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* * *

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Dextran und Kristallverlängerung. D. N. SUTHERLAND. *S.* 355–358

Versuche, in den Kristalle aus Sirop wachsen lassen wurden, zeigten, dass die Zugabe von Dextran eine Kristallverlängerung in Richtung der *c*-Achse bewirkt, so dass Dextran, das eine viel grössere Einwirkung auf Kristallhabitus als andere Polysaccharide hat, als besonders schädliche Verunreinigung betrachten muss.

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* * *

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Statistische Charakterizierung der Phospho-Defäkation von Rohrsaft. A. J. MACRITCHIE und R. M. MORRIS. *S.* 362–365

An Hand einer statistischen Erschätzung des Verhaltens während der Klärung von Saft aus N:Co 376 und N:Co 310 Rohrsorten hat man eine Korrelation abgeleitet, die eine genauige Berechnung der Klarsafttrübung aus einer Anzahl Verfahrens-Veränderlichen gestattet.

* * *

Rohrzucker in Liberia. *S.* 365

Der Zuckerrohranbau in Liberia und Zukunftsaussichten für Zuckererzeugung werden kurz besprochen.

Dextrana y alargamiento de cristales. D. N. SUTHERLAND. *Pág.* 355–358

Por medio de ensayos en que cristales se desarrollan de meladura, se muestra que la adición de dextrana causó elongación de los cristales á lo largo del eje *c*, y por eso debe considerarse como un impureza particularmente nocivo, con un efecto sobre forma cristalina mucho más grande que otros polisacáridos que se han investigado.

* * *

Producción de un cachaza seca con filtro-prensas mecanizadas. M. KEIJZER. *Pág.* 358–360

Se presentan detalles del obra, mientras algunas campañas, de filtro-prensas marca Choquenet, en la estación de filtracion de jugo de la primera carbonatación a la azucarera de Groningen en Holanda.

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El uso de tiras plásticas para identificar tallos de caña. A. C. ARVIER. *Pág.* 360–361

El uso de tiras de polietileno azul, anudado a tallos de caña, tiene algunas ventajas sobre otros métodos para definir los límites de tablones experimentales cuando la caña se quemará. Se describe la sistema que se emplea.

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Caracterización estatistical de la fosfo-defecación de jugo de caña. A. J. MACRITCHIE y R. M. MORRIS. *Pág.* 362–365

De un valuación estatistical de la conducta en clarificación de jugo de caña de variedades N:Co 376 y N:Co 310, se deriva una corelación para predecir exactamente la turbidez de jugo clarificado de un número de variables del proceso.

* * *

La caña de azúcar en Liberia. *Pág.* 365

La cultivación de caña en Liberia y perspectivas del futuro para producción de azúcar se discuten brevamente.

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Notes & Comments

International Sugar Agreement.

The Agreement reached in Geneva in late October is now open for ratification by the Governments of the countries concerned, and will come into force on signing by countries representative of 60% of the Exporters' votes and 50% of the Importers. The agreement contains 68 articles and some of these have been published recently[1]. Articles 34, 36 and 37 exclude from export quotas sugar supplied to the UK under the Commonwealth Sugar Agreement, sugar supplied under the Afro-Malagasy Sugar Agreement, and exports to the USA. Cuban exports to Albania, Bulgaria, Mongolia, North Korea, North Vietnam, Rumania, the USSR and Yugoslavia will not be charged against Cuba's quota, nor exports to Czechoslovakia, Hungary and Poland up to 250,000 metric tons, raw value, or to East Germany and China up to a total of 350,000 tons.

The USSR undertakes to limit its total exports of sugar, outside the socialist countries, in 1969 to 1,100,000 tons and in 1970 and 1971 to amounts between this figure and 1,250,000 tons to be determined later by the International Sugar Council.

C. Czarnikow Ltd.[2] have outlined the provisions of the agreement in regard to stocks, prices, quota adjustments and shortfalls.

"Important stock undertakings have been made by exporting member countries, which will provide a valuable safeguard for importing member countries should prices rise unduly. After setting aside supplies needed for domestic consumption and requirements under special arrangements, developed exporters as defined in the Agreement have undertaken that stocks at a date immediately preceding the start of their campaigns will not be less than 15% of their basic export tonnages, while for developing exporters the undertaking is in respect of a minimum of 10%. There is also a maximum limitation on stocks which will tend to control the weight of sugar that could overhang the market. Exporting members have the choice of either establishing a stock holding up to 20% of their crops in the immediately preceding year or of holding sufficient sugar for their domestic needs plus 20% of their basic export entitlements.

"The ISC price is calculated by taking the mean of the LDP and the No. 8 spot price, each converted to US cents per lb f.o.b. and stowed in bulk in a Caribbean port. If the difference between the two prices is in excess of six points the ISC takes the lower price plus three points. As was the case in the previous Agreement, wherever reference is made to a 'prevailing price' being above or below an indicated figure, this condition will be considered to have been fulfilled if the average of the ISC price over a period of seventeen consecutive market days is above or below the indicated figure and the price on the first and not less than twelve days within the period is also above or below it as the case may be. Should prices rise above 4·75c per lb 50% of the minimum stocks will be released and offered for prompt sale to member importers. Should prices continue to rise and pass 5·00c per lb the balance of the stocks will be released. If the price rises above 5·25c per lb, exporting members will give priority on commercially equal terms to importing members as against non-members. If, despite these provisions, the price rises above 6·50c per lb importing members will have an entitlement to purchase sugar from exporting members among their traditional suppliers at 6·50c per lb. The tonnage which may be purchased within a quota year under these arrangements will naturally vary according to the time of year.

"Every attempt has been made to cover circumstances relating to quotas at varying price levels and this has inevitably led to an involved formula. It is reported that should the prevailing price be in excess of 4·00c the aggregate of quotas must not be less than 100% of basic export tonnages. Should it rise to 4·50c, quotas must not amount to less than 110% of basic export tonnages. Quotas become inoperative if the prevailing price exceeds 5·25c, but should it thereafter fall below 5·00c the aggregate of quotas must not exceed 115% of basic export tonnages. A reduction of 5% of basic export tonnages must be made should the price fall below 4·50c with a further reduction of 5% if it should drop below 4·00c. The

[1] F. O. Licht, *International Sugar Rpt.*, 1968, **100**, (30), 2–6.
[2] *Sugar Review*, 1968, (890), 201.

aggregate of quotas must not be more than 95% of basic export tonnages if the price moves below 3·75c while if it moves to 3·50c or less the aggregate must be set at 90% of basic export tonnages. The above provisions may be varied by special vote of the Council, which may also, by special vote, reduce quotas to 85% of basic export tonnages if this is required in order to achieve the aims of the Agreement.

"The Council may use its discretion as to whether it should redistribute shortfalls, but in any case it may not make a redistribution when the price is below 3·25c per lb. When shortfalls are redistributed the following steps must be applied:

(a) Shortfalls must be redistributed pro rata to basic export tonnages until quotas in effect are raised to 100% of basic export tonnages.

(b) Of the balance, 20% must be redistributed among developing exporters.

(c) The remaining 80% must be redistributed among all exporters pro rata to basic export tonnages.

"It is understood that importing member countries will prohibit imports from non-members when the prevailing price is below the parity of 3·25c per lb. At prices from 3·25c per lb upwards, importing countries will limit their imports from non-members to their annual average of imports from non-members during the years 1966 to 1968. No restrictions will apply at any time when quotas are inoperative. This is a much stronger sanction against non-member countries than existed under the terms of the previous two International Agreements and it may act as an additional encouragement to exporting countries to adhere to the pact. Meanwhile the assurance of supplies, particularly at high prices, coupled with a ceiling price of 6·50c per lb, which is offered under the Agreement, will also provide a valuable incentive to importing countries."

* * *

Indian crop prospects.

The recommendations of the SEN Commission, published during the closing months of 1965, called for a substantial expansion in sugar production in India. Before these could be put into operation, however, the country was subjected to a severe drought and it was not possible to put the original plans into effect. Indeed, so drastic was the agricultural situation that production in 1966/67 fell to around 2·15 million metric tons, tel quel, compared with some 3·5 million tons in the previous year[1].

The 1967/68 campaign has been only marginally better than its predecessor and indications are that final output will be in the region of 2,220,000 tons. Even this low figure is far better than was envisaged at one time, but wise fiscal policies adopted by the Government of India brought back to the sugar factories cane which might well have been diverted for use in the production of gur and khandsari.

The Government measures have encouraged farmers and factory owners to increase production in 1968/69 and the present indication is for an output in the region of 2·6 million tons[2]. It has been suggested that India will certainly wish to ship a quantity to the United Kingdom, the USA and Canada in the region of 200,000 tons. Whether, and to what extent, India would be inclined to sell to the world market would seem largely to be dictated by the future course of values. Stocks in India have become very low and it can be readily understood that there should be some pressure to rebuild these to safer levels.

The following estimate of sugar movement during the year October 1968/September 1969 has been calculated:

	(metric tons, tel quel)
Initial stocks	450,000
Production 1968/69	2,600,000
Total availability	3,050,000
Domestic consumption	2,600,000
Exports to USA, UK and Canada	200,000
Final stocks	250,000

It will be appreciated that any sales in addition to those earmarked for the UK, USA and Canada will result in a corresponding reduction in final stocks.

* * *

US sugar supply quota, 1968.

On the 16th October the US Department of Agriculture announced an increase of 100,000 tons in the 1968 Supply Quota, bringing the total to 11,000,000 short tons, raw value. The domestic beet area's share of the increase—47,666 tons—was declared as an additional deficit, and was prorated to Western Hemisphere countries able to supply the sugar. Details of the original quotas, increases, and new quotas appear elsewhere in this issue.

* * *

European beet sugar production estimates, 1968/69[2].

The International Association for Sugar Statistics published estimates at the beginning of November of sugar production in most Western European countries. The figures have been supplemented by estimates made by F. O. Licht in respect of Greece, Ireland, Italy and Yugoslavia, which are not members of the Association.

Since publication of Licht's first estimates[3], weather conditions have been unfavourable and indicated output is lower by 145,000 tons in West Germany, 116,000 tons in France, and 30,000 tons in Turkey, while Licht's new figure for Yugoslavia is 47,000 tons lower. Other estimates show few changes but total output for Western Europe is now set at 10·9 million metric tons compared with Licht's earlier assessment of 11·3 million tons and the revised IASS figure for 1967/68 of 11·0 million tons.

[1] C. Czarnikow Ltd., *Sugar Review*, 1968, (876), 140.
[2] *ibid.*, (891), 205.
[3] *I.S.J.*, 1968, **70**, 322, 351.

Dextran and crystal elongation

By D. N. SUTHERLAND*

(Colonial Sugar Refining Company Ltd., Research Laboratories, Roseville, N.S.W., Australia.)

Introduction

ELONGATED crystals are a recurring problem in sugar factories and are associated with the processing of deteriorated juices. In the beet industry such crystals may be extended along either *b* or *c*-axis and raffinose is well established as a cause of *b*-axis needle crystals.

The form of elongated crystals in cane sugar mills and refineries processing cane sugar, appears, however, to be invariably extended along the *c*-axis. VAVRINECZ[1], in his comprehensive atlas of sugar crystals, lists 5 examples of *c*-axis elongated crystals from cane products but *none* of the 14 cited cases of *b*-axis elongation arise from cane syrups. A recent paper from Japan reports elongated crystals in low-grade strikes at a refinery processing raw sugar from Cuba, Australia and Natal[2]. Again the crystals all showed *c*-axis elongation. This form was shown too in reports from Mackay[3] and Hawaii[4] where investigations were carried out on laboratory-scale boiling of juice from badly deteriorated cane. Similarly the experience over many decades within this company has been that needle crystals resulting from stale cane always exhibit *c*-axis elongation.

This fact simplifies the study of needle crystals from cane sugar factories. The normal form of sucrose crystal grown in pure solution is lengthened somewhat along the *b*-axis and hence the dominant habit modifiers from a stale juice when added to pure sugar solution will reverse this tendency and yield *c*-axis elongation. Thus to test whether a material is one of these harmful impurities, it may be added to a pure sugar syrup, the solution boiled and seeded and crystals grown in the usual way. If the resulting crystal form is *b*-axis elongated the material being tested is either inert or promotes *b*-axis elongation; in either event it is not of primary importance as a habit modifier in the cane sugar industry. If the form is *c*-axis elongated the impurity is potentially harmful. This simple qualitative distinction may be used to classify components of the juice and determine which promote needle crystal formation.

It should be remembered that the present work is not concerned with crystal growth rate but only with the shape of the crystals produced. Habit modification is generally thought to be caused by inhibition of growth on particular faces, so that an impurity which changes the crystal shape may be assumed to reduce the overall crystallization velocity. But the converse is not necessarily true. If the growth on each face is equally retarded then the crystal shape will be unaltered despite a reduction in the total crystallization velocity and a consequent fall in effective pan capacity. The present classification of a substance as not harmful with respect to habit modification does not mean, therefore, that it has no effect on crystallization rate or pan performance.

EXPERIMENTAL METHOD

The half-gallon pan used for this research has been previously described[5]. Seed was introduced as a ball mill slurry in butanol and the crystals grown for 2 to 4 hours, depending on purity, until the form of the crystal could be clearly established and photographed through a microscope.

Boilings were carried out with pure sucrose or high quality factory syrups to which were added the metabolic products of sucrose solutions inoculated with some common organisms, alcohol precipitated dextran and other polysaccharides.

Refractory syrups from both mills and refineries were also studied. These syrups, which had produced needle crystals in the factory, were separated into two fractions by dialysis ("Visking" tubing 32/32) and boilings were carried out with the low molecular weight fraction and the high molecular weight materials added to standard sugar. The separation point of the membrane was in the region of 6000 molecular weight units[6] and, consequently, salts, invert sugar, oligosaccharides and other low molecular weight components passed through the membrane.

EXPERIMENTAL RESULTS

(*a*) *Organisms Cultured on Sucrose*

Several organisms which are frequently associated with stale cane were tested. The only one producing decomposition products promoting *c*-axis elongation was *Leuconostoc* and since this bacterium is known to produce dextran in almost quantitative yields it was highly probable that dextran was the active component. Marked *c*-axis elongation was observed.

(*b*) *Dextran*

Purified dextran from various sources was added to standard sugar solution. When the dextran levels were above 1% on solids *c*-axis elongation was apparent from crystals seeded by ball mill slurry. The crystal shape was mixed from very long to

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[1] "Atlas of Sugar Crystals" (Verlag Dr. Albert Bartens, Berlin), 1965.

[2] SHIRASAKI and KAMODA: *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1966, **17**, (4), 47.

[3] *Ann. Rev. Sugar Research Inst.* (Mackay), 1966–67, 9.

[4] *Ann. Rpt. Hawaiian Sugar Planters' Assoc.*, 1966, 43.

[5] RUSH and MEREDYTH: *Proc. 10th Congr. I.S.S.C.T.*, 1959, 269.

[6] CRAIG, KING and STRACHER: *J. Amer. Chem. Soc.*, 1957, **79**, 3729.

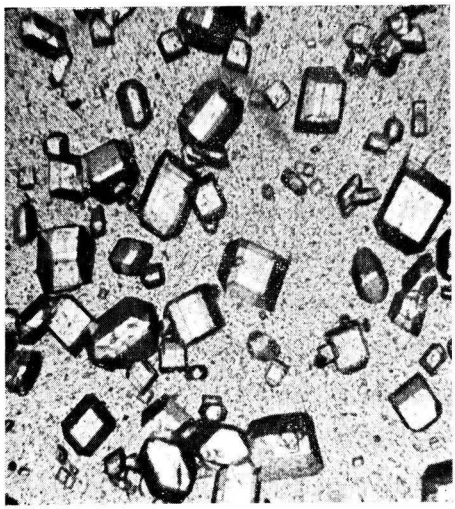

Fig. 1a. Crystals grown from normal quality syrup

almost square. The effect of adding dextran to a good quality syrup is shown in Fig. 1. The syrup, at 72·5 purity, yielded well shaped crystals as shown in Fig. 1a. Dextran was added at levels of $\frac{1}{4}$%, $\frac{1}{2}$% and 1%

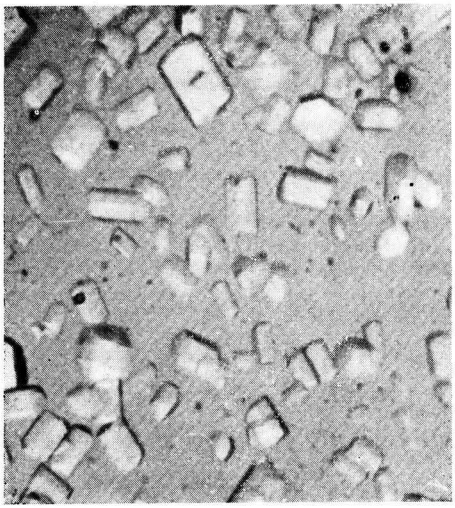

Fig. 1b. Same syrup with $\frac{1}{4}$% added dextran

and the results are shown in Figs. 1b, c, and d. Even with $\frac{1}{2}$% dextran the *c*-axis elongation is marked, while with 1% present extreme elongation is found.

(*c*) *Dialysed Syrups*

The effect of dialysing refractory material may be seen from Fig. 2. In Fig. 2a is shown the crystal shape resulting from a highly refractory mill syrup. Marked *c*-axis elongation is apparent. When this syrup was passed through a dialysis membrane, and the high molecular weight fraction removed, the syrup grew crystals as shown in Fig. 2b. The shape is now square and the cause of *c*-axis elongation has been eliminated.

If the high molecular weight fraction was added to standard sugar and the syrup boiled, the behaviour was the same as that with added purified dextran. Also the addition of purified dextran to the low molecular weight fraction of the dialysed syrup resulted once again in the growth of *c*-axis elongated crystals.

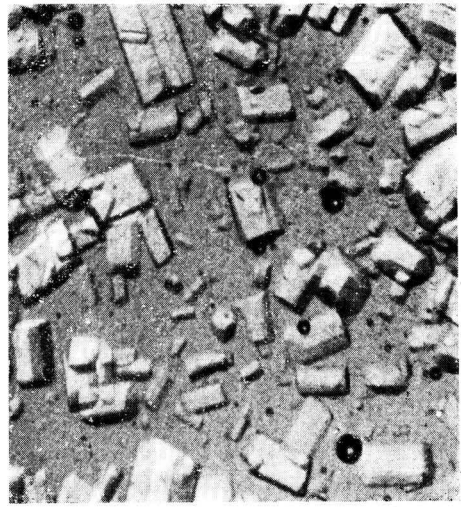

Fig. 1c. Same syrup with $\frac{1}{2}$% added dextran

(*d*) *Other Polysaccharides*

A number of commercially available polysaccharides were tested to see whether these related materials also produced *c*-axis elongation. Where possible the gums were added at the 1–2% level on standard sugar, but some formed such viscous solutions that only about 0·5% could be used without making boiling impossible.

The following were tested: inulin, starches from various sources and dextrin, polylevan, alginates, acacia gum, locust bean gum, carboxymethyl cellulose, "Ficoll", and dextran sulphate.

None of these materials showed evidence of producing *c*-axis elongation. This indicated that a specific chemical effect with dextran promoted habit modification since many of the other substances yielded far more viscous solutions than did dextran.

Discussion

Dextran does not seem previously to have been established as the major causative factor in needle grain formation, though there are many references to the deleterious effects of gums and dextran on factory performance and sugar quality. It is blamed for bad clarification, for high viscosities in syrups and massecuite, and for poor filtrability in the raw

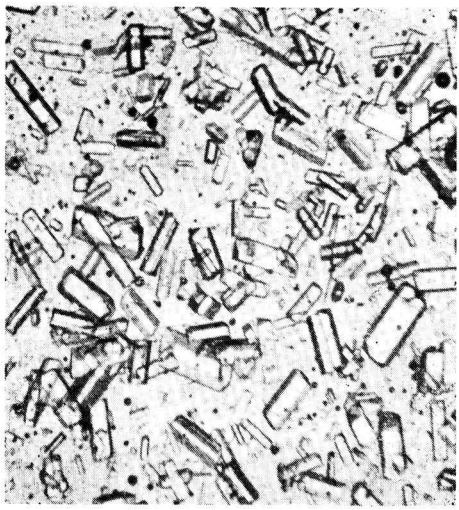

Fig. 1d. Same syrup with 1% added dextran

sugar produced; all of the effects may be readily demonstrated in the laboratory. It is known to occur often in stale cane and the levels of gums and dextrans have been found to increase with deterioration, so making them a useful measure of the quality of material entering a factory[7,8].

Despite the considerable interest in dextran its rôle in crystallization has been thought to be purely related to the viscosity of the surrounding syrup. The viscosity increase will hamper massecuite circulation in the pan and so reduce heat transfer, but laboratory studies of crystallization have indicated comparatively little drop in growth rate with added dextran despite an enormous increase in solution viscosity[9]. Dextran has thus been thought inert as regards habit modification and needle grain formation.

The present investigation has shown clearly that dextran promotes *c*-axis elongation in sugar crystals and that a refractory syrup which produces needle crystals may be purified by removing the high molecular weight materials. This effect on crystal shape, coupled with the physical one raising viscosity, makes dextran a particularly harmful impurity.

Habit modification of sucrose crystals has previously only been found with raffinose and some similar oligosaccharides which are closely related to sucrose[10]. It is of some interest that a polysaccharide can also have such a potent effect on crystal shape, though the mechanism by which dextran alters crystal habit has not yet been established.

It seems likely that a preferential adsorption is involved on the 110, $1\bar{1}0$, $\bar{1}10$ and $1\bar{1}0$ faces and that this retards growth along the *b*-axis, hence promoting *c*-axis elongation. The extreme specificity of dextran compared with related polysaccharides in producing this habit modification suggests a favourable configuration of the dextran molecule for bonding with the exposed sucrose molecules on these crystal faces.

A more detailed investigation of habit modification by dextran is now under way. Particular attention is being paid to the effects of temperature, concentration, molecular weight, degree of branching of the polymer molecule and the interaction between dextran and other constituents in the syrup.

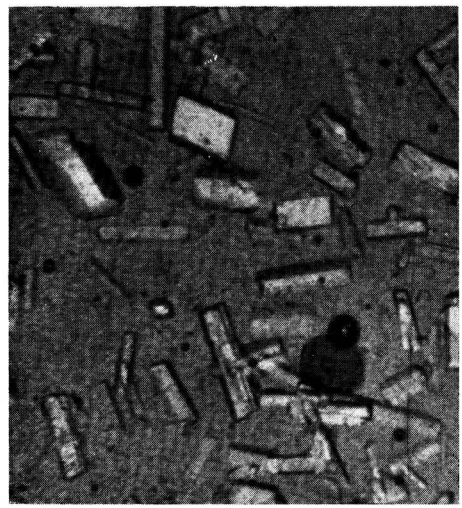

Fig. 2a. Crystals grown from refractory syrup

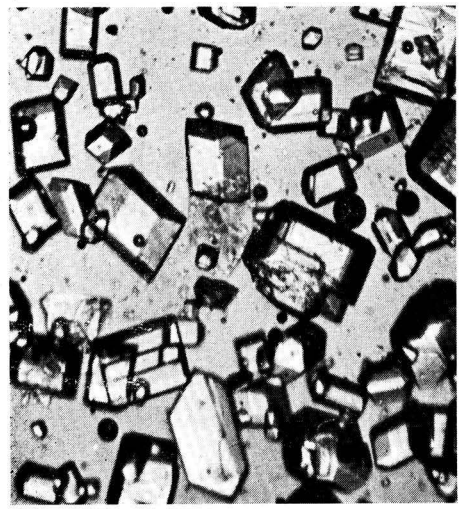

Fig. 2b. Same syrup with high molecular weight materials removed by dialysis

[7] BRUIJN: *I.S.J.*, 1966, **68**, 331.
[8] KENIRY, LEE and DAVIS: *ibid.*, 1967, **69**, 330–333, 357–360.
[9] SMYTHE: *Aust. J. Chem.*, 1967, **20**, 1097.
[10] *idem ibid.*, 1115.

Conclusion

The presence of dextran in sugar syrups causes *c*-axis elongated crystals to grow from solution. Dextran is thus a particularly harmful impurity, since it modifies the crystal habit and increases the viscosity of the syrup.

Acknowledgements

Mrs. E. Farkas and Mr. H. Suzor are thanked for technical assistance; Mr. B. Cortis-Jones, Mr. S. R. Harris, Miss M. McLean and Mr. P. Hidi for samples and advice; and the Colonial Sugar Refining Company Ltd. for permission to publish this work.

The production of a dry sludge with mechanized filter presses

By M. KEIJZER

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Paper presented to the 19th Tech. Conf., British Sugar Corporation Ltd., 1968.

As in many other older beet sugar factories our factory still has filter presses for the filtration of our 1st and 2nd carbonatation juices. They are of the well known type of plate and frame press, hydraulically closed, with juice and water plates and without juice outlet cocks on the plates.

Some years ago it became obvious that something had to be done about modernizing our filter station. The slicing capacity had been substantially increased and therefore pressure was put upon the entire filter station. This resulted in leaking presses, which in turn affected the clarification process because of recirculating juices. Also a very important point was that a relatively large number of men was needed to operate the station satisfactorily.

Our factory is situated in an area with acid soils and soils with a deficiency of lime. The farmers use the filter cake to improve the structural condition of their soil, but it is necessary to deliver the filter cake with a low moisture content. With the old filter presses we were able to obtain a cake with a moisture content of less than 40%.

With the increased capacity of the factory the amount of filter cake produced also increased and, as the storage facilities cannot be enlarged, a great amount of filter cake has to be delivered to the farmers during the working season of the factory. Most of the filter cake can be stored in a pile in the factory yard and is delivered to the various farmers by truck during the period March-September. Every year the entire production of the previous season is sold to make room for the next season.

From the foregoing it will be seen that in planning the new filter station we had to keep in mind that we were not to lose our market for filter cake. The filter cake produced had to be very dry and suitable for immediate delivery. Because of this the installation of continuous vacuum filters was not further considered.

It would, of course, have been possible to build a drying plant for filter sludge, but the investment and the cost of drying would have had ill effects on the price of our product as compared with the prices of other fertilizers of this kind.

When it was decided that continuous filtration with vacuum filters was not suitable for the filtration of our first carbonatation juice we started to think again about batch filtration. We even considered mechanizing our old filter presses.

Meanwhile new developments in this field came to our notice, especially the filter presses of Ritterhaus and Blecher (Wuppertal, West Germany) and the filter presses with the F.A.L.C.-Beauchamps mechanical discharge system from Fonderies et Ateliers L. Choquenet (Chauny, France). This last system was developed in close co-operation with a sugar technologist, and seemed to be the most suitable solution to our problem so one press was installed before the start of the 1964 season.

This filter press (a chamber-press type) is provided with a hydraulic closing and locking device and mechanical discharge equipment. Opening, discharging, closing and locking can be done by pressing a button. The successive actions of the press can be interrupted and resumed at the choice of the operator without disturbing its sequence.

The filter press has 65 plates, 1 metre square, with a filtering surface of 0·92 × 0·92 metres on each side. The filter was fitted with a cloth woven of artificial fibre, made in Belgium. Unfiltered juice is admitted through holes in the centre; these holes have a diameter of 125 cm. The effective filtering surface of the unit is 109 sq. metres and the sludge (or cake) volume is 1675 litres per charge. The space between two plates, or in other words the thickness of the cake, is 3 cm.

Neither the juice plates nor the water plates have outlet cocks. Only the juice plates have outlets below. The water plates discharge their filtered juice through the water inlet on top and from there the juice is led to a trough and mixed with the juice from the juice plates. When the filter cake is washed (sweetened-off) the juice valve to the trough is closed

and water passes through water-and-juice plates to the juice trough (Fig. 1).

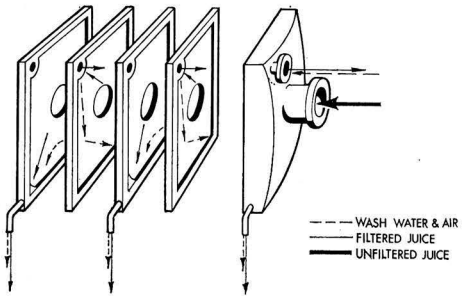

Fig. 1.

The advantages of this working method are: no leaking cocks, no maintenance costs for cocks, and less handling for the operator. The amount of wash water is predetermined and can be adjusted by a time clock. After washing the cake the remaining water is blown out with a burst of compressed air.

With the technological and technical experience gained in 1964 it was decided to install another 4 filter presses of this type. The 5 filter presses available for the 1965 season gave us a substantial part of our required filtering surface in good reliable filter presses. The improved results of the filter station were very significant. Recirculation of juice practically ceased because the older filters could be handled with more care. Clarification was much more regular and the number of men per shift could be reduced.

There was however one disturbing point, or rather two. The maximum working pressure for the new filters was limited to 2½–3 atm because the existing filter presses were still in use on the same juice circuit. The wash water circuit was common to both kinds of filter press and consequently sweetening-off of the new filter presses could not be accomplished properly. Installation of a separate water supply for the new filters improved matters greatly with regard to the washing of the filter cake.

In 1967, after the addition of another 2 filters, the total filtering surface was so great that the old filters hardly had to be used. During this season, however, we had favourable conditions with an unusual low juice draft. This allowed us during some periods to run the station practically with the new equipment only. During those periods the filters could be used at a higher working pressure (up to 5 atm) and the newly installed wash water pump allowed us to wash the filter cake adequately.

This higher working pressure and the larger quantity of wash water per wash period resulted in a considerable shortening of the time needed for a complete cycle. Consequently the amount of juice passing through each filter in 24 hours increased greatly.

The filters installed in previous years were all on the same hydraulic circuit. The 2 units installed in 1967 each had their own hydraulic system, complete with pump and safety devices. This added to the flexibility and the reliability of the station.

Table I shows the averages of 16 cycles recorded in 1964 with only one filter in operation.

Table I

Total cycle time	78 minutes
Filtration time	58 minutes
Washing time, including blowing with compressed air	11 minutes
Discharge	9 minutes
Juice per cycle	44 cu.m. (33·4 cu.m. per filter per hour)
Filter cake per total charge	2400 kg
Water per total charge	2240 kg = 93% cake or 5·1% juice
Pol % cake	1·27
Moisture % cake	36

Table II gives a comparison of juice quantities and total cycle times over some years, when the filtration was done with a different number of Choquenet filter presses.

Table II

	1964 *1 filter*	1965 *5 filters*	1967 *7 filters*
Total cycle time (minutes)	78	65	56
Washing time, including use of compressed air (minutes)	11	9½	4½
Juice per cycle (cu.m.)	44	40	42·9
Juice capacity (cu.m. per filter per hour)	33·4	36·9	45·9
Pol % cake	1·27		0·37
Men per shift	15	9	7

Table III gives details of a weekly run in the 1967 season.

In that particular week we were practically able to manage using only the new equipment. We therefore regard the results of this run as attainable values, although a certain amount of spare equipment must be available, especially to allow for cleaning of the filters.

With regard to this cleaning we have worked out a method of washing the filter cloths without removing them from the plates. The plates themselves are also left in the framework. In previous years we did some experiments and in 1967 arrangements were made to wash the cloths of all the new filters without removing anything. The washing is accomplished by circulating a solution of hydrochloric acid through the juice circuit (which of course is isolated), returning it through the water circuit. At 15-minute intervals the flow of the acid solution is reversed. An inhibitor is added to the hydrochloric acid solution. In this way the cleaning of a filter takes approximately 6 hours, depending on the amount of "dirt" to be removed. One filter is cleaned each day, which means that at present each filter is cleaned once a week. Halfway through the season the cloths are all removed once, to be washed in the normal way. With these arrangements, good filtrability of the cloth could be maintained and the discharging of the filter cake went well throughout the period of 5 weeks.

Table III

Date	Beet sliced, tons	Clarification: Raw juice, cu.m.	Milk of lime, cu.m.	1st Carb. juice, cu.m.	CaO % beet	1st Carbonatation filters discharged: Choquenet	Old	Cycle, min	Filter cake: Yield tons	Yield % beet	Dry matter %	Sugar content % cake	Sugar content % beet
16.11.67	7313	7740	114	7854	1·76	174	2	57	423	5·8	61·1	0·34	0·02
17.11.67	7240	7683	113	7796	1·75	182	7	53	452	6·2	64·1	0·29	0·02
18.11.67	7243	7673	113	7786	1·72	177	–	57	429	5·9	64·1	0·41	0·02
19.11.67	7253	7724	113	7837	1·72	186	2	54	454	6·3	64·4	0·29	0·02
20.11.67	7252	7723	113	7836	1·76	179	–	56	434	6·0	65·1	0·50	0·03
21.11.67	7251	7568	113	7681	1·73	177	2	56	432	6·0	64·0	0·44	0·03
22.11.67	7150	7535	112	7647	1·75	177	5	55	412	5·8	64·4	0·33	0·02
16-22.11.67	50705	53646	791	54437	1·74	1252	18	56	3035	6·0	63·9	0·37	0·022
	% beet	105·8	1·6	107·4									

Date	Wash water: total cu.m.	total % beet	per filter cu.m.	per filter % cake
16.11.67	336	4·6	1·91	78
17.11.67	365	5·0	1·93	81
18.11.67	315	4·3	1·78	73
19.11.67	357	4·9	1·90	79
20.11.67	358	4·9	2·00	82
21.11.67	334	4·6	1·86	77
22.11.67	349	4·9	1·92	85
16-22.11.67	2414	4·8	1·90	80

A further extension of the filter station with three more filter presses will give a total filtering surface of 1100 sq. metres which will probably be sufficient to handle all the juice even when the juice draft is somewhat greater than in the 1967 season. In the near future, the 2nd carbonatation filtration will be modernized, the 1st carbonatation filtration will be completely mechanized and the juice flow regulated. It should then not be difficult to run both stations with 2–3 men per shift and pass the juice through both filtrations in a continuous flow.

The use of plastic streamers to identify cane stalks

By A. C. ARVIER (Queensland Rural Division, I.C.I.A.N.Z. Ltd.)

THE problem of marking plot boundaries in sugar cane has irritated trial workers and experimentalists since the earliest days of field research with this crop. With "conventional" materials, e.g. metal or wooden pegs, the problem is mainly one of the prior organization required to prepare these items in adequate size and sufficient number. Then follows the task of painting the pegs a distinctive colour or pattern of colours for ready recognition against a confused shaded background of stalks, senile leaves and trash. Finally there is the laborious task of carrying bundles of pegs through the crop. If the soil is hard, additional equipment such as a hammer or tomahawk may be needed to drive the pegs firmly into the ground.

With sugar cane in Queensland a peculiar additional problem is posed—the crop is burned prior to harvest. Both metal and wooden pegs are usually neither destroyed nor distorted; however heat and a blanket of grey ash can affect the colour and surface of the painted faces of these types of markers, often rendering them indistinct as well as hard to identify. Theoretically this should not be much of a problem for the experimental worker on foot, with time available to restore obscure or missing pegs to identify his plots after burning. On the other hand the consequences can be serious if the pegs are not recovered and removed after the experimental cane has been evaluated or harvested, as neither cane knives nor the blades of a mechanical harvester can cut through hardwood or steel wire pegs without incurring damage! Pegs, entire or otherwise, that remain after harvest then constitute a hazard to cultivation equipment and tractor tyres during subsequent tillage operations.

THE USE OF PLASTIC STREAMERS TO IDENTIFY CANE STALKS

A distinctively coloured New Guinea cane 51NG142 provides a partial solution to the problem of defining plot boundaries. This cane is a thin purple-stemmed strain with attractive reddish leaves, features which contrast strongly with the stalk and leaf colours of commercial varieties. Provided plot dimensions of a trial can be decided before planting, 51NG142 can be included as a "living marker" to delineate plot boundaries. 51NG142 suffers none of the disadvantageous features of wooden or metal pegs; the only problem is the organization required to plant setts of 51NG142 in appropriate places when a trial plot is established.

If a *growing* stand of sugar cane is selected for an experiment, it is obviously too late to employ 51NG142 as a marker. However the advent of polyethylene as coloured film for covering bunches of bananas has now provided the means for marking stalks in a growing crop. It is fortunate that blue is the standard colour for polyethylene banana bunch covers, as strips of this film stand out in sharp contrast against a background of cane stalks and trash, even in semishade. Strips of film a couple of inches wide tied two or three times around a stalk will usually suffice, if strips 18–24 inches long are used. This length normally allows a hand stapler to be used, or a reef knot to be tied, with adequate loose material to hang free to attract attention. This film strip tied around the stalk will melt when the cane is burned; some material falls to the ground, but enough remains to form an inseparable bond with the rind of the stalk, and is still easily discerned by colour contrast against the grey background of burnt cane.

Fig. 1. Before burning

Fig. 2. After burning

Pegs will still be required in *young* plant or ratoon cane, but these can be replaced with strips of blue film as the cane grows taller, and access to the mature stalk becomes possible.

A reference plan of an experiment on paper is always necessary for record purposes, and correlation of plots marked with plastic film is required. Until the cane is burned, positive field identification of specific treatments can be undertaken by the use of felt marking pens and spirit-soluble ink. Otherwise simple multiples of blue strips are suggested, or even the different placement of strips—knee high, waist high, and so on, provided the cane stalks are long enough. Fusion of the coloured film into the rind of the stalk after burning is the essential safeguard.

In summary, polyethylene banana bunch cover material may be used to identify experimental plots of growing sugar cane. From a virtually weightless bundle of strips carried through the belt, stalks can be marked quickly and cheaply with the minimum of effort, with reasonable certainty that plot boundaries can still be identified after burning, and without danger to tractor tyres, cultivation equipment or harvester knives. The present cost in Australia of blue banana bunch cover tubular material, specified as 0·002 in thick, 28 in lay-flat width, in rolls 100 yards long, is almost 4 Australian cents per square yard. This is enough to label 36 stalks if strips $1\frac{1}{2}$ in $\times$ 24 in are used, i.e. a material outlay of one cent to label nine stalks.

Summary

Pegs of metal or wood are normally used to mark the boundaries of experimental plots in sugar cane. If an experiment is designed before planting, setts of a distinctively coloured "marker" variety may be planted in appropriate places. In ratoon or established plant cane, this technique cannot be used, and an acceptable method is to use blue plastic streamers. With scissors or a pocket knife, strips can be cut quickly from conventional blue polyethylene film, as manufactured for banana bunch covers. These strips should measure approximately $1\frac{1}{2}$ inches wide and 12–18 inches long, and may be stapled or tied around mature cane stalks. Such plastic strips weight virtually nothing, are only a fraction of the cost of wooden or metal markers, require little or no stooping to place in position, and can be seen easily from a distance of several yards inside cane. After burning, the blue plastic melts into the rind of the cane stalk, and stems so marked can be identified with little difficulty. Particularly important to the farmer is the elimination of hazards associated with misplaced metal or wooden pegs, namely the risk of damaging knives or tractor tyres at harvest, and during subsequent cultivations.

Statistical characterization of phospho-defecation of cane juice

By A. J. MACRITCHIE and R. M. MORRIS

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Introduction

THE presence of starch in cane juice has a pronounced effect on the viscosity of syrup and molasses and on the filtrability of raw sugars. With the relatively high starch content of South African canes, recourse has been made by the industry to the use of a vacuum flotation technique for the separation of muds from the clarified juice after low temperature phospho-defecation. It is desirable, therefore, to initiate a closer study of the mechanism by which the removal takes place and the effect of the process variables, both chemical and physical, on this removal.

BENNETT[1] has demonstrated that flocs formed in a clarification process should be regarded as clusters of particles bound together in a matrix of precipitated phosphate. The flocculation process is not accompanied by any appreciable change in zeta potential and is almost irrespective of the zeta potential. A special relationship must exist therefore between the precipitated calcium phosphate and the particles in the cane juice. It is suggested[2] that adhesion of particles to the phosphate precipitate takes place through calcium ions which are already chemically bound to the particle by an adsorbed protein layer. Flocculation in cane juice by calcium phosphate precipitation is therefore dependent upon the existence at the particle surface of a substance which will form complexes with calcium ions, and this provides a possible mechanism by which different juices show different responses to calcium phosphate precipitation[3]. In particle exchange experiments[2] it was demonstrated that the extreme abnormalities in a juice giving rise to refractoriness are associated with materials adsorbed from the continuous phase.

It is clearly pertinent then to examine the constituents of the continuous phase to identify key variables in the process. It is also plausible that, with the control being exercised by these constituents, a correlation will exist between these key variables and the turbidity of the clarified juice. With the increasing trend in the sugar industry towards complete automation, a characterizing function which will afford a means of predicting the turbidity of a clarified juice from a knowledge of the process variables will become necessary for automatic control in clarification. A function of this type will also assist in obtaining a better understanding of the clarification process, help in optimizing the performance of related equipment, and help in identifying the cause of refractoriness.

A statistical assessment of some variables in low temperature phospho-defecation is reported in this paper.

Experimental

Criterion

At the outset the relationship between starch content and turbidity (measured in a one-centimetre cell at 900 nm) was tested within a single variety on a series of clarified juices which had been obtained after cold clarification, settling and decanting. A correlation coefficient of 0·85 was obtained and the results are tabulated in Table I. Turbidity, as measured above, was therefore used as the dependent variable in this investigation.

Table I

Starch mg/litre	*Turbidity* (900 *nm*)
9·56	0·170
9·56	0·098
8·00	0·164
7·96	0·073
17·60	0·278
1·60	0·073
4·80	0·124
3·20	0·041
17·56	0·305
14·40	0·298
12·80	0·115
8·00	0·106

Clarification

Cane from the Mount Edgecombe Experiment Station was crushed in a pilot plant three-roller mill, and the juice was diluted to a standard 15° Brix. The mixed juice was analysed for total calcium, total magnesium and inorganic phosphate. In each run one litre of juice was heated to 60°C, this temperature being chosen midway between the range 55°C to 65°C, since above about 55°C the bacteria responsible for the inversion of sucrose are no longer viable while above 65°C starch gelatinization occurs. It has been established in a previous investigation[4] that the temperature was consistently totally insignificant over this range.

Phosphate was added as a saturated mono-calcium phosphate solution to raise the P_2O_5 level of the juice to some preset level. Calcium and magnesium were then added as calcium saccharate and magnesium chloride respectively, raising the Ca^{++} level and Mg^{++} level to preset values. The pH of the juice was adjusted using dilute hydrochloric acid or sodium hydroxide and flocculant (a 0·05% solution of a polyelectrolyte, type B.T.I.150) was added. One of two levels of agitation was used corresponding to either gentle

[1] *I.S.J.*, 1957, **59**, 208.
[2] BENNETT: *I.S.J.*, 1959, **61**, 77.
[3] *idem*: *Chem. and Ind.*, 1959, 1380.
[4] MORRIS and MACRITCHIE: *Internal Report, S.M.R.I.*, April 1967.

or violent mixing using a 2-inch diameter 3-bladed propeller. Throughout the period from heating to flocculation, the juice was stirred at a constant speed and for a constant time.

Range of Variables

A phosphate level of about 300 mg P_2O_5/litre is generally accepted as an optimum for clarification. A range of approximately 150 mg P_2O_5/litre above and below this optimum would therefore ensure a rigorous test of the effect of this variable. Calcium levels were chosen on the basis that they were in the range of the desired pH levels and would thus require little adjustment with acid or alkali to achieve the desired pH. The levels of the remaining variable—pH, Mg^{++} concentration, amount of flocculant and degree of mixing—were chosen to be in the region of practical interest but sufficiently far apart that their effects would be discernable.

It is demonstrated later that degree of mixing is significant and the effect of this parameter has been assessed as a power function, N^3D^5. A certain minimum number of dummy variables are necessary in the statistical technique used to assess the error variance.

Statistical Design and Evaluation

The classical method, studying one variable at a time while holding all others constant, is extremely inefficient in many cases especially where multi-variable screening is required. A multifactor screening technique has been treated by PLACKETT and BURMAN[5] and involves the confounding of main effects with two factor interactions. Consideration was not given to the second order interactions in this work owing to the extremely low probability of second order significance compared with first order significance. In this way a restricted number of experiments are necessary and yet a first order measure of the effect of a variable is ensured. Two levels of the variable are used, a high and a low level. The design consists of twelve experiments with eleven variables of which four were dummies to enable the error variance to be evaluated.

The following variables were treated: pH, total calcium, total magnesium, inorganic phosphate, degree of mixing, amount of flocculant and the variety of the cane. In this way the significance of each independent variable could be tested and, more especially, the refractory cane types could be identified. The latter is effected by raising the level of independent variables to a preset total value with all other inherent differences between cane types being regarded in the category, "variety of cane". A refractory cane would on analysis show a high significance of "variety of cane" when tested against a known normal cane.

Multiple non-linear regressions were developed according to standard techniques and the results were evaluated on an IBM 1620 computer

Table II shows a PLACKETT-BURMAN matrix for determining the effect of seven real variables and four dummy variables at two levels using twelve different combinations of conditions.

Table II. Plackett-Burman Matrix for 12 experiments

Expt. No.	$[P_2O_5^=]$	d_1	$[Ca^{++}]$	pH	d_2	d_3	floc	d_4	variety	$[Mg^{++}]$	$[N^3D^5]$
1	+	+	−	+	+	+	−	−	−	+	−
2	+	−	+	+	+	−	−	−	+	−	+
3	−	+	+	+	−	−	−	+	−	+	+
4	+	+	+	−	−	−	+	−	+	+	−
5	+	+	−	−	−	+	−	+	+	−	+
6	+	−	−	−	+	−	+	+	−	+	+
7	−	−	−	+	−	+	+	−	+	+	+
8	−	−	+	−	+	+	−	+	+	+	−
9	−	+	−	+	+	−	+	+	+	−	−
10	+	−	+	+	−	+	+	+	−	−	−
11	−	+	+	−	+	+	+	−	−	−	+
12	−	−	−	−	−	−	−	−	−	−	−

+ = high level − = low level

RESULTS

Three juice types obtained from N:Co 376, N:Co 310 and Co 331 cane varieties were used in this investigation which comprised eleven separate designs. The levels of each variable are indicated in Table III together with the pairs of cane types used. Table IV shows the level of significance of each variable and the standard error. From Table IV it can be seen that few variables except pH retain consistent levels of significance throughout the investigation. This implies a variability of effect within a variable. It is pertinent to point out, however, that the range of some of the variables, as seen in Table III, is part of a fairly large spectrum and may be located in a region of lesser or greater significance. Notwithstanding this variability, a general impression of the significance of each variable can be achieved and a refractory-tending type of cane may be identified. It is seen in Table IV that the cane variety is not significant in tests between types N:Co 376 and N:Co 310 except in design 3 where the variables tested have not been dosed up to the same starting level. In contrast, tests involving types Co 331 and, say, N:Co 376, for example, designs 6 and 7 which are carried out on juices from the same batch of cane, show a significance of "variety" even where the juices have been dosed up to the same starting level. It was deemed to be unnecessary at this stage to investigate the behaviour

[5] *Biometrika*, 1946, **33**, 305.

between juices from types N:Co 310 and Co 331 cane varieties since it has been demonstrated that the dissimilarity between types N:Co 310 and N:Co 376 can be overridden by correct dosing and the results with type N:Co 310 should be the same as with N:Co 376. In confirmatory tests, designs 9, 10 and 11 carried out three months later, it was demonstrated that this deduction was in fact valid.

