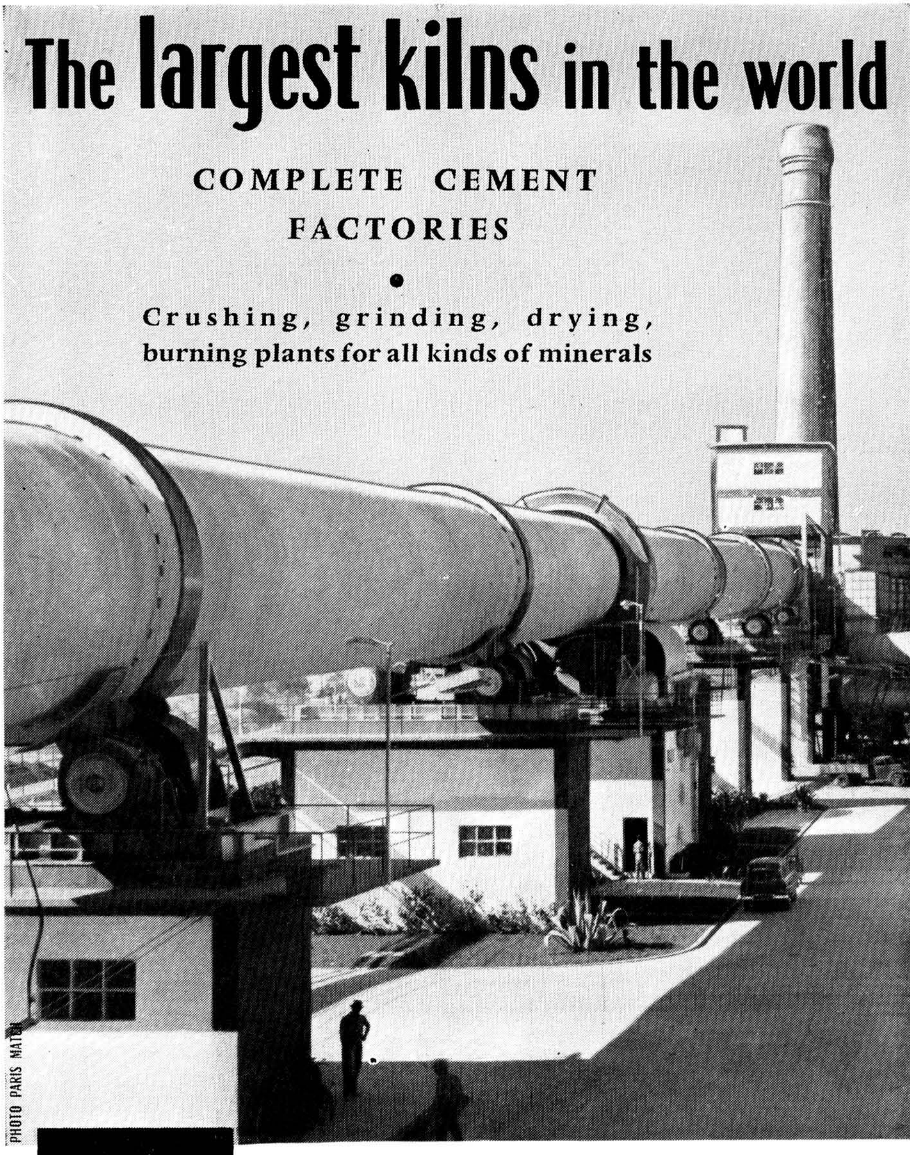
CEMENT
& LIME MANUFACTURE

VOL. XXXVI. No. 2 | MARCH, 1963 | Price 1s. 6d. Annual subscription 9s. ($1.75 in Canada and U.S.A.)

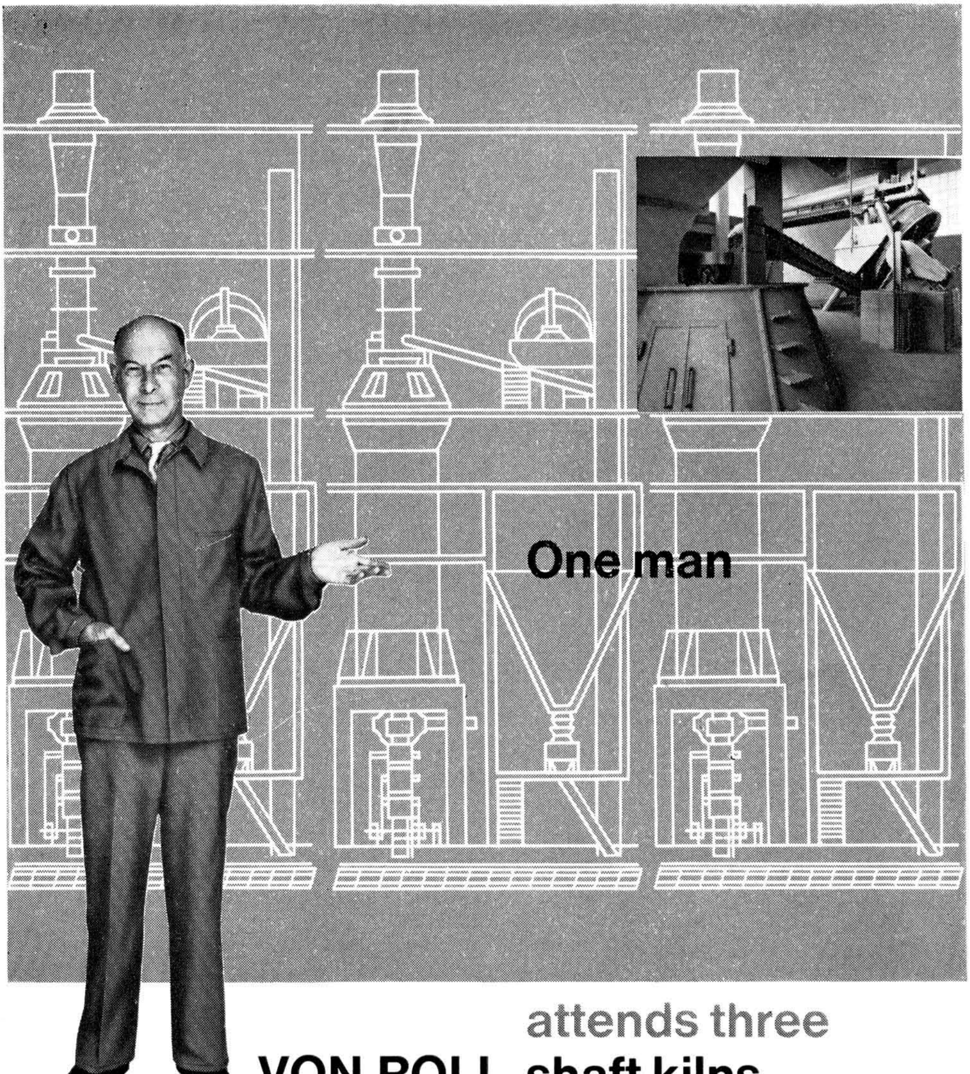


Alhandra cement factory (Portugal). View of the kiln (167.5 m x 4.8/5.3 m - 1600 T/day)

SAG - PARIS - 2022

FIVES LILLE - CAIL

7, rue Montalivet, PARIS (8e) - Tél.: ANJou 22-01 et 32-40



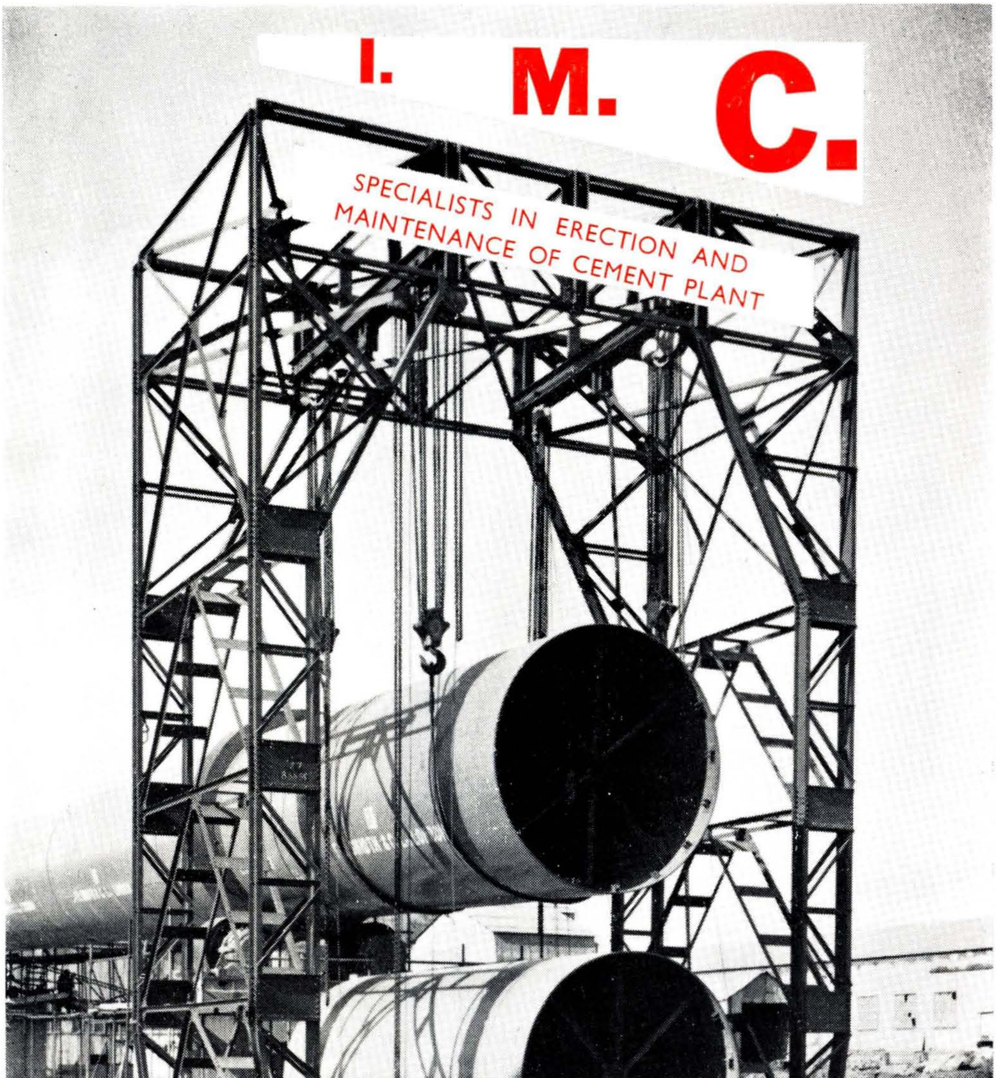
attends three
VON ROLL shaft kilns
at the same time

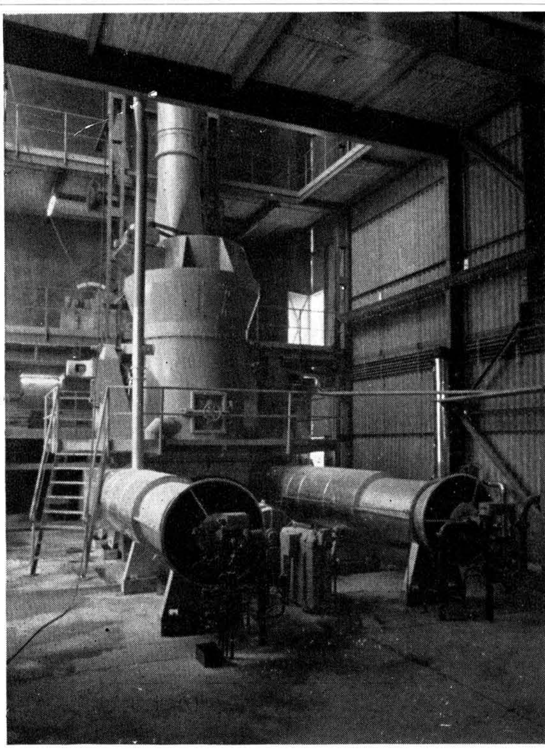
Rational working method
excellent survey of the kiln
low staff costs

are secured by arranging the pan noduliser beside the kiln head. The height of the kiln is reduced and so are the costs of construction

VON ROLL Ltd. Uraniastrasse 31/33, P.O.B. 511, Zurich/Switzerland

Photograph: Burner's platform of a VON ROLL shaft kiln in Western Germany


I. M. C.
SPECIALISTS IN ERECTION AND MAINTENANCE OF CEMENT PLANT
INSTALLATION & MANUFACTURING CONTRACTORS LTD.
27 CHURCH ST., WEST HARTLEPOOL. HIGH ST., WARE, HERTS.
HARTLEPOOL 5308. WARE 3302.



