kiln.

The Kiln and Ancillary Plant.

Various views of the kiln house and the new kiln are given in *Figs.* 1, 2, 5, 6, 7 and 8.

The new Vickers kiln, which is installed in a new building alongside the original kiln-house, is similar to the original kiln except that, being 500 ft. long, it is 50 ft. greater in length; the internal diameters are the same, namely, 13 ft. 6 in. and 14 ft. 6 in. at the burning zone. It is equipped with a system of curtains and festoon chains. The firing-hood (*Fig.* 2) is a duplicate of the hood on the first kiln, the large doors permitting the entry of small bulldozers, fork-lift trucks and other equipment used for handling the very considerable quantities of material involved when relining.

The kiln is fired on the direct system with pulverised coal. The centrifuged-washed Midland smalls which have hitherto been delivered by road will, in future, be delivered in hopper wagons by railway. A new siding, with an unloading station (*Fig.* 10), has been installed. The wagons are hauled over a track hopper by a Rolltug creeper-haulage. The coal is elevated from below the track hopper and conveyed over the coal-mill hoppers of each kiln, by a Birtley vibrating conveyor, to the existing coal store. It can thus be delivered to either of the hoppers or to the store, over which it is distributed by an overhead Redler conveyor. It can be reclaimed from the store by the original method of bulldozing it into a ground hopper in the store, from which it is elevated and conveyed by a Redler conveyor to either of the mill hoppers. The coal grinding plant is a duplicate of the original 112 M.P.S. mill fed by a Besta feeder. The mill is swept by hot air drawn from the clinker cooler, and thus the coal is dried while being ground. This air constitutes all the primary combustion air and is passed to the kiln burner-pipe by a Rema firing fan.

The shell of the kiln (*Figs.* 1 and 5) is of welded construction and is supported on eight beds (*Fig.* 5). Hydraulic thrust-gears operate on four of the beds

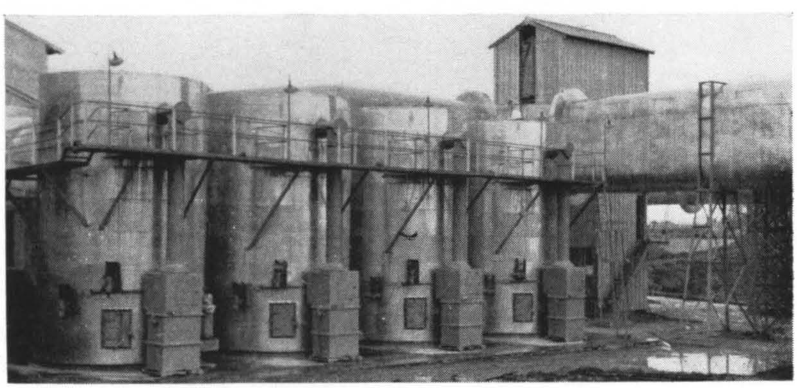


Fig. 6.—Precipitators.

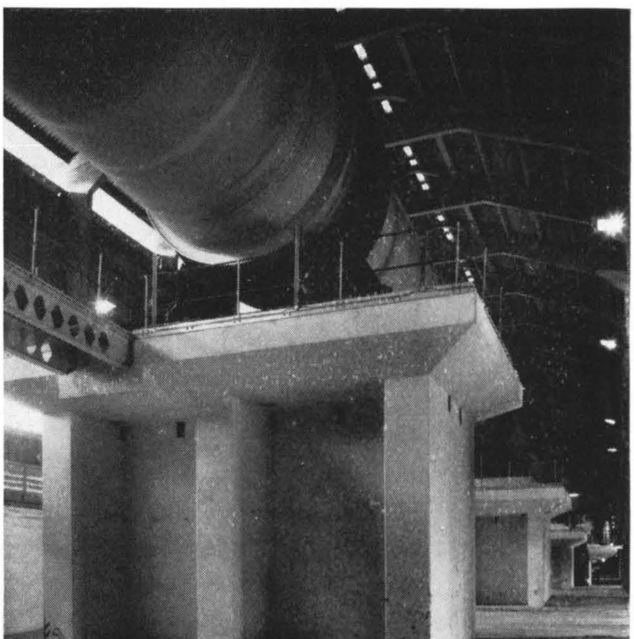
and give the kiln a slow oscillating axial movement. The drive is by two Lawrence-Scott commutator motors having a range of speed from 750 to 250 r.p.m. Each motor is coupled to a triple-reduction Turbine-Gears gear-box operating a pinion which engages with a single girth-gear on the kiln. The reinforced concrete plinths supporting the kiln beds are shown in *Fig. 7*.

The back-end chamber provides a straight-through flow to a cylindrical flue which, with easy bends, is brought into the eye of an induced-draught Keith-Blackman 125-in. 14-EK high-efficiency backward-blade fan. The fan is driven by a fixed-speed motor through V-ropes. The draught is controlled by a louvre damper which is in the inlet flue and which is operated by power from the kiln-control panel.

As previously mentioned, the method of feeding slurry to the kilns has been modified slightly, the original constant-level slurry head-tank having been removed. The slurry is now pumped direct from the storage tank through a Veriflux flowmeter and then through an Elliott-Fisher control valve direct to the kiln. The flowmeter operates the control valve through Honeywell controls to maintain constant flow at the desired rate, which can be controlled from the kiln instrument panel. Each kiln is provided with duplicate meters and control valves, to permit routine cleaning of either flowmeter.

The flue-gas is discharged by the induced-draught fan into a group of electro-

Fig. 7. Kiln Plinths.



