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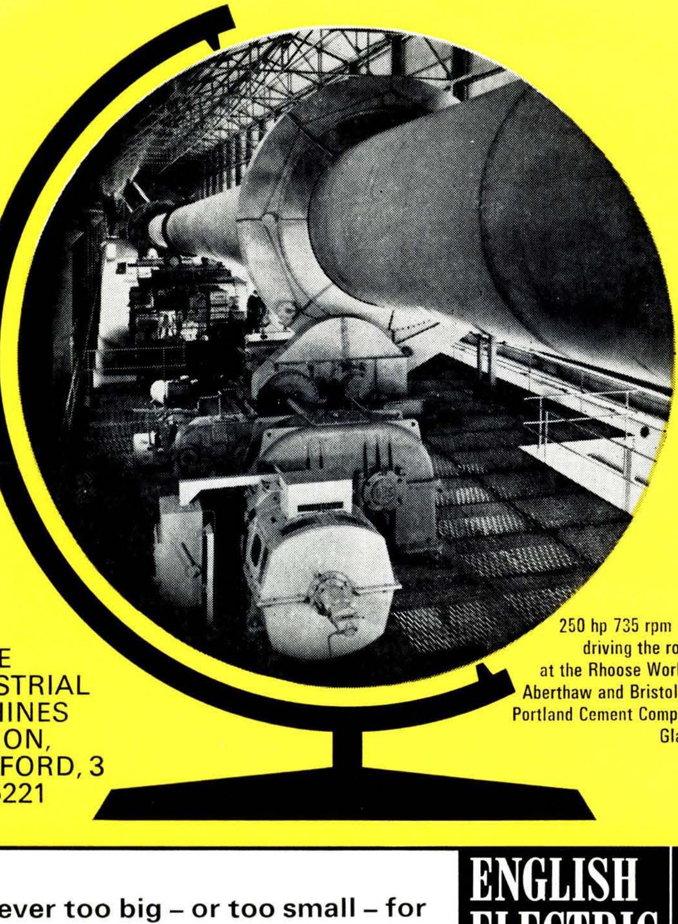

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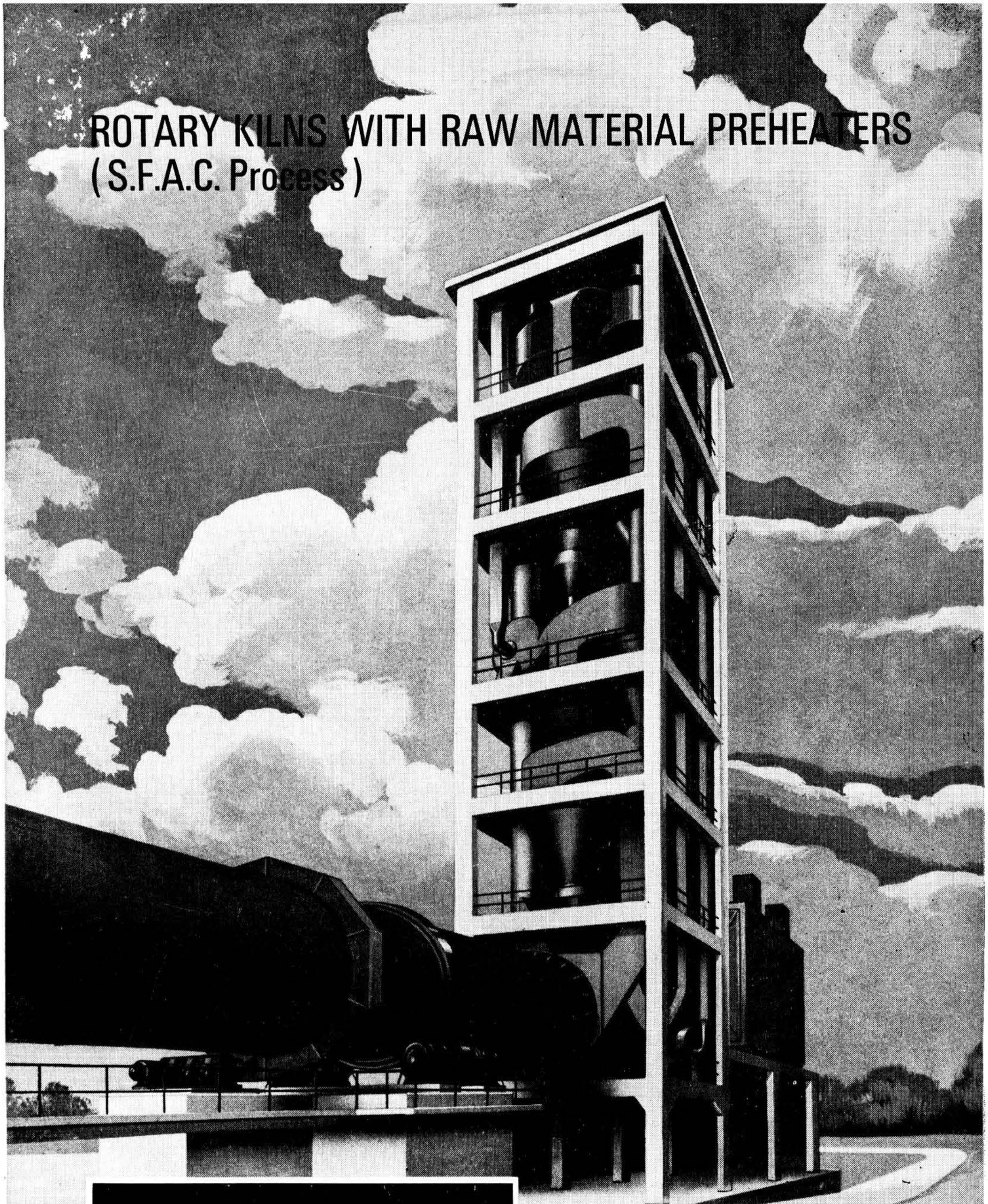
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VOLUME XLI NUMBER 2 MARCH, 1968

Reaction Products at Early Ages of C_3A and of C_3AH_6 with Calcium Sulphate.

By J. H. P. VAN AARDT* and S. VISSER*.

AS THE reaction products of C_3A** and of C_3AH_6 with sulphate are the same at equilibrium, and as C_3A in Portland cement causes expansion while apparently no distress is encountered with a similar quantity of C_3AH_6, it seems justifiable to assume that the expansion or distress is due to intermediate metastable reaction products or the formation of such phases before equilibrium is reached. It is with this in mind that the reactions at very early ages of C_3A and of C_3AH_6 with gypsum were investigated.

