CEMENT
& LIME MANUFACTURE

VOL. XXXVII. No. 5 SEPTEMBER, 1964

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Cement Works in Tunisia.

THERE are two cement works in the North African state of Tunisia. The larger is at Djebel-Djelloud, near Tunis, and the other is that at Bizerta. There are no national standard specifications for cement in Tunisia, the product being made to comply generally with the British, American or French standards as required by the purchaser.

The Djebel-Djelloud Works.

The works at Djebel-Djelloud is operated by Ciments Artifciels Tunisiens

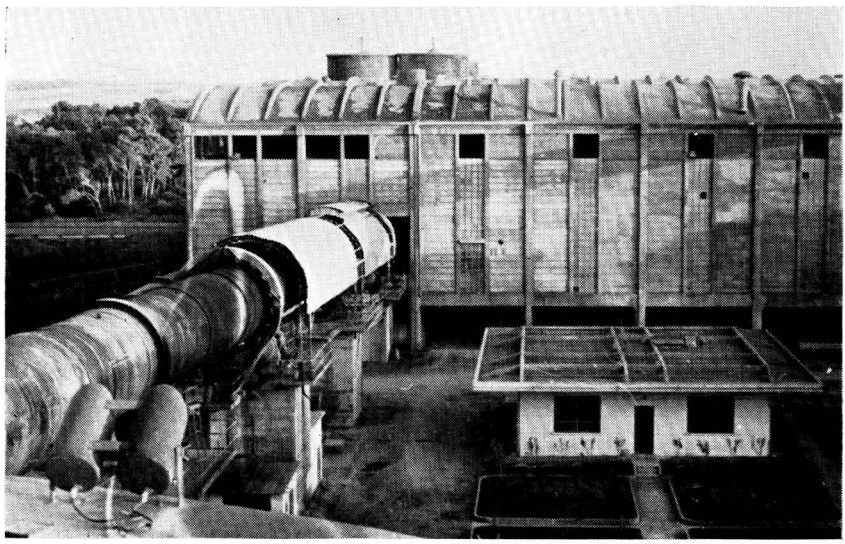

Fig. 1.—Cement Works at Bizerta.

KEY

3.—Intake for for limestone and marl.
4.—Marl drier.
5.—Raw materials crushers.
6.—Blending silos.
7.—Kiln.
8.—Kiln head.
9.—Materials store.
10.—Cement mills.
11.—Despatch.
12.—Wharf.
13.—Laboratory.
14.—Transformer House.
15.—Garage.
16.—Workshop.
17.—Stores.
18.—Offices.

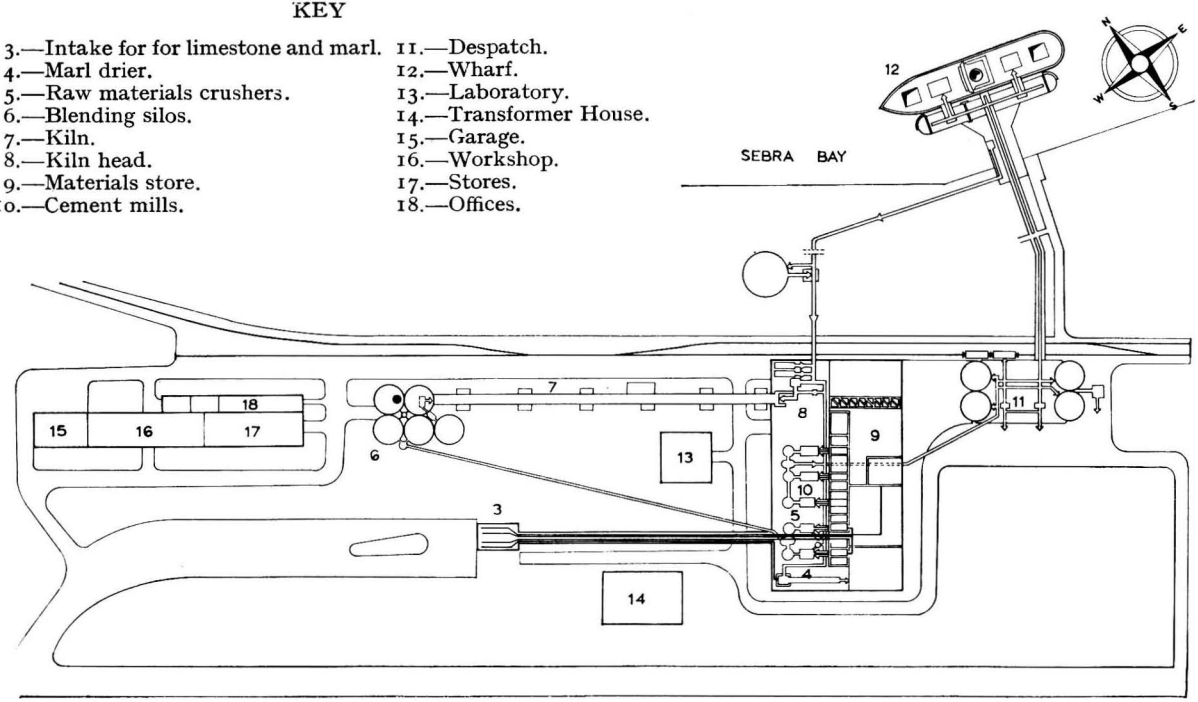

Fig. 2.—Plan of Cement Works at Bizerta.