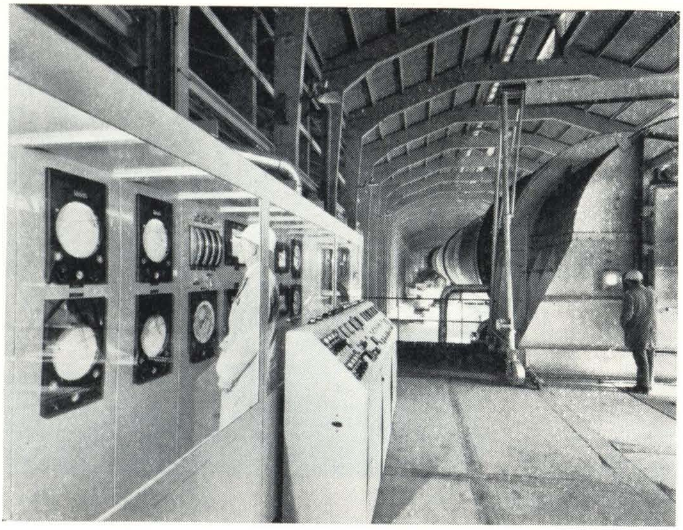


Fig. 8. Kiln Control Panel.

static precipitators, consisting of eight separate units disposed four on each side of the flue. Isolating dampers are provided so that any unit may be taken out of service for routine cleaning and maintenance, while leaving in operation the remaining seven, which have sufficient capacity to deal with the full output. The precipitators (*Fig.* 6) were designed by The Associated Portland Cement Manufacturers Ltd. A new reinforced concrete chimney 400 ft. high has been built to take the flue-gases from both kilns. The original 250-ft. chimney has been demolished.

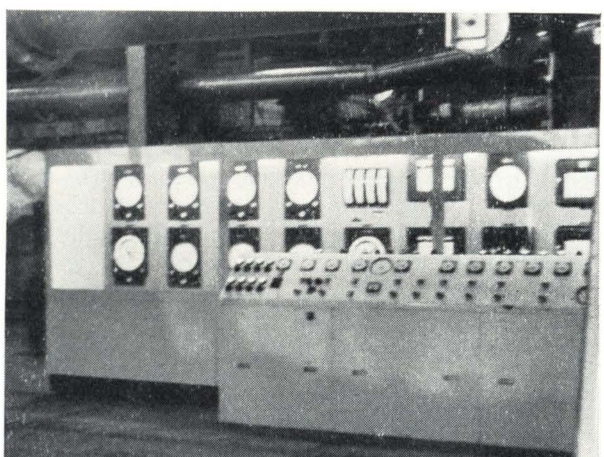


Fig. 9 Kiln Control Panel.

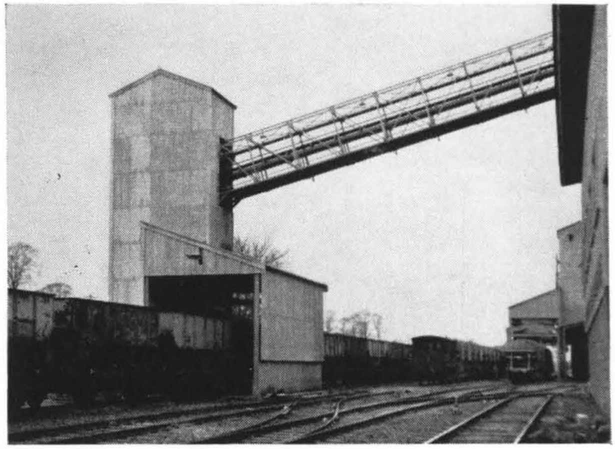


Fig. 10. Coal Intake.

The clinker is cooled in a Fuller-850 horizontal cooler with the drag-link chain conveyor enclosed in the pressure chamber. The discharge to atmosphere of air from the first pass is cleaned in a Prat-Daniels multi-cyclone collector.

Instrumentation and Kiln Control.

The instruments for recording, indicating and controlling the kiln are grouped in a panel (*Figs.* 8 and 9) on the firing floor. The floor is common to the two kilns both of which are controlled by one operator.

The instruments and automatic controllers are housed in a pressurised cabin in front of which is the manual control console. The whole of the instrumentation is a duplicate of that on the first kiln and was also supplied by Honeywell Controls Ltd., and designed in collaboration with The Associated Portland Cement Manufacturers Ltd.

The aim of the automatic control is to reduce to a minimum the fluctuations of the principal variables of kiln operation. The slurry feed is controlled by flowmeter. The combustion air supplied to the kiln from all sources is summated and linked to the fuel supply. The induced draught is controlled to give constant pressure in the chamber over the cooler-grate. The speed of the cooler-grate is regulated from the under-grate pressure to give a bed of clinker of constant thickness and therefore of constant resistance. Oxygen in the flue gas is kept steady by an over-riding control of the fuel-air ratio from the oxygen recorder. In addition, the fan supplying the cooling air to the cooling section of the grate, and the fan for discharging to atmosphere the excess through the dust collector are linked to preserve the over-grate pressure, while giving the required degree of cooling.

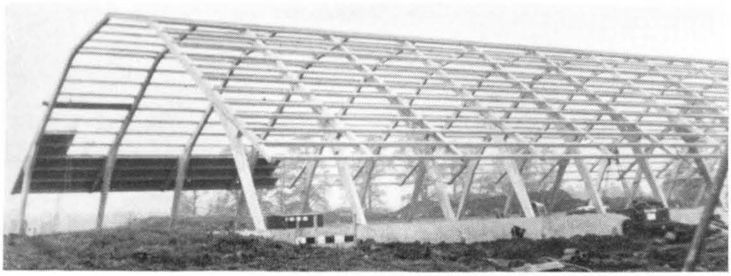


Fig. 12.—Clinker Store in the course of Construction.

Clinker Storage.