Experiments

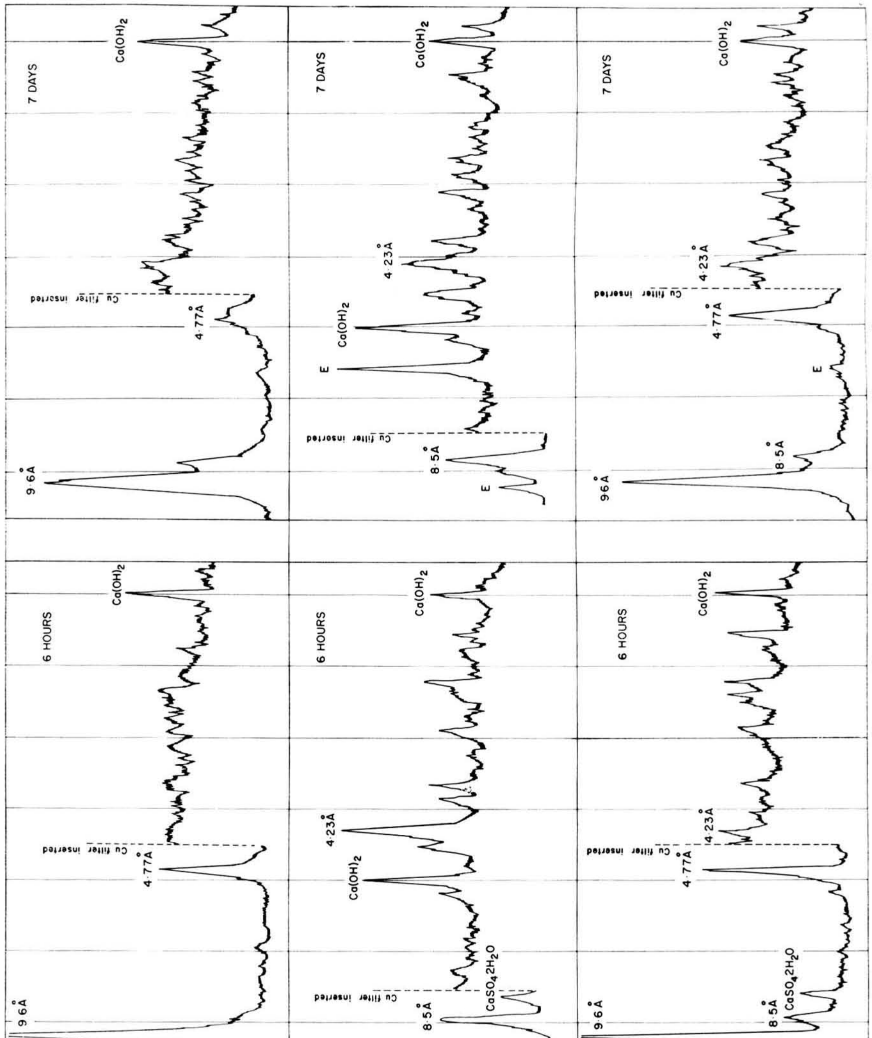
C_3A was prepared by repeated burning at 1370 deg. C. and crushing of a mixture of pure $CaCO_3$ and Al_2O_3. The material was ground to pass a 325-mesh sieve before being used in the experiments, C_3AH_6 was prepared by autoclaving C_3A at 150 lb. per sq. in. for two hours. Precautions were taken to exclude CO_2. Some solid was filtered off at various intervals and X-ray diagrams were prepared while the reaction mixture was kept at the required temperature in a humid nitrogen atmosphere. All X-ray diffraction work was carried out with copper $K\alpha$ radiation.

Reaction Mixtures

1.—C_3A (1·35g.) or C_3AH_6 (1·89g.) was reacted with $Ca(OH)_2$ (0·37g.) in water (100g.) or in saturated lime water [100g. plus 0·2g. $Ca(OH)_2$] at 5 deg. C. and 25 deg. C.

*National Building Research Institute, Council for Scientific and Industrial Research, Pretoria, S. Africa.

**The symbols are: $C=CaO$, $A=Al_2O_3$, $H=H_2O$.



(a). C_3A(1·35g.) and $Ca(OH)_2$(0·37g.) or C_3AH_6(1·89g.) and $Ca(OH)_2$(0·37g.) reacted at 5 deg. C. in saturated lime solution [water (100g.) plus $Ca(OH)_2$(0·20g.)]; $CaSO_4 2H_2O$(0·86g.) added after one week and mixture kept at 25 deg. C.

(b). C_3AH_6(1·89g.) and $Ca(OH)_2$(0·37g.) reacted at 25 deg. C. in saturated lime solution [water (100g.) plus $Ca(OH)_2$(0·16g.)]; $CaSO_4 2H_2O$(0·86g.) added after one week and mixture kept at 25 deg. C.

(c). C_3A(1·35g.) and $Ca(OH)_2$(0·37g.) reacted at 25 deg. C. in saturated lime solution [water (100g.) plus $Ca(OH)_2$(0·16g.)]; $CaSO_4 2H_2O$(0·86g.) added after one week and mixture kept at 25 deg. C.

Fig. 1.—X-ray Diffractograms of Calcium Sulpho-aluminates.

(a) C_3A(1·35g.) and $CaSO_42H_2O$(0·86g.) reacted in water (100g.) for one day at 25 deg. C.

(b) C_3AH_6(1·89g.) and $CaSO_42H_2O$(0·86g.) reacted in water (100g.) for one day at 25 deg. C.

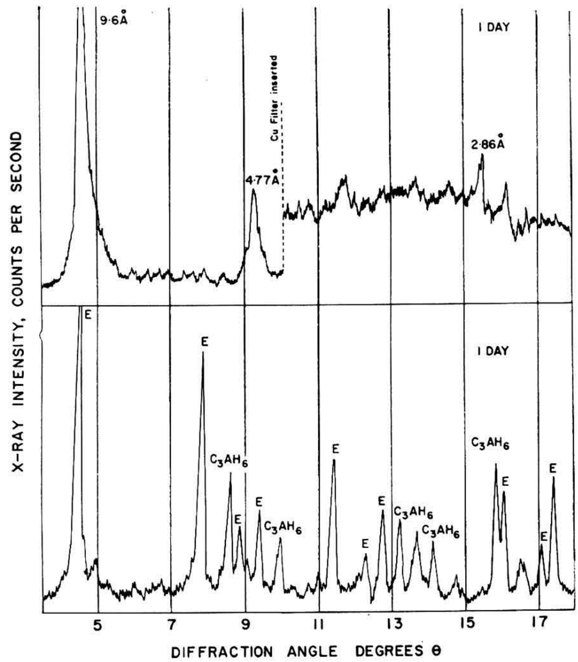


Fig. 2.—X-ray Diffractograms of Calcium Sulpho-aluminates.

2.—$CaSO_42H_2O$ (0·86g.) or $3CaSO_42H_2O$ (2·58g.) were added to the suspensions above and kept at 25 deg. C.

3.—C_3A (1·35g.) or C_3AH_6 (1·89g.) was reacted with $Ca(OH)_2$ (0·37g.) and $CaSO_42H_2O$ (0·86g.) or $3CaSO_42H_2O$ (2·58g.) in water (100g.) at 25 deg. C.

4.—C_3A (1·35g.) or C_3AH_6 (1·89g.) was reacted with $CaSO_42H_2O$ (0·86g.) or $3CaSO_42H_2O$ (2·58g.) in water (100g.) or in saturated lime water [100g. plus 0·16 $Ca(OH)_2$] at 25 deg. C.

