International Sugar Journal

Panel of Referees

Vertical or horizontal beet pulp press
- a question of space
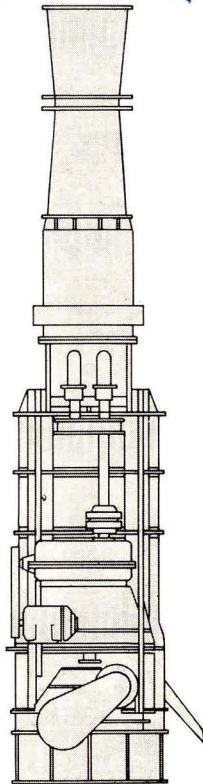
vertical...
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for small floor space
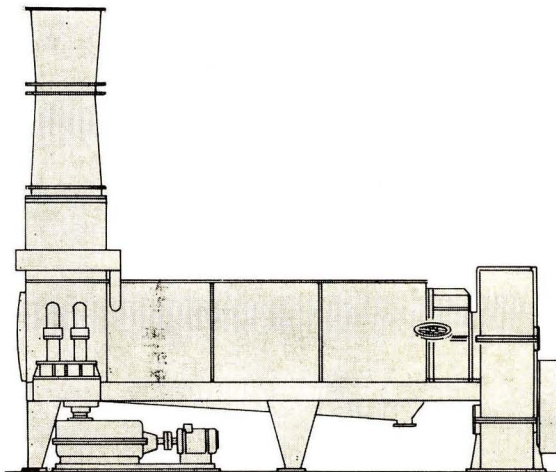
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NOTES AND COMMENTS

UNCTAD meeting in London.

The Secretary of UNCTAD, the United Nations Conference on Trade and Development, called a Preparatory Working Group on Sugar which met in London on the 26th–29th September to explore the prospects of a new International Sugar Agreement. Twenty-two nations were invited, including the main regional trading groups, and beet and cane sugar producers and importers, except for China. However, Cuba, Mexico and the Dominican Republic were not represented.

No press communiqué was issued but it was understood that some progress was achieved and hopes have been expressed that the full negotiating conference can be resumed next year. Representatives of the importing and exporting countries met separately to discuss their respective positions and prepare reports giving their points of view. These were not discussed but are to be studied at the next session of the Group to be held at the end of this month.

* * *

World sugar outlook.

Commenting on the prospects of world sugar production and consumption for the new 1966–67 crop year, Lamborn & Company Inc., international sugar brokers, conclude that again production promises to outdistance consumption by a considerable amount.

Lamborn's survey indicates that, strictly as a preliminary estimate, world sugar production for the 1966/67 crop year may be increased upwards of 2,500,000 metric tons, raw value, over the 1965/66 crop. Assuming such an increase, world production would be 66,853,000 tons as compared with the estimated production for the 1965/66 crop of 64,353,000 metric tons.

Assuming an estimated increase of 4% in world sugar consumption in the new year, Lamborn reports that world consumption for the 1966/67 crop year would be approximately 63,993,000 metric tons or 2,860,000 tons less than production. (A recent survey by F. O. Licht K.G.[1] indicates an increase of 4·7% in sugar consumption between 1965 and 1966,

which would reduce this surplus to approx. 2·3 million tons, without, however, affecting the gloomy outlook.)

If production and consumption figures turn out as estimated, then world sugar stocks on 31st August 1967 should be approximately 23,000,000 tons, which would establish an all-time record. The previous record was 20,274,000 tons and was held on 31st August 1966.

Lamborn does not anticipate in the foreseeable future a sustained advance in world sugar prices to a level sufficient to support even the low-cost producers until a reversal occurs in the current imbalance between supply and demand.

* * *

European beet sugar production, 1966/67.

The first estimates of beet sugar production in Europe during the 1966/67 campaign were published by F. O. Licht K.G. towards the end of September[2], and are reproduced elsewhere in this issue, together with the corresponding figures for 1965/66 and 1964/65. The total 24·6 million tons was rather higher than had been anticipated in many quarters but, even so, subsequent reports from France and Belgium indicate that the good weather experienced during September and October might well result in crops 10% higher than Licht's estimates.

Most of the other figures indicated by Licht are in accordance with beet tests which have been reported and show the effects of good growing weather on the likely sugar production; although the area devoted to beet in Europe in 1966 is some 4% less than the 1965 area, and in many cases sowing was delayed through rain, the beets have grown well in the subsequent good weather and over the last few months root weights have been greater and so have sugar contents.

The result is shown in the forecast 2·92% increase expected in sugar production, representing about a 7% increase in sugar per acre.

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[1] *International Sugar Rpt.*, 1966, **98**, (28), 1.
[2] *ibid.* **98**, (26), 1.

Philippines production plans[3].

The Philippine sugar industry needs 210 million pesos to raise production by 400,000 metric tons to 2,200.000 tons beginning next year.

The National Federation of Sugar Cane Planters, in a statement submitted to President FERDINAND MARCOS, said the industry had set an annual production goal of 2,100,000 tons of sugar to meet domestic requirements of 600,000 tons, an export quota in the United States of 1,281,267 tons and about 150,000 tons as the 15% reserve required by the U.S. sugar law.

The Federation urged the Government to make available about 60 million pesos in additional crop loans to farmers, and extend about 150 million pesos in long-term financing credits to sugar producers to enable them to expand present mills and build new ones.

* * *

Canada & Dominion Sugar Co. Ltd. 1964/65 report.

Refining operations.—Both Montreal and Toronto refineries operated for much of the year at higher rates and with less shut-down time, resulting in improved efficiency. The programme of modernization of conditioning, packing and warehousing at Montreal refinery was brought near to completion during the year and it was expected that final commissioning of the automatic warehouse would take place early in December.

A Research and Development Department has been set up in Montreal and now in progress are active investigations designed to improve plant and processes. With still higher throughputs anticipated in the current year, the full use of new facilities and stable labour conditions, efficient operations should be assured for 1966.

Beet sugar operations.—Another phase in the planned modernization of the Chatham plant was completed during the year with the installation of a new tower diffuser. Plans are now being made for the next phase, which concerns juice purification.

In 1965 acreage contracted was the lowest in many years and unfavourable weather caused further serious reductions. It is anticipated that this crop will have established a record tonnage per acre with sugar content about average. The new equipment installed for 1965 worked extremely well, giving good extraction.

Research is being directed towards development of new cultural and fertilizing practices as well as new seed varieties which will maintain yields per acre but increase sugar content.

The planned modernization of the Chatham plant was designed so to reduce costs that there could be greater assurance of a reasonable return on capital investment. This plan calls for major expenditure again in 1966. At the same time, the very low acreage of sugar beets harvested this year will adversely affect the sugar beet division operations. During the year, the Company made a fresh appraisal

of all aspects of its sugar beet operations and, in the light of the findings, it appears that a reasonable return on capital can be achieved providing that the Chatham plant can be operated to its full capacity.

This in itself requires a renewal of confidence in the long term future of the industry so that the Company can plan with certainty of operation and that growers can be assured that capital investment by them in mechanical equipment, so vital to cost reduction, will be worthwhile.

The Company therefore intends to plan its sugar beet operations for five years ahead and to do all in its power to encourage a profitable operation for all who are engaged in the industry.

* * *

U.S. sugar supply quota, 1966.

On the 6th October the U.S. Department of Agriculture announced a further increase of 50,000 tons in the sugar supply requirement for 1966, raising to 10,375,000 short tons raw value. The increase was distributed among 25 countries, most going to Central and South America. The Department declared that Nicaragua, the Philippines and Panama which would normally have shared in the increase did not have sugar available and their allocation was prorated to other countries. The increases and total quotas appear below.

Area	Increase (short tons,	Revised quota raw value)
Domestic Beet	—	3,025,000
Mainland Cane	—	1,100,000
Hawaii	—	1,200,227
Puerto Rico	—	730,000
Virgin Islands	—	10,000
Philippines	—	1,202,978
Argentina	1,123	58,265
Australia	1,605	187,127
Bolivia	109	5,639
Brazil	9,121	473,632
British Honduras	128	12,763
British West Indies	1,761	175,217
Colombia	965	50,120
Costa Rica	1,531	70,852
Dominican Republic	9,413	597,242
Ecuador	1,327	68,914
Fiji	352	41,064
French West Indies	554	55,119
Guatemala	1,291	59,708
Haiti	507	26,313
India	641	74,850
Ireland	—	5,351
Malagasy	75	8,836
Mauritius	147	17,153
Mexico	9,326	484,283
Nicaragua	—	19,000
Panama	—	13,000
Peru	7,275	377,777
Salvador	946	43,787
South Africa	472	55,098
Swaziland	58	6,757
Taiwan	668	77,969
Thailand	147	17,153
Venezuela	458	23,806
	50,000	10,375,000

[3] *Public Ledger*, 27th August 1966.

LATEST DEVELOPMENTS IN THE G.P. FILTER

by P. DUPONT

(Raffinerie Tirlemontoise, S.A., Tirlemont, Belgium)

PART I

Introduction

THE trials which led to the development of the G.P. filter in the sugar industry were described by HULPIAU[1] at the B.S.C. Technical Conference in June 1962. The G.P. filter is a pressurized sack-filter, equipped with textile bags. A sudden discharge of the juice filling the filter body removes the mud accumulated on the cloth.

It can be used in a sugar factory on 2nd carbonatation juice where, at the end of each filtration cycle, the inlet valve of the juice is closed. By an abrupt emptying of the filter through a valve located at the bottom, a hydraulic shock is created which gives rise to a counter-current stream of air through the filter bags. The mud is removed with the juice. Once the purging valve is closed, the filter is ready for another filtering cycle. The length of this cycle may vary, according to the factory conditions, between two and eight hours.

The mud, after mixing with the juice which has been dropped from the filter, is a thin slurry and is recirculated, for instance ahead of 1st carbonatation or sometimes to the prelimer.