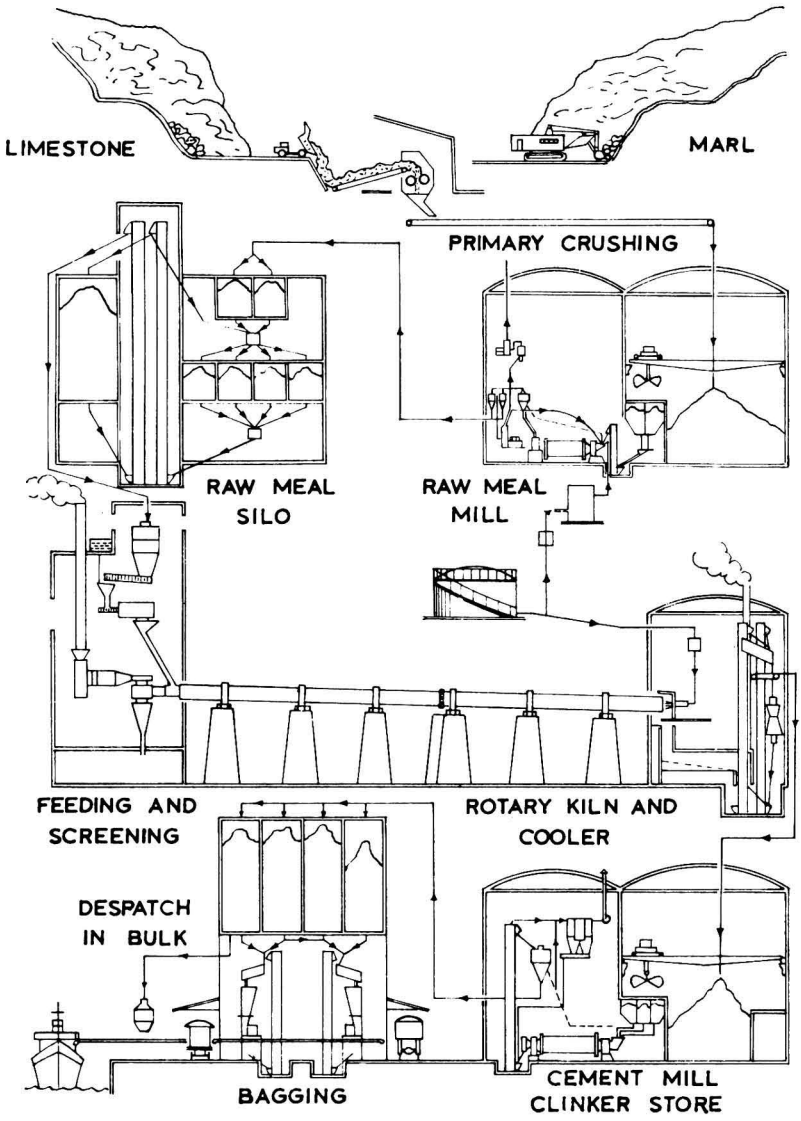

Fig. 3.—Flow Diagram: Cement Works at Bizerta.

S.A. There are three rotary kilns having an annual productive capacity of about 330,000 metric tonnes. The principal product is ordinary Portland cement of "Karrouba" brand, which is made by the wet process. The number of operatives is about 250 including staff.

Fig. 4.—Limestone and Marl Quarry for Bizerta Works.

The Bizerta Works.

The works at Baie de Sebra, Bizerta, is much smaller than the works near Tunis, since there is only one rotary kiln which operates on the dry process. The works, the annual productive capacity of which is about 180,000 metric tonnes, is owned by the Societé des Ciments Portland de Bizerte, and the principal product is ordinary Portland cement sold under the trade-name "Zitouna." A special cement for marine works and construction in sulphate-contaminated soils is also made in large quantities. The products in general comply with A.S.T.M.,

Fig. 5.—Discharging Raw Material at Bizerta Works.

Type I, or to B.S. 12 (1958), or C.P.A. 210/325 (French). Much of the product is exported, and to facilitate this, there is a wharf near the works where a " Liberty " ship of 10,000 tons (*Fig.* 10) is able to berth. There is, however, a reasonable inland trade, and much of the cement for the new Elfouladh steelworks being constructed at Menzil Bougiba, a few miles distant, is obtained from this works.

A characteristic of the ordinary Portland cement made at this works is the very dark colour, which is due to the comparatively high content of Fe_2O_3. It is stated that the dark colour is produced intentionally to suit the requirements of purchasers but, at the same time, this cement has an increased resistance to sea-water.

A general view and plan of the works and a flow diagram of the process is shown in *Figs.* 1, 2 and 3 respectively. The following description of the operations is based on information supplied by the Societé when the Editor of this journal visited the works recently.

RAW MATERIALS.—The raw materials are basically limestone and marl, the former having a carbonate content of about 80 per cent., and the latter about 30 per cent. The quarries are some three miles from the works but, in the near future, deposits some 1½ miles away are expected to be worked. The materials are excavated by two continuous-track mechanical shovels (*Fig.*4) which load into lorries of which there are five, each of which can hold 17 tons.

Upon reaching the works, the lorries are discharged (*Fig.* 5) by tipping into a large intake-hopper. The limestone is crushed in a primary crusher having

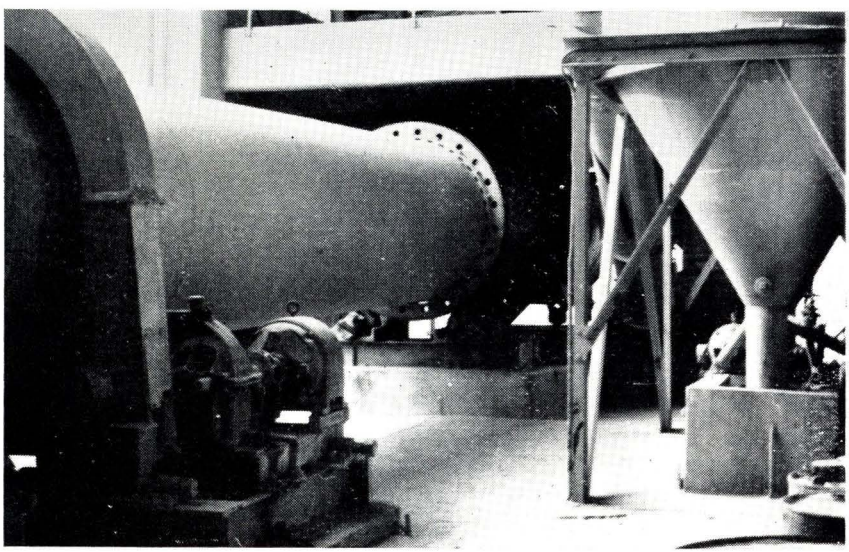

Fig. 6.—The Marl Drier at Bizerta Works.

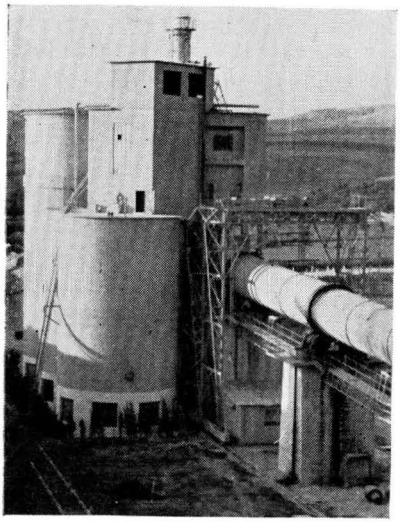

Fig. 7.—Silos.

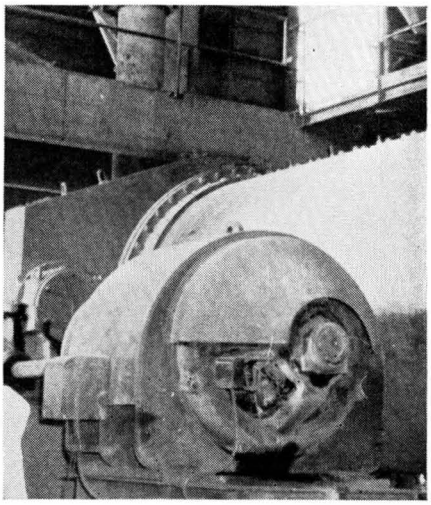

Fig. 8.—The Cement Mill.

a capacity of 150 tons per hour. The materials are transferred by an inclined conveyor to the main building where the marl is dried in a drier (*Fig.* 6) having a capacity of 30 tons per hour. The final crushing of the raw materials is carried out in two crushers each having a capacity of 24 tons per hour and driven by 400-h.p. motors.