Discussion

REACTION MIXTURE 1.—It has been recorded in a previous publication[1] that

(i) A compound with d-spacings 10·6Å, 5·3Å was observed when C_3A and $Ca(OH)_2$ or C_3AH_6 and $Ca(OH)_2$ were reacted in water at 5 deg. C.

(ii) A compound with d-spacings 8·2Å, 4·1Å was observed when C_3AH_6 and $Ca(OH)_2$ were reacted in water at 25 deg. C.; and

(iii) Both compounds were present when C_3A and $Ca(OH)_2$ were reacted in water at 25 deg. C.

Some C_3AH_6 and $Ca(OH)_2$ were always present in the reaction mixtures kept at 25 deg. C. When saturated $Ca(OH)_2$ water was used identical reaction products

1.—VAN AARDT, J. H. P. and VISSER, S. "Some reactions of Tricalcium-aluminate-hexahydrate at medium temperatures." *Cem. Lime Mf.*, vol. XL, No. 1, January 1967.

were formed and $Ca(OH)_2$ was detected in the mixtures kept at 5 deg. C.
REACTION MIXTURE 2.—The addition of one mole of sulphate to the 10·6Å compound produced a phase with d-spacings 9·6Å, 4·77Å at early ages, that is one hour to seven days (see *Fig.* 1*a*). This substance changed to a phase with d-spacings 8·9Å, 4·4Å at equilibrium. When three moles of sulphate were added, only the 9·6Å compound and $CaSO_42H_2O$ were observed at one hour; the equilibrium phase was ettringite. The presence of excess $Ca(OH)_2$ tended to retard the reaction rate. In brief:

$$10{\cdot}6\text{Å} \xrightarrow{+\ 1\ CaSO_42H_2O} 9{\cdot}6\text{Å} \xrightarrow{Ca(OH)_2\ +\ \text{time}} 8{\cdot}9\text{Å}.$$

$$10{\cdot}6\text{Å} \xrightarrow{+\ 3CaSO_42H_2O} 9{\cdot}6\text{Å} + CaSO_42H_2O \longrightarrow \text{ettringite}.$$

One mole of sulphate added to the 8·2Å compound, produced a phase with d-spacings 8·5Å, 4·23Å and ettringite: gypsum was also present at an early age, that is, one hour, but was not detected at seven days (see *Fig.* 1*b*). The 8·5Å compound changed to ettringite and finally at equilibrium the 8·9Å compound was observed; the change from ettringite to 8·9Å appeared to pass through the 9·6Å substance. When three moles of sulphate were added the 8·5Å phase and gypsum were observed at one hour; the equilibrium phase was ettringite. The presence of $Ca(OH)_2$ tended to retard the reaction rate.
In brief:

$$8{\cdot}2\text{Å} \xrightarrow{+\ 1\ CaSO_22H_2O} 8{\cdot}5\text{Å} + \text{E} \longrightarrow \text{E} + \text{aluminate} \longrightarrow 9{\cdot}6\text{Å} \longrightarrow 8{\cdot}9\text{Å}.$$

$$8{\cdot}2\text{Å} \xrightarrow{+\ 3\ CaSO_42H_2O} 8{\cdot}5\text{Å} + CaSO_42H_2O \longrightarrow \text{ettringite}.$$

In the presence of gypsum, a suspension containing both the 10·6Å and 8·2Å compounds gave the intermediate phases 9·6Å and 8·5Å at early ages (see *Fig.* 1*c*)
REACTION MIXTURE 3.—In this experiment the reactants were all added at once; C_3A and $CaSO_4$ rapidly formed ettringite; the latter then reacted with more calcium aluminate to form the 9·6Å compound within one day. C_3AH_6 reacted with the $CaSO_4$ to again produce ettringite; in this instance the ettringite was only slowly changed to the 9·6Å substance. The equilibrium phase was again the 8·9Å compound in both instances. Three moles of sulphate gave only ettringite at early ages while unreacted sulphate and aluminate were present.
REACTION MIXTURE 4.—With one mole of sulphate and C_3A the 9·6Å-phase was predominant after one day (see *Fig.* 2*a*), but with C_3AH_6, ettringite was predominant (see *Fig.* 2*b*); at later ages both suspensions contained the 9·6Å-compound. In the presence of saturated $Ca(OH)_2$ solutions, the 8·9Å-phase was detected at equilibrium. Ettringite was the only phase observed when three moles of gypsum were added to the aluminates.

Conclusions

It has been shown (reaction mixture 2) that if sulphate was added to suspensions of C_3A and $Ca(OH)_2$ or C_3AH_6 and $Ca(OH)_2$ that were kept for seven days at

5 deg. C before the addition of the sulphate, similar calcium sulpho-aluminates were observed, but if similar experiments were made at 25 deg. C, the reactions followed different courses to the same equilibrium phases, which are either the 8·9Å-calcium sulpho-aluminate, ettringite or a mixture of these two calcium sulpho-aluminates, depending on whether one mole or less, three moles, or one to three moles, of gypsum are used, respectively. The new phases at 9·6Å for C_3A and sulphate and 8·5Å for C_3AH_6 and sulphate, and the fact that C_3AH_6 tends to produce ettringite immediately while C_3A goes through the 9·6Å phase, may provide a lead to a precise explanation of sulphate expansion phenomena in Portland cement containing medium to high percentages of C_3A. This may also offer an explanation for the discrepancies sometimes observed in the relationship between C_3A content and sulphate susceptibility of a Portland cement.

New Cement Works in Nigeria

TWO NEW cement works have been established recently in Nigerian territories, namely at Ukpilla and Calabar. Both works are described briefly in the following.

UKPILLA WORKS

THE NEW cement works at Ukpilla, about 120 miles north-east of Benin City in Mid-western Nigeria, has been built for the Ukpilla Cement Co. Ltd., by a consortium comprising Friedrich Krupp of Rheinhaussen, which firm supplied the main mechanical equipment, Continho Caro & Co. of Hamburg, and Philipp Holzman, the civil engineering contractors. Electrical equipment was supplied by Brown-Boveri. The works, the daily productive capacity of which is 500 tons of ordinary Portland cement, operates on the dry process, with a Krupp suspended-dust preheater and rotary kiln. A plan of the works is shown in *Fig.* 1, a general view is shown in *Fig.* 2, and a view of the workshops and stores are shown in *Fig.* 3. The illustrations in *Figs.* 2 and 3 on page 26 are reproduced from photographs supplied by the Krupp organisation. *Fig.* 1 is given on pages 24 and 25.

Raw Material

A limestone quarry is being developed about 2 miles from the works. The stone is won by drilling and blasting and is loaded by a 1·3 cu. m. Demag diesel shovel into Aveling-Barford 15-ton dumpers for transport to the works, where it is discharged into a ground hopper. It is then fed by an apron-feeder into a hammer-crusher, where the stone is reduced in size from 800 mm. to 25 mm. The crushed product is conveyed by belt, with a throw-off carriage, to the storage hall.

Clay is dug in the neighbourhood of the works by contractors who deliver it to the works, where it is crushed by a roll-crusher and dried in a Rapid drier fired by oil. From the drier, the material is discharged into the storage hall.

