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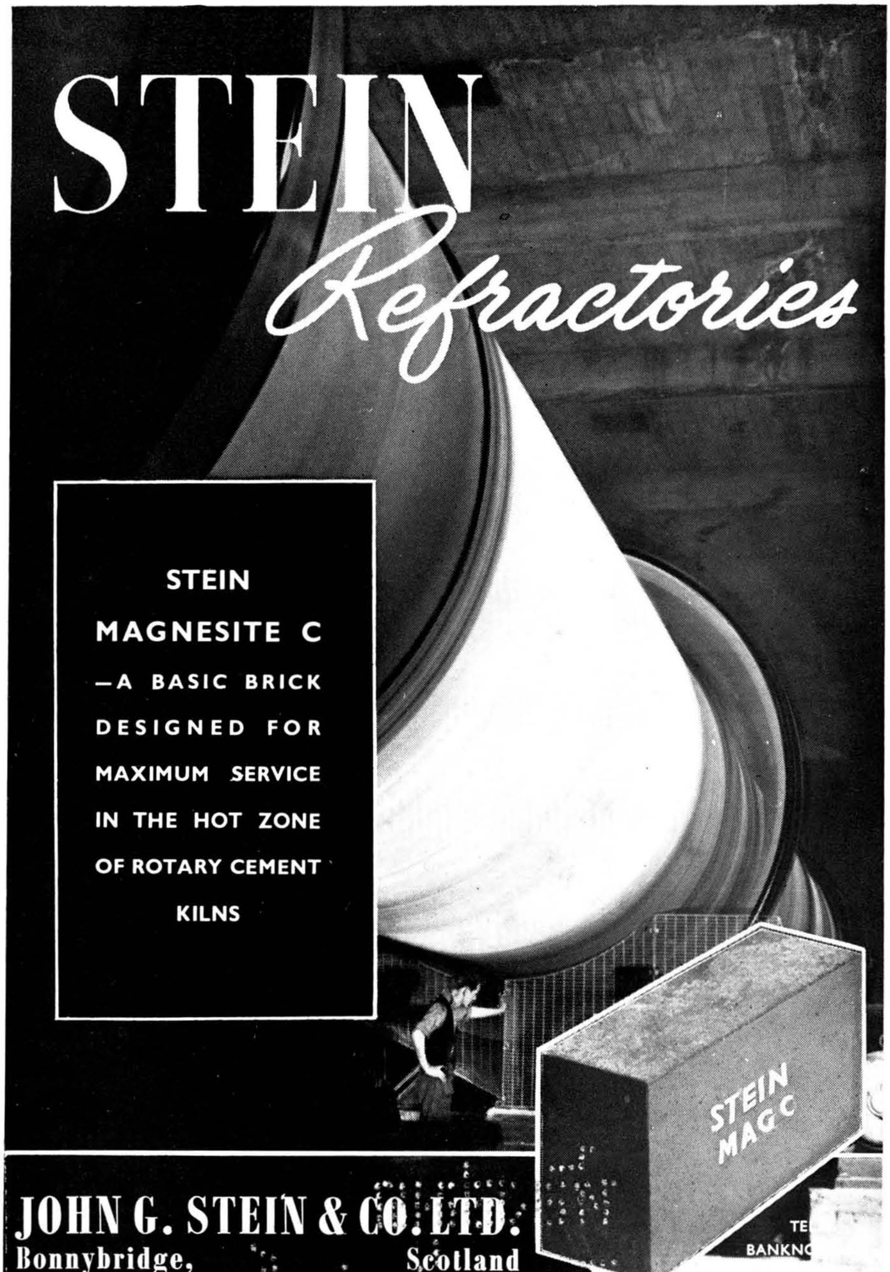
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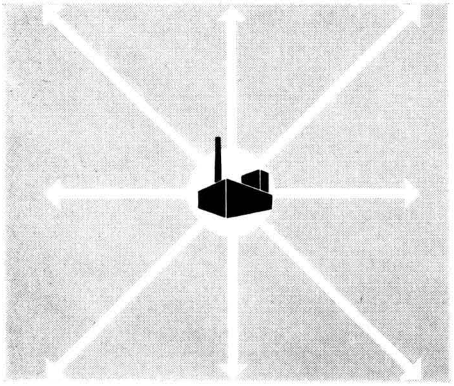

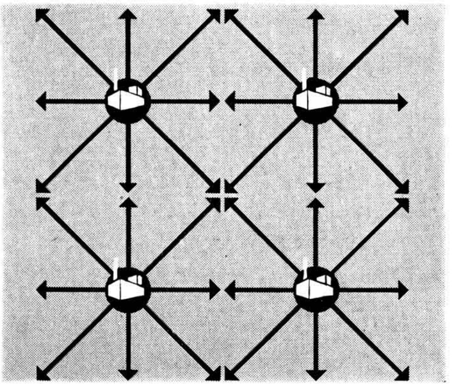

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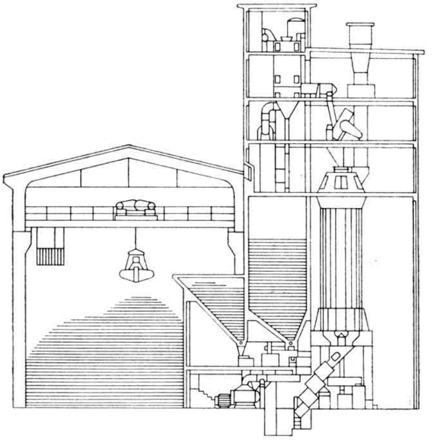

