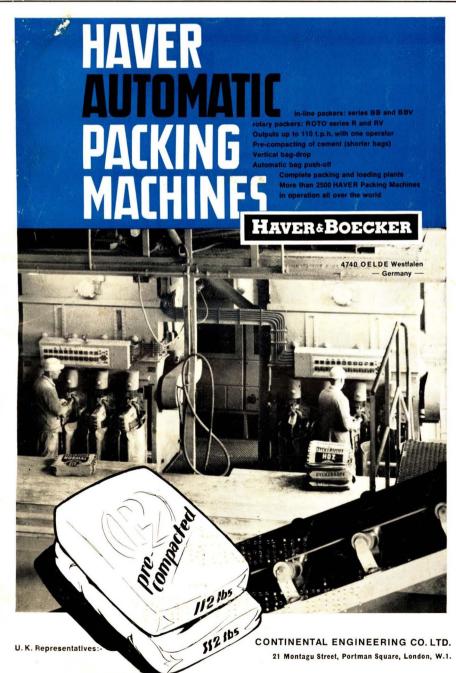
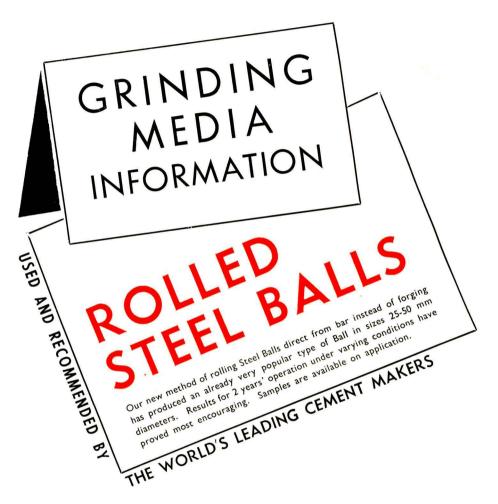
C E M E N T & LIME MANUFACTURE

VOL. XLII. No. 3

MAY, 1969

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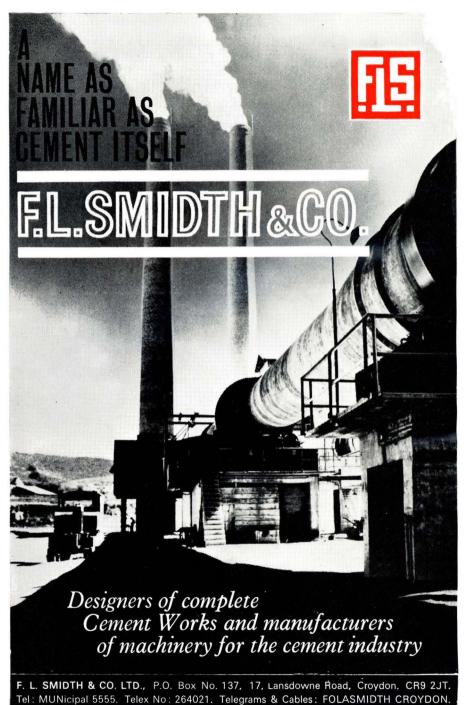
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PAGE vii



PAGE viii



CEMENT AND LIME MANUFACTURE

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VOLUME XLII NUMBER 3

MAY, 1969

Determining the Proportions of Slag and Cement or Lime in a Mixture of these Materials

By DR. F. S. FULTON Director, Portland Cement Institute, South Africa

IN SOUTH AFRICA, it is common practice on many construction sites to use blends of Portland cement and milled granulated blastfurnace slag for the manufacture of concrete. The hydraulic properties of the milled slag are relatively weak but, in a mixture of Portland cement and slag, the calcium hydroxide formed by the hydration of the cement appears to activate the slag. Provided the blending is adequate, the mixture on site of ordinary Portland cement and milled blastfurnace slag in equal proportions by weight produces a material having properties similar to those of Portland blastfurnace cement.

The blending is usually carried out on the site simultaneously with, and as part of, the concrete mixing operation. In practice one 94 lb. (43 kg.) sack of milled slag is substituted at the mixer for one 94 lb. (43 kg.) sack of Portland cement and no extension of the normal mixing time is necessary. On large works, the slag and the cement are generally supplied in bulk, and these materials are blended prior to feeding to the batching plant.

As a control measure, and more particularly as a check on the efficiency of the blending plant, it is necessary to be able to determine accurately the proportions of cement and milled slag in the mixture. A number of methods have been developed, involving X-ray diffraction,⁽³⁾ D.T.A.,⁽⁴⁾ or sulphide determinations.⁽⁵⁾ The disadvantages of these methods are the expensive apparatus required, the need for skilled interpretation of the results, and a rather low degree of accuracy.

The principle involved in the method proposed in this article is that, if curing water is continuously available to a fresh cement paste, water is continuously absorbed by the hydrating cement. The amount of water is a direct measure of

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the reduction in volume of the paste system, and approximates to a linear function of the amount of "combined" or non-evaporable water contained therein. According to Powers and Brownyard,⁽¹⁾ $W_a = kW_n$, where W_a is the weight of water absorbed to a given hydration stage, W_n is the weight of "combined" or nonevaporable water at this stage of hydration, and k is a constant depending on the particular cement contained in the paste.

The author ⁽²⁾ has shown that this expression should more accurately be written $W_a = A + BW_n$, where A and B are constants for the particular cement.

In a blend of milled slag and Portland cement, the amount of "combined" water at any stage of hydration depends on the characteristics of both the slag and the cement and their proportions in the mix. Consequently, if the absorption rates of blends of milled slag and Portland cement made up in known proportions are established by test, then the amount of water absorbed in the same period by a blend of unknown proportions can be used to establish the quantities of slag and cement in it.

The method has been developed specifically for use with slag mixtures, but it is considered probable that it can be applied to blends of cement and other materials having pozzolanic properties. The main disadvantage is that in order to perform the test, samples of the Portland cement and slag used in the mixture must be available. This is of little consequence on a large project where continuous sampling from bulk silos presents no difficulty.

Apparatus

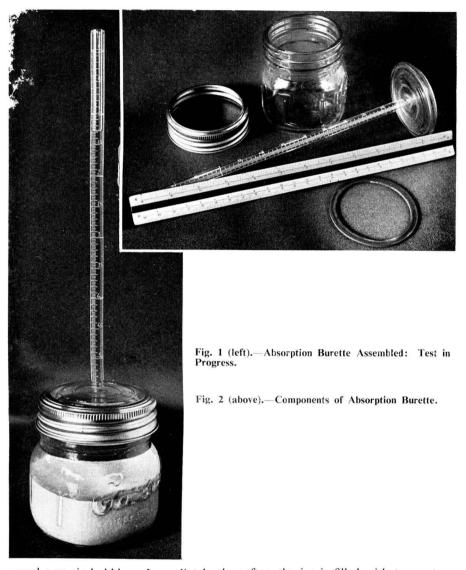
The only essential piece of apparatus, except for a balance, is the absorption burette shown on *Figs.* 1 and 2. The flask consists of a 500-c.c. Consol preserve jar provided with the usual glass cover plate, metal cap and rubber ring. The metal cap is drilled to receive a burette, the joint being made watertight with epoxy resin. The advantage of this type of apparatus is that the mass-produced Consol jars are so inexpensive that they can be discarded after use, while the cover plate and burette can be re-used any number of times.

It is convenient to use large samples of paste, say, up to about 400 c.c. Even with burettes graduated only to 0.1 ml., the amount of water absorbed can be accurately read to 0.1 mgm. per g. of cementitious material.