Provision is made to receive and handle a third component material available locally, if such is required.

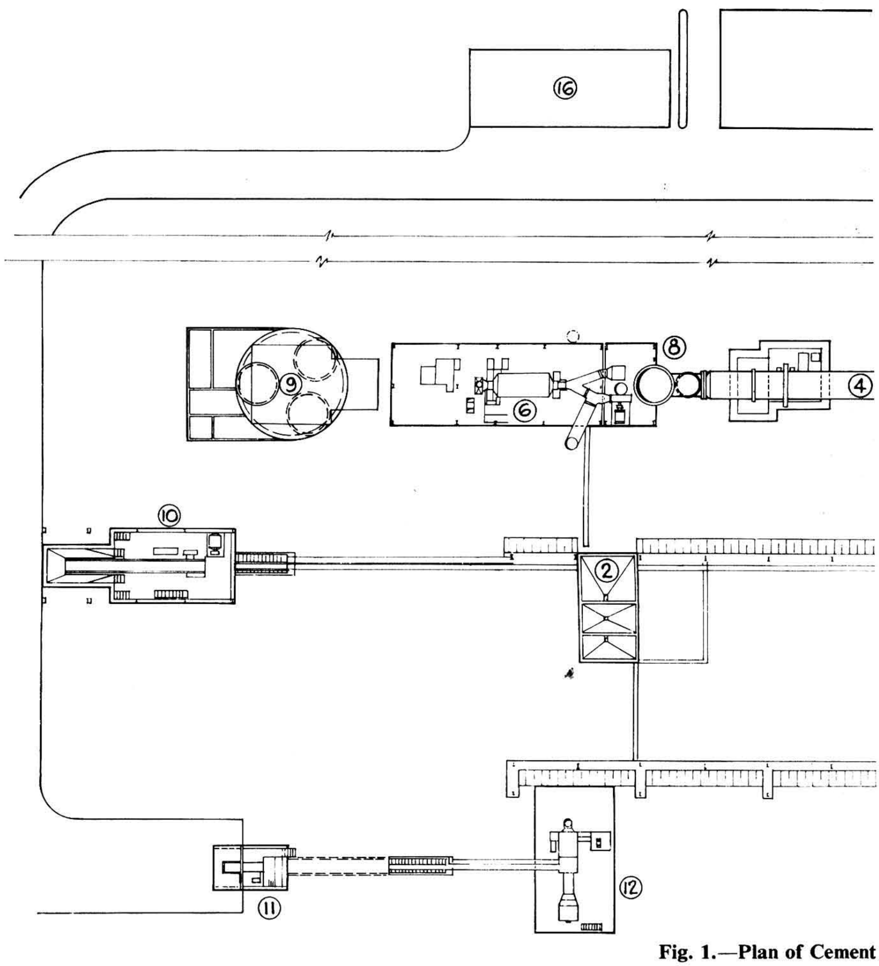
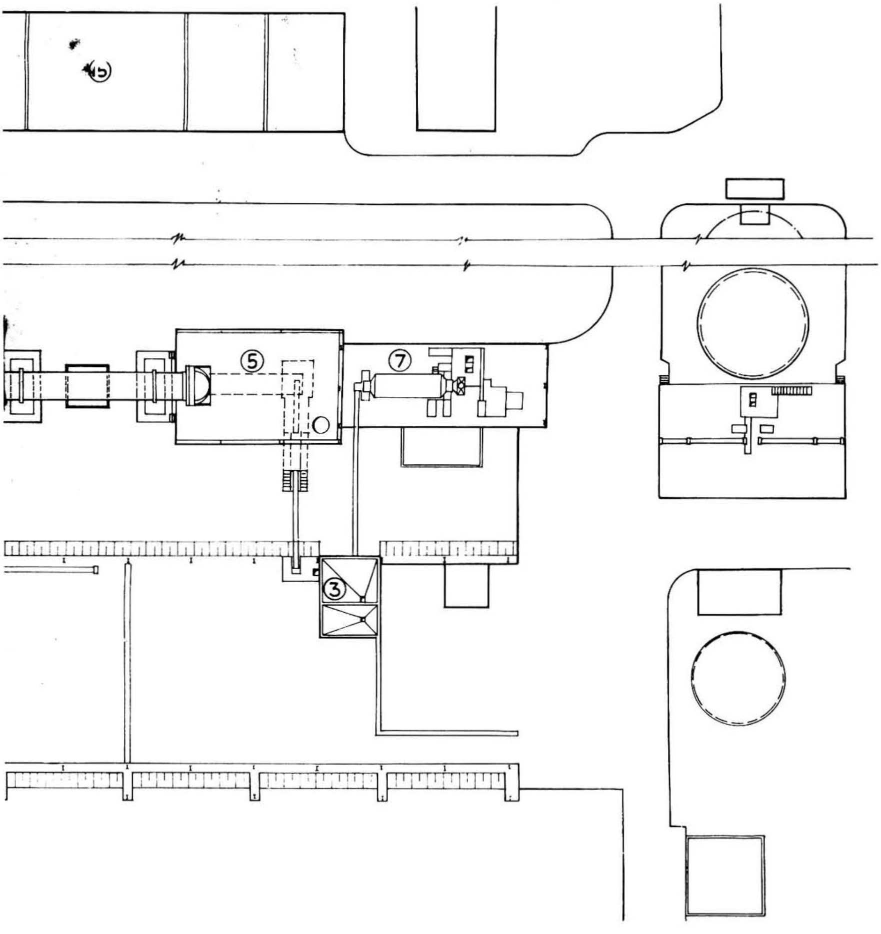


Fig. 1.—Plan of Cement

Preparation of Raw Material

The storage hall for the raw materials, clinker and gypsum is 130 m. long by 25 m. wide and is served by a travelling crane of 8-tons capacity. Concrete hoppers for each material are provided in the hall. The raw-material hoppers are equipped with feeder-weighers, with automatic control, which feed a correctly proportioned mixture on to a belt-conveyor by means of which it is transported to the raw-materials mill.

The raw-materials mill is a single-chamber tube-mill, which operates on closed circuit and is 6·5 m. long and 3·0 m. in diameter. The drying of the material to 0·5-per cent. moisture content is completed in the mill by hot flue gases from



/orks at Ukpilla, Nigeria.

the kiln. The purge from the closed circuit passes to an electrostatic precipitator on the kiln outlet. The product, after grinding, is taken to the blending and storage silos by pneumatic trough-conveyors and a pneumatic elevator.

There are three blending silos each of which is of 5-m. diameter and is equipped with air-agitation equipment. They are mounted on the top of a storage silo of 13-m. diameter. The silos are constructed of reinforced concrete, and the structure has an overall height of about 45 m.

The finished raw meal is extracted from the silo and elevated pneumatically to the kiln feeder-weigher from which it is taken to the feed-point of the kiln by a trough-conveyor and bucket-elevator.