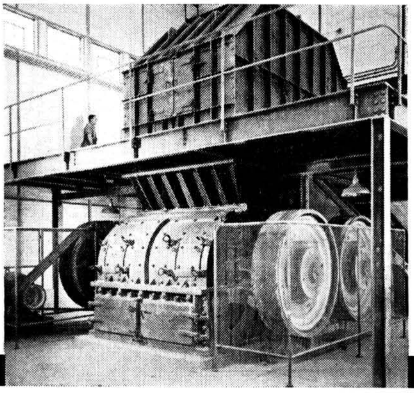

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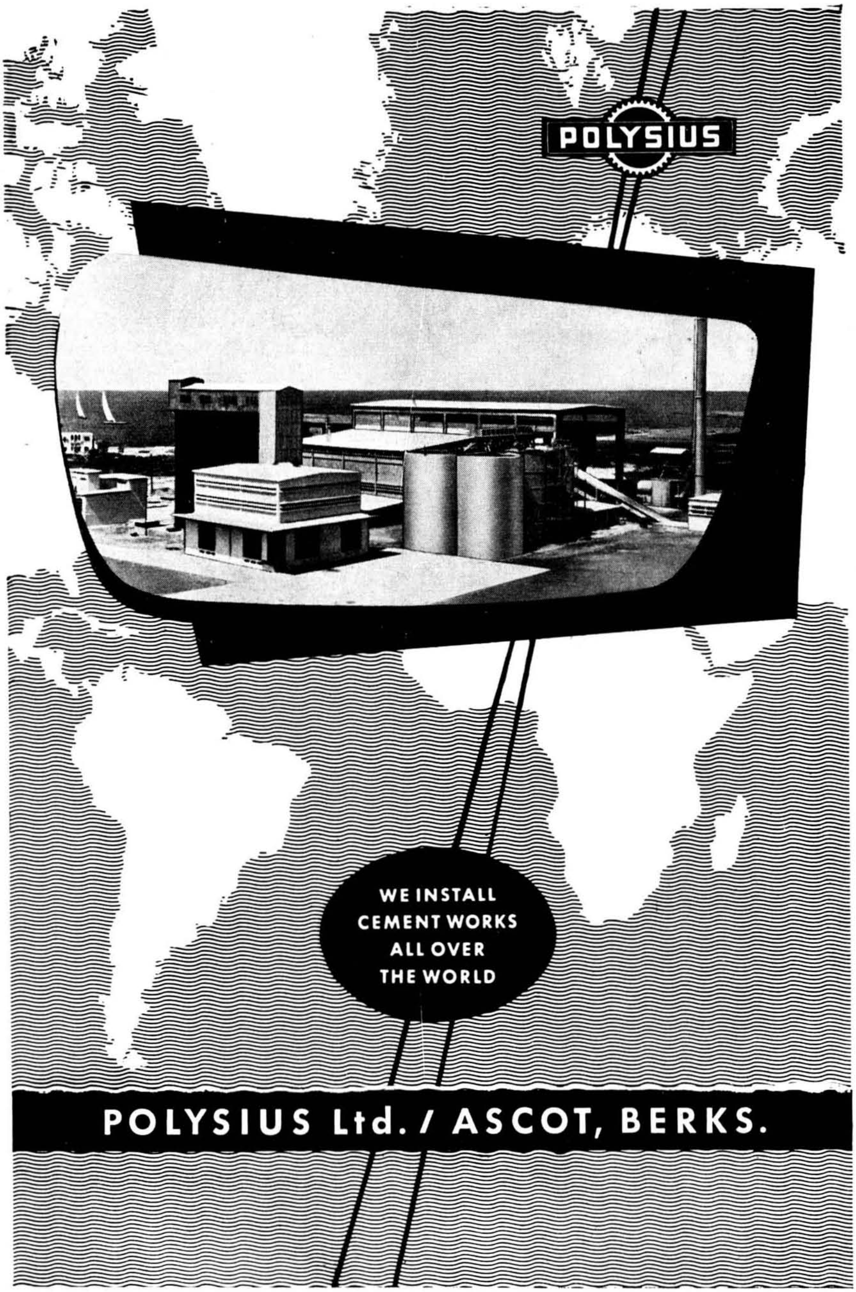

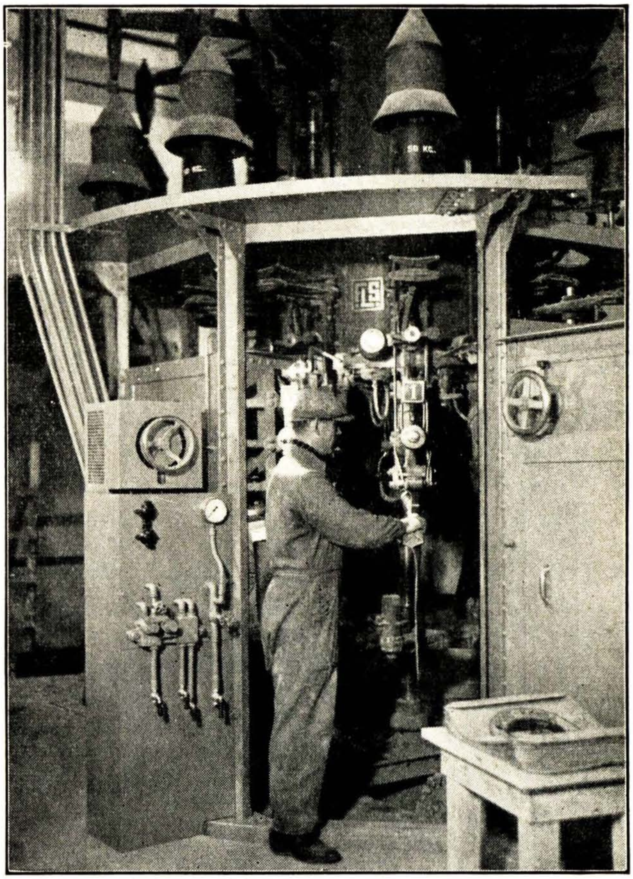

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RETIREMENT

Mr. H. L. Childe, who founded "Cement and Lime Manufacture" in the year 1928 and has since been its Editor, retired on December 31, 1959. Mr. Childe was appointed Editor of "Concrete and Constructional Engineering" and General Manager of Concrete Publications Limited thirty-eight years ago. During this period he also founded and edited "The Concrete Year Book", "Concrete Building and Concrete Products" and the "Concrete Series" books.

An Automatic Crushing, Storing, and Blending Plant for Raw Materials.

A NEW plant for automatically crushing, transporting, and blending raw materials for the dry-process works of the Riverside Cement Company at Oro Grande, California, U.S.A., commenced operation early in 1958 and is described in "Pit and Quarry" for July, 1959. A "flow diagram" is given in *Fig.* 2.

The material in sizes up to 5 ft. is transported from the quarry in trucks of 35-tons capacity to a gyratory crushing machine, which reduces the rock to less than 7 in. in size; this machine has a bag-type dust-collector. This material passes over a vibrating grid from which pieces of less than 3½ in. fall on to a conveyor passing beneath the grid and form a protecting layer upon which the larger material falls from the end of the grid. The conveyor is 4 ft. wide and carries the material, at an average rate of 1000 tons per hour, a distance of 450 ft. to a surge-hopper of 500 tons capacity. Iron is removed magnetically from the material on this conveyor. All the equipment is controlled from one panel and is interlocked electrically. Alarms warn the operator and the truck drivers of the failure of any equipment or of an abnormally high level of material in the surge-hopper, and also of low pressure or high temperature of the lubricating oil

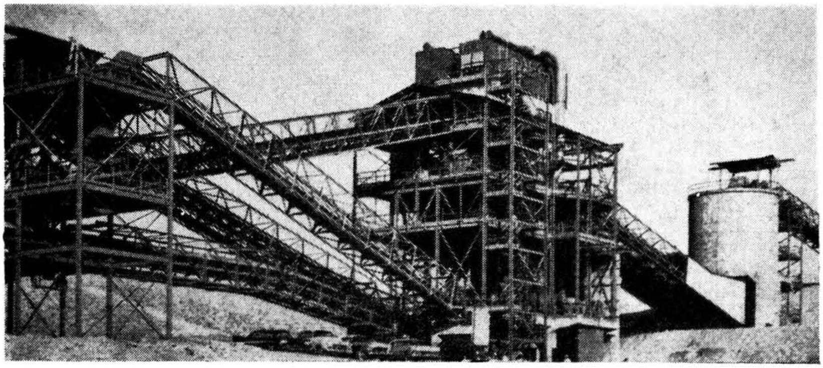

Fig. 1.—The Secondary Crushing and Screening Plant.