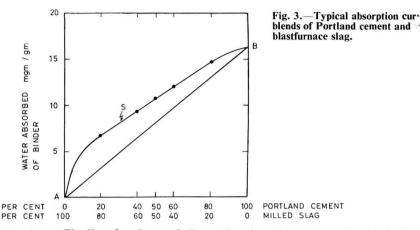
For the purposes of this test, a 6-ml. burette, graduated to 0.025 ml. is most suitable. For tests extending over periods exceeding twenty-four hours, a 20-ml. burette is preferable. It is important that the burette be thoroughly cleaned out, using a wad of cotton wool, after each test. If this is not done difficulties may be experienced in reading the meniscus.

Procedure

A quantity of 400 g. of binder is mixed with 160 g. of distilled water. Mixing is carried out by hand for a period of four minutes in a stainless-steel or enamel bowl. For accurate laboratory work, controlled humidity and temperature are desirable. The paste is then poured into the jar and consolidated by jolting to



expel any air bubbles. Immediately thereafter, the jar is filled with tap water, using a small hand syringe in such a way as to prevent disturbance of the surface of the paste. The operation is completed by placing the whole apparatus in a tank or sink filled with water, and fitting tightly the burette cover, metal cap and rubber ring to the jar under water in such a way as to exclude all air. On removal from the tank, the metal cap is finally tightened and the burette is filled to about the 0.5-ml. mark. Unfortunately, the tightening as at present carried out requires two



operators. Finally a few drops of oil are placed on the water surface in the burette to prevent evaporation, and the apparatus is placed in a storage cupboard. For accurate laboratory work, controlled temperature conditions during storage are necessary.

The first reading of the burette is taken exactly two hours after commencement of mixing, and this is regarded as the zero reading for the test. The final reading for each sample is taken exactly twenty-one hours after the addition of the mixing water. Other periods of storage could well be chosen, but the 21-hour period proved suitable at the Portland Cement Institute laboratories. Five samples were prepared in an afternoon in such a way that the zero reading for the last sample was taken just before the laboratories closed at 5 p.m. This meant that the test ran overnight, and the results were available first thing next morning.

Results

The 21-hour absorptions of various blends of milled slag and one cement are shown by the curve ASB in *Fig.* 3, which is typical of the results obtained. The absorptions are simply calculated by dividing the drop in the burette meniscus by the weight of combined slag and cement in the paste, the results being expressed in mg. per g. of cementitious material.

It may be noted that with slag:cement proportions between 40:60 and 60:40, the absorption curve is for all practical purposes a straight line. In order to determine the proportions of a blend, therefore, it is only necessary to make up blends of the available materials in 40:60 and 60:40 proportions, and to compare their 21-hour absorptions with that of the unknown mixture. The proportions of the latter can then be obtained by direct interpolation. For more accurate determinations an increased number of samples and a closer grouping are desirable.

Table 1 shows the results obtained for blends of five normal cements and milled slags from two sources. In addition, as a control measure, corresponding blends were made up of the cements blended with an inert material, for example, marble dust crushed to the fineness of cement. Although the water absorptions deter-

					Ac	tual P	roportio	ns			
υí	Cl	55	/45	52 <u>1</u>	/47 <u>1</u>	50	/50	47 <u>1</u>	/52 ¹ /2	45	/55
Cert	Slag	Wa	Det. %	Wa	Det. %	Wa	Det. %	Wa	Det. %	Wa	Det. %
03	1	11.08	44.57	10.60	48.05	10.30	49.98	9.97	52.62	9.67	54.78
	2	11.27	44.76	10.82	47.87	10.53	49.81	10.10	52.76	9.80	54.81
	Inert	11.32	44.98	10.82	47.71	10.42	49.89	10.00	52.17	9.43	55.25
	1	9.25	45.23	9.03	47.30	8.73	50.16	8.57	51.72	8.17	55.53
04	2	9.55	44.75	9.18	48.20	9.03	49.62	8.77	52.14	8.43	55.28
	Inert	9.32	44.84	8.95	47.71	8.68	49.78	8.27	52.99	8.05	54.70
	1	10.27	44.96	10.01	47.58	9.80	49.70	9.47	53.02	9.30	54.74
08	2	11.90	45.47	11.67	47.37	11.40	49.60	11.07	52.36	10.70	55.39
	Inert	10.56	45.05	10.30	47.33	9.92	50.65	9.82	51.52	9.37	55.45
	1	10.60	44.78	10.26	47.44	9.85	50.64	9.64	52.28	9.31	54.86
09	2	11.16	45.03	10.86	47.62	10.60	49.86	10.32	52.28	9.98	55.21
	Inert	11.24	44.93	10.82	47.43	10.35	50.24	9.97	52.51	9.57	54.89
	1	10.37	44.92	10.08	47.33	9.73	50.25	9.42	52.83	9.20	54.6
010	2	11.08	45.43	10.92	46.98	10.58	50.27	10.42	51.82	10.04	55.50
	Inert	11.05	44.80	10.63	47.80	*	*	9.99	52.37	9.62	55.02

I.E I-ACTUAL AND DETERMINED PROPORTIONS FOR BLENDS OF PORTLAND CEMENTS, MILLED SLAGS AND AN INERT MATERIAL

* Insufficient material

mined for the latter blends were corrected for the absorption of the marble dust with no additive, in practically all cases the results show values of W_a exceeding those obtained for the corresponding blends containing slag No. 1. This may point to some small reaction between the marble and the cement as postulated by a number of authorities.

Conclusions

(1) The test is extremely simple compared with present chemical or other methods.

(ii) The apparatus is simple and inexpensive, and the test can be confidently carried out by a practically unskilled laboratory technician.

(iii) The tests show that the error in the estimate of the proportions is usually less than 0.5 per cent.

(iv) The test is highly reproducible and obviates a number of undesirable variations inherent in other tests, namely, those due to the efficiency of the operator, compaction, use of aggregates, etc.

(v) The test can be carried out with fair accuracy in the field. Provided there is no large temperature change in the 40-minute interval between preparing the first and third specimens or in taking the corresponding burette readings, temperature control is not of much importance. If the specimens are stored together, any

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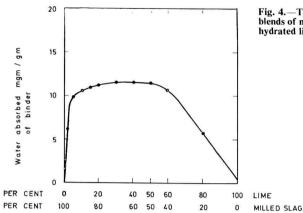


Fig. 4.—Typical absorption cur blends of milled blastfurnace s? hydrated lime.

change in ambient temperature will affect all three in the same degree. Humidity is of no importance unless very large changes are experienced in the short period of mixing the three samples.

(vi) The test offers a means of modifying concrete mixes to suit changes in slag or cement characteristics within twenty-one hours after receipt on the site of these materials.

(vii) It appears that the contribution of the milled slag to water absorption, and consequently to the strength of the blend is negligible at least up to the age of twenty-one hours.

Hydrated Lime and Milled Slag Blends

In South Africa, blends of hydrated lime and milled granulated slag are frequently used for the stabilisation of road bases. The lime and the slag are generally supplied in bulk and are blended prior to spreading in a specially designed portable blender. The problem is again that of determining the exact proportions of the two materials in the blend.