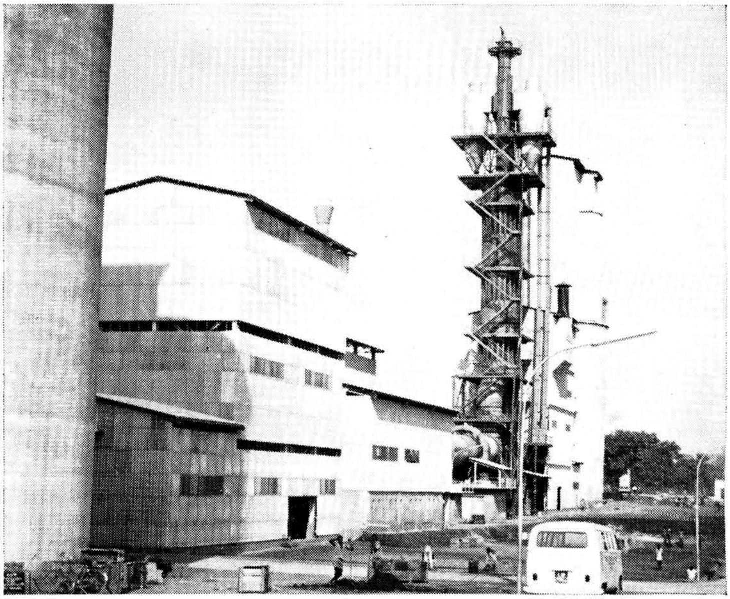


Fig. 2.—General View of Ukpilla Works, Nigeria.

Burning

The kiln plant comprises a Krupp counterflow preheater, about 60 m. high, with two cyclones and three chambers, a rotary oil-fired kiln 48 m. long and 3·45 m. in diameter, and a Fuller inclined-grate cooler. D.C. motors are used for obtaining variable speed for both the kiln and the induced-draught fan. The exit gases are finally cleaned in a Walther electrostatic precipitator.

The cooled clinker is transferred to the storage hall by a bucket-tray conveyor and a drum-weigher.

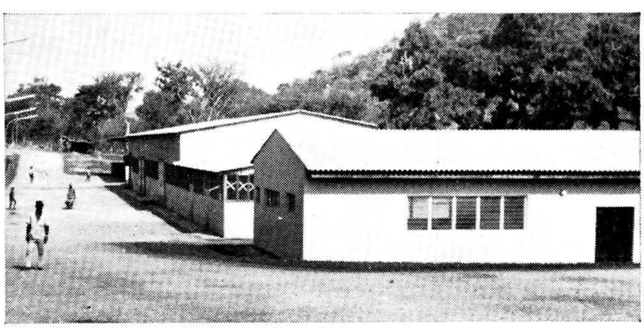


Fig. 3.—Workshop and Stores, Ukpilla Works.

Grinding, Storing and Packing

Clinker and gypsum are extracted from the hoppers in the storage hall by weigher-feeders with automatic proportioning control, and taken to the mill on a belt-conveyor. The mill, which is 8·5 m. long and 3·0 m. in diameter, has two chambers and works on closed circuit, the purge being cleaned in an Intensive filter containing 136 stockings. The mill-drive is a 920-kw. motor operating through a girth-gear and a reduction gear-box.

The finished cement is transferred to a single concrete silo 13 m. in diameter and 32 m. high. Sliding formwork was used in the construction of the structure and the blending and raw-meal silos.

The cement is packed into 50-kg. paper bags by two Haver & Boecker three-spout packers each equipped with retractable conveyors for loading lorries.

The works is equipped with the usual laboratory, workshop and office facilities. Living quarters for the supervisory staff have been built about two miles from the works.

CALABAR WORKS

THE OTHER new cement works in Nigeria is at Calabar and was officially opened in February 1967. The works was planned and built by Salzgitter Industriebau G.m.b.H., and Deutsche Industrielagen Fritz Werner G.m.b.H., of West Germany, the civil engineering contractors being the Monier Construction Co., of Port Harcourt, Nigeria. The designed annual productive capacity of clinker is 100,000 tonnes, part of which would be despatched as clinker.

The works, a plan of which is given in *Fig.* 5, operates on the wet process and is situated on the northern outskirts of Calabar on the bank of the Calabar River, where a deep-water berth has been constructed for loading clinker and packed cement into sea-going vessels. *Fig.* 5 is given on page 28. Some views of the works are shown in *Figs.* 4, 6 and 7.

The raw materials, limestone and shale, are won from a quarry about 20 miles to the east of the works. A road had to be constructed from the works and passes through areas of dense bush, forests with trees more than 50 ft. high, over deep swamps and the River Kwa, the crossing of which required a bridge

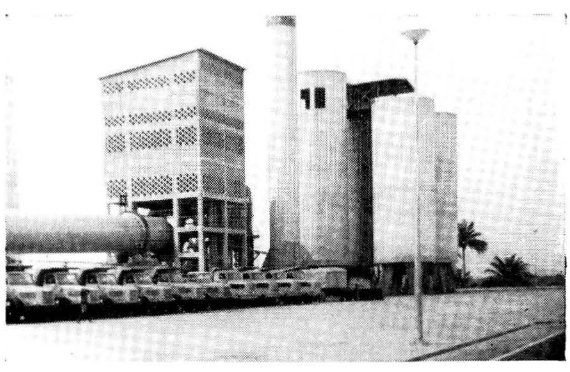


Fig. 4.—Calcinator House and Raw Meal Silos at Calabar Works.