The entire earlier installation has been duplicated by the addition of another row of four 1,000-ton steel silos (there being three for clinker and one for gypsum), and two 1,200-h.p. compound mills. The new silos are equipped with the same arrangement for filling, that is a transfer hopper, two Bagshawe continuous-bucket elevators and two Redler conveyors along the top of the silo structure. Each conveyor line will carry the output of one kiln. A new Clarke-Chapman tray-conveyor has been installed from the coolers which can carry the output from the two kilns, and conveys and elevates it to a hopper placed between the transfer hoppers of the silo elevating systems. Short Birtley vibrating-conveyors transfer the clinker to either of these transfer hoppers.

The original Clarke-Chapman conveyor is being extended to serve the new kiln and the trays are being enlarged so that the output of both kilns may be carried. This results in a very versatile arrangement of handling. Another intake for road-borne gypsum has been provided in the new line and

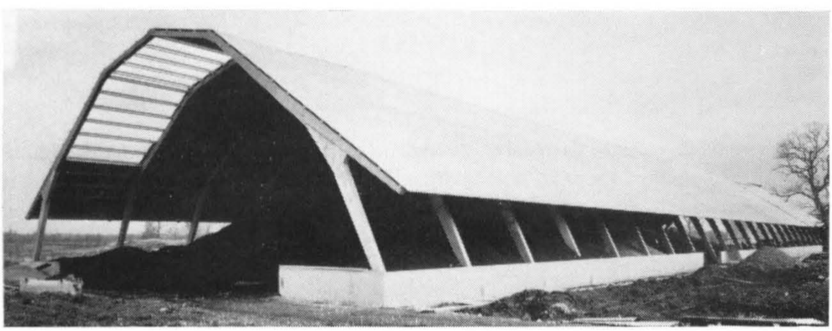


Fig. 13.—Clinker Store Completed.

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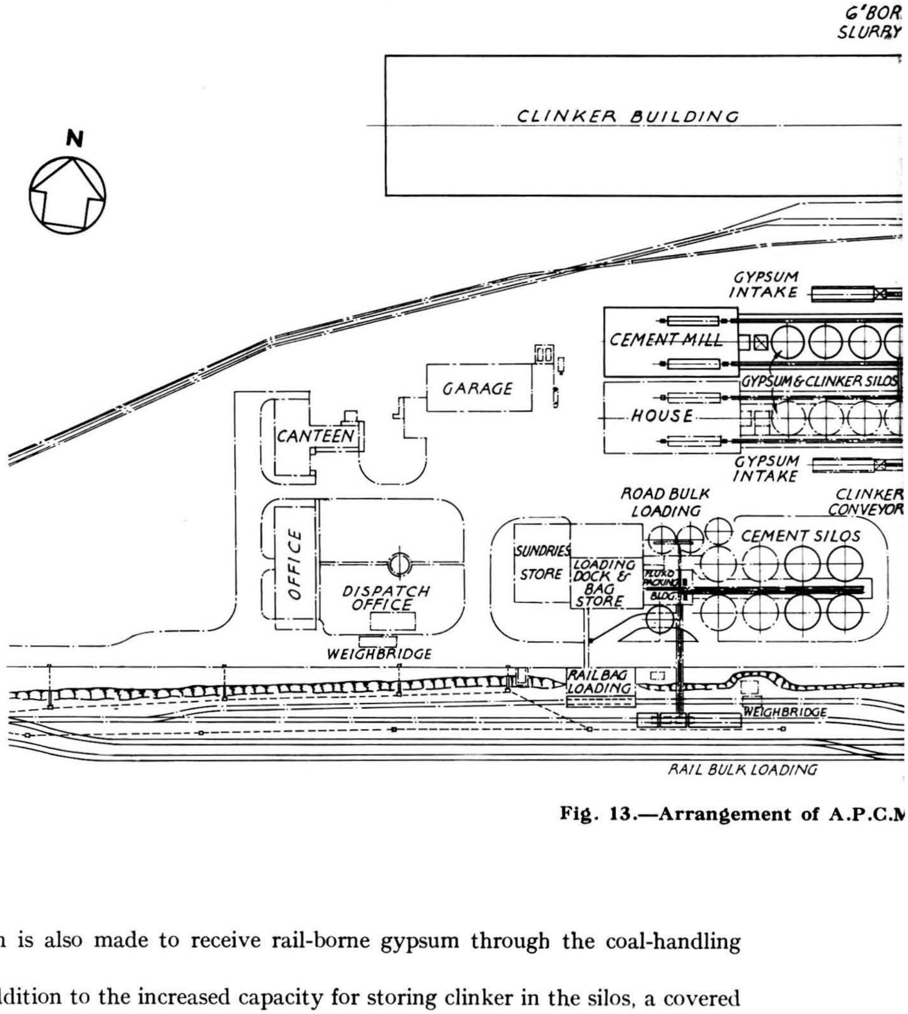
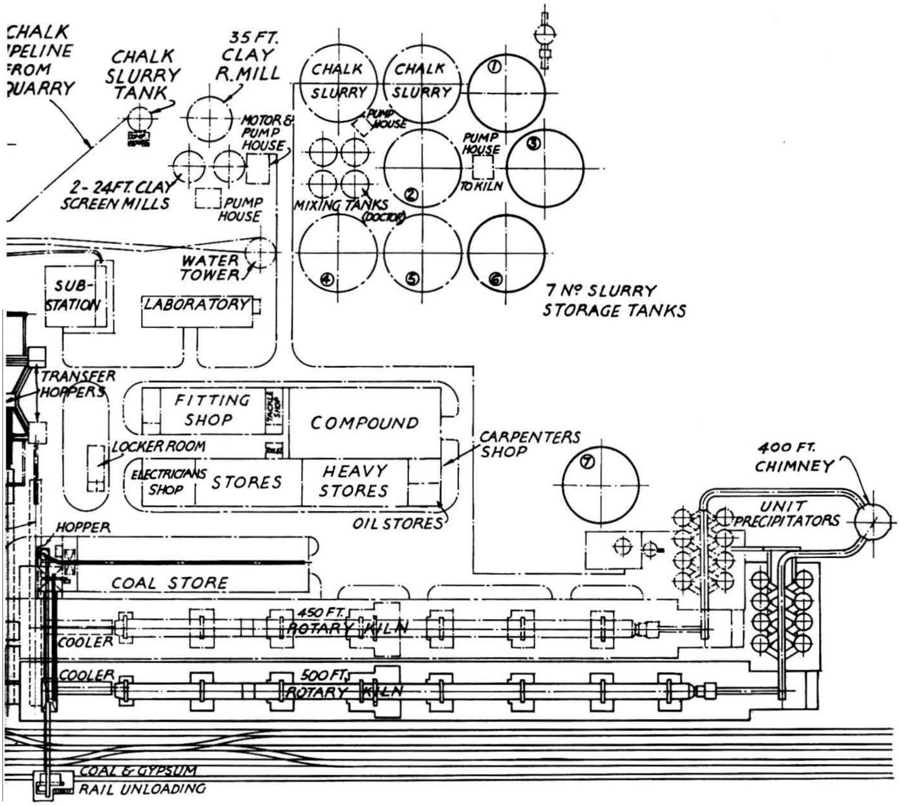