The G.P. filter may also be used as a check filter on a slightly turbid juice from a settler or following an imperfect filtration. In this application it is operated exactly as described above but the time of the cycle is lengthened.

Finally, it may be used as a thickening filter after first carbonatation.

At the end of the filtration cycle the inlet valve for the juice is closed and the filter is again suddenly emptied. This emptying is, however, not through a valve located at the bottom but by way of a lateral opening, provided underneath the lowest end of the filter bags. This is referred to as a partial purge. As in a G.P. II filter, this sudden emptying causes the removal of the mud from the cloths. In this case, however, the muds do not leave the filter with the juice through the side aperture but drop into the conical bottom of the filter. They are removed later by opening a second purge valve at the bottom.

This way of separating the major part of the carbonatated juice from the mud allows a very thick mud to collect. Its density may also be increased by providing two or three successive filtration cycles and partial purges before emptying the filter bottom in what is called the total purge.

Mud density may rise to 600 g of insoluble matter/litre, according to the length of the filter cycle, flow rate of filtered juice, filtration pressure and the ratio of partial purges to total purge.

The length of one filtration cycle between two partial purges varies from 15 to 30 minutes.

The G.P. filter initially achieved a rapid and widespread success in many sugar factories for filtering the juice from the 2nd carbonatation. Actually this success was probably due to the lack of an automated and continuous method of mud separation from the 2nd carbonatation juice, although this has already been realised for the 1st carbonatation juice, i.e. settling followed by a filtration on a vacuum drum filter. The G.P. filter answered this problem with 2nd carbonation juice at low cost, thus eliminating labour requirements.

The G.P. I filter is now also enjoying similar success and has been installed in several countries, including Belgium, Spain, Austria, Iran, the U.S.A. and Pakistan. For the 1966/67 sugar beet campaign, G.P. I thickening filters will handle the juice from about 35,000 tons' daily slice.

The designers are also of the opinion that the design of the G.P. I filter, which is a completely static unit with no moving mechanical parts and a hydraulic discharge requiring no auxiliary fluid, may be the origin of the recent growing interest in thickening filters. This has led many constructors of sugar equipment to include in their programme an alternative to a settling tank, and several models, similar to a G.P. I filter, are now appearing on the market.

The cylindrical G.P. filter

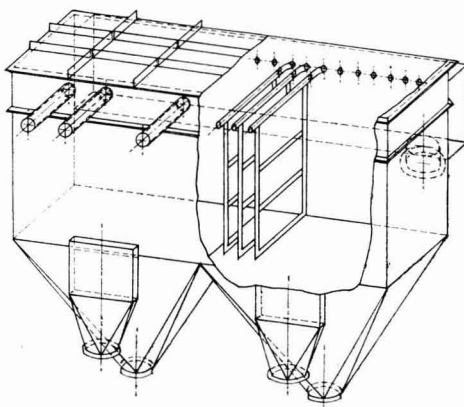Between 1963 and 1965, part of the work of the Research & Development Department of the Raffin-

Fig. 1

[1] *I.S.J.*, 1963, **65**, 77.

erie Tirlemontoise S.A. was devoted to the possible improvements on the filter as described in 1962.

At that time the G.P. filter, with a filtering area of 50 sq.m., was presented as a unit, the upper part of which had a parallelepipedical form containing the frames and the filtering bags, while the lower part was made of two juxtaposed cones (Fig. 1). The unit called for one feeding valve, two valves for the partial purge and two valves for the total purge.

At the present time the new filters are all of a cylindrical design (Fig. 2). Four models have been tried out with respectively 25, 33, 50 and 100 sq.m. filtering area.
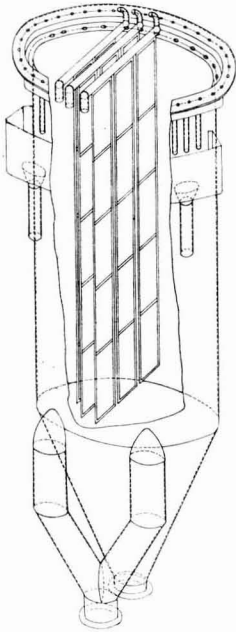
Fig. 2

Seen in cross section, the collecting tubes for the clear juice have each a different length while the filtering bags are all identical. According to its length, each collector is equipped with a variable number of identical vertical frames.

The feeding of the turbid juice into the filter has been designed so as to ensure a logical distribution of this juice through apertures provided above each collecting tube.

The following table gives some data on the different models of G.P. I filters.

Filtering area	Number of frames	Dimensions of each frame	Number of collecting tubes (juice outlets)
25 sq.m.	26	0·4 × 1·2 m	12
33 ,,	26	0·4 × 1·6 m	12
50 ,,	26	0·4 × 2·5 m	12
100 ,,	50	0·4 × 2·5 m	16

Compared with the earlier model, the new design of the filter has the following advantages:

(i) Economy of material with simplified plate work and welding; the filter may be built in a maintenance workshop of a sugar factory.

(ii) The number of valves for the purges is reduced, all models only requiring two valves (even the 100 sq.m. type), while the earlier rectangular filter for 50 sq.m. needed four valves.

(iii) By improving the distribution of the juice fed to the filter, accumulation of mud inside the filter is avoided.

(iv) The greater volume permits an increase in mud density.

(v) By narrowing the frames, the fixing and tightening of the filter bags has become easier.

(vi) The circular section of the unit allows an internal pressure up to 4 kg/sq.cm. (59 p.s.i.) compared with 1 kg/sq.cm. for the earlier model.

This last point permits some considerable modifications to the working conditions of the G.P. filter.

In Fig. 3 we have drawn the instantaneous flow rate as a function of time measured on the effluent from an earlier (rectangular) model of a G.P. filter. Fig. 3 also represents the average flow rate, i.e. the mean flow which would have been realised (taking into account the dead periods) if, at the time read on the abscissa, filtration had been stopped.

FILTERING TIME, min

Fig. 3

Filtration pressure remains constant all through the cycle.

The instantaneous flow reaches a peak immediately after filling of the filter body, at the actual start of the clear juice flow. This peak originates both from the low resistance of the cloth which has just been purged and from the low pressure loss through the outlet tubes flowing directly into the collector tank.

Once the cloth gets covered with mud the flow rate drops.

This repeated peak at each beginning of a cycle is very bad for the filtering cloth since the high velocity of the juice through the bare cloth (not yet protected by a cake deposit) may bring abrasive particles into the textile fibres.

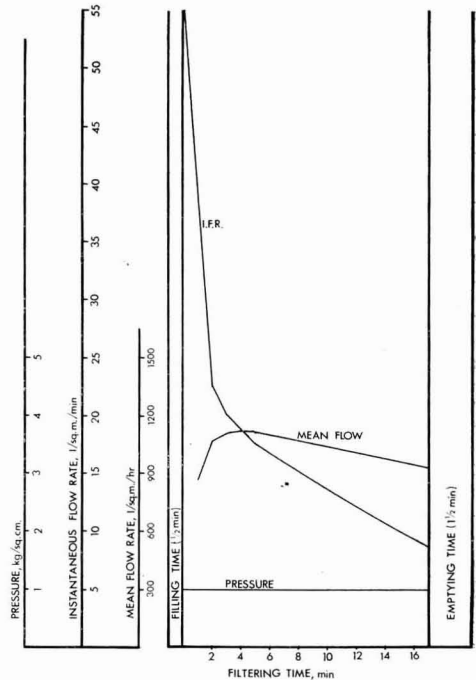An increase of the filtration pressure in the filter tank without providing other precautions would increase this peak in the flow rate and so the risks of damaging the cloth. Even the quality of the clear effluent might be reduced in this way.

In order to avoid these risks, although the pressure at the inlet has now been increased a calibrated diaphragm has also been installed on each collecting tube which means a counter-pressure is built up in the frame. This narrowing of the outlet of the clear juice presents no inconveniences, while—if it were done on the turbid juice at the inlet—it might lead to a decrease in filtrability.

The counter-pressure created by the diaphragm is a function of the square of the flow rate of clear juice. So it is highest at the beginning of the cycle, very low at the end and practically zero when air passes through it during the partial purges and when filling at the beginning of a filtration cycle.

The actual filtration pressure is given by the difference between the pressure inside the filter minus the counter-pressure in the frame, so that its value gradually increases from the beginning towards the end of the cycle. The aperture of the diaphragm to be installed in the collector tube is chosen with regard to the number of filter bags attached to each tube.

In Fig. 4 is recorded the instantaneous flow rate as observed on a G.P. filter equipped with diaphragm and thus filtering under rising pressure. Pressure rise and average flow rate are also given in this figure.

When comparing Fig. 4 with Fig. 3 it may be noted that:

(i) although the pressure is higher, the peak of the flow rate has become smaller

(ii) the gradual decrease of the flow rate becomes slower, and

(iii) the average flow rate is increased while its optimum is reached after a longer cycle.

A thorough investigation carried out at one factory on a G.P. filter gave the following figures:
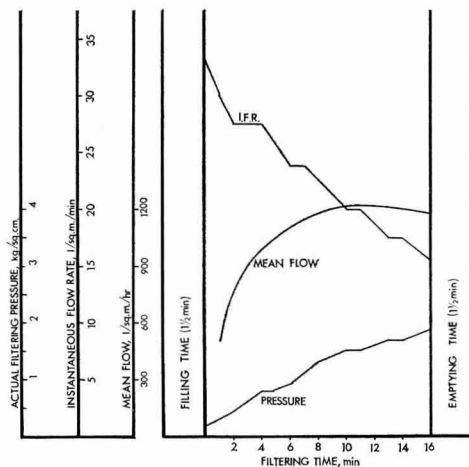
Fig. 4

Pressure inside the filter body	Diaphragm No.	Average flow rate l/sq.m./hour
1·0 kg/sq.cm.	none	800
2·7 ,,	1	1000
2·7 ,,	2	1200
2·7 ,,	3	1400
2·7 ,,	4	1800

It is not believed necessary to increase the performance of the filter so as to reach regularly 1400 or 1800 l/sq.m./hr; rather, it is recommended to stay at 1000 or 1200 l/sq.m./hr which ensures a longer life for the cloth before washing.