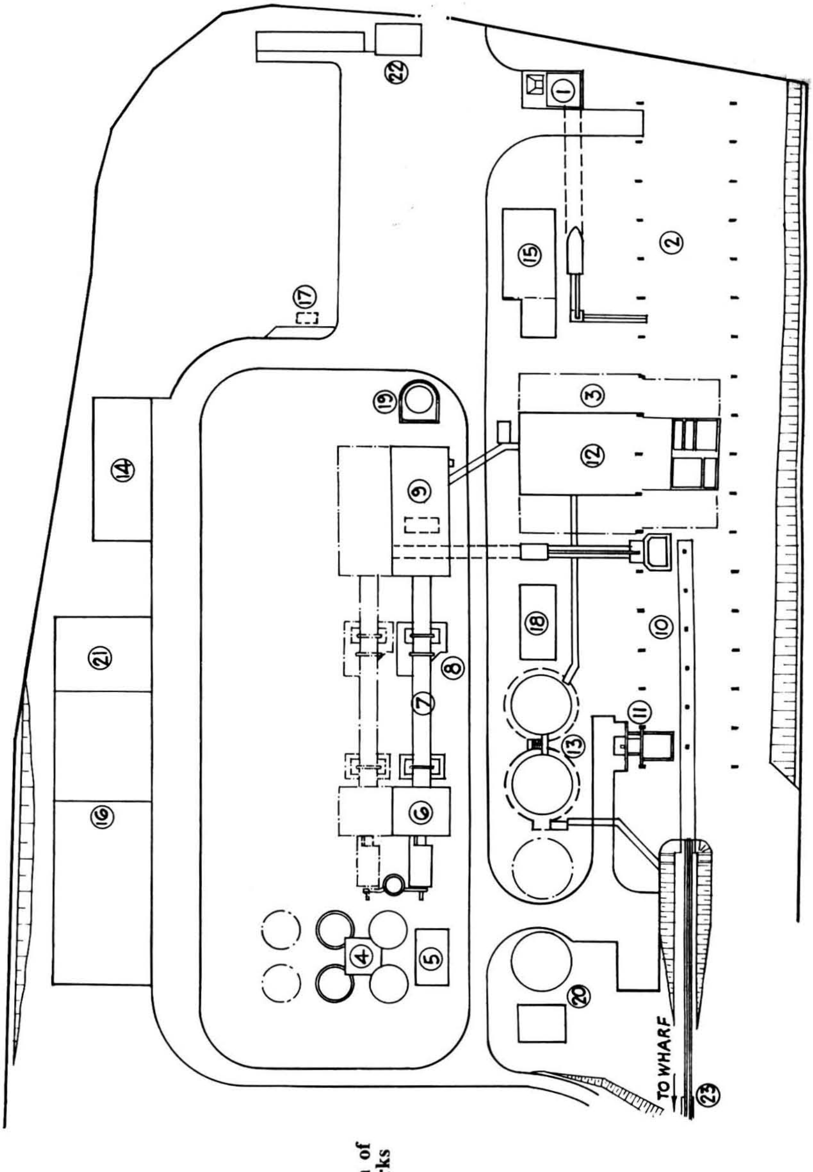


Fig. 5.—Plan of Cement Works at Calabar, Nigeria.

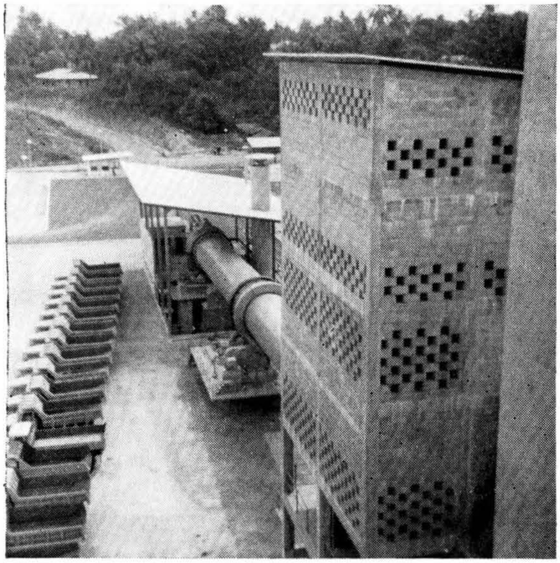


Fig. 6. — Calcinator House, Kiln and Quarry Dumpers at Calabar Works.

900 ft. long. The materials are transported, as dug, to the works by a fleet of sixteen dumpers and are there crushed to mill-size in a Miag-Titan hammer-crusher.

The raw materials, clinker and gypsum are stored in a main materials store, which is served by two overhead cranes. They are ground wet to produce slurry,

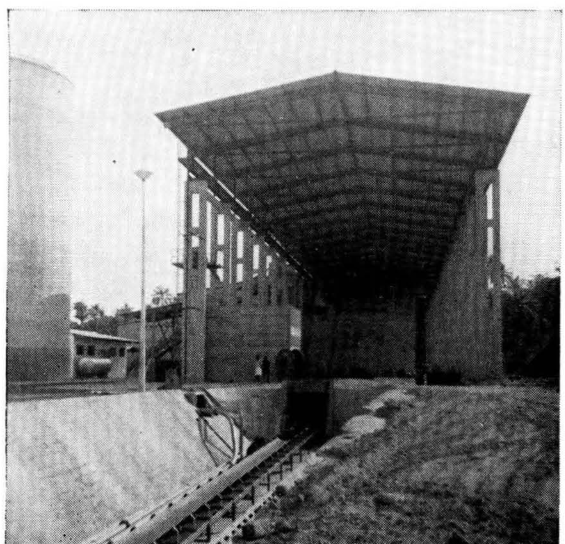


Fig. 7. — Materials Store (showing Clinker Conveyor to Wharf) at Calabar Works.

in a Miag open-circuit compound mill. There are two concrete silos with air-agitation equipment for blending, and two storage silos for the finished slurry.

The slurry is burned in a kiln plant comprising a Miag calcinator, a Miag rotary kiln, and a Fuller inclined-grate cooler. The flue-gases are cleaned in a multi-cyclone separator.

The clinker is ground in an open-circuit Miag compound mill, from which the cement is pumped to the two concrete silos.

The packing plant is on the river-side wharf. The cement is pumped from the silos to the hoppers at the packing plant by Fuller Kinyon pumps. The silos are about 750 ft. from and some 60 ft. above the wharf. The cement is packed by two two-spout Haver & Boecker packers into 50-kg. paper bags for loading on to lorries or into vessels berthed alongside.

Clinker for shipment in bulk is extracted from the storage hall through openings in the floor, and falls on to a belt-conveyor, equipped with a weigher, in a tunnel beneath the floor on which it is transported to the wharf, where it is discharged by means of a boom direct into the holds of berthed vessels.

The works was shown in a British news-reel on B.B.C. Television in November last. Unfortunately, some damage was sustained during the recent fighting and the works is now shut down.

The Cement Industry in Kenya

WITH REFERENCE to the note in the November 1967 number of this journal, the Bamburi Portland Cement Co. Ltd., of Mombasa, have informed this journal that the Bamburi works are referred to as belonging to the British Standard Portland Cement Co. Ltd. The latter Company is now known as the Bamburi Portland Cement Co. Ltd. In December last, a new Humboldt preheater and rotary kiln, with a guaranteed output of 750 tons per day, came into operation and, in the same month, a new bulk-carrying ship " Cementia " arrived in Mombasa to join her sister ship " Bamburi," giving additional carrying capacity for deliveries in the Indian Ocean area. During December, the Company sold a total of 26,916 tons of cement.

Separating Effect and Efficiency of Classifiers

IN THE article in the January number of this journal on the " Separating Effect and Efficiency of Classifiers," by DR. R. RUEGG, the formula at the bottom of page 8

$$\sigma_M = 1/(1-u_4)$$

should be given the serial number (6), and the reference to formula (5) near the bottom of page 10 should be to this formula (6).

The second term in formula (3) should be $\frac{F \cdot f}{A \cdot a}$

The symbols z and Σ in the text have the same significance respectively as the symbol γ in *Fig.* 3, and the symbol Σ in *Table* II and *Fig.* 6.