I ABLE II	-ACTUAL	AND	DETERMINED	PROPORTIONS	OF	BLENDS	OF	MILLED	SLAGS	AND
	HYDRATH	ED LI	ME							
		-			-	Sector Sector Sector	-			-

Sla	ag 1	Sla	ag 2
Wa	Det. %	Wa	Det. %
2.80	21.58	6.98	20.09
2.69	22.12		
2.62	26.44	6.55	26.58
		6.43	27.85
2.24	32.80		
2.36	33.80	6.03	33.12
		5.85	35.38
2.04	37.55		
2.09	41.58	5.43	40.76
	_	5.23	43.43
	Wa 2:80 2:69 2:62 2:24 2:36 2:04	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$

ne method already described in this article is entirely suitable for the purpose. ¹⁵Drtunately the blend commonly used is 2 parts by weight of slag to 1 part by 19th of lime. As can be seen from *Fig.* 4, the water absorption curves for blends 7 approximately these proportions are rather flat, and a high degree of precision

not possible. The difficulty is overcome by making up blends of slag and lime known proportions to "bracket" the unknown blend. These blends are intimately mixed with equal quantities by weight of hydrated lime. By this means it is possible to work in the range of lime contents characterised by the steep section of the absorption curve shown on Fig. 4. Re-conversion to the original blends is a matter of simple arithmetic.

The results of a limited series of tests are shown on *Table* II. The dilution of the original blends with lime introduced a degree of error which, having regard to the purposes of the blending, is nevertheless tolerable. It should, however, be pointed out that it is necessary to use a water: cementitious material ratio of 0.75 by weight in order, to obtain a grout sufficiently fluid to permit easy compaction in the jars.

REFERENCES

1.—T. C. POWERS and T. L. BROWNYARD: "Studies of the physical properties of hardened Portland cement pastes" J.A.C.I., Oct. 1946—Apr. 1947, V. 43, P.C.A. Res. Lab. Bull. No. 22. 2.—F. S. FULTON: "The rate of hydration of Portland cement" Portland Cement Institute, Johannesburg, Aug. 1962.

3.—K. SEHLKE: "X-ray diffraction as a method of determining the Portland cement content of mixtures of Portland cement and milled granulated blastfurnace slag" Cement and Lime Manufacture, V. XL, No. 4, July 1967.

4.—J. E. KRUGER: "The use of D.T.A. for estimating the slag content of mixtures of unhydrated Portland cement and ground granulated blastfurnace slag" Cement and Lime Manufacture, V.XXXV, No. 6, Nov. 1962.

5.—R. E. CROMARTY: "The use of a magnetic separator and sulphide determination in the determination of the slag content of Portland blastfurnace cement." Cement and Lime Manufacture, V.XXXVIII, No. 2, Mar. 1965.

Films on High-alumina Cement

LAFARGE ALUMINOUS CEMENT CO. LTD. have recently had made three films on the industrial uses of the high-alumina cements manufactured in the U.K. under the trade names of "Ciment Fondu" and "Secar". Each film is designed to be shown separately or in conjunction with the others.

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The films were produced by Chapman Raper & Associates Ltd. in association with Allardyce Palmer Ltd.

Cement Industry in the United Kingdom Cement Production in 1968

ACCORDING TO statistics prepared by the Ministry of Public Building & Works, the total production of cement in the United Kingdom for the year 1968 was 17,659,000 tons, which is 327,000 tons more than in 1967. Home deliveries of cement amounted to 17,573,000 tons, which is 385,000 tons more than in 1967.

The tonnage of cement delivered by the Rugby Portland Cement Co. Ltd. Group in 1968 in the U.K. was 7.9% in excess of that for 1967. Deliveries at home and overseas together, for 1968, were 10.3% up on 1967.

Extensions at Widnes Works

Holst & Co. Ltd. have been awarded the contract to construct the extensions to the cement works at Widnes for The Associated Portland Cement Manufacturers Ltd. The contract includes bulk-loading silos, extensions to the mill house, a cement intake pit, a motor repair depot, extension to stores, cement packing complex, paving and railway sidings. The consulting engineers for the work are Oscar Faber & Partners, and completion is expected early in October.

Equipment at Pitstone

In connection with the extension of the Pitstone works of Tunnel Cement Ltd., the firm of Kent Instruments Ltd. of the George Kent Group has secured several orders for instrumentation, the orders being placed through the main contractors, F. L. Smidth & Co. Ltd., of Croydon. The Kent equipment, which will feed in signals to a computer installed to control a new dry-process kiln, includes 30 DI transmitters, five Multipoint Mk. 3 recorders, gas-analysis equipment, the new quick-response pump, and sampling system for the analysis of industrial flue gas. Seventy-five current transmitters are also being supplied by Evershed & Vignoles, which firm is also in the George Kent Group.

The plant will have a high electrical content, the equipment for which includes nineteen motors of up to 2,700 h.p. and fed at 3,300 volts and over 350 medium-voltage motors fed from eighteen control panels and controlled, in turn, from a computerised process controller. Some twelve miles of cable are required in this installation and, in view of the vital importance of safety, the earthing system will contain nearly 5 tons of copper. The contract for the cables and earthing installation has been awarded to the Shoolbred Electrical Co. Ltd., members of the Electrical Division of the Deritend Group of Companies.

The illustration on page 49 shows the new reinforced concrete chimney at the Pitstone works in the course of construction. The chimney is 108 m. (350 ft.) high and the special travelling formwork is shown being removed by helicopter on the completion of the structure. The shaft tapers from 8.5 m. (27 ft. 6 in.) at the base to 3.1 m. (10 ft.) at the top and was constructed by the slipform method using special formwork which was capable of being continuously varied in diameter to suit the taper of the chimney. The consulting engineers are Sir Frederick Snow & Partners and the main contractors are J. L. Kier Ltd.

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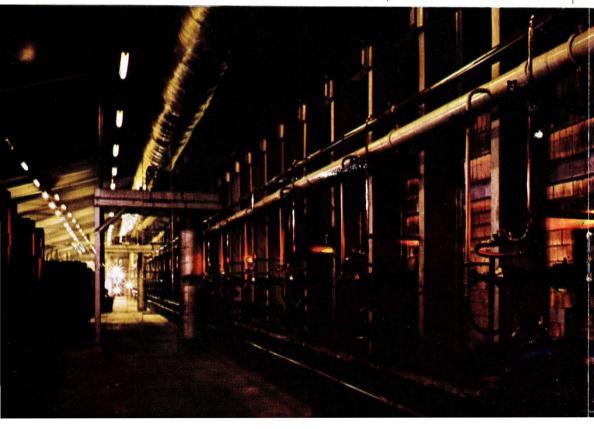
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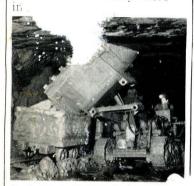
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ac batching plant. regely automatic imum uniformity rilities like these ...e Stein high ty basic bricks and most and most be anywhere