Example of installation

In order to illustrate how G.P. filters are used as thickening filters, a filter station for 1st carbonatation juice in a plant with a daily slicing capacity of 4000 tons is indicated schematically in Fig. 5.

Details such as the draft at the diffuser and the method of clarification for raw juice are omitted. The scheme supposes an hourly flow of 220 cu.m. of 1st carbonatation juice with a content of insoluble matter amounting to 30 g/litre, from which is produced a flow of 209 cu.m./hr of filtered juice.

From the outlet of the carbonatation tank the juice flows into a storage tank equipped with a mixer. From this tank the juice is pumped (sometimes through a heater) to the G.P. filter by means of a variable-speed centrifugal pump.

A level control on the storage tank regulates the speed of the pump, i.e. it speeds up when the level is rising while it slows down when the level gets lower. When the process in the plant is going smoothly, the level will only rise as a result of the increase in the resistance met by the juice through the filter, which resistance results from a lower filtrability of the juice. The rising level will speed up the pump so as
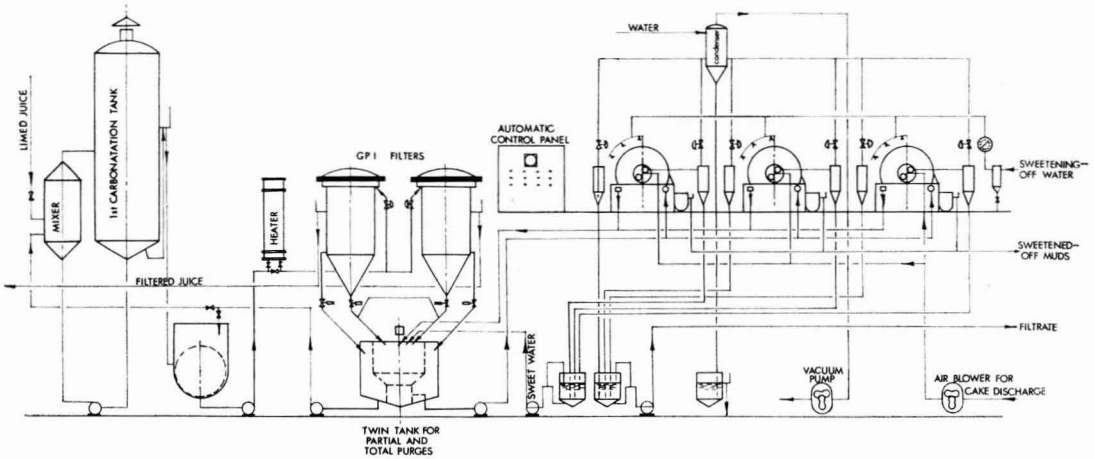
Fig. 5

to increase the pressure in the filter. On the other hand, if the juice quality improves, the rotary speed of the pump will automatically be lowered since the level in the storage tank is going down.

Assuming that the factory ahead of the filtration station runs smoothly, in this way is obtained a steady flow rate of filtered juice, corresponding at any time to a filtering pressure as low as possible and avoiding any manual throttling on the unfiltered juice line.

If the proportion of lime addition remains constant, this steady flow rate of clear juice leads to a constant mud density since it will then be governed by the volume of effluent between two total purges.

The filtrability of the juice being unknown, we must, for calculating the required filtering area, allow for a mean flow rate corresponding to a rather low juice quality, i.e. 750 l/sq.m./hr.

This figure indicates a requirement of four G.P. filters each of 100 sq.m., three to be in permanent use and the fourth as a spare unit.

The sequence and the duration of the cycles for filters is regulated automatically by means of an electrical timing unit which governs the three pneumatic valves on each filter. The length of a cycle will have to be modified, either when a severe change is made to the flow rate from the diffuser or when the mud density has to be altered.

Above the filters a tackle is provided, moving on a rail, which handles the covers and the frames when the filter bags are attached.

Two concentric cylindrical tanks are installed under the filters. The inner one collects the total purges at the rate of 11 cu.m./hr. containing 600 g/litre insoluble dry solids. It is equipped with a helicoidal mixing propeller which will release the cake and mix it with the juice so as to get a fluid and homogeneous slurry.

The effluent from the partial purges is led into the external tank. No mixing is required since this tank has to be emptied between two successive purges, while any deposit on the bottom will be removed by dropping the next purge.

A concentric design for these tanks is proposed since it enables the pipes for the partial purges to be installed practically vertically, assuming that the four filters would be located on the corners of a square, at the centre of which the tanks are installed. These pipes being vertical, the rate of emptying the filter is enhanced, which improves the discharge of the cake.

This design of the tanks also lowers the heat losses in the inner tank which should not be over-dimensioned. Indeed, before, when two separate tanks were installed, the capacity of the tank for receiving the total purge had to exceed the total volume of one filter in order to avoid its overflow if, for some accidental reason, the valve of the total purge was opened without previous drop of the partial purge. With the present design this over-flowing juice would go into the outer tank.

The turbid juice from the partial purges is removed by a 60 cu.m./hr pump and sent either to the storage tank before the filters or back to the carbonatation, since it is known that its filtrability is lower than for the initial juice.

The homogenized slurry in the inner tank is pumped to other filters for sweetening-off; by use of 11 cu.m./hr of sweetening-off water, a mud containing 700 g/litre of insoluble dry solids is produced at a rate of 9·4 cu.m./hr, as well as 12·6 cu.m./hr of filtrate.

This poses another problem which will be considered in detail.

(To be continued)

GRANULATED SUGAR HANDLING AT
SANKEY SUGAR REFINERY

A £200,000 installation for blending and storing granulated cane sugar is now in operation at the Earlestown, Lancs., refinery of The Sankey Sugar Co. Ltd., a member of the Manbré Group of Companies.

Sixteen bins, with a combined capacity of 800 tons of sugar, are contained in a 100-ft high, steel-framed building (Fig. 1) with aluminium and glass cladding and incorporating a lift. Eight of the bins are for storing graded sugar whilst the remainder are being used for blending prior to packing.
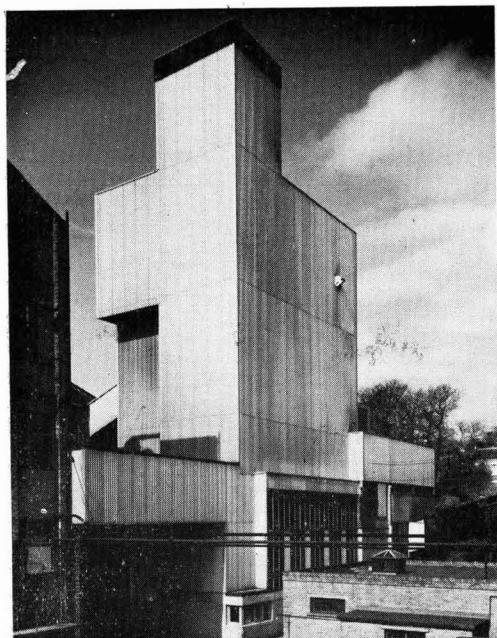
Fig. 1. The new 800-ton granulated sugar building which houses the blending, cooling, drying and packing machinery.

This installation has four times the capacity of the plant formerly used and is a major feature of Sankey's intensive programme of modernization to increase productivity.

The flexibility in operation of the new plant and the increased storage facilities will further promote Sankey's policy of guaranteeing a rapid delivery service to meet the individual requirements of every customer.

The whole programme of modernization was put in train three years ago because of the problems of maintaining a high degree of service to both manu-facturers and the grocery trade in the face of rapidly growing demand for Sankey's sugar and syrups.

In parallel with the expansion and streamlining of the processes at the Sankey refinery, similar developments are under way both at the main Manbré sugar refinery in London and Westburn Sugar Refineries at Greenock, Scotland. From these three refineries, the Manbré & Garton Group is now supplying one-seventh of all the sugar consumed in Great Britain.

In the new granulated sugar plant four different grades of refined sugar (at 40°C) are brought by a 120-ft belt conveyor from a "Rotary Louvre" dryer elsewhere in the refinery to the top of the new building where they are mechanically diverted into any one of the eight 35-ft deep storage bins which form an integral part of the building structure.
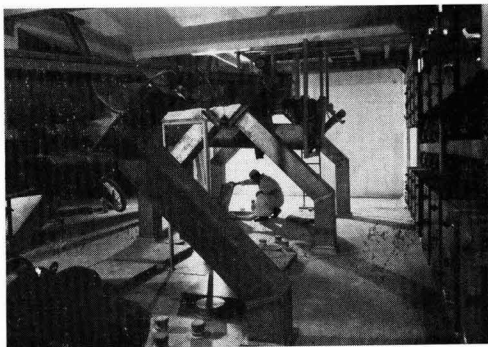
Fig. 2. The remotely controlled sugar distribution system above the sugar bins.

The outlet cone at the base of each bin is made of galvanized mild steel and the rest of the bin is constructed of "Plymax", an aluminium-faced plywood with, in this instance, a galvanized steel backing.

From the bins, sugar passes on to a blending conveyor through variable speed rotary valves adjusted to give a blended product of constant quality. At this point, the sugar is cooled by passing it through a "Rotary Louvre" cooler, manufactured by Dunford & Elliott Process Engineering Ltd., which is designed to reduce the temperature of the sugar to within 15°C of ambient.

Sugar takes about 15 minutes to pass along the 30-ft length of the cooler from which it is conveyed back to the top of the building via a belt and bucket elevator over 100 feet high.