Fig. 13.—Arrangement of A.P.C.M

provision is also made to receive rail-borne gypsum through the coal-handling plant.

In addition to the increased capacity for storing clinker in the silos, a covered space for stock-piling 50,000 tons of clinker has been provided. The precast reinforced concrete structure for the cover of the store is shown in *Fig.* 11 before



Cement Works, Westbury, Wilts.

the roof sheeting was fixed. The stock-pile will be stocked and emptied by means of a mechanical shovel and dumpers. The completed store is illustrated in *Fig.* 12.

[The Vickers cement mills and the associated Howe-Richardson equipment, and storage, packing and despatch plant will be described in the May number of this journal.—ED.]

(To be concluded.)

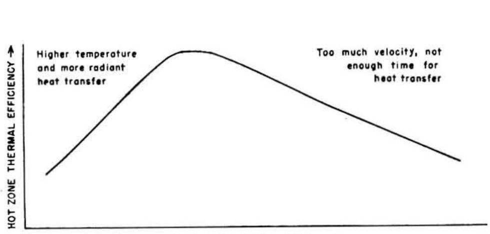
Enrichment of Combustion Air by Oxygen.

IN the number of the " Journal of the Portland Cement Association Research and Development Laboratories " for September last, MR. ROBERT A. GAYDOS, describes an investigation into the enrichment of the combustion air in rotary kilns by the introduction of oxygen. Over 90 per cent. of the energy used in cement manufacture is utilised in the production of clinker in the rotary kiln. Even in the newest kilns, the attainable thermal efficiency in the burning of clinker is less than 30 per cent. With such low thermal recovery in the process, it could be expected that the Portland cement industry should search for ways to reduce fuel costs.

From 1960 to 1962, the Southwestern Portland Cement Co., and the Linde Co., both in the U.S.A., co-operated in a test programme to determine the feasibility of such enrichment. In general, the results of this investigation confirm the claim that oxygen enrichment can be used successfully as a means of substantially increasing production from rotary kilns and at the same time reducing fuel consumption. Technically there appears to be no particular problem, the major deterrent at present being the cost of oxygen. However, as competition, standardisation, and the market for oxygen increase, the cost of producing oxygen may well decrease and the use of oxygen in rotary kilns may become common.

Interest in the use of oxygen in the manufacture of Portland cement clinker developed almost as soon as the commercial production of oxygen became practical, and in 1903, Geissler(1) suggested that oxygen could be used for clinker production However, nothing came of this primarily because of the economic factors involved in cement manufacture. The next serious attempt to use oxygen in the cement industry came in the late 1920's when Hillhouse (2) suggested its use to gasify fuels prior to their combustion in rotary kilns. Some experimental work on oxygen enrichment of kiln combustion air was carried out in Germany during the early 1940's, but the results of these studies are not available. The most extensive series of tests that has been reported was conducted by the Russians in 1946/47, the results of which were reported by Lourier and Volberg.(3) One method of introducing oxygen employed a post-mixed burner, and another the injection of oxygen into the secondary air. In both cases, the burning zone was shortened. With enrichments up to only 35 per cent., an increase of 56 per cent. in production was observed. So far as is known, no commercial kiln is operating with oxygen enrichment in Germany or Russia. Early in 1959, interest in oxygen enrichment

Fig. 1. Hot-zone Thermal Efficiency v. Combustion-gas-Velocity.



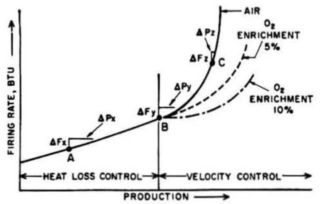


Fig. 2.—Production v. Firing Rates.

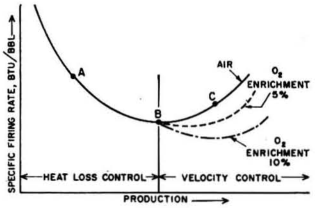


Fig. 3.—Production v. Specific Fuel Consumption.

increased in the U.S.A., and Huron Portland Cement Co., made a series of exploratory tests. The data, although inconclusive, gave indications that the oxygen did increase production.