From the extremely high levels of significance and conversely low standard errors in relation to the main effects, the results would afford a good basis for a multiple non-linear regression. Polynomials of various degrees in the independent variables were fitted to the experimental points but three correlations evaluated according to the form

$$T = e^{a}\,[\mathrm{pH}]^{b}\,[Ca^{++}]^{c}\,[Mg^{++}]^{d}\,[P_2O_5]^{e}\,[\mathrm{floc}]^{f}\,[P]^{g}$$

gave the best fit and the exponents on each variable and the overall confidence level of the correlations are tabulated in Table V.

Correlations 1 and 2 are for cane types Co 331 and N:Co 376, respectively, where results were taken from experiments in which the cane variety proved highly significant. In this way two dissimilar varieties are ensured, one presumably refractory and one normal. The signs of the exponent on magnesium are different in each correlation. The prositive sign, as in the case of type Co 331, implies an increase in turbidity of the clarified juice with an increase in the Mg^{++} concentration. The negative sign for type N:Co 376 is what would be expected. Whilst magnesium is significant in the regression analyses within a variety it is insignificant in the PLACKETT-BURMAN analysis between the varieties in certain comparisons since the exponents on $[Mg^{++}]$ in the regressions are equal in magnitude but opposite in sign.

Accepting BENNETT's hypothesis[2] that colloids are entrapped in the calcium phosphate floc, it appears therefore that the magnesium ions interfere with the formation of an effective floc matrix, leaving a high level of residual colloid in the clarified juice. This could occur by preferential complexing of Mg^{++} ions over Ca^{++} ions at the particle surface. One possibility is the formation of a magnesium ammonium phosphate type precipitate, $Mg(NH_4)PO_4, 6H_2O$, giving a more crystalline floc. Since the Mg^{++} concentrations were adjusted before experimentation to the same levels in both juices it must be concluded that the amount of proteinaceous material

Table III. Upper and lower levels of variables

Design No.	1		2		3	
	+	—	+	—	+	—
$[P_2O_5]$ mg/litre	300	200	428	120	328*	120*
					400†	192†
$[Ca^{++}]$ mg/litre	711	364	642	335	688*	352*
					681†	345†
pH	9·5	7·0	9·5	7·0	9·5	7·0
Floc, mg/litre	7·0	2·0	7·0	2·0	7·0	2·0
Variety	310	376	310	376	310	376
Power (N^3D^5)	16090	3473	16090	3473	16090	3473
$[Mg^{++}]$ mg/litre	396	396	310	294	310	294

4		5		6		7	
+	—	+	—	+	—	+	—
300	200	144‡	44‡	359‡	259‡	359	259
		206†	106†	470†	370†		
700	350	762‡	426‡	660‡	576‡	500	300
		704†	368†	581†	497†		
9·5	7·0	9·5	7·0	9·5	7·0	9·5	7·0
7·0	2·0	7·0	2·0	7·0	2·0	7·0	2·0
331	376	331	376	331	376	331	376
16090	3473	16090	3473	16090	3473	6784	6784
547	390	547	390	476	314	497	397

8		9		10		11	
+	—	+	—	+	—	+	—
300	200	500	350	300	150	500	350
700	500	500	250	500	250	500	250
9·5	7·0	9·5	7·0	9·5	7·0	9·5	7·0
7·0	2·0	7·0	2·0	7·0	2·0	7·0	2·0
331	376	331	376	331	310	376	310
6784	6784	16090	3473	16090	3473	16090	3473
397	269	800	650	1000	850	800	650

NOTES: Runs 3, 5, 6—constant amounts of Ca^{++}, P_2O_5 added to both juices to effect high and low levels. Mg^{++} levels unaltered.

Runs 1, 2, 4, 7, 8—concentrations of variables raised to same level. Mg^{++} level unaltered except in Runs 7, 8 where raised to same level.

Runs 9, 10, 11—confirmatory runs, three months later. Mg^{++} and all other variables raised to same level.

+, — signifies high and low levels respectively
* „ „ or „ level for type N:Co 310
† „ „ „ „ „ „ „ N:Co 376
‡ „ „ „ „ „ „ „ Co 331

Table IV. Confidence levels

Design No.:	1	2	3	4	5	6	7	8	9	10	11
Variable											
P_2O_5	97·5	95	80	97·5	97·5	70	95	80	80	90	—
Ca^{++}	90	80	70	97·5	80	80	55	75	95	85	80
pH	99	97·5	97·5	99·5	90	99	90	97·5	99·5	99·5	99
Flocculant	90	75	95	95	80	95	60	90	95	85	80
Variety	75	60	99	80	80	99·5	97·5	99	99	90	60
Agitation	95	97·5	60	99·5	75	99·5	—	—	97·5	80	90
Mg^{++}	—	—	—	—	—	—	60	70	95	85	60
Standard error	0·041	0·072	0·031	0·027	0·118	0·057	0·058	0·036	0·029	0·057	0·040

Table V. Exponents in Correlation

No.	*Type*	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*Regression Level*
1	331	—4·75	—0·84	—0·30	2·71	—0·93	—0·30	—0·41	90%
2	376	32·30	—3·32	—1·90	—2·74	—	—	—	99%
3	376/310/331	14·42	—2·50	—0·78	0·03	—0·64	—0·64	—0·32	99%

taking part in such complexing would be adsorbed on the colloid to a greater extent in the case of type Co 331. This investigation is being continued.

A third correlation, number 3, is presented and is an ensemble of all clarification tests carried out over design numbers 1 to 8. The cane types appear in the ratio 8:3:5 for N:Co 376, N:Co 310 and Co 331 with a total of 96 separate turbidity measurements. Table V illustrates the accuracy of this prediction technique.

In pactice, for control or systems analysis, each mill would develop an appropriate correlation with the correct cane ratios. From past annual summaries[6] of cane varieties it appears that these ratios remain sufficiently constant from month to month for a correlation to be sufficiently versatile and therefore adequate for automatic control.

NOMENCLATURE

D .... diameter of propeller, ft.
N .... speed of propeller, r.p.m.
P .... power function N^3D^5.
T .... turbidity at 900 nm.

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The authors acknowledge with thanks the assistance of the Mount Edgecombe Experiment Station in supplying cane for this investigation. Thanks also are due to the staff of the University of Natal Computer Centre for their assistance in the regression analysis.

SUMMARY

It was demonstrated, using a fractional factorial design technique, that the juices of the cane types N:Co 376 and N:Co 310 behave similarly in clarification once adjustment of the calcium and inorganic phosphate levels and pH are made to some preset values. With the juices from cane types Co 331 and N:Co 376 it was not possible to override the inherent dissimilarity in the canes, even with chemical dosing to similar levels. From multivariable non-linear regressions obtained for these two cane types there is a strong indication that magnesium ions are responsible for the refractory behaviour of Co 331 cane type and an explanation of this finding is proposed. An ensemble correlation

$$T = 1{\cdot}78 \times 10^6 (\mathrm{pH})^{-2{\cdot}5} [Ca^{++}]^{-0{\cdot}78} [Mg^{++}]^{0{\cdot}03} [P_2O_5]^{-0{\cdot}64} (\mathrm{floc})^{-0{\cdot}07} (P)^{-0{\cdot}32}$$

of the three types N:Co 376, N: Co 310 and Co 331 was evaluated and its 99% confidence level affords an accurate guide in the prediction of clarified juice turbidity from a knowledge of the process variables. Such a characterizing function may assist in the trend towards complete automation of cold clarification processes.

[6] PERK: *Proc. 41st Congr. S. African Sugar Tech. Assoc.*, 1967, 1–2

Sugar cane in Liberia

LITTLE is known concerning the early introduction of sugar cane to Liberia or of its cultivation in that country where it has never been grown on extensive or plantation lines for the production of commercial sugar. It is generally thought that sugar cane was introduced to Liberia from the Canary Islands by the Portuguese in the seventeenth century. For several centuries it has remained in cultivation on a small scale by the inhabitants for their own domestic use, the climatic conditions being well suited to it.

The country is well watered with several rivers running from the mainly elevated interior to the coast. Unlike some other parts of West Africa, there are no extensive lagoons along the coast. Rainfall is liberal, being about 150 inches in the western half of the country and 100 inches in the eastern half.

Recently a detailed account of sugar cane cultivation as it exists up and down the country has been given by Dr. STEFAN VON GNIELINSKI, Professor of Geography in the University of Liberia at Monrovia[1]. He points out that the warm and humid climate with liberal rainfall favours the growth of sugar cane. It is usually grown in small patches by the inhabitants, especially in the river valleys and near streams. Cultivation is not normally of a very high standard and yields are not as high as they could be. The soils are often leached and acidic but still fairly productive as far as sugar cane is concerned. There are farmers, however, who cultivate their cane well and obtain good yields.

At present sugar cane is grown mainly for the production of a fermented beverage or "beer" and the distillation of spirits or "rum", as is the case in some other parts of Africa and Malagasy (Madagascar). The question of establishing a modern sugar industry for factory-produced sugar has been considered. Difficulties that have to be faced are the small home market for sugar at present, little more than 5000 tons per annum, making it necessary to find export outlets to secure a stable market. Nevertheless it may well be that locally-produced sugar would automatically stimulate local consumption. Other drawbacks are the inaccessibility of many parts of the country, limited road facilities and high transport and other costs. Prof. VON GNIELINSKI considers that a start might be made by the Government initiating a co-operative movement among growers in a suitable area and establishing an open pan sulphitation white sugar plant of limited capacity so that Liberia could provide herself with locally-made white sugar.

F.N.H.

[1] The economic importance of sugar cane cultivation in Liberia. S. VON GNIELINSKI: *Zeitsch. Zuckerind.*, 1968, **93**, 70–75.

Sugar cane agriculture

Loss of soil nitrogen. ANON. *Producers' Rev.*, 1968, **58,** (1), 29.—It is pointed out that soil nitrogen losses take place in various ways such as leaching, crop removal, removal of animal products, erosion, fire, volatilization, denitrification and various unaccountable causes.

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Variations in the longevity of teleutospores of *Ustilago scitaminea*. K. SINGH, T. R. BUDHRAJA and A. LAL. *Indian Phytopath.*, 1966, **19,** 394–396; through *Rev. Appl. Mycology*, 1968, **47,** 122.—Longevity of cane smut spores was found to vary from 56 to 1306 days, depending on the collection, locality and sugar cane variety. This may suggest the existence of physiological strains of the fungus.

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Sugar cane in Tamil areas. E. ADICEM. *Inst. Franç. de Pondichery, Trav. Section Scient. Tech.*, 1967, **4,** (2), 1–134.—This is a general discussion of sugar cane cultivation and production in parts of southern India. The great increase in cultivation during the last 15 years is pointed out and the factors contributing to it discussed. Climate, soil, cultivation, irrigation and drainage, varieties of sugar cane grown, pests and diseases are covered.

* * *

Review and evaluation of current practices in rat control on Hawaiian sugar cane plantations. B. F. LOWERY. *Hawaiian Planters' Record*, 1967, **57,** 267–277.—The rat problem in Hawaiian cane fields is discussed, the problem having been re-evaluated in terms of species causing the most damage. New investigations on baits and toxicants and methods of applying them are reported on. The approval of the establishment of a field station in Hawaii for basic research on the ecology, physiology and control of rats is referred to.

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A technique for evaluating pre-emergence herbicides. H. W. HILTON. *Hawaiian Planters' Record*, 1967, **57,** 278–291.—Discussion revolves around: performance index technique, comparison of standard herbicides with each other, comparison of experimental herbicides with standards at 4 lb/acre, evaluation of herbicide combinations, the effect of application rate on performance, and measurement of crop tolerance as a tolerance index. "Ametryne" is the superior standard herbicide now in use on all islands except Hawaii where "Diuron" is superior. Of currently available new herbicides, the triazines, "Atratone" and GS-14254 show the maximum potential for improved weed control with minimum crop injury.

* * *

Effect of amount and timing on the fate of fertilizer nitrogen in lysimeter studies with ^{15}N. D. T. TAKAHASHI. *Hawaiian Planters' Record*, 1967, **57,** 292–309. Interesting facts and information on the utilization of nitrogen by the sugar cane plant by means of modern techniques are recorded. The merits of single *vs.* split applications of nitrogen are discussed in the light of data obtained. The importance of early application of adequate amounts of nitrogen fertilizer in order to obtain high yields became evident from the studies.

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Efficacy of fungicides against *Puccinia erianthi* **causing rust of sugar cane.** K. SINGH and M. C. MUTHAIYAM. *Paper presented to the 13th Congr. ISSCT*, 1968. This disease is important in some parts of India. Laboratory studies carried out to ascertain the protective and eradicative activity and duration of effectiveness of some fungicides are reported in this paper. The efficacies of certain copper, sulphur, nickel, "Thiram" and thiocarbamate fungicides were tested. A mixture of nickel sulphate and "Ferbam" proved to be the most effective.

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Vector-virus relationship of sugar cane mosaic virus. IV. Transmission of sugar cane mosaic virus by the sowthistle aphid, *Hyperomyzus lactucae*. N. ZUMMO and L. J. CHARPENTIER. *Paper presented to the 13th Congr. ISSCT*, 1968.—Laboratory transmission studies are reported. This aphid is more or less cosmopolitan as is the sowthistle itself (*Sonchus*), a common weed. It was found that aphids could become viruliferous within 15 minutes after being placed on mosaic-infected plants and transmitted the disease after 15 minutes on a healthy cane plant. Ability to transmit is lost one hour after removal from infected plants. Young sugar cane plants were more susceptible than older plants.

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Studies of downy mildew disease of sugar cane in Taiwan. H. T. CHU. *Paper presented to the 13th Congr. ISSCT*, 1968.—This disease (*Sclerospora sacchari*) is one of the most serious of the 50 or so cane diseases known to occur in Taiwan. A comprehensive account of the disease is given in 4 parts—a historical review of its prevalence, research results, control measures and variety resistance testing.

Studies on sugar cane mosaic in Louisiana. R. PERDOMO and I. L. FORBES. *Paper presented to the 13th Congr. ISSCT*, 1968.—Work is reported aimed at discovering additional sugar cane varieties that could be used instead of either of the two current differential host varieties in identifying strains of sugar cane mosaic virus. It was found that a change of temperature could induce symptom change or cause symptoms to disappear. If the original temperature was restored the symptoms would re-appear.

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The two gumming diseases of sugar cane. R. ANTOINE. *Paper presented to the 13th Congr. ISSCT*, 1968.—The history of gumming disease of sugar cane throughout the world is discussed and its special significance to Mauritius and Réunion pointed out. The belief that the disease originated from palms is discounted. The two strains of gummosis now known in Mauritius are described. The development and increased planting of resistant varieties in Mauritius is described, the total area having risen from 31% to 51% in less than 3 years.

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Investigations on the systemic infection of gumming disease. C. RICAUD. *Paper presented to the 13th Congr. ISSCT*, 1968.—Gummosis or gumming disease, caused by a bacterium, *Xanthomonas vasculorum*, is one of the most serious diseases of sugar cane. Control depends solely on the cultivation of resistant varieties. This paper deals with some aspects of the chlorotic symptom in relation to the development of the disease and its effect on the tolerant carrier variety M 147/44.

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Other papers presented to the Pathology or Sugar Cane Diseases Section of the 13th Congress of the ISSCT, 1968, were:

Varietal resistance trials for eye spot disease (*Helminthosporium sacchari*). S. OSADA and S. FLORES.

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The rôle of the rhizosphere microflora in the resistance of sugar cane to *Phythium* root rot. K. V. SRINIVASAN.

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Effects on cane of heat treatment as applied to the control of ratoon stunting disease of sugar cane. M. HOARAU.

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Evaluation of the aluminium-cap method for leaf scald disease resistance testing in Queensland. B. T. EGAN.

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The effect of temperature on various aspects of the development, occurrence and pathogenicity of *Helminthosporium stenospilum* and *Helminthosporium sacchari* in Puerto Rico. L. J. LIU.

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Ratoon stunting disease control in Taiwan. H. T. CHU and S. M. LEE.

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A note on disease resistance ratings for sugar cane varieties. P. B. HUTCHINSON.

Control of sugar cane mosaic in Louisiana by a new roguing technique. R. J. STEIB and S. J. P. CHILTON.

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Studies on sugar cane white leaf disease of Taiwan, with special reference to transmission by a leafhopper, *Epitettix hiroglyphicus*. T. MATSUMOTO, C. S. LEE and W. S. TENG.

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Red rot infection and its development in young sugar cane plants. G. R. SINGH.

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Nematode investigations in sugar cane fields in Taiwan and effects of soil fumigation. C. H. HU, T. K. TSAI and H. T. CHU.

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Occurrence of physiological races of *Helminthosporium stenospilum* in Puerto Rico. L. J. LIU.

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Heterokaryosis in *Colletotrichum falcatum*. P. DE C. T. DE CARVALHO.

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Yield decline of H37-1933 in Hawaii. J. N. WARNER.

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Studies on yellow spot disease (*Cercospora koepkei*) **of sugar cane.** P. PRAKASAM and V. SATYANARAYANA.

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Production of the sexual stage of *Ceratocystis paradoxa* on sugar cane. T. T. KUO, M. M. CHIEN and H. W. LI.

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Breeding sugar cane varieties for the northern Caribbean. G. ARCENEAUX. *Paper presented to the 13th Congr. ISSCT*, 1968.—An outline is given of the breeding work now being carried out in some of the northern Caribbean cane growing countries and the use being made of high-altitude stations to induce flowering. The area concerned accounts for a substantial part of the world's sugar cane, but so far it has depended largely on outside sources for its cultivated varieties. Reasons for this are given.

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Collecting wild cane in Taiwan. C. C. LO and S. SUN. *Paper presented to the 13th Congr. ISSCT*, 1968. An account is given of wild types or clones of *Saccharum spontaneum* throughout Taiwan in 1966. Propagating material of 138 clones was collected, of which 126 survived removal and transport and were established. Most (95%) were collected at altitudes below 300 m. Only one clone was found above 700 m. Most clones were found growing near water, especially along the banks of rivers and streams; many were from dry river beds.

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A history of major Louisiana sugar cane varieties. R. J. MATHERNE. *Paper presented to the 13th Congr. ISSCT*, 1968.—Sugar cane was first planted in Louisiana in 1751 but the identity of the early introductions is uncertain. For a long time noble canes

only were grown, such as Creole, Otaheite, Purple, Purple Striped, La Pice, Palfrey and Purple Elephant. By major canes the author means those planted on at least 15% of the acreage. Creole was a major variety for 100 years. Some details are given of major varieties grown up to the present time.

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Breeding of sugar cane varieties in Mauritius. J. A. LALOUETTE. *Paper presented to the 13th Congr. ISSCT*, 1968.—This paper reviews the changes that have taken place in sugar cane breeding in Mauritius in recent years and indicates the lines along which the production of new commercial cane varieties are being developed. The establishment in 1966 of equipment to mechanize data processing, i.e. a punched card system, has greatly assisted selection work.

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The rôle of leaves in the perception and inhibition of the flowering stimulus in sugar cane. R. JULIEN. *Paper presented to the 13th Congr. ISSCT*, 1968.—Experiments in Mauritius were carried out (on the variety US 4834) to determine the effect of the removal of selected leaves on flowering response in cane. Removal of leaves 3 and 4 resulted in earlier flowering when compared with undefoliated controls. Removal of spindle or leaf 1 or 2 resulted in delay and reduced intensity of emergence of the inflorescences. It was considered that the inhibitory effect of lower leaves on flowering can best be interpreted by assuming that the lower leaves produce a transmissable inhibitor which prevents growth of the inflorescence.

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Sugar cane breeding in Taiwan. C. S. LOH. *Paper presented to the 13th Congr. ISSCT*, 1968.—Sugar cane breeding in Taiwan on modern or scientific lines commenced in 1932 with the establishment of the Taiwan Sugar Experiment Station. Owing to the hazards of high winds and typhoons, breeding for wind resistance (necessitating the use of hard and not soft stemmed canes) has always been an important consideration. The variety PT 43-52 was important in this connexion. Work carried out or in progress in breeding for disease resistance is discussed, the diseases in question being mosaic, red rot, yellow spot, downy mildew and leaf scorch.

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Other papers presented to the Sugar Cane Breeding Section of the 13th Congress of the ISSCT, 1968, were:

The determination of fibre in new varieties of cane. P. N. STEWART.

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Sugar cane breeding—retrospect and prospect. C. S. LOH.

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Evaluation of germ plasm in the USDA sugar cane programme at Houma, Louisiana. P. H. DUNCKELMAN and R. D. BREAUX.

Milling quality of sugar cane varieties in Louisiana and Florida. L. P. HEBERT and L. G. DAVIDSON.

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The genetic basis for starch content in sugar cane. D. M. HOGARTH.

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Chromosome numbers in miscellaneous clones of *Saccharum* and allied genera. S. PRICE.

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***Saccharum* names and their interpretation.** C. O. GRASSL.

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List of varieties in the world reference collection of sugar cane at Canal Point, Florida, 1967. B. A. BELCHER.

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Breeding for resistance to sugar cane mosaic with interspecific hybrids. R. D. BREAUX and P. H. DUNCKELMAN.

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Cytological studies in *Saccharum*. 1. Chromosome transmission in interspecific crosses. B. T. ROACH.

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Quantitative effects of hybridization in *Saccharum officinarum* × *Saccharum spontaneum* crosses. B. T. ROACH.

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The use of chemical mutagens in sugar cane. N. HRISHI, S. MARIMUTHAMMAL and S. J. SALVANATHAN.

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Cytogenic studies in *Narenga porphyrocoma*. II. Study of self-incompatibility. D. JAGATHESAN and T. V. SREENIVASAN.

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***Saccharum* × *Bambusa* hybridization. Studies on the development of the hybrid embryo.** J. T. RAO, M. P. ALEXANDER and P. A. KANDASAMI.

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A study of the transmission of some important characteristics of Taiwan originated wild cane (*Saccharum spontaneum*). K. C. SHANG, P. Y. JUANG, T. L. CHU and S. T. HUANG.

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Germ plasm evaluation in sugar cane. I. Foreign hybrid varieties (Barbados, Queensland and USA). P. SANKARANARAYANAN, T. N. KRISHNAMURTHY and C. S. RAO.

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Breeding to develop improved varieties. J. T. RAO.

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Report of the Standing Committee on Germplasm and Breeding. ANON.

Effects of combined silicon and gibberellic acid on enzyme behaviour and sucrose content of immature sugar cane. A. G. ALEXANDER. *Paper presented to the 13th Congr. ISSCT*, 1968.—The fact that investigations in both Hawaii and Australia have shown that gibberellic acid and silicon affect sucrose production by sugar cane is discussed. An account is given of recent sand culture experiments in Puerto Rico with young sugar cane plants suggesting direct relationship of gibberellin and silicon with sucrose synthesis. Results showed that both gibberellin and silicon can affect sucrose production and storage as independent entities and when combined they can further increase sucrose to levels unattainable by either factor acting alone, relatively small amounts being needed. Indications are that oxidative and hydrolytic enzymes are involved in bringing about sugar changes, and that sufficient gibberellin and silicon can be provided through the foliage to accomplish these functions.

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The influence of variable manganese and silicon on the nutrition, sugar production and enzyme activity of immature sugar cane. G. SAMUELS and A. G. ALEXANDER. *Paper presented to the 13th Congr. ISSCT*, 1968.—The little-known but important function of silicon and manganese in the sugar cane plant is discussed and results of recent experiments outlined. Although absorption of only minute quantities of silicon will permit normal cane development, large quantities are usually taken up, sugar cane absorbing more silicon than any other mineral.

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Graduated delay of flowering in sugar cane with 11·5-hour dark periods. N. I. JAMES. *Paper presented to 13th Congr. ISSCT*, 1968.—The flowering of sugar cane varieties at Canal Point and its synchronization for breeding or pollination purposes is discussed. Work on early, mid-season and late varieties is considered, one of the objects being to ascertain whether sufficient delay could be obtained with early varieties to render crossing with late varieties possible. This was found to be so.

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On sugar cane leaf sampling for foliar diagnosis. P. HANUMANTHA and M. LAKSHMIKANTHAM. *Paper presented to the 13th Congr. ISSCT*, 1968.—Tissue diagnosis techniques employed in different countries to assess the nutritional requirements of sugar cane are discussed and the results given of recent investigations in India. The variability of nutrient composition of 6-in sub-sections of 3–6 leaves was estimated in respect of N, P, K, Ca and Mg. The level of N increased from the base towards the tip of the leaf. The level of P reached its maximum near the centre of the leaf. With K the maximum was near the base of the leaf and declined towards the tip while the reverse applied with Ca. Mg did not disclose any specific trend. The studies indicated the need for precise sampling.

A further assessment of nursery-raising and transplanting sugar cane. R. R. PANJE and P. S. GILL. *Paper presented to the 13th Congr. ISSCT*, 1968.—An account is given of further field experiments in utilizing "slip-setts" in sugar cane planting, these being setts rooted in nurseries in a mixture of sand and farmyard manure. The principal benefit was that it helped to extend the total growing season of the crop without keeping the field occupied. Yield increase was commensurate with the increase in the life span of the crop. It is thought that the technique could be mechanized to reduce labour.

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The effect of some soil sterilants on the nitrogen nutrition of sugar cane. S. C. SRIVASTAVA and A. K. GHOSH. *Paper presented to the 13th Congr. ISSCT*, 1968.—The belief and experience that the use of certain soil sterilizers results in increased nitrogen availability to the cane plant (with resulting increase in yield) through an inhibitory effect on soil nitrifiers was tested by controlled experiments. An account of these is given. The soil sterilants used were gamma-BHC, "Telodrin" and DD, while "N-Serve 24E" was used as a standard nitrification inhibitor. Results confirmed the belief already held.

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On raising sugar cane and sugar beet as intercrops in the subtropics. P. S. GILL. *Paper presented to the 13th Congr. ISSCT*, 1968.—With the increase in intercropping of sugar cane with other crops now taking place in many countries besides Taiwan, experiments were carried out in intercropping sugar cane with sugar beet. These were conducted at Lucknow in 1964-66 with October-planted sugar cane. Results, which were quite favourable, are discussed in terms of yield.

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Effects of trash burning on the temperature and microbial population of the soil. F. A. FOGLIATA. *Paper presented to the 13th Congr. ISSCT*, 1968. Results of experiments in Tucumán showed that soil temperatures in the top 5 cm of soil during trash burning did not alter very much or were not raised sufficiently to alter significantly the biological balance of the microflora of the soil or affect the nitrifying bacteria present. The writer advocates that trash be burned at the time of day when soil temperatures are as low as possible.

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Pre-emergence weed control in sugar cane with some substituted urea and uracil herbicides. W. N. L. DAVIES and K. HAKIM. *Paper presented to the 13th Congr. ISSCT*, 1968.—Experiments with a wide range of modern herbicides under Trinidad conditions are recorded. "Sinbar" and "EH 767" gave excellent control, especially when applied in combination with "Diuron". They were toxic to plant cane at rates above 1 lb/acre but ratoon cane was more tolerant. "Lenacil" (2, 3·2 and 4 lb/acre) showed promise in a screening trial and appeared to be non-toxic to plant cane, in contrast to the other uracils tested.

Sugar beet agriculture

Care of harvested beet. D. BRADFORD. *British Sugar Beet Rev.*, 1967, **36**, 64.—The need is stressed of having all beet out of the ground by early December and made safe from frost in properly-made accessible clamps, with concrete bases if possible. Beet stores well at temperatures just above 0°C, but at 10°C for any length of time there is danger of deterioration. This emphasizes the need for adequate ventilation to prevent overheating. Reference is made to a recently devised system of covering clamps in hard weather, making use of 1½-inch polyethylene netting and then placing loose straw on top. Such netting may be expected to last several seasons.

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Bolting in early sown sugar beet. L. A. WILLEY. *British Sugar Beet Rev.*, 1967, **36**, 65–66, 70.—Two tables give the results of observations made on bolting among commercial varieties of sugar beet grown in 18 factory areas during the years 1965–67. The physiological processes within the beet plant which cause bolting are complex but latitude appears to have a marked influence. Vagaries of the climate make prediction of the incidence of bolting uncertain. The variety Camkilt showed outstanding resistance to bolting. Other varieties showing good resistance were Sharpe's Klein E, Sharpe's Klein Polybeet and the monogerm variety Bush Munro.

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Post-emergence herbicide may help in spring. ANON. *British Sugar Beet Rev.*, 1967, **36**, 67–70.—The changing pattern of agricultural labour in Britain in recent years and its impact on spring work with sugar beet are discussed. Band spraying with pre-emergence herbicides (its advantages and disadvantages) is dealt with. The performance of a new post-emergence herbicide, produced in Germany, is then discussed. In trials it did not affect sugar beet, even at four times the recommended strength. It effectively controlled chickweed, fat-hen, orache, charlock, speedwell and some other weeds in early stages of growth. It was not very effective against knotgrass or mayweed. Other resistant weeds were wild oats and annual grasses.

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Soil compression by tractor wheels: its effect on sugar beet dirt tares. J. A. WAYMAN. *British Sugar Beet Rev.*, 1967, **36**, 87–90.—Experiments are described which were designed to test the widely-held belief that the soil compaction caused by the wheels of mechanical harvesters and the tractors towing them increases the dirt tare or the amount of earth adhering to the harvested roots. The conclusion reached was that generally soil compaction by tractor wheels will not increase dirt tare, although under certain conditions of soil type and moisture content compression may affect the amount of soil adhering to the roots.

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The effect of weedkillers applied post-emergence to sugar beet. L. DETROUX, M. MARTENS and J. M. BELIEN. *Publ. Inst. Belge pour Amél. Betterave*, 1967, **4**, 111–133.—Results of trials carried out in 1966 and 1967 are given. Products tested were "Pyrazon", "Schering 4072" and "4075H" (also called "Betanal"). These were tried in association with anti-grass weed-killers (TCA, "Dalapon", "Basinex"). "Schering 4072" and "Schering 4075H" were more selective towards sugar beet than "Pyrazon". It is considered that "Betanal" is likely to modify weedkilling technique in sugar beet cultivation.

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Sugar beet and crop rotation. B. ANDREAE. *Zucker*, 1968, **21**, 47–52.—Economical control of sugar beet nematodes is only possible at present through crop rotation. The period during which the land should be devoted to crops other than sugar beet varies greatly in different countries. It varies from one season, as in parts of northern Italy and the Paris basin, to eight years as in heavily infested soils. The various crops that are grown are discussed.

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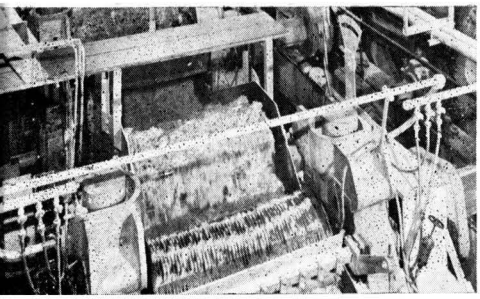
Boron deficiency—its prevention and cure. ANON. *Bulletin, Borax Consolidated Ltd.*, 1968, 18–19.—Signs of boron deficiency in various crops are described or illustrated in colour. In sugar beet the first signs are on the young leaves which become misshapen and have brittle petioles. They bend outwards and the upper surface of the midrib shows characteristic transverse cracks. The young leaves wilt, turn yellow, blacken and eventually die. In severe cases the older leaves may also become similarly affected. If spray treatment is carried out when the first signs of deficiency are noted new leaves develop normally. Otherwise the growing point dies and small bunches of leaves develop around the neck of the root. The crown of the beet blackens and dies. With boron deficiency severe blackening spreads and a hollow area may develop below the crown.



Cane sugar manufacture

De Smet diffuser for both cane and beet. ANON. *Sugar y Azúcar*, 1968, **63**, (2), 37–38.—See *I.S.J.*, 1968, **70**, 126.

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Automatic controls of First Farmers evaporator station. V. A. CUSTODIO. *Sugarland*, 1967, **4**, (6, 7, 8), 24–29. Automatic controls of the evaporator station (a quadruple-effect and a triple-effect evaporator plus a pre-evaporator) at the First Farmers Milling Co. cane factory (Philippines) include level transmitter/controllers for the clear juice tank and all evaporator effects, and Brix transmitters for the last effects. Juice flow is governed by syrup Brix, a fall in which is adjusted by opening a by-pass valve in the syrup pump discharge. Some of the outgoing syrup is thus recycled or returned to the last evaporator cell, in which a resultant rise in the juice level is countered by closing the juice feedline. This is done at each cell in succession back along the evaporator. Since this will cause a drop in flow from the juice tank, the tank level controller causes the vapour valve from the pre-evaporator to open, thus increasing vapour flow and hence the evaporation rate. When the juice level in each cell has fallen to a required level, the juice valves are re-opened. Should the tank juice level be insufficient, hot water is admitted to maintain a constant liquid supply to the pre-evaporator. Because of snags caused by a time lag between the Brix transmitters and regulators, Brix is being manually controlled until the problem is solved.

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Some practical proposals for checking the milling plant alignment. C. D. MALHOTRA. *Proc. 35th Conv. Sugar Tech. Assoc. India*, 1967, (1), 55–63.—Guidance is given on checking of cane milling plant alignment, which is recommended for each off-season.

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Bleaching powder for economical mill sanitation. M. MOHAN, K. K. SHARMA and G. C. SINGH. *Proc. 35th Conv. Sugar Tech. Assoc. India*, 1967, (1), 69–74. The disinfecting properties of chlorine, formalin, ammonium bifluoride, mercuric chloride and calcium hypochlorite were compared in tests in which mixed juice purity and pol were determined hourly up to 4 hr. The juice was stood at room temperature in sterilized beakers covered with filter paper and a known concentration of disinfectant added. Although mercuric chloride was the most effective, its high cost precludes its use, and calcium hypochlorite, which was next most effective and yet the cheapest, is recommended.

Phosphate treatment of clarified juice. A method of reducing losses in waste molasses. T. T. OOMMEN and B. S. GURUMURTHY. *Proc. 35th Conv. Sugar Tech. Assoc. India*, 1967, (1), 65–68.—Addition of about 30 mg P_2O_5 per litre to clarified juice in tests at Shimoga sugar factory reduced final molasses purity from 34·48 to 32·37 and increased the molasses reducing sugar:ash ratio from 1·90 to 2·33. Other advantages were greater molasses exhaustibility and reduced low-grade massecuite viscosity, accompanied by better massecuite curing.

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White sugar without sulphur. (A full season's trial of D.M.C. process.) A. C. CHATTERJEE. *Proc. 35th Conv. Sugar Tech. Assoc. India*, 1967, (1), 75–77. Experience at Aruna Sugars Ltd. with the defeco-melt crystallization process is discussed and compared with results achieved earlier by other authors. It has been found that besides the advantages found previously, the process does not suffer from the disadvantages attributed to it, i.e. greater steam consumption and more equipment needed for the same crushing rate. The E-30 grade white sugar produced was found to be better than that of some double-sulphitation factories.

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Cost of white sugar manufacture without sulphur reduced by (the) D.M.C. process. A. C. CHATTERJI and A. K. DEVARAJAN. *Proc. 35th Conv. Sugar Tech. Assoc. India*, 1967, (1), 79–93.—The economics of the defeco-melt crystallization process are calculated on the basis of a 135-day season to manufacture 150,000 bags of sugar. The process is shown to cut costs by Rs. 3 per bag.

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The deterioration of cane juices by *Leuconostoc mesenteroides*. K. JANAKIRAMAIAH, N. SATYANARAYANA. and T. S. N. MURTY. *Proc. 35th Conv. Sugar Tech. Assoc. India*, 1967, (1), 85–90.—Tabulated data demonstrate the extent of juice deterioration, expressed as pol loss, when mixed, 3rd mill and 1st mill juice was in contact with slime formed by *L. mesenteroides*. Since contact would normally be brief during continuous crushing, the only risk is considered to be in penetration of the bacterium into the juice weighing tanks. Tests with various disinfectants showed that spraying once every 4 hr with 1% ammonium bifluoride solution plus continuous addition of 1% formaldehyde solution to last mill juice considerably reduced pol loss. The need for adequate mill sanitation is emphasized.

Modification of continuous juice liming and sulphitation unit. S. N. G. RAO and S. C. SHARMA. *Proc. 35th Conv. Sugar Tech. Assoc. India*, 1967, (1), 127–135. The mud settling rate for juice treated in a modified continuous liming and sulphitation unit, in which the somewhat complicated stirring mechanism was replaced by an external circulation pump, was found to be better than with the old system. A correction tank after the unit was removed. Other less important modifications are also discussed with the aid of diagrams.

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A concept and design of (a) continuous juice sulphiter. B. B. PAUL. *Proc. 35th Conv. Sugar Tech. Assoc. India*, 1967, (1), 137–154.—A description and performance data are given of a continuous sulphitation unit which comprises a main sulphitation tank, a reaction tank and a mixing tank besides a SO_2 recovery tower and a lime proportioning tank. The sulphitation and reaction (correction) tank are provided with electrically-operated mechanical stirrers. The unit has been installed in three Indian sugar factories.

* * *

Practical hints for improvement of milling performance. S. C. ROY. *Proc. 35th Conv. Sugar Tech. Assoc. India*, 1967, (1), 155–169.—Among the factors considered in this discussion of mill performance are: (i) the use of shredders for cane preparation, found generally to increase sucrose extraction and reduce bagasse moisture content; (ii) mill settings; (iii) ram pressure adjustment and prevention of uneven top roller pressure, particularly with the use of hydraulic systems; (iv) imbibition with hot water at 160–165°F (this temperature is preferred to 200–210°F because of the melting of wax with consequent difficulties at the higher temperature) ; (v) the use of mill gutters for cush-cush and dirt removal; and (vi) accurate juice weighing. Reference is made to the literature and data are provided from various sources.

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Performance of coil pans and calandria pans with brass and steel tubes on *C*-grade boilings. S. P. MISHRA. *Proc. 35th Conv. Sugar Tech. Assoc. India*, 1967, (1), 171–181.—The performances of a coil pan, a floating calandria pan and a coil pan converted to a calandria type by installing steel tubing were compared. The pans, at Walterganj sugar factory, were used for *C*-strikes. The floating calandria pans with brass tubes gave higher massecuite Brix and purity, but with greater purity drop, than did the coil pan, while the latter had a lower boiling rate. The converted pan gave a massecuite of lower Brix and purity but a higher purity drop, with a higher boiling rate than the calandria pan. Heat transfer and circulation were much better in the converted pan than in the coil pan. The costs of conversion are tabulated. Caution to be exercised in the use of steel tubing is mentioned, although steel tubes are much cheaper than brass tubes. A live steam saving of 36 tons/day was obtained by converting the coil pan, while a 100% increase in *C*-massecuite capacity was also achieved.

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Decalcification of juice by ion exchange resins. S. C. GUPTA, N. A. RAMAIAH and S. K. SRIVASTAVA. *Proc. 35th Conv. Sugar Tech. Assoc. India*, 1967, (1), 183–196.—Tests are discussed in which 16–17°Bx clear juice was delimed with one of three different resins in Na^+ form. The maximum efficiency was 83·71% and 82·61% for juice containing 870 and 920 mg CaO/litre, respectively, and 90·50% and 97·42% for juice containing 1580 and 1618 mg CaO/litre, respectively. The ratio between juice volume and resin volume was 22–25:1.

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An improved formula for reduced clarification efficiency. C. CHANDRASEKARAN, S. K. KULKARNI and K. RAMANATHAN. *Proc. 35th Conv. Sugar Tech. Assoc. India*, 1967, (1), 197–202.—Formulae presented earlier by MITTAL[1] and JOSHI *et al.*[2] for calculation of the clarification factor are considered unsuitable, although they are better than the formula used by the Sugar Technologists' Association of India. A modified form of the MITTAL formula is presented for calculation of a reduced clarification factor in which the mixed juice purity is reduced to a standard of 85, as in the JOSHI formula.

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Whole reduced extraction. C. CHANDRASEKARAN, S. K. KULKARNI and K. RAMANATHAN. *Proc. 35th Conv. Sugar Tech. Assoc. India*, 1967, (1), 203–206. Use of MITTAL's Whole Reduced Extraction formula[3] is shown with the aid of tabulated milling data to give a better indication of mill performance than the conventional calculation method. A graph compares the mill extraction, reduced mill extraction and whole reduced mill extraction data from 12 runs at an Indian sugar factory.

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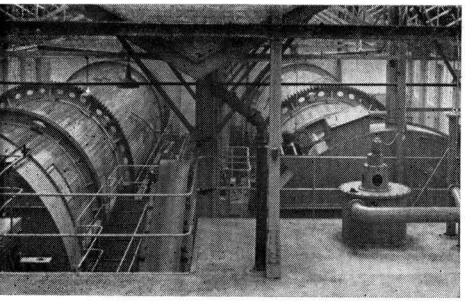
Partial third carbonatation of thin juice—a means (which) can be used for reducing sulphur consumption in a carbonatation factory. B. B. PAUL and I. S. SAXENA. *Proc. 35th Conv. Sugar Tech. Assoc. India*, 1967, (1), 211–215.—Tests at Dhuri double carbonatation sugar factory demonstrated the practicability of carbonatating thin juice (third carbonatation) to pH 7·4–7·6 in the recovery tower of the continuous sulphitation tank, thereby reducing sulphur consumption.

[1] *I.S.J.*, 1966, **68**, 314.
[2] *ibid.*, 1967, **69**, 346.
[3] *ibid* 1964, **66**, 119.



Beet sugar manufacture

The mechanism of the extraction of beet slices. W. RATHJE. *Paper presented to the 19th Tech. Conf., British Sugar Corp. Ltd.*, 1968.—Various tests to support the hypothesis of liquid exchange as the basis of beet sugar extraction are described. When beet tissue was saturated with a solution containing radioactive sucrose and brought into contact with an isotonic sucrose solution, the sucrose diffused only very slowly from the beet tissue. Under the test conditions liquid exchange was impossible.

* * *

Decolorization of thick juice and remelt liquor by active carbon. S. ZAGRODZKI, H. ZAORSKA and S. M. ZAGRODZKI. *Paper presented to the 19th Tech. Conf., British Sugar Corp. Ltd.*, 1968.—Results are given of tests in which thick juice and 2nd liquor were treated with "Carbopol Z extra" Polish active carbon using a two-stage filtration method, two layers of active carbon being applied to the filter cloths in a sleeve filter. Application of a thin cellulose pre-coat prevented carbon particles passing into the filtrate. Under process conditions, up to 80% decolorization was obtained, the specific extinction of the thick juice (at 560 nm) being reduced from an average of 0·557 to 0·098 and that of the liquor from 0·775 to 0·121. A purity rise of one unit was also obtained. Almost 1 kg of non-sugar was removed per kg of carbon. The decolorized solutions were of high clarity and entirely free from frothing in subsequent processing.

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Power in beet sugar factories. W. M. LANYON. *Paper presented to the 19th Tech. Conf., British Sugar Corp. Ltd.*, 1968.—The costs and efficiencies of ten schemes of steam raising and generating in sugar factories are considered. Among the plant discussed are industrial gas turbines, aero engine gas generators, condensing turbines and diesel engines. Beet pulp drying with flue gas dilution and with gas turbine exhaust with or without a waste heat boiler is examined. The advantages and disadvantages of the plant under investigation are discussed. Only if electricity must be bought would it pay to install a diesel generator, providing new boilers and turbines could not be afforded. In all other cases installation of the above power generators as new plant or ancillaries would be uneconomical.

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Pressure losses in sugar industry pre-heaters. T. BALOH. *Zeitsch. Zuckerind.*, 1968, **93**, 12–17.—Tests are discussed in which pressure losses in tubular pre-heaters were determined with a device consisting of a commercial pre-heater tube and two deflection chambers. The losses were measured at the tube entrance and exit as well as along the tube, so that the friction effect on pressure could also be gauged. The values agreed with losses calculated by GREGORIG's formula[1]; value obtained by HUGOT's formula[2] were somewhat higher, although they are still considered permissible in view of the increasing roughness of the tube walls during operation. No essential reduction in pressure drop results if the tube inlet is rounded off or the arrangement of deflection chambers altered to give optimum flow, whereas a considerable reduction is obtainable if the tubes are as long as possible and the number of circulation passages small.

* * *

Influence of organic non-sucrose matter on 1st carbonatation juice filtration rate. S. M. ZAGRODZKI. *Zeitsch. Zuckerind.*, 1968, **93**, 17–20.—Results of tests showed that the filtration rate of 1st carbonatation juice increased with increase in the amount of lime added, fell with a drop in raw juice purity, and was to a large extent proportional to the ratio between the amount of lime added and the quantity of precipitated organic non-sucrose matter in the filter cake. In view of this proportionality, any increase in campaign length should be accompanied by an increase in the amount of lime added, to counteract the higher non-sucrose matter content in the juice. While reduction in alkalinity increased the filtration rate, this effect was due to peptization of a major part of the colloids and their subsequent solubilization, so that juice purity fell, the colour content increased, and the lime salts content rose because of the high CO_2 content in the colloids.

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A new way of manufacturing sugar. V. SÁZAVSKÝ. *Zeitsch. Zuckerind.*, 1968, **93**, 24–26.—Reference is made to the practice of storing thick juice for future processing at Carlton and Hereford sugar factories in the USA. Tests conducted at Novy Bydzov sugar factory in Czechoslovakia and parallel investigations at the Sugar Industry Research Institute in Praha showed that 5-month storage of unsterilized, unfiltered thick juice of 66–69°Bx at 20°C under a surface coating of oil did not have any noticeable effect on the juice.

[1] "Wärmeaustauscher" (Verlag Sauerländer). 1959, p. 235 et seq.

[2] "La Sucrerie de Cannes" (Dunod, Paris). 1950, p. 295.

Danger of and protection against corrosion, particularly fuel oil tank protection against internal corrosion. F. TÖDT and W. KÖRNCHEN. *Zeitsch. Zuckerind.*, 1968, **93**, 26.—The danger of fuel oil tank corrosion from water which lies on the bottom of the empty tank and remains there when the tank is filled is discussed. One method of overcoming the problem is removal of oxygen from the steel bottom by adding sodium sulphite or iron filings. The extent of oxygen removal can be gauged by applying a noble metal surface to the bottom together with a base metal, such as zinc, and measuring the current at the galvanic element which results. Hence, galvanometer readings will indicate the height of the layer of water.

* * *

Reduction of repair and maintenance costs in the sugar industry through welding. P. LÜSCHER. *Zucker*, 1968, **21**, 75–77.—Examples of welding repairs to various machinery components are discussed to show how welding can cut overheads in the sugar factory. Some of the latest welding techniques are described.