The blended sugar is next sieved and separated by size of crystal into three basic grades using two banks of "Rotex" multiple deck screens supplied by Locker Industries Ltd. (Fig. 3) After screening, the sugar is

stored in eight bins holding up to 400 tons of the finished product.
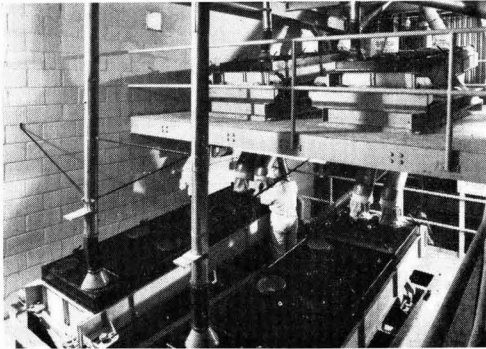
Fig. 3. Four "Rotex" screeners used to classify sugar by grain size.

From these bins, sugar may be diverted to one of several places. It may pass to the bagging-off station which is equipped with Reed-Medway "Sac-sealers" (Fig. 4) fitted with Avery automatic weighers (Fig.5).
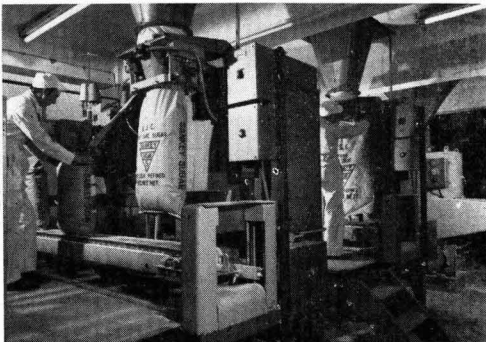
Fig. 4. Reed-Medway 1-cwt and 2-cwt sack filling and sealing lines.
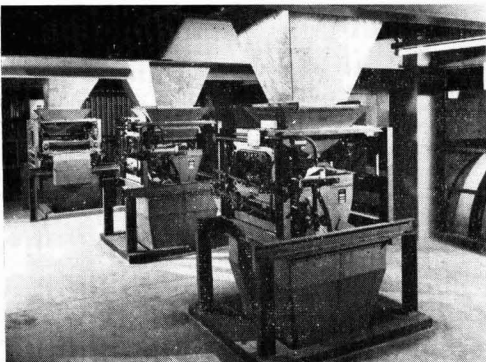
Fig. 5. Avery automatic pre-set weighers used for filling 1-cwt and 2-cwt sacks.

The "Sac-sealer" machines are provided with swing heads enabling both jute and paper sacks of various sizes to be filled.

Alternatively, sugar may be run from the silos onto one of two conveyors to the tanker loading station for bulk delivery in 15-ton vehicles.

Another conveying system takes sugar from the packing silos to the refinery's 2-lb packeting department which takes nearly half Sankey's output. As part of the overall modernization plan, this latter department has already been re-equipped over the past few years with high-speed "Titeseal" machines from Brecknell, Dolman & Rogers Ltd.

All the drying, conveying, cooling and screening equipment is automatically controlled from a central panel (Fig. 6) where an operator can see at a glance that the whole process is functioning correctly.
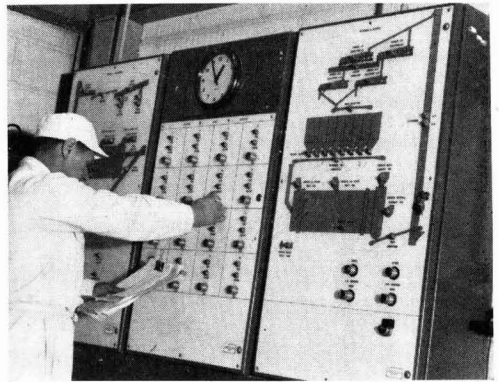
Fig. 6. One operator, here seen at the mimic panel, controls the sugar flow throughout the building.

The sugar stream is handled in totally enclosed elevators and conveyors, with the majority of the latter being troughed food quality rubber belt con-
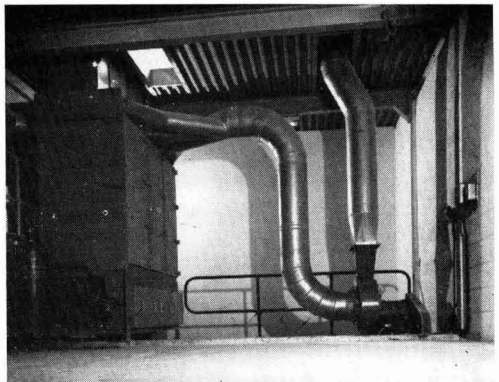
Fig. 7. Dust collection on the screening floor is provided by a D.C.E. "Dalamatic" unit of 4000 c.f.m. capacity.

veyors. The conveying equipment was supplied by Spencer (Melksham) Ltd.

Dust collection is provided at four screening points shown in Fig. 3 and at four conveyor transfer and elevator points using a D.C.E. "Dalamatic" filter. This filter is designed to operate continuously, using short bursts of reversed compresssed air for removing entrained collected dust from the flat envelope-type filter elements.

EFFECT OF FILTER AID CONCENTRATION ON THE FILTRATION RATE OF RAW SUGAR SOLUTIONS

By PETER HIDI and D. N. SUTHERLAND

(C.S.R. Research Laboratories, Roseville, N.S.W., Australia)

PART II

Predicting Filtration Rates

Equation (12) was checked by calculating and measuring filtration rates f, with different filter aid concentrations, of various sugars and sugar mixtures of which the Fia value was known from previous measurements.

Table V shows the results of such calculations. Here the filtration rates f, of mixtures of a C-sugar from factory M with standard sugar, were measured and calculated with various filter aid concentrations. All the filtration rates used in these calculations are taken from measurements made more than one year before the above correlation was recognised. The standard deviation between measured and calculated results (2·0%) was much smaller than the standard deviation of the filtrability test (3·2%) calculated from a large number of measurements in the Central Laboratory of the C.S.R. Co. Ltd.

To prove that the relationship between filtration rate and filter aid concentration established on C-sugar/standard sugar mixtures can be applied to raw sugars, eight raw sugars of very different origin were tested by measuring filtration rates (f) with six different filter aid concentrations ($a = 0.3, 0.5, 1.0, 2.0, 4.0$ and 9.0); the standard deviation between measured and calculated values, 2·8%, did not exceed the experimental error of the filtrability measurements. This indicates the validity of equation (12) for all these sugars in a very wide filter aid concentration range.

Maximum filtration rate

The correlation found between filter aid concentration and filtration rate for different sugars was used to calculate the filter aid concentration required to obtain the fastest filtration rate.

This was done by differentiating equation (12) with respect to a.

$$\therefore \frac{-\log_{10}e}{f} \cdot \frac{df}{da} = -\frac{1\cdot3\ Fia}{(a+0\cdot3)^2} + \frac{\log_{10}e}{2} \cdot \frac{1}{(a+0\cdot07)}$$

At the optimum $\dfrac{df}{da} = 0$ and $a = a_o$

$$\therefore 2\cdot6\ Fia\ (a_o + 0\cdot07) = 0\cdot4343\ (a_o + 0\cdot3)^2$$

$$\therefore 0\cdot4343\ a^2_o + (0\cdot260 - 2\cdot6\ Fia)\ a_o + 0\cdot09 - 0\cdot182\ Fia = 0$$

i.e. $a_o = \dfrac{1}{0\cdot4343}\left[1\cdot3\ Fia - 0\cdot13\right.$

$$\left. \pm \sqrt{(1\cdot3\ Fia - 0\cdot13)^2 + 0\cdot0791\ Fia - 0\cdot0391}\right]$$

$$\dots\dots\dots 12(a)$$

which allows direct calculation of a_o from Fia.

Table V
Deviation of measured and calculated filtration rates, applying double and triple filter aid concentrations

% C-sugar	Filtrability of sugar (F) at standard filter aid concentration	Filtration rate (f)					
		Double filter aid concentration			Triple filter aid concentration		
	Measured	Meas.	Calc.	Δ	Meas.	Calc.	Δ
10	0·454	0·445	0·459	0·014	0·418	0·430	0·012
20	0·224	0·330	0·307	0·023	0·325	0·326*	0·001
33	0·087	0·205	0·180	0·025	0·231	0·224	0·007
50	0·022	0·117	0·080	0·037	0·159	0·128	0·031
100	0·0005†	0·014	0·010	0·004	0·042	0·029	0·013

† Obtained by linear extrapolation via Fia.   * See detailed calculations above.

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Table VI and Fig. 6 show the result of such calculations for sugars with differing filtrabilities (F). Selecting the abscissa value in Fig. 6 according to the filtrability (or *Fia*) of the sugar involved, we can obtain from the graph the filter aid concentration (a_o) which is expected to give the fastest filtration rate for that sugar.

Table VI

The optimum filter aid requirement (a_o) and available maximum filtration rate (f_{max}) under standard conditions for different sugars.

Filtrability F	Fia $(-\log F)$	Optimum filter aid conc. (a_o)	Maximum filtration rate (f_{max})
0·020	1·70	9·42 units	0·198
0·050	1·30	7·23 ,,	0·227
0·100	1·00	5·44 ,,	0·261
0·200	0·70	3·61 ,,	0·314
0·398	0·40	1·77 ,,	0·428
0·500	0·30	1·24 ,,	0·510
0·620	0·21	0 ,,	0·627
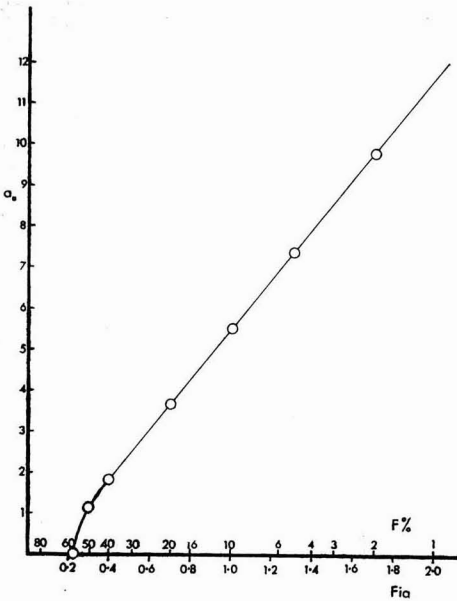
Fig. 6. Change in optimum filter aid concentration a_o with filtering quality *Fia* of the raw sugar.