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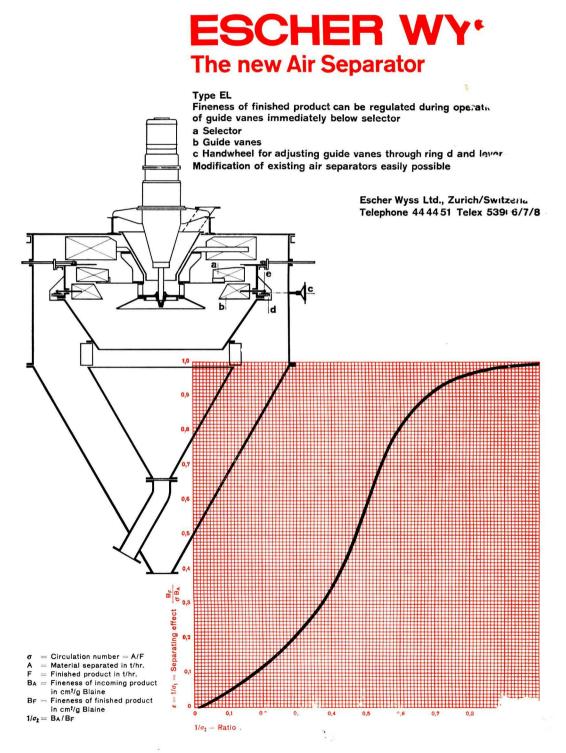
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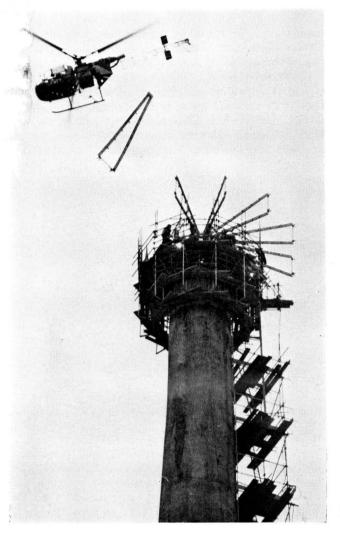
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MAY 1969





Pitstone Works Extensions: Reinforced Concrete Chimney in course of Erection (see page 48).

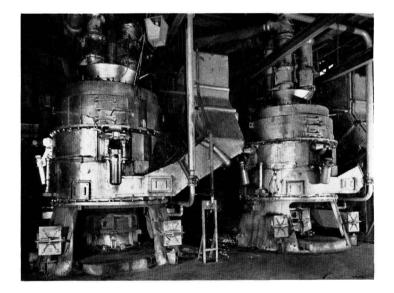
Cement From Billingham Works

All cement produced by I.C.I. at their Billingham works is now being sold and delivered by The Cement Marketing Company. This arrangement commenced on March 1, 1969, and orders are now dealt with through The Cement Marketing Company's office in Newcastle upon Tyne.

New Pulverised-fuel Mills

THE OUTPUT of the cement works of The Associated Portland Cement Manufact¹ Ltd., at Hope, Derbyshire, is being doubled and the new equipment includes tw coal mills for supplying pulverised fuel to the new kilns. The capacity of the kilnis 2,000 tons per day. The improved maintenance procedure devised for the r which are of the 7E type made by Babcock & Wilcox Ltd., is expected to result a considerable reduction in the time that mills are normally out of commission

Undertaking maintenance is avoided in the summer, when the demand for cement is at its peak. No stand-by plant for pulverising fuel is provided, and routine maintenance is kept to a minimum. Wear is greatest on the grinding



elements and, in the new mills, accessibility has been improved by providing for the easy removal of the upper part of the mill, the coal-chute above the mill, and part of the pulverised-fuel outlet. A pneumatic device automatically adjusts the pressure on the grinding elements to compensate for wear, an operation which, on the pulverised-fuel mills installed elsewhere is usually done manually, each loading point being adjusted in turn.

The new mills, which are similar to those shown in the accompanying illustration, will supply $12\frac{1}{2}$ tons of pulverised fuel an hour to each of the kilns. A supplementary pneumatic system will recover from the reject system coal which would otherwise escape grinding.

The air-flow through the mill will be induced by suction. By reducing the proportion of air-to-coal passing through the mill, the amount of cold air drawn into the kiln is reduced and economies in fuel consumption will be achieved.

AE-Air entrained

National Standards for Portland Cement

On PAGES 52 to 59 is given the second of a series of tables giving the requirements of most of the national standard specifications for Portland cement.

first table in this series related to the chemical composition and was given the number of this journal for March last. The table in the present number aclates to the tensile, compressive and bending strengths. Some of the data are abstracted from "Cement Standards of the World 1968", but some of the information is in accordance with the requirements of later available Standards. Other revisions may have been effected since these tables were prepared for the press.

In later numbers of this journal it is intended to publish additional tables giving data relating to other physical properties of Portland cements.

The following abbreviations for the various types of Portland cement are used:

O—Ordinary SR—Sulphate resistant

RH—Rapid hardening (or high early strength)

LH-Low heat

Cement Industry Abroad

Singapore.—IHI (Ishikawajima-Harima Heavy Industries Co. Ltd.) recently received an order from Onoda Cement Co. Ltd., of Japan, for a clinker unloader of the 330 tons per hour level-luffing type equipped with a hopper and a 500 cu. m. (655 cu. yd.) bag-filter dust collector, for the Singapore Cement Manufacturing Co. Ltd. This plant will replace the present 160 tons per hour unloader and will be installed at Singapore Port. It will be used by Singapore Cement Manufacturing Co. Ltd. for unloading clinker which is transferred to the works for grinding.

Singapore Cement Manufacturing Co. Ltd. was jointly established by Mitsui & Co. Ltd., Horyu Co. Ltd., and Onoda Cement Co. Ltd. and operates a cement works having a capacity of 500 tons per day. Because of an unexpected increase in the local demand for cement, the Company is doubling the works and the purpose of the new unloader is to increase the clinker-unloading capacity.

India.—The works of The India Cements Ltd., at Sankarnager, Tirunelveli District, Madras State, are being extended and as a consequence the present productive capacity of 1,500 tonnes per day will be increased to 1,000,000 tonnes per annum. The new plant is being supplied by F. L. Smidth & Co., Denmark. (*See also page 62.*)

UNITS.—Strength	s are given in	TABLE II.—STRENGTH OF PORTLAND CEMENT. (See page 51) kilogrammes per square centimetre. To convert to Newtons per square millin exactly, multiply by 9-8). To convert to pounds per square inch divide by 0-07.	BLE II. nmes p multipl	-STR ber squi ly by 9-	ENGTI are cent 8). To	TABLE IL.—STRENGTH OF PORTLAND CEMENT. grammes per square centimetre. To convert to Newtons cify, multiply by 9-8). To convert to pounds per square in	ORTL. To co. to pou	AND C nvert to inds pe	CEMEN o Newi r squar	VT. (S tons pe e inch	(See page 51) per square m ch divide by 0	51) e milli by 0-07	TABLE II.—STRENGTH OF PORTLAND CEMENT. (<i>See page 51</i>) UNITS.—Strengths are given in kilogrammes per square centimetre. To convert to Newtons per square millimetre multiply by 9-8). To convert to pounds per square inch divide by 0-07.
Country (Date of	Type	T Age o	ensile S f specii	Tensile Strength Age of specimen in days	days	Bendir Age o ir	Bending Strength Age of specimen in days	ngth men	Corr Age o	Compressive Strength Age of specimen in days	e Stren men in	gth days	Remarks
standard)	Cement	-	3	7	28	3	7	28	1	3	7	28	
Argentina	0	I	1	I	I	I	35	55	1	L	170	300	RH only Bending at 1 day: 22
O (1964; revised 1966) RH (1966)	RH	1	I	1	1	50	65	75	100	270	400	500	at 2 days: 40 Compressive at 2 days: 200
Australia	0		1	1	1	1	1	1	1	193	281	387	7.07 cm. cubes
amended	НЛ	I	1	1	I	l	1	1	1	176	246	316	
1904 & 1900)	RH	1	I	L	I	1	Ι	1	I	281	387	527	
Austria	OI 275			1		1	30*	50	1	I	110*	275	Bending at 1 day: 30* (HS
(0061)	OII 375	I	I	1	1	30*	40	60	I	150*	225	375	only) *optional
	HS 475	I	L	I.	I	50	*09	90	100*	300	360*	475	
Belgium	0		18	23	27	1			1	200	300	400	
(6661)	SH	ł	23	27	30	I	I	I	J	300	400	500	7.07 cm. cubes
	RH	20	27	30	32	l	Ι	I	225	400	500	575	
Brazil	0	1	1			1	1	1	1	80	150	250	Cylinders: 5 cm. dia. \times 10
(1061)	RH	1	I	T	1	l	I	Ι	110	220	310	I	ciii.