Refractory Gunite Lining of Lime Shaft-kiln

THE WEST'S vertical shaft-kiln at the lime works of Limestone Products Ltd., at Abergele, North Wales, has a capacity of 70 tons per day and is oil-fired by the Catagas system. It is in continuous operation permitting only one annual shut-down period, during which it is necessary to repair the refractory brick lining owing to erosion in the critical area in the burning zone. For this work West's (Manchester) Ltd., the constructors of the kiln, recommended Steetley Chambers Ltd., to be consulted and the latter firm suggested monolithic repairing. The process proposed and carried out was applying by the guniting method, "Gunolith L.I.", an aluminosilicate material. The repair, which was carried out over the

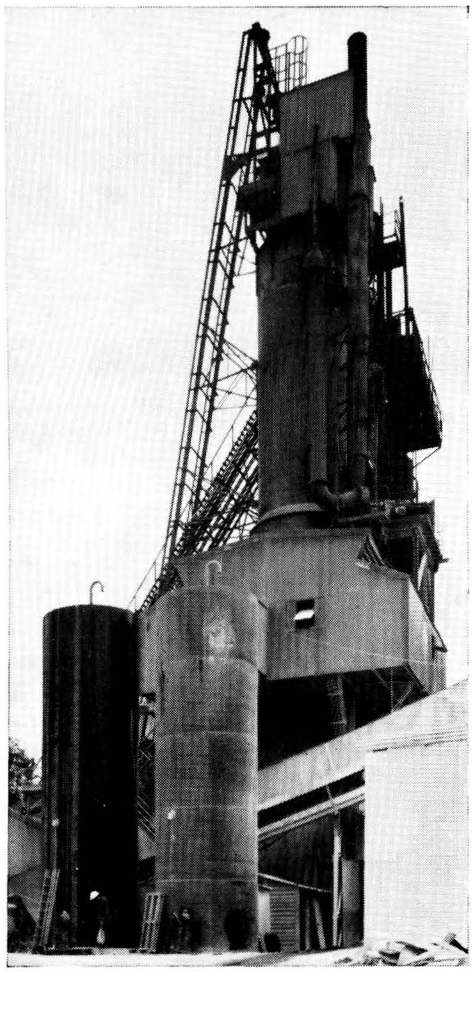


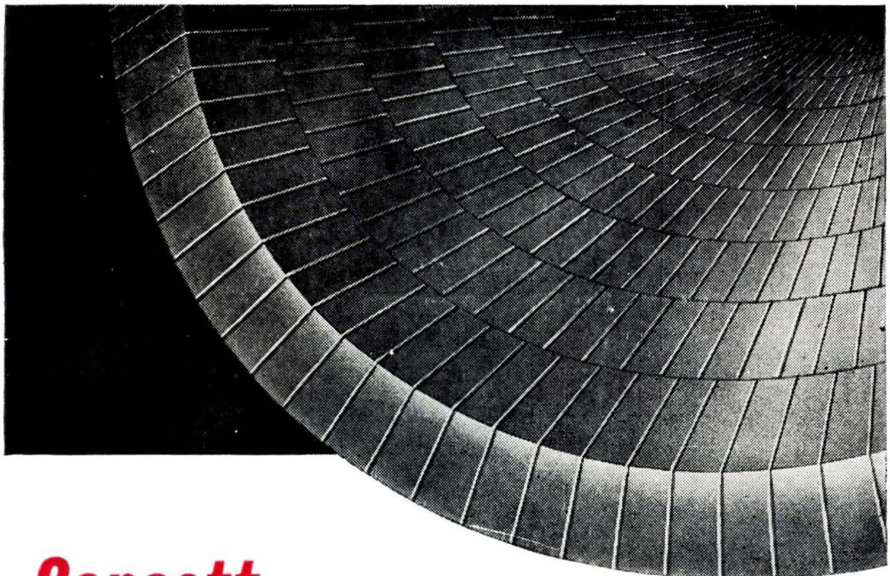
Fig. 1. Vertical Shaft Lime Kiln at Abergele.

Fig. 2.—Burning Zone of Vertical Lime Kiln at Abergele.

badly worn areas, gave a lining with a low iron content, high density and a good abradability index, suitable for working temperatures up to 1500 deg. C.

The accompanying illustrations show, in *Fig* 1, a general view of the kiln at Abergele and, in *Fig*. 2, the burning zone of the kiln when partly re-lined; a further application of the gunite lining is required to bring the lining to its correct profile.

Previous experience with gunite linings has shown that the degree of wear was no greater than with brick linings, and the benefits derived from the speedier work of the repairing of the lining are considerable. None of the existing worn brickwork needs to be taken out since the gunite is applied directly on to it, the thickness depending on the amount of wear of the brick lining. The time taken to reline the shaft-kiln at Abergele was reduced by 60 per cent. It is also claimed that the cost of materials was reduced by 25 per cent., since expensive bricks of special shapes were not required.



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The Cement Industry in the United Kingdom

Extension of Rugby Cement Works

THE NEW extension of the Rugby Portland Cement Co.'s works at Rugby is now proceeding and comprises mainly the installation of a new kiln. The site of the new kiln is an old quarry which has been filled, and therefore it is necessary to provide foundation piles extending down to the rock of the quarry floor to support the plant. The foundations will have to resist considerable lateral thrust from the movement and operations of the kiln and, to withstand this, inclined pressure-grouted piles of the M.V. system will be used. There will be forty-two of these piles, each 18 in. square and 83 ft. long ; the inclination will be 45 deg.

For supporting vertical loads, twenty vertical Hochstrasser-Weisepiles, 4 ft. in diameter and 112 ft. long will be provided.

The piles of both systems are being installed by Economic Foundations Ltd.

Extension of Southerham Works

EASTWOODS CEMENT LTD., one of the companies of the Rugby Portland Cement Co. Ltd., has applied for planning permission for extensions adjacent to the works at Southerham, near Lewes, Sussex. The proposals include the erection of a chimney 400 ft. high; the neighbouring Mount Caburn, a local beauty spot, is 488 ft. high. Excavation of the chalk is proposed up to the 350-ft. contour. The net area of the two quarries, Southerham Quarry and Machine Bottom Quarry, would be about 145 acres.

The new works comprise, in addition to the chimney, a kiln and kilnhouse, an electrostatic precipitator, a materials store, cement mill house, cement silos, and packing and loading plant, together with ancillary offices, stores, laboratory and railway sidings.

A new raw-materials plant proposed for Machine Bottom Quarry will comprise crushing plant, washmills, screening plant, slurry storage basins and pumphouse.

It is understood that the extraction rate from the new quarry could reach 500,000 tons of chalk a year.

A secondary application seeks to establish a 52-acre clay working, together with vehicle loading plant and repair shop, on land adjoining Ripe railway crossing. This is a completely new works.

Silo for White Cement

BECAUSE WHITE structural concrete is becoming increasingly popular, The Cement Marketing Company has recently installed a silo for storing white Portland cement, " Snowcrete," at the depot at Northenden, Manchester. Special road tankers are reserved for transporting this material direct from the depot to the sites.