For *Fia* > 0.3, i.e. $F < 50$, we may neglect the last two terms under the square root in equation (12a) and obtain the approximate expression

$$a_o \simeq \frac{2}{0.4343} \ (1.3 \ Fia - 0.13)$$

$$\simeq 5.9 \ Fia - 0.59 \ \dots \dots \dots \dots \dots (13)$$

This simple, linear correlation between *Fia* and a_o is another example of the application of the *Fia* concept introduced earlier[9].

It is interesting to observe the large difference in optimum filter aid concentration for raw sugars of different qualities. Thus a sugar with $F = 0.10$ has an optimum filter aid concentration of 5·4 units, while a sugar with $F = 0.50$ requires $a_o = 1.24$ units.

Other filter aids

Filtrability measurements were also made using a rather different, more porous, "Celite" filter aid and a similar relationship to equation (12) was again established. The b values for this system differed slightly from the values given in Table VI. Very small, but detectable, deviations in b values were also found between different batches of filter aid. Under those circumstances, equation(13), should be regarded only as an estimation of a_o.

Similar results were obtained by applying fiberized blue asbestos as the filter aid[11]. This is much finer with lower permeability, larger surface area, and filtration rates less than a third of those with "Celite 505"[11]. The effect of increasing the ratio of filter aid to filtration-impeding impurity also satisfied equation (12).

It should be emphasized that these calculations would have practical application only in a hypothetical refinery, working on constant pressure and with the other parameters also selected according to the conditions described in the filtrability test. However, the above experiments indicate that the two starting hypotheses relating filter aid concentration to filtration rate f may be extended to several different rigid filter aids.

SUMMARY

An equation has been developed which correlates the filtration rate of raw sugars with the filter aid concentration and the filtration-impeding impurity content. According to this, the negative logarithm of the filtration rate of raw sugars under standardized conditions increases linearly with the filtration-impeding impurity content of the sugar and the slope is inversely proportional to the applied concentration of filter aid. The equation was checked with a wide range of concentration of filtration-impeding impurity and filter aid.

From a single measurement of filtration rate within the range of concentrations of filter aid studies, it is possible to calculate the filtration rate at any concentration, and to estimate the optimum concentration for the fastest filtration of a given raw sugar.

Similar relationships were found to hold for different filter aids, and confirm the model developed[11] for quantitatively describing the filter cake blocking mechanism of impurities.

ACKNOWLEDGMENTS

LIST OF SYMBOLS

a = concentration of filter aid. The unit is the concentration of filter aid applied in the filtrability test (0·5 g/100 g solids).

a_o = the optimum filter aid concentration, that is, the filter aid concentration in the above-defined units which will allow the fastest filtration rate of the chosen sugar under standard conditions

b = $-\log f^{sucrose}$, i.e. the apparent filtration-impeding activity of pure sucrose.

Bx = The sugar + impurity content of the syrup in w/w% measured by calibrated refractometer.

F = $\dfrac{F\%}{100} = \dfrac{\Delta V}{\Delta V^{sucrose}}$ = sugar filtrability, expressed as a simple fraction. The filtrate volume (ΔV) of the tested 60°Bx sugar syrup is collected between the second and seventh minutes of filtration using the standard test filter, applying 50 p.s.i. excess pressure, the standard "Celite" filter aid in the prescribed concentration [a = 1 unit (0·5 g "Celite"/100 g solids)], room temperature and pH of 9·0.

This filtrate volume (ΔV) is divided by the volume of pure sucrose filtrate ($\Delta V^{sucrose}$) obtained under the same conditions, exactly the same temperature and one unit filter aid concentration.

The denominator is usually obtained from tables listing $\Delta V^{sucrose}$ for different temperatures.

f = $\dfrac{(\Delta V)\, a \neq 1}{(\Delta V^{sucrose})}$ = rate of filtration of sugar under standardized conditions as above, with a concentration of filter aid added to the tested sugar, divided by the rate of filtration of pure sugar under identical conditions, except that one unit of filter aid is used.

f_{rel} = $\dfrac{f}{f \text{ sucr.}} = \dfrac{(\Delta V)\, a^l \neq 1}{(\Delta V^{sucr})a^l}$ = relative filtration rate.

The same filter aid concentration (a') is applied for both standard and tested sugar, otherwise using standard conditions as above.

Fia = $-\log F$ = filtration-impeding activity. Calculated always from F, this equation is discussed in a previous publication[9].

Fia_{app} = $-\log f$ = apparent filtration-impeding activity, calculated from f.

k = $\dfrac{Fia}{C \text{ sugar \%}}$ = a constant which is a function of the C-sugar filtering quality.

m = a constant which is a function of the filter aid concentration.

n = the filter aid equivalent of the filter paper for raw sugar filtration in filter aid concentration units. Under standard conditions $n = 0·3$.

t = temperature (C°).

V = volume in ml.

w = weight in g.

DETERIORATION OF SUGAR CANE AFTER HARVESTING

Part I. Changes in juice composition

by J. BRUIJN

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INTRODUCTION

IT is well known that sugar cane has to be processed immediately after harvesting. If a delay occurs, the cane becomes less suitable for processing. Various products formed in stale or frozen cane have been mentioned in the literature and have been used for quality control[1, 2, 3].

The following investigation into the chemical changes in the composition of deteriorating cane was carried out in an attempt to find an analytical method for quality control of cane applicable to the local conditions. For this purpose volatile and non-volatile organic acids, alcohols, amino acids and polysaccharides present in freshly harvested and stale cane were investigated.

EXPERIMENTAL

Juice expression

All analyses were performed on juices obtained by milling the cane in a small 3-roller unit. For cane samples obtained at factories the variety could not always be established. However, most of the experiments were carried out on N:Co 310, N:Co 331 and N:Co 376.

Volatile acids

To 400 ml of juice 2 ml of 80% phosphoric acid was added. This mixture was distilled and 250 ml of distillate collected. An aliquot (25 ml) of the distillate was titrated against 0·01N sodium hydroxide.

The results are shown in Table I.

Table I

Cane sample	mg equivalent acidity per 25 ml distillate
Freshly harvested cane	0·025
" " "	0·010
After 10 days' storage	0·050
22 " "	0·061
Frozen	0·065

Paper chromatographic methods of analysis for acetic and butyric acid according to KENNEDY & BAKER[4] gave negative results. When the method was checked by the addition of 1 ml acetic and butyric acid to 400 ml of cane juice, strongly positive results were obtained.

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[1] FORT & LAURITZEN: *Anal. Chem.*, 1938, **10**, 251.

[2] IRVINE & FRILOUX: *Sugar y Azúcar*, 1965, **60**, (11), 58.

[3] WALTON & FORT: *Ind. Eng. Chem.*, 1931, **23**, 1295.

[4] *Anal. Chem.*, 1951, **23**, 1033.

Alcohols

Juice from fresh and deteriorated cane was distilled using a rectifying column 24 inches long, packed with stainless steel gauze rings. The column was provided with a jacket for adiabatic distillation. A small fraction distilling between 78°C and 80°C was collected and on testing with carbon disulphide and ammonium molybdate[5] showed a positive reaction for primary and secondary alcohols.

The fraction was boiled under reflux for one hour with potassium dichromate in dilute sulphuric acid. From this reaction mixture 100 ml was distilled off, the distillate neutralized with ammonium hydroxide and concentrated to a small volume. A drop of this concentrate was analysed by the paper chromatographic method of KENNEDY & BAKER[4]. A spot with R_f value identical to that of acetic acid was obtained.

The results for various samples of cane are shown in Table II, in which the juice purity and pH are also recorded. The ethanol percentage was calculated by measuring the volume of ethanol fraction distilled from 400 ml of cane juice.

Table II

Cane sample			Purity	pH	Ethanol vol. % on juice
6 days after harvest			57·0	4·5	0
11	,,	,,	44·9	3·8	0
25	,,	,,	36·1	3·5	0
4	,,	burning	87·0	5·2	0·3
R6	,,	,,	79·1	4·5	1·0
10	,,	,,	84·4	4·9	0·3
29	,,	,,	—	4·8	0·5

Non-volatile organic acids

Juice from fresh and deteriorated cane was analysed for the presence of non-volatile acids by means of paper chromatography. Unpurified juice showed considerable tailing. To prevent this, the acids were separated from cane juice by absorption on anion exchange resin and recovered by elution with 1N sodium hydroxide solution. A drop of the eluate analysed by paper chromatography was insufficiently concentrated to show the presence of acids other than aconitic. The method of analysis finally adopted was as follows[6]: 400 ml cane juice, mixed with 400 ml of water, was passed through a column of "Amberlite IRA 400" in carbonate form and the column subsequently washed with distilled water. The anions were recovered by eluting them with 100 ml 1·5N ammonium carbonate. The resulting solution was concentrated to dryness at 70°C. The residue obtained was dissolved in 1·5 ml 2N sulphuric acid and mixed with 2·5 g of silica gel. This resulted in a free flowing powder which was packed on top of a silica gel column (16 × 180 mm). Commercial silica gel gave insufficient separation of acids and for this reason silica gel was prepared from water glass using the method described by ISHERWOOD[7]. The elution was carried out with chloroform-butanol mixtures according to the method of ROBERTS & MARTIN[8] by a stepwise increase in the polarity of the eluant. The flow rate through the column was approximately 100 ml per hour gradually decreasing towards the end of the run, when a higher proportion of butanol in the eluant was used. A pressure of 3–10 p.s.i. was applied to the column. Fractions of 10 ml were collected and titrated in a stream of CO_2-free air against 0·01N sodium hydroxide using 0·1% phenol red in a 1% "Teepol" solution as the indicator. The titration results for each fraction were plotted on a graph and the total amount of each acid present was calculated from the area under each peak.

In this way most of the acids could be separated, but glycollic and oxalic acid were not sufficiently resolved. They were further separated by precipitation of the oxalic acid by calcium ions after evaporation of the eluant and redissolving the acids in distilled water.