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	Mortar cubes		4 in. concrete cubes. The	>shall be determined by trial.	Line weight depends on the s.g. of the aggregate and shall be approximately 1950 g. for each cube. Mix cement/ aggregate approx. 1:6. Water/cement ratio 0:60		7.07 cm. cubes		>2.75:1 mortar for com-	2 in. cubes	7-07 cm. cubes	
L	1	281	I	I	141	200 250 300	500 600	246	J	211	350	450
239	281	141	141	176	70	200 200	280 380 450	148	1	105	250	350
155	211	77	84	120	35		200 300	84	211	53	200	250
I	I	ļ	I	l			!		120	I	I.	1
l]	I	I	1				1	I	1		I
ĺ	I	I	I	I	1	1			ļ	I	1	I
١	l	l	I	l	1	T			1	I		I
I	l	1	I	١	[16 20 25	30 35 38	25]	23	30	35
I	I]	1	I]	12 16 20	25 30 32	19	1	18	25	30
1	Ι	1	I	I	I		20 25 27	14	26	11	20	25
I	21*	I	I	Ι	ł				19	I	1	l
O/SR	RH	ГН	O/SR	RH	ГН	0 200 250 300	HS 400 500 600	0	RH	SR	0	SH
Britain	0, N.H. LH (1958; amended	amended 1960 and 1962) SR (1966)				Bulgaria (1956)		Canada	revised 1963,	1966) 1966)	Chile	(1661)

TABLE II.—STRENGTH OF PORTLAND CEMENT. (Continued) UNITS.—Strengths are given in kilogrammes per square centimetre. To convert to Newtons per square multiply by ten (or, more

	9	exactly,	exactly, multiply by 9.8).	s to the	.8). 10	to convert to pounds per square inch divide by 0.07.	to por	ad spur	r squar	e inch	divide	by u-u/	
Country (Date of	Type of	Age	Tensile Strength Age of specimen in days	Strengt men in	h days	Bendi Age o ii	Bending Strength Age of specimen in days	ngth men	Con Age o	Compressive Strength Age of specimen in days	e Strer nen in	igth days	Remarks
stanuaru		-	3	7	28	3	2	28	-	3	2	28	
China	2))	1	1	12	18	I	I	1	1	Ι	100	200	7-07 cm. cubes
(mainland) (1959)	250	I	I	12	18	I	I	I	I	ł	140	250	
	300	Ι	I	15	22	I	I	1	1	l	180	300	
	400	I	15	19	23	I	ļ		I	160	260	400	
	500	1	19	23	27	1	1	1	1	220	350	500	
	600	I	21	27	32	1	I	I	I	260	420	600	
Cuba	0	1	=	19	25	1	1	1		84	148	246	
(0061)	MSR/MLH	1	6	18	23	1	I	Í	I	70	127	246	
	RH	19	26	I	I	l	T	1	120	211	I	l	>2.75:1 mortar for com-
	LH	I	1	12	21	l	I	l	1	I	56	141	2 in. cubes
	SR	l	l	18	23	I	1	1	I	1	105	211	
Czechoslovakia	0 250	I		17	25	I	1	1	I	I	180	250	7-07 cm. cubes
HS (1962) HS (1962)	O 350	I	I	23	30	L	I	1	1	1	250	350	
KII (1900)	O 450	L	25	28	33	1	I	1	I	275	375	450	
	O 550	1	28	32	35	1	l	1	I	340	430	550	
	HS 450	I	25	28	33	1	I	1	I	275	375	450	
	HS 500	I	28	32	35	I	I	1	I	300	400	500	
	RH 500	18	28	32	35	i	1		200	340	430	500	

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Denmark O (1933) RH (1942)	0	Ι	1	20*	25*	T	1	1	1	I	320	400	Tensile and compressive at 28 days combined wet and dry storage: 30 and 450
	RH	I	20	20	25	I	I	I	I	300	320	400	Ditto 30 and 6399/450
Eire	0		1		1	30	40	1	Г	150	225		RH only
(6061)	RH	1	1	1	I	40	Ţ	1	100	220	Ι	I	I day: 20 and 100
Finland (1945)	0	1			I	30*	40	09	1	150*	225	350	All types.—Mortar = 2 (coarse): 1 (fine): 1 (cement)
	RH	ſ	L	I	I	50	*09	70	100*	300	375*	450	 Pending strength at 1 day: 25 (RH only) Bending and compressive
	ГН	I	I	1	I	1	30*	50	I	1	125*	250	strengths at 90 days: 60 and 350 (LH only)
France	01	1	1	1	1	I.	35	50	I	1	160	250	
(+0.61)	11 0	1	I	ſ	1	I	40	55	1	1	270	325	
	RH I	I	I	I		I	55	65	Ι	1	315	400	Bending and compressive at 2 days: 45 and 160
	RH II	I	I	I	1	Į.	60	70	I	l	355	500	Bending and compressive at 2 days: 40 and 200
Germany (East)	0				1	30	40	60	I	150	225	350	Bending strength at 1 day:
(00/1)	RH I	l	I	I	1	40	50	70	1	200	300	400	
	RH II	I	l.	1	1	50	60	80	100	275	350	450	
Germany (West)	10	1					L	1	I	Ţ	175	375	⇒ 550 at 28 days
(6061)	IIO	l	I	I	I	1	l	1	T	100÷	I	375	⇒ 550 at 28 days
	I SH	I	I	I	I	I	1	I	1	\$C01	I	450	
	II SH	I	I	I	I	1	I		I	175†	I	450	t values at 2 days
	III SH	I	I	Ι	I	1	I		I	300	I	550	
	SR/LH	1	Ţ	ł	1	L	L		L	I.	100	275	≯ 450 at 28 days

TABLE IL.—STRENGTH OF PORTLAND CEMENT (*Continued*) UNITS.—Strengths are given in kilogrammes per square centimetre. To convert to Newtons per square millimetre multiply by ten (or, more exactly, multiply by 9-8). To convert to pounds per square inch divide by 0-07.

