CEMENT
& LIME MANUFACTURE

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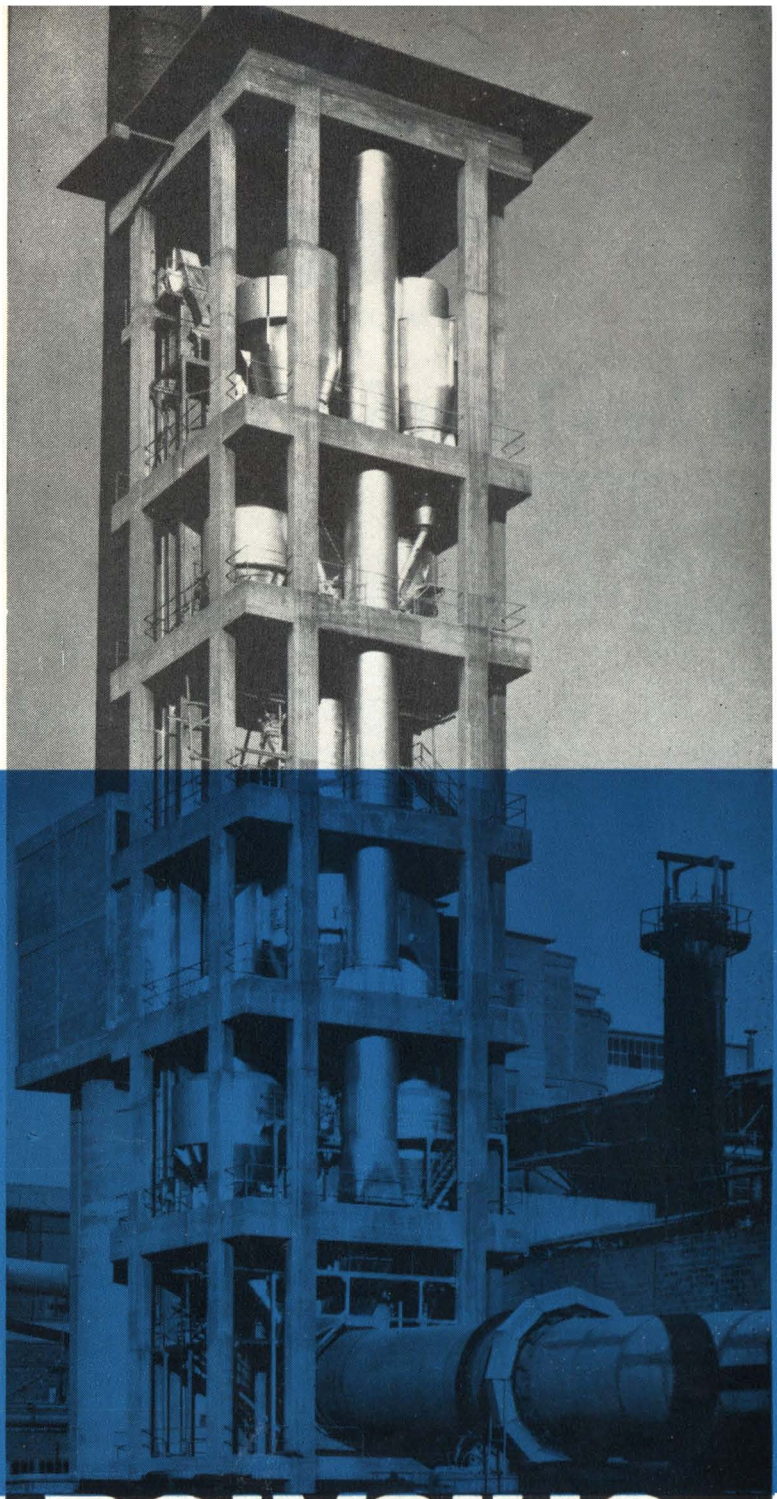

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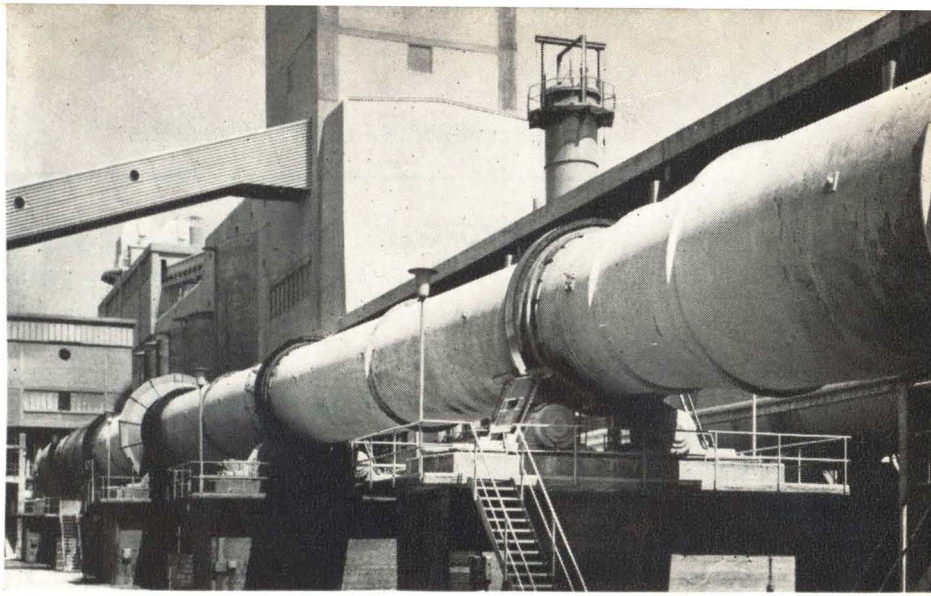