Succinic and lactic acid were also insufficiently separated by chloroform-butanol mixtures.

The fractions in which succinic acid was present were combined and the eluant evaporated. The residue was introduced into the silica gel column as before and eluted with a mixture of benzene and n-butanol[9]. A test mixture of authentic succinic and lactic acid could be separated in this way.

In cane juice samples the following acids were found to be present: succinic, aconitic, glycollic, oxalic and malic acids.

A synthetic mixture of these acids separated on the silica gel column resulted in an identical elution pattern to that obtained with cane acids.

The acids from various cane samples were recovered by evaporation of the fractions and were identified by specific spot tests[10]. In addition the presence of succinic and aconitic acids was confirmed by determination of their melting points, which were not depressed on admixture of an authentic sample.

The amounts of the above-mentioned acids differed with variety and other circumstances. However, concentration of the acids did not change during deterioration, except in the case of succinic acid. This was investigated by analysing sub-samples of the same quantity of sugar cane at regular time intervals.

The amount of succinic acid in deteriorating cane first increased and then dropped, as illustrated in a typical example shown in Table III.

Table III

Number of days after harvesting	0	6	15	21	24
Succinic acid, p.p.m. on solids in juice	80	350	750	350	250

Apart from the above-mentioned acids a few others were found in small quantities but were not identified. However, lactic acid was definitely absent.

5 FEIGL: "Spot tests in organic analysis" (Elsevier Publishing Co., Amsterdam), 1960, p. 186.
6 RESINK & LEE: *Anal. Chem.*, 1955, **27**, 925.
7 *Biochem. J.*, 1946, **40**, 688.
8 *Anal. Chem.*, 1954, **26**, 824.
9 BULEN & VARNER: *ibid.*, 1952, **24**, 187.
10 FEIGL: "Spot tests in organic analysis" (Elsevier Publishing Co., Amsterdam), 1960, p. 256.

Amino acids

Amino acids in fresh and deteriorated cane were investigated using the method of MOORE & STEIN[11]. After filtration, 1 ml of juice was chromatographed on an ion-exchange column without further pre-treatment[12].

The amino acids found to be present in more than trace amounts in cane juice were aspartic acid, glutamic acid, alanine, valine and α-amino-butyric acid. They were identified by comparison of the elution patterns obtained from an authentic mixture of these compounds with that obtained from cane juice, using the same column.

No change in concentration of these acids could be found during deterioration of the cane.

Polysaccharides

Starch in juice was determined using the method described by ALEXANDER[13]. A sub-sample was taken from a sample of cane stored in the open at regular intervals and the juice analysed for starch content. A typical result of these analyses is shown in Table IV.

Table IV

Days after harvest	0	2	6	8	13	15
Starch % solids in juice	0·14	0·12	0·09	0·06	0·06	0·05

Soluble polysaccharides other than starch were determined by precipitating 15 ml of juice with 100 ml acidified ethanol (150 ml 95% ethanol, 15 ml conc. HCl, 15 ml water) after filtration of the juice through Whatman No. 40 filter paper. After standing for 24 hours the precipitate was filtered through a Gooch crucible, dried, weighed, and the weight corrected for included ash after ignition of the precipitate. An example is shown in Table V.

Table V

Days after harvest	0	4	8	12	16	18
Polysaccharide % solids exclusive of starch	0·16	0·18	0·22	0·28	0·60	1·75

The formation of polysaccharides was further investigated by storing pieces of cane stalk in conical flasks under various conditions. The polysaccharide content of the juice after 21 days is shown in Table VI.

Table VI

	Original cane	After 21 days at 100% R.H.	After 21 days' aeration with air of 100% R.H.	After 21 days in dry air
Polysaccharide % solids exclusive of starch	0·20	0·50	0·50	2·63

Juice from freshly harvested cane was found to have an average polysaccharide content of 0·2–0·3% on dry solids.

DISCUSSION

The determination of volatile acids has been applied by FORT & LAURITZEN[1] for quality control of frozen cane. These authors found an excess acidity of 0·06–0·7 mg equivalents per 25 ml of distillate. In the present investigation the highest recorded acidity (Table I) was 0·06 mg equivalents per 25 ml of distillate despite the increase in the sample size. Previously a great number of juice samples from deteriorated cane in Natal, investigated by BUCHANAN and YOUNG[14], showed excess acidity equal to or lower than 0·06 mg equivalents per 25 ml. With the natural variation in juice acidity the increase obtained for stale cane is considered too small for practical quality control purposes. A similar conclusion was reached in the case of frozen cane[2].

Ethanol, the only alcohol detected, was formed in small quantities (Table II) and appeared to occur mainly in burnt cane. Unburnt stale cane did not contain detectable amounts of alcohol. Of the non-volatile organic acids only the succinic acid content of juice increased during deterioration (Table III), but its determination was far too complicated for routine analysis. No significant change could be detected in the amino acid composition of juice from deteriorated cane as compared with that obtained from freshly harvested cane.

The starch content of the juice decreased during deterioration (Table IV), while the total polysaccharides content increased. From the number of analyses carried out in this investigation it could be concluded that the starch content is normally reduced to about 25% of the original value 15 days after the harvest and that the decrease can already be noticed in the first 4 days of deterioration. However, the starch content is not a suitable parameter for determination of the quality of harvested cane, as it varies to a great extent with variety and soil conditions.

The amount of soluble polysaccharides in juice was reasonably constant for freshly cut cane and increased considerably during deterioration. The amount determined, however, is dependent on the alcohol concentration used in the analytical method. For comparative results the same method should always be followed. Dry conditions promoted the formation of these polysaccharides (Table VI). LAURITZEN & FORT have previously reported on the moisture content of deteriorated cane, and showed that sprinkling with water reduced the purity drop in stored harvested cane[15]. These soluble polysaccharides which can be easily determined by a simple method of analysis are probably directly related to processing difficulties in sugar manufacturing, being partially responsible for higher viscosities of massecuites and consequently reducing the crystallization rate of sucrose.

A partial elucidation of the structure of the polysaccharide which is different to that of normal dextran is reported in Part II of this series[16]. In addition, no lactic acid, which is a normal by-product in cultures of *Leuconostoc mesenteroides*, was found in stale cane.

[11] *Anal. Chem.*, 1958, **30**, 1185.
[12] ROBERTS & MARTIN: *Proc. 6th Tech. Session Bone Char*, 1959, 67.
[31] *Proc. 28th Congr. S. African Sugar Tech. Assoc.*, 1954, 100.
[14] Unpublished reports.
[15] *Sugar Bull.*, 1937, **16**, 5.
[16] BRUIJN: *I.S.J.*, 1966, **68**, in press.

It appears doubtful therefore that *Leuconostoc* is responsible for the formation of the polysaccharide in stale cane, especially in view of the fact that drying of the cane stalks promotes the formation of polysaccharide. If, however, the polysaccharide is formed by this micro-organism, it remains to be explained why its metabolism in cane is different from that in other sucrose containing media.

SUMMARY

Various compounds formed in deteriorating cane were investigated and their suitability for quality control of harvested cane considered. Volatile acids were found to be present in too low a concentration in stale cane to be used for quality control. Small amounts of ethanol were found only in samples of burnt cane. The concentration of succinic acid increases in deteriorating cane, but its determination was too cumbersome. The most promising method for quality control was found to be the analysis for soluble polysaccharides, which can be precipitated from juice by alcohol addition.

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Aerial spraying may damage Q 80. I. T. Freshwater. *Producers' Review*, 1966, **56**, 67.—A note of warning is given about the susceptibility to damage of the promising newly released variety Q 80 from aerial spraying of 2,4-D and 2,4,5-T, if too strong a dose is used.

* * *

Mechanization and soil building in the sugar industry. J. Bulanadi. *Sugar News*, 1966, **42**, 77–80.—The need for further mechanization in the sugar industry of the Philippines, in order to counteract soaring production costs, is emphasized. Figures are quoted showing the cost of tractor ploughing to be half that of buffalo ploughing. The advantages of the mechanical manure spreader and of green manuring are pointed out.

* * *

Borer infestation and loss in the 1965 Louisiana sugar cane crop. L. J. Charpentier, W. J. McCormick, R. Mathes and J. W. Sanford. *Sugar Bull.*, 1966, **44**, 212–214.—The 1965 survey consisted, as in past years, of two examinations of 100 stalks at each of 22 mills. Infestation counts consisted of the percentage of stalks bored or showing external signs of borer injury. Figures for the 15 parishes concerned are given in tabular form. Crop loss was estimated to be three-quarters of the percentage of joints bored or 14% of the 1965 crop. Losses for 1964, 1963 and 1962 were 8, 9 and 5% respectively.

* * *

Choice of sugar cane varieties for planting in tropical Africa. Anon. *Cahiers d'Agric. Pratique des Pays Chauds*, 1965, **2**, 81–84; through *Hort. Abs.*, 1966, **36**, (1), 242.—Varieties recommended for eating are Pindar, Ajax, M31/45, S17, B41/227, B43/62, B47/44, Co 419 and CB 40/77. For sugar production as a cottage industry, Co 290, Co 312, Co 419, Co 449, Co 527, BO 14, Pindar, Trojan, Regnar and M134/32 are recommended. For large scale industrial production it is suggested that trials be carried out with any proved commercial variety which comprises at least 10% of the crop of an important sugar-producing country. A list is given of the most frequently cultivated varieties in 13 such countries.

* * *

Significance of extractable aluminium in Hawaiian sugar cane soils. A. S. Ayres *et al. Proc. Soil Sci. Soc. Amer.*, 1965, **29**, 387–392; through *Hort. Abs.*, 1966, **36**, (1), 246.—Exchangeable aluminium appeared to account for only a small fraction of the aluminium extracted from some of the more highly weathered soils. Laboratory and field observations showed that aluminium levels in Hawaiian soils are not sufficiently high to depress cane growth.