The pulverised materials and an appropriate amount of Fe_2O_3, are then conveyed pneumatically direct to the blending silos (*Fig.* 7), which have a storage capacity of 3,000 tons, or to the materials store and thence pneumatically to the blending silos as required.

The mixed raw meal is then granulated and fed into the kiln.

THE KILN.—The rotary kiln (*Fig.* 9) is 122 m. (400 ft.) long and 3·40 m. (11 ft. 2 in.) in diameter. It has a daily productive capacity of 550 metric tonnes. It is fired through two oil-burners with Bunker 2 fuel-oil, having a viscosity of 20 deg. Engler at 50 deg. C. The oil is delivered at the wharf by tanker and stored in a tank outside the works, whence it is passed by pipe-line to the kiln-head. The burning zone of the kiln is 18 m. (60 ft.) in length and the calcining zone is 40 m. (132 ft.) long. The kiln is in the open air, except for the burner hood, which projects into the main building. A removable cover, as seen in *Fig.* 9 is provided over the burning zone.

The refractory lining in the burning zone is of bricks having a A_2lO_3 content of 80 per cent., those in the calcining zone 80 per cent., and in the remainder of the kiln 35 per cent. The refractories at present in use are " Smaprec " brand obtained from Casablanca, Morocco. The linings have to be renewed fairly frequently, especially in the burning zone; the public electricity supply fluctuates

and upon occasions it is cut off entirely for some hours, the consequent cooling and subsequent re-heating being very damaging to the linings. Currently a new high-tension power-line is being installed in this part of Tunisia and this is expected to have the result of regularising the supply.

COOLING AND GRINDING.—The clinker cooler is a Fuller plant and has a capacity of 600 tons per twenty-four hours. The cooling air is supplied by two compressors operated by heavy-oil engines.

The cooled clinker is transferred to the main materials store. The grinding plant comprises two rotary mills (*Fig.* 8) each having a capacity of 17 tons per hour and each being driven by a 500-h.p. motor. The cement is now transferred pneumatically to one of four 1000-ton storage silos at the packing and despatch plant.

STORAGE AND DESPATCH.—Cement intended for export is transferred by a long pneumatic conveyor to the wharf (*Fig.* 10). In addition to the cement exported

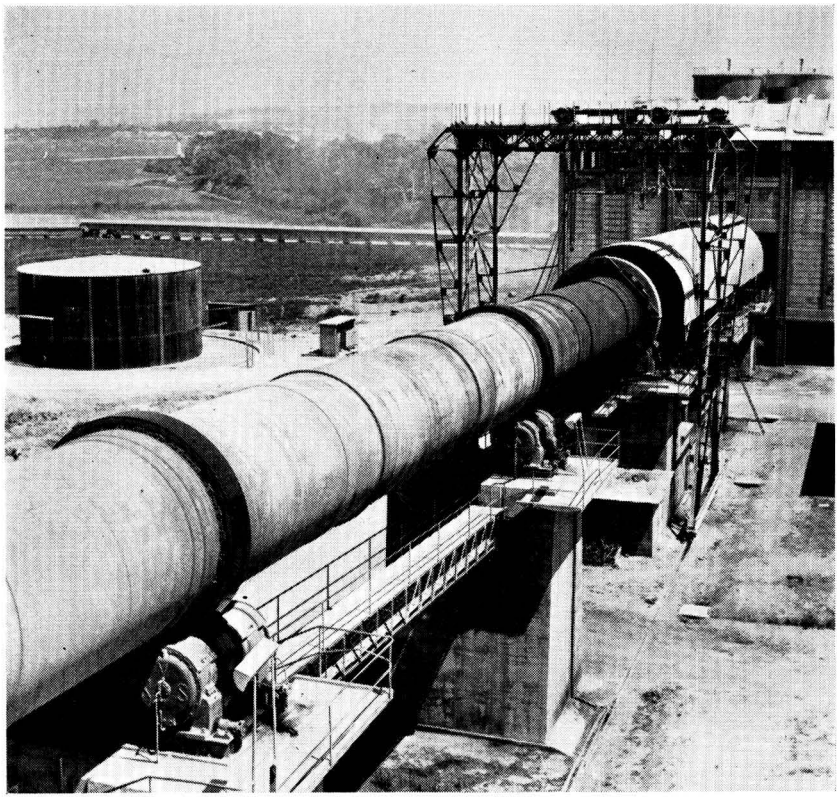

Fig. 9.—Cement Works at Bizerta: The Kiln.

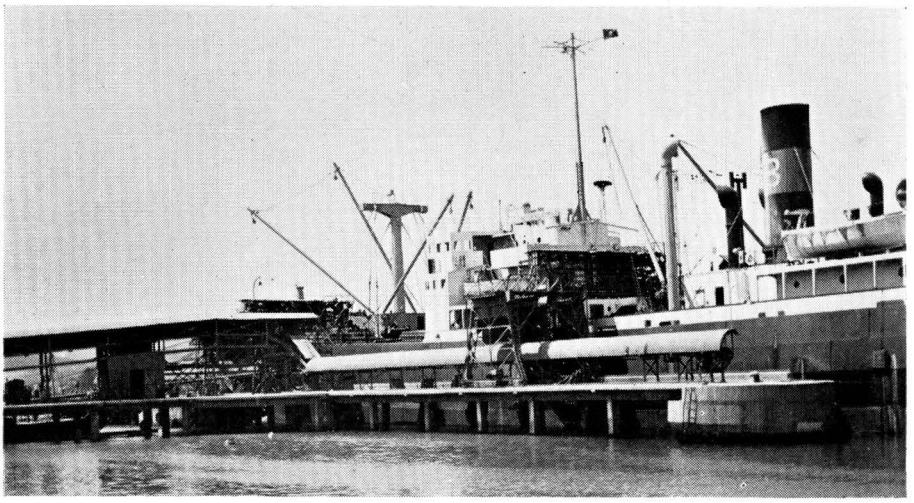

Fig. 10.—Cement Works at Bizerta: The Wharf.

by ship, there are facilities for bagging or despatch in bulk by railway or road. The bagging equipment comprises two Bates machines each of which has a capacity of 60 tons per hour.

There is a well equipped physical and chemical laboratory, which is seen at the lower right-hand corner of *Fig.* 1. Although a strength of 325 kg. per sq. cm. is mainly required the actual crushing strengths of cement specimens obtained exceed 400 kg. per sq. cm. and in many cases 500 kg. per sq. cm.

Most of the structures are of reinforced concrete construction including the raw material conveyor gantry.

The works, which employs about 320 persons, was established in 1953, the complete equipment being designed and supplied by Kennedy Van-Saun Inc. (U.S.A.). During the political troubles between Tunisia and France in 1961, the works, suffered from bombing during air-raids. Despite the extent of the damage, the works was reconstructed and was operating again within a few months.