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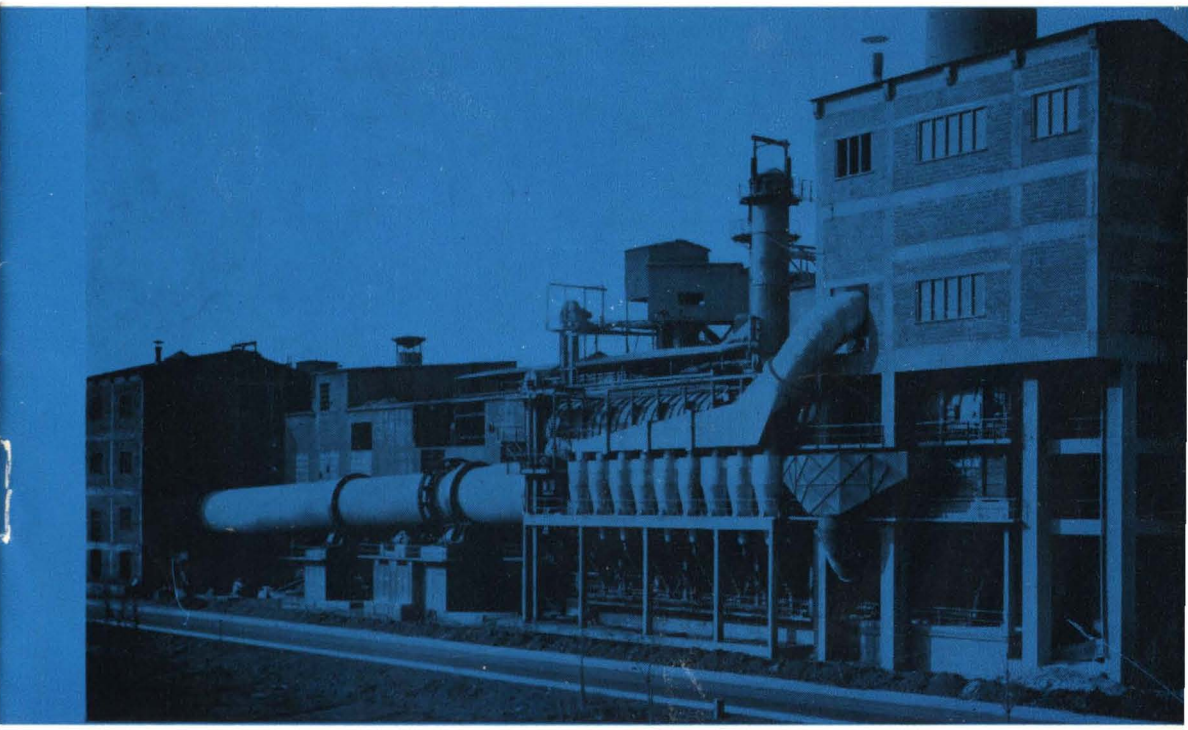

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Counterflow Preheaters for Rotary Kilns.

A PREHEATER operating on the suspended-dust principle, for rotary kilns working on the dry process, has been developed during some three years by Messrs. Fried. Krupp Maschinen-und-Stahlbau, Rheinhausen, and is now in commercial operation in five cement works and is under construction or projected for some nineteen more. An installation in Switzerland having a daily productive capacity of 500 tonnes of clinker is illustrated in *Fig.* 3. A diagram of the construction is shown in *Fig.* 2, and a photograph of a model in *Fig.* 1.

This counterflow preheater comprises a vertical tube with an inlet chamber, three preheating chambers and two cyclones. An auxiliary chimney, mounted above the topmost chamber, is provided with a top cover and dampers so that, while starting-up the kiln, the flue-gas can by-pass the cyclones and be discharged, under natural draught, to atmosphere. During normal operation, the cover is closed and the dampers open. The gases are then drawn from the kiln through the system of chambers and cyclones by an induced-draught fan and discharged either directly, or through the raw-material drying plant, to an electrostatic precipitator for cleaning before being discharged, via the main chimney, to atmosphere. In *Fig.* 3, the precipitator and main chimney are seen on the left of the preheater.

The feed of raw meal to the kiln is usually controlled by a feeder situated near ground level, as seen in *Fig.* 1. This controlled quantity of raw-meal is then transported by a mechanical or pneumatic elevator up to the auxiliary chimney, and there fed into the ascending current of gas, through a rotary valve, in the mechanical method, or directly in the pneumatic method. The raw meal caught by the cyclones is re-introduced by screw-conveyors into the system at the top chamber also seen in *Fig.* 1. from which it drops into the first narrowing tube section. In this section, the falling material is arrested by the comparatively strong current of gas and whirled in such a manner that it comes into close contact with the hot gas, thus ensuring a very complete exchange of heat. The whirled-up

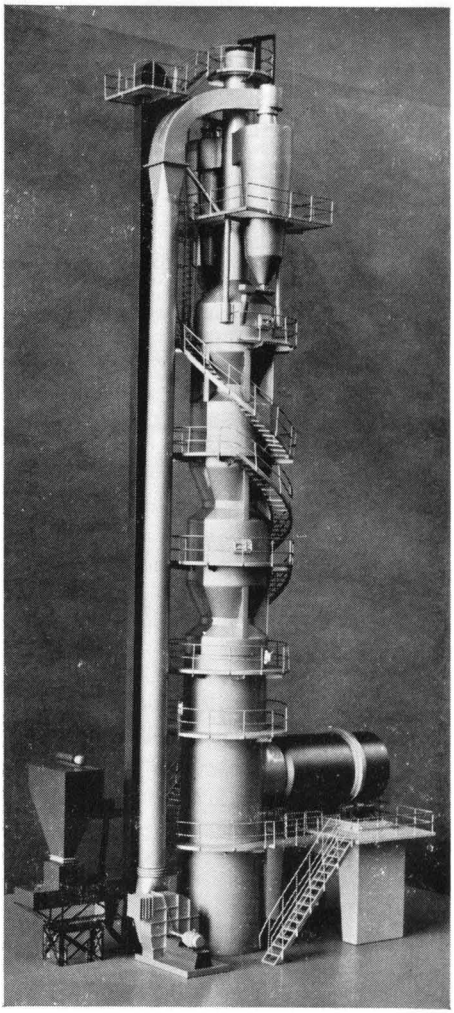

Fig. 1.—Model of Preheater.

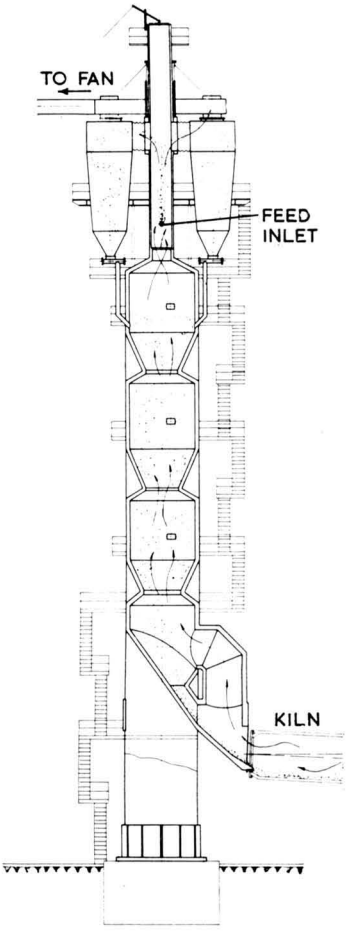

Fig. 2.—Diagrammatic View of Preheater.