Plants for making:

ASBESTOS CEMENT PIPES & SHEETS

WHITE CEMENT

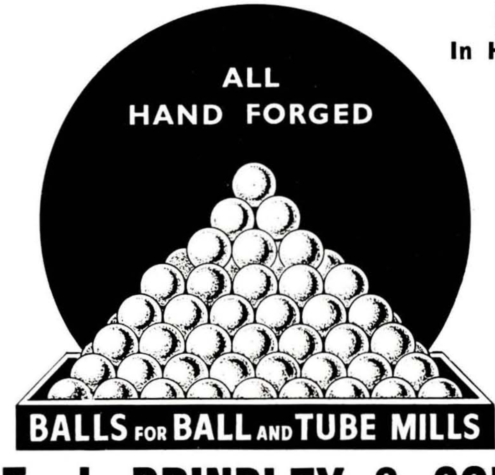
SLAG CEMENT

PRESTRESSED CONCRETE

RAILWAY SLEEPERS

ASBESTOS CEMENT ENGINEERING CO.

P.O. BOX 34.649 Haupstrasse 26, VADUZ, LIECHTENSTEIN, SWITZERLAND



STEEL GRINDING BALLS

In High Carbon and Chrome Steel
1″- 6″ Diameter

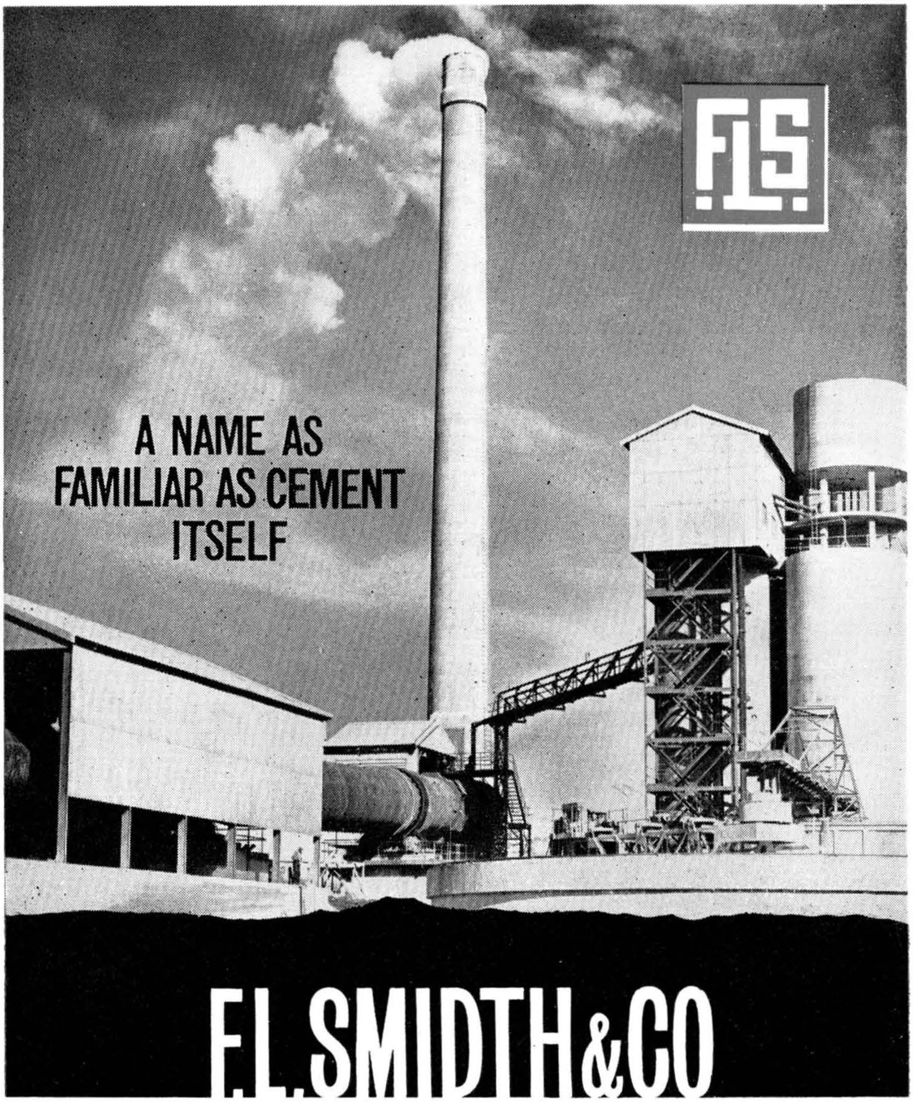
DESIGNED TO
GRIND FASTER,
LAST LONGER,
NEVER BREAK,
NEVER LOSE SHAPE

Also makers of fine hand-forged tools for QUARRY and MINE

F. J. BRINDLEY & SONS (SHEFFIELD) LTD.

CENTRAL HAMMER WORKS, SHEFFIELD, 1.

Phone and Grams: Sheffield 24201/2


FLS
A NAME AS
FAMILIAR AS CEMENT
ITSELF
F.L.SMIDTH&CO

CEMENT AND LIME MANUFACTURE

PUBLISHED ALTERNATE MONTHS. PRICE 1s. 6d. A COPY ANNUAL SUBSCRIPTION 9s. POST FREE
$1.75 IN CANADA AND U.S.A.

PUBLISHED BY
CONCRETE PUBLICATIONS LIMITED
60 BUCKINGHAM GATE, LONDON, S.W.1

TELEPHONE: VICTORIA 0705/6.
TELEGRAPHIC ADDRESS:
CONCRETIUS, PARL, LONDON.

PUBLISHERS OF
"CONCRETE & CONSTRUCTIONAL ENGINEERING"
"CONCRETE BUILDING & CONCRETE PRODUCTS"
"CEMENT & LIME MANUFACTURE"
"THE CONCRETE YEAR BOOK"
"CONCRETE SERIES" BOOKS.

VOLUME XXXVI. NUMBER 2. MARCH, 1963

A New Cement Works in Mexico.

THE new dry-process cement works installed by Cemento de Atotonilco, S.A. near Atotonilco de Tula in the State of Hidalgo, Mexico, has a productive capacity of 1000 tons per day. The site is in a desolate rural area about 45 miles from Mexico City and 7200 ft. above sea-level, but is served by a main line of railway. The principal plant (*Figs.* 1 and 2) for producing Portland cement comprises Humboldt preheaters and two rotary kilns fired by oil or natural gas.

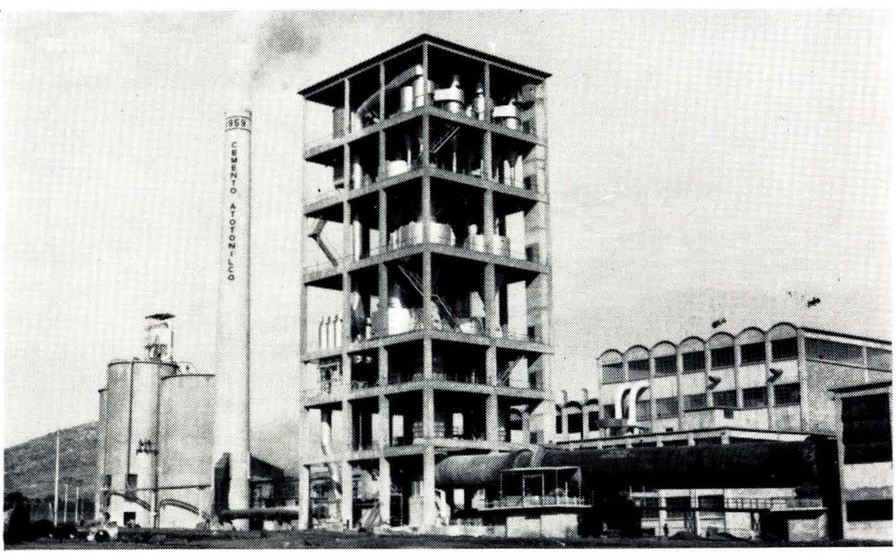


Fig. 1.—New Cement Works, Atotonilco, Mexico.

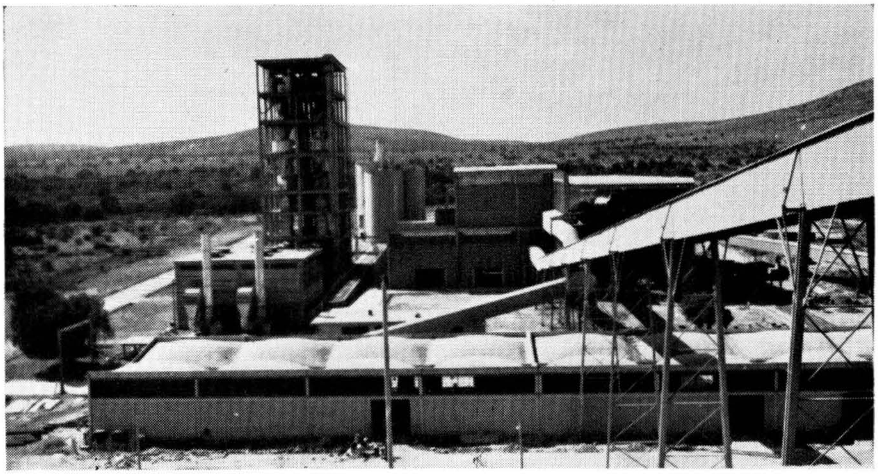


Fig. 2.—General View of Works looking towards Preheater.

Electricity is supplied by the Mexican Light & Power Co., at 20,000 volts. The raw materials are limestone and clay obtained from the Company's own abundant nearby deposits; gypsum and iron ore are obtained from outside sources.

Raw Materials.