High-temperature Studies on Blastfurnace Slags.–II.*

By J. E. KRÜGER, K. H. L. SEHLKE and J. H. P. VAN AARDT.**

Discussion of the Results (*Continued*).

The occurrence of the phases melilite, merwinite and monticellite, formed at various temperatures during devitrification and detected by X-ray diffraction, is illustrated graphically in *Fig.* 4 and 5 for slags Nos. 1 and 6 respectively. *Fig.* 5 clearly illustrates the disappearance of the primary phase, merwinite, during devitrification. The X-ray diffraction patterns of the same two slags at the various stages during devitrification are presented in *Figs.* 6 and 7.

It is known that all the slags investigated contain some sulphide. It is also known that the sulphide in the slags starts to oxidise in the vicinity of 1,000 deg. C. in an air atmosphere but it is not known to what extent the oxidation influences the appearance of the *dta*-thermograms.

MELTING OF THE DEVITRIFIED SLAG.—On completion of devitrification, it appears that the devitrified slag remains as melilite until melting begins. The *dta*-thermogram of melting of slag No. 6 exhibits more than one peak, as in the case of devitrification. The same is true for the *dta*-thermogram during cooling, which phenomenon, that is being investigated further, can be explained on the basis of the formation of primary and subsequent phases during crystallisation.

CRYSTALLISATION OF THE MOLTEN SLAG.—The quench data in *Table* III show that for the slags with the high magnesium-oxide content (*Table* I), the magnesium-bearing minerals spinel and monticellite appear as primary phases[6], with the exception that, for slag No. 3, melilite is the primary phase. It can be seen from *Table* II that the phases produced by complete devitrification at about 1,100 deg. C., and the crystallisation products of the molten slag cooled slowly to ambient temperature are in good agreement, as is shown in *Fig.* 8. It is observed from the quench data in *Table* III and the phases appearing in the slags cooled slowly,

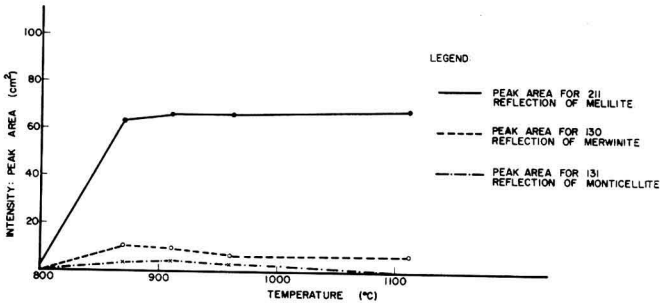

Fig. 4.—Change of Intensity of Main Diffraction Peak of Devitrification Phases of Slag No. 1.

*Continued from the number for July 1964.

**The authors are in the Materials Division, National Building Research Institute, Council for Scientific and Industrial Research, Pretoria, South Africa.

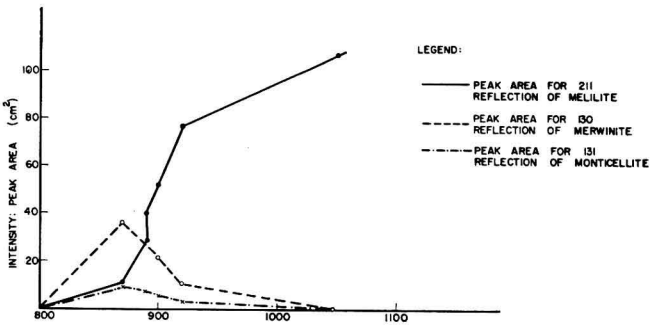

Fig. 5.—Change of Intensity of Main Diffraction Peak of Devitrification Phases of Slag No. 6.

that the primary phases do not disappear during the process of slow cooling. On the other hand merwinite, which appears as the primary phase of devitrification for all the slags except Nos. 4 and 5, disappears as the slags are heated to higher temperatures.

THE HYDRAULIC POTENTIAL OF THE SLAGS.—An examination of the results of compressive-strength tests on mortars containing equal proportions of slag and Portland cement as cementitious material and the appearance of the *dta*-thermograms indicate that there is no relationship between the form of the thermograms

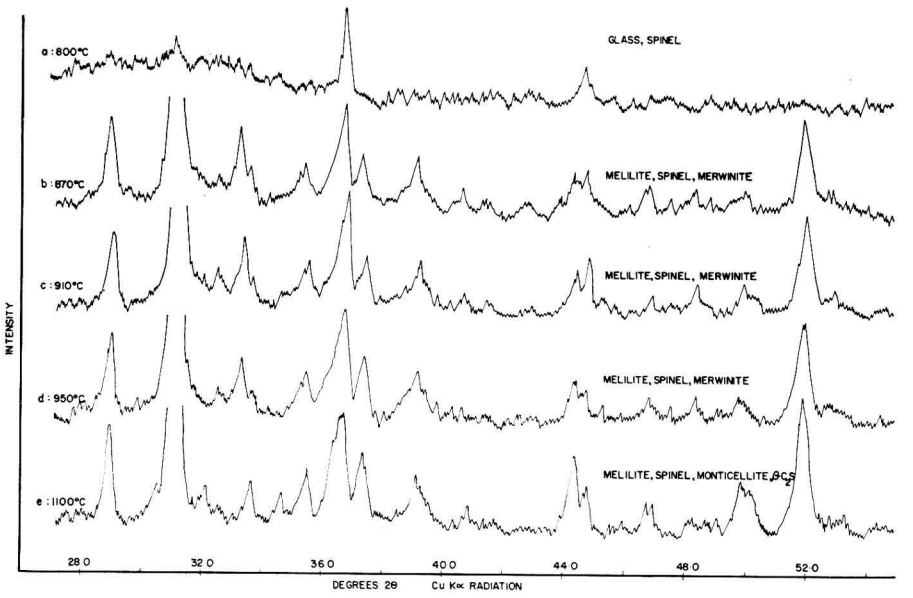

Fig. 6.—X-ray Powder Diffraction Patterns of Slag No. 1.