						-							-	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		ype of	T Age o	ensile S f specin	trength nen in e	lays	Bendir Age o ir	Bending Strength Age of specimen in days	ngth men	Con Age o	f specin	Compressive Strength Age of specimen in days	gth days	Remarks
0 - - 18 25 RH - 25 - 30 400 - 25 - 30 500 - - 27 30 600 - - 27 30 600 - 25 25 - 0 - 25 38 - 1H 25 38 - - 0 - 23 36 30 1H - 23 26 30 1H - 26 30 34 1H - 17 21 27			-	3	7	28	3	7	28	1	3	7	28	
RH - 25 - 30 400 - 25 - 30 500 - - 20 26 600 - - 27 30 600 - - 32 35 0 - 25 25 - 1 25 38 - - 1 - 25 38 - - 1 - - 23 30 34 1 - - 26 30 34 1 - 17 21 27 27	o [.]		1	1	18	25	1	1	1	1	I	180	275	Tensile and compressive at 28 days combined wet and dry storage: 30 and 350
400 20 26 500 - - 27 30 600 - - 32 35 0 - - 32 35 0 - 25 25 - RH 25 38 - - LH - 23 26 30 O - 23 38 - - RH 25 38 - - - RH - - 23 36 30 RH - - 23 26 30 RH - 26 30 34 LH - 17 21 27	RH		I	25	1	30	1	1		I	250	1	400	Ditto 40 and 500 7-07 cm cubes
500 - - 27 30 600 - - 32 35 0 - 25 25 - RH 25 38 - - LH - 23 26 30 0 - 23 26 30 RH - 23 26 30 RH - 23 26 30 LH - 17 21 27	400		1	1	20	26	I		1			280	400	7-07 cm cubes
600 - - 32 35 0 - 25 25 - RH 25 38 - - LH - - - - - KH 25 38 - - - LH - - - - - - RH - 23 26 30 34 RH - 26 30 34 LH - 17 21 27	500		ſ	I	27	30	I	I	I	I	[350	500	Tensile and compressive at 2 days: 20 and 200
0 - 25 25 - RH 25 38 - - LH - - - - O - 23 26 30 RH - 26 30 34 LH - 17 21 27	600		I	I	32	35		I	I	T	I	450	009	Ditto 25 and 250
RH 25 38 - - LH - - - - - O - 23 26 30 34 RH - 26 30 34 17 21 27	0		1	25	25		I	I			160	240	I	Bending tests to RILEM/
LH -	RH		25	38	1	I	I	1	I	160	295	1	I	CEMBOREAU methods and strengths optional
O - 23 26 30 RH - 26 30 34 LH - 17 21 27	ГН		I	I	I	Ι	I	I	I	I	100	160	370	7.07 cm. cubes
RH – 26 30 34 LH – 17 21 27	0			23	26	30		1	1	I	250	325	400	7-07 cm. cubes
- 17 21 27	RH		I	26	30	34	l	I	1	I	325	400	475	
	ГН		1	17	21	27	I	I	I	I	175	250	325	
Israel 0 - 22 27	0		I	22	27		1	1	1	Τ	100	155	1	12 cm. cubes
HS (1964) HS - 27 32			I	27	32	I	Ŧ	I	I	I	140	190	280	RILEM/CEMBUREAU
SK (1703) SR - 25 32 -			T	1	25	32	1	I	1	1	I	85	155	vinctious for bending and compressive if requested. Values to be agreed.
Italy 0 - 27 34 -	0			1	27	34	1		1	1		450	600	Tolerance 5%
(1960) HS - 24 33 38 -	HS		Ι	24	33	38	1	Т	1	I	450	600	730	

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Japan	0	T	1	T	Ĩ	15	25	40	1	55	110	220	1.1 monton (10 trans)
(+061)	RH	I	I	1	I	25	40	*09	40	60	180	280*	>Bending strength at 1 day.
	ΓН	1	L	1	1	10	20	30	I	35	70	150	10 101 KH.
Mexico	01	1	=	20	25	1	I	1	1	85	150	250	T.S.C. Portantine
(1061)	SR/LH II RH III	- 19	9 27	18	1 33	H	11	11	120	70 210	125	250	 > Sive test. 5 cm, cubes
	SR V	11	11	18	21	11	11		11	11	105	140 210	
Netherlands	0 (A)		1	1	1	22	33	44		90	150	250	Bending at 1 day: 25 for
(6641)	RHI (B) RH II (C)	11	11		11	30 40	40 50	50* 55*	100	125 250	225 350	325* 450*	КНШ
New Zealand	0	1	1	1		1	T	1	I	155	239	387	7.07 cm. cubes
CH (1964) LH (1962)	RH LH	11	11			11		11	11	239 70	352 113	492 264	
Norway	0	1	16	22	27	1	11		Ē	200	280	370*	7.07 cm. cubes
(1) Moist mortar	RH	I	25	27	30	I	1	l	l	350	400	450*	
(2) Plastic	0		1	I	1	40	50	09	1	175	250	350*	Compressive at 1 day: 150.
mortar	RH	I	I	I	I	50	60	70	150	250	350	400*	RILEM/CEMBUREAU method
Pakistan	0	1	21*	1		1	T	1	1	155	239		
(7061)	RH	21*	1	I	I	1	I	I	11	211 84	281 141		//0/ cm. mortar cubes
										120	176	1	4 In. concrete cuoes
Poland	01	I	1	I	1	1	30	50		1	130	250	
RH (1964) US I (1961)	0 II		I	l	l	25	40	09	I	130	225	350	
(1961) I SH (1961) II SH (1962) I SH	RH		1	I	I	45	Ι	65	100	200	I	400	Bending at 1 day: 25 RH only
	HS I HS II SR/LH	III	111	LT I	111	40 50	55 60 30	70 80 50	111	180 250 —	280 400 130	450 550 250	

TABLE IL—STRENGTH OF PORTLAND CEMENT. (<i>Continued</i>) UNITS.—Strengths are given in kilogrammes per square centinetre. To convert to Newtons per square millimetre multiply by ten			e
TABLE IL—STRENGTH OF PORTLAND CEMENT. (<i>Continue</i> , Strengths are given in kilogrammes per square centimetre. To convert to Newtons per square continue to a convert to Newtons per square control of the strength str		ten	
TABLE IL—STRENGTH OF PORTLAND CEMENT. (<i>Continue</i> ,Strengths are given in kilogrammes per square centimetre. To convert to Newtons per square continuent to new square square control of the second seco		by	Ċ
TABLE IL—STRENGTH OF PORTLAND CEMENT. (<i>Continue</i> ,Strengths are given in kilogrammes per square centimetre. To convert to Newtons per square continuent to new square square control of the second seco		multiply	
TABLE IL—STRENGTH OF PORTLAND CEMENT. (<i>Continue</i> ,Strengths are given in kilogrammes per square centimetre. To convert to Newtons per square continuent to new square square control of the second seco	-	millimetre	100
.—Strengths are given in kilogrammes per squar s.—Strengths are given in kilogrammes per squar	ontinued	square	ind a built
.—Strengths are given in kilogrammes per squar s.—Strengths are given in kilogrammes per squar	U	per	4
.—Strengths are given in kilogrammes per squar s.—Strengths are given in kilogrammes per squar	CEMENT.	Newtons	oui ononoo
.—Strengths are given in kilogrammes per squar s.—Strengths are given in kilogrammes per squar	ā	t to	
.—Strengths are given in kilogrammes per squar s.—Strengths are given in kilogrammes per squar	ORTLAN	To conver	obanoa o
	TABLE II.—STRENGTH OF P	s.—Strengths are given in kilogrammes per squai	avartly multiply by 0.8) To convert t