The limestone, the quarry for which is about $\frac{3}{4}$-mile from the works, is drilled

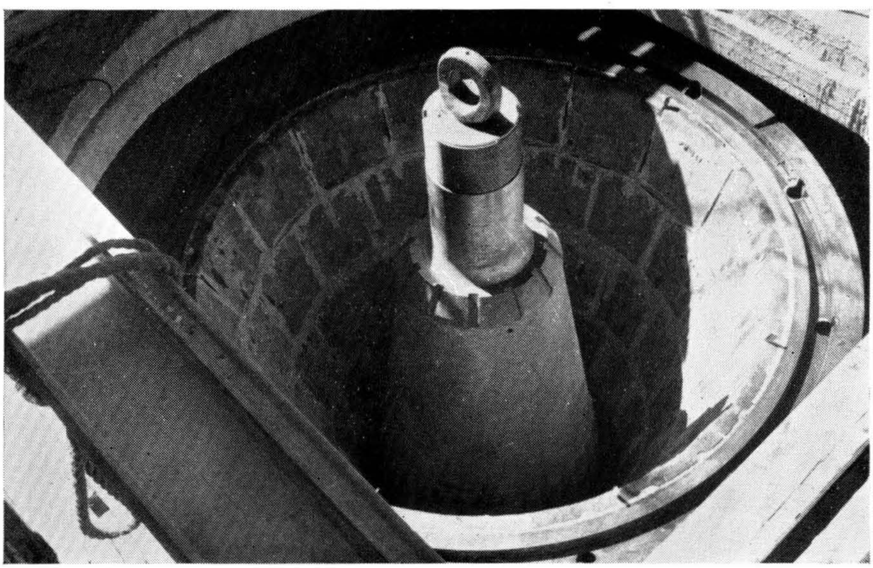


Fig. 3.—Primary Crusher.

by a 6-in. Joy rotary drill, blasted, and loaded by two 2½-yd. Bucyrus Erie 54B electrically-operated shovels into three 35-ton rear-dump Euclid diesel lorries, in which it is transported to the crushing plant at the quarry. The large lumps of limestone are discharged from the lorries into a 42-in. McGully gyratory primary crusher (*Fig.* 3) in which they are reduced to 6-in. pieces. This product is carried on a belt-conveyor to a stock pile over a tunnel in which there are three vibratory feeders depositing the crushed stone on to another belt-conveyor on which it is carried to the secondary crusher. The feeders are automatically controlled and linked to the motor of the secondary crusher to ensure that the motor is always fully loaded. The secondary crusher is a 600-h.p. Bulldog reversible hammer-mill working in a closed circuit with a screen, the material passing which is under ½-in. in size and is transported to the works on a belt-conveyor 3707 ft. long. The works-end of the gantry housing the conveyor is seen in *Fig.* 2. Limestone is supplied not only to the Atotonilco works but is transported by rail in hopper-wagons to an associated works nearer Mexico City. To avoid dust when loading and unloading the wagons, another screen to separate dust from the stone is installed at the discharge end of the conveyor from the quarry. The clean stone is then conveyed either to the raw materials store (*Fig.* 5) or to a stock-pile adjacent to railway tracks for loading into the hopper-wagons.

The clay, the pit for which is situated to the west of the works, is excavated by a Bucyrus Erie 38B diesel-operated shovel and is transported in lorries to the works where it is dumped on to a grizzly feeder to screen out over-size material which is passed to a 200-h.p. Dixie-type non-clogging hammer-mill for reduction.

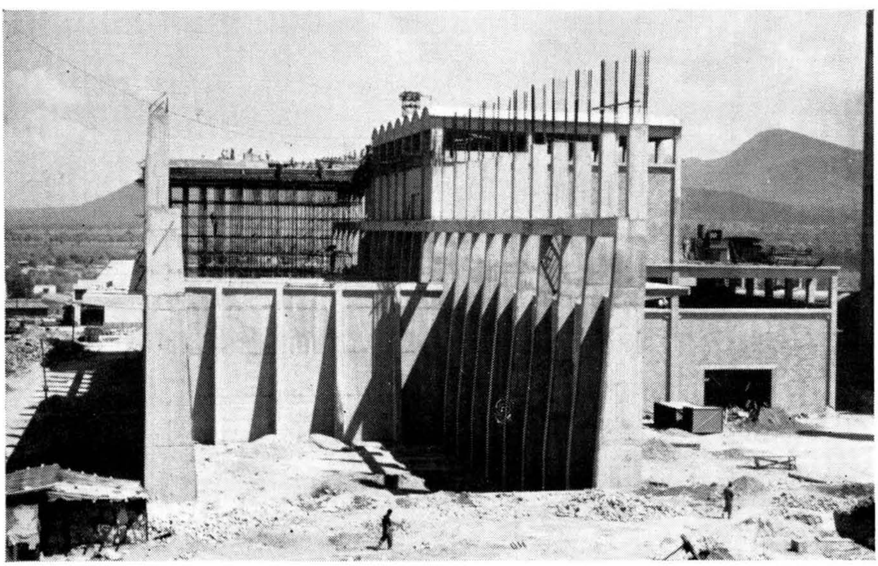


Fig. 4.—Materials Store in Course of Construction.

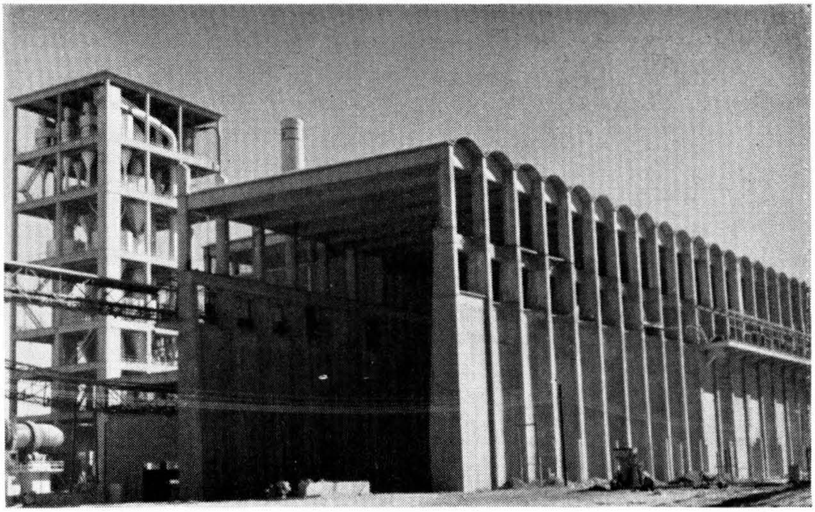


Fig. 5.—Materials Store. (Preheater in left background.)

The iron ore and gypsum are crushed in the clay hammer-mill and then transported by belt-conveyor to the materials store.

Materials Store.

The materials store (*Figs.* 4 and 5) in which the raw materials and clinker are stored, is a reinforced concrete building with a multiple-shell roof. It is equipped with a Harnischfeger 10-ton overhead travelling grab-crane. The columns are at 15-ft. centres, the walls between the columns being panels curved to a radius of 9 ft. 4 in.; the chord length is 12 ft. 4 in., and the height is 45 ft. The curved panels are 8 in. thick and are reinforced with $\frac{1}{2}$-in. bars. The wall between the raw materials store and the adjacent mill building is flat, and is 8 in. thick and reinforced with $\frac{3}{4}$-in. bars. The vaults of the shell roof, which are $2\frac{3}{4}$-in. thick reinforced with $\frac{5}{16}$-in. bars at 8-in. centres in two directions at right-angles, span between beams extending between the tops of opposite columns. Enough shuttering for four vaults was provided and was erected on tubular scaffolding. The concrete for two vaults was placed at the same time. While the concrete of these two vaults was hardening, the shutters of the two vaults concreted previously were removed and re-erected ready for the next placing operation, thus making the constructional process almost continuous.

Grinding and Blending the Raw Materials.

The raw materials are taken from the store and are ground in a single-chamber Smidth mill 12 ft. 6 in. in diameter and 25 ft. long. The mill, which is driven through a Symetro reduction gear (*Fig.* 8) by a 2000-h.p. auto-synchronous motor, operates on closed circuit with two 16-ft. Sturtevant air separators.

Since the moisture in the clay is 15 per cent., even in the dry season, hot air for drying is always required in the system and is provided by a Todd oil-fired furnace. The purge from the system is cleaned in a Norblo fabric filter. The raw meal is pumped by a Fuller Kinyon pump to a reinforced concrete blending silo of 900-ton capacity and equipped with Fuller Airmerge equipment for continuous blending. In this plant, porous panels, arranged in quadrants, are installed at the bottom of the silo, and compressed air is supplied to each quadrant in turn. The æration of the column of material above the quadrant induces rapid circulation of the raw meal in the silo resulting in thorough blending, which is further improved by ærating each quadrant in turn. By having a silo of large capacity in relation to the output of the mill, the contents of the silo are virtually homogeneous from top to bottom in spite of the fact that the feed enters at the top. The blended meal can be withdrawn safely from the top of the silo at the same rate at which it is being fed in, by allowing it to overflow into the three storage silos, which have a combined capacity of 7500 tons and are grouped around the blending silo. This method of operation avoids having to place the blending silo at a higher level than the storage silos to ensure gravity discharge, or having to instal pumps or elevators if all the silos are at the same level. The discharge from the storage silos is through "Airslides" into a constant-level box feeding two Fuller Kinyon pumps, by means of which the raw meal is either pumped to the kiln-feed hoppers, which are equipped with automatic level control to the pumps, or recirculated if necessary.

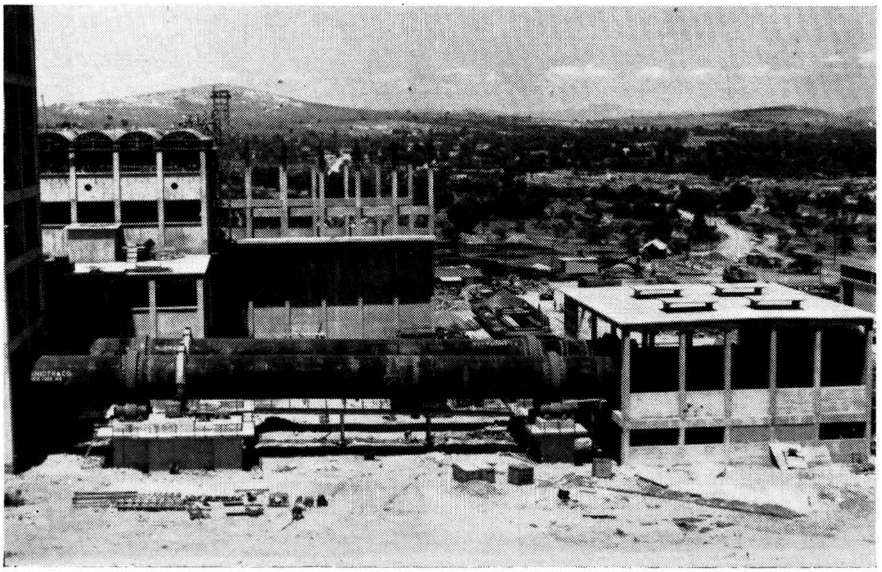


Fig. 6.—Kilns and Burner Platform.