Cement Silos, Ipswich

THE CONSTRUCTION of the reinforced concrete cement storage silos in *Fig.* 1 was completed early this year at Mason's Works, near Ipswich, which is one of the works of The Associated Portland Cement Manufacturers Ltd. The silos, each of

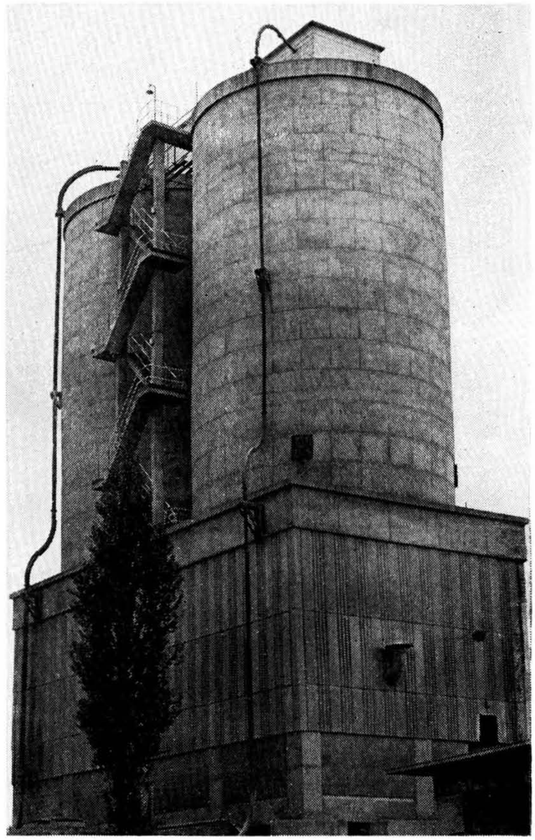

Fig. 1.—Cement Silos, Ipswich.

which has a capacity of 2,000 tons, are supported 40 ft. above the ground on an entablature the slab of which is carried on concrete columns 3 ft. square. Due to difficult ground conditions at the site, where the strata comprises filling overlying putty chalk, which becomes harder with increase in depth, it was necessary to provide a piled foundation. A total of 108 Frankipiles, each of 90-tons capacity, support the columns and extend to depth of 60 to 70 ft.

The consulting engineers were Messrs Oscar Faber & Partners, the contractors being The Mitchell Construction Co., Ltd.

Sulphuric-acid and Cement Plant at Whitehaven

THE ILLUSTRATION in *Fig.* 2 shows the five kilns, which are now on stream producing sulphuric acid at the rate of over 1,000 tons per day, at the Whitehaven works of Marchon Products Ltd. An equal quantity of cement is produced at the same time. The operation is independent of imported sulphur since it is based on the anhydrite process, the raw material for which is mined from Marchon's own mine on the site at Whitehaven.

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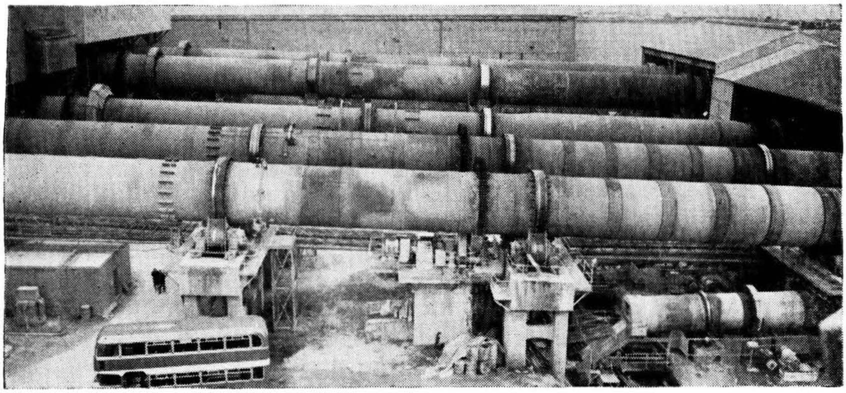

Fig. 2.—Kilns at Whitehaven.

Transport of Clinker

SPECIAL TRAINS have been arranged by the London Midland Region of British Rail to convey cement clinker in bulk from Whitehaven to Wishaw and Coatbridge in Scotland. The clinker, which is a by-product of the process for making sulphuric acid at the chemical plant of Marchon Products Ltd., is despatched in train loads to Scotland by the Cement Marketing Co., Ltd. Road vehicles bring the clinker from the works to the loading site at Whitehaven where it is tipped into a hopper and transferred by conveyor belts to the rail wagons. Two special trains run each week to Coatbridge and consist of forty-two wagons each having a capacity of 16 tons, giving a total train load of 640 tons. Originally one train, carrying about 700 tons of clinker in 26-ton capacity tipper wagons, was despatched each week to Wishaw. With the improved discharge facilities now completed at Wishaw, modified 30-ton hopper wagons are being used on this service and an average of two trains is run each week. The carriage of cement clinker from Whitehaven is eventually planned to reach a total of 200,000 tons per annum.

Cookstown Works, Northern Ireland

WITH REFERENCE to the article in the number of this journal for January 1968, describing some aspects of the new cement works for The Associated Portland Cement Manufacturers Ltd., at Cookstown, Northern Ireland, it should be mentioned that the design and supply of the rotary kiln and Lepol grate preheater, granulator plant and conveying equipment, the regrind mill and ancillaries for raw-meal preparation have been carried out by Polysius Ltd. This equipment is for the semi-dry process and is similar to the equipment installed by Polysius Ltd., at other works of The Associated Portland Cement Manufacturers Ltd., at Cauldon, Dunbar and Weardale.

Pitstone Works, Bucks

IN THE description of the new works of the Tunnel Portland Cement Co., Ltd., at Pitstone, Bucks., the size of the kiln house was given as 1,800 ft. by 500 ft. These are the overall dimensions of the entire works.

Cement Industry Abroad

U.S.S.R.—It has been announced that the Soviet Union, which is reported to have been leading the world in cement production during the past few years, has now taken first place in the world for exports of cement. These exports have increased by more than five times during the past seven years, and it is expected that, in 1968, about 2,300,000 tons, which is a record amount, will be exported. The exports are to twenty-one countries, but mainly to Africa and Asia. Deliveries to Latin America are expected to start shortly, Brazil having already bought 150,000 tons with possible further purchases to follow. White cement for facing buildings is supplied to southern countries. In 1966, Hungary commenced importing cement from the U.S.S.R., and exports to the Netherlands and possibly to Italy will commence this year.

Yugoslavia.—The Dalmacija Cement Company, the largest cement producing organisation in Yugoslavia, is extending its works at Prvoborac near Split, and has placed an order with the Humboldt division of Klöckner-Humboldt-Deutz A.G. (KHD), for the new plant. The plant will comprise a Humboldt preheater for a rotary kiln 64 m. long and 4·2 m. in diameter, as well as the raw material and clinker mills with the corresponding precipitators and dust-collecting systems. When the new plant is complete (production is expected by the end of 1969), the Dalmacija Cement Company will attain an annual output of 1,100,000 tons of cement.

The Dalmacija Cement Company had installed a Humboldt preheater in its Partizan works as long ago as 1956.

Eire.—It was announced last month that Cement Ltd., the sole cement manufacturing concern in Eire, had increased its annual sales by 15 per cent. in the year ending September 30, 1967. The total value of cement sold was £8,710,000. For the current year, exports are a little uncertain and there will be added competition in this field when the new works of The Associated Portland Cement Manufacturers Ltd., is in operation at Cookstown.

Publisher's Note

THIS NUMBER of "Cement & Lime Manufacture" is the first to be printed by Fleetway Printers in succession to Cornwall Press Ltd., the latter firm, which has now ceased business, had printed this journal since 1930.

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