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Reduction of the coagulating effect of proteins by means of their decomposition products. J. VAŠÁTKO, A. DANDÁR and J. ŠTUDNICKÝ. *Listy Cukr.*, 1968, **84**, 11–17.—Examination of the effect of protein degradation products on the amount of colloid removed during juice purification showed that the quantity removed fell with increase in deterioration of the beet, i.e. with increase in protein destruction. The effect of protein hydrolysis products on repeptization of the coagulate at high temperatures depended on the degree of destruction; this effect explains the deterioration of juice retained in clarifiers. The amount of protein (colloid) coagulated is given by N_c/N_t where N_c = total nitrogen content and N_t = nitrogen content in the protein, measured in terms of the N in precipitated tannin[1].

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Ion exchange membranes in the sugar industry. III. K. ČÍŽ and V. ČEJKOVÁ. *Listy Cukr.*, 1968, **84**, 17–20.—Electrodialysis demineralization tests with molasses solution showed that while the thickness and swelling of the cation membranes decreased with the number of cycles, the thickness of the anion membranes increased. Both types of membrane suffered a drop in conductivity and exchange capacity. Deionization not only caused a reduction in the size of the ash-forming molecular aggregates, which were subsequently sufficiently small to pass through a gel screen, but also caused a reduction in the size of some colouring matter molecules (cleavage) and, on the other hand, condensation of others into larger aggregates. Sorption of particles of a given size on the membranes, particularly anion membranes, also occurred, so that the mean size of the other particles changed.

* * *

Processing of deteriorated beet. W. STRUBE. *Gaz. Cukr.*, 1968, **76**, 1–4.—Details are given of a carbonatation scheme developed in East Germany for the processing of sub-standard beet and introduced in a number of East German sugar factories after a trial campaign at Prosigk sugar factory. The essential features are preliming with the Teschner countercurrent system, Ia carbonatation to pH 10·7–11·0 with 3-fold juice recirculation, settling and filtration, main liming with 0·3–0·4% CaO, followed by Ib and II carbonatation, the juice being heated to 95°C in between, and finally treatment by filter-thickeners. Before pre-liming, raw juice is mixed with 30% unfiltered juice from Ia carbonatation and with muds from Ib and II carbonatation.

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The lime salts content in sulphited (beet) juices. J. DOBRZYCKI. *Gaz. Cukr.*, 1968, **76**, 5–7.—Changes in the lime salts content of 1st carbonatation juices during sulphitation were investigated. The curve of lime salts content *vs.* pH had approximately the same configuration for sulphitation as for 2nd carbonatation, with a minimum followed by a steep climb. The value and position of this minimum differed from those for 2nd carbonatation, which in most cases occurred at about pH 8·5. The sulphitation curve was always higher than the 2nd carbonatation curve.

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Lengthening the life of DDS diffusers. W. GÓRALCZYK. *Gaz. Cukr.*, 1968, **76**, 8–14.—The wear on DDS diffusers, of which there are 45 in Polish sugar factories, after a number of campaigns is discussed and means of preventing excessive deterioration are described, including various corrosion-prevention applications such as epoxides. Economic aspects of the problem are also considered.

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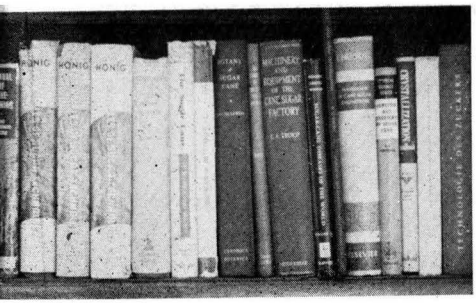
Michigan sugar industry continuing improvement programme. ANON. *Sugar y Azúcar*, 1968, **63**, (2), 44–45.—Mention is made of a BMA tower diffuser with a rated throughput of 2750 tons of beet/day, which was installed in the Sebewaing sugar factory of Michigan Sugar Co. and of three BMA continuous centrifugals supplied to the company's Carrollton factory for low-grade raw sugar massecuite treatment. Brief reference is also made to improvements at the Bay City sugar factory of Monitor Sugar Co. which is also planning installation of a BMA tower diffuser of about 4000 tons/day capacity.

* * *

Ways of increasing sugar yield and quality. A. P. PONOMARENKO. *Sakhar. Prom.*, 1967, **41**, (12), 6–10. The views and suggestions of MAR'YANCHIK *et al.*[2] regarding the yield and quality of Soviet white sugar are discussed and criticized, and alternative proposals for improving the situation are put forward, including adoption of a 3-boiling scheme by all beet sugar factories and other measures concerning campaign length and beet harvesting, transportation and reception.

[1] STANĚK & VONDRÁK: *Listy Cukr.*, 1921–22, **40**, 545.
[2] ***I.S.J.*, 1966, 68, 244.**



New books

Technologie des Zuckers (Sugar Technology). Ed. F. SCHNEIDER. 1068 pp.; $6\frac{1}{4} \times 9\frac{1}{2}$ in. (Verlag M. & H. Schaper, 3 Hannover 26, Postf. 26 0669, Germany.) 1968. Price: DM 180; £18 16s 0d.

The first edition of this book was published in 1955. The need for a second edition was felt because of the intensive developments that have taken place in the industry since then. The new edition certainly seems to reflect the progresses made in the industry, since it has 1068 pages of text compared with 781 pages in the first edition and includes three new chapters. The book is divided into 19 chapters, which are as follows: The beet and its structure (F. SCHNEIDER, E. REINEFELD and H. P. HOFFMANN-WALBECK); Beet agriculture and harvesting (H. LÜDECKE and M. NITZSCHE); Transport, storage and washing of beet (B. BRUKNER); Beet slicing (R. PILGRAM); Juice extraction (F. SCHNEIDER and E. REINEFELD); Juice purification (R. WEIDENHAGEN and G. BAUMGARTEN); Evaporation (R. WEIDENHAGEN and B. BRUKNER); Sugar crystallization and recovery (F. SCHNEIDER, D. SCHLIEPHAKE, A. EMMERICH and J. VON MALTZAN); Refining of cane sugar (D. BECKER); Ion exchange—this is one of the new chapters—(R. WEIDENHAGEN and H. SCHIWEK); Steam and power (F. MÜHLHAUSEN and W. VON PROSKOWETZ); Heat economy (T. BALOH); Measuring and control techniques—the second new chapter—(D. VON DUNGERN); Drying (F. BAUNACK); Lime, CO_2 and SO_2 preparation (B. BRUKNER); Water and waste water—the third new chapter—(F. SCHNEIDER and H. P. HOFFMANN-WALBECK); Factory organization and supervision (W. PARTALE and K.-H. FASOL); Molasses utilization (F. SCHNEIDER, G. BAUMGARTEN and G. BRASCH); and Agricultural uses of by-products (H. LÜDECKE and M. NITZSCHE). The book contains 394 illustrations (mostly line drawings, but also including a number of half-tones) and 115 tables. Modern processing methods and equipment are quite well covered, although it should be emphasized that the book is generally concerned with Western European, and particularly German, beet sugar processing, and only a brief section is devoted to the cane sugar industry. Generally, the work is well set out and includes as much on the modern beet sugar industry as the reader could reasonably expect to find in any book, apart from information on the very latest equipment. It is a pity that the book is available only in German, since it is one of the few books of any worth concerned with beet sugar technology. This and the rather high price might deter people from buying it, although it is certainly to be highly recommended as a reference book for the technologist or as a manual for the student's library. The typographical quality is excellent and the subject and author indexes quite adequate for a work of this type.

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Industrial filtration of liquids. D. B. PURCHAS. 463 pp.; $6 \times 8\frac{1}{2}$ in. (Morgan-Grampian Books Ltd., 28 Essex St., Strand, London W.C.2, England.) 1967. Price: £4 4s 0d.

The aim of this work, as stated by the author, is to summarize "in clear, practical terms all present methods available for solid/liquid separation. Emphasis is placed on the actual nature of the problem rather than the particular industry in which it occurs, so that the greatest possible experience can be gained of the innovations and advances in technique over the whole technology of the subject". In fact, the subject matter embraces the use of settlers and clarifiers as well as screens and centrifuges, besides liquid/liquid separation, which is, of course, of little interest to the sugar technologist. As far as the sugar industry is concerned, the equipment is quite well covered, although there are some commonly-used filters which are not mentioned, such as the Gaudfrin, Grand-Pont, Paterson Candy "Stellar" candle filters, and "Fas-Flo" filters. A section is included on filter aids and cloths, as well as some (but far from all) flocculants. The theoretical relationships involved in filtration are also dealt with. The field of filtration is vast, and it is inevitable that there will be gaps, particularly in view of the rapid rate of development of new types of equipment and new techniques. The author tackles the subject in a clear manner, although the reviewer would have preferred use of a different printing process, since the type used makes reading rather uncomfortable. Generally, the book can be regarded as a useful supplement to the sugar technologist's library.

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Sveklosakharnoe proizvodstvo (Beet sugar manufacture). A. I. VOSTOKOV and I. P. LEPESHKIN. 212 pp.; $5\frac{3}{4} \times 8\frac{3}{4}$ in. (Izd. "Pishchevaya promyshlennost", Moscow, U.S.S.R.) 1966. Price: 40 kop.

Intended as a textbook for further training of technicians engaged in the sugar industry, this book is also a useful source of information for readers outside the U.S.S.R., describing as it does processes and equipment used in Soviet beet sugar factories. After a survey of the Soviet sugar industry there are

chapters dealing with the botany of the beet, beet agriculture and the chemistry of sugar. The processes in a sugar factory are then systematically covered from reception of beet through to white sugar packaging and storage. The book concludes with sections on sugar factory heat and water economies, calculation of material balances and utilization of beet factory by-products.

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Tate & Lyle Ltd. Research Centre Annual Report, 1967. 359 pp; 8 ¼ × 11 in. (Tate & Lyle Ltd. Research Centre, Keston, Kent, England). 1968.

This is an inch-thick treasure house giving an account, much of it not yet published in detail in the literature, of the activities of the research teams at Ravensbourne under the direction of Dr. A. J. VLITOS. The Physical Chemistry Section, led by Dr. M. C. BENNETT, has studied the use of citric acid as a conglomerant in carbonatation on the laboratory and refinery scale; the mechanism of decolorization by bone char, activated carbon and resins; the surface chemical properties of sucrose crystals and phenomena occurring during crystallization; and improvement of filtrability in carbonatated liquor through careful application of lessons learnt by study of the fundamental principles.

The Organic Chemistry Section, under Dr. K. J. PARKER, has studied the decolorization of brown sugar liquors by resins. The gel permeation technique has been used to study molecular weight distribution of sugar colouring matter, and this has also been isolated in solid form. Some of its properties have been examined and that formed from the degradation of sugars shown to have a possible common chromophore structure, regardless of origin. Conditions for the phosphatation of refinery low-grade syrups and molasses to give a filtrable precipitate have been established, and a new equation has been developed to characterize sucrose inversion by acid, applicable to high Brix liquors. A laboratory-scale investigation of solvent affination has been completed, and a process for solvent precipitation of sucrose from molasses or Carob syrup is being studied.

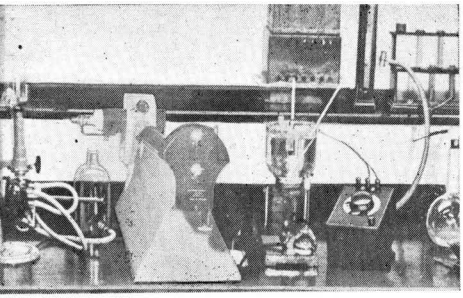
The Biophysics-Bioanalysis Section, a new Group formed during the year and led by Dr. D. GROSS, has investigated the possibilities of applying high-voltage paper and thin-layer electrophoresis to separate mixtures of gibberellins. The Technicon "Auto Analyzer" is also being investigated and analytical procedures devised for its use in the determination of invert, sucrose and total carbohydrates.

The Physics and Chemical Engineering investigations, under S. HILL, included work on the fluidized-bed drying of white sugar and moisture measurement by microwave absorption. It has studied the establishment of a steady-state cooling crystallizer for sucrose crystal nucleation and growth investigations. Theoretical studies have been made for a continuous vacuum pan system embodying crystal classification, and a simple classifier developed. New calculations of boiling point elevations have been made[1], and alumina carbon investigated; this is a carbonaceous adsorbent formed by decomposition of hexane within the pores of granular activated alumina. It is more expensive than bone char and requires more heat for regeneration, but has three times the decolorizing power and economics of its use are favourable. Bone chars from six refineries were compared for quality, and regeneration of heavily-loaded bone char was examined. Gas adsorption in carbonatation was investigated, with one study concerned with the bubble size in relation to its generation method and absorption, and another concerned with methods of producing great turbulence to promote gas absorption.

The Biology-Agriculture Section, led by Dr. D. W. FEWKES, carried out plant physiological studies on gibberellin-like substances obtained from sugar cane, developed techniques for greenhouse-phytotron study of cane growth, measurement and examination of CO_2 exchange by cane tissue, and studied the effects of chemical ripening agents on cane. Study of the biology of certain weeds and the action of herbicides is planned as is the testing of cane varieties for tolerance to stress conditions such as drought and salinity. Pot tests were made on soil conditioning with a number of materials and investigations made on pest control by use of sex attractants and irradiation and chemical means of inducing sterility in the pests.

The Microbiology Section, under Dr. M. P. SCARR, has worked on the production of microbial protein from molasses using saprophytic fungi, and testing of *Schizosaccharomyces pombé* for production of high-purity alcohol. Comparison of fermentation at 20 and 25% total sugars showed no significant change in fermentation efficiency with semi-osmophilic yeasts, and it was shown that the degree of sucrose exhaustion of a molasses was not a criterion of its suitability for fermentation. A Carob bean extract could be successfully fermented with 90% conversion of its sugars to alcohol using *Saccharomyces carlsbergensis*, and conditions were established for freeze-drying of yeasts to secure maximum survival for later use in fermentation. First stages of an investigation have shown that only the quaternary ammonium compounds and formalin have possible use in the preservation of high Brix low purity liquors for refining. Souring of cane has been confirmed as due to *Leuconostoc mesenteroides*, and a viscosity test devised to give warning of the onset of souring. Customer and refinery consulting services included advice on suitable sugar and yeasts for wine production, and the training of control personnel for liquid sugar production.

[1] NICOL: *I.S.J.*, 1968, **70**, 199–212.



Laboratory methods & Chemical reports

Determination of the technological maturity of beet. L. SCHMIDT, V. KEC and B. VORLÍČKOVÁ. *Listy Cukr.*, 1967, **83**, 248–253.—Sugar factory data were processed and field tests carried out to determine the time at which beets reach technological maturity. This is based on the MB factor (kg molasses/100 kg white sugar) and the conductimetric ash content per 100°S, the beets being technologically ripe when the values of both factors are minimal.

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Note on the relationship between refractive index and specific gravity of aqueous sucrose solutions. H. B. BASKER. *J.A.O.A.C.*, 1967, **50**, 1370–1371.—The accuracy of values of sucrose solution specific gravities[1] and refractive indices[2] (where the sucrose concentration is expressed on a weight-weight basis) was examined on the basis of the linear relationship between sucrose concentration and refractive index[3]. Although close correlation was found at 0–85% sucrose (w/w) between refractive index and concentration expressed as w/v, small systematic differences were found between values predicted from calculated regression lines and the tabulated data. Further investigation is required to eliminate these differences, and the experimental values of the refractive index and specific gravity should be judged according to their reliability, so that corrected refractive index values calculated from the regression line should vary by less than 0·00001 units and the differences should be random in sign.

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Beet molasses formation and composition. VII. Temperature dependence of the saturation function. G. VAVRINECZ. *Zeitsch. Zuckerind.*, 1968, **93**, 20–24. The effect of temperature on the melassigenic properties of non-sucrose substances has been found to depend on the substance in question. With rise in temperature, some increase their melassigenesis, others reduce it, while in the case of a third group the properties remain unaltered. Since the saturation function of non-sucrose mixtures conforms to the law of mixtures[4], the temperature coefficient will also conform to the law. Consequently, the temperature effects for non-sucrose substances of opposite melassigenesis (positive and negative) will be largely cancelled out, making it appear that non-sucrose mixtures are not temperature-dependent and explaining WIKLUND's rule concerning temperature independence[5]. The saturation functions for various non-sugars and non-sucrose fractions are shown in graph form for various temperatures, based on the findings of various authors.

Theory of continuous crystallization. S. HILL and W. J. ORCHARD. *Sucr. Belge*, 1967, **87**, 199–211; 1968, **87**, 265–271.—See *I.S.J.*, 1968, **70**, 89.

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Volumetric determination of furfural in distillates obtained from bagasse. E. RAMOS and C. BAU DE R. *Sugar y Azúcar*, 1968, **63**, (1), 21–22.—The KULLGREN & TYDEN method of determining furfural in bagasse distillate[6] has been modified to permit determinations to be made at ambient temperature in the tropics without any loss of accuracy. The method involves adding, to a 10-ml aliquot containing 50–150 mg of furfural, 25 ml of a 0·2N potassium bromate-bromide solution (5·57 g $KBrO_3$ + 50 g KBr/litre) followed by 5 ml of a 1% ammonium molybdate solution as catalyst for the bromine absorption. After bringing to 25–35°C, 250 ml of 1% HCl is added and the solution held in the dark for 30 sec, after which the reaction is complete. 10 ml of 10% KI solution is added and the released iodine titrated with 0·1N sodium thiosulphate solution, using starch solution as indicator. Comparison of the method with a spectrophotometric method showed a difference from the true values of 0·83% for the spectrophotometric technique and 1·12% for the proposed method. However, the latter takes a total of only 4 min, compared with ½ hr for the former method, although both are subject to interference from other bromine-absorbing substances such as hydroxymethyl furfural, which if present in large quantities should be destroyed by distillation with HCl saturated with NaCl.

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The need of phosphates in cane juice clarification. K. JANAKIRAMAIAH, N. SATYANARAYAN and T. S. N. MURTY. *Proc. 35th Conv. Sugar Tech. Assoc. India*, 1967, (1), 207–209.—A method for determining the phosphate content in raw juice is described, which involves neutralizing the juice with ammonia, acidifying with acetic acid and titrating with uranium acetate solution. Uranyl phosphate (or perhaps uranyl ammonium phosphate) is precipitated until no more free phosphate remains in solution. Any excess uranium acetate is revealed by reaction with

[1] "Official methods of analysis", 10th Edn. (Association of Official Agricultural Chemists, Washington, D.C., USA) 1965, pp. 825–826.
[2] *ibid.*, 828–829.
[3] GLOVER & GOULDEN: *Nature*, 1963, **200**, 1165–1166.
[4] *I.S.J.*, 1968, **70**, 346.
[5] *ibid.*, 1946, **48**, 304.
[6] *Ingenior-vetenskap Handl.*, 1929, (94).

potassium ferrocyanide, whereby a brown precipitate of uranium ferrocyanide is formed. The method is claimed to be rapid and simple.

* * *

Comparative measurements of colour and clarity of sugar solutions. E. B. PUYAOAN. *Sugar News*, 1967, **43**, 506–516.—In comparative tests, a Lange nephelometer combined with a Lange "Multiplex" galvanometer gave more accurate measurements of sugar solution colour (expressed as % transmittancy) and clarity than did a "Spectronic 20" colorimeter or a G.E. "Luximeter". Details are given of operating procedures and a wiring diagram is presented for the nephelometer-galvanometer combination.

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Determination of insolubles in sugars. P. DEVILLERS and J. C. CHARTIER. *Sucr. Franç.*, 1968, **109**, 25–27. Comparison of the method of DEVILLERS[1] with that of HIBBERT & PHILLIPSON[2] for determining insoluble matter in sugar showed that while the latter method, using membrane filters of 5μ pore size, seems preferable because it measures substances which are "foreign" to normal sugar manufacture, the DEVILLERS method, using membranes of 0·45μ pore size, permits determination of oxalate, and gives a better representation of sugar solution turbidity, which is caused by finer particles. Hence, this method is considered to give a more accurate value of total insoluble matter, while not requiring excessive time for filtration.

* * *

Phytopathogenic microflora of stored beet and their effect on the technological quality. J. ZAHRADNÍČEK. *Listy Cukr.*, 1968, **84**, 1–11.—Moulds found in stored beet during 1963–66 are listed. They include: *Mucor hiemalis* WEHM., *Rhizopus nigricans* EHRENB., *Botrytis cinerea* PERS., *Penicillium expansum* (LINK) THOM., *Aspergillus niger* V. TIEGH., *A. glaucus* DE BARY, *A. ochraceus* WILH., *Fusarium betae* (DESM.) SACC., *F. oxysporum* SCHL., *Phoma betae* FRANK, *Alternaria tenuis* NEES and *Cladosporium herbarum* (PERS.) LINK. *P. expansum*, *B. cinerea* and *F. betae* were those most frequently found. On heavily infected beet, e.g. exposed to considerable *Cercospora* attack, *A. tenuis*, *C. herbarum* and *P. betae* were the most common. *B. cinerea*, *A. niger* and *A. tenuis* were the most frequent in wet and warm conditions and in confined spaces. In dry and well ventilated conditions *C. herbarum*, *R. nigricans and P. expansum* were the commonest.

* * *

Colloidal substances in beet juice. J. VAŠÁTKO and J. ŠTUDNICKÝ. *Sborník Prác Chem. Fak. SVST*, 1966, 229–237; through *S.I.A.*, 1967, **29**, Abs. 934.—Colloids were extracted from samples of diffusion juice or press juice using 96% ethanol, with juice:ethanol ratios of 1:2, 1:6 or 1:12. More colloidal substances, particularly ash, were precipitated by the higher concentrations of ethanol. The amounts of pectin, protein, ash, pentosans, Na, K, Ca and Mg found are tabulated. Whereas the ash of the original juice contained mainly K salts, the ash of the precipitated colloids contained a considerable proportion of Mg and Ca salts. With increasing concentration of ethanol used for precipitation, the K salt content increased and the Mg and Ca contents decreased or remained the same.

* * *

Viscosity of sucrose solutions. J. P. STUPIELLO. *Seminario Inst. Zimotécnico* (São Paulo), 1966, (2), 14 pp.—The principles of viscosity are described, and the units of viscosity explained. Measurement of viscosity of pure and impure sugar solutions is reviewed. Aspects of the importance of viscosity in sugar factories are surveyed, with mention of heating, decantation, evaporation, boiling, crystallization and centrifugalling.

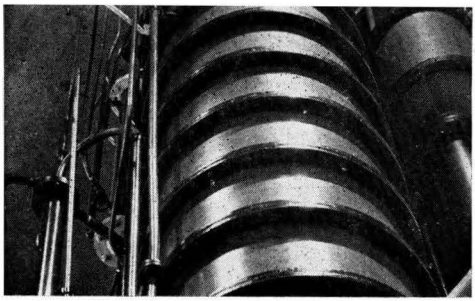
* * *

Turbidity measurements in juices after decanters and filters. H. SCHIWEK. *Zucker*, 1968, **21**, 85–90. Although descriptions of turbidity of filtered and clarified juices has tended to be imprecise, with vague terms used such as "clear and bright", it is shown that accurate measurement is possible on the basis of a linear relationship between turbidity (expressed in terms of the weight of turbidity-causing particles per unit volume of juice) and the light scattering intensity, which falls in proportion to the concentration of the particles. It has been found that the shape and particle size distribution of these particles are more uniform than previously considered. Results of tests on various juices using a nephelometer developed by Carl Zeiss, Oberkochen, as an attachment to the "ELKO II" instrument, are tabulated and given in graph form showing the amount of turbidity-forming material *vs.* filtration time. The tests were conducted with various types of filters and filter aids.

* * *

Rapid test for checking infection in sugar beet extraction plant. W. MAUCH and H. BOURZUTSCHKY. *Zeitsch. Zuckerind.*, 1968, **93**, 66–67.—For determining the extent of infection in press or raw juice on the basis of the nitrite content[3], a strip of plastic is available, one end of which is a test zone of specially-prepared paper. Manufactured by C. F. Boehringer & Söhne GmbH, of Mannheim, Germany, the "Nitur-Test" works on the principle of reaction between an aromatic amine (naphthylamine) and nitrite to form a diazo compound which is subsequently converted by a coupling reaction to an azo dyestuff. The paper turns to light pink in the presence of 1–2 mg of nitrite per litre, to strong pink at 10 mg/litre, and to wine red at 50 mg/litre. pH of the juice does not affect the result, which is obtainable after 1 minute's immersion of the plastic strip.

[1] *I.S.J.*, 1957, **59**, 289.
[2] *ibid.*, 1966, **68**, 39–44.
[3] CARRUTHERS *et al.*: *I.S.J.*, 1958, **60**, 335.



By-products

Beet tops for animal feeding. J. K. HUGHES. *Sugar J.*, 1967, **30**, (4), 28.—The use of beet tops as silage for cattle and sheep fodder is advocated on the basis of tests showing that weight gains were equal to those obtained with corn silage. The beet tops should be allowed to wilt before ensilage. Fresh beet tops have a laxative effect.

* * *

Molasses and the feeding of cattle. J. ARCHAMBAUD and S. CONTOUR. *Ind. Alim. Agric.*, 1967, **84**, 1065–1073.—The use of molasses as animal fodder is discussed and various pieces of equipment used in handling molasses and incorporating it in other feedstuffs are described.

* * *

Utilization and analysis of sucrose fatty acid esters. G. MIETH and F. LINOW. *Zeitsch. Zuckerind.*, 1967, **92**, 528–531.—The literature (147 references) on the production, properties, potential uses, analysis, etc. of sucrose esters is reviewed.

* * *

Some technical notes on the Behr process bagasse particle boards. C. S. L. CHIU. *Taiwan Sugar*, 1967, **14**, (4), 18–20, 17.—The notes, compiled by the manager of Kaohsiung bagasse particle board factory, concern storage, cutting, glueing, veneering, application of plastic foils, edge banding and surface finishing.

* * *

Utilization of distillery sludge for fodder yeast. J. P. SHUKLA and K. A. PRABHU. *Sharkara*, 1966, **8**, 120–124.—Sun-dried yeast obtained from distillery sludge was subsequently hot air-dried at 80–85°C to reduce the moisture content to 10–12% and then ground to a homogeneous coarse powder containing 32–35% total protein and 19·89% digestible protein. Preliminary feeding trials showed that sheep and goats liked the feed more than did cows and bullocks. Assimilation of nitrogen, calcium and phosphorus was 22%, 94% and 96%, respectively, while the digestible nutrients as a proportion of the total ration were comparable to the total ration when oil cake is included with wheat straw.

* * *

Production of carbon paper, floor and other polishes, candles, wax paper and paper cups, and emulsions for the preservation of fruits from sugar cane wax. ANON. *Sharkara*, 1966, **8**, 125–127.—The recovery and utilization of cane wax for the purposes mentioned in the title are discussed.

Fungal protein for food and feeds. VI. Direct use of cane juice. W. D. GRAY and R. PAUGH. *Economic Botany*, 1967, **21**, 273–276.—The successful production of the fungus *Cladosporium* on cane juice is described. Certain mineral additives (K_2HPO_4 and NH_4NO_3) greatly increased yield of mycelium and protein. The cane juice was first diluted to 2% and adjusted to pH 6·0. It is explained how high yields of protein are potentially available from an acre of cane in this way. With a cane yield of 40 tons per acre, fungal protein from the juice works out at 1280 lb/acre. This compares with 800 lb of protein/acre with a protein-rich crop like soya beans.

* * *

Cane molasses as a substitute for maize in beef-finishing rations. A. W. LISHMAN. *S. African J. Agric. Sci.*, 1967, **10**, (1), 51–52.—Results are given of extensive feeding trials with oxen over a period of eleven weeks. Molasses was used to supply 0, 10, 20 and 30% TDN (total digestible nutrients) of the ration. Molasses feed did not significantly increase the weight gains or affect the carcass significantly. Hay consumption was increased and the total dry matter intake was significantly higher, where molasses supplied 20 and 30% TDN.

* * *

Sucrose esters as raw materials for paints. II. Sucrose octaacetate. A. KRAUS. *Fette-Seifen-Anstrichmittel*, 1966, **68**, 869–871; through *S.I.A.*, 1967, **29**, Abs. 703. Sucrose octaacetate is suitable for use in nitrocellulose paints because of its good solubility and tolerance for plasticizers. The cold-check resistance of paints containing sucrose octaacetate were, in general, lower than those of paints containing SAIB (sucrose acetate isobutyrate)[1], but higher than those of paints containing sucrose benzoate or a ketone resin. Hardnesses were in the reverse order. Other possible uses of sucrose octaacetate are as an alcohol denaturant and in paper manufacture.

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The reason for water spraying of hardboards before their use. ANON. *Taiwan Sugar*, 1967, **14**, (5), 22. Guidance is given on water spraying of bagasse hardboard to prevent warping and other forms of deterioration.

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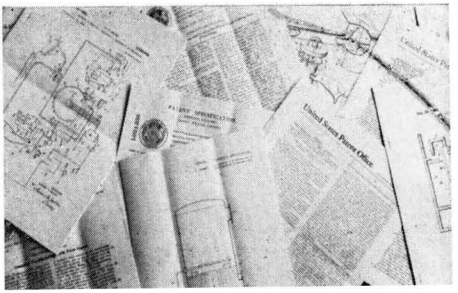
[1] *I.S.J.*, 1966, **68**, 315.

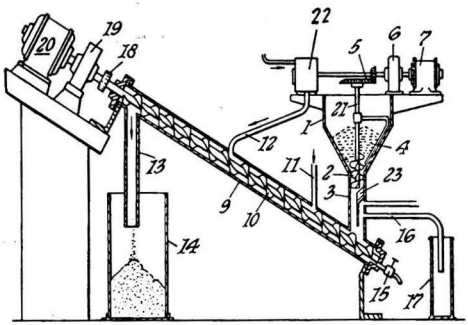
Patents



UNITED KINGDOM

Solvent affination of raw sugar. TATE & LYLE LTD., of London E.C.3. **1,104,342.** 11th March 1966; 21st February 1968.

Raw sugar crystals are treated to remove their molasses film by washing with a solvent comprising methanol and an agent which forms solvent-soluble compounds or complexes with the organic methanol-insoluble calcium or magnesium compounds in the molasses film, i.e. a solvent-soluble acid or anhydride with a dissociation constant greater than 0·01 (HCl, H_2SO_3, $ClCH_2COOH$, CCl_3COOH, lactic acid or SO_2) or an amide or salt of an aminodiacetic acid derivative with an organic base as a complexing agent. In addition to the methanol the solvent may contain a liquid which depresses the solubility of sucrose, i.e. acetone, acetonitrile, dioxan, diethyl ether, ethyl acetate, ethanol, 2,2'-dimethoxypropane, tetrahydrofuran or tetrahydrofurfuryl alcohol (20–30% of acetone) (and no more than 10% of water by volume).



The raw sugar is treated in counter-current first with the solvent, then with the agent in the presence of the solvent, and then with the solvent alone, finally being freed from excess of solvent and dried. This may be carried out in the manner illustrated whereby raw sugar from the hopper 1 is delivered at a predetermined rate by scroll 2 through funnel 3 into two inclined joined twin tubes 9 which are fitted with driven revolving intermeshing scrolls 10. The sugar is treated during its passage up the tubes and is discharged through outlet pipe 13 into container 14. A mixture of methanol and acetone is sent by pump 22 through pipe 12 into the tubes while SO_2 is admitted through pipe 11. The solvents and SO_2 are carried downwards against the flow of sugar and, after leaching the sugar, rise up funnel 3 and flow out of the molasses outlet 16 into container 17. A drain outlet 15 is provided for the tubes 9.

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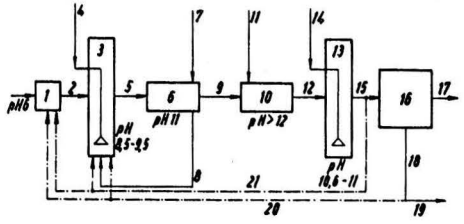
Beet harvester. E. J. E. HEYENS, of Hulst, Holland. **1,104,477.** 23rd November 1966; 28th February 1968.

* * *

Cane or beet juice extraction. KNAPSACK A.G., of 5033 Knapsack bei Köln, Germany. **1,106,139.** 26th October 1966; 13th March 1968.—Sliced beet or cane as cossettes or chips are extracted with water containing polyphosphoric acid and/or a dicarboxylic acid (Cf. U.K. Patent 1,056,170[1]) and also with an approximately equal amount of (colloidal) silicic acid, i.e. between 0·0001 and 0·3% w/w (preferably 0·01–0·1%).

* * *

Carbonatation of beet juice. F. SCHNEIDER, of Braunschweig, Germany. **1,106,276.** 14th March 1966; 13th March 1968.—Local overliming is prevented and mud and juice characteristics are improved by the process in which raw juice at pH 6 is supplied to a container 1 from which it passes through a pipeline 2 to an initial defeco-saturation zone 3. From this it passes through pipeline 5 to a reaction and mixing vessel 6 where milk-of-lime 9 is added to the extent that the pH does not exceed 11. A return line 8 from vessel 6 takes e.g. 400–1000% of the juice flow back to the zone 3 where, depending on the amount of recycled juice, sufficient CO_2 is introduced through pipeline 4 to give a pH of 8·5–9·5. The juice from



[1] *I.S.J.*, 1967, **69**, 220.

tank 6 which is not recycled passes through pipeline 9 to defecation zone 10 where line 11 is added to bring the pH to >12.

From this zone the juice passes through pipeline 12 to a saturation zone 13 where CO_2 introduced through pipeline 14 reduces the pH to 10·6–11. The resultant juice is partly returned from pipeline 15 to defeco-saturation zone 3 and partly transferred to a clarification zone 16. From this, clarified juice is withdrawn through pipe 17 to process while the concentrated mud is sent partly for filtration, partly back to the container 1 and partly back to the zone 3.

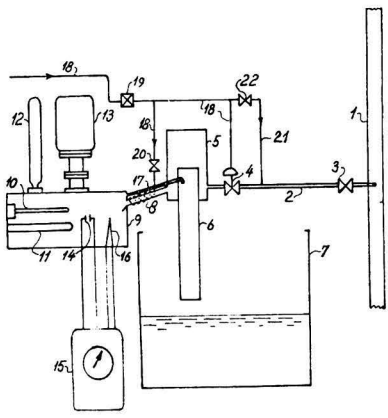
* * *

Producing L-glutamic acid by fermentation. ASAHI KASEI KOGYO K.K., of Osaka, Japan. **1,106,554.** 13th July 1965; 20th March 1968.—Biotin-requiring L-glutamic acid-producing bacteria (*Corynebacteria melassecola*) are inoculated into a medium containing cane or beet molasses plus an excess of biotin over that required for maximum bacterial growth, a nitrogen source and inorganic salts, and the medium cultured under aerobic conditions, a polyoxyethylene fatty acid ester type of nonionic surface active agent or an alkyl-amine salt type of cationic surface active agent being added to the medium between the initial and middle stages of the logarithmic growth period of the bacteria, and the second type of surface active agent being added between the middle and final stages.

* * *

Measurement of the purity of a flowing sugar solution. A/S DE DANSKE SUKKERFABRIKKER, of Copenhagen K., Denmark. **1,106,712.** 7th March 1966; 20th March 1968.

Measurement of purity R is based on the maximum conductivity H to which it is related in accordance with the equation $R = 100 - KH$, where K is a constant. The maximum conductivity is reached at a solids content of 28% at 20°C or of 32% at 70°C. In the apparatus illustrated, a syrup of 60–80°Bx flows along pipe 1 and is partly withdrawn through branch pipe 2 when needle valve 3 is opened. It flows through diaphragm valve 4 into a container 5 with an overflow 6 into receiver 7. From container 5 a tube leads through a heat exchanger 8 to a thermostat box 9 provided with a thermostat 10, a heating element 11, thermometer 12, an agitator 13 and electrodes 14 connected with a conductivity meter/recorder 15 associated with thermistor 16. Box 9 also has an overflow 17 to receiver 7. Condensate is supplied as dilution water through pipe 18, magnetic valve 19 and needle valve 20 to the entry side of the heat exchanger 8 and additionally to valve 4 and the pipeline 2 on the feed side of valve 4. When valve 4 is opened, syrup flows along the pipe 2, into container 5 and so through heat exchanger 8 to box 9 where it is brought to the appropriate temperature and excess overflows through pipes 6 and 17. When valve 19 is opened dilution water flows along pipes 18 and the change in pressure causes valve 4 to close (flow of water through valve 22 and tube 21 ensures that crystallization in tube 2 and valve 4 is prevented). As dilution proceeds the conductivity rises to a maximum and then starts to fall, when a control device on the meter closes valve 19; this changes the pressure in pipe 18, allowing valve 4 to re-open. More syrup enters the box and concentration rises, as does the conductivity which reaches a maximum again and then starts to fall. The meter then opens valve 19 again, valve 4 closes and the dilution again occurs to give a maximum conductivity, and so on. The setting of the control device is such that these changes occur at relatively small drops in conductivity from the maximum so that the cycles are frequent and the conductivity trace is practically linear instead of undulating, and gives a continuous trace corresponding to the purity of the syrup in pipe 1.



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Cane juice clarification (for starch removal). A. E. RABE, of Port Shepstone, Natal, South Africa. **1,108,296.** 7th September 1965; 3rd April 1968. Raw juice is limed to pH 7–9 to effect precipitation of impurities, the latter coagulated and the juice subjected to reduced pressure whereby the coagulated precipitate is brought to the surface of the juice from which it is removed. The process may be carried out at ambient temperature and may be continuous, and orthophosphoric acid or monocalcium phosphate may be added to the juice before liming. The clarified juice is withdrawn and sent for evaporation and crystallization or may be heated to separate further impurities which are removed before the juice is sent to process. The first coagulated impurities and the second precipitate from heating of the clarified juice are filtered and washed with water at ambient temperature; this prevents dissolution of the starch and gums content of the filter cake.

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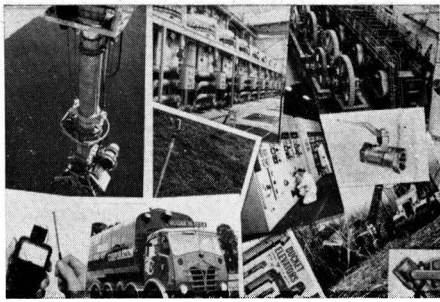
Cane harvester. I. A. BELL & CO. (PTY.) LTD., of Durban, Natal, South Africa. **1,109,747.** 1st March 1966; 10th April 1968.

Trade notices



Ball valve actuator. Worcester Valve Co. Ltd., Burrell Rd., Haywards Heath, Sussex, England.

The 400 Series "Flowmate" pneumatic ball valve actuator has been specially designed to give 90° operation on ball valves and combines the power output of a twin push-pull double-cylinder system with a rack-and-pinion action. The teeth are cut across the full width of the piston face and pinion, giving maximum engagement. Piston sealing is by "O" rings with minimum travel. The "Flowmate" can also be supplied with a spring return, 48 springs being arranged to give even pressure across the full face of each piston, and is also available with a pilot air control valve and solenoid.

* * *

Cane mechanization. Thomson Machinery Co. Inc., Thibodaux, La., U.S.A.

A new implement announced by Thomson is designed for subsoiling, cultivating, fertilizing and barring-off outsize ratoons in cane fields. Known as the "Trash King—Tres en Uno", it operates at the rate of three rows at a time with row spacing of 4½–6 ft. Its three hoppers hold a total of 1300 lb of fertilizer, extensions being available for increasing the capacity by 300 lb per hopper. The rate of fertilizer application is 50–1500 lb/acre. Spring-loaded bars hold down trash and leaves, so that the 22-in diameter coulters can cut through for placement of the fertilizer 4–8 in below the ground at the side of the cane. The basic frame is a tool bar which may be used as a carrier for an off-barring attachment of four 18-in cutaway discs which keep the stool uniform and remove ratoon suckers. Off-barring spacing is adjustable within the range 14–24 in.

* * *

In-line refractometer. Anacon Inc., 62 Union Street, Ashland, Mass., 01721 U.S.A.

Details are announced of a new in-line refractometer for continuous measurement and control of solution concentration. A light beam is directed onto a prism in the wall of the pipeline and is reflected back onto a photo-sensitive resistance element in the housing, which is also mounted in the wall of the pipeline. Changes in solution concentration cause changes in the reflected beam. Fluids flowing at hundreds of gal/min through pipelines of 2–10 inches dia. can be monitored and alarms or control signals actuated. Among systems illustrated in Bulletin 50 are a syrup Brix control scheme and a syrup cut-back system.

Liquid sugar from cane molasses. Braunschweigische Maschinenbauanstalt, Am alten Bahnhof 5, 33 Braunschweig, Germany.

The BMA "Goldstrap" process is an ion exchange process in which molasses is clarified by two-stage carbonatation and filtered before being passed through a cation exchanger on the H^+ cycle, followed by an anion exchanger on the OH^- cycle. The molasses is then evaporated to about 75°Bx at low temperature for 2–3 min to give a liquid sugar of high purity and quality, containing 90% of the total sugars present in the original blackstrap molasses.

* * *

"SWEETLAND" PRESSURE FILTER. Dorr-Oliver Inc., Stamford, Conn., U.S.A.

A revised 4-page leaflet (Bulletin 7400) gives information on the primary components and functions of the "Sweetland" pressure filter. Size and capacity specifications are given and the advantages of the filter discussed.

* * *

FALLING-FILM EVAPORATOR. Maschinenfabrik Buckau R. Wolf A. G., 4048 Grevenbroich, P.O. Box. 69, Germany.

Data are given in a leaflet of a falling-film evaporator installed at a West German sugar factory as a IIIc stage.

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Iran sugar refinery conversion.—Buckau R. Wolf A.G. have received an order for the conversion and extension of Ahvaz refinery in Iran, erected by them in 1957/58. The extended plant will process 2400 tons of beet per day from which it will produce white and refined sugar. A special molasses recovery plant will be built, and pressed beet pulp will be sold as fodder.

* * *

Steffen process agreement.—Under an agreement signed recently between Stork-Werkspoor Sugar N.V., of Hengelo, Holland, and Spreckels Sugar Co., of San Francisco, Calif., USA, the Dutch company will be provided with all the know-how required to design and operate continuous molasses desugaring plant according to the Steffen process, which has been greatly modernized into a continuous process by Spreckels. The first Spreckels continuous plant to be built by Stork-Werkspoor is to be erected at Neishabour beet sugar factory (Iran), which was completed by Stork-Werkspoor in 1967 and is being extended from a daily beet slicing capacity of 1000 tons to 1500 tons. The discard molasses from the Steffen plant will be dried on the beet pulp and pressed into pellets. The plant is to be ready for the 1969 campaign. The order has a total value of $2 million.

* * *

Mirrlees Watson equipment for Pakistan.—The Mirrlees Watson Co. Ltd. has received an order for the equipment required to extend the Hyeson sugar factory, in Khanpur, West Pakistan, from the original 1500 t.c.d. to 2500–3000 t.c.d. The factory was supplied by A. & W. Smith & Co. Ltd. in 1963. The new equipment will include a Searby shredder having a diameter of 50 in and a rotor of 72 in and driven by a 450-h.p. turbine. This will be the thirtieth Searby shredder supplied by Mirrlees Watson.

C. W. Murray Award

THE directors of Fletcher and Stewart are commemorating their late President, Mr. C. W. MURRAY, by making an annual award for the best essay submitted on a subject connected with beet or cane sugar technology along with supplementary prizes[1]. The editorial panel, consisting of Mr. W. B. BOAST, Technical Director of the British Sugar Corporation, Mr. R. R. FOLLETT-SMITH, Vice-Chairman, British Section, International Society of Sugar Cane Technologists and lately Chairman of Bookers Sugar Estates and Mr. C. R. D. SHANNON, Consulting Engineer, Jamaica, drew up the list of subjects from which competitors could make their choice and have now examined all the papers submitted.

The directors have accepted the panel's recommendations and have presented the 1968 Award to Mr. B. L. MITTAL, B.Sc., A.I.I.S.T., Chief Chemist, Shree Hanuman Sugar Mills Ltd., Motihari (Champaran) Bihar, India, for his paper entitled "Critical Survey of Formulae for Assessing Cane Milling Capacity and Cane Milling Efficiency". No supplementary prizes were awarded in 1968. Mr. MITTAL's paper is to be published shortly.

The award of £250 was made to Mr. MITTAL in November, 1968, the anniversary of the death of CECIL MURRAY, and he has also received a permanent token of his success.

A period of only sixteen months was available between the press release giving the choice of subjects and the last date for submission of papers for the 1968 award and it was clear from the papers received that those who had contributed had had to rely largely on their past experience. It is hoped that, in future, with a longer period provided for preparation, papers will display more originality of thought and it should then be possible to present both an award and supplementary prizes in 1969.

The list of subjects for the 1969 award was published in March, 1967[2] but for the 1970 and 1971 awards contributors are free to submit papers on any subject of their choosing connected with beet or cane sugar technology.

Details regarding the preparation and submission of papers and the list of subjects for the 1969 award can be obtained from Fletcher and Stewart Limited, Bucklersbury House, 83 Cannon Street, London E.C.4, England.

USSR beet campaign difficulties[3].—Acute transportation difficulties are jeopardizing the Soviet sugar beet harvest this year. According to *Pravda*, fully one-fifth of the beets harvested so far in the Ukraine were still lying in the fields, losing their sugar content, because of transport delays. Average yields in the Ukraine, the chief sugar beet growing region, are also about 200 kg/hectare below last year's nationwide average. Earlier this year the Food Industry Minister said it was hoped to produce 10 million tons of sugar from Soviet beets this year[4]. Last year's beet crop was a record 86,800,000 tons, but, since then, the crop area has been reduced by 300,000 hectares to around 3,500,000 ha. Foreign observers in Moscow feel the reduction in crop area, the lower yields and the transportation shortages militate against a similar harvest this year.

Brevities

Antigua sugar crop, 1968[5].—The crop which started on the 29th May ended on 19th July. A total of 16,320 tons of cane was crushed, producing 1,112 tons of sugar. More than 16 tons of cane was required to produce 1 ton of sugar, the highest on record; last year the figure was 11·11. Some 954 tons of sugar have been exported. Sugar cane producers were paid $12 per ton of cane. A total of 80,000 gallons of molasses was produced, most of which will be used locally. A sugar factory official reports that, with normal weather, the crop for next year should be in the region of 10,000 tons of sugar.

* * *

Bagasse board plants in Trinidad[6].—Two plants are to be set up soon in Trinidad, one for the manufacture of particle boards and the other to produce special finishes for application to the boards. Both plants would require investment of over $2 million and would employ between 100 and 150 persons.

* * *

British Honduras 1967/68 crop[7].—There was an overall increase in production of more than 5000 tons in the 1967/68 season which ended on the 10th July. In this period, 63,588 tons of sugar were manufactured from 643,776 tons of cane delivered at the Tower Hill and Libertad factories. However, production fell short of the goal of 75,000 tons by over 11,000 tons, most of the shortfall occurring in the Orange Walk district, owing to froghopper infestation and fires in that area. The average cane: sugar ratio throughout the crop was 9·29 for farmers and 10·36 for the Company.