The building housing the blending and grinding plant is seen to the right of the taller preheater structure in *Figs.* 1 and 2. The roof of this building is of similar construction to that of the raw materials store. The plant for blending and storing the raw meal was designed and supplied by the Fuller Company.

The Preheaters.

The preheaters are of the Fuller Humboldt type and are contained in the multiple-storey reinforced concrete framed structure, seen in *Figs.* 1, 2 and 5, which is 179 ft. 4 in. high. (A description of this type of preheater, which is also installed at the Plymstock works of the Associated Portland Cement Manufacturers Ltd., is given in this journal for January 1962.)

The foundation is unusual since it is composed of two inverted vaults, each 72 ft. long, and having a radius of 23 ft. 1 in. and a chord of 30 ft. (This type of foundation, called tympani, was developed mainly for use in the soft ground of Mexico City.) The correct curved profile of the excavation was ensured by using templates and finishing the excavation by hand. A blinding layer of concrete was then deposited and finished to the required curve. The reinforced concrete vaults, which are 8 in. thick, were constructed on this prepared base, and were then filled with rubble up to the underside of the ground floor of the preheater structure.

The Kilns.

The two rotary kilns (*Fig.* 6), which were supplied by F. L. Smidth, have each

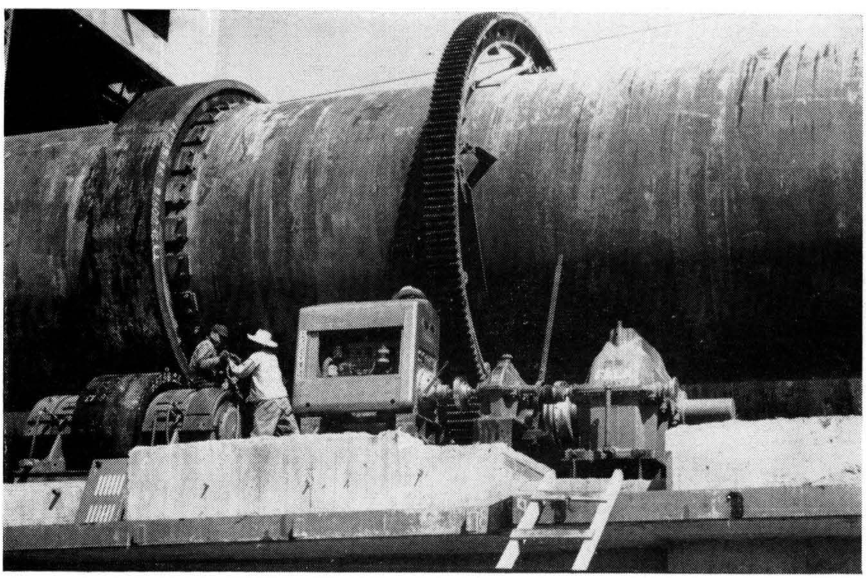
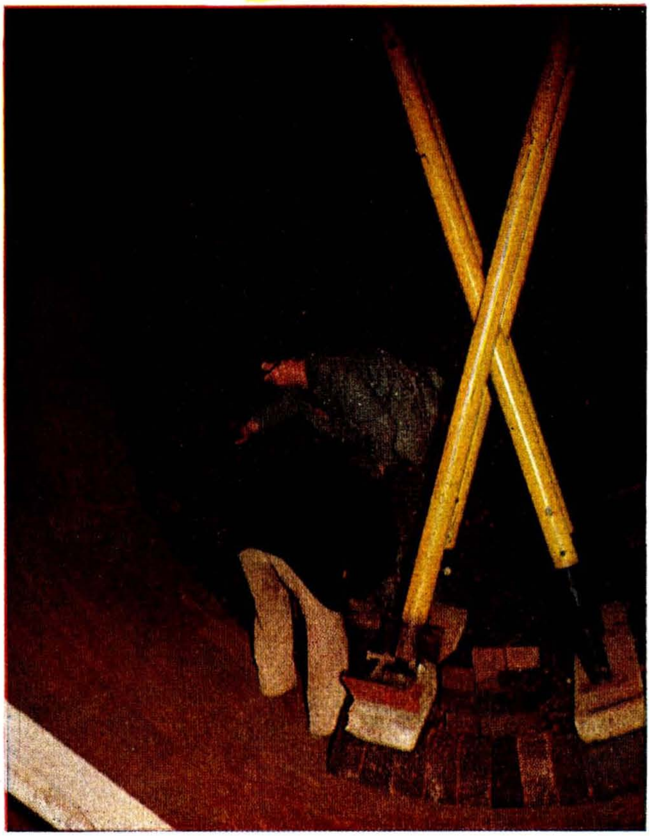


Fig. 7.—Kiln Drive during Assembly.

IF IT'S A QUESTION OF

Rotary Kiln Linings

— CONSULT STEETLEY



Kiln lining in progress with Magnesite/Chrome bricks

. . . Who are themselves rotary kiln operators and have a unique experience in design, manufacture and practical use of bricks to suit all conditions. For ordinary Portland Cement practice the choice is either Magnesite/Chrome or Serpex 'S' bricks, both developed after much research and practical experience of rotary kiln lining problems.

For white cements which must be burned at high temperatures on chrome-free brickwork, Steetley provide a spinel bonded magnesite brick designed to withstand the most arduous conditions prevailing.

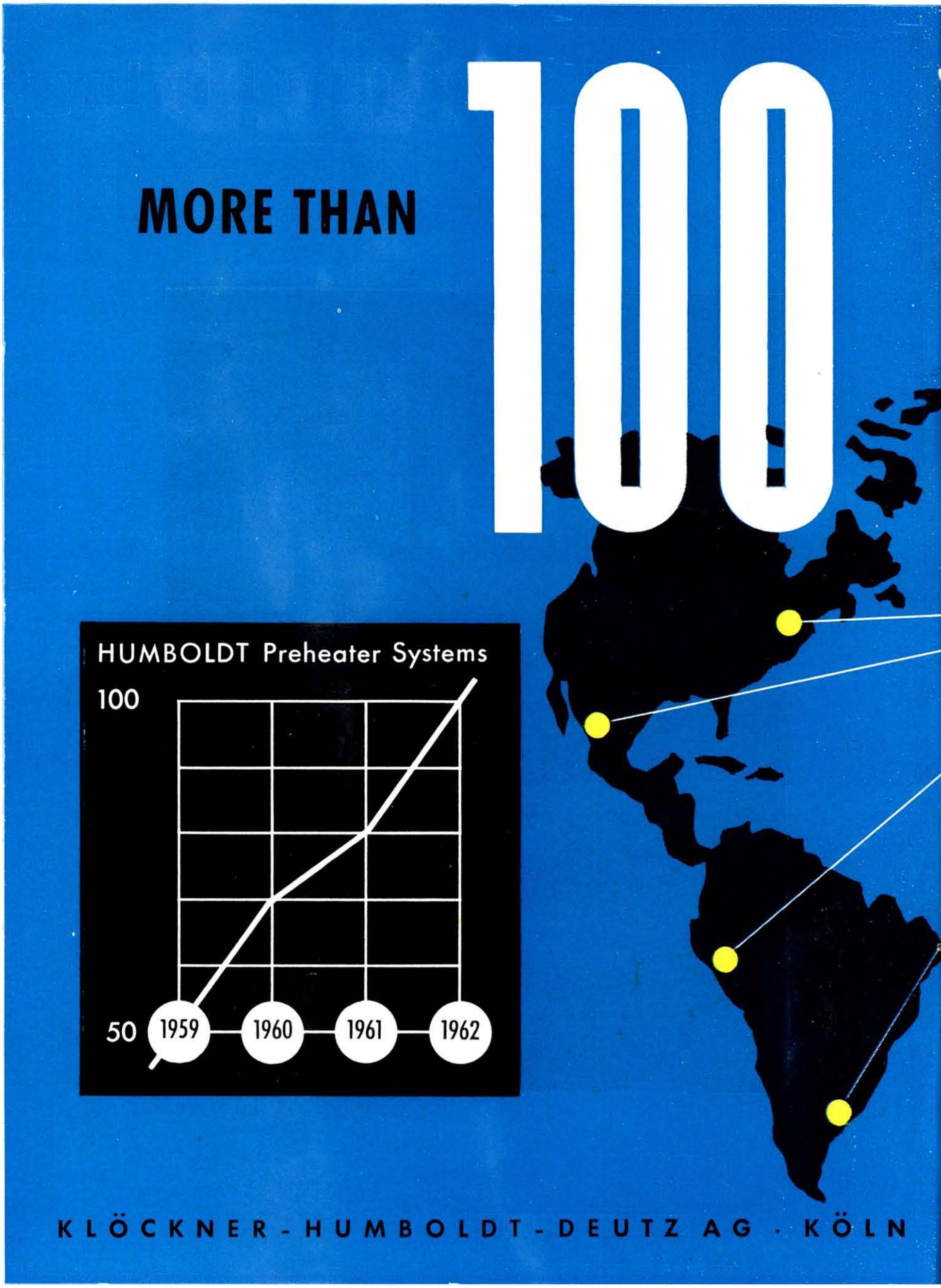
Send for special brochure —"Rotary Cement Kiln Refractory linings"

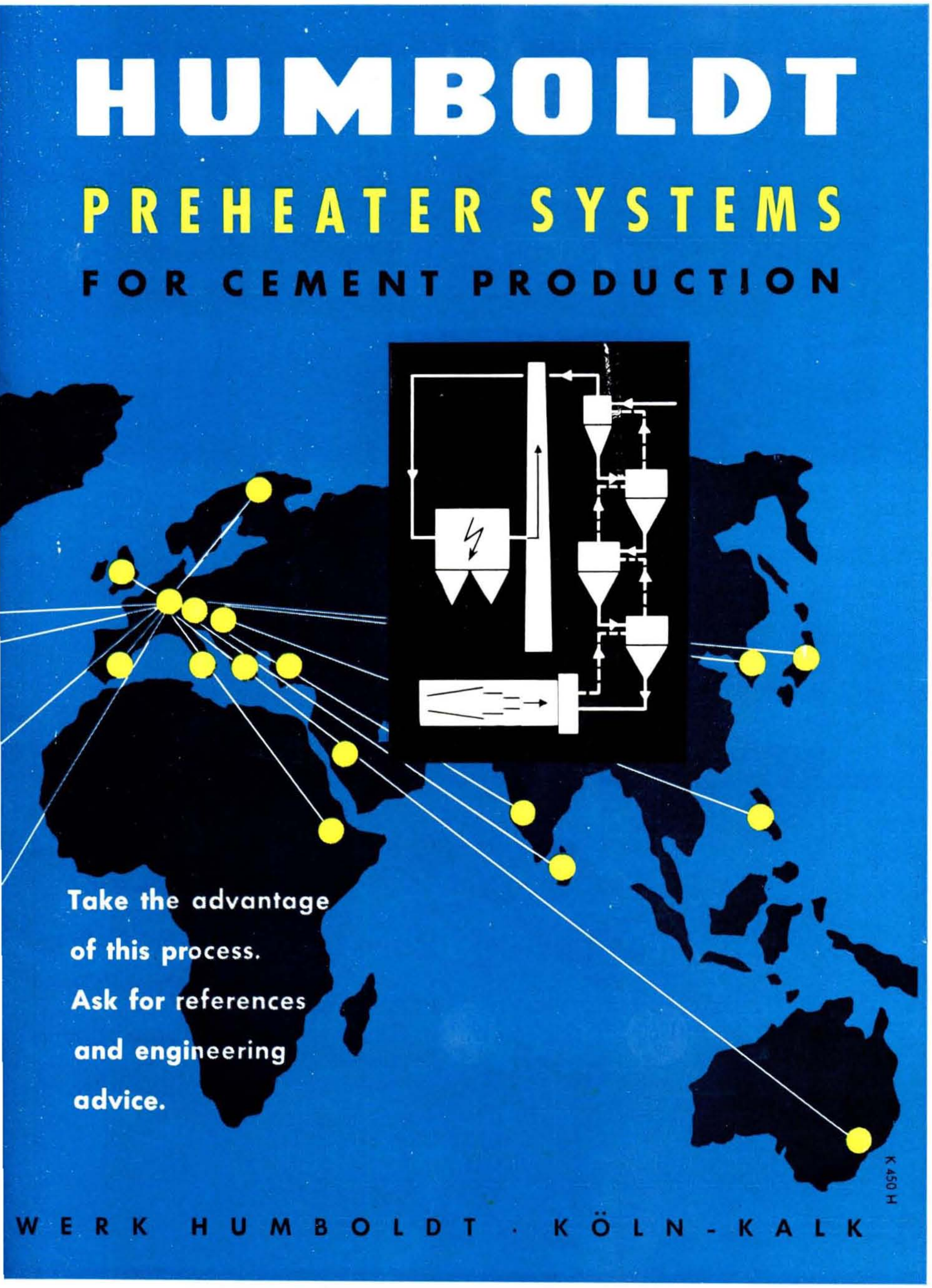
All enquiries to:

THE STEETLEY REFRACTORY BRICK CO. LTD.

Oughtibridge near Sheffield · Tel: Oughtibridge 2311

9/1963


MORE THAN
100
HUMBOLDT Preheater Systems
100
50
1959
1960
1961
1962
KLÖCKNER-HUMBOLDT-DEUTZ AG · KÖLN


HUMBOLDT
PREHEATER SYSTEMS
FOR CEMENT PRODUCTION
Take the advantage
of this process.
Ask for references
and engineering
advice.
K 450 H
WERK HUMBOLDT · KÖLN-KALK

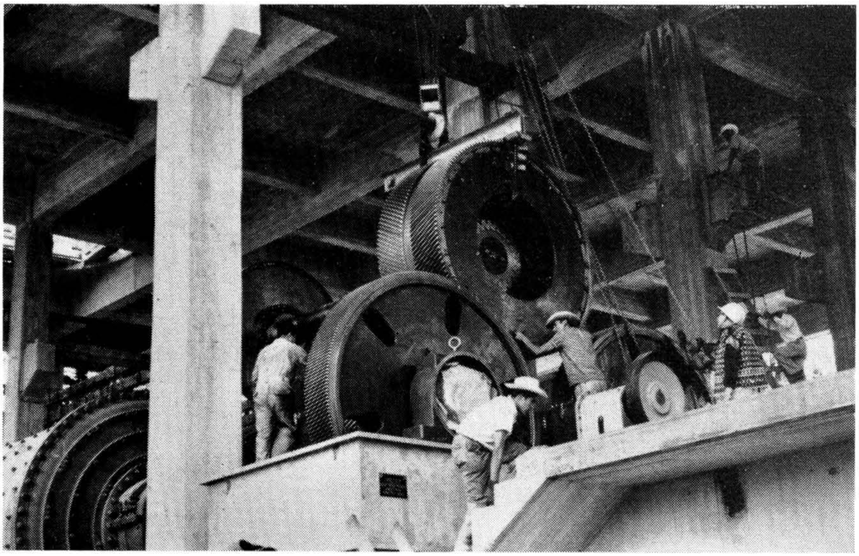


Fig. 8.—Installing Gearing for Raw Mill.

a productive capacity of 500 tons per day and have a diameter of 11 ft. 6 in. and a length of 175 ft. They are of welded steel construction, without stiffening rings, and are carried on two tyres. Plain thrust gear with screw adjustment is provided. Each kiln is driven by an 88-h.p. Asea commutator motor; the kiln drive is shown in course of erection in *Fig.* 7. The kilns are fired by oil, but a natural gas system is also being installed. Combustion is controlled manually, the control being based on continuous oxygen analysis. The induced draught fans run at constant speed, the draught being controlled by louvre dampers operated electrically from the kiln burner platform; the platform is seen to the right in *Fig.* 6. The flue gases are cleaned in multiple-cyclone dust collectors, the dust being returned to the system.

The clinker is cooled in Fuller horizontal grate coolers, and transported by a belt-conveyor to the materials store.

Grinding, Storing and Packing.

The clinker is ground in two Smidth two-compartment tube mills, each of 10 ft. diameter and 31 ft. 6 in. long. They operate in closed circuit with a 16 ft. Sturtevant air separator and are driven through a Symetro reduction gearbox by a 1500 h.p. auto-synchronous motor (*Fig.* 9). The mills are cooled by the system, devised by F. L. Smidth, of injecting water into the second chamber, the amount being controlled by the temperature of the cement. The ventilating air from the mill is discharged through an electrostatic precipitator. The auxiliary equipment is ventilated through a Norblo fabric filter.

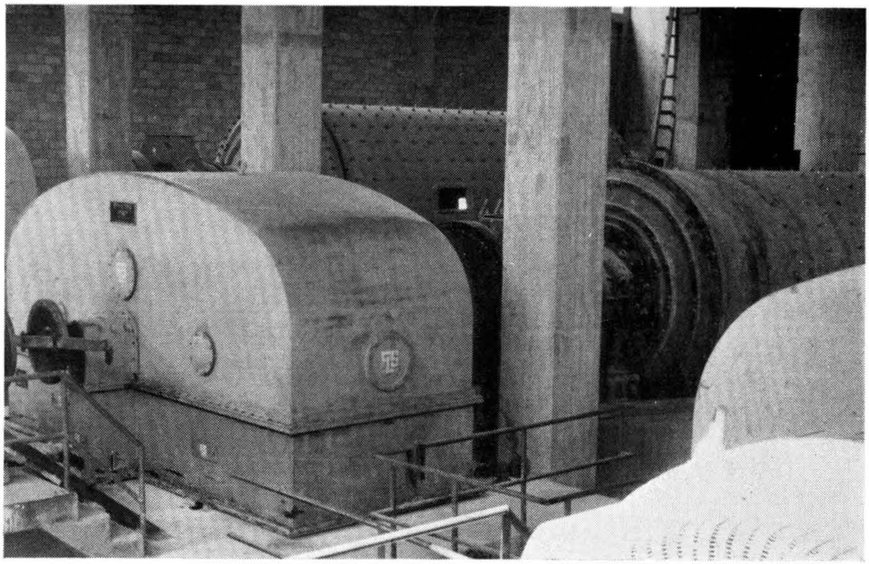


Fig. 9.—Clinker Grinding Plant.

The cement is conveyed to the storage silos (seen on the left in *Fig.* 1) by a 24-in. belt-conveyor 800 ft. long, the loading and discharge points being equipped with dust collectors. The silos and packing plant are in one structure, the packing plant being directly under the silos. There are six reinforced concrete silos having a combined capacity of 9000 tons. Each silo has a mild steel conical hopper bottom discharging into " Airslides " which convey the cement to two four-spout St. Regis packers. Bulk loading is by gravity.

Storage Silos.

The silos are arranged in two groups of three, one on each side of a central section containing the packing plant. The substructure of this building houses the fans and blowers required for the " Airslides." The packing floor is at the level of the floors of railway wagons and loading is possible from each side of the building. The storey above the packing floor contains the conical silo bottoms and provides storage space for bags. There is an elevator for bags with access from the rail tracks. A concrete bridge spans between the tops of the central silo of each group, and contains the delivery-head of the cement conveyor and the discharge chute to the " Airslides " which deliver the cement to the silos.

Each group of three silos is supported on twelve columns and is carried on separate inverted shell foundations 12 in. thick, which are independent of the foundation of the central packing section; this form of construction avoids stresses due to unequal settlement of the ground due to non-uniform pressures. The walls of the silos were constructed with the use of continuously sliding shuttering.

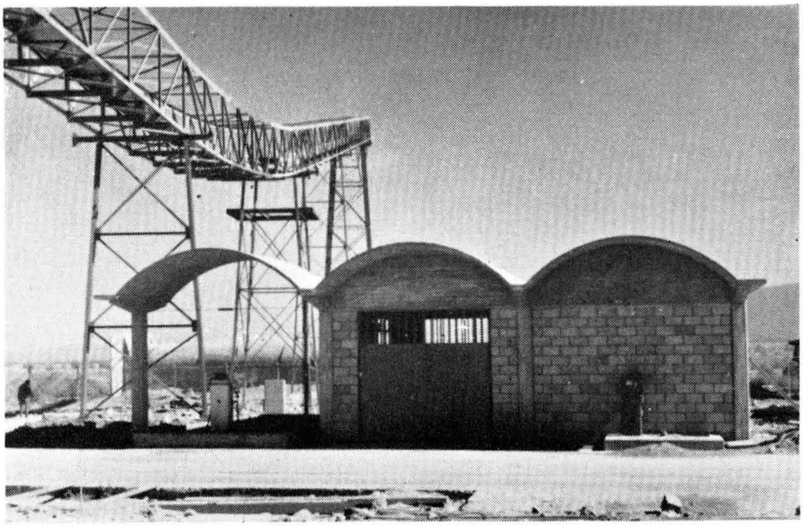


Fig. 10.—Petrol and Lubricant Stores, and Conveyor Gantry.

Auxiliary Buildings and Works.

In addition to the structures described in the foregoing, there are several other buildings and auxiliary works including a railway yard with over 4 miles of track and a railway station. The roofs of the larger buildings are of shell construction, and the shuttering from these roofs was used for the roofs of the petrol and lubricant stores (*Fig.* 10). The roof of the workshops and stores building shown in the foreground of *Fig.* 2 is composed of parabolic shells which are $2\frac{3}{4}$ in. thick and span 34 ft. 6 in. in one direction and 36 ft. in the other. The downpipes from the roof are inside the columns.

Two underground fuel oil tanks, each of 64 ft. diameter and 18 ft. deep, are provided. They are of reinforced concrete construction and have domed roofs 4 in. thick.

The works were planned by Cemento de la Tolteca Compania de Cemento Portland S.A. (of which Company, Cemento de Atotonilco S.A. is a subsidiary) in consultation with Associated Portland Cement Manufacturers Ltd.