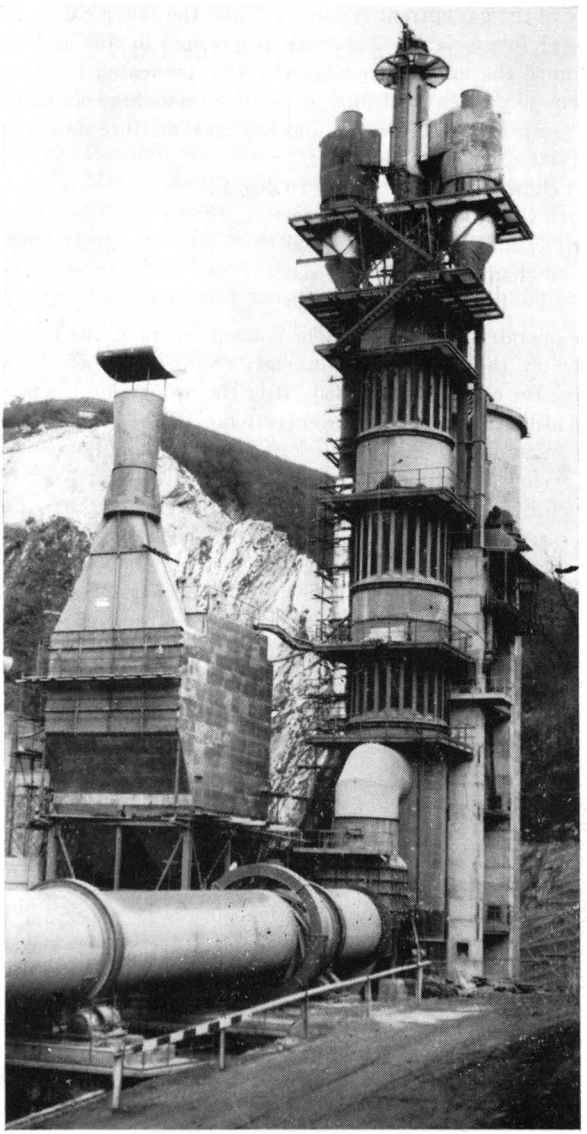

Fig. 3. Preheater installed in Cement Works in Switzerland.

material is then carried up by the gas into the expanded section of the tube where the velocity drops sufficiently for the majority of the raw meal to separate from the gas current and to fall again to the narrow tube section. With the continual feeding of fresh raw meal into the system, the point is very soon reached

where the lifting capacity of the gas current is exceeded, and the raw meal begins to drop into the next-lower tube section. The cycle is repeated in this and the following tube sections, until the material reaches the kiln, preheated to about 800 deg. C., and more than 30 per cent, calcined, depending on its lime standard.

Typical approximate temperatures of the gas and raw meal mixture measured at the various stages are stated to be as follows:

Inlet chamber	810 deg. C.
Fourth Chamber	700 ,,
Third Chamber	590 ,,
Second chamber	490 ,,
Cyclones	350 ,,

The preheater can be operated entirely from the control centre at the burner platform. During heating-up, the cover of the auxiliary chimney is opened and the dampers located before the cyclones are closed. After the rotary kiln has been heated up sufficiently and utilisation of the preheater is intended, the fan is switched on, raw meal is fed in, the cover of the auxiliary stack is closed and, simultaneously, the dampers before the cyclones are opened; all operations are carried out by means of electrical drives initiated from the control centre. Even in the event of a sudden failure of power supply, it is not necessary for the burner-attendant to leave the control centre because the cover of the auxiliary chimney as well as the dampers before the cyclones are connected with the burner platform by means of ropes and can be opened and closed from there by means of hand-winches in case of emergencies. Thus the cyclones and the induced draught fan will be protected against excessive temperatures due to suddenly retained heat.

The makers claim that this preheater is unaffected by deposits and incrustations arising from alkalis in the raw materials, largely because of the large cross-sectional areas of the tube in which any build-ups fall off by their own weight before hard rings or bridges are formed, and particularly through the avoidance of a large difference in the temperatures of the materials and gas in the inlet chamber, which has often been a point of trouble in suspension preheaters. In all their operating experience, no interruption resulting from deposits has occurred.

Stress is also laid on the following features of the preheater. The fuel consumption, depending upon the quality of the raw materials, is in the range 800 to 850 Kcal. per kg. of clinker; the pressure-drop through the preheater is from 250 mm. to a maximum of 300 mm. water-gauge (10 to 12 in.) corresponding to about 4 kWh per ton of clinker; there are no moving parts in the high temperature zones, and the only moving parts directly associated with it are the two screw-conveyors below the cyclones and the rotary feed valve, and consequently maintenance costs are negligible; and due to elimination of deposits and absence of moving parts, no attendant is required on the preheater.

The preheater is self-supporting and requires no steel or concrete tower construction. This not only reduces the cost but speeds up construction. The reduction in area occupied, facilitates the installing of a preheater in old rotary-kiln plants, where very restricted space only is likely to be available.

Fluidisation in the U.S.A. Lime Industry.

Research carried out recently in the U.S.A. by the Dorr-Oliver Co., has established that dry limestone can be successfully " sized " in a fluidising apparatus. An air-sizer unit was installed in the works of the New England Lime Co., at Adams, Massachusetts, to prepare a dust-free feed for a " FluoSolids " limestone calcining pilot reactor. The air-sizer, which has a diameter of 14 in., operated satisfactorily up to a capacity of 1 ton of feed per hour. In *Fig.* 1 is shown the Dorr-Oliver " FluoSolids " reactor installed at one end of a building housing an old rotary kiln. The reactor has a diameter of 12 ft. and a rating of 100 tons per day.

When the lime reactor was operated using feed prepared in the sizer, the dust loss from the reactor was reduced by 50 per cent., and the fuel requirement for the reactor was reduced from 42 U.S. gallons to 39 U.S. gallons of Bunker C oil per ton of lime produced.