* * *

European sugar beet area estimates, 1968.—F. O. Licht K.G. recently published their fourth estimate of 1968 beet areas in Europe[8]. By comparison with the third estimate, the Western Europe total is down from 1,957,194 hectares to 1,926,121 ha, almost the whole of the change being accounted for by a reduction of 16,000 ha in the West Germany figure and a 13,500 reduction expected for Turkey. The new figure for Western Europe is only 44,000 ha or 2% above the revised figure for the 1967 beet area. In Eastern Europe the total estimate is also down by comparison with the third estimate, from 4,779,000 to 4,675,500, as a result of reductions of 3500 ha expected for Hungary, 10,000 ha for Bulgaria and 100,000 ha for the USSR, partly offset by a 10,000 ha increase expected for Rumania. This Eastern Europe total represents a further reduction to 6·3% less than the 4,989,195 ha beet area in 1967. The overall total for Europe, now set at 6,601,621 ha, is some 3·9% less than the 1967 figure of 6,871,728 ha.

* * *

US imports against 1969 quotas[9].—On the 9th October, the US Department of Agriculture announced that an additional 75,000 short tons, raw value, of over-quota sugar would be permitted entry under bond to North of Hatteras refiners during the balance of the year. With the earlier import authorization[10], this made a total of 150,000 tons which might be brought in and carried at the refinery either in the form of raws or refined sugar at 1st January 1969. Later in October the Department lifted the limitation on 1969 quota imports, in order to counter supply difficulties if the waterfront strike scheduled for 20th December takes place[11].

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[1] See *I.S.J.*, 1967, **69**, 46.
[2] *ibid.*, 79.
[3] *The Times*, 26th September1968.
[4] *I.S.J.*, 1968, **70**, 258.
[5] *Barclays Overseas Review*, September 1968, 70.
[6] *W. Indies Chron.*, 1968, **83**, 461.
[7] *Barclays Overseas Review*, September 1968, 75.
[8] *International Sugar Rpt.*, 1968, **100**, (27), 2–3.
[9] *Willett & Gray*, 1968, **92**, 374.
[10] *I.S.J.*, 1968, **70**, 352.
[11] *Public Ledger*, 26th October 1968.

Brevities

Barbados consulting engineers' centenary.—In September, the oldest Barbados firm of consulting engineers, D. M. Simpson & Co., celebrated its centenary. Founded by Donald M. Simpson, who had been apprenticed to George Fletcher & Co. in Derby, the firm has been associated with the Barbados sugar industry since its inception, and has been concerned in the construction and development of many of the factories on the island, while of recent years it has branched out into building and architecture, while retaining its links with sugar.

* * *

Record US beet crop forecast[1].—Based on conditions as at 1st October, the US Dept. of Agriculture forecast a record crop of 26,626,000 short tons, a third more than the 1967 crop of 19,199,000 tons. The estimated crop is 10% higher than the record of 1964. The Department's estimate for the sugar cane crop was unchanged from the past three months at 26,681,000 tons as compared with the 1967 output of 26,628,000 tons.

* * *

Trinidad sugar crop, 1968[2].—Total sugar production for the 1968 crop amounted to 239,156 tons, some 41,301 tons more than last year. Of the 2,427,000 tons of cane crushed, farmers produced 791,000 tons and the sugar companies 1,636,000 tons. The sugar recovery from the cane was higher than in 1967, only 10·15 tons of cane being required to produce a ton of sugar compared with 10·87 tons last year. The farmers' crop was 117,000 tons greater than in 1967 and, for the first time, aerial control of the froghopper pest was carried out on farmers' holdings, the treated 400 acres giving a 60% higher yield. The planned area to be treated by similar means in the new crop is over 1000 acres.

* * *

New sugar factories for India[3].—According to press reports, a new co-operative sugar factory, estimated to cost 21·5 million rupees, has been set up at Supedi in the Dhoraji Taluka of Rajkot district. A loan of 10 million rupees has also been sanctioned for the establishment of Jeejamata co-operative sugar factory at Sindkhed Raj in Buldana district, the balance of 15 million rupees for the total cost to be share capital subscribed by the cane farmers.

* * *

Barbados sugar crop, 1968[4].—The sugar crop in Barbados which has now been completed produced 159,245 tons, compared with 200,612 tons in 1967.

* * *

Australian aid for the Ceylon sugar industry[5].—The Government of Ceylon has sought the assistance of Australian authorities in restoring efficiency to the two sugar mills in the island—Gal Oya in the south and Kantalai in the north. Mr. J. L. WRIGHT, recently-retired Chief Engineer of Farleigh mill, and Mr. M. HUTH, Chief Cane Inspector at Rocky Point mill, have taken up appointments as Supervisor of Mill Manufacture and Sugar Industry Agricultural Adviser, respectively, and Mr. WRIGHT left for Ceylon in July, expecting to be away for two years.

* * *

Mexico sugar production, 1967/68[6].—A total of 24,372,744 metric tons of sugar cane were crushed during the 1967/68 season in Mexico. Sugar production amounted to 2,195,728 metric tons, tel quel, equivalent to 2,327,175 tons, raw value. Last season 25,555,951 tons of cane were processed and sugar production, amounting to 2,327,250 tons, tel quel, equivalent to 2,476,719 tons, raw value, was considerably higher than in the 1967/68 season. According to a spokesman of the Ministry of Agriculture, the decrease in sugar production was due to heavy rainfall during the winter.

US sugar supply quotas, 1968

	Original quotas	*Increases*	*New quotas*
	(short tons, raw value)		
Domestic Beet	3,115,667	—	3,115,667
Mainland Cane	1,186,666	17,334	1,204,000
Hawaii	1,191,704	—	1,191,704
Puerto Rico	515,000	—	515,000
Philippines	1,126,020	—	1,126,020
Argentina	74,131	1,956	76,087
Australia	201,970	1,306	203,276
Bolivia	7,172	189	7,361
Brazil	602,611	15,905	618,516
British Honduras ..	15,520	325	15,845
British West Indies ..	213,033	4,458	217,491
Colombia	63,766	1,684	65,450
Costa Rica	70,940	2,163	73,103
Dominican Republic .	688,202	17,271	705,473
Ecuador.....	87,680	2,314	89,994
Fiji	44,321	287	44,608
French West Indies ..	66,463	—	66,463
Guatemala	59,784	1,823	61,607
Haiti	33,478	—	33,478
Honduras	7,172	218	7,390
India	80,788	523	81,311
Ireland	5,351	—	5,351
Malagasy	9,538	62	9,600
Mauritius	18,513	120	18,633
Mexico	616,159	16,265	632,424
Nicaragua	54,835	—	54,835
Panama	37,810	—	37,810
Peru	480,655	12,688	493,343
Salvador	43,844	1,335	45,179
South Africa	59,470	384	59,854
Swaziland	7,295	47	7,342
Taiwan	84,154	544	84,698
Venezuela	30,288	799	31,087
	10,900,000	100,000	11,000,000

* * *

US beet sugar factory[7].—The new Great Western Sugar Co. factory near Goodland, Kansas[8], named after FRANK A. KEMP, retired Chairman of the company, went into operation at the start of the 1968/69 campaign. Local beet plantings were about double that of the previous year and will provide more beet than the factory can handle so that some is being diverted to other Great Western sugar factories. The Kemp plant will produce more than 50,000 short tons of sugar during the current campaign, and about 22,000 tons of dried beet pulp pellets.

* * *

Food industry exhibition.—During the 27th October—4th November, the third International Food Industries Equipment Exhibition "MATERAL", was held in Paris, at the Palais du CNIT. It was of considerable interest in that many large European constructors of sugar machinery were exhibiting together, for the first time, including Alfa-Laval, Babcock-Atlantique, BMA, Buckau R. Wolf A.G., Filtres Gaudfrin, Soc. Fives Lille-Cail, Gutehoffnungshütte, Olier, and many others.

* * *

Indian beet sugar plant[9].—An 800 tons/day plant for processing sugar beet is to be installed at the Janta Cooperative Sugar Mills, Bhogpur, at a cost of Rs. 4,000,000.

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[1] *Public Ledger*, 12th October 1968.
[2] *Barclays Overseas Review*, August, 1968, 62.
[3] *Indian Sugar*, 1968, **18**, 9.
[4] F. O. Licht, *International Sugar Rpt.*, 1968, **100**, (24), 6.
[5] *Australian Sugar J.*, 1968, **60**, 205.
[6] F. O. Licht, *International Sugar Rpt.*, 1968, **100**, (26), 8.
[7] *Willett & Gray*, 1968, **92**, 349.
[8] *I.S.J.*, 1967, **69**, 31, 64.
[9] *Indian Sugar*, 1968, **18**, 235.

BUYERS' GUIDE

Certain of the classifications have sub-headings for individual types of equipment. Specialist makers appear under these sub-headings, while inclusion of manufacturers under the general headings implies that they supply all or most of the types of equipment described by the sub-headings.

Accumulators, Hydraulic.
Edwards Engineering Corp.
Soc. Fives Lille-Cail.
The Mirrlees Watson Co. Ltd.

Accumulators, Steam.
see Steam Accumulators.

Activated carbon.
Atlas Chemical Industries Inc.
Atlas Chemical Industries S.A.
Atlas Chemical Industries, Canada, Ltd.
Atlas Chemical Interamerica Inc.
Farnell Carbons.
Honeywill-Atlas Ltd.
Lurgi Gesellschaft fur Wärme- und Chemotechnik m.b.H.
Norit Sales Corporation Ltd.
Pittsburgh Activated Carbon Company.
Suchar.

Air clutches.
Farrel Corporation.

Air compressors.
Bosco S.p.A. Officine Meccaniche e Fonderie.
British Brown-Boveri Ltd.
Cotton Bros. (Longton) Ltd.
Soc. Fives Lille-Cail.
Krupp Stahlexport G.m.b.H., Department Krupp-Dolberg.
Nash International Company.
Tilghman Wheelabrator Ltd.
Worthington Corporation.

Air compressors, Oil-free.
Northey Rotary Compressors Ltd.
Tilghman Wheelabrator Ltd.

Air conditioning equipment.
A.B. Svenska Fläktfabriken.

Air coolers.
A.B. Svenska Fläktfabriken.

Air filters.
J. H. Carruthers & Co. Ltd.
Norit Sales Corporation Ltd.
Schumacher Filters Ltd.
Simon-Barron Ltd.
A.B. Svenska Fläktfabriken.

Air heaters.
Fluostatic Ltd.
A.B. Svenska Fläktfabriken.
Yarrow & Co. Ltd.

Air-operated portable stitchers.
Thames Packaging Equipment Co.

Air receivers.
Edwin Danks & Co. (Oldbury) Ltd.

Alcohol plant.
A.P.V. Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
Soc. Fives Lille-Cail.
T. Giusti & Son Ltd.
Honolulu Iron Works Co.
S.P.E.I. Chim.
Technoexport Czechoslovakia.

Anti-foam agents.
Hodag Chemical Corporation.
Schill & Seilacher Chemische Fabrik.

Asbestos products.
Cape Insulation Ltd.
Johns-Manville (Great Britain) Ltd.
Johns-Manville International Corp.

Automatic beet laboratories.
Instrumentenfabriek Venema.

Automatic saccharimeters and polarimeters.
Bendix Electronics Ltd.
Schmidt & Haensch.

Automatic tare rooms.
Instrumentenfabriek Venema.

Bag, *see* Sack.

Bagasse analysis apparatus.
A. H. Korthof N.V.

Bagasse baling presses.
Maschinenfabrik Buckau R. Wolf A.G.
Thibodaux Boiler Works Inc.

Bagasse depithing equipment.
Gruendler Crusher & Pulverizer Company.

Bagasse furnaces.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Patrick Murray (Pty.) Ltd.
S.E.U.M.
John Thompson Ltd., Design and Contracting Divn.

Bagasse preparation equipment for particle board manufacture.
Gruendler Crusher & Pulverizer Co.

Bagasse presses.
Silver Engineering Works Inc.

Bagasse utilization plant for manufacture of cellulose, particle board, pressure mouldings, etc.
Patrick Murray (Pty.) Ltd.

Beet diffusers, Continuous.
Babcock Atlantique.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
CEKOP.
A. F. Craig & Co. Ltd.
A/S De Danske Sukkerfabrikker.
Extraction De Smet S.A.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Silver Engineering Works Inc.
Stork-Werkspoor (V.M.F.)
Technoexport Czechoslovakia.

Beet flume equipment.
Cocksedge & Co. Ltd.
Dreibholz & Floering Ltd.

Beet harvesters.
Vicon N.V.

Beet mechanical discharging and storage equipment.
Soc. Fives Lille-Cail.
Silver Engineering Works Inc.

Beet pulp presses.
BMA Braunschweigische Maschinenbauanstalt.
Bosco S.p.A. Officine Meccaniche e Fonderie.
CEKOP.
Cocksedge & Co. Ltd.
Fletcher and Stewart Ltd.
Hein, Lehmann & Co. A.G.
AB. Landsverk.
Rose, Downs & Thompson Ltd.
Stord Bartz Industri A/S.

Beet sampling equipment.
Cocksedge & Co. Ltd.

Beet seed.
A/S De Danske Sukkerfabrikker.

Beet seed rubbing machines.
Cocksedge & Co. Ltd.

Beet slicers.
CEKOP.
Cocksedge & Co. Ltd.
Dreibholz & Floering Ltd.
Soc. Fives Lille—Cail.
H. Putsch & Comp.

Beet tail utilization plant.
Maschinenfabrik Buckau R. Wolf A.G.
CEKOP.
H. Putsch & Comp.

Beet tare house equipment.
Cocksedge & Co. Ltd.
Dreibholz & Floering Ltd.
Ingeniörsfirman Nils Weibull AB.

Beet washing plant.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
Cocksedge & Co. Ltd.
Salzgitter Maschinen A.G.
Silver Engineering Works Inc.

Beet water-jet unloading equipment.
Cocksedge & Co. Ltd.
Dreibholz & Floering Ltd.
Technoexport Czechoslovakia.

Belting, Conveyor & elevator.
see Conveyor belting.

Boiler water treatment.
Edwin Danks & Co. (Oldbury) Ltd.
Dorr-Oliver Inc.
Machinefabriek Reineveld N.V.
The Permutit Co. Ltd.
Robert Reichling & Co. K.G.
John Thompson Ltd., Design and Contracting Divn.
Unifloc Ltd.

Boilers, Shell.
Edwin Danks & Co. (Oldbury) Ltd.
Robey & Co. Ltd.
John Thompson Ltd., Shell Boiler Divn.

Boilers, Vertical.
John Thompson Ltd., Pressure Vessel Divn.

Boilers, Water tube.
Maschinenfabrik Buckau R. Wolf A.G.
CEKOP.
George Cohen Machinery Ltd.
Escher Wyss Ltd.
Soc. Fives Lille-Cail.
Murray Iron Works Company.
Robey & Co. Ltd.
S.E.U.M.
Simon-Carves Ltd.
Stork-Werkspoor (V.M.F.)
John Thompson Ltd., Design and Contracting Divn.
Yarrow & Co. Ltd.

Bone Char.
British Charcoals & Macdonalds Ltd.
see also Char.

Brushes.
Dendix Brushes Ltd.
The Kleen-e-ze Brush Co. Ltd.

Bulk handling.
see Conveyors and Elevators, *etc.*

Bulk storage hoppers.
Babcock Atlantique.
Cocksedge & Co. Ltd.
Fletcher & Stewart Ltd.
T. Giusti & Son Ltd.
Spencer (Melksham) Ltd.
John Thompson Ltd., Pressure Vessel Divn.
Welding Technical Services Ltd.

Bulk sugar containers, Transportable.
Robert Hudson (Raletrux) Ltd.
John Thompson Ltd., Transporter Divn.

Bunker discharge equipment.
Buhler Brothers Ltd.
Henry Simon Ltd.
The Triton Engineering Co. (Sales) Ltd.

Burners, Sulphur.
see Sulphur furnaces, Continuous.

Calciners, Fluidized bed.
Fluostatic Ltd.

Cane car tippers.
Fletcher and Stewart Ltd.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.

Cane cars and trailers.
Cary Iron Works.
Honolulu Iron Works Co.
Robert Hudson (Raletrux) Ltd.
J. & L. Engineering Company Inc.
Kingston Industrial Works Ltd.
Krupp Stahlexport G.m.b.H., Department Krupp-Dolberg.
Pletterij Spoorijzer N.V.
The Thomson Machinery Co. Inc.
Weeks & Co. (Engineers) Ltd.

Cane carts.
Cary Iron Works.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Kingston Industrial Works Ltd.
L. S. Miedema Landbouwwerktuigenfabriek N.V.
Pletterij Spoorijzer N.V.
The Thomson Machinery Co. Inc.
Weeks & Co. (Engineers) Ltd.

Cane conveyor drives.
Edwards Engineering Corp.

Cane cultivation equipment.
Broussard Machine Co.
J. & L. Engineering Company Inc.
The Thomson Machinery Co. Inc.

Cane diffusers, Continuous.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
A/S De Danske Sukkerfabrikker.
Extraction De Smet S.A.
Soc. Fives Lille-Cail.
Patrick Murray (Pty.) Ltd.
Silver Engineering Works Inc.
Technoexport Czechoslovakia.

Cane grapples.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Priestman Bros. Ltd.
Joseph Westwood & Co. Ltd.

Cane harvesters.
Cary Iron Works.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
The Thomson Machinery Co. Inc.
Toft Bros. Pty. Ltd.

Cane loaders.
Broussard Machine Co.
Cary Iron Works.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
The Thomson Machinery Co. Inc.
Toft Bros. Pty. Ltd.

Cane maturity testers.
A. H. Korthof N.V.

Cane preparation equipment for diffusion.
Gruendler Crusher & Pulverizer Co.
Patrick Murray (Pty.) Ltd.
Silver Engineering Works Inc.
Stork-Werkspoor (V.M.F.).

Cane shredders.
see Shredders.

Cane trash shredders.
Gruendler Crusher & Pulverizer Co.

Cane washing tables.
Cane Machinery and Engineering Co.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Salzgitter Maschinen A.G.
The Thomson Machinery Co. Inc.

Carbon, Decolorizing.
Atlas Chemical Industries Inc.
Atlas Chemical Industries S.A.
Atlas Chemical Industries, Canada, Ltd.
Atlas Chemical Interamerica Inc.
C.E.C.A.
Farnell Carbons.
Honeywill-Atlas Ltd.
Lurgi Gesellschaft für Wärme- und Chemotechnik m.b.H.
Norit Sales Corporation Ltd.
Pittsburgh Activated Carbon Company.
Suchar.
The Sugar Manufacturers' Supply Co. Ltd.

Carbon decolorizing equipment.
Cocksedge & Co. Ltd.
Norit Sales Corporation Ltd.

Carbon decolorizing systems.
Norit Sales Corporation Ltd.
Suchar.

Carbon reactivation.
Ashmore, Benson, Pease & Co. Ltd.
Norit Sales Corporation Ltd.
Suchar.

Carbonatation equipment.
Babcock Atlantique.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
CEKOP.
Dorr-Oliver Inc., Cane Sugar Division.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Patrick Murray (Pty.) Ltd.
Neyrpic.
H. Putsch & Comp.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
Technoexport Czechoslovakia.

Castings.
Stork-Werkspoor (V.M.F.).
John Thompson Ltd., Pressure Vessel Divn.

Cement, Sugar resistant.
Lafarge Aluminous Cement Co. Ltd.

Centrifugal backings.
Ferguson Perforating & Wire Co.
Fontaine & Co. G.m.b.H.
Krieg & Zivy Industries.
Charles Mundt & Sons.
The Western States Machine Co.

Centrifugal clarifiers.
Alfa-Laval AB.
Dorr-Oliver Inc., Cane Sugar Division.

Centrifugal motors.
ASEA.
The Western States Machine Co.

Centrifugal screens.
Balco Filtertechnik G.m.b.H.
BMA Braunschweigische Maschinenbauanstalt.
Cotton Bros. (Longton) Ltd.
Dorr-Oliver Inc., Cane Sugar Division.
Ferguson Perforating & Wire Co.
Fontaine & Co. G.m.b.H.
Hein, Lehmann & Co. A.G.
Krieg & Zivy Industries.
Charles Mundt & Sons.
Patrick Murray (Pty.) Ltd.
Silver Engineering Works Inc.
The Sugar Manufacturers' Supply Co. Ltd.
The Western States Machine Co.

Centrifugals and accessories.
ASEA.
BMA Braunschweigische Maschinenbauanstalt.
Bosco S.p.A. Officine Meccaniche e Fonderie.
Thomas Broadbent & Sons Ltd.
Maschinenfabrik Buckau R. Wolf A.G.
CEKOP.
Dorr-Oliver Inc., Cane Sugar Division.
Escher Wyss Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
Hein, Lehmann & Co. A.G.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
AB. Landsverk.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Salzgitter Maschinen A.G.
The Sugar Manufacturers' Supply Co. Ltd.
The Western States Machine Co.

Centrifugals—Complete electrical equipment.
ASEA.

Centrifugals, Continuous.
BMA Braunschweigische Maschinenbauanstalt.
Thomas Broadbent & Sons Ltd.
Maschinenfabrik Buckau R. Wolf A.G.
Dorr-Oliver Inc., Cane Sugar Division.
Escher Wyss Ltd.
Soc. Fives Lille-Cail.
Hein, Lehmann & Co. A.G.
Salzgitter Maschinen A.G.
Silver Engineering Works Inc.
Western States Machine Co.

Centrifugals—Fully automatic batch-type.
ASEA.
BMA Braunschweigische Maschinenbauanstalt.
Thomas Broadbent & Sons Ltd.
Maschinenfabrik Buckau R. Wolf A.G.
Escher Wyss Ltd.
Soc. Fives Lille-Cail.

Centrifugals—Fully automatic batch-type—*continued*
AB. Landsverk.
The Mirrlees Watson Co. Ltd.
Salzgitter Maschinen A.G.
The Western States Machine Co.

Centrifugals—Semi-automatic batch-type.
BMA Braunschweigische Maschinenbauanstalt.
Thomas Broadbent & Sons Ltd.
Maschinenfabrik Buckau R. Wolf A.G.
Escher Wyss Ltd.
The Mirrlees Watson Co. Ltd.
Salzgitter Maschinen A.G.
The Western States Machine Co.

Chain cane slings.
Wheway-Watson Ltd.

Chains.
Ewart Chainbelt Co. Ltd.
Fletcher and Stewart Ltd
Pennine Chainbelt Co. Ltd.
Renold Limited.
Wheway-Watson Ltd.

Char revivifying plants.
Ashmore, Benson, Pease & Co. Ltd.
James Buchanan & Son (Liverpool) Ltd.
Stein Atkinson Stordy Ltd.

Chemical plants.
A.P.V. Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
George Cohen Machinery Ltd.
Fletcher and Stewart Ltd.
T. Giusti & Son Ltd.
Simon-Carves Chemical Engineering Ltd.
S.P.E.I. Chim.
Technoexport Czechoslovakia.
John Thompson Ltd., Design and Contracting Divn.
John Thompson Ltd., Pressure Vessel Divn.
Unifloc Ltd.
Welding Technical Services Ltd.

Chemicals.
Basic Chemicals, Division Basic Inc.
Hodag Chemical Corporation.
Schill & Seilacher Chemische Fabrik.
The Sugar Manufacturers' Supply Co. Ltd.

Clarifiers.
Alfa-Laval AB.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
CEKOP.
Dorr-Oliver Inc., Cane Sugar Division.
The Eimco Corporation.
Eimco (Great Britain) Ltd.
Eimco Industriale S.p.A.
Fletcher and Stewart Ltd.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
H. Putsch & Comp.
Salzgitter Maschinen A.G.
Simonacco Ltd.
Stork-Werkspoor (V.M.F.).
Unifloc Ltd.

Clarifiers, Tray-type.
Dorr-Oliver Inc., Cane Sugar Division.
The Eimco Corporation.

Colorimeters.
C.Z. Scientific Instruments Ltd.
Phoenix Precision Instrument Co.
The Sugar Manufacturers' Supply Co. Ltd.

Condensers, Water jet ejector.
Patrick Murray (Pty.) Ltd.
Stork-Werkspoor (V.M.F.).

Condensing plant, Barometric.
Hamill & Company.

Continuous belt weighing machines.
Adequate Weighers Ltd.
Ashworth Ross & Co. Ltd.

Control switchgear—limit switches, centrifugal switches, emergency trip gear, etc.
British Brown-Boveri Ltd.
Honeywell Controls Ltd.
Negretti & Zambra Ltd.

Conveyor belt rotary brushes.
Dendix Brushes Ltd.
The Kleen-e-ze Brush Co. Ltd.
Unifloc Ltd.

Conveyor belting, Wire.
United States Steel International (New York) Inc.

Conveyor chains.
Buhler Brothers Ltd.
Ewart Chainbelt Co. Ltd.
G. Hopkins & Sons Ltd.
Pennine Chainbelt Co. Ltd.
Renold Limited.
Henry Simon Ltd.
A. & W. Smith & Co. Ltd.
Wheway-Watson Ltd.

Conveyors and elevators.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
CEKOP.
Cocksedge & Co. Ltd.
George Cohen Machinery Ltd.
The Eimco Corporation.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Hein, Lehmann & Co. A.G.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Kingston Industrial Works Ltd.
Patrick Murray (Pty.) Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Spencer (Melksham) Ltd.
Stork-Werkspoor (V.M.F.).
Ingeniörsfirman Nils Weibull AB.

Apron conveyors.
New Conveyor Co. Ltd.
Unifloc Ltd.

Belt and bucket elevators.
Buhler Brothers Ltd.
Crone & Taylor (Engineering) Ltd.
Mavor & Coulson Ltd.
New Conveyor Co. Ltd.
Henry Simon Ltd.
Simon-Barron Ltd.
Unifloc Ltd.

Belt conveyors.
Crone & Taylor (Engineering) Ltd.
Mavor & Coulson Ltd.
New Conveyor Co. Ltd.
Unifloc Ltd.

Bucket elevators.
Buhler Brothers Ltd.
Crone & Taylor (Engineering) Ltd.
Mavor & Coulson Ltd.
The Mirrlees Watson Co. Ltd.
New Conveyor Co. Ltd.
Henry Simon Ltd.
Simon-Barron Ltd.
Unifloc Ltd.

Chain and bucket elevators.
Buhler Brothers Ltd.
Crone & Taylor (Engineering) Ltd.
G. Hopkins & Sons Ltd.
Mavor & Coulson Ltd.
Simon-Barron Ltd.
Unifloc Ltd.

Chain conveyors.
Buhler Brothers Ltd.
Crone & Taylor (Engineering) Ltd.
Mavor & Coulson Ltd.
Henry Simon Ltd.
Unifloc Ltd.

Drag-bar conveyors.
Unifloc Ltd.

Feeder conveyors.
Crone & Taylor (Engineering) Ltd.
Unifloc Ltd.
see also Sugar throwers and trimmers.

Flight conveyors.
Unifloc Ltd.

Grasshopper conveyors.
Thomas Broadbent & Sons Ltd.
The Mirrlees Watson Co. Ltd.

Plate conveyors.
Unifloc Ltd.

Pneumatic conveyors.
Buhler Brothers Ltd.
G.m.b.H.
Henry Simon Ltd.

Scraper conveyors.
G. Hopkins & Sons Ltd.
Mavor & Coulson Ltd.
New Conveyor Co. Ltd.
Unifloc Ltd.

Screw conveyors.
Ewart Chainbelt Co. Ltd.
The Mirrlees Watson Co. Ltd.
New Conveyor Co. Ltd.
Simon-Barron Ltd.
The Triton Engineering Co. (Sales) Ltd.
Unifloc Ltd.

Siat conveyors.
G. Hopkins & Sons Ltd.

Vibratory conveyors.
Ewart Chainbelt Co. Ltd.
Henry Simon Ltd.
Simon-Barron Ltd.
The Triton Engineering Co. (Sales) Ltd.

Conveyors and elevators, Mobile.
Buhler Brothers Ltd.
Crone & Taylor (Engineering) Ltd.
G. Hopkins & Sons Ltd.
Mavor & Coulson Ltd.
L. S. Miedema Landbouwwerktuigenfabriek N.V.
Salzgitter Maschinen A.G.
Simon Handling Engineers Ltd.

Coolers, Fluidized bed.
Fluostatic Ltd.

Coolers, Sugar.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
Buell Ltd.
Büttner-Werke A.G.
Dunford & Elliott Process Engineering Ltd.
Fletcher and Stewart Ltd.
Honolulu Iron Works Co.
G. Hopkins & Sons Ltd.
Patrick Murray (Pty.) Ltd.
Salzgitter Maschinen A.G.
Standard Steel Corporation.
Stork-Werkspoor (V.M.F.).
see also Dryers.

Coolers, Water.
Film Cooling Towers (1925) Ltd.

Cranes.
Cary Iron Works.
J. H. Carruthers & Co. Ltd.
George Cohen Machinery Ltd.
Soc. Fives Lille-Cail.
John M. Henderson & Co. Ltd.
Robert Hudson (Raletrux) Ltd.
Orenstein-Koppel und Lübecker Maschinenbau A.G.
Priestman Bros. Ltd.
Stork-Werkspoor (V.M.F.)
Stothert & Pitt Ltd.
Vaughan Crane Co. Ltd.
Wheway-Watson Ltd.

Crystallization aids.
Basic Chemicals, Division Basic Inc.
Hodag Chemical Corporation.

Crystallizers.
Babcock Atlantique.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
CEKOP.
A. F. Craig & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Division.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Standard Steel Corporation.
Stork-Werkspoor (V.M.F.).
John Thompson Pressure Vessel Divn.

Cube-making machinery.
Maschinenfabrik Buckau R. Wolf A.G.
Goka N.V. Machine Works.
Standard Steel Corporation.

Cube sugar moulding, ranging and packeting plant.
Brecknell, Dolman & Rogers Ltd.
Fr. Hesser Maschinenfabrik A.G.
Standard Steel Corporation.

Cube wrapping machines.
Fr. Hesser Maschinenfabrik A.G.
SAPAL.

Deaerators.
Head Wrightson Process Engineering Ltd.
Machinefabriek Reineveld N.V.

Decolorizing plants.
Atlas Chemical Industries Inc.
Atlas Chemical Industries S.A.
Atlas Chemical Industries, Canada, Ltd.
Atlas Chemical Interamerica Inc.
BMA Braunschweigische Maschinenbauanstalt.
Honeywill-Atlas Ltd.
IMACTI.
Norit Sales Corporation Ltd.
The Permutit Co. Ltd.
Pittsburgh Activated Carbon Company.
Robert Reichling & Co. K.G.
Suchar.

Decolorizing resins.
Diamond Alkali Company, Western Division.
IMACTI.
The Permutit Co. Ltd.
Robert Reichling & Co. K.G.
Rohm and Haas Company.

Deliming plants.
BMA Braunschweigische Maschinenbauanstalt.
Dorr-Oliver Inc., Cane Sugar Division.
IMACTI.
Machinefabriek Reineveld N.V.
Robert Reichling & Co. K.G.

Demineralization plants.
BMA Braunschweigische Maschinenbauanstalt.
Dorr-Oliver Inc., Cane Sugar Division.
The Eimco Corporation.
IMACTI.
Machinefabriek Reineveld N.V.
The Permutit Co. Ltd.
Robert Reichling & Co. K.G.

Density meters, In-line.
Rotameter Manufacturing Co. Ltd.

Diatomaceous earth, *see* Filter-aids.

Diesel alternator sets.
Maschinenfabrik Buckau R. Wolf A.G.
Stork-Werkspoor (V.M.F.).

Distillery plant, *see* Alcohol plant.

Drives.
see also Cane conveyor drives, Flexible drives, Knives, Milling—Drives *and* Shredder drives.

Dryers.
Ashmore, Benson, Pease & Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Bosco S.p.A. Officine Meccaniche e Fonderie.
Maschinenfabrik Buckau R. Wolf A.G.
Buell Ltd.
Büttner-Werke A.G.
CEKOP.
Dunford & Elliott Process Engineering Ltd.
Escher Wyss Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Salzgitter Maschinen A.G.
S.E.U.M.
A. & W. Smith & Co. Ltd.
S.P.E.I. Chim.
Spencer (Melksham) Ltd.
Standard Steel Corporation.
Stork-Werkspoor (V.M.F.).
A.B. Svenska Fläktfabriken.

Dryers, Fluidized bed.
Büttner-Werke A.G.
Soc. Fives Lille-Cail.
Fluostatic Ltd.
AB. Svenska Flaktfabriken.

Duck boards.
Grill Floors Ltd.

Dust control equipment.
Buell Ltd.
Büttner-Werke A.G.
Centrifix Corporation.
Collectron Ltd.
C.Z. Scientific Instruments Ltd.
Dunford & Elliott Process Engineering Ltd.
Dust Control Equipment Ltd.
Mikropul Ltd.
Phoenix Precision Instrument Co.
Henry Simon Ltd.
A.B. Svenska Fläktfabriken.
Thermix Industries Ltd.
Tilghman Wheelabrator Ltd.

Dust sleeves and bags.
John R. Carmichael Ltd.
Cotton Bros. (Longton) Ltd.
Samuel Hill Ltd.
S.A. Lainière de Sclessin.
Porritt Bro. & Austin Ltd.
Porritts & Spencer Ltd., Industrial Fabrics Export Division.
Henry Simon Ltd.
Tilghman Wheelabrator Ltd.

Economizers.
Soc. Fives Lille-Cail.
John Thompson Ltd., Design and Contracting Divn.

Effluent treatment.
Edwin Danks & Co. (Oldbury) Ltd.
Dorr-Oliver Inc., Cane Sugar Division.
Eimco (Great Britain) Ltd.
Jones & Attwood Ltd.
The Permutit Co. Ltd.
Simon-Carves Ltd.
John Thompson Ltd., Design and Contracting Divn.

Electric motors.
British Brown-Boveri Ltd.
George Cohen Machinery Ltd.
Soc. Fives Lille-Cail.
The Harland Engineering Co. Ltd.

Electric power generators.
ASEA.
British Brown-Boveri Ltd.
George Cohen Machinery Ltd.
Soc. Fives Lille-Cail.
General Electric Company of U.S.A.
Krupp Stahlexport G.m.b.H., Department Krupp-Dolberg.
Murray Iron Works Company.
Stork-Werkspoor (V.M.F.)

Electric surface heaters.
Isopad Ltd.

Electronic equipment.
ASEA.
Bendix Electronics Ltd.
British Brown-Boveri Ltd
Honeywell Controls Ltd.
Negretti & Zambra Ltd.
Henry Simon Ltd.

Engineering design and contracting services.
The Mirrlees Watson Co. Ltd.

Engines, Diesel.
Maschinenfabrik Buckau R. Wolf A.G.
George Cohen Machinery Ltd.
Stork-Werkspoor (V.M.F.)
Worthington Corporation.

Engines, Steam.
George Cohen Machinery Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
The Mirrlees Watson Co. Ltd.
Robey & Co. Ltd.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)

Entrainment separators.
Centrifix Corporation.
Dunford & Elliott Process Engineering Ltd.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Kingston Industrial Works Ltd
Patrick Murray (Pty.) Ltd.

Evaporator additives.
Basic Chemicals, Division Basic Inc.
Hodag Chemical Corporation.

Evaporators and condensing plant.
Alfa-Laval AB.
A.P.V. Co. Ltd.
Babcock Atlantique.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
CEKOP.
A. F. Craig & Co. Ltd.
A/S. De Danske Sukkerfabrikker.
Escher Wyss Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
Hamill & Company.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Kingston Industrial Works Ltd.

Evaporators and condensing plant.— *continued.*
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
St. Mary Iron Works Inc.
Salzgitter Maschinen A.G.
S.E.U.M.
Silver Engineering Works Inc.
A. & W. Smith & Co. Ltd.
S.P.E.I. Chim.
Stork-Werkspoor (V.M.F.)
Technoexport Czechoslovakia.
John Thompson Ltd., Design and Contracting Divn.

Evaporator tube cleaners.
see Tube cleaners.

Fans, Induced and forced draft.
Büttner-Werke A.G.
Stork-Werkspoor (V.M.F).
AB. Svenska Fläktfabriken.

Fertilizers.
Fisons Overseas Ltd.

Filters.
CEKOP.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Sankey Green Wire Weaving Co. Ltd.
Henry Simon Ltd.
S.P.E.I. Chim.

Automatically controlled filters.
Chemap A.G.
Herfilco.
Schumacher Filters Ltd.
Schumacher'sche Fabrik.
Siemens A.G., Wernerwerk fur Messtechnik.
Sparkler Manufacturing Company.
Stella-Meta Filters Ltd.

Bag pressure filters.
A. F. Craig & Co. Ltd.
Salzgitter Maschinen A.G.

Candle filters.
BMA Braunschweigische Maschinenbauanstalt.
H. Putsch & Comp.
Schumacher Filters Ltd.
Schumacher'sche Fabrik.
Stella-Meta Filters Ltd.

Diatomite filters.
Chemap A.G.
Herfilco.
The Mirrlees Watson Co. Ltd.
Schumacher Filters Ltd.
Schumacher'sche Fabrik.
Sparkler Manufacturing Company.
Stella-Meta Filters Ltd.
Unifloc Ltd.

Filter presses.
BMA Braunschweigische Maschinenbauanstalt.
The Manor Engineering Co. Ltd.
Patrick Murray (Pty.) Ltd.

Filter thickeners.
Maschinenfabrik Buckau R. Wolf A.G.
Dorr-Oliver Inc., Cane Sugar Division.
H. Putsch & Comp.
Schumacher Filters Ltd.
Schumacher'sche Fabrik.

Gravity and pressure filters.
G. Hopkins & Sons Ltd.
Machinefabriek Reineveld N.V.
The Mirrlees Watson Co. Ltd.
The Permutit Co. Ltd.

Iron removal filters.
Brimag Ltd.
Electromagnets Ltd.
Machinefabriek Reineveld N.V.
The Permutit Co. Ltd.
Rapid Magnetic Ltd.

Leaf filters.
Dorr-Oliver Inc., Cane Sugar Division.
Ferguson Perforating & Wire Co.
G. Hopkins & Sons Ltd.
The Mirrlees Watson Co. Ltd.
A. & W. Smith & Co. Ltd.
Sparkler Manufacturing Company.
Stella-Meta Filters Ltd
Stork-Werkspoor (V.M.F.).
Suchar.

Plate and frame filters.
G. Hopkins & Sons Ltd.
The Manor Engineering Co. Ltd.
Stork-Werkspoor (V.M.F.).

Pressure filters.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
Chemap A.G.
Edwin Danks & Co. (Oldbury) Ltd.
Dorr-Oliver Inc., Cane Sugar Division.
G. Hopkins & Sons Ltd.
R. Lord & Sons Ltd.
Machinefabriek Reineveld N.V.
The Mirrlees Watson Co. Ltd.
The Permutit Co. Ltd.
Schumacher Filters Ltd.
Schumacher'sche Fabrik.
A. & W. Smith & Co. Ltd.
Sparkler Manufacturing Company.
Stella-Meta Filters Ltd.
Suchar.

Rotary vacuum filters.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
Dorr-Oliver Inc., Cane Sugar Division.
The Eimco Corporation.
Eimco (Great Britain) Ltd.
Eimco Industriale S.p.A.
Patrick Murray (Pty.) Ltd.
H. Putsch & Comp.
Unifloc Ltd.

Filter aids.
C.E.C.A.
Dicalite/GREFCO Inc.
Eagle-Picher Industries Inc.
Johns-Manville (Great Britain) Ltd.
Johns-Manville International Corp.
Kenite Corporation.
The Sugar Manufacturers' Supply Co. Ltd.

Filter cloths.
Jeremiah Ambler Ltd.
John R. Carmichael Ltd.
Cotton Bros. (Longton) Ltd.

Filter cloths—*continued*
Samuel Hill Ltd.
S.A. Lainière de Sclessin.
Nordiska Maskinfilt AB.
Porritt Bro. & Austin Ltd.
Porritts & Spencer Ltd., Industrial Fabrics Export Division.
Sankey Green Wire Weaving Co. Ltd.
Henry Simon Ltd.

Filter cloths washing machines.
Machinefabriek Reineveld N.V.

Filter leaves.
Dorr-Oliver Inc., Cane Sugar Division.
Ferguson Perforating & Wire Co.
G. Hopkins & Sons Ltd.
Charles Mundt & Sons.
Sankey Green Wire Weaving Co. Ltd.
Sparkler Manufacturing Company.

Filter papers.
J. Barcham Green Ltd.
G. Hopkins & Sons Ltd.
A. H. Korthof N.V.
The Sugar Manufacturers' Supply Co. Ltd.

Filter pulp.
J. Barcham Green Ltd.

Filter screens.
Cotton Bros. (Longton) Ltd.
Endecotts (Test Sieves) Ltd.
Ferguson Perforating & Wire Co.
Fontaine & Co. G.m.b.H.
Haver & Boecker.
Krieg & Zivy Industries.
Charles Mundt & Sons.
Sankey Green Wire Weaving Co. Ltd.

Flanges, Non-Ferrous.
Blundell & Crompton Ltd.

Flexible drives.
Flexible Drives (Gilmans) Ltd.

Flexible shaft couplings.
David Brown Gear Industries Ltd.
The Falk Corporation.
Renold Limited.
Henry Simon Ltd.

Flexible shafting.
Flexible Drives (Gilmans) Ltd.
Henry Simon Ltd.

Flowmeters.
Alfa-Laval AB.
Honeywell Controls Ltd.
G. Hopkins & Sons Ltd.
The Lunkenheimer Company.
Negretti & Zambra Ltd.
Rotameter Manufacturing Co. Ltd.
The Sugar Manufacturers' Supply Co. Ltd.

Friction materials (Industrial).
Johns-Manville (Great Britain) Ltd.
Johns-Manville International Corp.

Fume absorption.
Edwin Danks & Co. (Oldbury) Ltd.

Gas purifying equipment.
Centrifix Corporation.
Maschinenfabrik H. Eberhardt.
Lodge-Cottrell Ltd.
Stork-Werkspoor (V.M.F.).

Gear couplings.
David Brown Gear Industries Ltd.
The Falk Corporation.
Henry Simon Ltd.

Gearing, *see* **Reduction gears.**

Gearmotors.
ASEA.
David Brown Gear Industries Ltd.
The Falk Corporation.
Western Gear Corporation.

Grabs, Cane, Beet and Raw sugar.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Priestman Bros. Ltd.
Joseph Westwood & Co. Ltd.

Granulators, *see* Dryers.

Harvesters, *see* Beet harvesters *and* Cane harvesters

Heat exchangers, Air-cooled.
J. & L. Engineering Company Inc.

Heat-exchangers, Lamella-type.
Alfa-Laval AB.
A.P.V. Co. Ltd.

Heat exchangers, Plate type.
Alfa-Laval AB.
A.P.V. Co. Ltd.

Heat exchangers, Spiral-type.
Alfa-Laval AB.

Heat exchangers, Tubular.
Alfa-Laval AB.
A.P.V. Co. Ltd.
Ashmore, Benson, Pease & Co. Ltd.
Blundell & Crompton Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
Edwin Danks & Co. (Oldbury) Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
T. Giusti & Son Ltd.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Kingston Industrial Works Ltd.
R. Lord & Sons Ltd.
Patrick Murray (Pty.) Ltd.
Salzgitter Maschinen A.G.
S.E.U.M.
S.P.E.I. Chim.
Technoexport Czechoslovakia.
John Thompson Ltd., Design and Contracting Divn.
Welding Technical Services Ltd.
Worthington Corporation.

Heat sealers.
The Thames Packaging Equipment Co.

Heating mantles and tapes, Electric.
Isopad Ltd.

Herbicides.
Fisons Overseas Ltd.

Hydraulic controls for valves, etc.
Edwards Engineering Corp.
The Lunkenheimer Company.

Insecticides.
Fisons Overseas Ltd.

Instruments, Process control.
Anacon Inc.
ASEA.
Bellingham & Stanley Ltd.
Chemap A.G.
Electronic Switchgear (London) Ltd.
Hilger & Watts Ltd.
Honeywell Controls Ltd.
Negretti & Zambra Ltd.
Phoenix Precision Instrument Co.
Rotameter Manufacturing Co. Ltd.
The Sugar Manufacturers' Supply Co. Ltd.
G. H. Zeal Ltd.

Insulation, Thermal (heat and cold)
Cape Insulation Ltd.
Johns-Manville (Great Britain) Ltd.
Johns-Manville International Corp.
Lafarge Aluminous Cement Co. Ltd.

Ion exchange plants.
Edwin Danks & Co. (Oldbury) Ltd.
IMACTI.
Machinefabriek Reineveld N.V.
The Permutit Co. Ltd.
Robert Reichling & Co. K.G.

Ion exchange resins.
Diamond Alkali Company, Western Division.
IMACTI.
The Permutit Co. Ltd.
Robert Reichling & Co. K.G.
Rohm and Haas Company.
John Thompson Ltd., Design and Contracting Divn.

Irrigation equipment.
Worthington Corporation.
Wright Rain Ltd.
Wright Rain Africa (Pvt.) Ltd.

Jointings, *see* Packings and gaskets.

Juice heaters.
Babcock Atlantique.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
CEKOP.
A. F. Craig & Co. Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
Hamill & Company.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Salzgitter Maschinen A.G.
S.E.U.M.
Silver Engineering Works Inc.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
Technoexport Czechoslovakia.

Juice scales.
Ashworth Ross & Co. Ltd.
Fletcher and Stewart Ltd.
Carl Schenck Maschinenfabrik G.m.b.H.
see also Weighing Machines

Juice strainers and screens.
Maschinenfabrik Buckau R. Wolf A.G.
Cocksedge & Co. Ltd.
The Deister Concentrator Co. Inc.
Dorr-Oliver Inc., Cane Sugar Division.
Endecotts (Test Sieves) Ltd.
Farrel Corporation.
Ferguson Perforating & Wire Co.
Soc. Fives Lille-Cail.
Fontaine & Co. G.m.b.H.
Gutehoffnungshütte Sterkrade A.G.
Haver & Boecker.
The Mirrlees Watson Co. Ltd.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
The Sugar Manufacturers' Supply Co. Ltd.

Juice and syrup mixers.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
The Sugar Manufacturers' Supply Co. Ltd.

Knives, Beet.
Dreibholz & Floering Ltd.
H. Putsch & Comp.

Knives, Milling.
Babcock Atlantique.
BMA Braunschweigische Maschinenbauanstalt.
Broussard Machine Co.
Maschinenfabrik Buckau R. Wolf A.G.
A. F. Craig & Co. Ltd.
Farrel Corporation.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)

Knives, Milling—Drives.
Farrel Corporation.
General Electric Company of U.S.A.
Stork-Werkspoor (V.M.F.).
Western Gear Corporation.

Laboratory apparatus and equipment.
Chemap A.G.
Endecotts (Test Sieves) Ltd.
A. H. Korthof N.V.
Phoenix Precision Instrument Co.
The Sugar Manufacturers' Supply Co. Ltd.
see also Laboratory Instruments, *etc.*

Laboratory instruments.
Anacon Inc.
C.Z. Scientific Instruments Ltd.
Electronic Switchgear (London) Ltd.
Honeywell Controls Ltd.
A. H. Korthof N.V.
Negretti & Zambra Ltd.
Phoenix Precision Instrument Co.