Transile Strength of to ment Transile Strength in days Bending Strength in days Compressive Strength age of specimen in days Note 1 3 7 28 1 3 7 28 I 3 7 28 3 7 28 1 3 7 28 I 3 7 28 3 7 28 1 3 7 28 I 3 7 28 3 30 300 205 30 400 7 28 1 3 7 28 1 3 7 28 1 200 300 300 300 400 - 10 <td< th=""><th></th><th></th><th>· Common</th><th>dimmin</th><th></th><th>~</th><th>or and the second of the second of the second of the second of a second of a second of a second of a second of a</th><th></th><th>ad com</th><th>mphe 1</th><th></th><th>227410</th><th>· · · · ·</th><th></th></td<>			· Common	dimmin		~	or and the second of the second of the second of the second of a		ad com	mphe 1		227410	· · · · ·	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Country (Date of	Type of	T Age c	ensile :	Strengt men in	days	Béndi Age o ii	ng Stre if specii n days	ngth men	Con Age c	if speci	e Strer men in	ngth days	Remarks
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	statiuatuj		-	3	٢	28	3	7	28	-	3	7	28	
71 01 - 20 25 28 160 250 375 - 200 280 400 1 RH1 - 20 30 - - - 200 300 380 - - E 200 300 380 - E E E 260 300 380 - E E E 260 300 380 - E E E E 200 300 380 - E E E E 250 340 400 - E	Portugal (1956)	0	1	1	I	1	25	35	50	1	110	180	275	
OII $ 25$ 30 34 200 350 475 $ 260$ 380 500 RH I 20 26 30 $ 200$ 380 500 $ 200$ 380 $ -$	Roumania		1	20	25	28	160	250	375	1	200	280	400	Tensile and compressive:
RH1 20 26 30 - - - 200 300 380 - RH1I 22 23 32 - - - 250 340 400 - 0 - - - 18 28 - 155 239 - RH - - - 18 28 - 155 239 - RH - - - - 28 39 - 211 281 - RH - - - - - 37 56 - 167 250 350 350 O1/SR II - - - - 33 45 64 - 179 250 350 350 360 360 450 50 360 360 360 450 50 450 50 450 50 450 50 450 50 450 50 450 50 450 50 50 50 50 50 </td <td>RHI, RHII</td> <td>_</td> <td>I</td> <td>25</td> <td>30</td> <td>34</td> <td>200</td> <td>350</td> <td>475</td> <td>1</td> <td>260</td> <td>380</td> <td>500</td> <td>moist mortar. /·U/ cm. cubes</td>	RHI, RHII	_	I	25	30	34	200	350	475	1	260	380	500	moist mortar. /·U/ cm. cubes
RHII 22 28 32 - - - 250 340 400 - 0 - - - - 18 28 - 155 239 - RH - - - 18 28 - 155 239 - 01/SR I - - - 33 45 64 - 167 250 350 01/SR II - - - 33 45 64 - 167 250 350 011 - - - 33 45 65 - 160 260* 420* 0 0 - - - 30 45 65 - 160 260* 420* LH - - - 30 45 65 - 160 260* 420* LH - - - 50 60	(1961)	RH I	20	26	30	I	I	I	I	200	300	380]	Bending: plastic mortar 40 ×
$ \begin{array}{ cccccccccccccccccccccccccccccccccccc$		RH II	22	28	32	I	1	I	I	250	340	400	I	$40 \times 160 \text{ mm}$. prisms
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	South Africa	0	1	1			1	18	28	I	155	239		
01/SR1 37 56 - 167 250 01/SR11 - - 33 45 64 179 250 350 01/I - - - 33 45 64 179 250 350 01/I - - - - - 275 375 450 0 - - - - 179 250 350 RH - - - - 160 260* 420* 19 26 - - - - - 160 260* 420* RH 19 26 - - 30 50 - - 160 260*	(4641)	RH	I	l	Ī	l	ſ	28	39	1	211	281	1	
0 II/SR II - - - 33 45 64 - 179 250 350 350 0 III - - - 50 60 70 - 275 375 450 0 III - - - 50 60 70 - 275 375 450 0 - - - - 10 26.4 420* 420* RH - - - - 160 340* 420* - 0 - - - - - - 160 340* 420* - 19 55 - - 30 50 - - 160 290* RH 19 26 - 120 21 - 70 127 246	Spain	O I/SR I		1	1	1	1	37	56	L	1	167	250	
O III - - - 50 60 70 - 275 375 450 0 - - - - 30 45 65 - 160 260* 420* RH - - - 60 65 - 160 340* 420* - LH - - - - 160 50* 420* - D - - - - 160 340* 420* - RH - - - - 30 50 - - 160 290* SR/LH - 9 18 23 - - - 70 127 246	(1904)	O II/SR II	I	I	1	I	33	45	64	I	179	250	350	
0 - - - - - 160 260* 420* RH - - - 60 65 - 160 340* 420* LH - - - - 60 65 - 160 340* 420* LH - - - - 160 340* 420* - 0 - - - - - 30 50 - - 160 290* SR/LH - 9 18 23 - - - 70 127 246 RH 19 26 - - - - 70 127 246		0 III	l	1	l	I	50	60	70	-1	275	375	450	
RH - - 60 65 - 160 340* 420* - LH - - - - 30 50 - - 160 290* O - 11 19 25 - - 84 148 246 SR/LH - 9 18 23 - - 70 127 246 RH 19 26 - - - 120 211 - -	Sweden	0		1	1	1	30	45	65	I	160	260*	420*	*Optional
LH - - - 30 50 - - 160 290* 0 - 11 19 25 - - 84 148 246 SR/LH - 9 18 23 - - 70 127 246 RH 19 26 - - - 120 211 - -	(0061)	RH	l	1	1	I	60	65	1	160	340*	420*	I	Bending at 1 day: 30.
O - 11 19 25 84 148 246 SR/LH - 9 18 23 12 246 RH 19 26 2 120 211		LH	I	I	I	I	1	30	50	I	I	160	290*	Bending and compressive at 90 days; 60 and 420*
SR/LH – 9 18 23 – – – 70 127 246 RH 19 26 – – – – 120 211 – –	Taiwan	0	I	Ξ	19	25	I	I	l	1	84	148	246	2 in. cubes.
19 26 - - - - 120 211 -	(7061)	SR/LH	l	6	18	23	Ì	I	1	1	70	127	246	2.75:1 mortar
		RH	19	26	1	1	1	J	1	120	211	1	1	

CEMENT AND LIME MANUFACTURE MAY 1969

(or, more

7-07 cm. cutes	Cylinders 5 cm. diam. × 10 long		loug			Unless specified compressive tests shall govern.		2 in. cubes. 2.75:1 mortar.	Adoption of 40 × 40 × 160 prisms for bending and compressive							2 in. cubes. 2:75:1 mortar. Prisms $40 \times 40 \times 160$, for bending and compressive			>Tolerance 10%			
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Turkey (1959)		Uruguay (1962)		U.S.A.	(A.S. I.M. 1967)	I A O/AE I SR/LH II SR/LH/AE II SR/LH/AE			III A RH/AE IV LH V SR			U.S.S.R. (1962; amended 1967)				Venezuela (1960)			Yugoslavia (1967)			

Slurry-press Conveyors

IN CONNECTION with the extensions at the Dunstable works of The Associated Portland Cement Manufacturers Ltd., a system of seven press conveyors, used for the first time to hold the complete volume of cake from the press to provide a controlled rate of discharge, has been installed. The duty of the conveyors, which are installed directly below each of the cement slurry presses, is to receive slurry cake in slab form from each of the presses which are discharged in sequence. Each pressing operation and slab discharge takes $34\frac{1}{2}$ minutes, and during this period each conveyor belt is stationary. The quantity of slurry cake discharged by each press is 15 tons, which corresponds to the holding capacity of one conveyor. This amount is then discharged by the conveyor in $7\frac{1}{2}$ minutes. The discharge rate, therefore, of each conveyor is 120 tons per hour. Each cake slab is 4 ft. (1.2 m.) square and 2 in. (5 cm.) thick.

Each conveyor has a 60-in. (1.5 m.) flat belt and is 43 ft. (13.1 m.) long. A slight incline of the belt assists water shedding over the taildrum to fall onto the belt during the pressing operation, and also assists in washing down the belt when it is stationary. The drive-head comprises a 5 h.p. 1,500-r.p.m. foot-mounted motor connected to a double reduction worm-reduction box by means of a V-rope drive. The gear-box is connected to the head-shaft by a flexible coupling and spur-wheel and pinion. The speed of the head-shaft is 0.54 r.p.m. and results in a belt speed of 3 ft. (0.9 m.) per minute.