Field studies of aphid vectors of sugar cane mosaic and methods of control. K. N. Komblas. *Diss. Abstr.*, 1965, **25**, 4637; through *Hort. Abs.*, 1966, **36**, (1), 246.—Four of the seven known aphid vectors of the disease were observed. About 80% of the total mosaic spread took place during late winter and spring. There was no significant difference due to age of plant. Rate of spread was greatest in plants adjoining maize fields. "Dementon" at $\frac{1}{4}$ lb/acre, applied 10–24 times, reduced populations of flying insects and lowered the incidence of mosaic in untreated plots.

* * *

Virus-vector relationship of sugar cane mosaic virus. N. Zummo and L. J. Charpentier. *Plant Dis. Reptr.*, 1965, **49**, 827–829; through *Hort. Abs.*, 1966, **36**, (1), 246.—The article refers to the transmission of sugar cane mosaic virus by the rusty plum aphid (*Hysteroneura setariae*). Details are given of virus aquisition, transmission time and duration of infective period.

* * *

Effect on germination and growth of dipping sugar cane seed pieces in juice from sugar cane plants with ratoon stunting disease and from healthy sugar cane plants. N. Zummo. *Phytopathology*, 1965, **55**, 1085; through *Hort. Abs.*, 1966, **36**, (1), 247.—One-bud setts of four varieties were used. The setts dipped in juice showed higher mortality than undipped setts. Heating the juice to 100°C for 10 minutes removed the cause of the growth supression.

* * *

Soil micro-organisms associated with sugar cane sett rots. P. de C. T. Carvalho. *Rev. Agric. Piracicaba*, 1965, **40**, 83–94; through *Hort. Abs.*, 1966, **36**, (1), 247.—Tissue culture and other studies showed that the fungi attacking setts in the Piracicaba region could be grouped under four categories, viz. those which prevent germination, those which retard it, those which do not affect germination and those which do not develop in healthy tissue. The fungi in each group are listed.

* * *

Effect of nitrogen fertilizers and lodging on the quality of sugar cane. I. Hague and M. Ahmad. *Pakistan J. Sci. Res.*, 1964, **16**, 129–132.—Sulphate of ammonia, ammonium nitrate, ammonium sulphate nitrate, ammonium phosphate and urea were applied in doses of 40, 80 and 120 lb/acre, the variety of cane being Co 312. In general the lowest doses improved juice quality while higher doses had a depressing effect. At 80 lb/acre all fertilizer forms lowered sucrose content. The effect of lodging on the juice quality of Co L 54 was deleterious: total solids and sucrose content decreased while glucose increased compared with juice from erect canes.

Sugar cane rust in Tanzania. D. R. W. WATSON. *Plant Dis. Reptr.*, 1965, **49**, 764; through *Hort. Abs.*, 1966, **36**, (1), 247.—Severe infection of rust (*Puccinia erianthi*) on the leaves of variety Co 475 on two estates is recorded—the first record of the fungus in Africa. Other varieties were unaffected.

* * *

Effects of soil fumigation and organic amendments on plant-parasitic nematodes and sugar cane yields. W. BIRCHFIELD. *Phytopathology*, 1965, **55**, 1051–2; through *Hort. Abs.*, 1966, **36**, (1), 247.—Molasses and filter press cake, applied to alluvial sugar cane soils, did not appreciably reduce nematode damage. Nematodes of the genera *Aphelenchus* and *Aphelenchoides* were significantly increased by the molasses treatment.

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Light and translocation of ¹⁴C in detached blades of sugar cane. C. E. HARTT. *Plant Physiol.*, 1965, **40**, 718–724; through *Hort. Abs.*, 1966, **36**, (1), 248.—The aspects of translocation which were affected by light were polarity and the percentage of translocation. The suggestion is made that the initiation of translocation of sugar from the leaf is under photocontrol.

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Infection of sugar cane with mechanically transmitted corn virus. J. L. DALE and L. ANZALONE. *Plant Dis. Reptr.*, 1965, **49**, 757–760; through *Hort. Abs.*, 1966, **36**, (1). 346.—Introduction of sugar cane hybrid seedlings with a maize virus resulted in typical mosaic symptoms in 12 out of 107 seedlings. These resembled the symptoms of sugar cane mosaic although the two viruses did not appear to be identical.

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Germination of seeds of sugar beet at low temperature. V. MEGO. *Biologia* (Bratislava), 1965, **20**, (9), 663–670; through *Biol. Abs.*, 1966, **47**, 2896.—The germination of eight varieties of Czechoslovakian sugar beet was studied under low temperatures, varying from 2·3° to 9·1°C, in order to determine the feasibility of earlier seeding. Varieties from drier areas germinated faster, while polyploid varieties required higher temperatures to germinate.

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The effect of soil strength on sugar cane root growth. N. H. MONTEITH and C. L. BANATH. *Trop. Agriculture*, 1965, **42**, 293–296.—Experiments on three soil types showed that root growth was more closely correlated with penetrometer measurements of soil strength than with determinations of either soil bulk density or air porosity. Air porosity was the least well correlated with sugar cane root growth. The critical values of bulk densities for root growth varied according to soil.

Reducing the manual labour requirements and production costs of sugar beet. A. VON HORN. *Gesunde Pfl.*, 1965, **17**, (7), 142–145; through *Weed Abs.*, 1966, **15**, (1), 9.—"Pyramin" ("Pyrazon 80%") applied as pre-emergence herbicide at 4 kg/ha overall or in bands over the rows at 1·3 kg/ha of actual area sprayed could reduce the number of man-hours required for singling and subsequent cultivation by 64–71%, representing a saving of between 28 and 54% in the cost of producing the crop. A second application of "Pyramin" after singling, or "Simazine", could be beneficial.

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The defoliation of sugar beet for combine seed harvesting. K. GALLWITZ. *Medel. Landb. Hogesch. Opzoek Stns. Gent*, 1964, **29**, (3), 1181–8; through *Weed Abs.*, 1966, **15**, (1), 10.—Trials with the above method of harvesting sugar beet seed have been conducted since 1958. The most suitable defoliant was 10–12 litres of "Diquat" in 800–1000 litres of water/ha. The best date for spraying was 5–10 days later than the usual date for binder harvesting. In dry weather combine-harvesting could be carried out 5–6 days after spraying and in wet weather up to 10 days afterwards.

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The control of Johnson grass on ditch banks with DSMA. W. P. ANDERSON and L. McCAW. *Res. Prog. Rep. West Weed Control Conf.*, 1964, 102–103; through *Weed Abs.*, 1966, **15**, (1), 30.—Johnson grass (*Sorghum halepense*) is one of the worst cane weeds, especially in the United States. On ditch banks it was well controlled by foliar applications of the hexahydrate formulations of disodium methylarsonate and of monoammonium methylarsonate at 4 lb per acre in 90 gal of water + 0·5% wetter (X-77).

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Chemical control of Johnson grass on ditch banks. W. P. ANDERSON, J. W. WHITWORTH and L. McCAW. *Res. Prog. Rep. West Weed Control Conf.*, 1964, 103; through *Weed Abs.*, 1966, **15**, (1), 30.—"Dalapon" at 10 lb/acre in 80 gal of water with or without wetter (X-77) at 1·5 pints per 100 gal of water applied 4 to 5 times annually gave 90% or more control for an established stand of Johnson grass (*Sorghum halepense*) in ditch banks. The addition of "Amitrole" at 3 lb/acre to the spray solution improved suppression of regrowth and prevented the establishment of other weeds. Johnson grass 6–10 in high was also effectively controlled by repeat applications of "Dalapon" at rates down to 6 lb/acre.

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Sugar cane cultivation in north eastern Brazil. W. CARNEIRO. *Brasil Açucareiro*, 1965, **33**, (6), 45–49. The pros and cons of expanding sugar cane cultivation in north-eastern Brazil are discussed, much of the area being marginal for the crop. It is considered that by 1970 there will be a greatly increased internal demand for sugar.

Pelleted versus calibrated monogerm beet seed. P. N. EVERS. *Zucker*, 1966, **19,** 83–87.—Investigations showed that germination of pelleted monogerm seed in the Rhineland in 1965 was 1·1 times higher than that of calibrated monogerm seed.

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Sugar cane smut in São Paulo. C. T. DE CARVALHO. *Brasil Açuc.*, 1966, **34,** (1), 55–61.—Observations are recorded on the occurrence of sugar cane smut (*Ustilago scitaminea*) in some parts of São Paulo. Conditions favouring the spread of the disease and the question of resistant varieties are discussed.

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French method of sugar beet harvesting. J. JOHANNES. *Zucker*, 1966, **19,** 111–116.—The large-scale French method of harvesting sugar beet, several rows at a time, in stages—topping, harvesting and loading by several machines—is unsuitable for German conditions because of the smaller farms. The French method is only superior with an area of more than 40 hectares and when the leaves are not required as stock feed, as they are in Germany.

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Response of sugar cane to different nitrogenous fertilizers. Effects on yield of cane and gur and its quality. G. N. MISRA, B. S. MATHUR and J. D. SINGH. *Proc. 33rd Ann. Conv. Sugar Tech. Assoc.*, *India*, 1965, 39–48.—Throughout Uttar Pradesh sugar cane soils are deficient in nitrogen, so that nitrogenous fertilizers, organic or inorganic, give marked results. The differences in yield or quality of gur due to different fertilizers were not consistent and differences noted did not warrant rejection of any of the fertilizers, considering the shortage of fertilizers in India.

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Availability of phosphorus from different phosphatic fertilizers in sugar cane growing soils. A. P. GUPTA and S. C. SEN. *Proc. 33rd Ann. Conv. Sugar Tech. Assoc. India*, 1965, 69–75.—Two types of Gangetic alluvium soils, one highly calcareous (pH 8·6) and the other non-calcareous (pH 6·8) were incubated in laboratory tests with 6 different kinds of phosphatic fertilizer (at a rate corresponding to 200 lb of P_2O_5/acre). The behaviour of rock phosphate and steamed bone meal differed from that of other phosphate fertilizers, being very suitable for non-calcareous soils. Their residual effects were more marked in non-calcareous than calcareous soils.