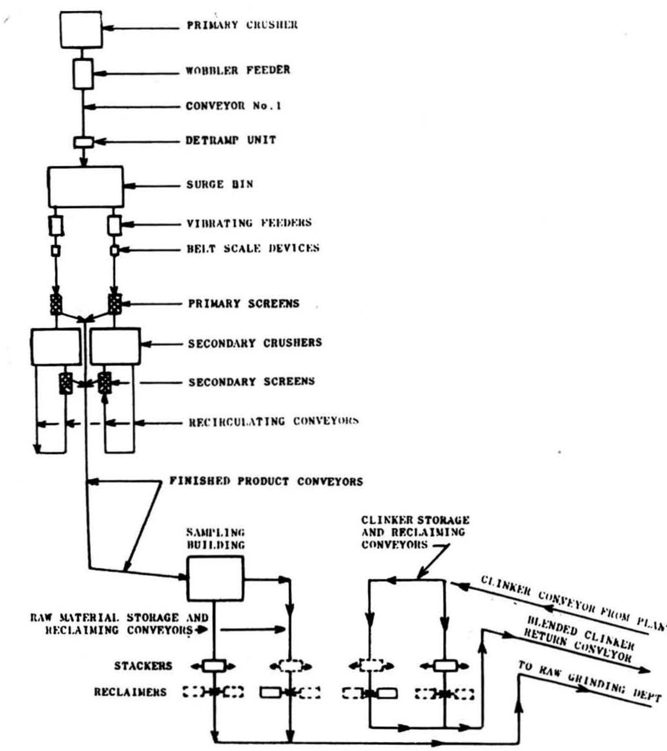

Fig. 2.—Flow Diagram.

Fig. 3.—Method of Storing Raw Material: The Boom Travels Upwards as the Height of the Piles Increases.

for the primary crusher. If damage occurs to the lubricating system the crusher stops automatically after a delay of one minute to allow it to empty.

From the surge-hopper the material is delivered to two belts 3 ft. 6in. wide and carried 130 ft. to the secondary crushing plant (*Fig.* 1). On the way the weight of the material is recorded and the rate of supply to the secondary crushers is automatically controlled. The material from each conveyor passes to a pair of primary vibrating screens set one above the other. The stone passing over the screens is reduced to less than $\frac{3}{8}$ in. in size by two impact crushers each of a capacity of 500 tons per hour and each driven at 600 revolutions per minute by an 800-h.p. motor. Material from each of these mills is conveyed to four screens which separate the coarse material to be returned to the impact-crushers and allow the fine material to join that which has passed through the primary screens and is on its way to the sampling building. The secondary crushing equipment is controlled from a central panel on which a single control is provided to stop each crusher and its associated equipment automatically in a sequence such that the system is empty when it comes to rest.

After leaving the secondary crushers the material is conveyed to a sampling building where a sample cutter moves from side to side of the conveyor. The material removed by the sampler is delivered to an air-swept mill. The material which would pass through a 50-mesh screen is separated by air and passed to another sample cutter which extracts about 18 lb. of material per hour. The sample is analysed and from the results are calculated the amounts of other materials required to provide a properly-proportioned mixture. The calculations are carried

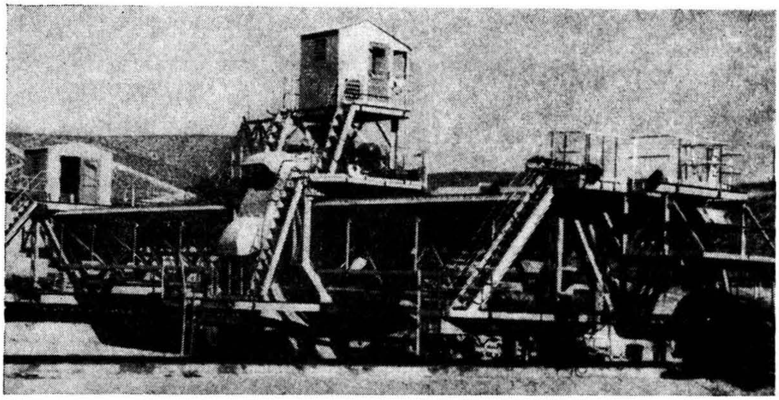

Fig. 4.—" Digging Wheel " for Removing Material from the Storage Heaps.

out by means of a digital computor which is supplied with information concerning the required mixture of raw materials. This information is retained until each stock pile is complete. From the results of the analyses of the material going into the various layers of a stock pile, and its cost, the computor provides information on the cheapest way to combine the material to produce a required mixture.

After the material has passed the sampling building it is distributed by two parallel belt-conveyors to any of four stock piles which are each 517 ft. long and 36 ft. high and contain about 35,000 tons of material. Either conveyor may be reversed, and one conveyor is usually distributing material while the other is carrying reclaimed material. Distribution is by means of the machine shown in *Fig.* 3. The ends of the booms are elevated to the height of the top of the pile to prevent breaking of the stone.

Material is reclaimed by means of the machine shown in *Fig.* 4, two of which are in use. A rotating wheel equipped with buckets moves back and forth through the pile as the machine moves forward so that a mixture is obtained corresponding to that in a cross section of the pile. Each machine has a capacity of 300 tons per hour These machines are mounted on rails 90 ft. apart, and the wheel is 24 ft. in diameter. The cutting arc of the wheel corresponds roughly to the natural slope of the material.

In an attempt to exclude dust most of the switches and relays have sealed mercury contacts. Whenever possible controls are grouped at control panels equipped with audible and visible signals. A television system is to be installed later. A similar plant is to be installed to deal with clinker, which it is proposed to store in four piles each 600 ft. long and containing about 35,000 tons of clinker; each pile will contain sufficient material for ten days' production of the cement mills.

The Determination of the Manganese, Sodium and Potassium Content of Cement by Flame Photometry.

A PHOTOMETRIC method of determining the amounts of manganese, sodium and potassium in cement with only one sample and one set of standard solutions is described by Mr. C. L. Ford in Bulletin No. 233 (October, 1958) of the American Society for Testing Materials[1]. By this method the amount of manganese is determined by means of a spectrophotometer. Calibration charts are prepared from the results of studying solutions containing known amounts of manganese, and of calcium equivalent to 6300 parts per million of calcium oxide. The method is described elsewhere[2] but is extended so that, by including known amounts of sodium and potassium in the standard solutions, the same solutions may be used to obtain calibration charts for the successive determination of the amounts of sodium and potassium in the sample prepared for the determination of the amount of manganese. It is unnecessary to separate any matter from the sample except a small amount of material which is insoluble in hydrochloric acid and which is removed by filtration.

Preparation of Solutions.

REAGENTS. The reagents are prepared as follows.