Because the slurry cakes are in slabs and are of a soft plastic nature, they have to be broken up so as to produce material of a size which is more suitable for handling by a belt-conveyor. This is done by a rotating picker shaft, which is mounted above the conveyor drive-drum and comprises a series of blades set around the circumference and along the length of a shaft mounted in ball-bearing plummer blocks, set parallel to and above the conveyor head-drum. The speed and distance between the blade and the top of the conveyor head-drum is determined by the rate of discharge required from the conveyor, and the nature of the material being handled. The picker shaft is driven by a 5-h.p. 1,500 r.p.m. foot-mounted motor through a V-rope drive and torque-arm gear-box to produce a shaft speed of 30 r.p.m.

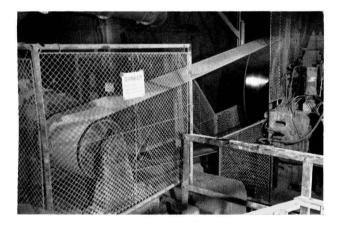
The frame of the conveyor consists of channel stringers supporting a closelypitched bed of mild steel flat idlers 4 in. (10 cm.) in diameter, above which are skirt plates to receive and retain the material on the belt. Because of the large quantity of material amounting to 15 tons, and the sizes of the slabs, the height of the skirt plates is 4 ft. 3 in. (1·2 m.) above the belt line and nominally the same distance between plates. Because of the soft plastic nature of the material, the cross-section of the skirt plates are specially designed to stop the material adhering to them by sloping the plates outwardly to give a distance between skirts of 4 ft. 3 in. (1·2 m.) at the top and 4 ft. 6 in. (1·3 m.) at the bottom. To ensure a clean discharge, the skirt plates are increased by 3 in. (7·5 cm.) in width between the tailend and the discharge end. Because of the non-abrasive nature of the material and its softness, and in order to reduce skirt friction to a minimum, rubber seals were replaced by circular rods welded continuously to the bottom edge of the skirt plates, leaving a small clearance between the rods and the belt. To prevent water spilling over the edges of the belt, the edges are inclined on short continuous rubbing plates.

The tail-end unit is screw operated. The belt, which is 60 in. (1.5 m.) wide, is of three-ply ribbed-fabric construction with $\frac{1}{8}$ in. (3 mm.) top cover and $\frac{1}{16}$ in. (1.5 mm.) bottom cover and a vulcanised joint. The conveyor is provided with guards for couplings and V-rope drives, the skirt plates and tail-end units being protected by open-mesh guards.

The design, supply and installation of the press conveyors was undertaken by Richard Sutcliffe Ltd.

A Transmission Belt at Lime Works

IT IS REPORTED that the drive-belt on a crusher at the Clitheroe works of the Horrocksford Lime Co. Ltd. has been in continuous operation since 1965. The belt is 20 in. (50 cm.) wide and is a T.B.A. whipcord flat transmission belt of

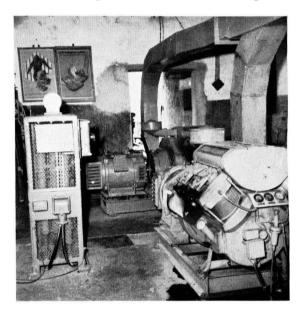


quality number RB.63. It is 48 ft. 6 in. (14.8 m.) long and was supplied by Turner Brothers Asbestos Co. Ltd. The Hadfield crusher to which it is attached runs at a normal load of 200 h.p. with peak loads up to 300 h.p. The accompanying illustration shows the belt in operation.

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New Equipment at an Indian Limestone Quarry

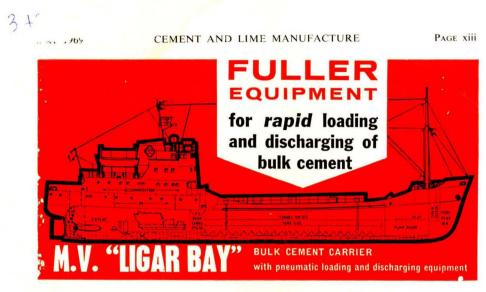
INDIA CEMENTS LTD., which was established as a public company in 1949, had initially a daily output of 300 tons, and by 1956 the output had reached about 700 tons per day. By 1959 the plant had been doubled. In Madras State, the Company obtains about two-thirds of the requirements of limestone from contractors working deposits about five miles from the cement works. The bands of limestone run east-west on either side of the Sankarankoil Road for about three miles. This deposit, which is of igneous and metamorphic origin and contains intrusions of granite and quartz, is for the most part suitable for making cement. Occasional pockets of coarse calcite, fine-grained saccharoidal



marbles and of calciphyres occur. The balance of the Company's limestone requirements are obtained from its own quarry near the works, where there is a band of medium-grained saccharoidal calcite limestone and white marble extending for $1\frac{1}{2}$ miles along the eastern foot of the Talaiyuthu Hill. The greater part of the deposit is impure and contains only narrow bands of high-grade calcite.

In the early 1960s, in order to satisfy the increased demands from India Cements Ltd., one of the contractors installed two "Atlas Copco AR3" stationary compressors. In view of the performance of these machines, India Cements Ltd. recently obtained two "Atlas Copco BT6" stationary two-stage single-acting air-cooled compressors. Each of these machines, one of which is shown in the accompanying illustration, has a capacity of 282 cu. ft. (9 cu. m.) per minute.

The compressors supply power to operate jack-hammers and rock-drills.





Wall of screw conveyor tunnel equipped with inspection windows, and catwalk over self-cleaning haunching.



F-H Airslide conveyor in self-cleaning valley, showing blade of adaptor gate operated from tunnel.



Fuller Kinyon pump with F-H Airslide conveyors from fluid lift.

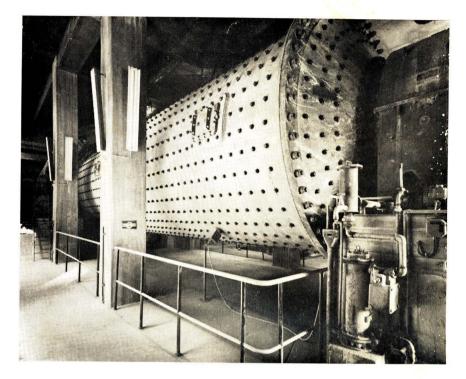
The bulk carrier M.V. "Ligar Bay", built by Henry Robb Ltd., Leith, for the Tarakohe Shipping Company of Wellington N.Z., is equipped with Fuller Kinyon pneumatic cementhandling equipment supplied by Constantin (Engineers) Ltd., capable of automatically loading bulk cement at over 550 tons per hour, and discharging—up to 1,500 ft. from the ship's side, and a lift of 60 ft.—at 130 tons per hour.

Please write or telephone for full details of Fuller equipment.



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CORRECT LAYOUT IS OF MAJOR IMPORTANCE

About 50 POLYSIUS mills go into operation every year. A wealth of experience is available to solve your grinding problems. Polysius design and construct complete open and closed circuit plants for dry and wet process grinding with drives up to 6000 KW.

The illustration shows a closed circuit grinding mill, 4 metres diameter, 12 metres long, with twin pinion drive. This mill has an output of 80 tons/hour of cement at a fineness (Blaine) of 3000 cm²/g when grinding hard clinker from a rotary kiln.





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POLYSIUS LTD. The Brackens. Ascot, Berks. (England) Telephone, Winkheld Row 2011 POLY: US (PTY.) LTD, Telex: 84:102 Johannesburg

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