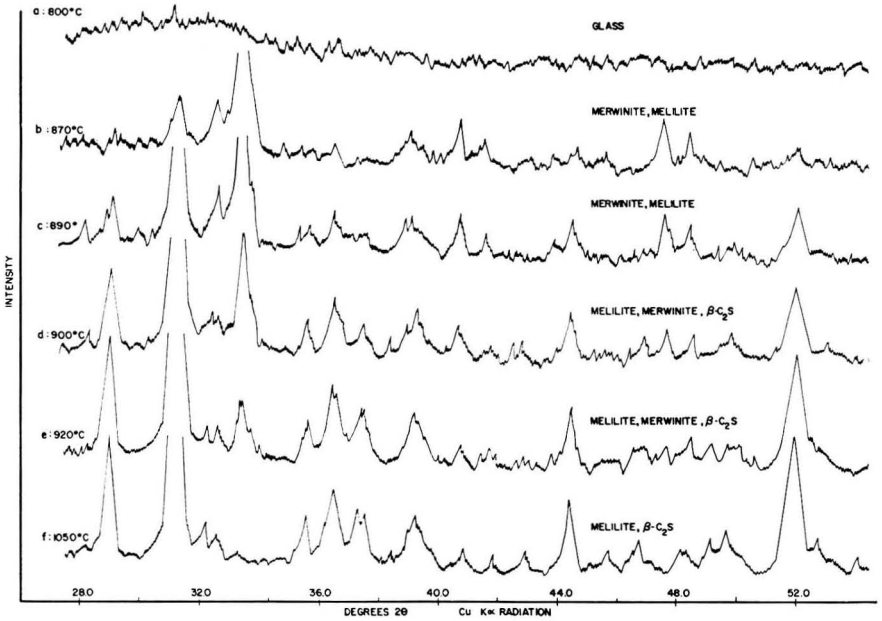

Fig. 7.—X-ray Powder Diffraction Patterns of Slag No. 6.

of glassy slags and their hydraulic properties; this is in agreement with the findings of Schrämli[5]. The compressive strengths indicate that slag No. 4 had no hydraulic properties and that slags Nos. 5 and 10 exhibit somewhat poorer hydraulic properties than the remainder, as reflected by their compressive strengths up to twenty-eight days. It is seen from *Table* II that slags Nos. 5 and 10 are the only slags giving mono-calcium silicate, pseudo-wollastonite, as a devitrification phase on complete devitrification, indicating a low lime potential for these particular slags. This result is in agreement with the generally accepted opinion that the lime potential of, or the ratio of, CaO to SiO_2 in a slag is a fair measure of its hydraulic properties; in the case of the high-magnesia slags, the MgO-content should be taken into consideration since it serves as a substitute for CaO.

It may be possible to get an idea of the hydraulic properties of a slag from a study of the phases formed during and/or after devitrification.

Lastly it may be mentioned that when the slags are subjected to hydration for prolonged periods, they still exhibit devitrification peaks during differential thermal analysis; although the appearance of the peaks may change slightly, the magnitudes are similar.

Summary.

For the slags examined, the appearance of the *dta*-thermograms differed from slag to slag even if the chemical compositions of the slags were similar.

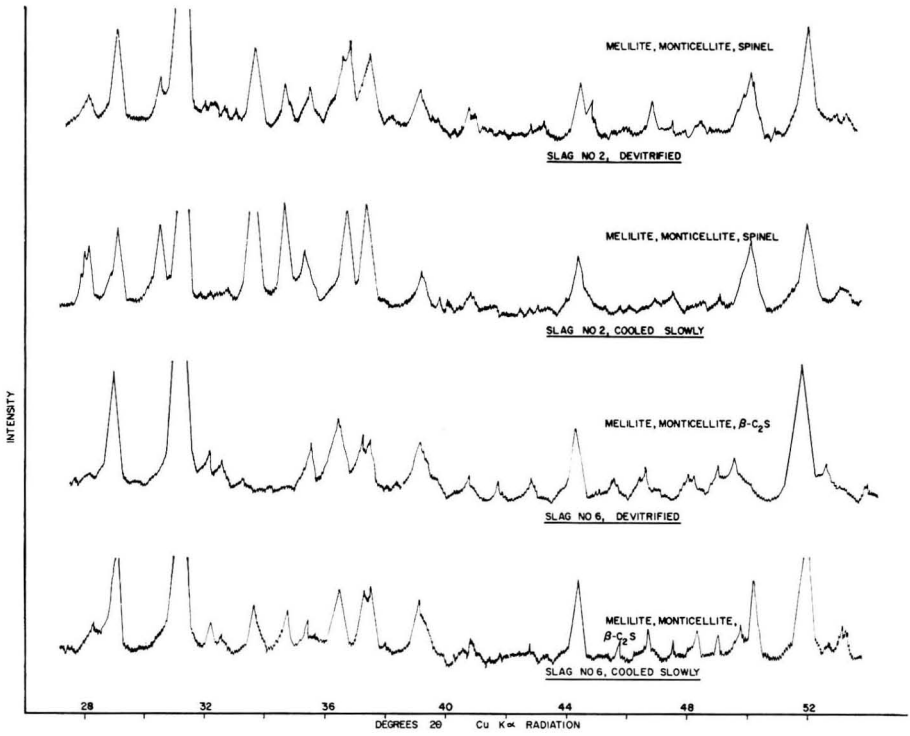

Fig. 8.—X-ray Powder Diffraction Pattern of Slags Nos. 2 and 6 after complete Devitrification.

When samples of the slags were heated to temperatures corresponding to different points on the *dta*-thermograms and subjected to X-ray diffraction analysis, it was found that, analogous with the process of slow cooling of slag, different crystalline phases formed during devitrification; in the process, some of the phases formed during the early stages of devitrification may disappear with the formation of new phases. The form of the *dta*-thermograms can be explained on this basis.

There is marked agreement between the phases of a slag formed after complete devitrification and the phases which emerged after slow cooling of the molten slag to ambient temperatures.

It appears that the slags which have poor hydraulic properties would, on complete devitrification, give phases of low calcium content such as pseudo-wollastonite and diopside, indicating a low calcium potential for these slags.

Devitrification *dta*-peaks persist even after the slags have been subjected to hydration for prolonged periods.

The authors wish to thank Mr. R. E. Cromarty for carrying out the chemical analysis on the slags discussed in this paper.

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Revised and New British Standards

MANY of the British Standards relating to special cements are being reviewed and some new Standards are being considered. Some particulars of this work are given in the Annual Report for 1963 of The Reinforced Concrete Association, from which the following information is abstracted.

Among Standards, the drafting for which is in hand and which are not referred to below, are supersulphated cement, high-alumina cement (revision of B.S. 915), masonry cement, and sulphate-resisting Portland cement. Consideration has been given to the need for a third class of cement within B.S. 12, but a majority of the committee concerned agreed that there was no justification for this.

Co-operative tests on low-heat slag cement carried out by five laboratories to investigate the suitability of concrete cube strength tests for slag cement have been completed.

A new panel has been formed to draft a standard for ground granulated blastfurnace slag powder for blending with Portland cement at the concrete mixer, the resulting material having the characteristics of Portland-blastfurnace cement.

Experiments to standardise the chemical analysis of sulphate-resisting cement continue.

The Chemistry of Cements.