Laboratory instruments—*continued*
Rotameter Manufacturing Co. Ltd.
The Sugar Manufacturers' Supply Co. Ltd.
G. H. Zeal Ltd.
see also Automatic saccharimeters and polarimeters, Laboratory apparatus and equipment, Refractometers, Saccharimeters and polarimeters, *etc.*

Laboratory reagents.
A. H. Korthof N.V.
The Sugar Manufacturers' Supply Co. Ltd.

Ladders, Steel lattice.
Grill Floors Ltd.
John Thompson Ltd., Pressings Divn.

Lens cleaning tissues.
J. Barcham Green Ltd.

Level indicators and controllers.
Electronic Switchgear (London) Ltd.
Haver & Boecker.
Honeywell Controls Ltd.
Negretti & Zambra Ltd.
Rotameter Manufacturing Co. Ltd.

Lime density meters.
Rotameter Manufacturing Co. Ltd.

Lime slaking equipment.
Cocksedge & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Division.
Maschinenfabrik H. Eberhardt.
The Eimco Corporation.
Fluostatic Ltd.
Stork-Werkspoor (V.M.F.).

Limestone pulverizers for agricultural stone.
Gruendler Crusher & Pulverizer Co.

Liming equipment.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
Cocksedge & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Division.
Maschinenfabrik H. Eberhardt.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Patrick Murray (Pty.) Ltd.
H. Putsch & Comp.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
The Sugar Manufacturers' Supply Co. Ltd.
Unifloc Ltd.

Loading machinery.
Buhler Brothers Ltd.
The Eimco Corporation.
Orenstein-Koppel und Lübecker Maschinenbau A.G.
F. E. Weatherill Ltd.

Locomotives, Diesel.
Soc. Fives Lille-Cail.
General Electric Company of U.S.A.
Robert Hudson (Raleirux) Ltd.
Krupp Stahlexport G.m.b.H., Department Krupp-Dolberg.

Locomotives, Diesel—*continued*
Orenstein-Koppel und Lübeckr Maschinenbau A.G.
Pletterij Spoorijzer N.V.
Plymouth Locomotive Works.

Magnesium oxide.
Basic Chemicals, Division Basic Inc.

Magnetic lifting equipment.
Brimag Ltd.
Electromagnets Ltd.
Rapid Magnetic Ltd.

Magnetic separators.
Brimag Ltd.
Electromagnets Ltd.
Rapid Magnetic Ltd.
Unifloc Ltd.

Massecuite heat treating equipment.
Babcock Atlantique.
Fletcher and Stewart Ltd.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Silver Engineering Works Ltd.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
U.C.M.A.S.
The Western States Machine Co.

Metal detectors.
ASEA.
Dunford & Elliott Process Engineering Ltd.

Mill hydraulics.
Edwards Engineering Corp.
Fletcher and Stewart Ltd.
The Mirrlees Watson Co. Ltd.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)

Mill rolls.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
A. F. Craig & Co. Ltd.
Farrel Corporation.
Soc. Fives Lille-Cail.
G. M. Hay & Co. Ltd.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.).
United States Steel International (New York) Inc.

Mill roll movement indicators and recorders.
Edwards Engineering Corp.

Milling plant.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
A. F. Craig & Co. Ltd.
Farrel Corporation.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
G. M. Hay & Co. Ltd.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.

Milling plant—*continued*
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.).
Technoexport Czechoslovakia.
see also Knives, Milling *and* Shredders.

Milling plant—complete electrical equipment.
ASEA.
General Electric Company of U.S.A.

Molasses addition plants for beet pulp.
Maschinenfabrik Buckau R. Wolf A.G.
Amandus Kahl Nachf.

Molasses tanks.
Babcock Atlantique.
BMA Braunschweigische Maschinenbauanstalt.
Maschinfabrik Buckau R. Wolf A.G.
Fletcher and Stewart Ltd.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
Krupp Stahlexport G.m.b.H., Department Krupp-Dolberg.
Patrick Murray (Pty.) Ltd.
Salzgitter Maschinen A.G.
Stork-Werkspoor (V.M.F.)

Packeting machinery.
Brecknell, Dolman & Rogers Ltd.
Fr. Hesser Maschinenfabrik A.G.
SIG Swiss Industrial Company.

Packeting machinery for individual sachets.
SIG Swiss Industrial Company.

Packings and gaskets.
Johns-Manville (Great Britain) Ltd.
Johns-Manville International Corp.

Pan boiling aids.
Basic Chemicals, Division Basic Inc.
Hodag Chemical Corporation.

Pans, Vacuum.
A.P.V. Co. Ltd.
Babcock Atlantique.
Blundell & Crompton Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
CEKOP.
A. F. Craig & Co. Ltd.
A/S De Danske Sukkerfabrikker.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
T. Giusti & Son Ltd.
Gutehoffnungshütte Sterkrade A.G.
Hamill & Company.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Salzgitter Maschinen A.G.
S.E.U.M.
Silver Engineering Works Inc.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
Technoexport Czechoslovakia.
John Thompson Ltd., Pressure Vessel Divn.

Parcelling machines.
Carl Drohmann G.m.b.H.
Fr. Hesser Maschinenfabrik A.G.
SIG Swiss Industrial Company.

Pelleting presses for bagasse and pith.
Amandus Kahl Nachf.
Simon-Barron Ltd.

Pelleting presses for dried pulp.
Amandus Kahl Nachf.
Simon-Barron Ltd.
Richard Sizer Ltd.

Perforated metals.
Ferguson Perforating & Wire Co.
Krieg & Zivy Industries.
Charles Mundt & Sons.

Pipe fittings.
see Tube fittings

Pipes, Non-ferrous.
The Birmingham Battery & Metal Co. Ltd.
Yorkshire Imperial Metals Ltd.

Pipes, Steam.
John Thompson Ltd., Pipework Divn.

Pipework installation.
Blundell & Crompton Ltd.

Polythene bag sealers.
The Thames Packaging Equipment Co.

Power actuators.
The Lunkenheimer Company.

Power plants.
ASEA.
British Brown-Boveri Ltd.
General Electric Company of U.S.A.
Stork-Werkspoor (V.M.F.).

Power transmission equipment.
ASEA.
Thomas Broadbent & Sons Ltd.
Ewart Chainbelt Co. Ltd.
The Falk Corporation.
Farrel Corporation.
Renold Limited.
Henry Simon Ltd.
Western Gear Corporation.

Preliming equipment.
A/S De danske Sukkerfabrikker.
Dorr-Oliver Inc., Cane Sugar Division.

Pressure gauges.
Honeywell Controls Ltd.
Negretti & Zambra Ltd.
G. H. Zeal Ltd.

Pressure vessels.
Ashmore, Benson, Pease & Co. Ltd.
Babcock Atlantique.
Edwin Danks & Co. (Oldbury) Ltd.
T. Giusti & Son Ltd.
R. Lord & Sons Ltd.
Machinefabriek Reineveld N.V.
Robey & Co. Ltd.
S.E.U.M.
Stork-Werkspoor (V.M.F.)
Thibodaux Boiler Works Inc.
John Thompson Ltd., Pressure Vessel Divn.
Welding Technical Services Ltd.

Printing machinery—Rotary multi-colour for sugar cartons and bags, etc.
Fr. Hesser Maschinenfabrik A.G.

Pulley blocks.
Wheway-Watson Ltd.

Pulverizers, Sugar.
Gruendler Crusher & Pulverizer Co.
Henry Simon Ltd.
The Sugar Manufacturers' Supply Co. Ltd.

Pumps.
Dorr-Oliver Inc., Cane Sugar Division.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
The Harland Engineering Co. Ltd.
G. Hopkins & Sons Ltd.
The Lunkenheimer Company.
Stork-Werkspoor (V.M.F.)
The Sugar Manufacturers' Supply Co. Ltd.

Boiler feed pumps.
Worthington Corporation.

Centrifugal pumps.
The Albany Engineering Co. Ltd.
A.P.V. Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Saunders Valve Co. Ltd.
Schabaver.
Simonacco Ltd.
Stothert & Pitt Ltd.
Wallwin (Pumps) Ltd.
Worthington Corporation.

Corrosion-proof pumps.
The Albany Engineering Co. Ltd.
A.P.V. Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Mono Pumps Ltd.
Simonacco Ltd.
Stothert & Pitt Ltd.
Worthington Corporation.

Dosing pumps.
BMA Braunschweigische Maschinenbauanstalt.

Filtrate pumps.
BMA Braunschweigische Maschinenbauanstalt.
The Eimco Corporation.
Mono Pumps Ltd.
Simonacco Ltd.
Stothert & Pitt Ltd.

Irrigation pumps.
BMA Braunschweigische Maschinenbauanstalt.
Saunders Valve Co. Ltd.
Worthington Corporation.
Wright Rain Ltd.
Wright Rain Africa (Pvt.) Ltd.

Massecuite pumps.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
Soc. Fives-Lille-Cail.
Machinefabriek Reineveld N.V.
Patrick Murray (Pty.) Ltd.
A. & W. Smith & Co. Ltd.
Stothert & Pitt Ltd.

Membrane pumps.
The Eimco Corporation.
Saunders Valve Co. Ltd.

Molasses pumps.
The Albany Engineering Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Amandus Kahl Nachf.
Machinefabriek Reineveld N.V.
Mono Pumps Ltd.
Patrick Murray (Pty.) Ltd.
Stothert & Pitt Ltd.
Worthington Corporation.

Positive-action pumps.
The Albany Engineering Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Mono Pumps Ltd.
Stothert & Pitt Ltd.
Worthington Corporation.

Rotary pumps.
The Albany Engineering Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
The Eimco Corporation.
Mono Pumps Ltd.
Stothert & Pitt Ltd.
Worthington Corporation.

Self-priming pumps.
The Albany Engineering Co. Ltd.
The Eimco Corporation.
Mono Pumps Ltd.
Stothert & Pitt Ltd.
Wallwin (Pumps) Ltd.

Sump pumps.
The Albany Engineering Co. Ltd.
BMA Braunschweigische Macshinenbauanstalt.
The Eimco Corporation.
Mono Pumps Ltd.
Saunders Valve Co. Ltd.
Simonacco Ltd.
Wallwin (Pumps) Ltd.

Vacuumpumps.
see Vacuum pumps.

Railway, *see* Locomotives *and* Track.

Rectifiers.
ASEA.
British Brown-Boveri Ltd.

Reduction and composting equipment for trash and cane waste.
Gruendler Crusher & Pulverizer Co.

Reduction gears.
ASEA.
David Brown Gear Industries Ltd.
Maschinenfabrik Buckau R. Wolf A.G.
The Falk Corporation.
Farrel Corporation.
Soc. Fives Lille-Cail.
Murray Iron Works Company.
Power Plant Gears Ltd.
Renold Limited.
Salzgitter Maschinen A.G.
Henry Simon Ltd.
A. &. W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
Vulcan Iron Works Inc.
Western Gear Corporation.

Refinery equipment.
ASEA.
BMA Braunschweigische Maschinenbauanstalt.

Refinery equipment—*continued*
James Buchanan & Son (Liverpool) Ltd.
Maschinenfabrik Buckau R. Wolf A.G.
CEKOP.
A. F. Craig & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Division.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Norit Sales Corporation Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Stein Atkinson Stordy Ltd.
Stork-Werkspoor (V.M.F.)
Suchar.
Technoexport Czechoslovakia.

Refractometers.
Anacon Inc.
Bellingham & Stanley Ltd.
Hilger & Watts Ltd.
A. H. Korthof N.V.
Phoenix Precision Instrument Co.
Schmidt & Haensch.
VEB Carl Zeiss Jena.

Refractory bricks.
Johns-Manville (Great Britain) Ltd.
Johns-Manville International Corp.
Lafarge Aluminous Cement Co. Ltd.

Refractory cement
Johns-Manville (Great Britain) Ltd.
Johns-Manville International Corp.

Road transport pneumatic bulk vehicles
John Thompson Ltd., Transporter Divn.

Roller chain.
Ewart Chainbelt Co. Ltd.
Morse Chain Division of Borg-Warner Ltd.
Pennine Chainbelt Co. Ltd.
Renold Limited.

Rubber belt cane carriers.
Farrel Corporation.

Saccharimeters and polarimeters.
Bellingham & Stanley Ltd.
Bendix Electronics Ltd.
C.Z. Scientific Instruments Ltd.
Hilger & Watts Ltd.
A. H. Korthof N.V.
Schmidt & Haensch.
The Sugar Manufacturers' Supply Co. Ltd.

Sack closing machines.
Thomas C. Keay Ltd.
Reed Medway Sacks Ltd.
The Sack Filling & Sewing Machine Syndicate Ltd.
The Thames Packaging Equipment Co.

Sack counting equipment.
The Thames Packaging Equipment Co.

Sack filling machines.
Brecknell, Dolman & Rogers Ltd.
Haver & Boecker.
Reed Medway Sacks Ltd.
Ingeniörsfirman Nils Weibull AB.

Sack openers.
Thames Packaging Equipment Co.

Sack printing machines.
Thomas C. Keay Ltd.

Sampling equipment.
The Thames Packaging Equipment Co.
Ingeniörsfirman Nils Weibull AB.

Scaffold boards.
Grill Floors Ltd.

Scale removal and prevention.
Basic Chemicals, Division Basic Inc.
Flexible Drives (Gilmans) Ltd.
Hodag Chemical Corporation.
The Sugar Manufacturers' Supply Co. Ltd.
see also Tube Cleaners.

Screens, Centrifugal, *see* Centrifugal Screens.

Screens, Filter, *see* Filter screens.

Screens, Rotary.
Jones & Attwood Ltd.

Screens, Vibrating.
Büttner-Werke A.G.
Cocksedge & Co. Ltd.
The Deister Concentrator Co. Inc.
Electromagnets Ltd.
Fletcher and Stewart Ltd.
Gruendler Crusher & Pulverizer Company.
Gutehoffnungshütte Sterkrade A.G.
Haver & Boecker.
Hein, Lehmann & Co. A.G.
Carl Schenck Maschinenfabrik G.m.b.H.
Spencer (Melksham) Ltd.
The Sugar Manufacturers' Supply Co. Ltd.
John Thompson Ltd., Design and Contracting Divn.
The Triton Engineering Co. (Sales) Ltd.
Unifloc Ltd.
see also Juice Strainers and Screens.

Sedimentation accelerator.
Hodag Chemical Corporation.

Sewing threads, Heavy grade.
Thames Packaging Equipment Co.

Ship loading installations.
Buhler Brothers Ltd.
Fletcher and Stewart Ltd.
Spencer (Melksham) Ltd.

Shredders.
BMA Braunschweigische Maschinenbauanstalt.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gruendler Crusher & Pulverizer Co.
Gutehoffnungshütte Sterkrade A.G.
The Mirrlees Watson Co. Ltd.
Stork-Werkspoor (V.M.F.)

Shredder drives.
ASEA.
Farrel Corporation.
Stork-Werkspoor (V.M.F.).
Western Gear Corporation.

Silos.
Buhler Brother Ltd.
Ingeniörsfirman Nils Weibull AB.

Skip hoists.
Cocksedge & Co. Ltd.

Slats for slat conveyors.
William Bain & Co. Ltd.
Ewart Chainbelt Co. Ltd.

Spectropolarimeters.
Bellingham & Stanley Ltd.
Bendix Electronics Ltd.
C.Z. Scientific Instruments Ltd.

Spray nozzles.
The Lunkenheimer Company.

Spraying and dusting machinery.
Cooper Pegler & Co. Ltd.

Sprockets.
Ewart Chainbelt Co. Ltd.
Pennine Chainbelt Co. Ltd.
Renold Limited.

Steam accumulators.
Centrifix Corporation.
Fletcher and Stewart Ltd.
R. Lord & Sons Ltd.
Stork-Werkspoor (V.M.F.).
John Thompson Ltd., Design and Contracting Divn.

Steam separators.
Hamill & Company.

Steam storage equipment.
see Steam accumulators.

Steam superheaters.
Maschinenfabrik Buckau R. Wolf A.G.
Stork-Werkspoor (V.M.F.).

Steam traps.
von Arnim'sche Werke G.m.b.H., Werk Schneider & Helmecke.

Steam turbines for mill drives, etc.
ASEA.
British Brown-Boveri Ltd.
George Cohen Machinery Ltd.
A. F. Craig & Co. Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
General Electric Company of U.S.A.
Gutehoffnungshütte Sterkrade A.G.
A.G. Kühnle, Kopp & Kausch.
The Mirrlees Watson Co. Ltd.
Murray Iron Works Company.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
Worthington Corporation.

Steam turbo-alternator sets.
ASEA.
British Brown-Boveri Ltd.
Escher Wyss Ltd.
Soc. Fives Lille-Cail.
General Electric Company of U.S.A.
A.G. Kühnle, Kopp & Kausch.
Murray Iron Works Company.
Stork-Werkspoor (V.M.F.).
Worthington Corporation.

Steel flooring and handrailing.
Grill Floors Ltd.
John Thompson Ltd., Pressings Divn.

Steel framed buildings.
William Bain & Co. Ltd.
Platterij Spoorijzer N.V.

Stokers—Bagasse burning spreader type.
Maschinenfabrik Buckau R. Wolf A.G.

Storage vessels, Stainless steel.
A.P.V. Co. Ltd.
Ashmore, Benson, Pease & Co. Ltd.
T. Giusti & Son Ltd.
G. Hopkins & Sons Ltd.
S.E.U.M.
Stork-Werkspoor (V.M.F.).
John Thompson Ltd., Pressure Vessel Divn.
Welding Technical Services Ltd.

Sugar factory (beet) molasses-free process.
BMA Braunschweigische Maschinenbauanstalt.

Sugar factory design and erection (Cane and Beet).
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
A. F. Craig & Co. Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Honolulu Iron Works Co.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Salzgitter Maschinen A.G.
Silver Engineering Works Inc.
A. & W .Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)

Sugar machinery, General.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
CEKOP.
A. F. Craig & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Division.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
Hamill & Company.
Honolulu Iron Works Co.
J. & L. Engineering Company Inc.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Salzgitter Maschinen A.G.
Silver Engineering Works Inc.
A. &. W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
Technoexport Czechoslovakia.

Sugar silos.
Buhler Brothers Ltd.
A/S De Danske Sukkerfabrikker.
Soc. Fives Lille-Cail.
Henry Simon Ltd.
Ingeniörsfirman Nils Weibull AB.

Sugar tabletting machinery.
Goka N.V. Machine Works.
Pletterij Spoorijzer N.V.
Standard Steel Corporation.

Sugar throwers and trimmers.
Buhler Brothers Ltd.
Cocksedge & Co. Ltd.
Crone & Taylor (Engineering) Ltd.
Fletcher and Stewart Ltd.
Spencer (Melksham) Ltd.

Sulphur furnaces, Continuous.
Maschinenfabrik H. Eberhardt.
Stork-Werkspoor (V.M.F.).

Switchgear.
ASEA.
British Brown-Boveri Ltd.

Switchgear, Ironclad.
ASEA.

Temperature recorders and controllers.
Chemap A.G.
Honeywell Controls Ltd.
A. H. Korthof N.V.
Negretti & Zambra Ltd.
The Sugar Manufacturers' Supply Co. Ltd.
G. H. Zeal Ltd.

Test sieves, B.S. and A.S.T.M.
Endecotts (Test Sieves) Ltd.
Haver & Boecker.
A. H. Korthof N.V.

Test sieve shakers.
Endecotts (Test Sieves) Ltd
Haver & Boecker.

Thermometers.
Honeywell Controls Ltd.
A. H. Korthof N.V.
Negretti & Zambra Ltd.
G. H. Zeal Ltd.

Thickeners, Tray-type.
Dorr-Oliver Inc., Cane Sugar Division.
The Eimco Corporation.

Track and track accessories.
Robert Hudson (Raletrux) Ltd.
Krupp Stahlexport G.m.b.H., Department Krupp-Dolberg.
Pletterij Spoorijzer N.V.

Tractors, Crawler.
The Eimco Corporation.

Trailers.
Cary Iron Works.
Honolulu Iron Works Co.
Robert Hudson (Raletrux) Ltd.
J. & L. Engineering Company Inc.
L. S. Miedema Landbouwwerktuigenfabriek N.V.
Pletterij Spoorijzer N.V.
John Thompson Ltd., Transporter Divn.
Weeks & Co. (Engineers) Ltd.

Transformers.
ASEA.
British Brown-Boveri Ltd.

Trench gratings.
Grill Floors Ltd.

Tube cleaners, Rotary (Electric and air).
Flexible Drives (Gilmans) Ltd.
see also Scale removal and prevention.

Tube fittings.
A.P.V. Co. Ltd. (*stainless steel*).
Blakey's Boot Protectors Ltd. (*malleable iron*).
The Lunkenheimer Company.
Henry Simon Ltd.
Welding Technical Services Ltd.
Yorkshire Imperial Metals Ltd. (*copper, brass and gunmetal*).

Tubes, Bimetal.
Birmingham Battery & Metal Co. Ltd.
Yorkshire Imperial Metals Ltd.

Tubes for boilers, evaporators, juice heaters, vacuum pans, etc.
The Birmingham Battery & Metal Co. Ltd.
Soc. Fives Lille-Cail.
Kamani Tubes Private Ltd.
Welding Technical Services Ltd.
Yorkshire Imperial Metals Ltd.

Vacuum pans, *see* **Pans.**

Vacuum pumps.
Bosco S.p.A. Officine Meccaniche e Fonderie.
George Cohen Machinery Ltd.
Cotton Bros. (Longton) Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
The Mirrlees Watson Co. Ltd.
Nash International Company.
Neyrpic.
A. & W. Smith & Co. Ltd.
Spencer (Melksham) Ltd.
Stork-Werkspoor (V.M.F.)
Worthington Corporation.

Vacuum pumps, Oil-free.
Nash International Company.
Northey Rotary Compressors Ltd.

Valves.
A.P.V. Co. Ltd.
von Arnim'sche Werke G.m.b.H., Werk Schneider & Helmecke.
Chemap A.G.
Honeywell Controls Ltd.
The Lunkenheimer Company.
Patrick Murray (Pty.) Ltd.

Ball valves.
Saunders Valve Co. Ltd.
The Worcester Valve Co. Ltd.

Diaphragm valves.
Negretti & Zambra Ltd.
Saunders Valve Co. Ltd.

Relief valves.
Blundell & Crompton Ltd.
Hattersley (Ormskirk) Ltd.
G. Hopkins & Sons Ltd.

Rotary valves.
Mikropul Ltd.

Stainless steel valves.
Saunders Valve Co. Ltd.

Variable speed controls.
British Brown-Boveri Ltd.

Vehicle washes.
Grill Floors Ltd.

Vibrating feeders.
Haver & Boecker.
Carl Schenck Maschinenfabrik G.m.b.H.
Simon Handling Engineers Ltd.
The Triton Engineering Co. (Sales) Ltd.

Vibrators.
The Triton Engineering Co. (Sales) Ltd.

Water cooling towers.
Film Cooling Towers (1925) Ltd.
Head Wrightson Process Engineering Ltd.
Pletterij Spoorijzer N.V.
AB. Svenska Fläktfabriken.

Weedkillers, *see* **Herbicides.**

Weighing machines.
Adequate Weighers Ltd.
Ashworth Ross & Co. Ltd.
Dunford & Elliott Process Engineering Ltd.
Fletcher and Stewart Ltd.
Haver & Boecker.
Fr. Hesser Maschinenfabrik A.G.
Carl Schenck Maschinenfabrik G.m.b.H.
Stork-Werkspoor (V.M.F.)
The Sugar Manufacturers' Supply Co. Ltd.
see also Juice Scales.

Wire brushes, Rotary and manual.
Flexible Drives (Gilmans) Ltd.
The Kleen-e-ze Brush Co. Ltd.

Wire cloth.
Endecotts (Test Sieves) Ltd.
Ferguson Perforating & Wire Company.
Fontaine & Co. G.m.b.H.
Haver & Boecker.
Sankey Green Wire Weaving Co. Ltd.
Unifloc Ltd.

Wire tying sack tool.
Thames Packaging Equipment Co.

Woven wire.
Endecotts (Test Sieves) Ltd.
Sankey Green Wire Weaving Co. Ltd.

Wrapping machines.
Fr. Hesser Maschinenfabrik A.G.
SAPAL.
SIG Swiss Industrial Company.

Yeast plants.
A.P.V. Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
G. Hopkins & Sons Ltd.

BUYERS' GUIDE—ADDRESS LIST

Adequate Weighers Ltd.,
Bridge Road, Sutton, Surrey, England.
Tel.: 01-642 6666/8. *Cable.* Adegrate, London.

The Albany Engine ring Co. Ltd.,
Church Road, Lydn:y, Glos. England.
Tel.: Lydn.y 2275/2276/2277. *Cable:* Bolthead, Lydney.

Alfa-Laval AB.,
Tumba, Sweden.
Tel.: 0753/31100. *Cable:* Alfalaval Tumba.
Telex: 10260, 10261.

Jeremiah Ambler Ltd.,
Midland Mills, Bradford 2, Yorks., England.
Tel.: Bradford 28456/9. *Cable:* Ambler, Bradford
Telex: 51195.

Anacon Inc.,
62 Union St., Ashland, Mass., 01721 U.S.A.
Tel.: 617 881-3000.

The A.P.V. Co. Ltd.,
Manor Royal, Crawley, Sussex, England.
Tel.: Crawley 27777. *Cable:* Anaclastic, Crawley, Telex.
Telex: 87237.

von Arnim'sche Werke G.m.b.H., Werk Schneider & Helmecke,
605 Offenbach/Main, Germany.
Tel.: 8205-4. *Cable:* Kondenstopf, Offenbachmain.
Telex: 4152899 shof.

ASEA,
Västeras, Sweden.
Tel.: 021/11000. *Cable:* Asea, Vasteras.
Telex: 4720

Ashmore, Benson, Pease & Co. Ltd.,
South Works, Stockton-on-Tees, Co. Durham, England.
Tel.: Stockton 65171. *Cable:* Ashmores, Stockton.
Telex: 58570.

Ashworth Ross & Co. Ltd.,
P.O. Box 5, Midland Iron Works, Scout Hill, Dewsbury, Yorks., England.
Tel.: Dewsbury 1760/2. *Cable:* Duros, Dewsbury.

Atlas Chemical Industries Inc.,
Wilmington, Delaware, 19899 U.S.A.
Tel.: (302) OL8-9311. *Cable:* Atchem, Wilmington.
TWX: 762-2355.

Atlas Chemical Industries S.A.,
15 Rue Blanche, Brussels 5, Belgium.

Atlas Chemical Industries, Canada, Ltd.,
P.O. ox 1085, Brantford, Ontario, Canada.

Atlas Chemica Interamerica Inc.,
Apartado 4994, Panama 5, Pepublic of Panama.

Babcock Atlantique,
48 Rue la Boétie, Paris 8e (75), France.
Tel.: 359-89-50/225-21-50. *Cable:* Babcock, Paris.
Telex: 29 027.

William Bain & Co. Ltd.,
80 Ebury St., Westminster, London S.W.1., England.
Tel.: Sloane 2219. *Cable:* Lochrin, London

Balco-Filtertechnik G.m.b.H.,
Elektro-Chemische Fabrik, 33 Braunschweig, Am Alten Bahnhof 5, Germany.
Tel.: 26518. *Cable:* Balco, Braunschweig.
Telex: 0952509.

Basic Chemicals, Division Basic Inc.,
845 Hanna Building, Cleveland, Ohio, 44115 U.S.A.
Tel.: (216)-241-5000. *Cable:* Brinc, Cleveland.

Bellingham & Stanley Ltd.,
61 Markfield Rd., London N.15., England.
Tel.: 01-808 2675. *Cable:* Polyfract, London, N.15.

Bendix Electronics Ltd.,
High Church Street, New Basford, Nottingham, England.
Tel.: Nottingham 75115. *Cable:* Bendelec, Nottingham.
Telex: 37142.

The Birmingham Battery & Metal Co. Ltd.,
Selly Oak, Birmingham 29, England.
Tel.: Selly Oak 1151. *Cable:* Batmetco, Birmingham, Telex.
Telex: 338285.

Blakey's Boot Protectors Ltd.,
see Pennine Chainbelt Co. Ltd.

Blundell & Crompton Ltd.,
West India Dock Road, London, E.14, England
Tel.: 01-987 6001/3838. *Cable:* Blundell, London, E 14.

BMA Braunschweigische Maschinenbauanstalt,
(33) Braunschweig, Bahnhofstrasse 5, Germany.
Tel.: Brauns.hweig 20111 and 23691.
Cable: Bema, Braunschweig.
Telex: Bema Bsgw. 0952840.

Bosco S.p.A. Officine Meccaniche e Fonderie,
Piazzale Antonio Bosco n.3, Terni, Italy.
Tel.: 55341. *Cable:* Bosco, Terni.
Telex: 66032 Boscoter.

Brecknell, Dolman & Rogers Ltd.,
Pennywell Road, Bristol 5, England.
Tel.: Bristol 58222. *Cable:* Bremaners, Bristol.

Brimag Ltd.,
80A Stratford Rd., Shirley, Solihull, Warwickshire, England.
Tel.: 021-SHI 4504.

British Brown-Boveri Ltd.,
Glen House, Stag Place, London S.W.1, England.
Tel.: 01-828 9422. *Cable:* Reactance, London, Telex.
Telex: 23448.

British Charcoals & Macdonalds Ltd.,
21 Dellingburn St., Greenock, Scotland.
Tel.: 20273. *Cable:* Brimac, Greenock.

Thomas Broadbent & Sons Ltd.,
Central Ironworks, Huddersfield, Yorkshire, England.
Tel.: Huddersfield 22111. *Cable:* Broadbent, Huddersfield.
Telex.: 51515.

Broussard Machine Company,
see Logan Perkins.

David Brown Gear Industries Ltd.,
Park Gear Works, Huddersfield, Yorks., England.
Tel.: Huddersfield 22180. *Cable:* Gearing, Huddersfield.
Telex: 51367.

James Buchanan & Son (Liverpool) Ltd.,
105 Brasenose Road, Liverpool 20, England.
Tel.: Bootle 2117/8/9. *Cable:* Buchanan, Liverpool 20

Maschinenfabrik Buckau R. Wolf A.G..
Grevenbroich/Ndrrh., Germany.
Tel.: Grevenbroich 421. *Cable:* Buckauwolf, Grevenbroich.
Telex: 08517111.

Buell Ltd.,
8–10 Minerva Road, London N.W.10, England.
Tel.: 01–965 1761. *Cable:* Buellon, London, N.W.10.

Buhler Brothers Ltd.,
Engineering Works, 9240 Uzwil, Switzerland.
Tel.: (073) 5 01 11. *Cable:* Buhler, Uzwil.
Telex: 7 75 41.

Büttner-Werke A.G.,
Postfach 4 and 6, Krefeld-Uerdingen 1, Germany.
Tel.: Krefeld 448–1. *Cable:* Büttner, Krefeld-Uerdingen

Cane Machinery and Engineering Co.,
P.O. Box 968, Thibodaux, La., 70301 U.S.A.
Tel.: (504)-447-7285. *Cable:* Cameco, Thibodaux.

Cape Insulation Ltd.,
114 Park Street, London, W.1, England.
Tel.: 01–499 6022. *Cable:* Incorrupt, London, Telex.
Telex: 23759.

John R. Carmichael Ltd.,
Kenmore Works, Broad Lane, Liverpool 11, England.
Tel.: 051-STA 1336/7. *Cable:* Filclo, Liverpool.

J. H. Carruthers & Co. Ltd.,
Peel Park Place, College Milton, East Kilbride, Glasgow, Scotland.
Tel.: East Kilbride 20591. *Cable:* Hoisting, Glasgow.
Telex: 77782.

Cary Iron Works,
see Logan Perkins.

C.E.C.A.,
24 Rue Murillo, Paris 8e, France.
Tel.: Carnot 82-00. *Cable:* Ceca, Paris.

CEKOP Foreign Trade Enterprise,
Kosciolna 12, Warsaw, Poland.
Cable: Cekop Warszawa.
Telex: 81234.

Centrifix Corporation.
P.O. Box 20447, Houston, Texas, 77025 U.S.A.
Tel.: (713)-RI 7-3620. *Cable:* Centrifix, Houston.
Telex: 910–881–2616.

Chemap A.G.,
Alte Landstrasse 415, 8708 Männedorf ZH, Switzerland.
Tel.: 73 91 01. *Cable:* Servochemie, Männedorf.
Telex: 75 508.

Cocksedge & Co. Ltd.,
P.O. Box 41, Grey Friars Road, Ipswich, Suffolk, England.
Tel.: Ipswich 56161. *Cable:* Cocksedge, Ipswich.

George Cohen Machinery Ltd.,
600 Wood Lane, London W.12, England.
Tel.: 01-743 2070. *Cable:* Omniplant, London W.12.
Telex: 21288/9.

Collectron Ltd.,
175 Leckhampton Rd., Cheltenham, Gloucestershire, England.
Tel.: 0CH2-56355. *Cable:* Colextract, Cheltenham.

Cooper, Pegler & Co. Ltd.,
P.O. Box 9-98, Burgess Hill, Sussex, England.
Tel.: Burgess Hill 2525. *Cable:* Stomata, Burgess Hill.

Cotton Bros (Longton) Ltd.,
Crown Works, Portland Rd., Longton, Stoke-on-Trent Staffs., England.
Tel.: Stoke-on-Trent 33021. *Cable:* Cotbro, Stoke-on-Trent.

A. F. Craig & Co. Ltd.,
Caledonia Engineering Works, Paisley, Scotland.
Tel.: Paisley 2191. *Cable:* Craig, Paisley.
Telex: 778051.

Crone & Taylor (Engineering) Ltd.,
Sutton Oak, St. Helens, Lancs, England.
Tel.: St. Helens 23283. *Cable:* Crontaylor, St. Helens.
Telex: 627110 Chamcon Liverpool

C.Z. Scientific Instruments Ltd.,
93/97 New Cavendish St., London W.1., England.
Tel.: (01)-580 0571. *Cable:* Cezet, London.
Telex: Cezet London 262537.

Edwin Danks & Co. (Oldbury) Ltd.,
P.O. Box No. 4, Oldbury, Warley, Worcs., England.
Tel.: Broadwell 2531. *Cable:* Edanks, Warley.
Telex: 33-352.

A/S De Danske Sukkerfabrikker,
(The Danish Sugar Corporation),
Langebrogade 5, Copenhagen K, Denmark.
Tel.: ASTA 6130. *Cable:* Sukkerfabrikker, Copenhagen.
Telex: 5530 Sukker KH.

The Deister Concentrator Co. Inc.,
901–935 Glasgow Avenue, Fort Wayne, Ind., 46801 U.S.A.
Tel.: 742-7213. *Cable:* Retsied, Fort Wayne.

Dendix Brushes Ltd.,
Lower Church St., Chepstow, Monmouthshire NP6 5XT, England.
Tel.: Chepstow 2277/9. *Cable:* Brushes, Chepstow.

Diamond Alkali Company, Western Division,
P.O. Box 829, 1901 Spring Street, Redwood City, Calif., U.S.A.
Tel.: (415) 369–0071. *Cable:* Daco-West, Redwood City, Calif.

Dicalite/GREFCO Inc.,
630 Shatto Place, Los Angeles, California 90005. U.S.A.
Tel.: (213) DUnkirk 1-5081. *Cable:* Dicalite, Losa.
Telex: 67-4224.

Dorr-Oliver Inc., Cane Sugar Division,
Stamford, Conn., 06904 U.S.A.
Tel.: (203) 348-5871.
Telex: 965912.

Dreibholz & Floering Ltd.,
Dereham, Norfolk, England.
Tel.: Dereham 3145. *Cable:* Slicing, Dereham.
Telex: 97357.

Carl Drohmann G.m.b.H.,
Remscheider Str. 3–5, Postfach 360, 7 Stuttgart-Bad Canstatt Germany.
Tel.: 54 11 06. *Cable:* Drohmannpacker, Stuttgart-Bad Canstatt.
Telex: 072 2886.

Dunford & Elliott Process Engineering Ltd.,
143 Maple Road, Surbiton, Surrey, England.
Tel.: Kingston 7799. *Cable:* Lindaresco, Telex, London.
Telex: 22413.

Dust Control Equipment Ltd.,
Thurmaston, Leicester LE4 8HP, England.
Tel.: Syston 3333. *Cable:* Dust, Leicester.
Telex: 34500.

Eagle-Picher Industries Inc.,
American Building, Cincinnati, Ohio, 45201 U.S.A.
Tel.: (513) 721-7010. *Cable:* Eaglepich, Cincinnati.

Maschinenfabrik H. Eberhardt,
3340 Wolfenbüttel, Frankfurterstr. 14/17, P.O. Box 266, Germany.
Tel.: 22002 and 3263. *Cable:* Eberhardt, Wolfenbüttel.
Telex: 09 52620 ebhdtd.

Edwards Engineering Corp.,
1170 Constance Street, New Orleans, La., 70130 U.S.A.
Tel.: 524-0175. *Cable:* Joedco, New Orleans.
Telex: 058-342.

The Eimco Corporation,
P.O. Box 300, Salt Lake City 10, Utah, U.S.A.,
Tel.: (801)328-8831. *Cable:* Eimco, Salt Lake City.
Telex: 2066-038546.

Eimco (Great Britain) Ltd.,
Filter Process Division, Station Rd. ,St. Neots, Hunts., England.
Tel.: St. Neots 3461. *Cable:* Eimfilt, St. Neots.
Telex: 32111.

Eimco Industriale S.p.A.,
Strada Cerca, Tribiano (Milano), Italy.
Tel.: 9064. 234/5/6/7. *Cable:* Eimcoit, Milano.

Electromagnets Ltd.,
Boxmag Works, Bond Street, Hockley, Birmingham 19, England.
Tel.: 021-236 9071. *Cable:* Boxmag, Birmingham.
Telex: Electromagnets, Chamcom, Birmingham.

Electronic Switchgear (London) Ltd.,
58 Wilbury Way, Hitchin, Herts., England.
Tel.: Hitchin 3646. *Cable:* Eurotronic, Hitchin.

Endecotts (Test Sieves) Ltd.,
Lombard Road, London S.W.19, England.
Tel.: Liberty 8121/2/3. *Cable:* Endtesiv, London S.W.19.

Escher Wyss Ltd.,
Case Postale-Gare Centrale, 8023 Zurich, Switzerland.
Tel.: 444451. *Cable:* Escherwyss, Zurich.
Telex: 53906/7/8.

Ewart Chainbelt Co. Ltd.,
Colombo Street, Derby, England.
Tel.: Derby 45451. *Cable:* Chainbelt, Derby.
Telex: 37575.

Extraction De Smet S.A.,
265 Ave. Prince Baudouin, Edegem-Antwerp, Belgium.
Tel.: 49 42 40. *Cable:* Extraxsmet, Antwerp.
Telex: 31824.

The Falk Corporation,
P.O. Box 492, Milwaukee, Wis., 53201 U.S.A.
Tel.: 342-3131. *Cable:* Falk, Milwaukee.
Telex: 026-722

Farnell Carbons,
Division of Forestal Industries (U.K.) Ltd.,
The Adelphi, John Adam St., London W.C.2, England.
Tel.: (01)-930-6777. *Cable:* Scofar, London W.C.2.
Telex: 22817/22818.

Farrel Corporation,
Ansonia, Conn., U.S.A.
Tel.: 734-3331. *Cable:* Farrelmach, Ansonia.

Ferguson Perforating & Wire Co.,
130-140 Ernest Street, Providence, R.I., U.S.A.
Tel.: Williams 1-8876. *Cable:* Ferguson, Providence.

Film Cooling Towers (1925) Ltd.,
Chancery House, Parkshot, Richmond, Surrey, England.
Tel.: 01-940 6494. *Cable:* Aloof, Richmond.

Fisons Overseas Ltd.,
9 Grosvenor St., London W.1, England.
Tel.: Hyde Park 1611. *Cable:* Fisons, London.
Telex: 263184 Fisons London.

Société Fives Lille-Cail,
7 Rue Montalivet, 75 Paris 8e, France.

Fletcher and Stewart Ltd.
Masson Works, Litchurch Lane, Derby, England.
Tel.: Derby 40261. *Cable:* Amarilla, Derby, Telex.
Telex: 37514.

Flexible Drives (Gilmans) Ltd.,
Skatoskalo Works, Millers Road, Warwick, England.
Tel.: Warwick 42693/4/5. *Cable:* Skatoskalo, Warwick.
Telex: 31451.

Fluostatic Ltd.,
Borough Green, Kent, England.
Tel.: Borough Green 2806. *Cable:* Fluostatic, Sevenoaks.
Telex: 262535.

Fontaine & Co. G.m.b.H.,
51 Aachen, Grüner Weg 31, Germany.
Tel.: 31340. *Cable:* Fontaineco, Aachen.

General Electric Company of U.S.A.,
159 Madison Ave., New York, N.Y., 10016 U.S.A.
Tel.: PL1-1311. *Cable:* Ingeco, New York.
Telex: 224698.

T. Giusti & Son Ltd.,
202-224 York Way, Kings Cross, London N.7, England.
Tel.: 01-607 5021-5. *Cable:* Giustison, London N.7.

Goka N.V. Machine Works,
Postbus 3530, Koestraat 2a, Amsterdam C, Holland.
Tel.: 222255/6. *Cable:* Kagodam, Amsterdam.
Telex: 14173.

J. Barcham Green Ltd.,
Hayle Mill, Tovil, Maidstone, Kent, England.
Tel.: Maidstone 52040/56852. *Cable:* Green, Tovil, Maidstone.

Grill Floors Ltd.,
West Row, North Kensington, London, W.10, England.
Tel.: 01-969 3066/7. *Cable:* Etyladec, London, W.10.

Gruendler Crusher & Pulverizer Co.,
2915 North Market Street, St. Louis, Mo., 63106 U.S.A.
Tel.: Jefferson 1-1220. *Cable:* Grupulco, St. Louis.

Gutehoffnungshütte Sterkrade A.G.,
Werk Düsseldorf, 4 Düsseldorf-Grafenberg, Germany.
Tel.: Düsseldorf 66 61 21. *Cable:* Hoffnungshütte, Düsseldorf.
Telex: 0858 6710.

Hamill & Company,
P.O. Box 362, Kailua, Hawaii, 96734 U.S.A.

The Harland Engineering Co. Ltd.,
Harland House, 20 Park Street, London, W.1, England.
Tel.: 01-499 1221/3. *Cable:* Rheometric, London, Telex. *Telex:* 22881.

Haver & Boecker,
4740 Oelde/Westfalen, Postfach 163, Germany.
Tel.: (02522) 301. *Cable:* Haboe, Oelde. *Telex:* 8921571 havr.

G. M. Hay & Co. Ltd.,
Strathclyde Foundry, Boydstone Rd., Thornliebank, Glasgow. Scotland.
Tel.: Giffnock 6521/2. *Cable:* Castiron, Glasgow.

Head Wrightson Process Engineering Ltd.,
Special Products Division,
Teesdale House, 16/26 Baltic Street, London E.C.1, England.
Tel.: 01-253 1299.
Telex: 28879.

Hein, Lehmann & Co. A.G.,
P.O. Box 4109, Fichtenstr. 75, 4000 Düsseldorf, Germany.
Tel.: 780201. *Cable:* Herrmannsieb, Dusseldorf.
Telex: 8582740.

John M. Henderson & Co. Ltd.,
P.O. Box 26, King's Works, Aberdeen, AB9 8BU Scotland.
Tel.: 24262. *Cable:* Cranes, Aberdeen.

Herfilco,
76 Bd. Victor Hugo, 96 Clichy, France.
Tel.: 737.95.14. *Cable:* Herfilco, Paris.
Telex: Herfilco 28 543F.

Fr. Hesser Maschinenfabrik A.G.
7 Stuttgart-Bad Cannstatt, Nauheimerstr. 99, Germany.
Tel.: Stuttgart 566 141. *Cable:* Hesser, Stuttgart-Bad Cannstatt.
Telex: 072-2362.

Hilger & Watts Ltd.,
98 St. Pancras Way, Camden Rd., London N.W.1, England.
Tel.: 01-485 5636. *Cable:* Sphericity, London N.W.1.
Telex: 23852.

Samuel Hill Ltd.,
Balderstone Mill, Oldham Rd., Rochdale, Lancashire, England.
Tel.: Rochdale 46748/9. *Cable:* Filtering, Rochdale.

Hodag Chemical Corporation,
7247 North Central Park Avenue, Skokie, Ill., 60076 U.S.A.
Tel.: Orchard 5-3950. *Cable:* Hodag, Skokieill.

Honeywell Controls Ltd.,
Great West Rd., Brentford, Middlesex, England.
Tel.: 01-568 9191. *Cable:* Honeywell, Hounslow, Telex.
Telex: 22765.

Honeywill-Atlas Ltd.,
Mill Lane, Carshalton, Surrey, England.
Tel.: Franklin 2261/2/3/4.

Honolulu Iron Works Company,
475 Fifth Avenue, New York, N.Y., 10017 U.S.A.
Cable: Honiron, New York.

G. Hopkins & Sons Ltd.,
United House, North Rd., London N.7, England.
Tel.: North 3321. *Cable:* Seamanlike, London N.7.
Telex: 23407.

Robert Hudson (Raletrux) Ltd.,
Raletrux Works, P.O. Box 4, Morley, Leeds, England.
Tel.: Morley 4931. *Cable:* Raletrux Leeds
Telex: 55133 Leeds.

IMACTI Industrieele Maatschappij Activit N.V.,
Postbus 240c, Amsterdam, Holland.
Tel.: 60153, 60821. *Cable:* Activit, Amsterdam.
Telex: 11652 Ion exchange.

Ingeniörsfirman Nils Weibull A.B.,
see Weibull.

Instrumentenfabriek Venema,
Smirnoffstraat 3, Groningen, Holland.
Tel.: 05900/23538. *Cable:* Venapp, Groningen.

Isopad Ltd.,
Barnet By Pass, Boreham Wood, Herts., England.
Tel.: 01-953 2817. *Cable:* Isopad, Borehamwood.
Telex: 261761.

J. & L. Engineering Company Inc.,
P.O. Box. 620, Jeanerette, La., 70544 U.S.A.
Tel.: 318/276-6314. *Cable:* Jalenco, Jeanerette.

Johns-Manville (Great Britain) Ltd.,
20 Albert Embankment, London S.E.1, England.
Tel.: 01-735 6464. *Cable:* Johnmanvil, London.

Johns-Manville International Corp.,
22 East 40th Street, New York, N.Y., 10016 U.S.A.
Tel.: Lexington 2-7600. *Cable:* Johnmanvil, New York.

Jones & Attwood Ltd.,
Stourbridge, Worcestershire, England.
Tel.: Stourbridge 5106/7/8/9. *Cable.* Heat, Stourbridge.
Telex: 338120.