(a) The calcium-chloride stock solution.—Add 300 ml. of water to 112·5 gm. of calcium carbonate, which is of reagent-grade with a low alkali content and contains no more than 0·02 per cent. of alkali present as sulphates. Place the solution in a 2000-ml. flask and, while stirring, add slowly 500 ml. of hydrochloric acid (specific gravity 1·18). Cool the solution to room temperature. Filter the solution into a 1-l. volumetric flask and add water until the flask contains 1 l. The solution then contains 63,000 parts per million of CaO.

(b) The manganese-alkali stock solution.—Dissolve in water 1·8858 gm. of reagent-grade sodium chloride, 1·5830 gm. of reagent-grade potassium chloride, and enough manganese sulphate suitable for use as a reagent to be equivalent to 1 gm. of Mn_2O_3 (about 2·1412 gm.). The reagents should be dried at 105 deg. C. for several hours before use. Make the solution up to 1 l. in a volumetric flask while mixing thoroughly. This solution then contains 1000 parts per million of each of the compounds Na_2O_3, K_2O, and Mn_2O_3.

Standard Solutions.—Seven standard solutions are prepared as follows. (1) Add 200 ml. of stock solution (a) to 200 ml. of stock solution (b) and make up to 2 l. (2) Add 100 ml. of (a) to 75 ml. of (b) and make up to 1 l. (3) Add 100 ml. of (a) to 50 ml. of (b) and make up to 1 l. (4) Add 100 ml. of (a) to 25 ml. of (b) and make up to 1 l. (5) Add 100 ml. of (a) to 10 ml. of (b) and make up to 1 l. (6) Dilute 100 ml. of (a) to a volume of 1 l. (7) Dilute 100 ml. of (b) to a volume of 1 l.

SOLUTION OF THE CEMENT.—Grind a sample of the cement so that it passes a 100-mesh sieve and remix thoroughly. Put 1 gm. of the sample into a 250-ml. beaker and disperse with 20 ml. of water. Swirl the contents of the beaker, and while it is still swirling add 5 ml. of hydrochloric acid (specific gravity 1·18) all at once. With a rubbe r pestle break up any lumps of undissolved cement Dilute immediately with 25 ml. of water, washing the pestle at the same time. Heat the solution to almost boiling on a hot plate, digest it on a steam-bath for 15 minutes, and filter through a paper of medium texture into a calibrated 100-ml. volumetric flask. Wash the beaker and filter-paper thoroughly with water. Cool the contents of the flask to a temperature near that of the standard solution and dilute to 100 m.l while mixing the solution thoroughly.

Preparation of Apparatus.

The apparatus required is a Beckman model DU spectrophotometer with a model No. 9200 flame attachment, an oxyhydrogen burner, and a No. 4300 photo-multiplier attachment. The apparatus should be prepared as directed by the manufacturers and the pointer on the meter should be set to zero by means of the "dark current control." The instrument should then be set for each element to be determined as follows.

For Manganese.—Wavelength, 403·3 (mμ). Phototube, blue. Resistance, 22 megohms. Width of slit, 0·01 mm. Selector switch, 0·1. Photomultiplier, full.

For Sodium.—Wavelength, 589. Phototube, blue. Resistance, 22 megohms. Width of slit, 0·1 mm. Selector switch, 0·1. Photomultiplier, 2.

For Potassium.—Wavelength, 768. Phototube, red. Resistance, 10,000 megohms (a 2000-megohm resistance may be better for some instruments). Width of slit, 0·05 mm. Selector switch, 0·1. Photomultiplier, off.

CALIBRATION OF APPARATUS.—Set the instrument to the required wavelength. To ensure that the greatest response occurs at the correct wavelength, set the transmittance dial at 100 per cent. and atomize solution (7) into the flame, turn the shutter-switch on, and adjust the pointer to zero by means of the sensitivity control. Rotate the wavelength dial slightly in each direction until, after adjusting the pointer to zero, further changing of the wavelength produces no movement of the pointer to the left. Turn off the shutter-switch, remove the solution, and clean the apparatus by atomizing distilled water.

With the shutter closed, ensure that the pointer is at zero by adjusting the dark current. With the transmittance dial indicating 100, atomize solution (1) into the flame. Open the shutter and set the pointer to zero by adjusting the sensitivity control.

Clean the apparatus as before, atomize solution No. (2), and set the pointer to zero by adjusting the transmittance dial. Check the reading produced by solution (1), and if it is no longer 100 reset the pointer to zero by means of the sensitivity control. Repeat the tests of solutions (1) and (2) alternately until the difference between the readings is negligible. Record the transmittance values as the "gross luminosity."

Repeat the procedure in the foregoing with solutions (3), (4), (5), and (6) and record the gross luminosity of each. The value obtained for solution (6) is the blank or background emission, and should be subtracted from all readings of the standard solutions and solutions of cement. Having obtained the correct values of the gross luminosity, draw calibration curves for each oxide.

Determination of Mn_2O_3

Adjust the spectrometer to the greatest response to Mn_2O_3. Atomize the solution (1) with the transmittance dial indicating 100, and bring the pointer to zero by adjusting the sensitivity.

Atomize the cement solution and note the reading on the transmittance dial after the pointer has been brought to zero again but by adjusting the transmittance control. Clean the apparatus. Select the standard solution nearest in Mn_2O_3 content to the cement solution and observe its transmittance reading with the pointer again at zero. This value should be within one division of the transmittance dial of the value established during the calibration of the apparatus. If it is not, readjust the transmittance dial to the original calibration point and bring the pointer to zero by adjusting the sensitivity control. Check that the transmittance produced by solution (1) is 100; if this is not the case readjust the dial to a transmittance of 100. Finally, test the standard solution and the cement solution alternately until readings for the cement agree within one division of the transmittance dial, and the standard solution agrees similarly with the calibration point. Record as gross luminosity the average of the last two readings from the cement solution. Ascertain that the figure for the correction for background emission is unaltered

Determination of Na_2O and K_2O.

The determination of Na_2O and K_2O is as for Mn_2O_3 except that the controls should be set as described for these oxides. The wavelength should be adjusted to give maximum response to Na_2O or K_2O by means of standard solution (7). With the net values of luminosity of Mn_2O_3, Na_2O, and K_2O in the cement solution the percentage of each oxide can be determined from the calibration curves.

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A Patent Method of Making Cement.

Portland cement is made by passing a flowable mixture of the ingredients in a vaporizable liquid through an elongated tubular heating zone to vaporize the liquid and form a dispersion of the solids in the resulting vapour, passing the dispersion through a succeeding zone at high velocity flow whilst subjecting the dispersion to turbulence and a velocity sufficient to disintegrate the solids, and then sintering to form clinker, Specified liquids are water, kerosene, coal tar distillates, alcohols, glycols and carbon tetrachloride; calcareous materials are limestone, chalk, marl, marine shells, and waste precipitated calcium carbonate; argillaceous materials are clay, shale, slate, blastfurnace slag, and ashes.—798,972. Texaco Development Corporation, February 20, 1956.

A Large Cement Works in Russia.