The New England Lime Co., uses rotary kilns for calcining dolomite at its works at Canaan, Connecticut, and it was thought that a sized feed might prove advantageous here. For this works, the Dorr-Oliver Co., designed a combined dryer and sizer plant capable of handling up to 50 tons of feed, of variable moisture content, per hour. The plant, an operational diagram of which is shown in *Fig.* 2, is operating satisfactorily on a commercial basis. The welded steel shell of the dryer-sizer plant has an internal diameter of 5 ft. 8 in. and an overall height of 15 ft. 6 in. The air-heater compartment and the wind-box are provided with an insulating lining of refractory bricks. The equipment employed in conjunction with the plant

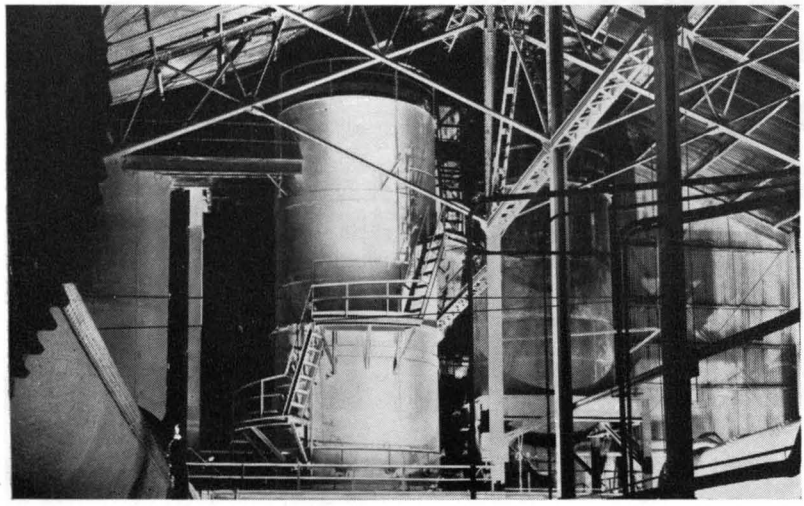

Fig. 1.—"FluoSolids" Plant installed in a U.S.A. Lime Works.

includes a proportioning oil-burner, a turbine air-blower, a vibrating feeder, and indicating and control equipment for temperature, pressure and flow.

In *Fig.* 3 is shown the flow-sheet for the drying and sizing of dolomite. Because

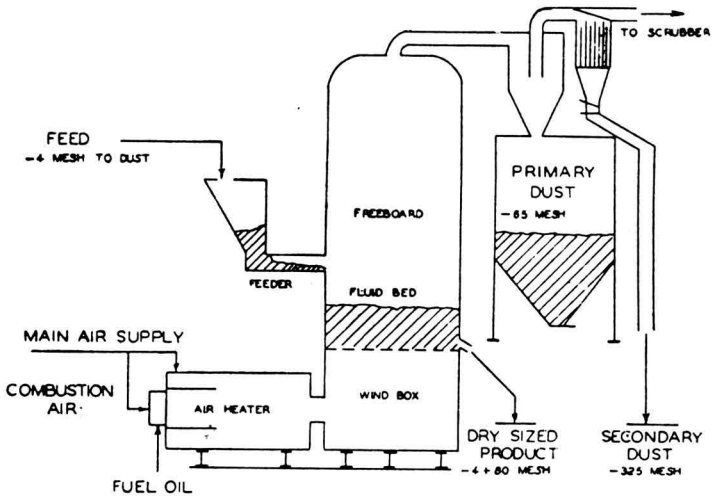

Fig. 2.—Air-sizer and Drier.

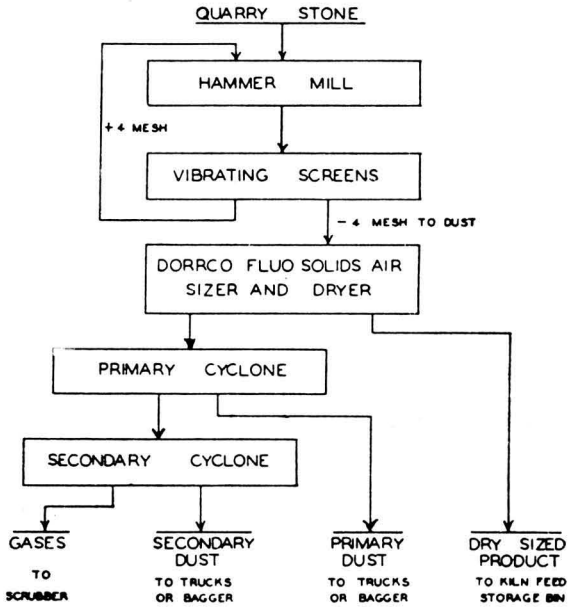

Fig. 3.—Flow-sheet for Continuous Operation.

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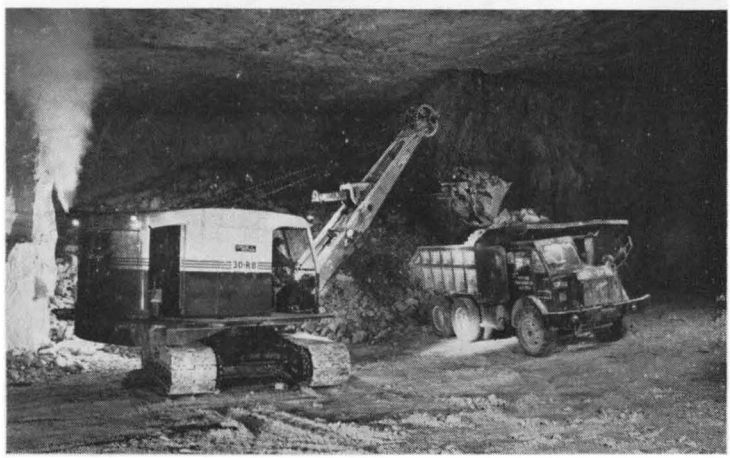
the plant is operated on a one-shift per day basis, it must be started up each morning. As soon as the first load of limestone arrives, the blower is switched on and the air rate adjusted to about 5,000 cu. ft. per minute. The burner is then lighted and the apparatus warms up. When the freeboard thermocouple indicates a temperature of 75 deg.C., the vibrating feeders for both the hammer-mill and the dryer are turned on. As soon as the fluid builds up to a depth of 1 ft., the automatic discharge gate actuated by the differential pressure across the fluid bed takes over and holds the depth of the bed at 1 ft. The rate of feed and the moisture content of the stone vary, and the oil rate is automatically adjusted by a temperature controller to maintain a temperature of 75 deg.C. in the freeboard. The range of rates of supply of oil to the burner which come within the control of the automatic controller can be quickly adjusted up or down to take care of unusual loads. The pressure at the blower under existing conditions is 1·2 lb. per sq. in.