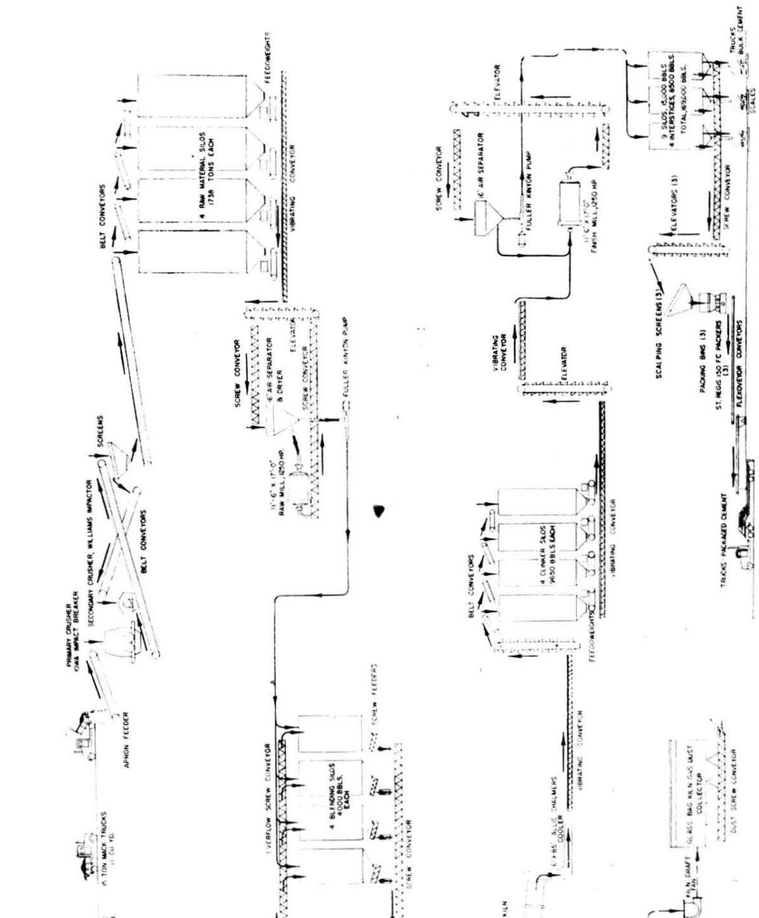


Fig. 2.—Flow Diagram of Ideal Cement Co.'s Works at Tijeras, New Mexico.

(See facing page.)

A Cement Works in New Mexico.

THE diagram *Fig.* 2) on page 28 shows the flow sheet for the cement works established recently at Tijeras, New Mexico, by the Ideal Cement Co. The works, which have a productive capacity of about 350,000 tons per annum, are in desert country on the borders of the States of Arizona and New Mexico, U.S.A.

The sequence of operations and the principal equipment installed are indicated on *Fig.* 2. The rotary dry-process kiln, the temperature in which may reach 2750 deg. F., is 375 ft. long and is inclined $\frac{3}{8}$ in. per foot, and is in the open air.

A feature of the plant is the dust control. Some £500,000 was spent on installing efficient dust collecting equipment. The kiln gases are filtered through a battery of 1280 glass fibre bags, each $11\frac{1}{2}$ in. in diameter and 25 ft. long. The provision of these bags, the fabric of which can withstand temperatures up to 650 deg. F., obviates the necessity to provide a tall chimney. A total of thirty-two other dust collectors are provided elsewhere in the works. In the control room (*Fig.* 3), in which is installed the electronic control panel from which the works are automatically operated, a slight positive pressure is maintained to prevent entry of dust which might adversely affect the instruments.

Since the nearest railway is some 22 miles from the works, the cement is despatched by road either in bulk or in bags. The three packing machines have a capacity of 3600 sacks (of 94 lb. each) per hour.

The storage silos, seen in the background of *Fig.* 1, are 131 ft. high and comprise nine silos and four smaller bins having a combined capacity of about 2800 tons. The walls were constructed by the use of continuously-moving shutters.

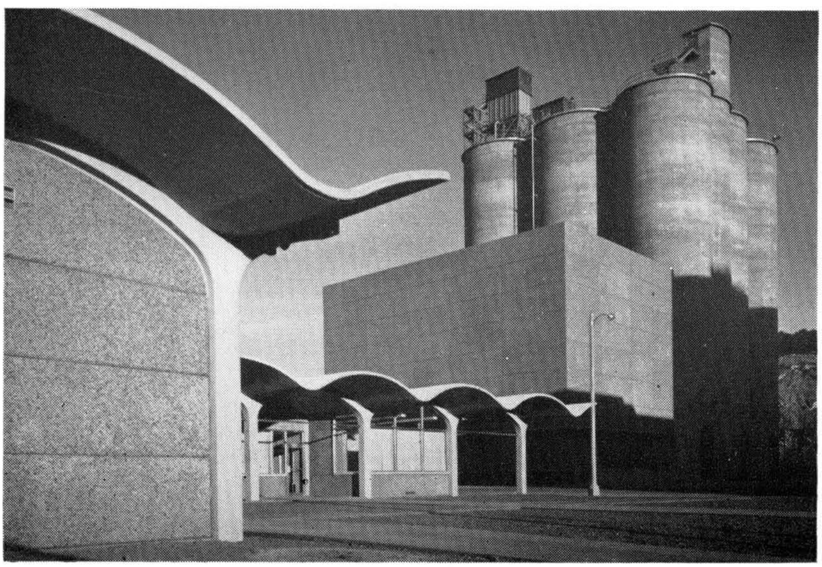


Fig. 1.—Ideal Cement Co.'s Works at Tijeras.

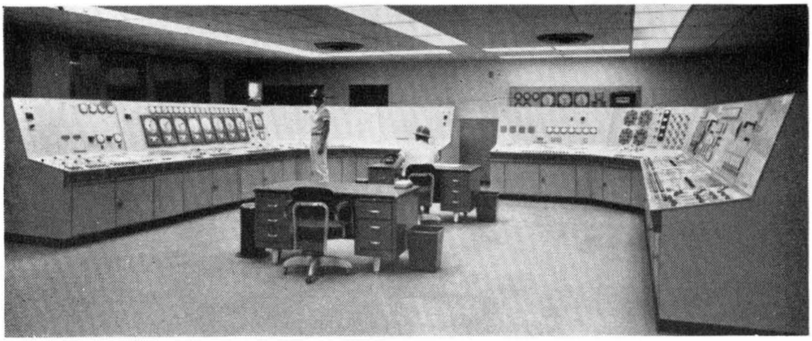
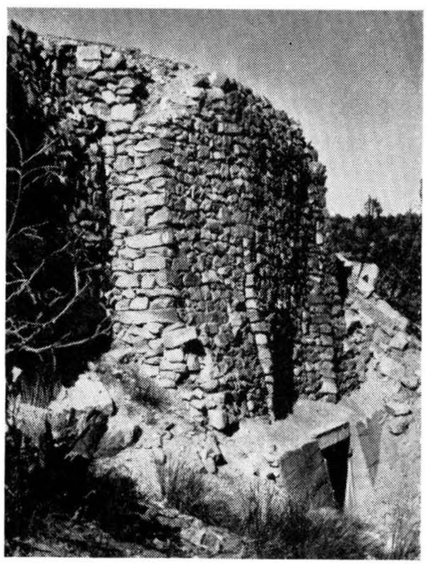


Fig. 3.—Control Room, Tijeras.

Elsewhere much of the structural work is of precast concrete. For example, the raw materials conveyor is carried in one part over a 75-ft. span by a prestressed precast concrete beam, and the curved shell roofs of some of the buildings, such as those seen in the foreground of *Fig.* 1, were precast, as were also the decorative wall panels and louvres.

An Early Mexican Kiln.



THE illustration shows a kiln said to have been installed by the Mexican Indians a century ago. The position is on the hillside of Tijeras Canyon, near the site of the Ideal Co.'s cement works described in the foregoing. It was used presumably for burning limestone.

Dependence of Hydraulic Properties of Clinker Compounds on the Burning Temperature and Crystalline Structure

IN the process of clinker burning, the compounds such as C_3A, aluminoferrites of various compositions, and to some extent also C_2S, are formed in the temperature range of 1250 to 1350 deg. C., and are subjected to definite structural changes if this range is significantly exceeded. Such changes in the crystalline structure exert then a considerable effect on the final properties of cement. Even alite, which is considered as a high temperature clinker compound, is capable of undergoing essential changes in its crystal structure at about 900 to 1000 deg. C., in the presence of, for example, $CaSO_4$ or CaF_2. This overburning of Portland cement clinker is of a considerable interest both from the practical and theoretical points of view. The phenomenon was recently investigated by BUTT and TIMASH and some results, which are given in the following, are translated and summarised from a recent number of "Tsement."

The starting materials used in the preparation of synthetic clinker compounds were pure calcium carbonate, amorphous silica, washed natural sands from several pits, various types of cristobalite, alumina and ferric oxide. Cristobalite was prepared by burning of pure sand at 1600 deg. C., and by burning it also in the presence of 1 per cent. $NaCO_3$ at 1400 deg. C.

The starting components were ground to a specific surface of 3000 sq. cm. per g. and then intimately mixed in the required proportion by wet-grinding in a porcelain laboratory mill. The resulting mixture was dried and formed into test prisms under a pressure of 350 kg. per sq. cm. The specimens were then burned in a silite furnace lined with platinum and chrome-magneisite refractories. The burning temperature was varied from 1200 to 1700 deg. C. Mixtures with the composition of C_2S and C_3S were burned at each temperature until all the lime was absorbed. In the mixtures with the compositions of C_3A, C_6A_2F, C_4AF and C_6AF_2, which were burned once only, full absorption of lime was achieved in a few specimens only. The furnace temperature was increased at the rate of 200 deg. C. per hour. The burned specimens were then rapidly quenched in air.

After grinding the samples were tested for their physico-mechanical properties on 1·41-in. neat paste cubes cured in both air and water. Burned and hydrated specimens of clinker minerals were examined by means of microscopic, thermographic and X-ray analyses.

The conclusions from these tests, full details of which are given in the original article, are as follows:

1.—From the point of view of the initial strength, the greatest contribution is exerted by C_3A burnt at 1400 deg. C., although high strength at later curing ages is shown also by specimens of C_3A burnt at 1500 deg. C. Similar character of the hydration products of C_3S samples with almost identical free-lime content depends obviously on their contents of active C_3A. In particular, C_3A obtained by burning at 1500 deg. C., has a lower proportion of the active form of the compound in comparison with that burnt at 1400 deg. C. The cause of such different behaviour on burning is to be sought in the higher degree of partial melting of C_3A burnt at 1500 deg. C., which leads to the formation of a more slowly hydrating glass of the same composition. The residue of various non-hydrated glasses, which " reinforce " the structure of the hardening mass, plays a positive role in the development of strength of C_3A specimens burnt at 1500 deg. C.

2.—Solid solutions of calcium aluminoferrites react readily with water and form a strong hard mass. The highest strength at all curing ages is shown by specimens burnt at the lower temperatures, although in the case of the high-alumina compound (C_6A_2F) the higher rate of hydration is characteristic of the compound itself irrespective of the temperature of its burning.

The cause of a reduction in the hydraulic activity of aluminoferrites of various chemical compositions as a function of increasing burning temperature depends on a reduction in the proportion of the active part of the compound because of the formation of a glassy phase in the system. This conclusion is confirmed by X-ray analysis as well as by thermographic results obtained in studies of hydrated mineral samples. It was found that the value of the endothermic effect of calcium hydroaluminates decomposition diminishes in all cases with increasing burning temperature.

The sequence of the relative reduction in strength of specimens prepared with aluminoferrites of various compositions is as follows: $C_4AF > C_6AF_2 > C_6A_2F > C_3A$. This order of decomposition applies to all curing ages for samples prepared at all test temperatures.