Amandus Kahl Nachf.,
Hamburg 26, Eiffestrasse 432, Germany.
Tel.: 0411/722/4245. *Cable:* Kahladus, Hamburg.
Telex: 0212775.

Kamani Tubes Private Ltd.,
Lal Bahadur Shastri Marg., Kurla, Bompay 70 (A.S.), India.
Tel.: 555561. *Cable:* Kamatubes, Kurla North.

Thomas C. Keay Ltd.,
P.O. Box 30, Baltic Street, Dundee, Scotland.
Tel.: Dundee 26031/4. *Cable:* Keay, Dundee.

Kenite Corporation,
Overhill Building, Scarsdale, N.Y., U.S.A.
Tel.: 914-723-8110. *Cable:* Diatomitescarsdaleny.

Kingston Industrial Works Ltd.,
138 Spanish Town Road, P.O. Box 72, Kingston 11, Jamaica, West Indies.
Tel.: 36121. *Cable:* Industrial, Kingston.

The Kleen-e-ze Brush Co. Ltd., Industrial Division,
Hanham, Bristol, England.
Tel.: Bristol 673027. *Cable:* Kleeneze, Bristol.

A. H. Korthof N.V.,
48 Herengracht, P.O. Box 46, Amsterdam-C., Holland.
Tel.: 020/230734. *Cable:* Sugarlab, Amsterdam.

Krieg & Zivy Industries,
17 rue Louis-Lejeune, 92 Montrouge, France.
Tel.: 253-40-80. *Cable:* Zedka, Montrouge.

Krupp Stahlexport G.m.b.H., Dept. Krupp-Dolberg,
4 Dusseldorf, Grabbeplatz 2, Germany.
Tel.: 91/87791. *Cable:* Kruppstahl, Essen.
Telex: Essen 0857732.

Aktiengesellschaft Kühnle, Kopp & Kausch,
6710 Frankenthal/Pfalz, Germany.
Tel.: Frankenthal (06233)-4021.
Cable: Maschinenkessel, Frankenthal/Pfalz.
Telex: 04 65221.

Lafarge Aluminous Cement Co. Ltd.,
73 Brook Street, London W.1, England.
Tel.: Mayfair 8546. *Cable:* Cimenfondu, London W.1.

S.A. Lainière de Sclessin,
Sclessin-lez-Liège, Belgium.
Tel.: (04) 52.21.50. *Cable:* Lainière, Sclessin.

AB. Landsverk,
Landskrona, Sweden.
Tel.: 16200. *Cable:* Landsverk, Landskrona
Telex: 4285.

Lodge-Cottrell Ltd., *see* Simon Engineering Ltd.

R. Lord & Sons Ltd.,
Barnbrook Boiler Works, Bury, Lancs, England.
Tel.: Bury 4862. *Cable:* Lords, Bury.

The Lunkenheimer Company,
Beekman St. at Waverly Ave, Cincinnati, Ohio, 45214 U.S.A.
Tel.: 513-922-1092. *Cable:* Lunken, Cincinnati.

Lurgi Gesellschaft für Wärme- und Chemotechnik m.b.H.,
6 Frankfurt (Main), Lurgihaus, Germany.
Tel.: 55071. *Cable:* Lurgiwaerme, Frankfurt.

Machinefabriek Reineveld N.V.,
Haagweg 127, P.O. Box 22, Delft, Netherlands.
Tel.: 01730/24890. *Cable:* Reineveld, Delft.
Telex: 31027.

The Manor Engineering Co. Ltd.,
Trentham Road, Longton, Stoke-on-Trent, Staffs., England.
Tel.: Stoke-on-Trent 33081.

Mavor & Coulson Ltd.,
47 Broad St., Bridgeton, Glasgow S.E., Scotland.
Tel.: Bridgeton 1800. *Cable:* Prodigious, Phone, Glasgow.
Telex: 778109.

L. S. Miedema Landbouwwerktuigenfabriek N.V.,
Kleasterdyk 43, Winsum (Fr.), Netherlands.
Tel.: (05173) 541. *Cable:* Miedema, Winsumfriesland.
Telex: 46056.

Mikropul Ltd.,
40 Towerfield Rd., Shoeburyness, Essex, England.
Tel.: Shoeburyness 2373. *Cable:* Mikropul, Southend-on-Sea.

The Mirrlees Watson Co. Ltd.,
Cosmos House, 1 Bromley Common, Bromley, Kent, England.
Tel.: 01-464-3681. *Cable:* Mirwat, Bromley, Kent.
Telex: 2-2404.

Mono Pumps Ltd.,
Mono House, Sekforde Street, Clerkenwell Green, London, E.C.1, England.
Tel.: 01-253 8911. *Cable:* Monopumps London EC1.
Telex: 24453.

Morse Chain Division of Borg-Warner Ltd.,
Works Rd., Letchworth, Herts., England.
Tel.: Letchworth 2333. *Cable:* Borgwarner, Letchworth.
Telex: 82249.

Charles Mundt & Sons,
53 Fairmont Avenue, Jersey City, N.J., U.S.A.
Tel.: Area Code 201–333–6200. *Cable:* Mundt, New Jersey.
Telex: JCY 774.

Murray Iron Works Company,
Burlington, Iowa, U.S.A.
Tel.: Area Code 319 754–6541. *Cable:* Murrayiron, Burlington.
Telex: 256448.

Patrick Murray (Pty.) Ltd.,
P.O. Box 1541, Durban, South Africa.
Cable: Sugarequip, Durban.
Telex: 6-7119 DN.

Nash International Company,
Norwalk Conn., 06856 U.S.A.
Tel.: (203) 866–3351. *Cable:* Hytor, Norwalk, Conn.
Telex: 96–5926.

Negretti & Zambra Ltd.,
Stocklake, Aylesbury, Bucks., England.
Tel.: Aylesbury 5931. *Cable:* Negretti, Aylesbury Telex.
Telex: 83285.

New Conveyor Co. Ltd.,
Brook St., Smethwick, Warley, Worcs., England.
Tel.: 021-SME 2100. *Cable:* Newconti, Birmingham.
Telex: 338063.

Neypric,
Boite Postale 52, Grenoble (Isère), France.
Tel.: Grenoble 44 55 30. *Cable:* Neypric, Grenoble

Nordiska Maskinfilt AB.,
Halmstad, Sweden.
Tel.: 11 87 00. *Cable:* Nordiskafilt, Halmstad.
Telex: 3558.

Norit Sales Corporation Ltd.,
see N.V. Norit Verkoopcentrale.

N.V. Norit Verkoopcentrale,
2de Weteringplantsoen 15, P.O. Box 1720, Amsterdam C, Holland.
Tel.: Amsterdam 239911. *Cable:* Noritcarbo, Amsterdam.
Telex: 12317.

Northey Rotary Compressors Ltd.,
Alder Rd., Parkstone, Poole, Dorset, England.
Tel.: Parkstone 4900. *Cable:* Northey, Bournemouth.

Orenstein-Koppel und Lübecker Maschinenbau A.G.,
4600 Dortmund-Dorstfeld., Karl-Funkestrasse 30, Germany.
Tel.: (0231)6811. *Cable:* Railways, Dortmund-Dorstfeld
Telex: 08 22222.

Patrick Murray (Pty.) Ltd., *see* Murray

Pennine Chainbelt Co. Ltd.,
Modder Place, Armley, Leeds 12, Yorkshire, England.
Tel.: Leeds 63–8755. *Cable:* Pennine, Leeds.

Logan Perkins,
613 Dumaine Street, New Orleans 16, La., U.S.A.
Cable: Perco, New Orleans.

The Permutit Co. Ltd.,
Pemberton House, 632–652 London Rd., Isleworth, Middx., England.
Tel.: (01)-560-5199. *Cable:* Permutit, London.
Telex: 24440.

Phoenix Precision Instrument Co.,
3805 N. Fifth Street, Philadelphia, Pa., 19140 U.S.A.
Tel.: 215–228–7417. *Cable:* Ppico, Philadelphia.

Pittsburgh Activated Carbon Company,
P.O. Box 1346, Calgon Center, Pittsburgh, Pa., 15230 U.S.A.
Tel.: (412) 923–2345. *Cable:* Pitcarb, Pittsburgh.
Telex: 086739.

Pletterij Spoorijzer N.V.,
Postbus 10, Delft, Holland.
Tel.: 25931. *Cable:* Spoorijzer, Delft.
Telex: 31031.

Plymouth Locomotive Works,
Division of the Fate-Root-Heath Co.,
Plymouth, Ohio, 44865 U.S.A.
Tel.: (419) 687-4641. *Cable:* Fateco, Plymouth, Ohio.
Telex: 810-491-2550.

Porritt Bro. & Austin Ltd.,
Broadway Mills, Haslingden, Lancs., England.
Tel.: Rossendale 3421. *Cable:* Neotex, Telex, Haslingden.
Telex: 63127 Neotex Hasden.

Porritts & Spencer Ltd, Industrial Fabrics Export Division,
Broadway, Haslingden, Lancs., England.
Tel.: Rossendale 3421. *Cable:* Neotex, Telex, Haslingden.
Telex: 63127 Neotex Hasden.

Power Plant Gears Ltd.,
West Drayton, Middlesex, England.
Tel.: West Drayton 2626. *Cable:* Roc, West Drayton.

Priestman Bros. Ltd.,
Hedon Rd., Hull, Yorkshire, England.
Tel.: Hull 75111. *Cable:* Priestman, Hull.
Telex: Hull 52120.

H. Putsch & Comp.,
Postfach 4221, Frankfurter Str. 5–25, 58 Hagen, Germany.
Tel.: Hagen 31031. *Cable:* Putsch, Hagen.
Telex: 823795.

Rapid Magnetic Ltd.,
Lombard St., Birmingham 12, England.
Tel.: 021-772 1137. *Cable:* Magnetism, Birmingham.

Reed Medway Sacks Ltd.,
Larkfield, near Maidstone, Kent, England.
Tel.: Maidstone 7–7777. *Cable:* Satchelsac, Larkfield.
Telex: 89148 Reed, Aylesford.

Robert Reichling & Co. K.G.,
Kölner Strasse 397-403a, Postfach 2380, 415 Krefeld, Germany.
Tel.: 3.32.17. *Cable:* Reichling, Krefeld.
Telex: 0853 757.

Renold Limited,
Renold House, Wythenshawe, Manchester, England.
Tel.: 061-MER 5221. *Cable:* Driving, Manchester.
Telex: 669052.

Robey & Co. Ltd.,
P.O. Box No. 23, Globe Works, Lincoln, England.
Tel.: Lincoln 21381. *Cable:* Robey, Lincoln.

Rohm and Haas Company,
Independence Mall West, Philadelphia, Pa., 19105 U.S.A.
Tel.: 592-3000.

Rose, Downs & Thompson Ltd.,
Cannon Street, Hull, England.
Tel.: 29864. *Cable:* Rosedowns, Hull
Telex: 52226.

Rotameter Manufacturing Co. Ltd.,
330 Purley Way, Croydon CR9 4PG, England.
Tel.: 01-688 3816. *Cable:* Rotaflo Croydon.
Telex: 24292.

Sackfilling & Sewing Machine Syndicate Ltd.,
Timewell Works, Lockfield Avenue, Brimsdown, Enfield, Middlesex, England.
Tel.: Howard 1188. *Cable:* Fecit, Enfield.

Salzgitter Maschinen A.G.,
P.O. Box 23, 3327 Salzgitter-Bad, Federal Republic of Germany.
Tel.: (053 41) 34141. *Cable:* Samag, Salzgitter-Bad.
Telex: 9 522 445 smg d.

Sankey Green Wire Weaving Co. Ltd.,
Thelwall, Warrington, Lancs., England.
Tel.: Warrington 61211. *Cable:* Sanco, Warrington.

SAPAL Société Anonyme des Plieuses Automatiques.
36 Avenue du Tir Fédéral, 1024 Ecublens près Lausanne, Switzerland.
Tel.: (021) 34 44 61. *Cable:* Autoplieuse, Lausanne
Telex: 24 541.

Saunders Valve Co. Ltd.,
Grange Rd., Cwmbran, Monmouthshire, England.
Tel.: Cwmbran 2044. *Cable:* Saunval, Newportmon.
Telex: 49241.

Schabaver,
Zone Industrielle de Mélou, 81 Castres, France.
Tel.: 59-00-49. *Cable:* Schabaver, Castres s/Agout.

Carl Schenck Maschinenfabrik G.m.b.H.,
6100 Darmstadt, Landwehrstrasse 55, Germany.
Tel.: 06151/71021. *Cable:* Schenck, Darmstadt.
Telex: 04 189 441 c s d d.

Schill & Seilacher Chemische Fabrik,
2000 Hamburg 74, Moorfleetstr. 28, Germany.
Tel.: 73 16 66. *Cable:* Schillseilacher, Hamburg
Telex: 0212932.

Schmidt & Haensch,
Berlin 62, Naumannstrasse 33, Germany.
Tel.: 71 06 31. *Cable:* Polarisation, Berlin

Schumacher Filters Ltd.,
69/71 Wilkinson St., Sheffield 10, Yorkshire, England.
Tel.: 28103. *Cable:* Schufilt, Sheffield 10
Telex: 54280.

Schumacher'sche Fabrik.
Bietigheim/Württemberg, Germany.
Tel.: 7721. *Cable:* Schumafilt, Bietigheim
Telex: 724217.

S.E.U.M.,
62 Corbehem, France.
Tel.: (20) 88–70–40. *Cable:* SEUM, Corbehem.

SIG Swiss Industrial Company,
CH–8212 Neuhausen Rhine Falls, Switzerland.
Tel.: (053) 8 15 55. *Cable:* Sig, Neuhausenamrheinfall.
Telex: 7 61 56.

Silver Engineering Works Inc.,
3309 Blake St., Denver, Colo. 80205 U.S.A.
Tel.: 303–623–0211. *Cable:* Silver, Denvercolo.
Telex: 045-567 Silverengr Dvr.

Henry Simon Ltd., *see* Simon Engineering Ltd.

Simon Engineering Ltd.,
P.O. Box 31, Stockport, England.
Tel.: Gatley 3621. *Cable:* Simon, Stockport, Telex.
Telex: 669071.

Simon-Barron Ltd., *see* Simon Engineering Ltd.

Simon-Carves Ltd., *see* Simon Engineering Ltd.

Simon-Carves Chemical Engineering Ltd., *see* Simon Engineering Ltd.

Simon Handling Engineers Ltd., *see* Simon Engineering Ltd.

Simonacco Ltd.,
Durranhill, Carlisle, England.
Tel.: Carlisle 24391. *Cable:* Simonacco, Carlisle.
Telex: 6455 Simonacco Carlisle.

Richard Sizer Ltd.,
Cuber Works, Hull, England.
Tel.: Hull 23155. *Cable:* Sizer, Hull Telex.
Telex: 52236.

A. & W. Smith & Co. Ltd.,
Cosmos House, 1 Bromley Common, Bromley, Kent, England.
Tel.: 01-464 3681. *Cable:* Sugrengine, Bromley, Kent.
Telex: 2-2404.

Sparkler Manufacturing Company,
101 Cartwright Rd., Conroe, Texas, 77301 U.S.A.
Tel.: (713) 756-4471. *Cable:* Spafiltco, Conroe.
TWX: 910-880-4183.

S.P.E.I. Chim.,
106 Rue d'Amsterdam, Paris 9e, France.
Tel.: 744-73-79. *Cable:* Rectifpast, Paris.
Telex: 23012 Spechim.

Spencer (Melksham) Ltd.,
(A member of the Elliott-Automation Group),
Melksham, Wilts., England.
Tel.: Melksham 3481. *Cable:* Spencer, Melksham.
Telex: 44392.

Spoorijzer N.V. Delft,
Postbus 10, Delft, Holland.
Tel.: 25931. *Cable:* Spoorijzer, Delft
Telex: 31031.

Standard Steel Corporation,
5073 South Boyle Avenue, Los Angeles, California, 90058 U.S.A.
Tel.: Area 213-585-1234. *Cable:* Stansteel, Los Angeles.
Telex: 674737.

Stein Atkinson Stordy Ltd.,
Westminster House, Kew Rd., Richmond, Surrey, England.
Tel.: Richmond 4861. *Cable:* Metasteina, Richmond
Telex: 262324.

Stella-Meta Filters Ltd.,
Laverstoke Mill, Whitchurch, Hants., England.
Tel.: Whitchurch 360. *Cable:* Stellameta, Whitchurch, Hants

Stord Bartz Industri A/S.,
P.O. Box 777, Bergen, Norway.
Tel.: Bergen 10030. *Cable:* System, Bergen.
Telex: System 2051.

Stork-Werkspoor (V.M.F.),
Hengelo, Holland.
Tel.: Hengelo 54321. *Cable:* Machinefabriek, Hengelo
Telex: 31324.

Stothert & Pitt Ltd.,
Lower Bristol Rd., Bath, Somerset, England.
Tel.: Bath 63401/63041. *Cable:* Stothert, Bath.
Telex: 44177.

Suchar,
Division of Bangor Punta Operations Inc.,
9 East 41st St., New York, N.Y., 10017 U.S.A.
Tel.: (212) 867-0540. *Cable:* Sucharing, New York.

The Sugar Manufacturers' Supply Co. Ltd.,
196-204 Bermondsey Street, London, S.E.1, England.
Tel.: 01-407 5422. *Cable:* Sumasuco, London, S.E.1.

A.B. Svenska Fläktfabriken,
P.O. Box 20040, Stockholm 20, Sweden.
Tel.: Stockholm 23 83 20. *Cable:* Flaktfabriken, Stockholm.
Telex: 10430 flakt sthlm s.

Technoexport Czechoslovakia,
56 Vaclavske nam., Prague 1, Czechoslovakia.
Cable: Technoexport, Prague.

The Thames Packaging Equipment Co.
28 City Road, London, E.C.1, England.
Tel.: 01-606 7387/8. *Cable:* Pakitup, London.

Thermix Industries Ltd.,
see Dunford & Elliott Process Engineering Ltd.

Thibodaux Boiler Works Inc.,
P.O. Box 32, Thibodaux, La., 70301 U.S.A.
Tel.: (Area Code 504)-446-1363.
Cable: Thibworks, Thibodaux.

John Thompson Ltd.,
Ettingshall, Wolverhampton, England.
Tel.: Bilston 41121. *Cable:* Boiler. Telex, Wolverhampton.
Telex: 33-212.

The Thomson Machinery Co. Inc.,
P.O. Box 71, Thibodaux, Louisiana, U.S.A.
Tel.: (504)-447-3773. *Cable:* Thomson, Thibodaux.

Tilghman Wheelabrator Ltd.,
Broadheath, Altrincham, Cheshire, England.
Tel.: Altrincham 4242. *Cable:* Tilghmans, Altrincham.
Telex: 668945.

Toft Bros. Pty. Ltd.,
Private Mail Bag, Avoca Road, Bundaberg, 4670 Queensland, Australia.
Tel.: Bundaberg 2216. *Cable:* Toftequip, Bundaberg.

The Triton Engineering Co. (Sales) Ltd.,
Kingsnorth Industrial Estate, Wotton Road, Ashford, Kent, England.
Tel.: Ashford (Kent) 2051-5. *Cable:* Triton, Ashford, Kent.

Tygadure Ltd.,
see Fothergill & Harvey Ltd.

Unifloc Ltd.,
11/16 Adelaide Street, Swansea, Glamorgan, Wales.
Tel.: Swansea 55164. *Cable:* Unifloc, Swansea.

United States Steel International (New York) Inc.,
Glen House, Stag Place, London S.W.1., England.
Tel.: Tate Gallery 0111. *Cable:* Steelmaker, London.
Telex: 27738 and 261021.

Vaughan Crane Co. Ltd.,
West Gorton, Manchester 12, England.
Tel.: (061)-223-2771. *Cable:* Vaunting Manchester 12.

Vicon N.V.,
Nieuw Vennep, Holland.
Tel.: (02526)-2855.
Telex: 41149.

Wallwin (Pumps) Ltd.,
Saltisford Iron Works, Warwick, England.
Tel.: Warwick 41581. *Cable:* Unbeaten, Warwick.

F. E. Weatherill Ltd.,
Tewin Road, Welwyn Garden City, Herts., England.
Tel.: Welwyn Garden 20141.
Cable: Weatherhyd, Welwyn Garden City, Telex.
Telex: 24198.

Weeks & Co. (Engineers) Ltd.,
Bridge Works, Ferry Rd., Hessle, East Yorkshire, England.
Tel.: Hull 642171. *Cable:* Weeks, Hull.

Ingeniörsfirman Nils Weibull AB.,
Box 65, Malmö 1, Sweden.
Tel.: Malmö 73495. *Cable:* Nilswei, Malmö.

Welding Technical Services Ltd.,
Pershore Road South, Kings Norton, Birmingham 30, England.
Tel.: Kings Norton 5541-4. *Cable:* Weltexa, Birmingham.

Western Gear Corporation,
Industrial Products Division, P.O. Box 126, Belmont, Calif., U.S.A.
Tel.: (415)-593-7611. *Cable:* Westgear, Los Angeles.
Telex: 47-34468 via ITT

The Western States Machine Company,
Hamilton, Ohio, U.S.A.
Tel.: 513-894-4758. *Cable:* Wesmaco, Hamilton, Ohio

Joseph Westwood & Co. Ltd.,
Napier Yard, West Ferry Rd., Millwall, London, E.14, England.
Tel.: 01-987 1043. *Cable:* Westwood, London E.14.

Wheway-Watson Ltd.,
Green Lane, Walsall, Staffordshire, England.
Tel.: Walsall 27511. *Cable:* Wheway, Walsall.

The Worcester Valve Co. Ltd.,
Burrell Rd., Haywards Heath, Sussex, England.
Tel.: Haywards Heath 51581.
Telex: 87189.

Worthington Corporation,
Harrison, New Jersey, U.S.A.
Tel.: 201-HU-4-1234. *Cable:* Worthington, Harrison.
Telex: 201-621-7848.

Wright Rain Ltd.,
Crowe, Ringwood, Hants., England.
Tel.: Ringwood 2251. *Cable:* Wrightrain, Ringwood, Telex
Telex: 41206.

Wright Rain Africa (Pvt.) Ltd.,
35 Birmingham Road, Box 3237, Salisbury, Rhodesia.
Tel.: Salisbury 25810. *Cable:* Wrightrain, Salisbury.

Yarrow & Co. Ltd.,
Scotstoun, Glasgow W.4, Scotland.
Tel.: Scotstoun 1207. *Cable:* Yarrow, Glasgow.
Telex: 77357 Yarrow Glasgow.

Yorkshire Imperial Metals Ltd.,
P.O. Box 166, Leeds, Yorkshire, England.
Tel.: 0LE2 (Leeds) 7-2222. *Cable:* Yorkimp, Leeds
Telex: 55-311.

G. H. Zeal Ltd.,
Lombard Rd., Merton, London S.W.19., England.
Tel.: 01-542 2283/6. *Cable:* Zealdom, London S.W.19.

VEB. Carl Zeiss Jena,
Carl-Zeiss-Strasse 1, 69 Jena/Thür, D.D.R.
Tel.: 27042. *Cable:* Zeisswerk, Jena.
Telex: 058 8622

BUYERS' GUIDE

Certain of the classifications have sub-headings for individual types of equipment. Specialist makers appear under these sub-headings, while inclusion of manufacturers under the general headings implies that they supply all or most of the types of equipment described by the sub-headings.

Accumulators, Hydraulic.
Edwards Engineering Corp.
Soc. Fives Lille-Cail.
The Mirrlees Watson Co. Ltd.

Accumulators, Steam.
see Steam Accumulators.

Activated carbon.
Atlas Chemical Industries Inc.
Atlas Chemical Industries S.A.
Atlas Chemical Industries, Canada, Ltd.
Atlas Chemical Interamerica Inc.
The Clydesdale Chemical Co. Ltd.
Farnell Carbons.
Honeywill-Atlas Ltd.
Lurgi Gesellschaft fur Wärme- und Chemotechnik m.b.H.
Norit Sales Corporation Ltd.
Pittsburgh Activated Carbon Company.
Suchar.

Air clutches.
Farrel Corporation.

Air compressors.
Bosco S.p.A. Officine Meccaniche e Fonderie.
British Brown-Boveri Ltd.
Peter Brotherhood Ltd.
Cotton Bros. (Longton) Ltd.
Soc. Fives Lille-Cail.
Nash International Company.
Worthington Corporation.

Air compressors, Oil-free.
Peter Brotherhood Ltd.
Northey Rotary Compressors Ltd.

Air conditioning equipment.
A.B. Svenska Fläktfabriken.

Air coolers.
A.B. Svenska Fläktfabriken.

Air filters.
J. H. Carruthers & Co. Ltd.
Norit Sales Corporation Ltd.
Schumacher Filters Ltd.
Simon-Barron Ltd.
A.B. Svenska Fläktfabriken.

Air heaters.
Fluostatic Ltd.
E. Green & Son Ltd.
A.B. Svenska Fläktfabriken.
Yarrow & Co. Ltd.

Air-operated portable stitchers.
Thames Packaging Equipment Co.

Alcohol plant.
A.P.V. Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
Soc. Fives Lille-Cail.
T. Giusti & Son Ltd.
Honolulu Iron Works Co.
Lepage, Urbain & Cie.
S.P.E.I. Chim.
Technoexport Czechoslovakia.

Anti-foam agents.
Hodag Chemical Corporation.
Schill & Seilacher Chemische Fabrik.

Asbestos products.
Cape Insulation Ltd.
General Refractories Ltd.

Automatic beet laboratories.
Instrumentenfabriek Venema.

Automatic saccharimeters and polarimeters.
Schmidt & Haensch.
Thorn Bendix Ltd.
Carl Zeiss.

Automatic tare rooms.
Instrumentenfabriek Venema.

Bag, *see* Sack.

Bagasse analysis apparatus.
A. H. Korthof N.V.

Bagasse baling presses.
Shirtliff Bros. Ltd.
Thibodaux Boiler Works Inc.

Bagasse depithing equipment.
Gruendler Crusher & Pulverizer Company.

Bagasse furnaces.
Honolulu Iron Works Co.
Patrick Murray (Pty.) Ltd.
S.E.U.M.
John Thompson (Design & Contracting Divn.) Ltd.

Bagasse preparation equipment for particle board manufacture.
Gruendler Crusher & Pulverizer Co.

Bagasse presses.
Silver Engineering Works Inc.

Bagasse utilization plant for manufacture of cellulose, paper pulp, particle board, etc.
Cellulose Development Corporation Ltd.
Patrick Murray (Pty.) Ltd.

Beet diffusers, Continuous.
Babcock Atlantique.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
A. F. Craig & Co. Ltd.
A/S De Danske Sukkerfabrikker.
Extraction De Smet S.A.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Silver Engineering Works Inc.
Stork-Werkspoor (V.M.F.)
Technoexport Czechoslovakia.

Beet flume equipment.
Cocksedge & Co. Ltd.
Dreibholz & Floering Ltd.

Beet mechanical discharging and storage equipment.
Soc. Fives Lille-Cail.
Silver Engineering Works Inc.

Beet pulp presses.
BMA Braunschweigische Maschinenbauanstalt.
Bosco S.p.A. Officine Meccaniche e Fonderie.
CEKOP.
Cocksedge & Co. Ltd.
Fletcher and Stewart Ltd.
Hein, Lehmann & Co. A.G.
AB. Landsverk.
Etablissements F. Moret.
Rose, Downs & Thompson Ltd.
Stord Bartz Industri A/S.
Weigelwerk A.G.

Beet sampling equipment.
Cocksedge & Co. Ltd.

Beet seed.
A/S De Danske Sukkerfabrikker.

Beet seed rubbing machines.
Cocksedge & Co. Ltd.

Beet slicers.
CEKOP.
Cocksedge & Co. Ltd.
Dreibholz & Floering Ltd.
Soc. Fives Lille—Cail.
H. Putsch & Comp.

Beet tail utilization plant.
CEKOP.
H. Putsch & Comp.

Beet tare house equipment.
Cocksedge & Co. Ltd.
Dreibholz & Floering Ltd.
Ingeniörsfirman Nils Weibull AB.

Beet washing plant.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
Cocksedge & Co. Ltd.
Salzgitter Maschinen A.G.
Silver Engineering Works Inc.

Beet water-jet unloading equipment.
CEKOP.
Cocksedge & Co. Ltd.
Dreibholz & Floering Ltd.
Technoexport Czechoslovakia.

Belting, Conveyor & elevator.
see Conveyor belting.

Blending machines.
Arenco-Alite Ltd.

Boiler water treatment.
CEKOP.
Dorr-Oliver Inc.
Machinefabriek Reineveld N.V.
The Permutit Co. Ltd.
Robert Reichling & Co. K.G.
John Thompson (Design & Contracting Divn) Ltd.
Unifloc Ltd.

Boilers, Shell.
Marshall, Sons & Co. Ltd.
Robey & Co. Ltd.
John Thompson Ltd., Shell Boiler Divn.

Boilers, Vertical.
John Thompson (Design & Contracting Divn.) Ltd.

Boilers, Water tube.
CEKOP.
George Cohen Machinery Ltd.
Escher Wyss Ltd.
Soc. Fives Lille-Cail.
Foster Wheeler John Brown Boilers Ltd.
Marshall, Sons & Co. Ltd.
Murray Iron Works Company.
Robey & Co. Ltd.
S.E.U.M.
Simon-Carves Ltd.
Stork-Werkspoor (V.M.F.)
John Thompson (Design & Contracting Divn.) Ltd.
Yarrow & Co. Ltd.

Bone Char.
British Charcoals & Macdonalds Ltd.
see also Char.

Brushes.
Dendix Brushes Ltd.
Flexotube (Liverpool) Ltd.
The Kleen-e-ze Brush Co. Ltd.

Bulk handling.
see Conveyors and Elevators, *etc.*

Bulk storage hoppers.
Babcock Atlantique.
Cocksedge & Co. Ltd.
Fletcher & Stewart Ltd.
T. Giusti & Son Ltd.
Spencer (Melksham) Ltd.
John Thompson (Pressure Vessel Divn.) Ltd.
Walkers Ltd.
Welding Technical Services Ltd.

Bulk sugar containers, Transportable.
Robert Hudson (Raletrux) Ltd.
John Thompson (Transporter Divn.) Ltd.

Bunker discharge equipment.
Buhler Brothers Ltd.
Henry Simon Ltd.
The Triton Engineering Co. (Sale) Ltd.

Burners, Sulphur.
see Sulphur furnaces, Continuous.

Calciners, Fluidized bed.
Fluostatic Ltd.

Cane car tippers.
Cane Machinery and Engineering Co. Inc.
Fletcher and Stewart Ltd.
Honolulu Iron Works Co.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Walkers Ltd.

Cane cars and trailers.
Cane Machinery and Engineering Co. Inc.
Cary Iron Works.
Honolulu Iron Works Co.
Robert Hudson (Raletrux) Ltd.
Kingston Industrial Works Ltd.
Pletterij Spoorijzer N.V.
The Thomson Machinery Co. Inc.
Walkers Ltd.
Weeks & Co. (Engineers) Ltd.

Cane carts.
Cane Machinery and Engineering Co. Inc.
Cary Iron Works.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
L. S. Miedema Landbouwwerktuigenfabriek N.V.
Pletterij Spoorijzer N.V.
The Thomson Machinery Co. Inc.
Weeks & Co. (Engineers) Ltd.

Cane conveyor drives.
Edwards Engineering Corp.

Cane cultivation equipment.
Broussard Machine Co.
Cane Machinery and Engineering Co. Inc.
The Thomson Machinery Co. Inc.

Cane diffusers, Continuous.
BMA Braunschweigische Maschinenbauanstalt.
A/S De Danske Sukkerfabrikker.
Extraction De Smet S.A.
Soc. Fives Lille-Cail.
Patrick Murray (Pty.) Ltd.
Silver Engineering Works Inc.
Technoexport Czechoslovakia.

Cane grapples.
Cane Machinery and Engineering Co. Inc.
Honolulu Iron Works Co.
Joseph Westwood & Co. Ltd.

Cane harvesters.
Cane Machinery and Engineering Co. Inc.
Cary Iron Works.
Honolulu Iron Works Co.
The Thomson Machinery Co. Inc.
Toft Bros. Pty. Ltd.

Cane loaders.
Broussard Machine Co.
Cane Machinery and Engineering Co. Inc.
Cary Iron Works.
Honolulu Iron Works Co.
The Thomson Machinery Co. Inc.
Toft Bros. Pty. Ltd.

Cane maturity testers.
A. H. Korthof N.V.

Cane preparation equipment for diffusion.
Gruendler Crusher & Pulverizer Co.
Patrick Murray (Pty.) Ltd.
Silver Engineering Works Inc.
Stork-Werkspoor (V.M.F.).

Cane shredders.
see Shredders.

Cane trash shredders.
Gruendler Crusher & Pulverizer Co.

Cane washing tables.
Cane Machinery and Engineering Co. Inc.
Honolulu Iron Works Co.
The Thomson Machinery Co. Inc.

Carbon, Decolorizing.
Atlas Chemical Industries Inc.
Atlas Chemical Industries S.A.
Atlas Chemical Industries, Canada, Ltd.
Atlas Chemical Interamerica Inc.
C.E.C.A.
The Clydesdale Chemical Co. Ltd.
Farnell Carbons.
Honeywill-Atlas Ltd.
Lurgi Gesellschaft für Wärme- und Chemotechnik m.b.H.
Norit Sales Corporation Ltd.
Pittsburgh Activated Carbon Company.
Suchar.
The Sugar Manufacturers' Supply Co. Ltd.

Carbon decolorizing equipment.
Cocksedge & Co. Ltd.
Norit Sales Corporation Ltd.

Carbon decolorizing systems.
Norit Sales Corporation Ltd.
Suchar.

Carbon reactivation.
Ashmore, Benson, Pease & Co. Ltd.
Norit Sales Corporation Ltd.
Suchar.

Carbonatation equipment.
Babcock Atlantique.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
Dorr-Oliver Inc., Cane Sugar Division.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Patrick Murray (Pty.) Ltd.
Neyrpic.
H. Putsch & Comp.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
Technoexport Czechoslovakia.

Castings.
E. Green & Son Ltd.
Stork-Werkspoor (V.M.F.).
John Thompson (Pressure Vessel Divn.) Ltd.

Cement, Sugar resistant.
Lafarge Aluminous Cement Co. Ltd.

Centrifugal backings.
Ferguson Perforating & Wire Co.
Fontaine & Co. G.m.b.H.
Krieg & Zivy Industries.
Charles Mundt & Sons.
The Western States Machine Co.

Centrifugal clarifiers.
Alfa-Laval AB.
Dorr-Oliver Inc., Cane Sugar Division.

Centrifugal motors.
ASEA.
The Western States Machine Co.

Centrifugal screens.
Balco Filtertechnik G.m.b.H.
BMA Braunschweigische Maschinenbauanstalt.
Cotton Bros. (Longton) Ltd.
Dorr-Oliver Inc., Cane Sugar Division.
Ferguson Perforating & Wire Co.
Fontaine & Co. G.m.b.H.
N. Greening (Warrington) Ltd.
Hein, Lehmann & Co. A.G.
Krieg & Zivy Industries.
Charles Mundt & Sons.
Patrick Murray (Pty.) Ltd.
Silver Engineering Works Inc.
The Sugar Manufacturers' Supply Co. Ltd.
The Western States Machine Co.

Centrifugals and accessories.
ASEA.
BMA Braunschweigische Maschinenbauanstalt.
Bosco S.p.A. Officine Meccaniche e Fonderie.
Thomas Broadbent & Sons Ltd.
CEKOP.
Dorr-Oliver Inc., Cane Sugar Division.
Escher Wyss Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
Hein, Lehmann & Co. A.G.
Honolulu Iron Works Co.
AB. Landsverk.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Salzgitter Maschinen A.G.
The Sugar Manufacturers' Supply Co. Ltd.
The Western States Machine Co.

Centrifugals—Complete electrical equipment.
ASEA.

Centrifugals, Continuous.
BMA Braunschweigische Maschinenbauanstalt.
Thomas Broadbent & Sons Ltd.
CEKOP.
Dorr-Oliver Inc., Cane Sugar Division.
Escher Wyss Ltd.
Soc. Fives Lille-Cail.
Hein, Lehmann & Co. A.G.
Salzgitter Maschinen A.G.
Silver Engineering Works Inc.
Western States Machine Co.

Centrifugals—Fully automatic batch-type.
ASEA.
BMA Braunschweigische Maschinenbauanstalt.
Thomas Broadbent & Sons Ltd.
Escher Wyss Ltd.
Soc. Fives Lille-Cail.
AB. Landsverk.
The Mirrlees Watson Co. Ltd.
Salzgitter Maschinen A.G.
The Western States Machine Co.

Centrifugals—Semi-automatic batch-type.
BMA Braunschweigische Maschinenbauanstalt.
Thomas Broadbent & Sons Ltd.
Escher Wyss Ltd.
The Mirrlees Watson Co. Ltd.
Salzgitter Maschinen A.G.
The Western States Machine Co.

Chain cane slings.
Wheway-Watson Ltd.

Chains.
Bagshawe & Co. Ltd.
Ewart Chainbelt Co. Ltd.
Fletcher and Stewart Ltd.
Parsons Chain Co. Ltd.
Pennine Chainbelt Co. Ltd.
Renold Limited.
Walkers Ltd.
Wheway-Watson Ltd.

Char revivifying plants.
Ashmore, Benson, Pease & Co. Ltd.
James Buchanan & Son (Liverpool) Ltd.
Stein Atkinson Stordy Ltd.

Chemical plants.
A.P.V. Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
George Cohen Machinery Ltd.
Fletcher and Stewart Ltd.
T. Giusti & Son Ltd.
Lepage, Urbain & Cie.
Simon-Carves Chemical Engineering Ltd.
S.P.E.I. Chim.
Technoexport Czechoslovakia.
John Thompson (Design & Contracting Dvn.) Ltd.
John Thompson (Pressure Vessel Divn.) Ltd.
Unifloc Ltd.
Welding Technical Services Ltd.

Chemicals.
Fabcon Inc.
Hodag Chemical Corporation.
Schill & Seilacher Chemische Fabrik.
The Sugar Manufacturers' Supply Co. Ltd.

Clarifiers.
Alfa-Laval AB.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
Dorr-Oliver Inc., Cane Sugar Division.
The Eimco Corporation.
Eimco (Great Britain) Ltd.
Eimco Industriale S.p.A.
Fletcher and Stewart Ltd.
Honolulu Iron Works Co.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
H. Putsch & Comp.
Salzgitter Maschinen A.G.
Simonacco Ltd.
Stork-Werkspoor (V.M.F.).
Unifloc Ltd.
Walkers Ltd.

Clarifiers, Tray-type.
Dorr-Oliver Inc., Cane Sugar Division.
The Eimco Corporation.

Colorimeters.
Phoenix Precision Instrument Co.
The Sugar Manufacturers' Supply Co. Ltd.

Condensers, Water jet ejector.
Patrick Murray (Pty.) Ltd.
Stork-Werkspoor (V.M.F.).

Condensing plant, Barometric.
Hamill & Company.

Continuous belt weighing machines.
Adequate Weighers Ltd.
Ashworth Ross & Co. Ltd.

Control switchgear—limit switches, centrifugal switches, emergency trip gear, etc.
ASEA.
British Brown-Boveri Ltd.
Honeywell Controls Ltd.

Conveyor belt rotary brushes.
Dendix Brushes Ltd.
The Kleen-e-ze Brush Co. Ltd.
Unifloc Ltd.

Conveyor belting, Wire.
N. Greening (Warrington) Ltd.
United States Steel International (New York) Inc.

Conveyor chains.
Bagshawe & Co. Ltd.
Buhler Brothers Ltd.
Ewart Chainbelt Co. Ltd.
Parsons Chain Co. Ltd.
Pennine Chainbelt Co. Ltd.
Renold Limited.
Henry Simon Ltd.
A. & W. Smith & Co. Ltd.
Wheway-Watson Ltd.

Conveyor idler rollers and pulleys.
Mavor & Coulson Ltd.
New Conveyor Co. Ltd.

Conveyors and elevators.
Bagshawe & Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
Cocksedge & Co. Ltd.
George Cohen Machinery Ltd.
The Eimco Corporation.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Hein, Lehmann & Co. A.G.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
Patrick Murray (Pty.) Ltd.
Parsons Chain Co. Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Spencer (Melksham) Ltd.
Stork-Werkspoor (V.M.F.)
Walkers Ltd.
Ingeniörsfirman Nils Weibull AB.

Apron conveyors.
Etablissements F. Moret.
New Conveyor Co. Ltd.
Unifloc Ltd.

Belt and bucket elevators.
Buhler Brothers Ltd.
Crone & Taylor (Engineering) Ltd.
Mavor & Coulson Ltd.
Etablissements F. Moret.
New Conveyor Co. Ltd.
Henry Simon Ltd.
Simon-Barron Ltd.
Unifloc Ltd.

Belt conveyors.
Crone & Taylor (Engineering) Ltd.
Mavor & Coulson Ltd.
Etablissements F. Moret.
New Conveyor Co. Ltd.
Unifloc Ltd.

Bucket elevators.
Buhler Brothers Ltd.
Crone & Taylor (Engineering) Ltd.
Mavor & Coulson Ltd.
The Mirrlees Watson Co. Ltd.
Etablissements F. Moret.
New Conveyor Co. Ltd.
Henry Simon Ltd.
Simon-Barron Ltd.
Unifloc Ltd.

Chain and bucket elevators.
Buhler Brothers Ltd.
Crone & Taylor (Engineering) Ltd.
Mavor & Coulson Ltd.
Etablissements F. Moret.
New Conveyor Co. Ltd.
Simon-Barron Ltd.
Unifloc Ltd.

Chain conveyors.
Buhler Brothers Ltd.
Crone & Taylor (Engineering) Ltd.
Mavor & Coulson Ltd.
Henry Simon Ltd.
Unifloc Ltd.

Drag-bar conveyors.
Unifloc Ltd.

Feeder conveyors.
Crone & Taylor (Engineering) Ltd.
Unifloc Ltd.
see also Sugar throwers and trimmers.

Flight conveyors.
Unifloc Ltd.

Grasshopper conveyors.
Thomas Broadbent & Sons Ltd.
The Mirrlees Watson Co. Ltd.

Plate conveyors.
Unifloc Ltd.

Pneumatic conveyors.
Buhler Brothers Ltd.
G.m.b.H.
Collectron (Sales) Ltd.
New Conveyor Co. Ltd.
Henry Simon Ltd.

Scraper conveyors.
Mavor & Coulson Ltd.
New Conveyor Co. Ltd.
Unifloc Ltd.

Screw conveyors.
Ewart Chainbelt Co. Ltd.
The Mirrlees Watson Co. Ltd.
Etablissements F. Moret.
New Conveyor Co. Ltd.
Simon-Barron Ltd.
The Triton Engineering Co. (Sales) Ltd.
Unifloc Ltd.

Vibratory conveyors.
Ewart Chainbelt Co. Ltd.
Henry Simon Ltd.
Simon-Barron Ltd.
The Triton Engineering Co. (Sales) Ltd.

Conveyors and elevators, Mobile.
Buhler Brothers Ltd.
Crone & Taylor (Engineering) Ltd.
Mavor & Coulson Ltd.
L. S. Miedema Landbouwwerktuigenfabriek N.V.
Salzgitter Maschinen A.G.
Simon Handling Engineers Ltd.

Coolers, Fluidized bed.
Fluostatic Ltd.
The Witte Co. Inc.

Coolers, Sugar.
BMA Braunschweigische Maschinenbauanstalt.
Buell Ltd.
Büttner-Werke A.G.
Fletcher and Stewart Ltd.
Honolulu Iron Works Co.
Manlove Alliott & Co. Ltd.
Etablissements F. Moret.
Patrick Murray (Pty.) Ltd.
Newell Dunford Engineering Ltd.
Salzgitter Maschinen A.G.
Standard Steel Corporation.
Stork-Werkspoor (V.M.F.).

Coolers, Water.
Film Cooling Towers (1925) Ltd.
Metal Propellers Ltd.

Cranes.
Butters Cranes Ltd.
Cary Iron Works.
J. H. Carruthers & Co. Ltd.
George Cohen Machinery Ltd.
Soc. Fives Lille-Cail.
John M. Henderson & Co. Ltd.
Robert Hudson (Raletrux) Ltd.
O. & K. Export- und Handelsgesellschaft m.b.H.
Priestman Bros. Ltd.
Stork-Werkspoor (V.M.F.)
Stothert & Pitt Ltd.
Vaughan Crane Co. Ltd.
Wheway-Watson Ltd.

Crystallization aids.
Fabcon Inc.
Hodag Chemical Corporation.

Crystallizers.
Babcock Atlantique.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
A. F. Craig & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Division.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
St. Mary Iron Works Inc.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Standard Steel Corporation.
Stork-Werkspoor (V.M.F.).
John Thompson (Pressure Vessel Divn.) Ltd.

Cube-making machinery.
Goka N.V. Machine Works.
Standard Steel Corporation.

Cube sugar moulding, ranging and packeting plant.
Brecknell, Dolman & Rogers Ltd.
Fr. Hesser Maschinenfabrik A.G.
Standard Steel Corporation.

Cube wrapping machines.
Fr. Hesser Maschinenfabrik A.G.
SAPAL.

Deaerators.
Head Wrightson Process Engineering Ltd.
Machinefabriek Reineveld N.V.

Decolorizing plants.
Atlas Chemical Industries Inc.
Atlas Chemical Industries S.A.
Atlas Chemical Industries, Canada, Ltd.
Atlas Chemical Interamerica Inc.
BMA Braunschweigische Maschinenbauanstalt.
Honeywill-Atlas Ltd.
IMACTI.
Norit Sales Corporation Ltd.
The Permutit Co. Ltd.
Pittsburgh Activated Carbon Company.
Robert Reichling & Co. K.G.
Suchar.

Decolorizing resins.
Diamond Shamrock Chemical Co., Resinous Products Division.
IMACTI.
The Permutit Co. Ltd.
Robert Reichling & Co. K.G.
Rohm and Haas Company.

Deliming plants.
BMA Braunschweigische Maschinenbauanstalt.
Dorr-Oliver Inc., Cane Sugar Division.
IMACTI.
Machinefabriek Reineveld N.V.
Robert Reichling & Co. K.G.

Demineralization plants.
BMA Braunschweigische Maschinenbauanstalt.
Dorr-Oliver Inc., Cane Sugar Division.
The Eimco Corporation.
IMACTI.
Machinefabriek Reineveld N.V.
The Permutit Co. Ltd.
Robert Reichling & Co. K.G.

Density meters, In-line.
Rotameter Manufacturing Co. Ltd.

Diatomaceous earth, *see* **Filter-aids.**

Diesel alternator sets.
Stork-Werkspoor (V.M.F.).

Distillery plant, *see* **Alcohol plant.**

Drives.
see also Cane conveyor drives, Flexible drives, Knives, Milling—Drives *and* Shredder drives.