A thermal analysis based on work done by Martin[4] was developed by Linde Co., to facilitate the study of the effect of oxygen on kiln performance. This analysis was based on the premises that the rate of heat loss of the kiln is a function of time, not rate of production; the amount of high-grade energy (available above 1,481 deg. F.) needed to clinker the raw material exceeds the low-grade energy requirements; and the velocity of the products of combustion in the burning zone greatly affects the efficiency of heat transfer in the burning zone.

Considering the fact that the CO_2 in kiln gases has a partial pressure of 182 mm.Hg and that the dissociation pressure of calcium carbonate is also 182 mm.Hg at 1,481 deg. F., it can reasonably be expected that no calcination will take place while the raw materials are cooler. For an average raw mix, Martin indicates that to produce 1 lb. of clinker about 918 B.t.u. must be added above 1481 deg. F., but only 652 B.t.u. are needed below this temperature. A calculation of the quantity of energy made available by cooling the products of combustion to a temperature such as would be expected above the material that is at 1,481 deg. F. shows that more low-grade than high-grade energy is available. The use of oxygen in kiln systems makes more high-grade energy available.

The effect of the velocity of the gases on heat transfer in the hot zone of a kiln can be important. *Fig.* 1 shows the results of a series of analyses based on kilns of 9 ft. 6 in. diameter. The thermal efficiency is defined as the useful hot-zone work divided by the combustion energy input plus the energy in the secondary air.

If the three basic premises are accepted, kiln operations can be represented by the diagrams in *Figs.* 2 and 3. This leads to the conclusion that there are two governing factors in kiln operation, namely control of heat loss, and control of velocity.

Consider a kiln operating at optimum efficiency at point A in *Fig.* 2. If more fuel is added ($\triangle$ Fx), the production at optimum efficiency will increase by $\triangle$ Px, assuming the feed rate to be increased. Owing to the fact that the heat-loss rate will remain constant, a proportion of the increment of fuel will be available for clinkering. As the fuel input is raised, however, the volume of combustion products will increase. The heat-transfer efficiency will tend to decrease so that at some point

B an addition of fuel of the same amount ($\triangle$ Fy) will yield a production increase of only $\triangle$ Py. If the fuel is further increased ($\triangle$ Fz= $\triangle$ Fy= $\triangle$Fx), the kiln efficiency will decrease and the kiln will show a still smaller increase of production.

If an increase in fuel ($\triangle$ Fy) were made along with an oxygen addition, the gas volume through the burning zone would drop. This decrease in volume would be a function of the magnitude of the oxygen addition. Therefore, at this stage the heat transfer efficiency should not drop even though the fuel input has been increased (see broken curves in *Fig.* 2). *Fig.* 3 shows that the fuel consumption continues to drop even when the firing rate is increased beyond the point at which the optimum B.t.u. per barrel is observed when using only air for combustion. In effect, using oxygen will shift the point at which kiln operation transfers from control of heat loss to control of velocity of thermal efficiency.

In the original paper, from which the foregoing is abstracted, numerical examples are given together with particulars of the preliminary and production tests. The conclusions are given as follows.

Oxygen enrichment can be used successfully as a means of increasing kiln production and reducing fuel consumption but the use of oxygen would not be feasible or desirable for all cement-producing installations. Each kiln system must be evaluated to determine the applicability of oxygen enrichment.

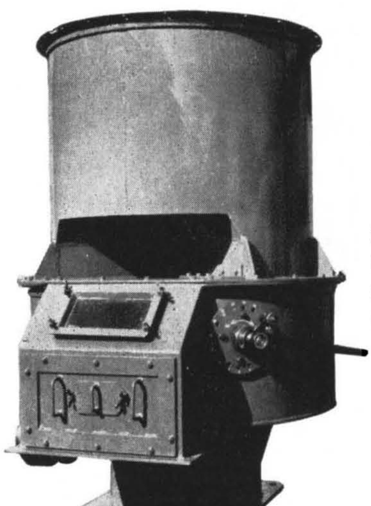
The test results generally conformed qualitatively to the theoretical calculations. However, the actual increase in production and savings of fuel were not so large as the calculations predicted. The difference is attributed to a lack of flexibility in the kiln systems. Further, a lack of capacity in the auxiliary equipment limited the oxygen enrichment rates attainable.

Much technical information has been developed which will permit in future work, a reasonable prediction of the production increases and fuel consumption that can be expected for any given kiln system at a given level of oxygen enrichment.

More work needs to be done to perfect the method of oxygen enrichment in a rotary kiln, further refinements being needed in the burner and burner-control systems. For gas and coal firing, lance injection into the load quadrant between the flame and the load gave the best results. For oil firing using pressure atomisation, a burner-pipe in which oxygen was introduced around the spray at the point of atomisation worked best. Further improvement of cperating technique is unlikely to be a major problem.

There appeared to be no particular problem in maintaining a good burning zone coating in the kilns during the tests.

In general, the case for the use of oxygen enrichment in rotary kilns is strong. However, a major deterrent at present is the cost of oxygen, but an encouraging aspect is that the cost seems to be continually getting lower. Additional reduction of costs could be accomplished by recovering some of the waste heat from the clinker coolers and the kiln exhaust gases. Should this excess heat be converted to steam for driving the turbine of the oxygen-plant compressor, it is estimated



that a worthwhile saving could be realised, and would, no doubt, make the use of oxygen more attractive to the cement producer.

Oxygen enrichment can be considered for existing or new works. Each kiln system should be analysed for proper evaluation. Fuel costs, power costs, production requirements, expansion problems, and the amount of oxygen to be used, are some of the factors which must be considered in this evaluation.

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Roman Cement in Early Railway Construction.

The following is abstracted from " The Railway Magazine " for February, 1966.