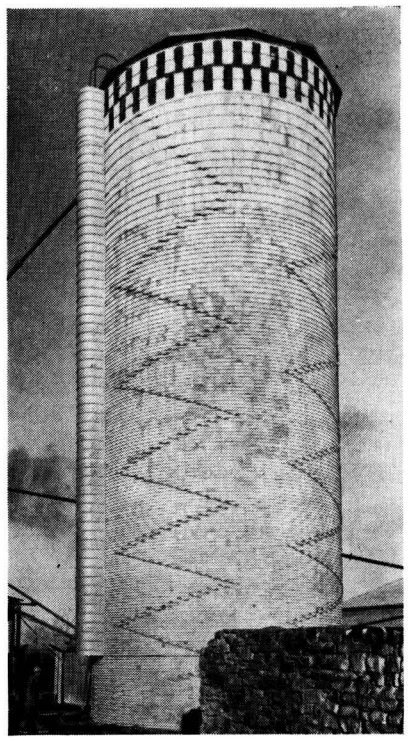
Separation from 20 to 100 mesh per inch is possible. Mesh of separation is defined as that on which the undersize product registers 1·5 per cent. Separation finer than 100-mesh requires relatively low velocities with resulting low capacities of sizing and drying. For fine meshes of separation the feed is first crushed to a relatively small size.

Mining Limestone.



The accompanying illustration shows limestone being loaded, after excavation, at the underground mines of Derbyshire Stone Quarries Ltd., at Middleton-by-Wirksworth. The mine is currently producing about 5,000 tons of crushed limestone each week for use in industry. The machine is a diesel-powered Ruston-Bucyrus 30-RB, a special feature of which is that, for underground working, irritant sulphur and aldehyde exhaust gases are absorbed by means of a conditioning scrubber installed in the exhaust system.

Precast Concrete Silos at Lime Works.

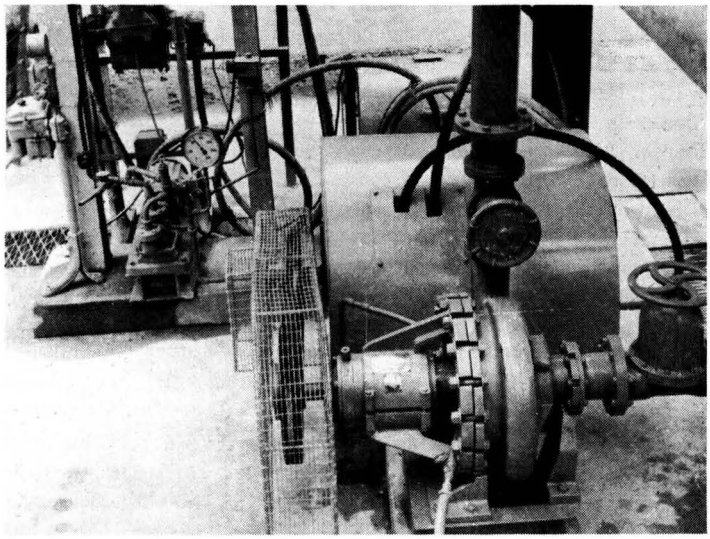


THE accompanying illustration shows a precast concrete silo erected at Blencowe lime works, Derbyshire, where it is used for storing ground limestone. The silo is constructed of concrete staves banded with post-stressed galvanised steel hoops, which are set at closer spacing near the bottom of the silo where the outward pressures may be up to 1,700 lb. per sq. ft. The hoops are joined by lugs which form the zig-zag pattern clearly visible in the illustration.

The silo is one of a range manufactured by Edenhall Concrete Products Ltd., of Penrith, Cumberland, which Company is associated with London & Northern Securities Ltd. It is similar to that provided for agricultural purposes in co-operation with Colman & Co. (Agricultural) Ltd., of Sudbury, Suffolk. The Blencowe Lime Co., is also an associated concern.

The design and size of the outer wall is standard, but a wide range of internal layouts and filling and emptying systems can be accommodated. The external dimensions range from 12-ft. diameter and 16 ft. high up to 30-ft. diameter, 80 ft. high. The largest silos have a capacity of 56,000 cu. ft., nominally 2,200 tons. The precast concrete staves are 30 in. by 10 in. and are $3\frac{5}{8}$ in. thick. Erection times are claimed to be ten to twelve days.

Seals for a Slurry Pump.



At the Shoreham Works of The Associated Portland Cement Manufacturers Ltd., an Allis-Chalmers CWG pump is used to pump cement slurry under pressure from a storage tank to a pipeline feeding the hydrocyclones. The slurry consists of hard grains of silica, fine textured chalk and particles of clay all mixed with water to give a suspension having an average specific gravity of 1·6. The slurry is abrasive and, because of the fine particles (maximum size No. 200 B.S. sieve), is notoriously difficult to seal effectively. The fine particles tend to penetrate between conventional carbon seal-faces, and wear seepage paths which become enlarged, resulting in leakage.

In association with Allis-Chalmers (Great Britain) Ltd., Crane Packing Ltd., recommended a double seal comprising two type 1A mechanical shaft seals arranged back to back, and fitted with special faces which resist the tendency of abrasive particles to penetrate and abrade. The double-seal arrangement, which is shown in the accompanying illustration, was installed in May 1966, and operates continuously and efficiently. The pump in which the seal is installed handles 205 tons of cement slurry per hour.

Petrological Study of Limestone.

A STUDY has been made, by the Road Research Laboratory, of the petrological characteristics of soft limestones, mainly from Jamaica, by microscopical examination of thin sections cut from specimens impregnated with dyed resin to strengthen the material and delineate the voids. A report of the investigation is given in RRL Report No. 21, " A Study of the Petrology of Some Soft Limestones from Jamaica in Relation to Their Engineering Properties," by L. W. Tubey and P. J. Beaven. Although the investigation was mainly directed to the use of such limestones for roadstone, the methods of analysis and the results are of interest to the cement industry.