Dryers.
Arnold Dryer Company.
Ashmore, Benson, Pease & Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Bosco S.p.A. Officine Meccaniche e Fonderie.
Buell Ltd.
Büttner-Werke A.G.
CEKOP.
Escher Wyss Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Honolulu Iron Works Co.
Manlove Alliott & Co. Ltd.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Newell Dunford Engineering Ltd.
Salzgitter Maschinen A.G.
S.E.U.M.
Richard Simon & Sons Ltd.
A. & W. Smith & Co. Ltd.
S.P.E.I. Chim.
Spencer (Melksham) Ltd.
Standard Steel Corporation.
Stork-Werkspoor (V.M.F.).
A.B. Svenska Fläktfabriken.

Dryers, Fluidized bed.
Büttner-Werke A.G.
Soc. Fives Lille-Cail.
Fluostatic Ltd.
AB. Svenska Fläktfabriken.
The Witte Co. Inc.

Duck boards.
Grill Floors Ltd.

Dust control equipment.
Buell Ltd.
Büttner-Werke A.G.
Centrifix Corporation.
Collectron (Sales) Ltd.
Dust Control Equipment Ltd.
E. Green & Son Ltd.
Mikropul Ltd.
Newell Dunford Engineering Ltd.
Phoenix Precision Instrument Co.
Henry Simon Ltd.
A.B. Svenska Fläktfabriken.
Thermix Industries Ltd.

Dust sleeves and bags.
John R. Carmichael Ltd.
Cotton Bros. (Longton) Ltd.
Samuel Hill Ltd.
S.A. Lainière de Sclessin.
Porritt Bro. & Austin Ltd.
Porritts & Spencer Ltd., Industrial Fabrics Export Division.
Henry Simon Ltd.

Economizers.
E. Green & Son Ltd.
John Thompson (Design & Contracting Dinv.) Ltd.

Effluent treatment.
Dorr-Oliver Inc., Cane Sugar Division.
Eimco (Great Britain) Ltd.
Jones & Attwood Ltd.
The Permutit Co. Ltd.
Simon-Carves Ltd.
John Thompson (Design & Contracting Divn.) Ltd.

Electric motors.
ASEA.
British Brown-Boveri Ltd.
George Cohen Machinery Ltd.
Soc. Fives Lille-Cail.
The Harland Engineering Co. Ltd.

Electric power generators.
ASEA.
British Brown-Boveri Ltd.
George Cohen Machinery Ltd.
Soc. Fives Lille-Cail.
General Electric Company of U.S.A.
Murray Iron Works Company.
Stork-Werkspoor (V.M.F.)

Electric surface heaters.
Isopad Ltd.

Electrical meters and relays.
Hartmann & Braun A.G.

Electronic equipment.
ASEA.
British Brown-Boveri Ltd
Hartmann & Braun A.G.
Honeywell Controls Ltd.
Henry Simon Ltd.
Taylor Instrument Companies (Europe) Ltd.
Thorn Bendix Ltd.

Engineering design and contracting services.
The Mirrlees Watson Co. Ltd.

Engines, Diesel.
George Cohen Machinery Ltd.
Stork-Werkspoor (V.M.F.)
Worthington Corporation.

Engines, Steam.
CEKOP.
George Cohen Machinery Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
The Mirrlees Watson Co. Ltd.
Robey & Co. Ltd.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)

Entrainment separators.
Centrifix Corporation.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
Patrick Murray (Pty.) Ltd.
Newell Dunford Engineering Ltd.
St. Mary Iron Works Inc.

Evaporator additives.
Fabcon Inc.
Hodag Chemical Corporation.

Evaporators and condensing plant.
Alfa-Laval AB.
A.P.V. Co. Ltd.
Babcock Atlantique.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
A. F. Craig & Co. Ltd.
A/S. De Danske Sukkerfabrikker.
Escher Wyss Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
Hamill & Company.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.

Evaporators and condensing plant.— *continued.*
Patrick Murray (Pty.) Ltd.
St. Mary Iron Works Inc.
Salzgitter Maschinen A.G.
S.E.U.M.
Silver Engineering Works Inc.
A. & W. Smith & Co. Ltd.
S.P.E.I. Chim.
Stork-Werkspoor (V.M.F.)
Technoexport Czechoslovakia.
John Thompson (Design & Contracting Divn.) Ltd.

Evaporator tube cleaners.
see Tube cleaners.

Fans, Induced and forced draft.
Büttner-Werke A.G.
Stork-Werkspoor (V.M.F).
AB. Svenska Fläktfabriken.

Fertilizers.
Fisons Ltd., International Division.

Filling machines.
Arenco-Alite Ltd.

Filters.
CEKOP.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Sankey Green Wire Weaving Co. Ltd.
Henry Simon Ltd.
S.P.E.I. Chim.

Automatically controlled filters.
Chemap A.G.
Herfilco.
Schumacher Filters Ltd.
Schumacher'sche Fabrik.
Siemens A.G., Wernerwerk fur Messtechnik.
Sparkler Manufacturing Company.
Stella-Meta Filters Ltd.

Bag pressure filters.
A. F. Craig & Co. Ltd.

Candle filters.
BMA Braunschweigische Maschinenbauanstalt.
H. Putsch & Comp.
Schumacher Filters Ltd.
Schumacher'sche Fabrik.
Stella-Meta Filters Ltd.

Diatomite filters.
Chemap A.G.
Enzinger Division, The Duriron Co. Ltd.
Herfilco.
The Mirrlees Watson Co. Ltd.
Schumacher Filters Ltd.
Schumacher'sche Fabrik.
Sparkler Manufacturing Company.
Stella-Meta Filters Ltd.
Unifloc Ltd.

Filter presses.
BMA Braunschweigische Maschinenbauanstalt.
Manlove Alliott & Co. Ltd.
Patrick Murray (Pty.) Ltd.

Filter thickeners.
Dorr-Oliver Inc., Cane Sugar Division.
H. Putsch & Comp.
Schumacher Filters Ltd.
Schumacher'sche Fabrik.

Gravity and pressure filters.
Machinefabriek Reineveld N.V.
The Mirrlees Watson Co. Ltd.
The Permutit Co. Ltd.

Iron removal filters.
Brimag Ltd.
Electromagnets Ltd.
Machinefabriek Reineveld N.V.
The Permutit Co. Ltd.
Rapid Magnetic Ltd.

Leaf filters.
Dorr-Oliver Inc., Cane Sugar Division.
Ferguson Perforating & Wire Co.
The Mirrlees Watson Co. Ltd.
A. & W. Smith & Co. Ltd.
Sparkler Manufacturing Company.
Stella-Meta Filters Ltd.
Stork-Werkspoor (V.M.F.).
Suchar.

Plate and frame filters.
Manlove Alliott & Co. Ltd.
Stork-Werkspoor (V.M.F.).

Pressure filters.
BMA Braunschweigische Maschinenbauanstalt.
Chemap A.G.
Dorr-Oliver Inc., Cane Sugar Division.
R. Lord & Sons Ltd.
Machinefabriek Reineveld N.V.
The Mirrlees Watson Co. Ltd.
The Permutit Co. Ltd.
Schumacher Filters Ltd.
Schumacher'sche Fabrik.
A. & W. Smith & Co. Ltd.
Sparkler Manufacturing Company.
Stella-Meta Filters Ltd.
Suchar.

Rotary vacuum filters.
BMA Braunschweigische Maschinenbauanstalt.
Dorr-Oliver Inc., Cane Sugar Division.
The Eimco Corporation.
Eimco (Great Britain) Ltd.
Eimco Industriale S.p.A.
Patrick Murray (Pty.) Ltd.
H. Putsch & Comp.
Unifloc Ltd.

Filter aids.
C.E.C.A.
Dicalite/GREFCO Inc.
Eagle-Picher Industries Inc.
Kenite Corporation.
The Sugar Manufacturers' Supply Co. Ltd.

Filter cloths.
Jeremiah Ambler Ltd.
John R. Carmichael Ltd.
Cotton Bros. (Longton) Ltd.
N. Greening (Warrington) Ltd.
Samuel Hill Ltd.
S.A. Lainière de Sclessin.
Nordiska Maskinfilt AB.
Porritt Bro. & Austin Ltd.
Porritts & Spencer Ltd., Industrial Fabrics Export Division.
Sankey Green Wire Weaving Co. Ltd.
Henry Simon Ltd.

Filter cloths washing machines.
Machinefabriek Reineveld N.V.

Filter leaves.
Dorr-Oliver Inc., Cane Sugar Division.
Ferguson Perforating & Wire Co.
Charles Mundt & Sons.
Sankey Green Wire Weaving Co. Ltd.
Sparkler Manufacturing Company.

Filter papers.
J. Barcham Green Ltd.
A. H. Korthof N.V.
The Sugar Manufacturers' Supply Co. Ltd.

Filter pulp.
J. Barcham Green Ltd.

Filter screens.
Cotton Bros. (Longton) Ltd.
Endecotts (Test Sieves) Ltd.
Ferguson Perforating & Wire Co.
Fontaine & Co. G.m.b.H.
N. Greening (Warrington) Ltd.
Haver & Boecker.
Krieg & Zivy Industries.
Charles Mundt & Sons.
J. & F. Pool Ltd.
Sankey Green Wire Weaving Co. Ltd.

Flanges, Non-Ferrous.
Blundell & Crompton Ltd.

Flexible drives.
Flexible Drives (Gilmans) Ltd.
Flexotube (Liverpool) Ltd.

Flexible shaft couplings.
David Brown Gear Industries Ltd.
The Falk Corporation.
Moss Gear Co. Ltd.
Renold Limited.
Henry Simon Ltd.

Flexible shafting.
Flexible Drives (Gilmans) Ltd.
Flexotube (Liverpool) Ltd.
Henry Simon Ltd.

Flowmeters.
Alfa-Laval AB.
Hartmann & Braun A.G.
Honeywell Controls Ltd.
Neptune Measurement Ltd.
Rotameter Manufacturing Co. Ltd.
The Sugar Manufacturers' Supply Co. Ltd.
Taylor Instrument Companies (Europe) Ltd.

Gas purifying equipment.
Centrifix Corporation.
Maschinenfabrik H. Eberhardt.
Lodge-Cottrell Ltd.
Stork-Werkspoor (V.M.F.).

Gear couplings.
David Brown Gear Industries Ltd.
The Falk Corporation.
Moss Gear Co. Ltd.
Henry Simon Ltd.

Gearing, *see* Reduction gears.

Gearmotors.
ASEA.
David Brown Gear Industries Ltd.
The Falk Corporation.
Western Gear Corporation.

Grabs, Cane, Beet and Raw sugar.
Cane Machinery and Engineering Co. Inc.
Honolulu Iron Works Co.
Joseph Westwood & Co. Ltd.

Granulators, *see* Dryers.

Harvesters, *see* Beet harvesters *and* Cane harvesters

Heat exchangers, Air-cooled.
J. & L. Engineering Company Inc.

Heat-exchangers, Lamella-type.
Alfa-Laval AB.
A.P.V. Co. Ltd.

Heat exchangers, Plate type.
Alfa-Laval AB.
A.P.V. Co. Ltd.

Heat exchangers, Spiral-type.
Alfa-Laval AB.

Heat exchangers, Tubular.
Alfa-Laval AB.
A.P.V. Co. Ltd.
Ashmore, Benson, Pease & Co. Ltd.
Blundell & Crompton Ltd.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Foster Wheeler John Brown Boilers Ltd.
T. Giusti & Son Ltd.
E. Green & Son Ltd.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
Lepage, Urbain & Cie.
R. Lord & Sons Ltd.
Patrick Murray (Pty.) Ltd.
St. Mary Iron Works Inc.
Salzgitter Maschinen A.G.
S.E.U.M.
S.P.E.I. Chim.
Technoexport Czechoslovakia.
John Thompson (Design & Contracting Divn.) Ltd.
Walkers Ltd.
Welding Technical Services Ltd.
Worthington Corporation.

Heat sealers.
The Thames Packaging Equipment Co.

Heating mantles and tapes, Electric.
Isopad Ltd.

Herbicides.
Fisons Ltd., International Division.

Hydraulic controls for valves, etc.
Edwards Engineering Corp.
The Lunkenheimer Company.

Insecticides.
Fisons Ltd., International Division.

Insect control equipment.
Henry Simon Ltd.

Instruments, Process control.
Anacon Inc.
ASEA.
Bellingham & Stanley Ltd.
Chemap A.G.
Hartmann & Braun A.G.
Honeywell Controls Ltd.
Joseph Long Ltd.
Neptune Measurement Ltd.
Phoenix Precision Instrument Co.
Rotameter Manufacturing Co. Ltd.
Scientific Furnishings Ltd.
The Sugar Manufacturers' Supply Co. Ltd.
Taylor Instrument Companies (Europe) Ltd.
G. H. Zeal Ltd.

Insulation, Thermal (heat and cold)
Cape Insulation Ltd.
General Refractories Ltd.
Lafarge Aluminous Cement Co. Ltd.

Ion exchange plants.
IMACTI.
Machinefabriek Reineveld N.V.
The Permutit Co. Ltd.
Robert Reichling & Co. K.G.

Ion exchange resins.
Diamond Shamrock Chemical Co., Resinous Products Division.
IMACTI.
Montecatini Edison S.p.A.
The Permutit Co. Ltd.
Robert Reichling & Co. K.G.
Rohm and Haas Company.
John Thompson (Design & Contracting Divn.) Ltd.

Irrigation equipment.
Worthington Corporation.
Wright Rain Ltd.
Wright Rain Africa (Pvt.) Ltd.

Jointings, *see* Packings and gaskets.

Juice heaters.
Babcock Atlantique.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
A. F. Craig & Co. Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
Hamill & Company.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
St. Mary Iron Works Inc.
Salzgitter Maschinen A.G.
S.E.U.M.
Silver Engineering Works Inc.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
Technoexport Czechoslovakia.
Walkers Ltd.

Juice scales.
Ashworth Ross & Co. Ltd.
Fletcher and Stewart Ltd.
Carl Schenck Maschinenfabrik G.m.b.H.
N.V. Servo-Balans.
see also **Weighing** Machines

Juice strainers and screens.
Cocksedge & Co. Ltd.
The Deister Concentrator Co. Inc.
Dorr-Oliver Inc., Cane Sugar Division.
Endecotts (Test Sieves) Ltd.
Farrel Corporation.
Ferguson Perforating & Wire Co.
Soc. Fives Lille-Cail.
Fontaine & Co. G.m.b.H.
N. Greening (Warrington) Ltd.
Gutehoffnungshütte Sterkrade A.G
Haver & Boecker.
The Mirrlees Watson Co. Ltd.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
The Sugar Manufacturers' Supply Co. Ltd.
Walkers Ltd.

Juice and syrup mixers.
Anacon Inc.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
The Sugar Manufacturers' Supply Co. Ltd.
Walkers Ltd.

Knives, Beet.
Dreibholz & Floering Ltd.
H. Putsch & Comp.

Knives, Milling.
Babcock Atlantique.
BMA Braunschweigische Maschinenbauanstalt.
Broussard Machine Co.
A. F. Craig & Co. Ltd.
Farrel Corporation.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
Walkers Ltd.

Knives, Milling—Drives.
Farrel Corporation.
General Electric Company of U.S.A.
Stork-Werkspoor (V.M.F.).
Western Gear Corporation.

Laboratory apparatus and equipment.
Chemap A.G.
Endecotts (Test Sieves) Ltd.
A. H. Korthof N.V.
Phoenix Precision Instrument Co.
The Sugar Manufacturers' Supply Co. Ltd.
see also Laboratory Instruments, *etc.*

Laboratory instruments.
Anacon Inc.
Honeywell Controls Ltd.
A. H. Korthof N.V.
Joseph Long Ltd.
Phoenix Precision Instrument Co.
Rotameter Manufacturing Co. Ltd.
The Sugar Manufacturers' Supply Co. Ltd.

Laboratory instruments—*continued*
G. H. Zeal Ltd.
Carl Zeiss.
see also Automatic saccharimeters and polarimeters, Laboratory apparatus and equipment, Refractometers, Saccharimeters and polarimeters, *etc.*

Laboratory reagents.
A. H. Korthof N.V.
The Sugar Manufacturers' Supply Co. Ltd.

Ladders, Steel lattice.
Grill Floors Ltd.
John Thompson (Pressings Divn.) Ltd.

Lens cleaning tissues.
J. Barcham Green Ltd.

Level indicators and controllers.
Haver & Boecker.
Honeywell Controls Ltd.
Rotameter Manufacturing Co. Ltd.
Taylor Instrument Companies (Europe) Ltd.

Lime density meters.
Rotameter Manufacturing Co. Ltd.

Lime slaking equipment.
Cocksedge & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Division.
Maschinenfabrik H. Eberhardt.
The Eimco Corporation.
Fluostatic Ltd.
Etablissements F. Moret.
Stork-Werkspoor (V.M.F.).

Limestone pulverizers for agricultural stone.
Gruendler Crusher & Pulverizer Co.

Liming equipment.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
CEKOP.
Cocksedge & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Division.
Maschinenfabrik H. Eberhardt.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Etablissements F. Moret.
Patrick Murray (Pty.) Ltd.
H. Putsch & Comp.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
The Sugar Manufacturers' Supply Co. Ltd.
Unifloc Ltd.

Loading machinery.
Bray Construction Equipment Ltd.
Buhler Brothers Ltd.
The Eimco Corporation.
O. & K. Export- und Handelsgesellschaft m.b.H.
F. E. Weatherill Ltd.

Locomotives, Diesel.
General Electric Company of U.S.A.
Robert Hudson (Raletrux) Ltd.
O. & K. Export- und Handelsgesellschaft m.b.H.
Pletterij Spoorijzer N.V.

Magnetic lifting equipment.
Brimag Ltd.
Electromagnets Ltd.
Industrial Magnets Ltd.
Rapid Magnetic Ltd.

Magnetic separators.
Brimag Ltd.
Electromagnets Ltd.
Industrial Magnets Ltd.
Rapid Magnetic Ltd.
Unifloc Ltd.

Massecuite heat treating equipment.
Babcock Atlantique.
Fletcher and Stewart Ltd.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Silver Engineering Works Ltd.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.).
U.C.M.A.S.
Walkers Ltd.
The Western States Machine Co.

Metal detectors.
ASEA.
Newell Dunford Engineering Ltd.

Meters, Integrating, for liquids.
Hartmann & Braun A.G.
Neptune Measurement Ltd.

Meters for liquid fuels.
Hartmann & Braun A.G.
Neptune Measurement Ltd.

Mill hydraulics.
Edwards Engineering Corp.
Fletcher and Stewart Ltd.
The Mirrlees Watson Co. Ltd.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)

Mill rolls.
BMA Braunschweigische Maschinenbauanstalt.
A. F. Craig & Co. Ltd.
Farrel Corporation.
Soc. Fives Lille-Cail.
G. M. Hay & Co. Ltd.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.).
United States Steel International (New York) Inc.
Walkers Ltd.

Mill roll movement indicators and recorders.
Edwards Engineering Corp.

Milling plant.
BMA Braunschweigische Maschin-A.G.
A. F. Craig & Co. Ltd.
Farrel Corporation.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
G. M. Hay & Co. Ltd.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.).
Technoexport Czechoslovakia.
Walkers Ltd.

Milling plant—complete electrical equipment.
ASEA.
General Electric Company of U.S.A.

Mixing machines.
Arenco-Alite Ltd.

Moisture expellers.
Richard Simon & Sons Ltd.

Molasses addition plants for beet pulp.
Amandus Kahl Nachf.

Molasses tanks.
Babcock Atlantique.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
Fletcher and Stewart Ltd.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
Lepage, Urbain & Cie.
Patrick Murray (Pty.) Ltd.
St. Mary Iron Works Inc.
Salzgitter Maschinen A.G.
Stork-Werkspoor (V.M.F.)

Packeting machinery.
Brecknell, Dolman & Rogers Ltd.
Fr. Hesser Maschinenfabrik A.G.
SIG Swiss Industrial Company.

Packeting machinery for individual sachets.
SIG Swiss Industrial Company.

Pan boiling aids.
Fabcon Inc.
Hodag Chemical Corporation.

Pans, Vacuum.
A.P.V. Co. Ltd.
Babcock Atlantique.
Blundell & Crompton Ltd.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
A. F. Craig & Co. Ltd.
A/S De Danske Sukkerfabrikker.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
T. Giusti & Son Ltd.
Gutehoffnungshütte Sterkrade A.G.
Hamill & Company.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
St. Mary Iron Works Inc.
Salzgitter Maschinen A.G.
S.E.U.M.
Silver Engineering Works Inc.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
Technoexport Czechoslovakia.
John Thompson (Pressure Vessel Divn.) Ltd.
Walkers Ltd.

Parcelling machines.
Carl Drohmann G.m.b.H.
Fr. Hesser Maschinenfabrik A.G.
SIG Swiss Industrial Company.

Pelleting presses for bagasse and pith.
Amandus Kahl Nachf.
Simon-Barron Ltd.

Pelleting presses for dried pulp.
Amandus Kahl Nachf.
Simon-Barron Ltd.
Richard Sizer Ltd.

Perforated metals.
Ferguson Perforating & Wire Co.
N. Greening (Warrington) Ltd.
Krieg & Zivy Industries.
Charles Mundt & Sons.
J. & F. Pool Ltd.

Pipe fittings.
see Tube fittings

Pipes, Non-ferrous.
The Birmingham Battery & Metal Co. Ltd.
Yorkshire Imperial Metals Ltd.

Pipes, Steam.
John Thompson (Pipework & Ordnance Divn.) Ltd.

Pipework installation.
Blundell & Crompton Ltd.
W. G. Jenkinson Ltd.

Polythene bag sealers.
The Thames Packaging Equipment Co.

Power actuators.
The Lunkenheimer Company.

Power plants.
ASEA.
British Brown-Boveri Ltd.
General Electric Company of U.S.A.
Stork-Werkspoor (V.M.F.).

Power transmission equipment.
ASEA.
Thomas Broadbent & Sons Ltd.
Ewart Chainbelt Co. Ltd.
The Falk Corporation.
Farrel Corporation.
Moss Gear Co. Ltd.
Renold Limited.
Henry Simon Ltd.
Western Gear Corporation.

Preliming equipment.
A/S De danske Sukkerfabrikker.
Dorr-Oliver Inc., Cane Sugar Division.

Pressure gauges.
Honeywell Controls Ltd.
Taylor Instrument Companies (Europe) Ltd.
G. H. Zeal Ltd.

Pressure vessels.
The A.P.V. Co. Ltd.
Ashmore, Benson, Pease & Co. Ltd.
Babcock Atlantique.
W. P. Butterfield (Engineers) Ltd.
T. Giusti & Son Ltd.
R. Lord & Sons Ltd.
Machinefabriek Reineveld N.V.
Robey & Co. Ltd.
St. Mary Iron Works Inc.
S.E.U.M.
Stork-Werkspoor (V.M.F.).
Thibodaux Boiler Works Inc.
John Thompson (Pressure Vessel Divn.) Ltd.
Welding Technical Services Ltd.

Printing machinery—Rotary multi-colour for sugar cartons and bags, etc.
Fr. Hesser Maschinenfabrik A.G.

Process pipework, Stainless steel.
W. G. Jenkinson Ltd.

Pulley blocks.
Wheway-Watson Ltd.

Pulverizers, Sugar.
Gruendler Crusher & Pulverizer Co.
Mikropul Ltd.
Henry Simon Ltd.
The Sugar Manufacturers' Supply Co. Ltd.

Pumps.
Dorr-Oliver Inc., Cane Sugar Division.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
The Harland Engineering Co. Ltd.
Stork-Werkspoor (V.M.F.).
The Sugar Manufacturers' Supply Co. Ltd.

Boiler feed pumps.
Worthington Corporation.

Centrifugal pumps.
The Albany Engineering Co. Ltd.
A.P.V. Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Peter Brotherhood Ltd.
Etablissements F. Moret.
Saunders Valve Co. Ltd.
Schabaver.
Simonacco Ltd.
Stothert & Pitt Ltd.
Wallwin (Pumps) Ltd.
Worthington Corporation.

Corrosion-proof pumps.
The Albany Engineering Co. Ltd.
A.P.V. Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Mono Pumps Ltd.
Simonacco Ltd.
Stothert & Pitt Ltd.
Worthington Corporation.

Dosing pumps.
BMA Braunschweigische Maschinenbauanstalt.

Filtrate pumps.
BMA Braunschweigische Maschinenbauanstalt.
The Eimco Corporation.
Mono Pumps Ltd.
Etablissements F. Moret.
Simonacco Ltd.
Stothert & Pitt Ltd.

Irrigation pumps.
BMA Braunschweigische Maschinenbauanstalt.
Saunders Valve Co. Ltd.
Worthington Corporation.
Wright Rain Ltd.
Wright Rain Africa (Pvt.) Ltd.

Massecuite pumps.
BMA Braunschweigische Maschinenbauanstalt.
Soc. Fives-Lille-Cail.
Machinefabriek Reineveld N.V.
Patrick Murray (Pty.) Ltd.
A. & W. Smith & Co. Ltd.
Stothert & Pitt Ltd.

Membrane pumps.
The Eimco Corporation.
Saunders Valve Co. Ltd.

Molasses pumps.
The Albany Engineering Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Amandus Kahl Nachf.
Machinefabriek Reineveld N.V.
Mono Pumps Ltd.
Etablissements F. Moret.
Patrick Murray (Pty.) Ltd.
Stothert & Pitt Ltd.
Worthington Corporation.

Positive-action pumps.
The Albany Engineering Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Mono Pumps Ltd.
Stothert & Pitt Ltd.
Worthington Corporation.

Rotary pumps.
The Albany Engineering Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
The Eimco Corporation.
Mono Pumps Ltd.
Etablissements F. Moret.
Stothert & Pitt Ltd.
Worthington Corporation.

Self-priming pumps.
The Albany Engineering Co. Ltd.
The Eimco Corporation.
Mono Pumps Ltd.
Stothert & Pitt Ltd.
Wallwin (Pumps) Ltd.

Sump pumps.
The Albany Engineering Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
The Eimco Corporation.
Mono Pumps Ltd.
Etablissements F. Moret.
Saunders Valve Co. Ltd.
Simonacco Ltd.
Wallwin (Pumps) Ltd.

Vacuum pumps.
see Vacuum pumps.

Railway, *see* Locomotives *and* Track.

Rectifiers.
ASEA.
British Brown-Boveri Ltd.

Reduction and composting equipment for trash and cane waste.
Gruendler Crusher & Pulverizer Co.

Reduction gears.
ASEA.
David Brown Gear Industries Ltd.
The Falk Corporation.
Farrel Corporation.
Soc. Fives Lille-Cail.
Lufkin Foundry & Machine Co.
Moss Gear Co. Ltd.
Murray Iron Works Company.
Power Plant Gears Ltd.
Renold Limited.
Salzgitter Maschinen A.G.
Henry Simon Ltd.
A. &. W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.).
Vulcan Iron Works Inc.
Western Gear Corporation.

Refinery equipment.
ASEA.
BMA Braunschweigische Maschinenbauanstalt.
James Buchanan & Son (Liverpool) Ltd.
CEKOP.
A. F. Craig & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Division.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
Honolulu Iron Works Co.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Norit Sales Corporation Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Stein Atkinson Stordy Ltd.
Stork-Werkspoor (V.M.F.).
Suchar.
Technoexport Czechoslovakia.

Refractometers.
Anacon Inc.
Bellingham & Stanley Ltd.
A. H. Korthof N.V.
Phoenix Precision Instrument Co.
Schmidt & Haensch.
Scientific Furnishings Ltd.
Carl Zeiss.
VEB Carl Zeiss Jena.

Refractory bricks.
General Refractories Ltd.
Lafarge Aluminous Cement Co. Ltd.

Refractory cement.
General Refractories Ltd.

Road transport pneumatic bulk vehicles.
W. P. Butterfield (Engineers) Ltd.
John Thompson (Transporter Divn.) Ltd.

Rodent control equipment.
Henry Simon Ltd.

Roller chain.
Ewart Chainbelt Co. Ltd.
Morse Chain Division of Borg-Warner Ltd.
Pennine Chainbelt Co. Ltd.
Renold Limited.

Rubber belt cane carriers.
Farrel Corporation.

Saccharimeters and polarimeters.
Bellingham & Stanley Ltd.
A. H. Korthof N.V.
Schmidt & Haensch.
The Sugar Manufacturers' Supply Co. Ltd.
Thorn Bendix Ltd.
Carl Zeiss.

Sack closing machines.
Carl Drohmann G.m.b.H.
Thomas C. Keay Ltd.
Reed Medway Sacks Ltd.
The Sack Filling & Sewing Machine Syndicate Ltd.
The Thames Packaging Equipment Co.

Sack counting equipment.
The Thames Packaging Equipment Co.

Sack filling machines.
Brecknell, Dolman & Rogers Ltd.
Carl Drohmann G.m.b.H.
Haver & Boecker.
Reed Medway Sacks Ltd.
Richard Simon & Sons Ltd.
Ingeniörsfirman Nils Weibull AB.

Sack openers.
Thames Packaging Equipment Co.

Sack printing machines.
Thomas C. Keay Ltd.

Sampling equipment.
The Thames Packaging Equipment Co.
Ingeniörsfirman Nils Weibull AB.

Scaffold boards.
Grill Floors Ltd.

Scale removal and prevention.
Fabcon Inc.
Flexible Drives (Gilmans) Ltd.
Flexotube (Liverpool) Ltd.
Hodag Chemical Corporation.
The Sugar Manufacturers' Supply Co. Ltd.
see also Tube cleaners.

Screens, Centrifugal, *see* Centrifugal screens.

Screens, Filter, *see* Filter screens.

Screens, Rotary.
Jones & Attwood Ltd.

Screens, Vibrating.
Büttner-Werke A.G.
CEKOP.
Cocksedge & Co. Ltd.
The Deister Concentrator Co. Inc.
Electromagnets Ltd.
Fletcher and Stewart Ltd.
Gruendler Crusher & Pulverizer Company.
Gutehoffnungshütte Sterkrade A.G.
Haver & Boecker.
Hein, Lehmann & Co. A.G.
Carl Schenck Maschinenfabrik G.m.b.H.
Spencer (Melksham) Ltd.
The Sugar Manufacturers' Supply Co. Ltd.
John Thompson (Design & Contracting Divn.) Ltd.
The Triton Engineering Co. (Sales) Ltd.
Unifloc Ltd.
Walkers Ltd.
The Witte Co. Inc.
see also Juice strainers and screens.

Sedimentation accelerator.
Hodag Chemical Corporation.

Sewing threads, Heavy grade.
Thames Packaging Equipment Co.

Ship loading installations.
Buhler Brothers Ltd.
Fletcher and Stewart Ltd.
Spencer (Melksham) Ltd.

Shredders.
BMA Braunschweigische Maschinenbauanstalt.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gruendler Crusher & Pulverizer Co.
Gutehoffnungshütte Sterkrade A.G.
The Mirrlees Watson Co. Ltd.
Stork-Werkspoor (V.M.F.)
Walkers Ltd.

Shredder drives.
ASEA.
Farrel Corporation.
Stork-Werkspoor (V.M.F.).
Western Gear Corporation.

Silos.
Buhler Brothers Ltd.
Ingeniörsfirman Nils Weibull AB.

Skip hoists.
Cocksedge & Co. Ltd.

Slats for slat conveyors.
William Bain & Co. Ltd.
Ewart Chainbelt Co. Ltd.

Spectropolarimeters.
Bellingham & Stanley Ltd.
Thorn Bendix Ltd.

Spray nozzles.
The Lunkenheimer Company.

Spraying and dusting machinery.
Cooper Pegler & Co. Ltd.

Sprockets.
Ewart Chainbelt Co. Ltd.
Pennine Chainbelt Co. Ltd.
Renold Limited.

Steam accumulators.
Centrifix Corporation.
Fletcher and Stewart Ltd.
R. Lord & Sons Ltd.
Stork-Werkspoor (V.M.F.).
John Thompson (Design & Contracting Divn.) Ltd.

Steam separators.
Hamill & Company.

Steam storage equipment.
see Steam accumulators.

Steam superheaters.
Foster Wheeler John Brown Boilers Ltd.
Stork-Werkspoor (V.M.F.).

Steam traps.
von Arnim'sche Werke G.m.b.H., Werk Schneider & Helmecke.

Steam turbines for mill drives, etc.
ASEA.
British Brown-Boveri Ltd.
Peter Brotherhood Ltd.
George Cohen Machinery Ltd.
A. F. Craig & Co. Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
General Electric Company of U.S.A.
Gutehoffnungshütte Sterkrade A.G.
A.G. Kühnle, Kopp & Kausch.
The Mirrlees Watson Co. Ltd.
Murray Iron Works Company.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.).
Worthington Corporation.

Steam turbo-alternator sets.
ASEA.
British Brown-Boveri Ltd.
Peter Brotherhood Ltd.
CEKOP.
Escher Wyss Ltd.
Soc. Fives Lille-Cail.
General Electric Company of U.S.A.
A.G. Kühnle, Kopp & Kausch.
Murray Iron Works Company.
Stork-Werkspoor (V.M.F.).
Worthington Corporation.

Steel flooring and handrailing.
Grill Floors Ltd.
John Thompson (Pressings Divn.) Ltd.

Steel framed buildings.
William Bain & Co. Ltd.
Pletterij Spoorijzer N.V.

Stokers—Bagasse burning spreader type.
Maschinenfabrik Buckau R. Wolf A.G.

Storage vessels, Stainless steel.
A.P.V. Co. Ltd.
Ashmore, Benson, Pease & Co. Ltd.
W. P. Butterfield (Engineers) Ltd.
T. Giusti & Son Ltd.
W. G. Jenkinson Ltd.
St. Mary Iron Works Inc.
S.E.U.M.
Stork-Werkspoor (V.M.F.).
John Thompson (Pressure Vessel Divn.) Ltd.
Welding Technical Services Ltd.

Sugar factory (beet) molasses-free process.
BMA Braunschweigische Maschinenbauanstalt.

Sugar factory design and erection (Cane and Beet).
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
A. F. Craig & Co. Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Honolulu Iron Works Co.
The Mirrlees Watson Co. Ltd.
St. Mary Iron Works Inc.
Patrick Murray (Pty.) Ltd.
St. Mary Iron Works Inc.
Silver Engineering Works Inc.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.)
Walkers Ltd.

Sugar machinery, General.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
A. F. Craig & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Division.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
Gutehoffnungshütte Sterkrade A.G.
Hamill & Company.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Patrick Murray (Pty.) Ltd.
Salzgitter Maschinen A.G.
Silver Engineering Works Inc.
A. &. W. Smith & Co. Ltd.
Stork-Werkspoor (V.M.F.).
Technoexport Czechoslovakia.
Walkers Ltd.

Sugar silos.
Buhler Brothers Ltd.
A/S De Danske Sukkerfabrikker.
Soc. Fives Lille-Cail.
Henry Simon Ltd.
Ingeniörsfirman Nils Weibull AB.

Sugar tabletting machinery.
Goka N.V. Machine Works.
Pletterij Spoorijzer N.V.
Standard Steel Corporation.

Sugar throwers and trimmers.
Buhler Brothers Ltd.
Cocksedge & Co. Ltd.
Crone & Taylor (Engineering) Ltd.
Fletcher and Stewart Ltd.
Spencer (Melksham) Ltd.

Sulphur furnaces, Continuous.
Maschinenfabrik H. Eberhardt.
Stork-Werkspoor (V.M.F.).

Switchgear.
ASEA.
British Brown-Boveri Ltd.

Switchgear, Ironclad.
ASEA.

Temperature recorders and controllers.
Chemap A.G.
Hartmann & Braun Ltd.
Honeywell Controls Ltd.
A. H. Korthof N.V.
The Sugar Manufacturers' Supply Co. Ltd.
Taylor Instrument Companies (Europe) Ltd.
G. H. Zeal Ltd.

Test sieves, B.S. and A.S.T.M.
Endecotts (Test Sieves) Ltd.
N. Greening (Warrington) Ltd.
Haver & Boecker.
A. H. Korthof N.V.

Test sieve shakers.
Endecotts (Test Sieves) Ltd
Haver & Boecker.

Thermometers.
Honeywell Controls Ltd.
A. H. Korthof N.V.
Joseph Long Ltd.
G. H. Zeal Ltd.

Thickeners, Tray-type.
Dorr-Oliver Inc., Cane Sugar Division.
The Eimco Corporation.

Track and track accessories.
Robert Hudson (Raletrux) Ltd.
Pletterij Spoorijzer N.V.

Tractors.
John Fowler & Co. (Leeds) Ltd.

Tractors, Crawler.
The Eimco Corporation.
John Fowler & Co. (Leeds) Ltd.

Tractors, Wheeled.
Bray Construction Equipment Ltd.

Trailers.
Cary Iron Works.
Honolulu Iron Works Co.
Robert Hudson (Raletrux) Ltd.
Lufkin Foundry & Machine Co.
L. S. Miedema Landbouwwerktuigenfabriek N.V.
Pletterij Spoorijzer N.V.
John Thompson (Transporter Divn.) Ltd.
Weeks & Co. (Engineers) Ltd.

Transformers.
ASEA.
British Brown-Boveri Ltd.

Trench gratings.
Grill Floors Ltd.

Tube cleaners, Rotary (Electric and air).
Flexible Drives (Gilmans) Ltd.
Flexotube (Liverpool) Ltd.
see also Scale removal and prevention.

Tube fittings.
A.P.V. Co. Ltd. (*stainless steel*).
Blakey's Boot Protectors Ltd. (*malleable iron*).
Lepage, Urbain & Cie.
Henry Simon Ltd.
T.I. Stainless Tubes Ltd. (*stainless steel*).
Welding Technical Services Ltd.
Yorkshire Imperial Metals Ltd. (*copper, brass and gunmetal*).

Tubes, Bimetal.
Birmingham Battery & Metal Co. Ltd.
T.I. Stainless Tubes Ltd.
Yorkshire Imperial Metals Ltd.

Tubes for boilers, evaporators, juice heaters, vacuum pans, etc.
The Birmingham Battery & Metal Co. Ltd.
Soc. Fives Lille-Cail.
Kamani Tubes Private Ltd.
T.I. Stainless Tubes Ltd.
Welding Technical Services Ltd.
Yorkshire Imperial Metals Ltd.

Vacuum pans, *see* **Pans.**

Vacuum pumps.
Bosco S.p.A. Officine Meccaniche e Fonderie.
George Cohen Machinery Ltd.
Cotton Bros. (Longton) Ltd.
Soc. Fives Lille-Cail.
Fletcher and Stewart Ltd.
The Mirrlees Watson Co. Ltd.
Nash International Company.
Neyrpic.
A. &. W. Smith & Co. Ltd.
Spencer (Melksham) Ltd.
Stork-Werkspoor (V.M.F.).
Worthington Corporation.

Vacuum pumps, Oil-free.
Nash International Company.
Northey Rotary Compressors Ltd.

Valves.
A.P.V. Co. Ltd.
von Arnim'sche Werke G.m.b.H., Werk Schneider & Helmecke.
Chemap A.G.
Honeywell Controls Ltd.
The Lunkenheimer Company.
Patrick Murray (Pty.) Ltd.
Taylor Instrument Companies (Europe) Ltd.

Ball valves.
Saunders Valve Co. Ltd.
The Worcester Valve Co. Ltd.

Butterfly valves, Resiliently seated.
I.V. Pressure Controllers Ltd.

Diaphragm valves.
Saunders Valve Co. Ltd.

Relief valves.
Blundell & Crompton Ltd.
Hattersley (Ormskirk) Ltd.

Rotary valves.
Mikropul Ltd.

Stainless steel valves.
Saunders Valve Co. Ltd.

Variable speed controls.
ASEA.
British Brown-Boveri Ltd.

Vehicle washes.
Grill Floors Ltd.

Vibrating feeders.
Haver & Boecker.
Carl Schenck Maschinenfabrik G.m.b.H.
Simon Handling Engineers Ltd.
The Triton Engineering Co. (Sales) Ltd.

Vibrators.
The Triton Engineering Co. (Sales) Ltd.

Water cooling towers.
Film Cooling Towers (1925) Ltd.
Foster Wheeler John Brown Boilers Ltd.
Head Wrightson Process Engineering Ltd.
Metal Propellers Ltd.
Pletterij Spoorijzer N.V.
AB. Svenska Fläktfabriken.

Weedkillers, *see* **Herbicides.**

Weighing machines.
Adequate Weighers Ltd.
Ashworth Ross & Co. Ltd.
Fletcher and Stewart Ltd.
Haver & Boecker.
Fr. Hesser Maschinenfabrik A.G.
Newell Dunford Engineering Ltd.
Carl Schenck Maschinenfabrik G.m.b.H.
N.V. Servo-Balans.
Richard Simon & Sons Ltd.
Stork-Werkspoor (V.M.F.).
The Sugar Manufacturers' Supply Co. Ltd.
see also Juice scales.

Wire brushes, Rotary and manual.
Flexible Drives (Gilmans) Ltd.
Flexotube (Liverpool) Ltd.
N. Greening (Warrington) Ltd.
The Kleen-e-ze Brush Co. Ltd.

Wire cloth.
Endecotts (Test Sieves) Ltd.
Ferguson Perforating & Wire Company.
Fontaine & Co. G.m.b.H.
N. Greening (Warrington) Ltd.
Haver & Boecker.
Sankey Green Wire Weaving Co. Ltd.
Unifloc Ltd.

Wire tying sack tool.
Thames Packaging Equipment Co.

Woven wire.
Endecotts (Test Sieves) Ltd.
N. Greening (Warrington) Ltd.
Sankey Green Wire Weaving Co. Ltd.

Wrapping machines.
Auto Wrappers (Norwich) Ltd.
Fr. Hesser Maschinenfabrik A.G.
SAPAL.
SIG Swiss Industrial Company.

Yeast plants.
A.P.V. Co. Ltd.
BMA Braunschweigische Maschinenbauanstalt.
CEKOP.
Lepage, Urbain & Cie.

BUYERS' GUIDE—ADDRESS LIST

Adequate Weighers Ltd.,
Bridge Road, Sutton, Surrey, England.
Tel.: 01-642 6666/8. *Cable:* Adegrate, London.

The Albany Engineering Co. Ltd.,
Church Road, Lydney, Glos. England.
Tel.: Lydney 2275/2276/2277. *Cable:* Bolthead, Lydney.

Alfa-Laval AB.,
Tumba, Sweden.
Tel.: 0753/31100. *Cable:* Alfalaval, Tumba.
Telex: 10260, 10261.

Jeremiah Ambler Ltd.,
Midland Mills, Bradford 2, Yorks., England.
Tel.: Bradford 28456/9. *Cable:* Ambler, Bradford.
Telex: 51195.

Anacon Inc.,
62 Union St., Ashland, Mass., 01721 U.S.A.
Tel.: 617 881-3000.

The A.P.V. Co. Ltd.,
Manor Royal, Crawley, Sussex, England.
Tel.: Crawley 27777. *Cable:* Anaclastic, Crawley, Telex.
Telex: 87237.

Arenco-Alite Ltd.,
Pixmore Avenue, Letchworth, Herts., England.
Tel.: Letchworth 3965-9. *Cable:* Aral, Letchworth.
Telex: 82368.

von Arnim'sche Werke G.m.b.H., Werk Schneider & Helmecke,
605 Offenbach/Main, Germany.
Tel.: 832054. *Cable:* Kondenstopf, Offenbachmain.
Telex: 4152899 shof.

Arnold Dryer Company,
Division of the Heil Co.,
3000 W. Montana St., Milwaukee, Wis., 53201 U.S.A.
Tel.: (414) 671-3000. *Cable:* Heilco, Milwaukee.

ASEA,
Västeras, Sweden.
Tel.: 021/11000. *Cable:* Asea, Vasteras.
Telex: 4720.

Ashmore, Benson, Pease & Co. Ltd.,
South Works, Stockton-on-Tees, Teesside, Co. Durham, England.
Tel.: Stockton 65171. *Cable:* Ashmores, Stockton.
Telex: 58570.

Ashworth Ross & Co. Ltd.,
P.O. Box 5, Midland Iron Works, Scout Hill, Dewsbury, Yorks., England.
Tel.: Dewsbury 1760/2. *Cable:* Duros, Dewsbury.

Atlas Chemical Industries Inc.,
Wilmington, Delaware, 19899 U.S.A.
Tel.: (302) OL8-9311. *Cable:* Atchem, Wilmington.
TWX: 762-2355.

Atlas Chemical Industries S.A.,
15 Rue Blanche, Brussels 5, Belgium.

Atlas Chemical Industries, Canada, Ltd.,
P.O. Box 1085, Brantford, Ontario, Canada.

Atlas Chemical Interamerica Inc.,
Apartado 4994, Panama 5, Pepublic of Panama.

Auto Wrappers (Norwich) Ltd.,
Whiffler Road, Norwich, NOR 07N, England.
Tel.: Norwich 49231.

Babcock Atlantique,
48 Rue la Boétie, Paris 8e (75), France.
Tel.: 359-89-50/225-21-50. *Cable:* Babcock, Paris.
Telex: 29 027.

Bagshawe & Co. Ltd.,
Church Street, Dunstable, Beds., England.
Tel.: Dunstable 64302.
Telex: 82187.

William Bain & Co. Ltd.,
80 Ebury St., Westminster, London S.W.1., England.
Tel.: Sloane 2219. *Cable:* Lochrin, London.

Balco-Filtertechnik G.m.b.H.,
Elektro-Chemische Fabrik, 33 Braunschweig, Am Alten Bahnhof 5, Germany.
Tel.: 26518. *Cable:* Balco, Braunschweig.
Telex: 0952509.

Bellingham & Stanley Ltd.,
61 Markfield Rd., London N.15., England.
Tel.: 01-808 2675. *Cable:* Polyfract, London, N.15.

The Birmingham Battery & Metal Co. Ltd.,
Selly Oak, Birmingham 29, England.
Tel.: Selly Oak 1151. *Cable:* Batmetco, Birmingham, Telex.
Telex: 338285.

Blakey's Boot Protectors Ltd.,
see Pennine Chainbelt Co. Ltd.

Blundell & Crompton Ltd.,
West India Dock Road, London, E.14, England.
Tel.: 01-987 6001/3838. *Cable:* Blundell, London, E 14.

BMA Braunschweigische Maschinenbauanstalt,
(33) Braunschweig, Bahnhofstrasse 5, Germany.
Tel.: Braunschweig 20111 and 23691.
Cable: Bema, Braunschweig.
Telex: Bema Bsgw. 0952840.

Bray Construction Equipment Ltd.,
Faggs Road, Feltham, Middlesex, England.
Tel.: 01-890 3471. *Cable:* Braydozer, Feltham.
Telex: Braycon Feltham 261703.

Bosco S.p.A. Officine Meccaniche e Fonderie,
Piazzale Antonio Bosco n.3, Terni, Italy.
Tel.: 55341. *Cable:* Bosco, Terni.
Telex: 66032 Boscoter.

Brecknell, Dolman & Rogers Ltd.,
Pennywell Road, Bristol 5, England.
Tel.: Bristol 58222. *Cable:* Bremaners, Bristol.