The so-called " Roman " cement frequently referred to as being used in the early days of railway building should not be confused with the mortar used by the Romans. " Roman " cement was the invention of James Parker, who took out a patent (No. 2,120) in 1796 for " Cement or Terras to be used in Aquatic and other Buildings and Stucco Work." Between 1810 and 1820 it was growing in popularity and between 1796 and 1850, in civil engineering work and building, the word " cement " meant Parker's " Roman " cement. It was first made on the coast of Kent but the industry moved to Essex, and Harwich became the chief centre of production. At the time of the Great Exhibition it was selling at 30*s*. to 40*s*. per ton. By the middle of the nineteenth century the superior qualities of Portland cement drove " Roman " cement off the market. By 1859 only two firms were making it in Essex, and its manufacture ceased in 1890.

" Roman " cement was made from hard stone-like concretions called septaria, locally known as "cement-stone" or " rock stone." The cement or mortar used by the Romans consisted of pozzolana, a volcanic clay or tufa consisting of clay and gravel with a percentage of soluble silica, which, in combination with lime, formed the strongest cement known to them. Parker's product in no way resembled it. At the time of the building of the early railways by Brunel, the two Stephensons, and others, " Roman " cement was the only type available, hence the frequent references to its use. The true Portland cement was not produced until 1845 when J. C. Johnson burnt the raw materials " with unusually strong heat until the mass was nearly vitrified " and then ground up the clinker. According to Sir Humphrey Davy, Parker's " Roman " cement contained 45 per cent. of clay and 55 per cent. of carbonate of lime, but Cressy (1856) quotes 55 per cent. of lime, 38 per cent. alumina and 7 per cent. oxide of iron. The foregoing information was freely extracted from a comprehensive article by A. P. Thurston in *Engineering*, of June 23, 1939, entitled " Parker's ' Roman ' Cement."

Transportation of Cement and Raw Materials.

IN this journal for January last, particulars were given of some new types of vehicles for the transportation of cement in bulk, and illustrations of the installations of the Tunnel Portland Cement Co., Ltd., at the Pitstone works and the Kew Bridge distribution depot were given. The illustrations in this page and page 37 are of two new bulk-carrier vehicles put into service recently by this cement company. The new vehicles are a pneumatic-discharge cement tanker of 28 tons gross weight, and a hopper vehicle of 30 tons gross weight for transporting limestone. Both vehicles are articulated.

The cement tanker (*Fig.* 1), which has a pay-load of 18 tons, is a frameless vehicle designed for non-tipping pneumatic discharge. The normal landing gear for this semi-trailer is eliminated so as to increase the payload. Operation of the pneumatic-discharge system is by means of two controls, one for the material supply and the other for the air supply. When once set, the controls require no further adjustment. Effective discharge is possible to a height of 100 ft. vertically at a rate of 60 to 70 tons an hour. Allowing for pressurisation of the tank, which is designed for a working pressure of 28 lb. per sq. in., the full load may be discharged at the rate of more than a ton a minute. The cylindrical tank, which is entirely of aluminium-alloy plate, is conical in shape at the forward end to reduce the overall height. The length is 25 ft. 3 in. inside the ends and the diameter, excluding the cone, is 6 ft., giving a net capacity of 650 cu. ft. The tank is mounted at an angle of 8 deg., and is pressurised by two or three cylinder compressors driven by the tractors full-torque power take-off. The cement is discharged through a 4-in. outlet at the rear of the tank, the outlet being fitted with a " Unicone " coupling for connection to the delivery hose.

The hopper vehicle (*Fig.* 2) is intended to replace ordinary tipping vehicles working the 15-mile round journey between the Tunnel Cement Co's. works at Padeswood and the limestone quarry. The payload is 21 tons. Since it has a greater capacity, its use will reduce the volume of traffic on the congested roads in the town of Mold, North Wales. The limestone is discharged through two sliding gates at the bottom of the hopper, the slides being actuated by double-acting

Fig. 1.—Cement Transporter

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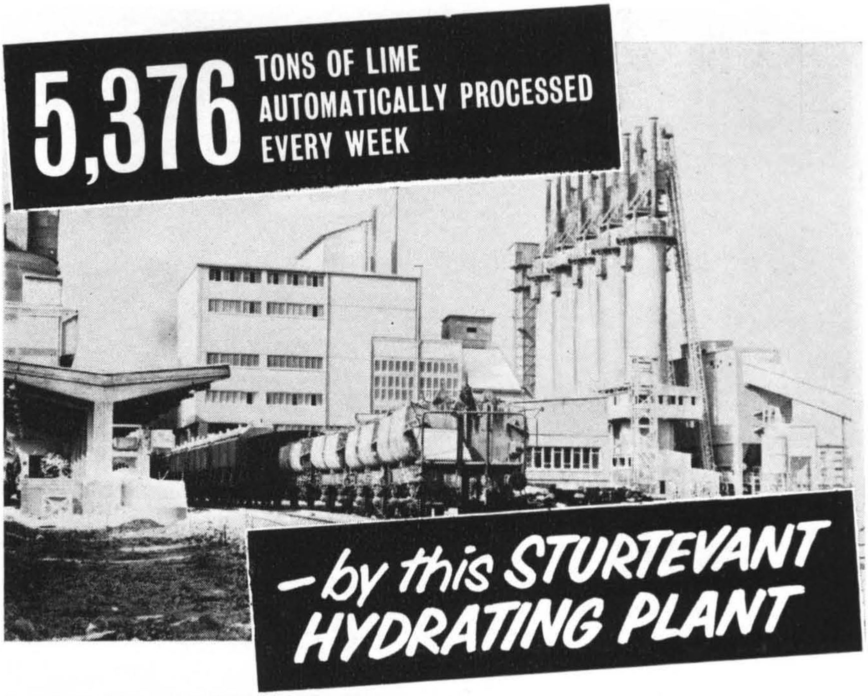