The general deductions from the foregoing are as follows.

(*a*) The form and dimensions of the crystals of clinker compounds are determined by the duration and temperature of burning, character of the furnace atmosphere, and the method of clinker cooling. The determining role in the development of crystal structure of clinker compounds is played by the structure of the acid components of the raw meal (SiO_2, Al_2O_3 and Fe_2O_3). Tests showed that the form and structure of C_2S crystals depends entirely on the structure of the grains of SiO_2, because of which, the resulting structure of C_2S will depend on the type of sand used as a component of the raw meal.

The structure of C_3S crystals depends, in its turn, on that of the grains of C_2S. Although CaO enters into both compounds, its introduction in an additional quantity into the structure of C_3S brings about no change in the structure of belite crystals. Consequently, the greater the structural differences in C_2S crystals, the greater the difference to be expected in the structure of C_3S formed from it.

The crystals of C_3A and calcium aluminoferrites have also structures reflecting those of Al_2O_3 and Fe_2O_3 although the differences as seen under a microscope are not very pronounced because of the high density of the above compounds.

(*b*) Hydraulic activity of clinker compounds depends on the structure of their crystal lattices. The maximum hydraulic activity of each compound is developed at definite crystal lattice parameters. A departure from the optimum burning conditions of a given compound has a negative effect on its capacity for hydration and strength development. The optimum burning temperatures for the individual clinker compounds (from the point of view of their hydraulic activity) are as follows: for C_3S, 1500 deg. C.; for C_2S, 1500 to 1600 deg. C.; for C_6A_2F, 1200 deg. C.; for C_4AF, 1200 deg. C.; for C_6AF_2, 1200 deg. C.; and for C_3A, 1400 deg. C.

Consequently, an increase of clinker burning temperature to 1700 to 1800 deg. C. should not be regarded as desirable from the point of view of reaching full hydraulic capacity of all the clinker compounds. Overburning of clinker leads to an increase in the density of the crystal lattices of the constituent compounds and a more uniform distribution in them of the entrapped impurity atoms. This, in turn, neutralises the previously unsaturated electrical bonds in the crystal lattice and can even lead to the formation of a new chemical compound of the alite type. All such factors tend to diminish the hydraulic activity of the resultant clinker.

(*c*) Results of the investigations concerning the retardation of the conversion of β-C_2S into the γ-form by means of crystallo-chemical (addition of B_2O_3, $CaNaPO_4$, Na_2O, Al_2O_3 and Fe_2SiO_4) and physical (development of films of solidified melts) measures showed that the physical method of β-C_2S stabilisation is effective only to the period of clinker grinding. After grinding, the β-C_2S crystals stabilised in this way are rapidly transformed into γ-C_2S because the protective film of the solidified melt is destroyed during grinding. Crystallo-chemical stabilisation of belite under conditions in cement works depends on the usually accidental presence of certain impurities and therefore the method is only partly successful. Consequently, industrial cements often contain considerable quantities of hydraulically inactive γ-C_2S because the raw meals used in their manufacture are often devoid of suitable stabiliser compounds.

If β-C_2S is only partly stabilised (when the stabilising actions are present in the raw meal at low concentrations only), the belite crystals formed may initially preserve their identity but within a period of ten to thirty days they, too, are converted into the inactive γ-form. A cement of this kind shows a rate of strength development slower than usual during that time and, in some cases, the final strength may even be appreciably reduced. If a grain of C_2S surrounded by a protective film of a solidified glassy melt remains as such even after grinding, its transformation into the inactive γ-form occurs after the protective film is dissolved away on contact with hydrating water and, for this reason, the polymorphism of dicalcium silicate can, under certain conditions, be one of the factors responsible for strength reduction of hydrating cements.

The Cement Industry in European Trade Areas

IN a comprehensive study of the building industry in Great Britain, entitled "The Builder Survey: The Building Industry—1962 onward," (published by "The Builder" Ltd., London; price £7 7s.), considerable attention is given to the cement industry especially as regards the present European Common Market (E.C.M.) and European Free Trade Area (E.F.T.A.). The following is abstracted by permission from the Survey.

Table I shows trends in the production of cement in various E.C.M. and E.F.T.A. countries during recent years. Production has increased more steeply in the E.C.M. and the remainder of the E.F.T.A. than in the United Kingdom (U.K.). During the period 1954 to 1960, production in the E.C.M. countries expanded by 57 per cent. and in the E.F.T.A. countries (other than the U.K.) by 40 per cent., but production in U.K. expanded only by 11 per cent.

Trends in the consumption of cement in the major European countries are given in *Table II*. (*Tables I and II are given on page 35.*)

Figures for Italy (E.C.M.) and Switzerland (E.F.T.A.) are not available, although the trend of consumption of these countries is probably not materially different from that of production (*Table I*). The rise in consumption of cement has been particularly marked in the case of West Germany (over 60 per cent. increase during the period 1954 to 1960), France (about 70 per cent.) and Austria (76 per cent.). Consumption in West Germany and France stood respectively at 24·4 million tons and 15 million tons in 1960 compared with 12·4 million for U.K. Other countries in Europe showed a less steep rise in consumption in the period; in U.K. the rise was 20 per cent., one of the slowest rates of growth of any European country.

The *per capita* consumption of cement in the countries shown in *Table II* was as follows for the years 1954 and 1960:

Country	1954 (tons *per capita*)	1960 (tons *per capita*)	Increase in *per capita* consumption (per cent.)
Belgium	0·32	0·34	6
France	0·20	0·33	65
Netherlands	0·20	0·28	40
West Germany	0·30	0·46	54
Austria	0·23	0·40	74
Denmark	0·23	0·26	13
Finland	0·19	0·29	52
Norway	0·27	0·31	14
Portugal	0·07	0·12	72
Sweden	0·30	0·35	16
U.K.	0·20	0·24	20

TABLE I.—PRODUCTION OF CEMENT: 1954 TO 1960 (MILLION TONS)*

Country	1954	1955	1956	1957	1958	1959	1960
E.C.M.							
Belgium	4·5	4·8	4·8	4·9	4·3	4·4	4·4
France	9·6	10·8	12·5	13·9	14·7	15·2	15·3
Italy	8·8	10·7	11·3	11·9	12·6	14·1	15·6
Netherlands	1·0	1·1	1·3	1·3	1·4	1·6	1·8
West Germany ..	15·6	18·2	18·9	18·8	19·4	22·9	24·9
Total	39·5	45·6	48·8	50·8	52·4	58·2	62·0
Index	100	115	124	129	133	148	157
E.F.T.A.†							
Austria	1·6	1·9	1·9	2·1	2·2	2·4	2·8
Denmark	1·2	1·3	1·2	1·2	1·1	1·4	1·4
Finland	1·1	1·0	1·0	0·9	0·9	1·2	1·3
Norway	0·8	0·8	0·9	1·0	1·0	1·1	1·2
Portugal	0·8	0·8	1·0	1·0	1·0	1·0	1·2
Sweden	2·5	2·6	2·5	2·5	2·5	2·8	(2·8)
Switzerland	1·8	2·1	2·4	2·5	2·2	2·7	3·0
Total	9·8	10·5	10·9	11·2	10·9	12·6	13·7
Index	100	107	111	114	111	129	140
Total E.C.M. plus E.F.T.A.	49·3	56·1	59·7	62·0	63·3	70·8	75·7
Index	100	114	121	126	128	144	154
United Kingdom ..	12·0	12·5	12·8	12·0	11·7	12·6	13·3
Index	100	104	107	100	98	105	111

TABLE II.—CONSUMPTION OF CEMENT: 1954 TO 1960 (MILLION TONS)*

Country	1954	1955	1956	1957	1958	1959	1960
E.C.M.							
Belgium	2·8	2·9	3·2	3·2	3·0	(3·2)	(3·1)
France	8·7	10·0	11·8	13·4	14·0	(15·0)	(15·0)
Netherlands	2·1	2·4	2·6	2·8	2·5	2·9	3·2
West Germany ..	15·0	17·2	28·4	17·8	18·5	22·2	24·4
E.F.T.A.							
Austria	1·6	1·9	1·9	2·1	2·2	2·4	2·8
Denmark	1·0	0·9	0·9	1·0	0·9	1·2	1·2
Finland	0·9	1·0	1·0	0·9	1·0	1·1	1·3
Norway	0·9	0·9	0·9	1·0	1·0	1·1	1·1
Portugal	0·6	0·7	0·8	0·9	1·0	1·0	1·1
Sweden	2·2	2·2	2·2	2·2	2·3	2·6	2·6
United Kingdom ..	10·3	10·7	11·3	10·6	10·5	11·5	12·4

*Figures in brackets are estimates.
†Excluding U.K. but including Finland (an associate member of the E.F.T.A.).

It can be seen from this analysis that the use of cement is very intensive in West Germany, Austria, Sweden and Belgium. Consumption has also increased rapidly in France. *Per capita* consumption of cement in the U.K. was the lowest of any European country shown in 1960, except Portugal, reflecting to some extent it is stated, the popularity of structural steel over the past 10 years and the lower price of steel in Britain compared with other European countries (although this situation is now changing rapidly).

Between 1954 and 1960 the percentage increase in the wholesale price of cement in certain European countries was as follows:

France 25 per cent.; Norway 14; U.K. 11; Switzerland 9; Austria 8; Netherlands 6; Denmark 5; Finland 2; and West Germany 2.

The price of cement in Portugal was held stable during this period, while in Italy there was a fall of 11 per cent.

Of the countries in the E.C.M., Belgium, France and Germany are net exporters of cement, and Netherlands and Italy net importers. In the E.F.T.A., Denmark, Sweden and the U.K. are net exporters.

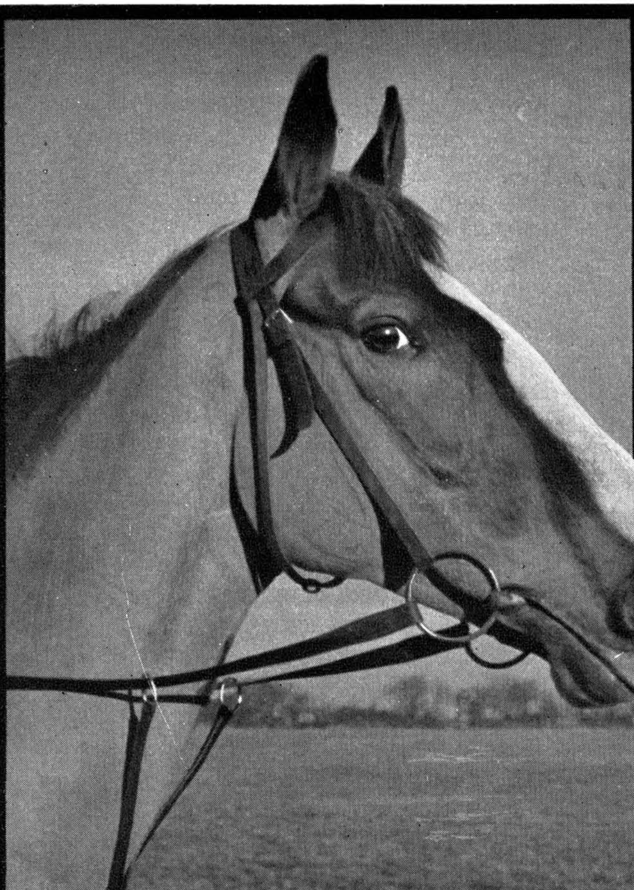
During the period 1954 to 1960, there was a steady decline in U.K. exports from 1·8 million tons to 1 million tons. Exports from the other major European producers also fell during this period.