THE first of two volumes of a book entitled the " Chemistry of Cements "* was published recently and deals comprehensively with most aspects of the subject, each being dealt with by a specialist. As the Editor points out in his preface, cement chemistry is largely the chemistry of the calcium silicates and aluminates, both anhydrous and hydrated, and the book deals with these and related compounds and with the more important chemical aspects of the manufacture and use of cements. The principal cements used in building are considered, including Portland, high-alumina, slag and expansive cements, and also pozzolanas and calcium-silicate products. Crystallographic and other data for the principal compounds are given in an appendix. The object has been not so much to produce a technical handbook as to set out the basic chemistry and to show how this can be applied. The more technical aspects of cement chemistry are treated in other books but, the Editor claims, there is no recent and full summary of the basic chemistry of existing materials and processes. The more specialised experimental methods, such as high-temperature phase equilibria, electron microscopy and X-ray diffraction, are described. Since cement chemistry is a subject in which intensive research is taking place, and in which it is inevitable that differences of opinion or approach exist between different authors, cross references are given to draw the reader's attention to conflicting views and to provide a guide to those concerned with development.

The first volume comprises three parts. Following a general introduction to the subject, the first part deals with anhydrous cement compounds and the production of Portland cement. In this part, the subject of raw materials and the processes of manufacture is dealt with by H. W. W. Pollitt of the Research Department of The Associated Portland Cement Manufacturers Ltd. As this author points out, the history of the development of Portland cement and the materials and processes used in its manufacture were comprehensively described by Bogue and by Lea as recently as 1955 and 1956 respectively, and in many respects there has since been little advance; there is, therefore, occasional but understandable repetition of these authorities. In dealing with the burning process, this author briefly describes the ordinary wet process, the Humboldt dry process, the Lepol semi-dry process, and the Davis semi-wet process, and the preheaters associated therewith. An interesting form of dry process, the Pyzel, which is being developed in the U.S.A., is also described.

Phase equilibria and high-temperature chemistry in the CaO-Al_2O_3-SiO_2 and related systems is dealt with by J. H. Welch of the Building Research Station. The treatment is limited to systems at high temperatures and atmospheric pressure, no attempt being made to discuss hydrothermal or high-pressure conditions. Of the binary systems, it is stated that successive studies of the CaO-Al_2O_3 system have resulted in the original phase diagram being much modified, but there is probably still no definite version. The author's version is illustrated and is based

* "The Chemistry of Cements". Volume 1. Edited by H. F. W. Taylor. London: Academic Press. 1964. Price 100s.

partly on new data reported in this section. Consideration of the ternary and quaternary systems and the associated compounds follows. In a single chapter it is possible to give only a brief résumé of phase equilibrium and other high-temperature studies, and the author contends rightly that for a more detailed appreciation of the great volume of work undertaken in this field, the numerous references cited should be consulted. The author surveys some of the progress that has been made and indicates some of the problems awaiting solution, for which existing knowledge is still either inadequate or controversial.

The formation and phase composition of Portland cement clinker is considered by H. G. Midgley, also of the Building Research Station. In his introduction the author, in mentioning the basic constituents of clinker, states that the presence of glass, in amounts ranging up to 20 per cent. or more, has been postulated, but recent work casts doubt on this conclusion. It is also now well established that none of the major phases has an exact composition; all are modified by solid solution, both by the major oxides and by minor components. After a detailed consideration of all aspects of this particular subject, in which the author himself has contributed much original work, he summarises the position as follows. The established method of compound determination is the Bogue calculation, but this method has been shown to be in error owing to the very variable ferrite composition. If the composition of the ferrite can be determined separately, however, a modified Bogue calculation can be of use. If independent estimates of the compounds are required, the silicate phases can be determined by point counting with a microscope, but the aluminate phases cannot be determined accurately by this method. X-Ray diffractometry can be used for all four phases; it is most accurate for the aluminate phases and less accurate for the silicate phases. Infrared absorption can be used, but does not yet appear to give accurate results.

J. W. Jeffery of Birkbeck College deals with the crystal structures of the anhydrous compounds, but first gives consideration to polymorphism and isomorphism. The crystal structures considered are the silicates and aluminates and related compounds and structures, and the oxides.

In Part II, the chemistry of hydrated cement compounds is considered, commencing with the calcium-silicate hydrates which are dealt with by the Editor, H. F. W. Taylor of the University of Aberdeen. This is essentially a long chapter since it deals successively with methods of investigation, compounds structurally related to wollastonite, the tobermorite group (including crystalline and ill-crystallised tobermorites), the gyrolite group, compounds structurally related to β-C_2S, other calcium-silicate hydrates, and calcium silicates containing fluoride or carbonate ions. The conditions of formation and stability, and thermal behavior and topotactic reactions are dealt with and the chapter concludes with a short note on optical and crystallographic data.

The calcium-aluminate hydrates and related compounds are next dealt with, the author being R. Turriziani of the University of Cagliari, Italy. One of the points made by this author is the equilibria in the CaO-Al_2O_3-H_2O and CaO-Fe_2O_3-H_2O systems, and in the related quaternary systems which also contain

SO_4^{2-}, Cl^-, CO_3^{2-} or SiO_4^{4-}, must be taken into account in the hydration reactions and they are particularly important in connection with the chemical resistance of cements to natural waters. Early interest centred mainly on the synthesis of calcium-aluminate and ferrite hydrates containing other anions. Research on equilibria remained practically in abeyance until about 1940, since when it has progressed steadily, particularly for the systems containing Al_2O_3. A reasonably accurate account of the present state of the subject, based on the more recent and quantitative studies, is given.

Next follows a consideration of the hydration of tricalcium silicate and β-dicalcium silicate from 5 to 50 deg. C. The authors are S. Brunauer and D. L. Kantro of the Portland Cement Association, U.S.A., and they explain that the two calcium silicates constitute about 75 per cent. (by weight) of a Portland cement, and in their hydration reactions both produce similar calcium-silicate hydrates. The latter, because of its similarity to tobermorite and its gel-like properties, is called tobermorite gel, which is the main cementing material in hardened pastes. Thus tobermorite gel plays a vital role in determining the rheological properties of fresh Portland cement paste, which properties in turn determine the consistence and workability of fresh concrete. It also plays a dominant role in the setting and hardening of Portland cement paste and in determining the strength and dimensional stability of hardened paste and concrete. Thus, tobermorite gel is the most important constituent of concrete. With this background, the stoichiometry of the hydration reactions are considered and are followed by consideration of the heat of hydration and other aspects of the energetics of the hydration process.

Part III of the first volume deals with a number of aspects of Portland cement including the chemistry of hydration at ordinary temperatures, by L. E. Copeland and D. L. Kantro of the Portland Cement Association, U.S.A., electron microscopy of Portland cement pastes, by A. Grudemo of the Swedish Cement & Concrete Research Institute, and the physical structure of Portland cement paste, by T. C. Powers, also of the Portland Cement Association, U.S.A. The first volume concludes with a chapter on the steam curing of Portland cement concrete products, by H. F. W. Taylor; low-pressure and high-pressure steam curing are considered.

The second volume, which deals with non-Portland cements and experimental methods, has now been published and will be reviewed in a later number of this journal.

Cement Production in the United Kingdom in 1963.