Brimag Ltd.,
80A Stratford Rd., Shirley, Solihull, Warwickshire, England.
Tel.: 021-SHI 4504.

British Brown-Boveri Ltd.,
Glen House, Stag Place, London S.W.1, England.
Tel.: 01-828 9422. *Cable:* Reactance, London, Telex.
Telex: 23448.

British Charcoals & Macdonalds Ltd.,
21 Dellingburn St., Greenock, Scotland.
Tel.: 20273. *Cable:* Brimac, Greenock.

Thomas Broadbent & Sons Ltd.,
Central Ironworks, Huddersfield, Yorkshire, England.
Tel.: Huddersfield 22111. *Cable:* Broadbent, Huddersfield.
Telex: 51515.

Peter Brotherhood Ltd.,
Peterborough, Northants., England.
Tel.: 71321. *Cable:* Brotherhood, Peterborough.
Telex: 32154 Brotherhd Pboro.

Broussard Machine Company,
see Logan Perkins.

David Brown Gear Industries Ltd.,
Park Gear Works, Huddersfield, Yorks., England.
Tel.: Huddersfield 22180. *Cable:* Gearing, Huddersfield.
Telex: 51367.

James Buchanan & Son (Liverpool) Ltd.,
105 Brasenose Road, Liverpool 20, England.
Tel.: Bootle 2117/8/9. *Cable:* Buchanan, Liverpool 20.

Buell Ltd.,
8–10 Minerva Road, London N.W.10, England.
Tel.: 01–965 1761. *Cable:* Buellon, London, N.W.10.

Buhler Brothers Ltd.,
Engineering Works, 9240 Uzwil, Switzerland.
Tel.: (073) 5 01 11. *Cable:* Buhler, Uzwil.
Telex: 7 75 41.

W. P. Butterfield (Engineers) Ltd.,
P.O. Box 38, Shipley, Yorkshire, England.
Tel.: Shipley 52244. *Cable:* Tanks, Shipley.
Telex: 51583.

Butters Cranes Ltd.,
The Crane Works, Station Approach, Long Lane, Hillingdon, Middlesex, England.
Tel.: Uxbridge 37271.
Telex: 24301.

Büttner-Werke A.G.,
Postfach 4 and 6, Krefeld-Uerdingen 1, Germany.
Tel.: Krefeld 448–1. *Cable:* Büttner, Krefeld-Uerdingen.

Cane Machinery and Engineering Co. Inc.,
P.O. Box 968, Thibodaux, La., 70301 U.S.A.
Tel.: (504)-447-7285. *Cable:* Cameco, Thibodaux.

Cape Insulation Ltd.,
114 Park Street, London, W.1, England.
Tel.: 01-499 6022. *Cable:* Incorrupt, London, Telex.
Telex: 23759.

John R. Carmichael Ltd.,
Kenmore Works, Broad Lane, Liverpool 11, England.
Tel.: 051-STA 1336/7. *Cable:* Filclo, Liverpool.

J. H. Carruthers & Co. Ltd.,
Peel Park Place, College Milton, East Kilbride, Glasgow, Scotland.
Tel.: East Kilbride 20591. *Cable:* Hoisting, Glasgow.
Telex: 77782.

Cary Iron Works,
see Logan Perkins.

C.E.C.A.,
24 Rue Murillo, Paris 8e, France.
Tel.: Carnot 82-00. *Cable:* Ceca, Paris.

CEKOP Foreign Trade Enterprise,
Koscielna 12, Warsaw, Poland.
Cable: Cekop Warszawa.
Telex: 81234.

Cellulose Development Corporation Ltd.,
Villiers House, 41-47 Strand, London W.C.2, England.
Tel.: 01–839 5805. *Cable:* Celdecor, London, Telex.
Telex: 28444.

Centrifix Corporation,
P.O. Box 20447, Houston, Texas, 77025 U.S.A.
Tel.: (713)-RI 7-3620. *Cable:* Centrifix, Houston.
Telex: 910–881–2616.

Chemap A.G.,
Alte Landstrasse 415, 8708 Männedorf ZH, Switzerland.
Tel.: (051) 73 91 01. *Cable:* Servochemie, Männedorf.
Telex: 75 508.

Clydesdale Chemical Co. Ltd.,
142 Queen Street, Glasgow C.1, Scotland.
Tel.: 041–CEN 5247. *Cable:* Cactus, Glasgow.
Telex: 77580.

Cocksedge & Co. Ltd.,
P.O. Box 41, Grey Friars Road, Ipswich, Suffolk, England.
Tel.: Ipswich 56161. *Cable:* Cocksedge, Ipswich.

George Cohen Machinery Ltd.,
600 Wood Lane, London W.12, England.
Tel.: 01-743 2070. *Cable:* Omniplant, London W.12.
Telex: 21288/9.

Collectron (Sales) Ltd.,
175 Leckhampton Rd., Cheltenham, Gloucestershire, England.
Tel.: 0CH2-56355. *Cable:* Colextract, Cheltenham.

Cooper, Pegler & Co. Ltd.,
P.O. Box 9-98, Burgess Hill, Sussex, England.
Tel.: Burgess Hill 2525. *Cable:* Stomata, Burgess Hill.

Cotton Bros (Longton) Ltd.,
Crown Works, Portland Rd., Longton, Stoke-on-Trent Staffs., England.
Tel.: 0782-33021. *Cable:* Cotbro, Stoke-on-Trent.

A. F. Craig & Co. Ltd.,
Caledonia Engineering Works, Paisley, Scotland.
Tel.: Paisley 2191. *Cable:* Craig, Paisley.
Telex: 778051.

Crone & Taylor (Engineering) Ltd.,
Sutton Oak, St. Helens, Lancs, England.
Tel.: St. Helens 23283. *Cable:* Crontaylor, St. Helens.
Telex: 627110 Chamcom Liverpool.

A/S De Danske Sukkerfabrikker,
(The Danish Sugar Corporation),
Langebrogade 5, Copenhagen K, Denmark.
Tel.: ASTA 6130. *Cable:* Sukkerfabrikker, Copenhagen.
Telex: 5530 Sukker KH.

The Deister Concentrator Co. Inc.,
901–935 Glasgow Avenue, Fort Wayne, Ind., 46801 U.S.A.
Tel.: 742-7213. *Cable:* Retsied, Fort Wayne.

Dendix Brushes Ltd.,
Lower Church St., Chepstow, Monmouthshire NP6 5XT, England.
Tel.: Chepstow 2277/9. *Cable:* Brushes, Chepstow.

Diamond Shamrock Chemical Company, Resinous Products Division,
P.O. Box 829, 1901 Spring Street, Redwood City, Calif., 94064 U.S.A.
Tel.: (415) 369–0071. *Cable:* Daco-West, Redwood City, Calif.

Dicalite/GREFCO Inc.,
630 Shatto Place, Los Angeles, California 90005. U.S.A.
Tel.: (213) DUnkirk 1-5081. *Cable:* Dicalite, Losa.
Telex: 67-4224.

Dorr-Oliver Inc., Cane Sugar Division,
Stamford, Conn., 06904 U.S.A.
Tel.: (203) 348-5871.
Telex: 965912.

Dreßholz & Floering Ltd.,
Dereham, Norfolk, England.
Tel.: Dereham 3145. *Cable:* Slicing, Dereham.
Telex: 97357.

Carl Drohmann G.m.b.H.,
Remscheider Str. 3–5, Postfach 360, 7 Stuttgart-Bad Canstatt. Germany.
Tel.: 54 11 06. *Cable:* Drohmannpacker, Stuttgart-Bad Canstatt.
Telex: 072 2886.

Dust Control Equipment Ltd.,
Thurmaston, Leicester LE4 8HP, England.
Tel.: Syston 3333. *Cable:* Dust, Leicester.
Telex: 34500.

Eagle-Picher Industries Inc.,
American Building, Cincinnati, Ohio, 45201 U.S.A.
Tel.: (513) 721-7010. *Cable:* Eaglepich, Cincinnati.

Maschinenfabrik H. Eberhardt,
3340 Wolfenbüttel, Frankfurterstr. 14/17, P.O. Box 266, Germany.
Tel.: 22002 and 3263. *Cable:* Eberhardt, Wolfenbüttel.
Telex: 09 52620 ebhdtd.

Edwards Engineering Corp.,
1170 Constance Street, New Orleans, La., 70130 U.S.A.
Tel.: 524-0175. *Cable:* Joedco, New Orleans.
Telex: 058-342.

The Eimco Corporation,
P.O. Box 300, Salt Lake City 10, Utah, U.S.A.,
Tel.: (801)328-8831. *Cable:* Eimco, Salt Lake City.
Telex: 2066-038546.

Eimco (Great Britain) Ltd.,
Filter Process Division, Station Rd. ,St. Neots, Hunts. ,England.
Tel.: St. Neots 3461. *Cable:* Eimfilt, St. Neots.
Telex: 32111.

Eimco Industriale S.p.A.,
Strada Cerca, Tribiano (Milano), Italy.
Tel.: 9064. 234/5/6/7. *Cable:* Eimcoit, Milano.

Electromagnets Ltd.,
Boxmag Works, Bond Street, Hockley, Birmingham 19. England.
Tel.: 021-236 9071. *Cable:* Boxmag, Birmingham.
Telex: Electromagnets, Chamcom, Birmingham.

Endecotts (Test Sieves) Ltd.,
Lombard Road, London S.W.19, England.
Tel.: Liberty 8121/2/3. *Cable:* Endtesiv, London S.W.19.

Enzinger Division,
The Duriron Co. Inc.,
P.O. Box 71, 9542 Hardpan Rd., Angola, N.Y., 14006 U.S.A.
Tel.: 716549-2500.

Escher Wyss Ltd.,
Case Postale-Gare Centrale, 8023 Zurich, Switzerland.
Tel.: 444451. *Cable:* Escherwyss, Zurich.
Telex: 53906/7/8.

Ewart Chainbelt Co. Ltd.,
Colombo Street, Derby, England.
Tel.: Derby 45451. *Cable:* Chainbelt, Derby.
Telex: 37575.

Extraction De Smet S.A.,
265 Ave. Prince Baudouin, Edegem-Antwerp, Belgium.
Tel.: (03) 49.42.40. *Cable:* Extraxsmet, Antwerp.
Telex: 31824.

Fabcon Inc.,
314 Public Square Building, Cleveland, Ohio, 44113 U.S.A.
Tel.: (216) 621-2344.

The Falk Corporation,
P.O. Box 492, Milwaukee, Wis., 53201 U.S.A.
Tel.: 342-3131. *Cable:* Falk, Milwaukee.
Telex: 026-722.

Farnell Carbons,
Division of Forestal Industries (U.K.) Ltd.,
The Adelphi, John Adam St., London W.C.2, England.
Tel.: (01)-930-6777. *Cable:* Scofar, London W.C.2.
Telex: 22817/22818.

Farrel Corporation,
Ansonia, Conn., U.S.A.
Tel.: 734-3331. *Cable:* Farrelmach, Ansonia.

Ferguson Perforating & Wire Co.,
130-140 Ernest Street, Providence, R.I., U.S.A.
Tel.: Williams 1-8876. *Cable:* Ferguson, Providence.

Film Cooling Towers (1925) Ltd.,
Chancery House, Parkshot, Richmond, Surrey, England.
Tel.: 01-940 6494. *Cable:* Aloof, Richmond.

Fisons Ltd., International Division,
9 Grosvenor St., London W.1, England.
Tel.: 01-493 1611. *Cable:* Fisons, London.
Telex: 263184 Fisons London.

Société Fives Lille-Cail,
7 Rue Montalivet, 75 Paris 8e, France.
Tel.: 265.22.01. *Cable:* Fivcail, Paris.
Telex: Fivcail 65328.

Fletcher and Stewart Ltd.
Masson Works, Litchurch Lane, Derby, England.
Tel.: Derby 40261. *Cable:* Amarilla, Derby, Telex.
Telex: 37514.

Flexible Drives (Gilmans) Ltd.,
Skatoskalo Works, Millers Road, Warwick, England.
Tel.: Warwick 42693/4/5. *Cable:* Skatoskalo, Warwick.
Telex: 31451.

Flexotube (Liverpool) Ltd.,
25 Hope Street, Liverpool 1, Lancs., England.
Tel.: 051-ROY 3345. *Cable:* Flexotube, Liverpool.

Fluostatic Ltd.,
Borough Green, Kent, England.
Tel.: Borough Green 2806. *Cable:* Fluostatic, Sevenoaks.
Telex: 262535.

Fontaine & Co. G.m.b.H.,
51 Aachen, Grüner Weg 31, Germany.
Tel.: 31340. *Cable:* Fontaineco, Aachen.

Foster Wheeler John Brown Boilers Ltd.,
3 Ixworth Place, London S.W.3, England.
Tel.: 01-589 6363. *Cable:* Rewopstream, London.
Telex: 23945.

John Fowler & Co. (Leeds) Ltd.,
Leathley Road, Leeds 10, Yorkshire, England.
Tel.: Leeds 30731.
Telex: 55461.

General Electric Company of U.S.A.,
159 Madison Ave., New York, N.Y., 10016 U.S.A.
Tel.: PL1-1311. *Cable:* Ingeco, New York.
Telex: 224698.

General Refractories Ltd.,
Genefax House, Tapton Park Rd., Sheffield, S10 3FJ, England.
Tel.: 31113. *Cable:* Genefax, Sheffield.
Telex: 54128.

T. Giusti & Son Ltd.,
202-224 York Way, Kings Cross, London N.7, England.
Tel.: 01-607 5021-5. *Cable:* Giustison, London N.7.

Goka N.V. Machine Works,
Postbus 3530, Koestraat 2a, Amsterdam C, Holland.
Tel.: 222255/6. *Cable:* Kagodam, Amsterdam.
Telex: 14173.

E. Green & Son Ltd.,
Calder Vale Road, Wakefield, Yorkshire, England.
Tel.: Wakefield 71171. *Cable:* Economiser, Wakefield.
Telex: 55452.

J. Barcham Green Ltd.,
Hayle Mill, Tovil, Maidstone, Kent, England.
Tel.: 0622/52040/56852. *Cable:* Green, Tovil, Maidstone.

N. Greening (Warrington) Ltd.,
Britannia Works, Warrington, Lancs., England.
Tel.: Warrington 32401. *Cable:* Greenings, Warrington, Telex.
Telex: 62195.

Grill Floors Ltd.,
West Row, North Kensington, London, W.10, England.
Tel.: 01-969 3066/7. *Cable:* Etyladec, London, W.10.

Gruendler Crusher & Pulverizer Co.,
2915 North Market Street, St. Louis, Mo., 63106 U.S.A.
Tel.: Jefferson 1-1220. *Cable:* Grupulco, St. Louis.

Gutehoffnungshütte Sterkrade A.G.,
Werk Düsseldorf, 4 Düsseldorf-Grafenberg, Germany.
Tel.: Düsseldorf 66 61 21. *Cable:* Hoffnungshütte, Düsseldorf.
Telex: 0858 6710.

Hamill & Company,
P.O. Box 362, Kailua, Hawaii, 96734 U.S.A.

The Harland Engineering Co. Ltd.,
Harland House, 20 Park Street, London, W.1, England.
Tel.: 01-499 1221/3. *Cable:* Rheometric, London, Telex.
Telex: 22881.

Hartmann & Braun A.G.,
6 Frankfurt 90, Postfach 900507, Germany.
Tel.: 770611 (7991). *Cable:* Hartmannbraun, Frankfurtmain.
Telex: 4 14071 hbfm d.

Haver & Boecker,
4740 Oelde/Westfalen, Postfach 163, Germany.
Tel.: (02522) 301. *Cable:* Haboe, Oelde.
Telex: 8921571 havr.

G. M. Hay & Co. Ltd.,
Strathclyde Foundry, Boydstone Rd., Thornliebank, Glasgow, Scotland.
Tel.: Giffnock 6521/2/3. *Cable:* Castiron, Glasgow.

Head Wrightson Process Engineering Ltd.,
Special Products Division,
Teesdale House, 16/26 Baltic Street, London E.C.1, England.
Tel.: 01-253 1299.
Telex: 28879.

Hein, Lehmann & Co. A.G.,
P.O. Box 4109, Fichtenstr. 75, 4000 Düsseldorf, Germany.
Tel.: 780201. *Cable:* Herrmannsieb, Dusseldorf.
Telex: 8582740.

John M. Henderson & Co. Ltd.,
P.O. Box 26, King's Works, Aberdeen, AB9 8BU Scotland.
Tel.: 24262. *Cable:* Cranes, Aberdeen.

Herfilco,
76 Bd. Victor Hugo, 96 Clichy, France.
Tel.: 737.95.14. *Cable:* Herfilco, Paris.
Telex: Herfilco 28 543F.

Fr. Hesser Maschinenfabrik A.G.
7 Stuttgart-Bad Cannstatt, Nauheimerstr. 99, Germany.
Tel.: Stuttgart 566 141. *Cable:* Hesser, Stuttgart-Bad Cannstatt.
Telex: 072-2362.

Samuel Hill Ltd.,
Balderstone Mill, Oldham Rd., Rochdale, Lancashire, England.
Tel.: Rochdale 46748/9. *Cable:* Filtering, Rochdale.

Hodag Chemical Corporation,
7247 North Central Park Avenue, Skokie, Ill., 60076 U.S.A.
Tel.: Orchard 5-3950. *Cable:* Hodag, Skokieill.

Honeywell Controls Ltd.,
Great West Rd., Brentford, Middlesex, England.
Tel.: 01-568 9191. *Cable:* Honeywell, Hounslow, Telex.
Telex: 22765.

Honeywill-Atlas Ltd.,
Mill Lane, Carshalton, Surrey, England.
Tel.: Franklin 2261/2/3/4.

Honolulu Iron Works Company,
475 Fifth Avenue, New York, N.Y., 10017 U.S.A.
Cable: Honiron, New York.

Robert Hudson (Raletrux) Ltd.,
Raletrux Works, P.O. Box 4, Morley, Leeds, England.
Tel.: Morley 4931. *Cable:* Raletrux, Leeds.
Telex: 55133 Leeds.

IMACTI Industrieele Maatschappij Activit N.V.,
Postbus 240c, Amsterdam, Holland.
Tel.: 60153, 60821. *Cable:* Activit, Amsterdam.
Telex: 11652 Ion exchange.

Industrial Magnets Ltd.,
Station Road, Acocks Green, Birmingham 27, England.
Tel.: 021-706 0706. *Cable:* Indmag, Birmingham.

Ingeniörsfirman Nils Weibull A.B.,
see Weibull.

Instrumentenfabriek Venema,
Smirnoffstraat 3, Groningen, Holland.
Tel.: 05900/23538. *Cable:* Venapp, Groningen.

Isopad Ltd.,
Barnet By-Pass, Boreham Wood, Herts., England.
Tel.: 01-953 2817. *Cable:* Isopad, Borehamwood.
Telex: 261761.

I. V. Pressure Controllers Ltd.,
North Feltham Trading Estate, Spur Rd., Feltham, Middlesex, England.
Tel.: 01-890 6371. *Cable:* Iveepress, Telex, Hounslow.
Telex: 262003 Iveepressure Fel.

W. G. Jenkinson Ltd.,
Arundel Street, Sheffield, Yorkshire, England.
Tel.: 27438/9.

Jones & Attwood Ltd.,
Stourbridge, Worcestershire, England.
Tel.: Stourbridge 5106/7/8/9. *Cable:* Heat, Stourbridge.
Telex: 338120.

Amandus Kahl Nachf.,
Hamburg 26, Eiffestrasse 432, Germany.
Tel.: 0411/722/4245. *Cable:* Kahladus, Hamburg.
Telex: 0212775.

Kamani Tubes Private Ltd.,
Lal Bahadur Shastri Marg., Kurla, Bompay 70 (A.S.), India.
Tel.: 555561. *Cable:* Kamatubes, Kurla North.

Thomas C. Keay Ltd.,
P.O. Box 30, Baltic Street, Dundee, Scotland.
Tel.: Dundee 26031/4. *Cable:* Keay, Dundee.

Kenite Corporation,
Overhill Building, Scarsdale, N.Y., U.S.A.
Tel.: 914-723-8110. *Cable:* Diatomitescarsdaleny.

Kingston Industrial Works Ltd.,
138 Spanish Town Road, P.O. Box 72, Kingston 11, Jamaica, West Indies.
Tel.: 36121. *Cable:* Industrial, Kingston.

The Kleen-e-ze Brush Co. Ltd., Industrial Division,
Hanham, Bristol, England.
Tel.: Bristol 673027. *Cable:* Kleeneze, Bristol.

A. H. Korthof N.V.,
48 Herengracht, P.O. Box 46, Amsterdam-C., Holland.
Tel.: 020/230734. *Cable:* Sugarlab, Amsterdam.

Krieg & Zivy Industries,
17 rue Louis-Lejeune, 92 Montrouge, France.
Tel.: 253-40-80. *Cable:* Zedka, Montrouge.

Aktiengesellschaft Kühnle, Kopp & Kausch,
6710 Frankenthal/Pfalz, Germany.
Tel.: Frankenthal (06233)-4021.
Cable: Maschinenkessel, Frankenthal/Pfalz.
Telex: 04 65221.

Lafarge Aluminous Cement Co. Ltd.,
73 Brook Street, London W.1, England.
Tel.: Mayfair 8546. *Cable:* Cimenfondu, London W.1.

S.A. Lainière de Sclessin,
Sclessin-lez-Liège, Belgium.
Tel.: (04) 52.21.50. *Cable:* Lainière, Sclessin.

AB. Landsverk,
Landskrona, Sweden.
Tel.: 77000. *Cable:* Landsverk, Landskrona.
Telex: 72285.

Lepage, Urbain & Cie.,
5 Rue René Robin, 94 Ivry-sur-Seine, France.
Tel.: 482.27.13/482.47.59. *Cable:* Alepage, Paris.

Lodge-Cottrell Ltd., *see* Simon Engineering Ltd.

Joseph Long Ltd.,
184 Station Road, Harrow, Middx., England.
Tel.: 01-427 4505. *Cable:* Longeph, Norphone, London.

R. Lord & Sons Ltd.,
Barnbrook Boiler Works, Bury, Lancs, England.
Tel.: 061-764 4862. *Cable:* Lords, Bury.

Lufkin Foundry & Machine Co.,
P.O. Box 849, Lufkin, Texas, 75901 U.S.A.
Tel.: NE4-4421. *Cable:* Luffo, Lufkin.
Telex: 713-632-3103.

The Lunkenheimer Company,
Beekman St. at Waverly Ave, Cincinnati, Ohio, 45214 U.S.A.
Tel.: 513-921-3400. *Cable:* Lunken, Cincinnati.

Lurgi Gesellschaft für Wärme- und Chemotechnik m.b.H.,
6 Frankfurt (Main), Lurgihaus, Germany.
Tel.: 55071. *Cable:* Lurgiwaerme, Frankfurt.

Machinefabriek Reineveld N.V.,
Haagweg 127, P.O. Box 22, Delft, Netherlands.
Tel.: 01730/24890. *Cable:* Reineveld, Delft.
Telex: 31027.

Manlove, Alliott & Co. Ltd.,
P.O. Box 81, Bloomsgrove Works, Nottingham, NG7 3HQ, England.
Tel.: 75127. *Cable:* Manloves, Nottingham.
Telex: Chamcom Nottm No. 37605.

Marshall, Sons & Co. Ltd.,
Britannia Works, Gainsborough, Lincs., England.
Tel.: Gainsborough 2301.
Telex: 56134.

Mavor & Coulson Ltd.,
47 Broad St., Bridgeton, Glasgow S.E., Scotland.
Tel.: Bridgeton 1800. *Cable:* Prodigious, Phone, Glasgow.
Telex: 778109.

Metal Propellers Ltd.,
74 Purley Way, Croydon, Surrey, England.
Tel.: 01-684 3611.
Telex: 25635.

L. S. Miedema Landbouwwerktuigenfabriek N.V.,
Kleasterdyk 43, Winsum (Fr.), Netherlands.
Tel.: (05173) 541. *Cable:* Miedema, Winsumfriesland.
Telex: 46056.

Mikropul Ltd.,
40 Towerfield Rd., Shoeburyness, Essex, England.
Tel.: Shoeburyness 2373. *Cable:* Mikropul, Southend-on-Sea.

The Mirrlees Watson Co. Ltd.,
Cosmos House, 1 Bromley Common, Bromley, Kent, England.
Tel.: 01-464-3681. *Cable:* Mirwat, Bromley, Kent.
Telex: 2-2404.

Mono Pumps Ltd.,
Mono House, Sekforde Street, Clerkenwell Green, London E.C.1, England.
Tel.: 01-253 8911. *Cable:* Monopumps, London E.C.1.
Telex: 24453.

Montecatini Edison S.p.A.,
Division Estero,
Largo G. Donegani 1/2, Milan, Italy.
Tel.: Milan 6333/4. *Cable:* Gabbroesteri, Milan.
Telex: 31415 Gabbro.

Etablissements F. Moret,
33 Ave. Faidherbe, St. Quentin 02, France.
Tel.: 62-50-93.

Morse Chain Division of Borg-Warner Ltd.,
Works Rd., Letchworth, Herts., England.
Tel.: Letchworth 2333. *Cable:* Borgwarner, Letchworth.
Telex: 82249.

Moss Gear Co. Ltd., Industrial Gear Division,
Corporation Street, Accrington, Lancs., England.
Tel.: Accrington 32223. *Cable:* Mosgear, Accrington.

Charles Mundt & Sons,
53 Fairmont Avenue, Jersey City, N.J., U.S.A.
Tel.: Area Code 201-333-6200. *Cable:* Mundt, New Jersey.
Telex: JCY 774.

Murray Iron Works Company,
Burlington, Iowa, U.S.A.
Tel.: Area Code 319 754-6541. *Cable:* Murrayiron, Burlington.
Telex: 46-8448.

Patrick Murray (Pty.) Ltd.,
P.O. Box 1541, Durban, South Africa.
Cable: Sugarequip, Durban.
Telex: 6-7119 DN.

Nash International Company,
Norwalk Conn., 06856 U.S.A.
Tel.: (203) 866-3351. *Cable:* Hytor, Norwalk, Conn.
Telex: 96-5926.

Neptune Measurement Ltd.,
P.O. Box No. 2, Dobcross, Oldham, Lancs., England.
Tel.: 0457-8 424. *Cable:* Meters, Dobcross.

New Conveyor Co. Ltd.,
Brook St., Smethwick, Warley, Worcs., England.
Tel.: 021-558 2100. *Cable:* Newconti, Birmingham.
Telex: 338063.

Newell Dunford Engineering Ltd.,
143 Maple Road, Surbiton, Surrey, England.
Tel.: 01-546 7799. *Cable:* Lindaresco, Telex, London.
Telex: 22413.

Neyrpic,
Boite Postale 52, Grenoble (Isère), France.
Tel.: Grenoble 44 55 30. *Cable:* Neypric, Grenoble.

Nordiska Maskinfilt AB.,
S-301 03 Halmstad 1, Sweden.
Tel.: 11 87 00. *Cable:* Nordiskafilt, Halmstad.
Telex: 3558.

Norit Sales Corporation Ltd.,
see N.V. Norit Verkoopcentrale.

N.V. Norit Verkoopcentrale,
2de Weteringplantsoen 15, P.O. Box 1720, Amsterdam C, Holland.
Tel.: Amsterdam 239911. *Cable:* Noritcarbo, Amsterdam.
Telex: 12317.

Northey Rotary Compressors Ltd.,
Alder Rd., Parkstone, Poole, Dorset, England.
Tel.: Parkstone 4900. *Cable:* Northey, Bournemouth.

O. & K. Export- und Handelsgesellschaft m.b.H.,
4600 Dortmund-Dorstfeld., Karl-Lindestrasse 24, Germany.
Tel.: (0231)6811. *Cable:* Railways, Dortmund-Dorstfeld
Telex: 08 22222.

Parson Chain Co. Ltd.,
Worcester Road, Stourport-on-Severn, Worcs., England.
Tel.: Stourport-on-Severn 2557.
Cable: Chainworks, Stourport-on-Severn.
Telex: 33775.

Patrick Murray (Pty.) Ltd., *see* Murray

Pennine Chainbelt Co. Ltd.,
Modder Place, Armley, Leeds 12, Yorkshire, England.
Tel.: Leeds 63-8755. *Cable:* Pennine, Leeds.

Logan Perkins,
613 Dumaine Street, New Orleans 16, La., U.S.A.
Cable: Perco, New Orleans.

The Permutit Co. Ltd.,
Pemberton House, 632-652 London Rd., Isleworth, Middx., England.
Tel.: (01)-560-5199. *Cable:* Permutit, Hounslow.
Telex: 24440.

Phoenix Precision Instrument Co.,
3805 N. Fifth Street, Philadelphia, Pa., 19140 U.S.A.
Tel.: 215-228-7417. *Cable:* Ppico, Philadelphia.

Pittsburgh Activated Carbon Company,
P.O. Box 1346, Calgon Center, Pittsburgh, Pa., 15230 U.S.A.
Tel.: (412) 923-2345. *Cable:* Pitcarb, Pittsburgh.
Telex: 086739.

Pletterij Spoorijzer N.V.,
Postbus 10, Delft, Holland.
Tel.: 25931. *Cable:* Spoorijzer, Delft.
Telex: 31031.

J. & F. Pool Ltd.,
Hayle, Cornwall, England.
Tel.: Hayle 3213. *Cable:* Perforator, Hayle.
Telex: 45286 A.B. Poolperf Hayle.

Porritt Bro. & Austin Ltd.,
Broadway Mills, Haslingden, Lancs., England.
Tel.: Rossendale 3421. *Cable:* Neotex, Telex, Haslingden.
Telex: 63127 Neotex Hasden.

Porritts & Spencer Ltd, Industrial Fabrics Export Division,
Broadway, Haslingden, Lancs., England.
Tel.: Rossendale 3421. *Cable:* Neotex, Telex, Haslingden.
Telex: 63127 Neotex Hasden.

Power Plant Gears Ltd.,
West Drayton, Middlesex, England.
Tel.: West Drayton 2626. *Cable:* Roc, West Drayton.

H. Putsch & Comp.,
Postfach 4221, Frankfurter Str. 5-25, 58 Hagen, Germany.
Tel.: Hagen 31031. *Cable:* Putsch, Hagen.
Telex: 823795.

Rapid Magnetic Ltd.,
Lombard St., Birmingham 12, England.
Tel.: 021-772 1137. *Cable:* Magnetism, Birmingham.

Reed Medway Sacks Ltd.,
Larkfield, near Maidstone, Kent, England.
Tel.: Maidstone 7-7777. *Cable:* Satchelsac, Larkfield.
Telex: 89148 Reed, Aylesford.

Robert Reichling & Co. K.G.,
Kölner Strasse 397-403a, Postfach 2380, 415 Krefeld, Germany.
Tel.: 3.32.17. *Cable:* Reichling, Krefeld.
Telex: 0853 757.

Renold Limited,
Renold House, Wythenshawe, Manchester, England.
Tel.: 061-MER 5221. *Cable:* Driving, Manchester.
Telex: 669052.

Robey & Co. Ltd.,
P.O. Box No. 23, Globe Works, Lincoln, England.
Tel.: Lincoln 21381. *Cable:* Robey, Lincoln.

Rohm and Haas Company,
Independence Mall West, Philadelphia, Pa., 19105 U.S.A.
Tel.: 592-3000.

Rose, Downs & Thompson Ltd.,
Cannon Street, Hull, England.
Tel.: 29864. *Cable:* Rosedowns, Hull.
Telex: 52226.

Rotameter Manufacturing Co. Ltd.,
330 Purley Way, Croydon CR9 4PG, England.
Tel.: 01-688 3816. *Cable:* Rotaflo, Croydon.
Telex: 24292.

Sackfilling & Sewing Machine Syndicate Ltd.,
Timewell Works, Lockfield Avenue, Brimsdown, Enfield, Middlesex, England.
Tel.: Howard 1188. *Cable:* Fecit, Enfield.

St. Mary Iron Works Inc.,
P.O. Box 581, Franklin, La., 70538 U.S.A.
Tel.: 318-828-5390. *Cable:* SMIW, Franklin.

Salzgitter Maschinen A.G.,
Postfach 23, 3327 Salzgitter-Bad, Federal Republic of Germany.
Tel.: (053 41) 3921. *Cable:* Samag, Salzgitter-Bad.
Telex: 9 522 445 smg d.

Sankey Green Wire Weaving Co. Ltd.,
Thelwall, Warrington, Lancs., England.
Tel.: Warrington 61211. *Cable:* Sanco, Warrington.

SAPAL Société Anonyme des Plieuses Automatiques,
36 Avenue du Tir Fédéral, 1024 Ecublens près Lausanne, Switzerland.
Tel.: (021) 34 44 61. *Cable:* Autoplieuse, Lausanne.
Telex: 24 541.

Saunders Valve Co. Ltd.,
Grange Rd., Cwmbran, Monmouthshire, England.
Tel.: Cwmbran 2044. *Cable:* Saunval, Newportmon.
Telex: 49241.

Schabaver,
Zone Industrielle de Mélou, 81 Castres, France.
Tel.: 59-00-49. *Cable:* Schabaver, Castres s/Agout.
Telex: 51786.

Carl Schenck Maschinenfabrik G.m.b.H.,
6100 Darmstadt, Landwehrstrasse 55, Germany.
Tel.: 06151/71021. *Cable:* Schenck, Darmstadt.
Telex: 419 441 c s d d.

Schill & Seilacher Chemische Fabrik,
2000 Hamburg 74, Moorfleetstr. 28, Germany.
Tel.: 73 16 66. *Cable:* Schillseilacher, Hamburg.
Telex: 0212932.

Schmidt & Haensch,
Berlin 62, Naumannstrasse 33, Germany.
Tel.: 71 06 31. *Cable:* Polarisation, Berlin.

Schumacher Filters Ltd.,
69/71 Wilkinson St., Sheffield 10, Yorkshire, England.
Tel.: 28103. *Cable:* Schufilt, Sheffield 10.
Telex: 54280.

Schumacher'sche Fabrik.
Bietigheim/Württemberg, Germany.
Tel.: 7721. *Cable:* Schumafilt, Bietigheim.
Telex: 724217.

Scientific Furnishings Ltd.,
Poynton, Cheshire, England.
Tel.: Poynton 2215. *Cable:* Design, Poynton.

N.V. Servo-Balans,
Wegastraat 40, Den Haag, Holland.
Tel.: (070)-835503. *Cable:* Servobalans, Den Haag.

S.E.U.M.,
62 Corbehem, France.
Tel.: (20) 88-70-40. *Cable:* SEUM, Corbehem.

Shirtliff Bros. Ltd.,
Icknield Way, Letchworth, Herts., England.
Tel.: 2161. *Cable:* Shirtliff, Letchworth.

SIG Swiss Industrial Company,
CH-8212 Neuhausen Rhine Falls, Switzerland.
Tel.: (053) 8 15 55. *Cable:* Sig, Neuhausenamrheinfall.
Telex: 7 61 56.

Silver Engineering Works Inc.,
3309 Blake St., Denver, Colo. 80205 U.S.A.
Tel.: 303-623-0211. *Cable:* Silver, Denvercolo.
Telex: 045-567 Silverengr Dvr.

Henry Simon Ltd., *see* Simon Engineering Ltd.

Richard Simon & Sons Ltd.,
Phoenix Works, Basford, Nottingham, England.
Tel.: 74211-9. *Cable:* Balance, Nottingham.

Simon Engineering Ltd.,
P.O. Box 31, Stockport, England.
Tel.: Gatley 3621. *Cable:* Simon, Stockport, Telex.
Telex: 669071.

Simon-Barron Ltd., *see* Simon Engineering Ltd.

Simon-Carves Ltd., *see* Simon Engineering Ltd.

Simon-Carves Chemical Engineering Ltd., *see* Simon Engineering Ltd.

Simon Handling Engineers Ltd., *see* Simon Engineering Ltd.

Simonacco Ltd.,
Durranhill, Carlisle, England.
Tel.: Carlisle 24391. *Cable:* Simonacco, Carlisle.
Telex: 6455 Simonacco Carlisle.

Richard Sizer Ltd.,
Cuber Works, Hull, England.
Tel.: Hull 23155. *Cable:* Sizer, Hull, Telex.
Telex: 52236.

A. & W. Smith & Co. Ltd.,
Cosmos House, 1 Bromley Common, Bromley, Kent, England.
Tel.: 01-464 3681. *Cable:* Sugrengine, Bromley, Kent.
Telex: 2-2404.

Sparkler Manufacturing Company,
101 Cartwright Rd., Conroe, Texas, 77301 U.S.A.
Tel.: (713) 756-4471 *Cable:* Spafiltco, Conroe.
TWX: 910-880-4183.

S.P.E.I. Chim.,
106 Rue d'Amsterdam, Paris 9e, France.
Tel.: 744-73-79. *Cable:* Rectifpast, Paris.
Telex: 23012 Spechim.

Spencer (Melksham) Ltd.,
(A member of the English Electric Elliott-Automation Group).
Melksham, Wilts., England.
Tel.: Melksham 3481. *Cable:* Spencer, Melksham.
Telex: 44392.

Standard Steel Corporation,
5013 South Boyle Avenue, Los Angeles, California, 90058 U.S.A.
Tel.: Area 213-585-1234. *Cable:* Stansteel, Los Angeles.
Telex: 674737.

Stein Atkinson Stordy Ltd.,
Westminster House, Kew Rd., Richmond, Surrey, England.
Tel.: Richmond 4861. *Cable:* Metasteina, Richmond.
Telex: 262324.

Stella-Meta Filters Ltd.,
Laverstoke Mill, Whitchurch, Hants., England.
Tel.: Whitchurch 360. *Cable:* Stellameta, Whitchurch, Hants.

Stord Bartz Industri A/S.,
P.O. Box 777, Bergen, Norway.
Tel.: Bergen 10030. *Cable:* System, Bergen.
Telex: System 2051.

Stork-Werkspoor (V.M.F.),
P.O. Box 147, Hengelo (O.), Holland.
Tel.: Hengelo 54321. *Cable:* Stowesugar, Hengelo.
Telex: 31324.

Stothert & Pitt Ltd.,
Lower Bristol Rd., Bath, Somerset, England.
Tel.: Bath 63401/63041. *Cable:* Stothert, Bath.
Telex: 44177.

Suchar,
Division of Bangor Punta Operations Inc.,
9 East 41st St., New York, N.Y., 10017 U.S.A.
Tel.: (212) 867-0540. *Cable:* Sucharing, New York.

The Sugar Manufacturers' Supply Co. Ltd.,
196-204 Bermondsey Street, London, S.E.1, England.
Tel.: 01-407 5422. *Cable:* Sumasuco, London, S.E.1.

A.B. Svenska Fläktfabriken,
P.O. Box 20 040, S-104 60 Stockholm 20, Sweden.
Tel.: Stockholm 23 83 20. *Cable:* Flaktfabriken, Stockholm.
Telex: 10430 flakt sthlm s.

Taylor Instrument Companies (Europe) Ltd.,
Gunnels Wood Rd., Stevenage, Herts., England.
Tel.: Stevenage 2366. *Cable:* Taylortrol, Stevenage.
Telex: 82281.

Technoexport Czechoslovakia,
56 Vaclavske nam., Prague 1, Czechoslovakia.
Cable: Technoexport, Prague.

The Thames Packaging Equipment Co.
28 City Road, London, E.C.1, England.
Tel.: 01-606 7387/8. *Cable:* Pakitup, London.

Thermix Industries Ltd.,
see Newell Dunford Engineering Ltd.

Thibodaux Boiler Works Inc.,
P.O. Box 32, Thibodaux, La., 70301 U.S.A.
Tel.: (Area Code 504)-446-1363.
Cable: Thibworks, Thibodaux.

John Thompson Ltd.,
Ettingshall, Wolverhampton, England.
Tel.: Bilston 41121. *Cable:* Boiler. Telex, Wolverhampton.
Telex: 33-212.

The Thomson Machinery Co. Inc.,
P.O. Box 71, Thibodaux, Louisiana, U.S.A.
Tel.: (504)-447-3773. *Cable:* Thomson, Thibodaux.

Thorn Bendix Ltd.,
High Church Street, New Basford, Nottingham, England.
Tel.: Nottingham 75115. *Cable:* Bendelec, Nottingham.
Telex: 37142.

T. I. Stainless Tubes Ltd.,
Broadwell Road, Oldbury, Warley, Worcestershire, England.
Tel.: 021-552 1585.
Telex: 33387.

Toft Bros. Pty. Ltd.,
Private Mail Bag, Avoca Road, Bundaberg, 4670 Queensland, Australia.
Tel.: Bundaberg 2216. *Cable:* Toftequip, Bundaberg.

The Triton Engineering Co. (Sales) Ltd.,
Kingsnorth Industrial Estate, Wotton Road, Ashford, Kent, England.
Tel.: Ashford (Kent) 2051-5. *Cable:* Triton, Ashford, Kent

Unifloc Ltd.,
11/16 Adelaide Street, Swansea, Glamorgan, Wales.
Tel.: Swansea 55164. *Cable:* Unifloc, Swansea

United States Steel International (New York) Inc.,
Glen House, Stag Place, London S.W.1., England.
Tel.: Tate Gallery 0111. *Cable:* Steelmaker, London.
Telex: 27738 and 261021.

Vaughan Crane Co. Ltd.,
West Gorton, Manchester 12, England.
Tel.: (061)-223-2771. *Cable:* Vaunting, Manchester 12.

Walkers Ltd.,
Bowen St., Maryborough, Queensland, Australia.
Tel.: Maryborough 2321. *Cable:* Itolzak, Maryborough.

Wallwin (Pumps) Ltd.,
Saltisford Iron Works, Warwick, England.
Tel.: Warwick 41581. *Cable:* Unbeaten, Warwick.

F. E. Weatherill Ltd.,
Tewin Road, Welwyn Garden City, Herts., England.
Tel.: Welwyn Garden 20141.
Cable: Weatherhyd, Welwyn Garden City, Telex.
Telex: 24198.

Weeks & Co. (Engineers) Ltd.,
Bridge Works, Ferry Rd., Hessle, East Yorkshire, England.
Tel.: Hull 642171. *Cable:* Weeks, Hull.

Ingeniörsfirman Nils Weibull AB.,
Box 65, Malmö 1, Sweden.
Tel.: Malmö 73495. *Cable:* Nilswei, Malmö.

Weigelwerk A.G.,
43 Essen, Weigelwerkstr. 11, Germany.
Tel.: 294001–9. *Cable:* Weigelwerk, Essen.
Telex: 08 57 404.

Welding Technical Services Ltd.,
Pershore Road South, Kings Norton, Birmingham 30, England.
Tel.: 021–458 5541–4. *Cable:* Weltexa, Birmingham.

Western Gear Corporation,
Industrial Products Division, P.O. Box 126, Belmont, Calif., U.S.A.
Tel.: (415)-593-7611. *Cable:* Westgear, Los Angeles.
Telex: 47-34468 via ITT.

The Western States Machine Company,
Hamilton, Ohio, U.S.A.
Tel.: 513–894–4758. *Cable:* Wesmaco, Hamilton, Ohio.

Joseph Westwood & Co. Ltd.,
Napier Yard, West Ferry Rd., Millwall, London, E.14, England.
Tel.: 01-987 1043. *Cable:* Westwood, London E.14.

Wheway-Watson Ltd.,
Industrial Estate, Bellshill, Lanarkshire, Scotland.
Tel.: Bellshill 2437. *Cable:* Parts, Bellshill.

The Witte Co. Inc.,
Route 31 South, P.O. Box 163, Washington, N.J., 07882 U.S.A.
Tel.: 201–486–8253.

The Worcester Valve Co. Ltd.,
Burrell Rd., Haywards Heath, Sussex, England.
Tel.: Haywards Heath 51581.
Telex: 87189.

Worthington Corporation,
Harrison, New Jersey, U.S.A.
Tel.: 201–HU–4–1234. *Cable:* Worthington, Harrison.
Telex: 201–621–7848.

Wright Rain Ltd.,
Crowe, Ringwood, Hants., England.
Tel.: Ringwood 2251. *Cable:* Wrightrain, Ringwood, Telex.
Telex: 41206.

Wright Rain Africa (Pvt.) Ltd.,
35 Birmingham Road, Box 3237, Salisbury, Rhodesia.
Tel.: Salisbury 25810. *Cable:* Wrightrain, Salisbury.

Yarrow & Co. Ltd.,
Scotstoun, Glasgow W.4, Scotland.
Tel.: 041-959 1207. *Cable:* Yarrow, Glasgow.
Telex: 77357 Yarrow Glasgow.

Yorkshire Imperial Metals Ltd.,
P.O. Box 166, Leeds, Yorkshire, England.
Tel.: 0LE2 (Leeds) 7-2222. *Cable:* Yorkimp, Leeds.
Telex: 55-311.

G. H. Zeal Ltd.,
Lombard Rd., Merton, London S.W.19., England.
Tel.: 01-542 2283/6. *Cable:* Zealdom, London S.W.19.

Carl Zeiss,
Western Germany.
Tel.: Oberkochen (07364) 201. *Cable:* Zeisswerk, Oberkochen.
Telex: 7-13 213.

VEB. Carl Zeiss Jena,
Carl-Zeiss-Strasse 1, 69 Jena/Thür, D.D.R.
Tel.: 27042. *Cable:* Zeisswerk, Jena.
Telex: 058 8622

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SOME REMARKS ON ITS USE

In using this Index it should be noted that the principal entries cover the several stages of production: CULTIVATION (*see* Beet; Cane; Diseases; Fertilizer; Irrigation; Mechanization; Pests; Soil; Transport; Varieties; Weeds, etc.); SUGAR PROCESSING (*see* Bagasse; Boilers; Boiling; Carbonatation; Centrifugals; Clarification; Crystallization; Diffusion; Evaporators; Filter; Massecuite; Mills; Milling; Molasses; Pans, Vacuum; Scale; Sucrose; Sugar; Sugars; Sulphitation; Water, etc.); REFINING (*see* Bone Char; Carbon; Refining; etc.); and BY-PRODUCTS (*see* Alcohol; Animal Fodder; By-Products; Fermentation; Paper; Pulp; Yeast, etc.).

Subjects covered separately include Ash; Bulk handling and Bulk storage; Colour; Control, Automatic and Chemical; Countries; Ion exchange; Juice; Micro-organisms; pH; Polarization; Weighing, etc. Glucose and Fructose are to be found under Dextrose and Levulose. Obituaries, Statistics and Trade Notices are collected together under those headings. "Sucrose" implies the pure chemical; "Sugar" the commercial product; and "Sugars" the chemical family, rather than grades of sugar. When looking under the author's name, it should be remembered that the surname may be the penultimate in Spanish.

(Abs.) indicates *Abstract*; (Brev.), *Brevity*; (N.B.), *New Books*; (Corr.), *Correspondence*; (F.N.H.), *Dr. Howes*, our Agricultural Editor; (N.C.), *Note and Comment*; (Pat.), *Patent*; (Stat.), *Statistics*; (T.N.), *Trade Notice.*

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