ACCORDING to " Rock Products " (U.S.A.) two cement kilns 575 ft. long are being installed at a works at Acympt, Siberia. The raw material will comprise a mixture of limestone and nepheline residue, which is a waste product to be pumped from a nearby aluminium works, and which is claimed to increase production by as much as 25 per cent. compared with mixtures of limestone and clay. The nepheline residue is a compound of 80 per cent. dicalcium silicate (C_2S, or Belite) and 20 per cent. alumina, iron, and silica, and has the consistency of mud. The wet process is to be used. The complete plant is being supplied by Société Fives-Lille-Cail, of Paris. The capacity of each kiln is to be about 5500 tons of cement a day.

The three-compartment tube mills used for crushing the raw material are to be 46 ft. long and 8 ft. 8 in. in diameter, and will weigh 260 tons each. Each mill will contain 110 tons of grinding media, and be driven by a 2500-h.p. synchronous motor; the rated capacity is 75 tons per hour. The nepheline will be delivered to the mills with the limestone, and the resulting slurry will have a water content of 32 per cent.

The eight slurry tanks will be 40 ft. high and 10 ft. in diameter, and will have a total capacity of 24,000 tons. When it enters the kiln the slurry will comprise 51·87 per cent. limestone and 48·13 per cent. nepheline.

The diameters of the kilns will be 19 ft. in the drying zone, 16 ft. in the decarbonating zone, and 17 ft. 5 in. in a burning zone 82 ft. long. Each kiln will weigh 2100 tons, and be supported on seven tyres, the largest of which weighs 60 tons; the speed of rotation will be 0·6 to 1·2 revolutions per minute. The fuel will be hard lignite, and the fuel consumption is estimated to be 25 tons per hour.

Each kiln will have an inclined clinker cooler of the reciprocating-grate type. The coolers will be 75 ft. long by 14 ft. diameter, and weigh 290 tons each. The capacity will be 2500 tons a day of clinker cooled from 2500 deg. Fahr. to 150 deg. Fahr. The clinker will be discharged by two chains each 1 ft. 8 in. wide and with a capacity of 104 tons per hour.

Ordinary and rapid-hardening Portland cements will be made. Four grinding mills will be used for ordinary cement and one for rapid-hardening cement. All the mills will be 46 ft. long by 10 ft. 5 in. diameter, and each will contain 170 tons of grinding media. Each mill will have a capacity of 55 to 60 tons of cement per hour of a fineness (by the Blaine method) of 2800 sq. cm. per gramme in the case of ordinary cement and 4000 sq. cm. per gramme in the case of rapid-hardening cement.

There will be twenty storage silos for cement with a capacity of 80,000 tons.

Recovery of Creep in Mortars Made with Different Cements.

WHEN specimens of mortar are loaded for a period creep occurs in addition to elastic strain; when the load is removed, the elastic strain disappears almost instantaneously and there follows a slow recovery of the strain due to creep. Mr. A. M. Neville in a paper entitled " Creep Recovery of Mortars Made with Different Cements " in the Journal of the American Concrete Institute, August 1959, describes some tests made with British cements for the purpose of determining the factors affecting the recovery of the non-elastic strain. Briefly, it appears that the recovery of creep is not related to the strength of the mortar in the simple manner in which creep has been found to depend on strength. Some data on the change of weight shows that creep does not produce an additional movement of water from the cement paste into the surrounding medium. The author's discussion on the results of the tests is as follows.

The exact nature of creep remains still largely unknown but it is possible to suggest that the mechanism of creep is related to the movement of zeolitic water from the calcium-silicate hydrate into the capillary pores in the gel. It has been reported(2) that the calcium-silicate hydrates are in the form of thin fibrous crystals with a short fibre repeat unit of 3·65 Å, and this has been interpreted to mean that there exist silicate tetrahedra joined by hydrogen bonds. The hydrate has a layer structure with spacing varying between 14 and 9 Å on loss of water. It could be thought that this loss of intracrystalline water and the reduction in *c*-spacing are associated with creep. X-rays and the electron microscope have shown the presence of crystals of dimensions of $500 \times 100 \times 50$ Å, which fall within the range of the size of particles of gels. These lath-shape needles with a tendency to parallel aggregation and a capacity for retaining water would account for the colloidal properties of hydrated calcium-silicate crystals.

The chemical composition of the cement does not appear to be a primary factor in creep, presumably because different cements produce a gel of approximately similar properties. It is true that the calcium silicates are the main cementitious materials so that their content determines the strength of the hydrated paste, but there are strong indications that the rate of gain of strength of the paste varies little between the different cements, at least beyond the age of 28 days(1). It is interesting that the fractional rates of hydration of the various compounds in cement are approximately the same(3).

The problem of the relation between the fundamental chemical and physico-chemical constituents and the mechanical properties of the cement paste is complex because the mechanical properties depend more on a grosser structure of colloidal dimensions than on the elementary chemical constituents(2). This might explain why there is no significant correlation between chemical composition of cement and creep of mortar, although some correlation between composition and strength has been obtained(1).

Cement pastes loaded to the same proportion of their strengths have been found to have approximately the same creep, that is, creep would appear to be a function of the relative amount of the unfilled gel space (strength being proportional to the cube of the gel-space ratio[4]), and it could be speculated that it is the voids in the gel which are responsible for the relatively lower strength and higher creep.

The observed values of creep-recovery indicate that it may not be an elastic or delayed elastic phenomenon connected with the movement of water between mortar and the surrounding medium but, more likely, a movement of the cement paste due to its return to a hygral equilibrium with the ambient medium; some of the zeolitic water expelled under load may be restored but the movement is not truly reversible. The rigidity of the cement paste as a whole may be the governing factor, and for mature pastes this rigidity is believed to be sensibly the same.

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The Control of Grinding Mills.

A new method of controlling the operation of ball mills at the works at Speed, Indiana, U.S.A., of the Louisville Cement Company is claimed to have increased production by about 12 tons a day. The mills are used for crushing rock and shale and also for grinding the clinker, and operate on the closed-circuit principle; oversize particles are separated by air and re-circulated. It was considered that the load on the motor operating the discharge elevator of the mill was in direct relation to the loading of the mill and therefore to its efficiency, and it was decided to use a measure of the load on the motor operating the elevator to control the rate of delivery of material to the mill. The basic instruments used are thermal converters used as load-sensing devices and electronic recorder controllers; the thermal converters measure the consumption of electricity and deliver this information to the recorder-controller which regulates the speed of the motor driving the conveyor which delivers material to the mill and consequently the supply of material.

The Durability of Concrete.

A review of the results, after ten years' exposure, of the long-term tests of the American Portland Cement Association is given by Mr. Frank H. Jackson in the September, 1959, number of the "Journal of the Research and Development Laboratories," published by the Association.