The monthly average production of cement in the United Kingdom in 1963 was, according to statistics issued recently by the Ministry of Public Building and Works, 1,153,000 tons and the average monthly deliveries were 1,134,000 tons. In the first eleven months of 1963, imports of cement totalled 100,000 tons, which is the same amount as in 1962. Exports in the same period totalled 241,000 tons compared with 285,000 tons in the comparable period of 1962.

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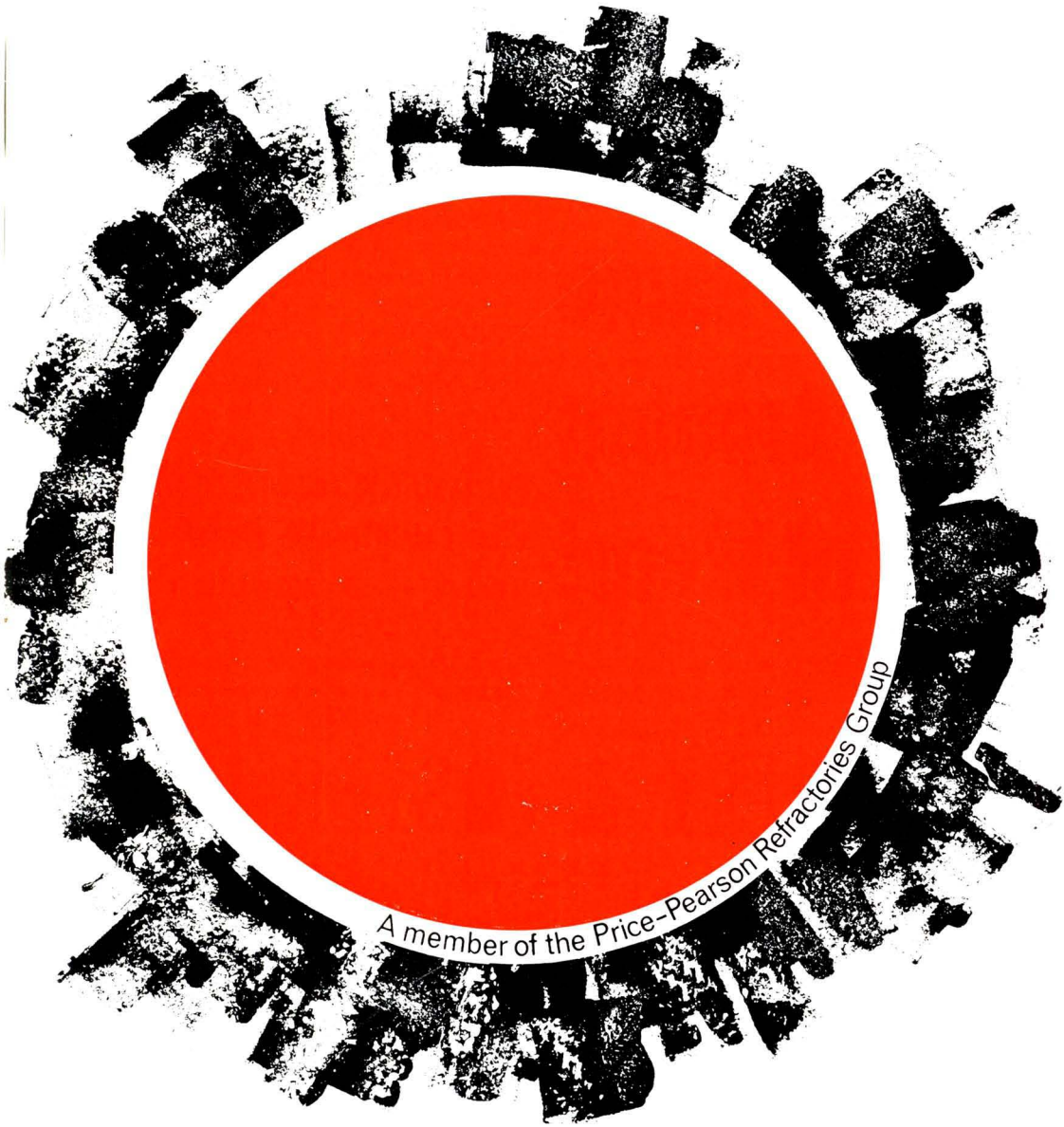


A Polymer Cement.

FOR several years The Associated Portland Cement Manufacturers Ltd., has supported investigations into cements having an organic resin content. A new material called " Estercrete " was invented in January 1962, and since then it has been subjected to intense research and development and has now reached a stage at which a statement can be made of the present position.

" Estercrete " is the first convertible polymer cement, and is based on a polyester resin in conjunction with a specially prepared Portland cement. It is a viscous liquid which, when mixed with water, sets by a process which combines the chemistries of both constituents. The material has been investigated first for those uses for which Portland cement presents technical difficulties. On account of its strength, resistance to chemical attack and quite exceptional adhesion, it is economical for these uses. A development programme is to be carried out during the next two years by the Cement Marketing Company Ltd., in industrial flooring, patching of road and airfield slabs and mortars for special purposes.

Electronic Model For Planning The Russian Cement Industry.

SOVIET economists are using mathematical methods to determine the best distribution of the cement industry in the U.S.S.R. by 1970. This was stated at a United Nations international seminar in Moscow dealing with questions of planning for certain countries in Asia, Africa and Latin America. In solving this complex problem, the requirements of cement in 136 areas have been taken into consideration. The several variants studied showed that sixty-six cement works could satisfy these requirements, although it had previously been planned to establish twice this number.

An electronic model, with all economic processes and phenomena expressed as mathematical formulæ, is now being prepared, for the first time, of the requirements of a big economic area, which includes the three Baltic republics. The scope and difficulty of the experiment is such that the instructions for preparing the model fill 600 pages.

Book Review.

"A History of Cementing Materials from Antiquity to the Middle of the Nineteenth Century." By I. L. Znatchko-Javorsky. (Moscow: The Publishing House of the Academy of Science of the U.S.S.R., 1963. Price 2*r.* 60*c.*)

THIS monograph (in Russian) is a comprehensive study of the history of development of the chemistry and technology of building and constructional cementing materials in the territory of U.S.S.R., and other countries, from the earliest times to the time of the invention of Portland cement. The research on which the work is based involved not only a study of written historical sources, but also the experimental investigation of material sources and historical and etymological analysis of terminology. The study of new sources of research and the application of new methods enabled the author to produce a more complete picture of the history of cementing materials and to show the close connection existing between their past and present states. The contents include an introduction to the subject followed by separate histories of gypsum and calcareous cementing materials.

Cement-Carrying Ships.

A BULK cement-carrying ship for the Golden Bay Cement Co., Ltd., of Wellington, New Zealand, one of the Blue Circle Group of Companies, was named m.v. " Ligar Bay " in June last. The vessel will be used to carry cement from the Tarakohe cement works in the South Island to distribution depots in the South and North Islands. The " Ligar Bay," which is being built by Henry Robb Ltd., at Leith, at a cost exceeding £350,000, will have a carrying capacity of 1,200 tons of cement. She will be a sister ship of the m.v. " Golden Bay," which was also built by the same shipbuilders and went into service in 1955; since that time she has carried more than 1,000,000 tons of cement. It is expected that " Ligar Bay " will be leaving for New Zealand before the end of the year.