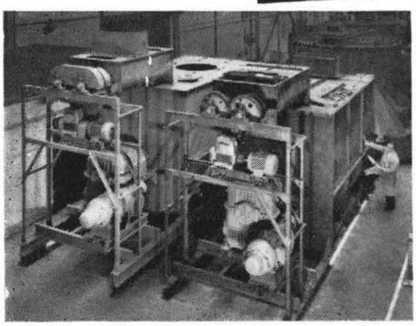

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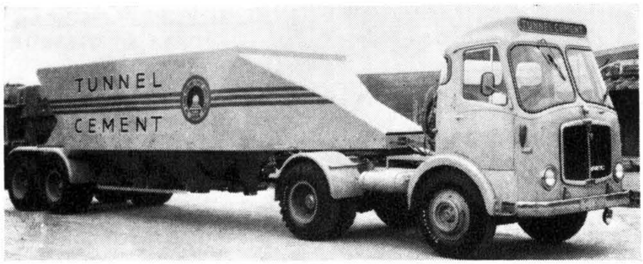

Fig. 2.—Limestone Transporter.

cylinders using compressed air from the braking system of the tractor. They are operated by remote control from the driver's cab. The forward end of the body is extended to form a housing for the rubbing-plate, kingpin, compressed-air equipment and an anti-jack-knife device, access for servicing being provided by a removable cover in the top of the housing. Discharge of the entire load of limestone is achieved in half a minute.

The tractor for both vehicles is powered by a six-cylinder dry-liner diesel engine, which produces up to 205 b.h.p., and has a six-speed overdrive transmission and triple-line air braking with power-assisted steering and hand-brake. Future vehicles will be powered by a diesel engine developing up to 226 b.h.p.

The prime-movers are A.E.C. " Mandator " tractors, and the semi-trailers were developed and built by Bonallack & Sons Ltd., to designs originated by the Tunnel Cement Co., Ltd.

The Cement Industry in Spain.

THE data on the productive capacities of the various cement works in Spain given in the number of this journal for January last were based on the following sources.

The productive capacities in 1960 were abstracted from " World Cement Directory " (published by Cembureau in 1961 but now out of print) and relate to conditions at the beginning of that year.

The increased productive capacities were abstracted from "Cemento Homigon," October 1965, and relate to conditions at the end of 1964, the last year for which there are any tabulated statistics.

MR. S. R. DEVLIN informs us that the following are among the new cement works which commenced operation during 1965.

The new plant of the Cia. Catalana de Cementos in Vallirana produced and sold 180,000 tons in 1965. The new plant of Hispano Suiza in Mecco began operation in May 1965 and produced 240,000 tons last year. Cementos Cinca in Monzon produced upwards of 80,000 tons last year. These three works operate entirely with " Loesche " vertical kilns.

Cement Industry In Europe.

Hungary.—A new cement works having an annual productive capacity of 1,000,000 tons is to be established at Beremend near the Yugoslavian border. The works is expected to be in production in the early 1970's. Negotiations for the supply of the necessary plant are in progress with companies in Czechoslovakia, the U.S.S.R., and Western and Eastern Germany.

THE following notes are abstracted from an article by MR. M. COOPER in a recent number of " Cement, Lime and Gravel."

Denmark.—The annual production of cement in the district around Aalborg, where there is one of the largest cement works in Europe, exceeds 1,000,000 tons. The works at Rordal, which is the largest of the four managed by Aalborg Portland Cement, is currently increasing its production by 50 per cent.

Norway.—The export of cement from Norway has risen remarkably in recent years, and has increased from 54,000 tons in 1960 to some 300,000 tons in 1964; the expected total for 1965 is about 350,000 tons. The largest single foreign market is the U.S.A. to which 160,000 tons annually are exported, mainly in bulk in ships for which a cement terminal has been built in Brooklyn. The total production in 1964 at the Brevik works of the A.S. Dalen Portland Cement, Norway's largest cement producer, was about 750,000 tons, and a new kiln is to come into operation this year, increasing the annual productive capacity to some 1,200,000 tons. A £5,000,000 investment is involved and, for this development, plant is being supplied from Britain and Germany.

Greece.—In 1965, the increase in production of cement was nearly 1,000,000 tons, the total being 3,200,000 tons. This increase is attributed to the commencement of operation of a new rotary kiln by the Titan Cement Manufacturing Co., at their Saloniki works, improvements in the rotary kiln at the Eleusis plant of Halyps Cement, the installation of 2,700-h.p. cement mill in the Heracles works of the General Cement Co., at Draptesona, and the new installations of the Chalkis Ciments Portland Artificiels which have a daily productive capacity of 1,200 tons. The following plans for expansion in 1966 have been announced. Titan Cement Manufacturing Co., is to install a new rotary kiln in their Eleusis works and the General Cement Co., are adding a rotary kiln to their Olympos works at Volos.

Production of Cement in the United Kingdom in 1965.

ACCORDING to provisional figures collected by the Ministry of Public Building and Works, stocks of cement and cement clinker in Great Britain were appreciably higher at the end of 1965 than at the end of 1964. The total production of cement in 1965 was 16,700,000 tons which is equal to the record output achieved in 1964. Home deliveries in 1965 amounted to 16,400,000 tons compared with 16,500,000 tons delivered in 1964. Imports in 1965 amounted to about 200,000 tons mainly in the early part of the year, when some slight shortage was experienced.