Consideration of the relation between the petrological nature of the limestones and their engineering properties as indicated by laboratory tests has shown that the proportion of voids has a marked two-fold influence on strength as measured by the ten-per-cent. fines test; strength increases as void-content decreases and as the proportion of voids filled by calcitic cement increases. The voids are themselves affected by the type and proportion of fossils present. The turbidity, which is a measure of the fine material, correlates well with abrasion, polished stone, specific gravity and water-absorption values. In general, a higher degree of correlation between petrological and engineering properties occurs for the soft limestones examined than for the harder material in the United Kingdom. The Jamaican materials were compared with British materials obtained from Cement Works Pit, Harefield, Middlesex, which is upper chalk from the micraster coranguinum zone, and samples of lower chalk from the Chinnor Cement Co., Ltd., Chinnor, Oxfordshire.

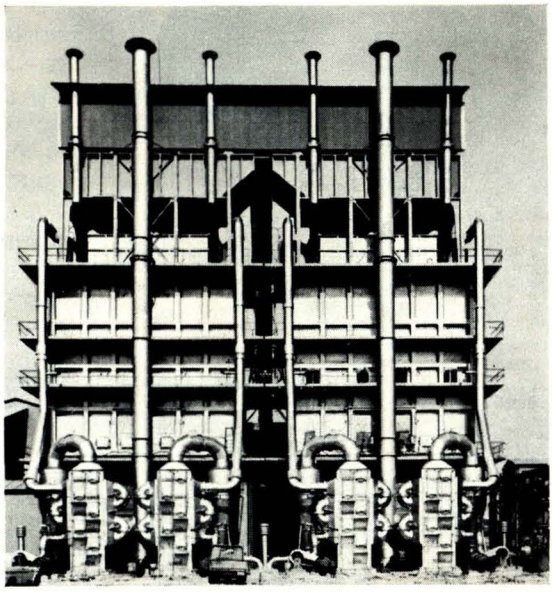
It is considered that petrological examination could usefully be extended to other soft limestones to improve understanding of their engineering behaviour and to aid in selecting the most suitable stone in a range of soft limestones for commercial and other purposes.

New Symbol for Tunnel Cement

THE Tunnel Portland Cement Co., Ltd., which is the second largest cement manufacturing group in Britain, recently adopted a new symbol, a big " T ". It will appear on cement bags, lorries and railway waggons, as well as on the company's stationery and industrial clothing. The symbol was designed by Allied Industrial Designers Ltd.

The Tunnel Portland Cement Co., Ltd., which was founded in 1911, has cement works and other factories in Britain, including paper-bag factories at West Thurrock and Padeswood, North Wales, and a Thames-side asbestos-cement plant. The cement works are situated at West Thurrock, Essex; Pitstone, near Tring, Hertfordshire; and Padeswood, near Mold, Flintshire. The Company has a 50 per cent. share in Ribblesdale Cement Ltd., at Clitheroe, Lancashire, and a clinker grinding plant on the River Clyde, Scotland, operated by The Clyde Portland Cement Co., Ltd.

HUMBOLDT offer something new in the range of lime shaft furnace construction:



A furnace type which has successfully been built for the past seven years.

HP 7/67

Now is that we have taken over the design, construction and sales of a furnace type which up to now had been built by the Friedrich-Siemens, Industrieofenbau GmbH, Düsseldorf. It is the cross flow kiln - Röchling system. A lime shaft furnace which has successfully been sold in all parts of the world during the past seven years.

Now, through Klöckner-Humboldt-Deutz AG, this furnace system is further available to the construction, steel and chemical industries. If you have any problems in the field of lime shaft furnace construction, consult us and we shall answer with a completely new HUMBOLDT product — with a gas or oil operated cross flow kiln, Röchling system.

HUMBOLDT design and build: Dressing plants for mineral-bearing raw materials, smelting works cement factories, plants for the chemical and fertilizer industries, automatic control systems, special centrifugal pumps and steel constructions. Humboldt Works, Telephone Köln 8231, Telex 088 73501.

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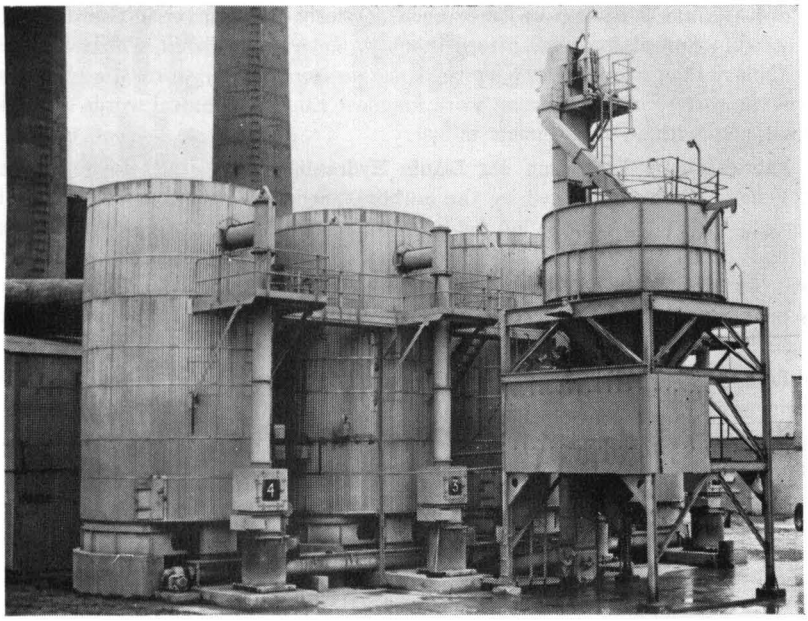
Insulating Dust Plant.



The cement works of The Associated Portland Cement Manufacturers Ltd., at Kirton in Lindsey, Lincolnshire, produces weekly some 5,000 tons of ordinary Portland and rapid-hardening cement and "Walcrete". The dust is removed from the kiln gases, before they pass into the chimneys, by modern electrostatic precipitators. Because a sudden drop in the temperature of the gases would cause condensation and corrode the ducting and precipitators, the ducts from the kilns to the precipitators and the latter are insulated with mineral-wool slabs covered with sheets of aluminium. As a result of this protection, the temperature drop is only 10 deg. F., from 400 deg. F. to 390 deg. F. The accompanying illustration shows the installation at Kirton in Lindsey.