In addition to observations on full-size structures, two sites are in use for the exposure of specimens larger than those tested in a laboratory but smaller than full-sized members as used in structures. One of these sites is near Chicago where the weather conditions are severe and the other is in the milder climate of Georgia. At each site there are about a thousand specimens made with different cements and aggregates, with different proportions of cement to aggregate, and mixed with different water-cement ratios. At the end of ten years it was considered that the deterioration of the specimens at the site in Georgia was not sufficient to warrant any comparison being made of the cements. At the site near Chicago evidence of deterioration was in general to be seen only in the case of specimens having very high water-cement ratios (slumps of 8 in.). One of these specimens contained 423 lb. of cement per cubic yard and good aggregate; the others contained 423 lb. or 610 lb. of cement per cubic yard and were made with aggregate of doubtful quality. Of these specimens those containing low-heat cement and sulphate-resisting cement appeared to be in a slightly better condition than those containing ordinary Portland cement. No correlation has been found between the chemical composition or other properties of non-air-entraining cements and their performances. On the other hand, all the specimens containing air-entraining cements, irrespective of proportions, consistency, or aggregate, were in practically perfect condition, thus emphasizing the conclusion that durability depends upon the void structure of the concrete rather than on the chemical composition of the cement.

The committee makes the following observations on the tests.

(1) The cements were well made and met the specifications in all respects. They differed in varying degrees with respect to water requirements, early hardening characteristics, tendency to premature stiffening and "bleeding" capacity. They differed also in their effect on the durability of concrete. However, no consistent order of durability is evident among the non-air-entraining cements. Some, which had high durability in certain exposures, had relatively low durability in others. Even on the same test site non-air-entraining cements which performed well in some concrete mixtures were not necessarily among those which performed well in others.

(2) There is no consistent correlation between the behaviour of concrete exposed to freezing and thawing and the chemical composition or fineness of the cement, except in cases of exposure to freezing soon after the concrete was cast. In those cases (in which the slow-hardening cements appeared to be particularly susceptible to damage) there had been only a short curing period, with little or no drying before exposure to freezing. The rate of hardening of cement is affected by its composition and fineness, so that in these special conditions durability might be dependent upon these factors.

(3) No relation has been found between kinds or sources of cement raw materials and the performance of the cements in concrete.

(4) For cements within the usual ranges of composition and fineness, normal differences in manufacture do not appear to be significant with respect to the durability of concretes made with them.

(5) The resistance of concrete to attack by solutions of sulphate salts increases with reduction of the potential C_3A content of the cement. Air entrainment improved the performance of almost all of the specimens exposed to alternate drying and soaking in solutions of sulphate salts.

(6) There is overwhelming evidence to show that the proper use of air entrainment enormously increases the ability of concrete to endure freezing and thawing without deterioration. Air entrainment is particularly beneficial in preventing scaling when chloride salts are used for removing ice from concrete roads.

(7) The beneficial effects of air entrainment extend to concretes made with high water-cement ratios and to lean concrete mixtures. Nevertheless, it should not be concluded that air entrainment nullifies the need for good aggregates, proper proportioning, or sound construction practices.

(8) A principal object of this study was to investigate the effects of the composition, fineness, and conditions of manufacture of cements on their behaviour in concrete. It has now become evident that the behaviour of cements in concrete cannot be adequately expressed or understood solely on these terms, and that the usual methods of testing and analyzing cements provide an incomplete basis for predicting their behaviour. There is much reason to believe that unexplored physical properties or physico-chemical aspects are most important in this connection. The committee recommends that the investigation be continued and that greater emphasis be given to more fundamental properties of the cements and the pastes they form. Such an approach may provide specific information by which differences in the performance of the structures may be explained.

Later reports on laboratory tests show conclusively that, of the nine different test procedures designed to disclose specific physical properties of the cements (as, for example, premature stiffening, autoclave expansion, etc.) only one—the test for air content—is of any value in indicating relative resistance to freezing and thawing.

The Cement Industry in Formosa.

The Asia Cement Corporation is to build a cement factory with a capacity of 150,000 metric tons a year. The Taiwan Cement Corporation is asking for U.S.A. aid to increase the capacity of its works at Kaohsiung to 220,000 tons a year and is building a new works at Hualien with a capacity of 50,000 tons a year. Other new works are expected to increase the capacity of the cement industry in Formosa to 1,600,000 tons a year by 1962.

The Shrinkage of Cement Paste During Drying.

A method of measuring the changes in volume and weight of thin layers of Portland cement paste during carbonation and drying, without disturbing the curing process, was described in this journal for November 1959. The method was devised by Mr. K. M. Alexander and Mr. J. Wardlaw at the Cement and Ceramics Section of the Commonwealth Scientific and Industrial Research Organisation (Melbourne, Australia), and its use to determine the effects of fine aggregate and minerals powdered to the fineness of cement upon the shrinking of Portland cement paste while it dries is described by the authors in the Journal of the American Concrete Institute for June 1959, from which the following is abstracted.

A series of tests is described in which the amounts of water and of the powdered aggregate in cement paste were varied both separately and simultaneously, and the effects were studied of progressively increasing the size of the grains of the mineral. It is concluded that if the Portland cement in a paste be partially replaced by powdered basalt of the fineness of cement and the ratio of water to cement plus basalt be kept constant, the effect on shrinking while drying depends upon a balance between the influences of the simultaneous changes of the ratios between the water and cement and the aggregate and cement. An equation is given which relates the changes in shrinking and strength to changes in the contents of water and aggregate. If $\Delta S'_{O-R}$ is the change in shrinkage when the amount of aggregate is increased from O to R per cent. by volume, Δx is the accompanying change in the water-cement ratio by volume, R is the proportion (by volume) of Portland cement replaced by aggregate, and a and b are constants, then

$$\log \Delta S_{O-R} = \log \Delta x_{O-R} + aR + b.$$

It is also concluded that, when the effect of aggregate on shrinking due to drying is considered in relation to the elastic constants of the embedded particle and the surrounding material, distinction should be made between the restraint imposed by particles of stone small enough to fit between the grains of cement and the restraint imposed by the same volume of stone in the form of grains or pebbles large enough to displace whole zones of cement grains.

Filter Bags of Wool and Nylon.

It is claimed by British Nylon Spinners, Ltd., that the cost of filter-bags used for the collection of dust at cement works is reduced by 80 per cent. if the bags are made of a mixture of wool and nylon instead of wool alone. The initial cost of wool-and-nylon bags is no greater than that of woollen bags, and it is stated that their efficiency is the same and they last four times as long. At a British cement works it has been found that bags made with 25 per cent. of nylon and 75 per cent. of wool generally last for a year or more compared with about three months in the case of all-wool bags; the annual saving at this works is said to be more than £1000.

Measurement of the Size of Particles.

THE papers read at the Symposium on Particle Size Measurement held recently in the U.S.A. have been published in book form by the American Society for Testing Materials (price $6.25). The book contains the following papers.