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PATENT

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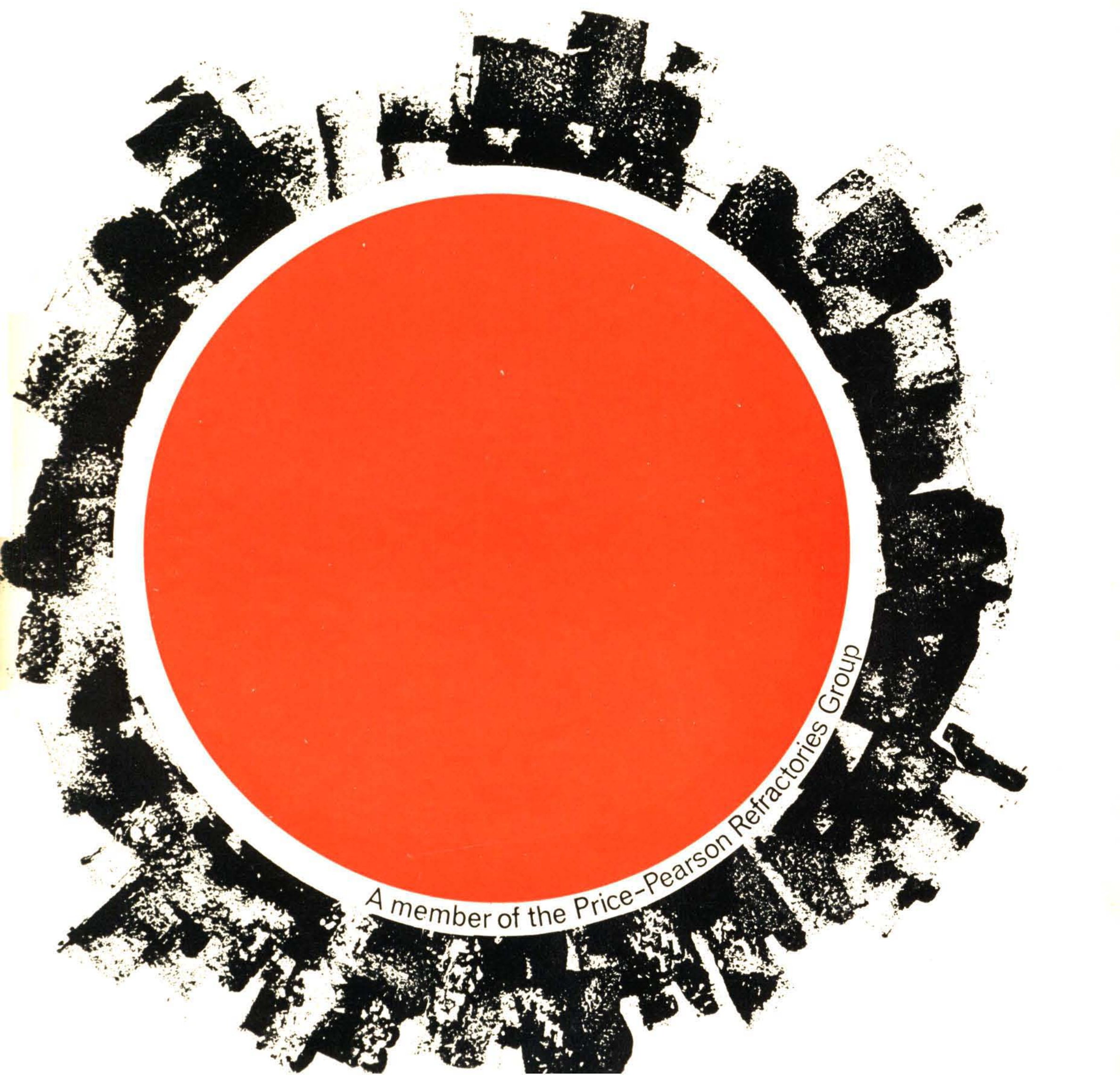

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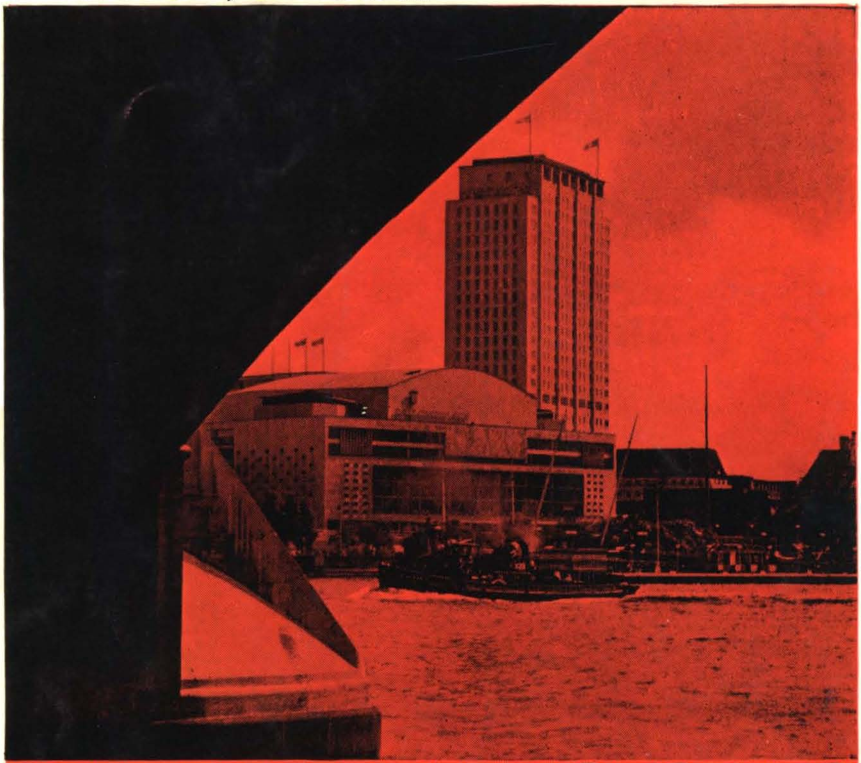

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