Italian Vessels.

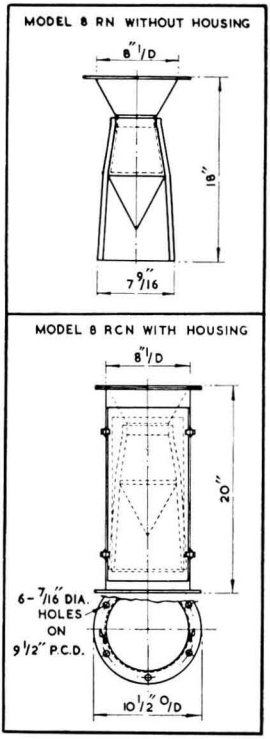
The motor vessel *Mar Grande* is the first ship to be specially designed and built in Italy for the transportation of cement, and will be brought into service during the current year. A sister ship, *Mar Piccolo* the keel of which was laid at the Ansaldo shipyards on the day the *Mar Grande* was launched, is expected to be completed towards the end of next year (1965). Both vessels, each of which will carry 5,600 tons gross, have three holds with longitudinal bulkheads to prevent the cargo from shifting. The instruments and controls for loading and unloading the cement are grouped together so that only one operator will be required. The vessels will be equipped with radio-telegraphy, radio-telephone, radio-compass, radar, and automatic internal telephones.

The vessels are intended for the distribution of the cement produced at the Taranto works, which is now being built at the same time as a steel mill belonging to the same industrial group. It is considered that the cement works will be one of the most modern in Europe. It is to be built in two stages, production being due to start early in 1965, when it will have an initial potential annual productive capacity of 600,000 tons; this will eventually rise to 1,000,000 tons.

The cement will be conveyed to the wharf by means of a moving belt about 2,800 ft. long, and will then be passed through flexible pipes to the holds of the vessel, the flow being automatically controlled to avoid uneven distribution. Special junction pieces in the pipe-line will ensure that the piping will not be damaged by the movement of the vessel while lying alongside the wharf. The equipment aboard the ship and on the wharf will permit about 500 tons of cement to be loaded or unloaded every hour. About 60 per cent. of the cement from the Taranto works will be shipped to large storage silos now being constructed at Porto Marghera, near Venice, and to others at Crotone, at both of which places there will be distributing depots.

A New Russian Cement.

A NEW type of cement has been produced at Azerbaijan cement and gypsum works in the U.S.S.R. It can withstand temperatures up to 300 deg. C. and pressures up to 700 atmospheres, which properties make it very suitable in drilling deep wells. The new cement is made from nepheline slime, a waste product of the aluminium industry, and silicon dioxide.



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The Cement Industry Abroad.

Europe.

Spain.—The Associated Portland Cement Manufacturers Ltd., announce that agreement in principle has been reached with Compania General de Asfaltos y Portland Asland of Barcelona, the largest manufacturers of cement in Spain, to proceed with a joint project for the establishment of a new cement works at Cordoba, in Southern Spain, and for the modernisation of the existing Asland works in Cordoba. The new works will have an annual productive capacity of 450,000 tons. Both the new and the existing works will be owned by a new Spanish company in which the A.P.C.M. and Asland will each have a 40 per cent. interest, the balance being held by the Banco del Desarrollo Economico Espanol of Madrid. The total cost of the proposed works is estimated to be about £4,000,000. The works are expected to be in production by the middle of 1966.

Sweden.—The total consumption of cement in Sweden increased by nearly 7 per cent. to 3,180,000 tons in 1963. Deliveries of cement in bulk showed a continued relative increase, deliveries rising from 68 per cent. in 1962 to 72 per cent. in 1963. Exports of cement were up from 101,000 to 115,000 tons.

Poland.—During 1964, two of the three cement works under construction will be commissioned, each of them having an annual productive capacity of over 1,000,000 tons. By the end of 1963, the Warta cement works in Dzialoszyn had begun its trial run; two kilns are already working and the entire works, including two more kilns, is expected to be operating fully this summer. During this year also, a cement works in Rudniki, near Czestochowa, will begin its trial run; upon reaching full capacity, this works will have an annual output of about 1,300,000 tons, and will be one of the largest and most modern cement works in Poland. Here, for the first time in Poland, the dry-process will be used, resulting in estimated annual savings of up to 100,000 tons of coal.

Production of cement in Poland in 1964, is expected to amount to 8,350,000 tons, which is 14.4 per cent. more than in 1963.

Africa

Nigeria.—A contract valued at over £500,000 has been awarded to the Northern Construction Co., Ltd. (a member of the Taylor Woodrow Group), by the Cement Company of Northern Nigeria Ltd., for the construction of a cement works at Sokoto, Northern Nigeria. The contract includes levelling and grading the site, the construction of reinforced concrete foundations and sub-structures, silos, pits, and ancillary buildings for the plant which is to be able to produce 100,000 tons annually. Provision is being made for a further kiln which will double the capacity. The site is above a sub-stratum of limestone overlying some 24 ft. of overburden. The work is expected to be completed early in 1965. The joint consultants for the work are Hochtief A.G. and Salzgitter Industriebau GmbH (both of Germany).

Ethiopia.—The foundation stone of a new cement works being built near Massawa was recently laid by H.I.M. Haile Selassie. The construction is expected to take two years and is being carried out by Krupp of Germany. The annual output is estimated to be about 70,000 tons.

Mombasa.—It has been announced that The Associated Portland Cement Manufacturers Ltd., have acquired a 45 per cent. interest in the British Standard Portland Cement Co., of Bamburi, Mombasa. An equal proportion is held by Cementia Ltd., of Switzerland. The Company operates a works of 400,000-tons annual capacity at Bamburi, and has a controlling interest in a 130,000-ton works now being built near Dar-es-Salaam, Tanganyika. The Company also has bulk depots at Dar-es-Salaam, Mauritius and Reunion, and is well placed for trading in the Persian Gulf and Red Sea areas

Near East.

Yemen.—It is reported that it is proposed to establish in Yemen a cement works having an annual production capacity of 60,000 to 80,000 tons of clinker. Geologists from the U.S.S.R. have recently investigated two areas rich in deposits of limestone. One is to the north of Sana and the other is near Badjil.

Israel.—The Rassco Co., is reported to be planning to invest about £700,000 in the Shimshon cement works at Beit Shemesh, near Jerusalem. The additional capital will be used to improve production both as regards quality and cost.

America.

Jamaica.—The expansion of the Rockfort works of the Caribbean Cement Co., Ltd., is practically complete and, it is reported, production has just commenced. The expansion, which is estimated to cost £3,000,000, includes among other items, a rock storage building, a new kiln, raw and finishing mills, cement storage silos and bulk-loading facilities.

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