The Mechanics of Fine Sieving by K. T. Whitby; Application of Electroformed Precision Micromesh Sieves to the Determination of Particle Size Distribution, by H. W. Daeschner, E. F. Seibert, and E. D. Peters; Measurement of Physical Properties of Cracking Catalysts, by L. Mittelman; Methods of Particle-Size Analysis by R. P. Loveland; Recent Developments in the Hydrometer Method as Applied to Soils, by E. E. Bauer; Sedimentation Procedures for Determining Particle Size Distribution, by W. F. Sullivan and A. E. Jacobsen; Centrifuge Sedimentation Size Analysis of Samples of Airborne Dusts Collected in Membrane Filters, by K. T. Whitby, A. B. Algren, and J. C. Annis; Liquid Sedimentation Method for Particle Size Distributions, by L. M. Cartwright and R. Q. Gregg; Determination of Particle-Size Distribution by Examining Gravitational and Centrifugal Sedimentation According to the Pipet Method and with Divers, by S. Berg; Photoelectric Sedimentation Method for Particle Size Determination in the Sub-sieve Range, by H. R. Harner and J. R. Musgrave; Light Scattering Instrumentation for Particle Size Distribution Measurements, by C. T. O'Konski, M. D. Bitron, and W. I. Higuchi; Turbidimetric Particle Size Distribution Theory: Application to Refractory Metal and Oxide Powders, by A. I Michaels; Electronic Size Analysis of Subsieve Particles by Flowing Through a Small Liquid Resistor, by R H. Berg; Determination of Particle Size by Adsorption Methods, by R. J. Fries; A Study of the Blaine Fineness Tester and a Determination of Surface Area from Air Permeability Data, by S. S. Ober and K. J. Frederick; A Discussion of the A.S.T.M. Recommended Practice for Reporting Particle Size Characteristics of Pigments, by J. H. Calbeck; The Stanford Research Institute Particle Bank, by R. D. Cadle and W. Thuman. There is also a list of A.S.T.M. standards for the measurement of the sizes of particles.

Speed of Kilns controlled by Amplidynes.

Although amplidynes have been in use in other industries for about fifteen years, it is thought that their application to the control of the speed of rotation of cement kilns by the Olympic Portland Cement Co. at Bellingham, Washington, U.S.A., is the first time they have been used in the cement industry. It has been found that with the use of amplidynes there is no perceptible change in the speed of the kiln due to variations of load; the burner has a closer control of the kiln because the speed of rotation conforms exactly to the setting of the apparatus; the response to a desired change of speed is rapid; the speed can be varied in stages of half a revolution per minute; the greatest speed can be any value less than a hundred revolutions per minute; the slurry-feeder can be adjusted to follow the speed of the kiln. The apparatus was supplied by the U.S.A. General Electric Company of Seattle.

Patent Applications Relating to Cement.

Cement Slurries.

Raw material, either dry or of water content less than that required for a froth flotation process, is divided into two fractions, water is added to one fraction to produce a slurry which is froth flotated, at least a part of the resulting concentrate is mixed either with incoming raw material or the other fraction, this other fraction as such, or mixed with part of the concentrate, but without dewatering giving the required slurry for making cement. A fine fraction may be separated, by centrifugal separations, from that fraction to be flotated, and mixed without dewatering either with the raw material or with the other fraction, a fine fraction being also separated from the concentrate from the flotation and returned to the flotation, the remainder of the concentrate, without dewatering, being mixed with the other fraction.—No. 816,474. F. L. Smidth & Co. A.S. October 19, 1955.

Cement raw slurries of water content suitable for efficient kiln operation are obtained by wet grinding part of the raw materials in a closed circuit containing a centrifugal separator, whereby a fine fraction of high water content is removed from the circuit, and to which dry raw material is added to form the slurries. Intermediate grindings and separations may be made.—785,390. F. L. Smidth & Co. Aktieselskab, September 5, 1955.

Solids in Slurry.

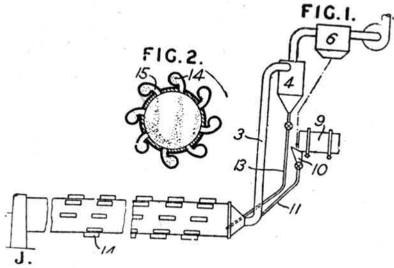
A method of making cement comprises determining the amount of solids in dewatered slurry in a continuous flow thickener by supplying liquid slowly to an open-ended duct which passes downwards into the slurry and measuring the heights of the surfaces of the liquid within the duct and of the slurry outside the duct, and keeping that amount constant. The slurry is fed from the thickener to a cement burning kiln at a rate controlled in accordance with the amount determined. If the amounts of solids at a plurality of levels are required a corresponding plurality of ducts passes into the slurry to these levels.—No. 785,335, F. L. Smidth & Co. Aktieselskab. May 27, 1955.

Viscosity of Slurry.

A method of controlling the viscosity of an aqueous slurry of alkaline inorganic hydrophilic solids comprises the addition of carbon dioxide until a pH content of 6 to 7 is obtained. The method, by which for a specific solid content the viscosity is reduced, or for a specific viscosity the solid content is increased, is applied particularly to slurries of cement, soil, clay, or ceramics. Wetting agents may also be present.—No. 812,147. Monolith Portland Midwest Co. August 30, 1955.

Burning Cement.

Cement or lime to be burned is formed into nodules or agglomerates of an average diameter not exceeding 2 mm. which are preheated by passage through a gas at right angles to the gas-flow. The preheating may be within the kiln in which the burning occurs. Nodules formed in an apparatus (9) pass to a hopper

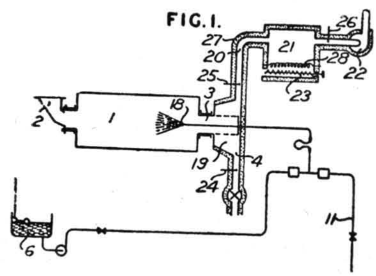


(10), through a pipe (11) to the bottom of a pipe (3). The smallest nodules are carried up the pipe (3) and separated in the cyclone (4) from which they pass, via pipe (13), to the kiln. Larger nodules pass directly from the bottom of pipe (3) into the kiln. Externally the kiln has a number of chambers (14) communicating with the kiln interior through curved ducts (15). As the kiln rotates, nodules enter the chambers at their lowermost position and are poured out at their uppermost position.—No. 789,963. F. L. Smidth & Co. Aktieselskab, December 6, 1956.

A mineral such as montmorrillonite (which swells when moistened and shrinks on subsequent drying) is added to raw materials used in the wet and dry processes of cement manufacture to strengthen the nodules formed on heating. The montmorrillonite may be added as bentonite or fuller's earth.—No. 786,504. F. L. Smidth & Co. Aktieselskab, November 30, 1955.