Aerial Ropeway for Conveying Limestone

An aerial ropeway 2,250 m. (1·4 miles) in length is to be installed at the United Provinces Government cement works at Churk, India. The ropeway, which is designed to carry 400 tons of crushed limestone per hour, is to be supplied by The British Ropeway Engineering Co., Ltd.

Books and Brochures Received.

Dictionary of Cement Manufacture and Technology. (German-English and English-German.) By C. van Amerangen. (Wiesbaden: Bauverlag GmbH. 1966. Price: £5)—Containing some fifteen-thousand entries, this book, which is more a vocabulary than a true dictionary since the meanings of the words are not given, gives the corresponding German word for most English technical words (and vice versa) met with in the cement industry.

Fabrication et Utilisation des Liauts Hydrauliques. By M. Papadakis and M. Venaut (Paris: published by the authors. Second edition. 1966. Price: 65 francs.)—This book is intended for manufacturers and users of cement. Modern methods of manufacture are described in sufficient detail to constitute a reference book for chemists, engineers and superintendents in the cement industry. Users of cement are given practical advice and useful information about the choice of cements and the making of concrete.

Testing Equipment for Concrete, Cement, Aggregates and Plaster. (Caplin Engineering Co., Ltd.)—Section 2 of this brochure gives particulars of the H. F. Vibrator for making cubes for cement tests in accordance with the various British Standards, Le Chatelier moulds and Vicat apparatus.

The Sir George Earle Trophy.

THE British Non-ferrous Metals Federation has won the Sir George Earle Trophy which is awarded annually by The Royal Society for the Prevention of Accidents. The Federation has been awarded the trophy in recognition of the work "performed since 1956 on behalf of the industry, both nationally and internationally, not only by fully exploiting well-established safety techniques, but also through a system of works visits as part of a general advisory service to its member companies. Furthermore, it has undertaken and continues to carry out a series of specialist studies in collaboration with Her Majesty's Factory Inspectorate and with other organizations to the advantage of industry as a whole."

A certificate of commendation has been awarded to Messrs. Joseph Lucas Ltd., the outstanding safety record of which firm made the task of choosing this year's Trophy winner difficult.

Reactions of Tobermorite Gel

AN article entitled " Reactions of Tobermorite Gel with Aluminates, Ferrites, and Sulfates," by L. E. COPELAND, E. BODOR, T. N. CHANG and C. H. WEISE, all of the Basic Research Section of the Research and Development Laboratories of the Portland Cement Association (U.S.A.), was published in the " Journal of the P.C.A." for January 1967.

The conclusions drawn by the authors resulting from their investigations on the reactions of tobermorite gel with aluminates, ferrites and sulphates are that such reactions are consistent with the requirements for substitution reactions.

Aluminium, iron and the sulphur of sulphate ions will substitute for silicon in tobermorite gel. Aluminium and iron will also substitute for calcium. The maximum amount of substitution that occurs corresponds to approximately one atom of substitute to six atoms of silicon.

Substitution will occur directly into the tobermorite gel, and also during the formation of the gel if the substitute is present. It occurs in hardened pastes as well as in slurries.

In the case of sulphate ion, charge balance is maintained by the replacement of two hydroxyl ions by an oxygen ion. When aluminium substitutes for silicon, charge balance is maintained by the introduction of a proton to change one of the unshared oxygens of the tetrahedron to hydroxyl. Two Fe^{3+} substitute for $1Ca^{2+}$ and $1Si^{4+}$ simultaneously, thus maintaining charge balance. Aluminium substitutes for calcium in the ratio of $2Al^{3+}$ to $3Ca^{2+}$, to balance the charge.

Changes in the morphology of the gel and apparent structure of hardened pastes accompany the substitution reactions.

That one substitute in a gel can be displaced by another is shown by the reaction of sulphate ion with aluminium-substituted gel to form calcium sulphoaluminate and sulphate-substituted gel; the converse reaction also occurs.

The Cement Industry Abroad

Malaysia—The Associated Portland Cement Manufacturers Ltd., announce that its subsidiary Malayan Cement Ltd., has concluded an agreement with Pan Malaysia Cement Works Ltd., Ipoh. This will result in the formation of a new company with a value of over £7,000,000 and called Associated Pan Malaysia Cement Ltd., which will be jointly owned on a fifty-fifty basis. This Company will acquire the manufacturing plants of Malayan Cement Ltd., near Kuala Lumpur, and of Pan Malaysia Cement Works Ltd., in Northern Malaya and Singapore. The management of the joint enterprise will be carried out by Malayan Cement Ltd., subject to a joint board of directors. A.P.C.M. Ltd., has undertaken to act as the technical managers, and it is confidently expected that substantial benefits in economies and increased efficiency will accrue from the merger. The combined annual productive capacity of cement under Blue Circle management in Malaysia will, after the merger, be over 700,000 tons, which is substantially more than half the total production in Malaysia and Singapore combined.

The Cement Industry Abroad (*continued*).

South Africa.—White's S.A. Portland-cement Co. Ltd., a subsidiary of The Associated Portland Cement Manufacturers Ltd., has placed an order for the extension of the Lichtenburg works, which is situated at an altitude of some 1,500 m. in the Transvaal, 240 km. west of Johannesburg. The works is at present equipped with three rotary kilns operating on the wet-process. The dry process is to be adopted for the extension, as by so doing it is expected that the heat consumption will be reduced by some 50 per cent.

The principal plant in the extension is a Humboldt rotary kiln of 3·8 m. diameter and 54 m. long, and fitted with a preheater. The annual productive capacity will be 250,000 tonnes which is nearly twice the capacity achieved so far by the wet-process. The installation also includes the raw-material combined grinding and drying plant, the raw mix homogenizing and storage silos, the clinker cooler and the dust-collecting plant which incorporates electrostatic precipitators. All of this plant is being supplied by Klöckner-Humboldt-Deutz A.G., which firm is also supplying the complete electrical equipment, the measuring and control apparatus the structural steelwork for the buildings, and the silos. Most of the equipment is being made in South Africa. It is expected that the new works will be started up in Spring 1968.

It is reported that cement production in South Africa in 1966 amounted to 4,000,000 tons which was an increase of 119,000 tons compared with 1965.