The difficulty of selling to Europe is said by British manufacturers to be due to high prices caused by the high cost of fuel in this country.

The Cement Industry in Eire.

CEMENT Ltd., of Eire, are considering plans for increasing the company's productive capacity from 750,000 tons to at least 900,000 tons a year. The increase has been necessitated by a bigger demand for cement on the home and export markets. A decision on whether the expansion would take place at the Limerick works, or whether a new works would be built in the north-west, has yet to be taken. The rated capacity of the two cement works at Drogheda and Limerick has increased from 225,000 tons in 1936, when the Company was started, to the present amount of 750,000 tons. Under the Cement Amendment Act, 1962, the ban on the importation of cement was revoked and, at the request of the Company, provision was made for the imposition of a customs duty of 30 per cent. (full) and 20 per cent. (preferential).

Cement Ltd., are to build, at their own cost, a berthing dock at Conigar, Mungret, near Limerick. The Limerick Harbour Commissioners will receive the same berthing fees as are paid for using the existing quays at Limerick. Cement Ltd., intend to import 200,000 tons of coal, 90,000 tons of oil, and 35,000 tons of gypsum a year. This will be the first time that gypsum would be imported to the works at Limerick. They expect to export large quantities of cement yearly. Raw materials at the Drogheda works may be exhausted in a few years and then all cement exports would be from the Limerick works.



Radio Times Hulton Picture Library

Horse-sense

claims a dictionary definition of 'plain, robust sense'

. . . but the dictionary offers little help in defining

Know-how

which might be described as 'horse-sense allied to experience'

IN MORE THAN FIFTY YEARS

as manufacturers of **electric motor control gear,** Allen West & Co Ltd have developed a specialist 'know-how', backed by intensive programmes of testing and research.

For all industrial, traction, and marine applications, the acknowledged symbol of service and reliability is

ALLEN WEST

ALLEN WEST & CO LTD BRIGHTON ENGLAND · Telephone: Brighton 66666 · Telegrams: Control, Brighton

Engineers and Manufacturers of Electric Motor Control Gear and Switchgear

SUBSIDIARY COMPANIES IN CANADA, SOUTH AFRICA AND RHODESIA · AGENCIES THROUGHOUT THE WORLD

Recent Technical Publications.

THE following publications dealing with cement, cement manufacture, and ancillary subjects were issued during 1961/62.

"Cement Chemistry and Physics for Civil Engineers." By W. Czernin. (London: Crosby Lockwood & Son Ltd. 1962. Price 25*s*.)

The author of this slim volume, which is a translation of the original German book, is Director of the Cement Research Institute of the Austrian Cement Makers' Federation. Although cement chemistry is generally presented as an abstruse subject, he has produced a readable text illustrated by clear diagrams. The book does not seem to have suffered in translation, although what minor defects there are may be attributed to the translator, who uses such terms as "temperature figures" for "temperatures", and "aluminous" where "high-alumina" is meant.

The author states that the chemistry of cement is a closed book to the builder, engineer, reinforced concrete designer, concrete technologist and tester of materials, and his aim to help to bridge the gap is well achieved. He assumes the reader to have no more knowledge of chemistry and physics than might be retained by him from his schooldays. but he is expected to have some familiarity with the practical characteristics of cement as used in building and some knowledge of standard methods of testing. The contents deal successively with the constituents of cement; hydraulic limes (the inclusion of which would not be expected from the title of the book); the manufacture, chemical composition, hydration, setting, hardening, mechanical strength tests, volume changes, heat of hydration, and other factors relating to Portland cement; slag, pozzolanic, high-alumina and other special cements; and concrete admixtures. The section on manufacture deals mainly with the wet process; the dry process is mentioned but briefly and there is no mention of vertical kilns.

"Chemistry of Cement." Proceedings of the Fourth International Symposium on the Chemistry of Cement held in Washington D.C., in October 1960. (Published in 1962 by the U.S.A. National Bureau of Standards, Vol. I: 576 pages, price 5·75 dollars. Vol. II: 564 pages, price 5·50 dollars. Postage is 25 per cent. extra to countries outside the U.S.A.).

Volume I contains the texts of the two addresses presented at the opening session: "Some Problems Associated with the Growth of Science," by Dr. Wallace R. Brode, and "Cement Research: Retrospect and Prospect," by Dr. F. M. Lea. Also contained in Volume I are the texts of the papers presented at three technical sessions dealing with the chemistry of clinker; the chemistry of hydration of cement compounds, and the chemistry of hydration of Portland cement. The technical communications include the principal and supplementary papers, and the discussions of these papers.

Volume II contains the texts of papers delivered at the remaining sessions and deals with the properties of cement paste and concrete, destructive processes in concrete, chemical additions and admixtures, and special cements.

The papers were presented in condensed form at the Symposium, but they and the discussions are given in full in the " Proceedings."

"Review of the Fourteenth General Meeting of the Japan Cement Engineering Association." (Published in Tokyo by the Association).

This book contains the synopses of the ten reports and seventy-seven of the papers read at the meeting held in Tokyo in May 1960. The reports include those of the committees dealing separately with standard specifications, concrete, volume change, chemical analysis, heat of hydration, fineness, crushing and grinding. Some of the subjects of the papers are as follows.

CHEMISTRY OF PORTLAND CEMENT.—Lower calcium silicates. Inversion of the crystal form of dicalcium silicate. Manganese. Uniformity of chemical composition of raw mixture and clinker. Actions of calcium lignosulphate. Quantitative analysis for calcium hydroxide. Effect of adsorption of calcium lignosulphate.

SETTING.—False set caused by dehydrated gypsum. Effect of phosphates. Studies of the properties of hardened cement paste. Effect of different forms of calcium sulphate. Gypsum and calcium sulphite. Shrinkage.

FINENESS.—Nitrogen adsorption methods.

RAW MIXTURE.—Mixing in gypsum. Control of water content by radioisotopes.

MANUFACTURE.—Grinding research. Gayco separators. Disk granulators. Sampling exhaust gases from dry-process kilns. Inclined and horizontal coolers. Over-grinding.

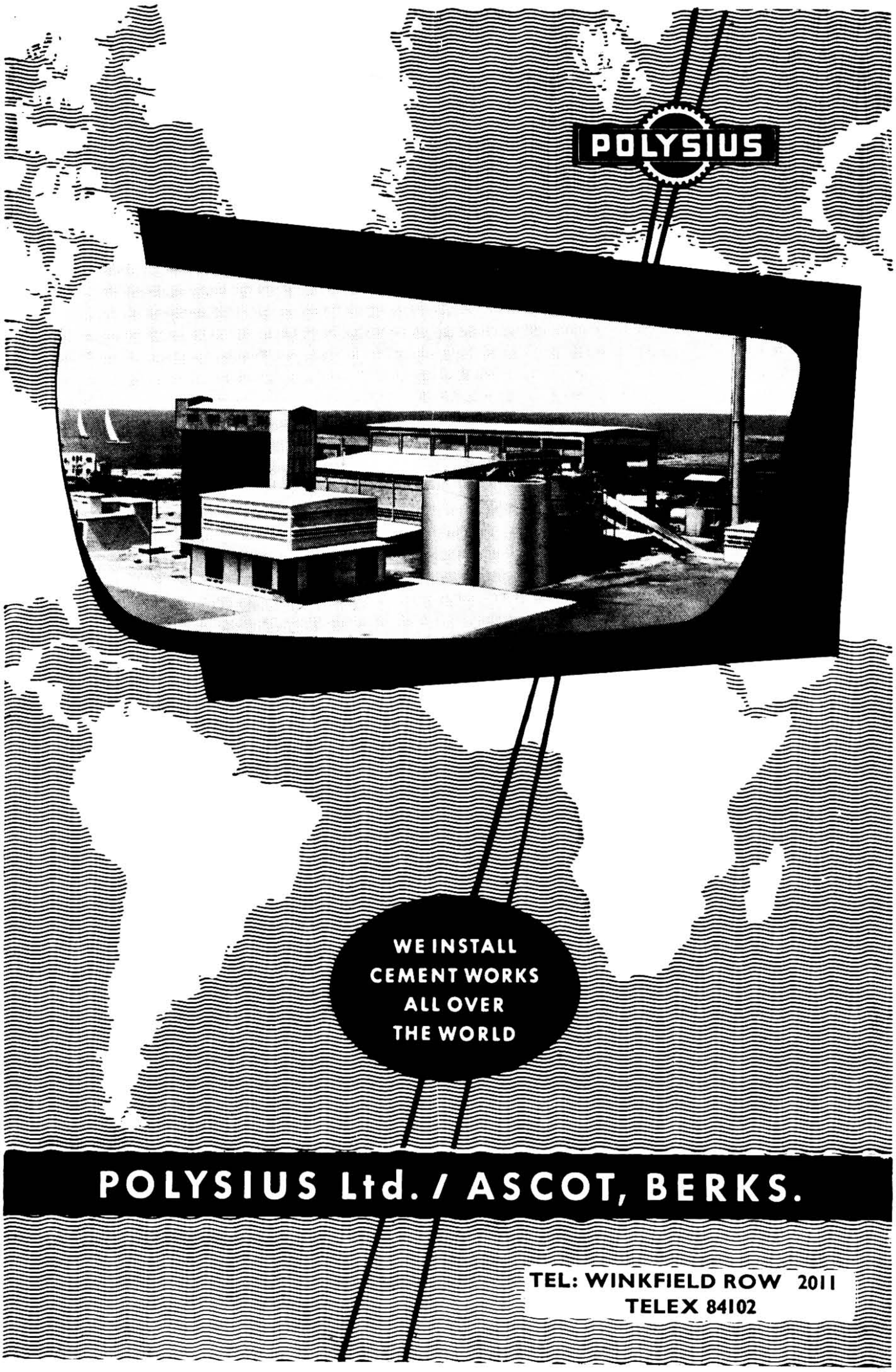
SLAG CEMENTS.—Heat of hydration. Effect of gypsum. Concrete. Physical properties. Dam construction. Improving defects.

Other papers dealt with cements suitable for special purposes, cement mortars, air entrainment, autogenous healing, strengths of mortars and concretes, lightweight aggregates, latex-cement mortars, bond, prestressed concrete, effect of heat, and similar subjects.

Lime-hydrating Plants.

Fluostatic Ltd. announced recently that they have acquired the world rights for manufacture of the Knibbs Lime Hydrating System. Hitherto these rights have been restricted to individual firms operating in defined areas and the granting of world rights to a single Company is to ensure uniformity of design and to promote development of the process.

The Company states that whilst continuing to serve the home market, particular attention will be paid to developing overseas markets for lime-hydrating plant and their fluidised-bed equipment.



Published by CONCRETE PUBLICATIONS, LTD., 60, Buckingham Gate, London, S.W.1, England.
Printed in Great Britain by CORNWALL PRESS LTD., 1-6, Paris Garden, Stamford Street, London S.E.1.