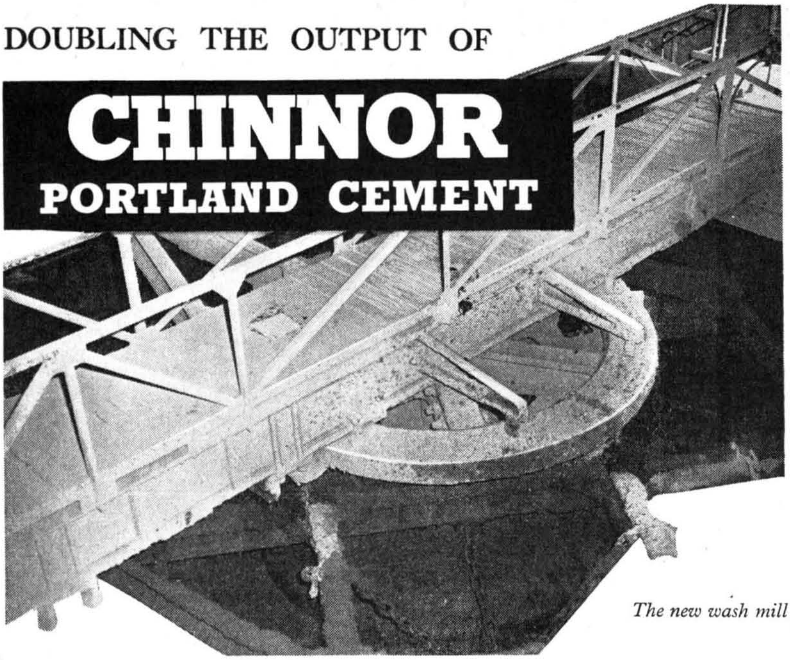
Grinding Cement.

Apparatus for the removal of heat generated by grinding cement raw meal, clinker, or other materials, comprises a grinding chamber, a filter, a pipe leading from the chamber to the filter, and thermal insulation on the pipe and filter to



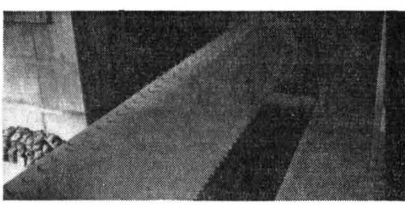
prevent condensation therein of the vapour supplied to the mill to absorb some of the heat generated. In the figure a mixture of cement clinker and gypsum is introduced into a tube mill (1) through inlet (2). Water flows from a tank (6) below the chamber (1) and is atomized at (18) by compressed air supplied through pipe (11), the water being introduced into the chamber when the temperature therein due to grinding is about 100 deg. C. Ground cement leaves the mill (1)

DOUBLING THE OUTPUT OF CHINNOR PORTLAND CEMENT

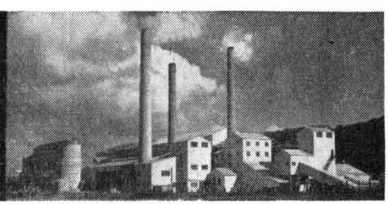


The new wash mill

Extensive modernisation of the Chinnor Cement plant in the Chiltern Hills has increased its annual capacity from 100,000 to 220,000 tons. As main contractors Vickers-Armstrongs undertook the design and engineering work. They manufactured the new kiln and cement mill, and through their associated companies they also supplied all the steel-framed buildings, plate work and the majority of the conveying equipment. The whole contract was completed without interruption to existing production.



The new cement mill



General view of the new plant

MAIN CONTRACTORS:
Vickers-Armstrongs (Engineers) Ltd. Civil Engineering & Mechanical Erection: *Demolition & Construction Co. Ltd.*

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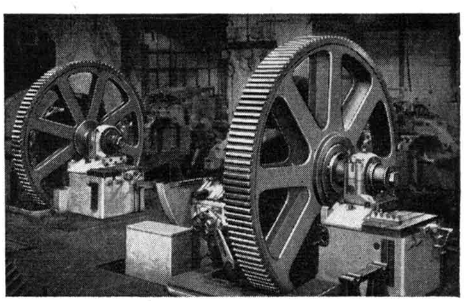

via a trunnion (3) and passes down shaft (4) to a conveyor (not shown). Cement dust, water vapour, compressed air and any air sucked in through inlet (2), pass up pipe (20) to an electrostatic filter (21) connected to a fan (22), the filter trapping the suspended cement dust from which it is discharged by a worm conveyor (23) designed to exclude the direct entry of atmospheric air. The filter is provided with heating elements (28). The temperature of the cement being ground is maintained between 100 deg. C. and 130 deg. C. to prevent loss of water of crystallization from the gypsum and condensation inside parts (19) to (22). A layer (27) of insulating material reduces heat loss. Thermometers (24, 25 and 26) assist the maintenance of optimum working temperatures by giving impulses to an alarm device when the desired temperatures are not met.—No. 808,061. F. L. Smidth & Co., A.S. November 15, 1955.

The Cement Industry in the Philippines.

In addition to three proposals for the establishment of cement works in the Philippines, which were approved earlier this year, further proposals for the construction of cement works have been submitted by the Atlas Cement Corporation, the Superior Cement Corporation, and the Filipinas Cement Corporation.

The capacity of the works of the Republic Cement Corporation at Norzagaray, near Manila, has been doubled and is now 880 tons daily. All the electrical equipment was supplied from Great Britain by the English Electric Co., Ltd., and includes a main transformer of 3750 kVA. rating, a switchboard of eleven cabinets with a rupturing capacity of 250 MVA. at 6·6 kV., two motors of 1,320 h.p. each for the raw material crushing and grinding mills, a motor of 460 h.p. for the mill fan, a motor of 385 h.p. for the exhaust fan, and sixty-two other motors ranging in power from 140 h.p. to $1\frac{1}{4}$ h.p. The value of the contract for the electrical equipment was about 350,000 U.S.A. dollars.

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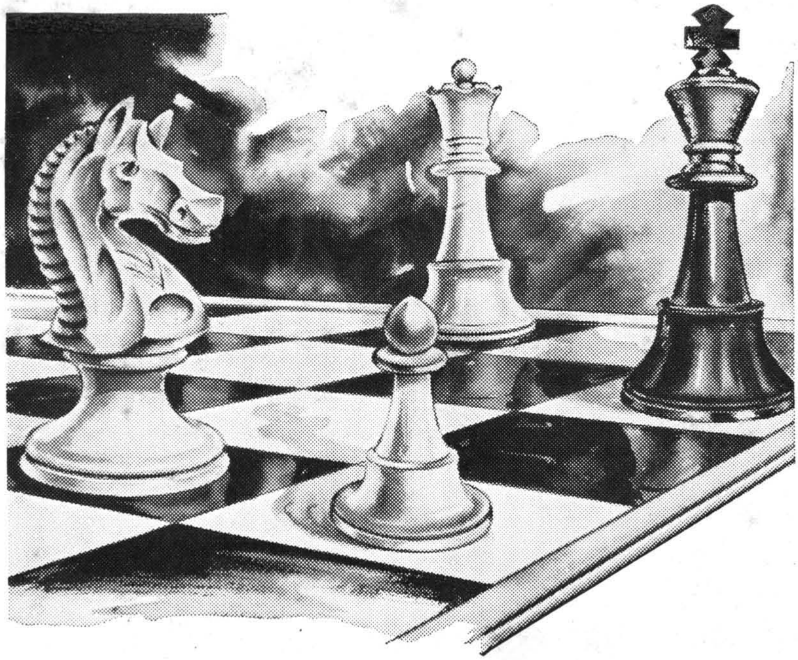

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