New Zealand.—It was reported in a recent number of the "Tarakohe & Waitomo News," that the installation of the new plant is proceeding well and that the alteration to kiln No. 2 is completed. The No. 2 Lepol grate, Fuller cooler and auxiliary equipment was also complete and, by now, the installation of the electrostatic precipitators on the exhaust of kiln No. 2, and the bleed-off for alkali removal, and the cascade blending silo should all have been completed. The foundations for No. 5 cement mill were commenced early this year.

U.S.A. and Canada.—In the early stages of the efforts made by Lafarge Aluminous Cement Co. Ltd., to enter the highly competitive Canadian and U.S.A. markets, selling companies were set up and, for reasons of currency restrictions, were largely financed locally. Now that these concerns are firmly established, particularly in Canada, the entire activities of both distributing companies have been acquired under the names of Ciment Fondu Lafarge (Canada) 1966 Ltd., Montreal, and Ciment Fondu Lafarge Corporation, New York.

Editorial appointments

Concrete Publications Ltd

publishers of CONCRETE and other journals and books related to the cement and concrete industries, have two vacancies on the Editorial Staff.

SENIOR EDITORIAL ASSISTANT

Applicants should have had a training in structural engineering, but previous editorial experience is not necessary. The ability to write plain English is, however, essential and the ability to prepare engineering drawings is desirable.

The work in this position would include obtaining information for, and preparing articles on the design and construction of concrete structures, and on the precast concrete and cement industries, and would necessitate visiting meetings, offices, sites and works for this purpose. The duties also include liaison with the Concrete Society and other bodies, and some general office work related to the production of technical journals and books. The holder of this position would work directly under the Technical Editor.

EDITORIAL ASSISTANT

The duties in this position would be mainly the performance of the general work of an editorial office, including correspondence, but would also include visiting and reporting meetings and the like. Gaining experience of preparing articles and other productive work would be encouraged.

For this position, the ability to type is essential and some previous editorial experience and knowledge of shorthand would be an advantage. The position would be suitable for a young man or lady.

Both positions offer progressive careers and an interesting and varied life. It would be an added advantage if applicants for either of the positions have a flair for or could acquire the knowledge of the ' art lay-out ' of technical magazines.

The positions are permanent and pensionable. A bonus scheme is in operation and luncheon club and sports facilities are available. The working conditions in an office near Victoria Station are good and include a five-days' week and generous holidays.

Applicants should write in the first instance, giving particulars of their education, experience and range of salary expected to

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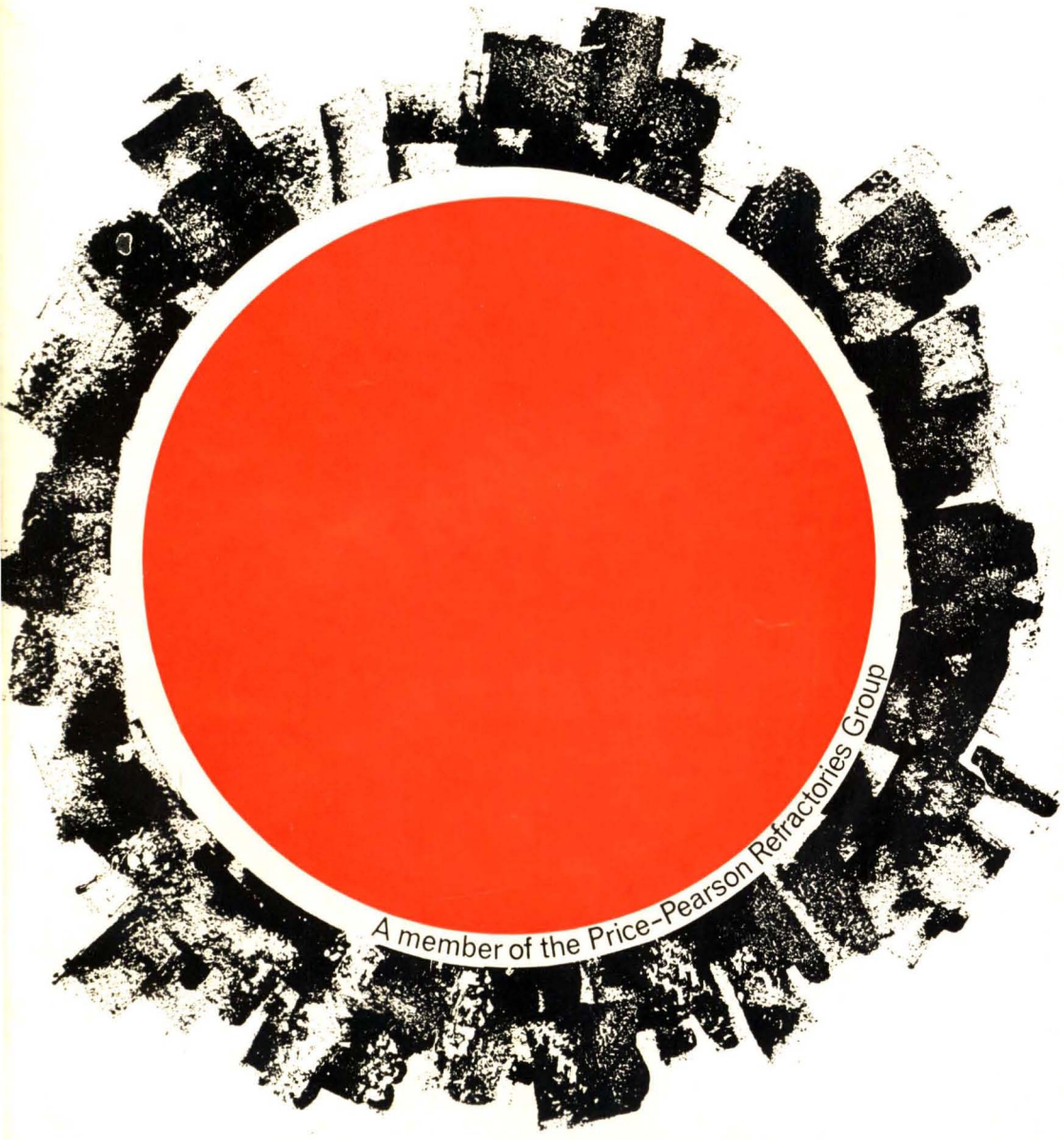

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