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Studies on microbial population and nitrification of zonal soil types of Jarwal Rd. and Tulsipur cane development zones. N. S. SINHA. *Proc. 33rd Ann. Conv. Sugar Tech. Assoc. India*, 1965, 85–88.—Soil samples were collected from cane fields under aseptic conditions and brought to the laboratory for planting and culture to determine microbial population. The effects of various fertilizers on microbial population were also tested. Silty loam soils showed the highest microbial population. With them urea nitrogen was utilized within 10 days of application. Ammonium sulphate, ammonium chloride and fish meal all nitrified satisfactorily.

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A study on mineralization of nitrogen and phosphorus in waste by-products of the sugar industry. A. P. GUPTA and S. P. SHUKLA. *Proc. 33rd Ann. Conv. Sugar Tech. Assoc. India.* 1965, xxvii–xxxvii.—A sandy alluvium soil from cane fields was mixed in the laboratory with farmyard manure, molasses or filter press mud, all being previously analysed for nitrogen and phosphorus. Mineralization of phosphorus took place along with nitrogen and to a greater degree with press-mud than with molasses and farmyard manure. Mineralization of N and P generally started after 3–4 weeks of incubation, showing the advisability of applying these manures a month before planting the crop.

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Field mechanization. D. SMITH. *Sugar y Azúcar*, 1966, **61,** (3), 14–16.—The subject of mechanical harvesting of sugar cane is reviewed. There is wide interest in the subject, especially in the United States, where it now "reaches fever heat". Reasons given are the urgent need to reduce production costs with the fall in the price of sugar and no fall in labour costs. Labour for harvesting is considered to be less efficient than it was. In some areas adequate manpower is no longer available.

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A world survey of sugar cane mosaic virus strains. E. V. ABBOTT and I. E. STOKES. *Sugar y Azúcar*, 1966, **61,** (3), 27–29.—What is known of the earlier history of sugar cane mosaic and its different strains is reviewed. The only important cane-growing countries where there are no records of its occurrence are Guyana (British Guiana) and Mauritius. Some 29 accessions of the virus from 15 important cane-growing countries were established in quarantine and compared with U.S. strains of the virus. Seven were identified as strain *A*, 7 as strain *B* and 7 as strain *D*; 5 strains produced symptoms distinct from the U.S. strains.

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Co 853—a substitute for Co 419 for late season crush. R. P. RAJA. *Indian Sugar*, 1966, **15,** 661–664.—A detailed account is given of the variety Co 853 and its good points. It attains peak juice quality late in the season and maintains this for some time, a desirable attribute in some districts especially where satisfactory early and mid-season varieties exist.

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Flower induction in cane varieties by means of light and temperature control. H. ANTON. *La Ind. Azuc.*, 1966, **71,** 23.—Results of a study made on several varieties in Tucumán are recorded, some varieties being easy to bring into flower, others difficult.

SUGAR HOUSE PRACTICE

Studies on the use of phosphate in the clarified juice.
S. C. GUPTA, N. A. RAMAIAH and M. B. KUMAR.
Proc. 33rd Conv. Sugar Tech. Assoc. India, 1965,
205–215.—The effect of phosphate in clarified juice
was studied. Addition of 0·01% phosphate caused a
decrease from 28·35% to 11·65% in the destruction
of reducing sugars in processing of clarified juice to
A-massecuite, reduced molasses purity and yield, and
reduced raw and white sugar colour. The effect of
phosphate on evaporator scale could not be assessed
in view of the short duration of the tests, and no
quantitative data were obtainable showing its effect
on pan boiling.

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**Studies on some additives for better performance of
low-grade massecuites in sugar factories.** S. C. GUPTA,
N. A. RAMAIAH, M. SINGH and H. S. SRIVASTAVA.
Proc. 33rd Conv. Sugar Tech. Assoc. India, 1965,
232–239.—The effects of "Cutol" and "Instol"
surface-active agents on the viscosity of various
intermediate products, in particular final molasses
and low-grade massecuite, were studied in factory
trials. Both agents were effective in reducing viscosity
when used in concentrations from 7 c.c./lb to 200 c.c./
ton. Generally, the effect reached a maximum at a
concentration of 1·6%, after which viscosity remained
constant. The agents had no appreciable effect on
the viscosity of sugar solutions.

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Cooling towers for (the) sugar industry. S. R. NAIR. *Proc.
33rd Conv. Sugar Tech. Assoc. India*, 1965, 241–248.
The adverse effect of an inefficient cooling system on
vacuum and hence on factory efficiency is considered,
and various types of cooling system are discussed.
The requirements of an induced-draught cooling
tower for a particular duty are listed and aspects of
tower design and construction considered.

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**Exhaustibility of molasses: some observations on the
treatment of low-grade massecuites in crystallizers.**
S. C. GUPTA, M. N. S. GUPTA and J. C. BHARGAVA.
Proc. 33rd Conv. Sugar Tech. Assoc. India, 1965,
ix–xix.—Investigations of low-grade massecuite cool-
ing in various types of crystallizers are discussed. It
was found that cold water circulation permitted a
progressive, rapid drop in massecuite temperature
and mother liquor purity, that cooling to 40°C
followed by reheating to temperatures below the
saturation temperature of the massecuite (54°C) gave
optimum molasses exhaustion, while dilution of the
massecuite in place of reheating had an adverse effect
on molasses exhaustion. Details are given of a recomm-
ended procedure for low-grade massecuite treatment.

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**Improvements in clarification in (the) khandsari
industry.** S. K. D. AGARWAL, V. M. BHALWAR and
M. L. BARMAN. *Proc. 33rd Conv. Sugar Tech. Assoc.
India*, 1965, xxi–xxvi.—Details are given of a hot
liming and sulphitation technique for khandsari

factories. Compared with the conventional cold
process of bulk or batch liming followed by sulphita-
tion, the hot process gave a higher purity rise and a
greater clarification efficiency.

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**Studies on standardization of (the) true seeding technique
for low-grade boiling in sugar factories.** S. C. GUPTA,
M. SINGH, B. C. JAIN and H. S. SRIVASTAVA. *Proc.
33rd Conv. Sugar Tech. Assoc. India*, 1965, xxxix–lvii.
The theory of graining is briefly described and three
methods of establishing grain are considered. A
brief survey of work carried out on one of these
methods—true seeding—is followed by the technique
as used in Indian factories. Tests on seed slurry
preparation using a ball mill are reported. The
desired slurry obtained of 5μ average grain size was
used in seeding tests for low-grade massecuites. The
purity of the slurry was adjusted to approx. 75 by
mixing with *A* heavy molasses and syrup, and it was
introduced into the pan when the massecuite Brix
had reached 79–80°. The resultant purity drop in
the pans was increased from 15–20 units to 21–30
units (average of 4–6 units).

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**The problem of industrial waste treatment with par-
ticular reference to the treatment of wastes from sugar
factories.** S. D. GUPTA. *Proc. 33rd Conv. Sugar
Tech. Assoc. India*, 1965, lix–lxvii.—Anaerobic de-
composition of sugar factory effluent by lagooning
as adopted at the Hindusthan Sugar Mills Ltd. is
described with the aid of a diagram. The waste is
collected in a sedimentation tank whence it is pumped
to an equalization pond, where it is retained for a
sufficient length of time to render the contents homog-
eneous. The effluent passes via two anaerobic ponds in
series, where it is held for a total of 7 days, to four
oxidation ponds, again in series, where it is retained
for a total of 12 days. Active bacterial growth is
promoted by adding a cow dung slurry. During two
seasons, the BOD was reduced by 55–60% in the
anaerobic tanks and by a total of 80% in the whole
plant. The final effluent was odourless and contained
no sediment. Its pH was on the alkaline side. A
slightly black tinge due to dissolved H_2S disappeared
with increase in temperature.

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Transport of raw sugar and difficulties due to caking.
S. C. GUPTA, N. A. RAMAIAH and A. P. GUPTA.
Proc. 33rd Conv. Sugar Tech. Assoc. India, 1965,
lxxiii–lxxv.—Raw sugar samples stored in desiccators
in which the relative humidity was controlled within
the range 30–90% absorbed moisture at R.H. values
greater than 65% and lost moisture at R.H. below
65%. Caking tests showed that hard caking of raw
sugar occurred at a moisture content less than 0·5%.
To eliminate caking in storage and facilitate trans-
portation of the sugar, it is suggested that suitable
means be employed to raise the R.H. to above 65%.
In experiments this had the desired effect of making
the sugar bags easy to handle.

Some notes on Natal C-massecuites and C-molasses. W. S. GRAHAM. *S. African Sugar J.*, 1966, **50,** 153–163.—Measurements of the viscosity of final molasses from some Natal factories have been carried out. The purity *vs.* viscosity relationships for samples from different factories showed appreciable differences. The viscosities of different molasses samples having purities equivalent to the target purities predicted by the DOUWES DEKKER formula were not always similar. Comparative data are given for C-massecuites and molasses from three different factories. The ideal cooling rate for a massecuite was found to depend on the supersaturation coefficient of the mother liquor when the pan was dropped. The factory which boiled C-massecuite of the lowest purity and highest Brix produced the lowest purity final molasses.

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Audubon sugar factory after 75 years in chemical engineering training. J. J. SEIP. *Sugar J.* (La.), 1966, **28,** (9), 14–22.—A brief history is provided of the sugar factory which is part of the Louisiana State University Faculty of Chemical Engineering. The factory is the site of a course which involves student group study projects conducted concurrently with actual crushing operations. The 1965/66 projects are reviewed; these include development of a pilot-scale procedure for bagasse paper and pulp production and evaluation, assay of the effect on cane quality of mechanical cane harvesting, reduction of evaporator scale by clarification expedients, evaluation of surface-active materials in sugar boiling, examination of a new model refractometer and testing of sucrose determination using the borax technique, supplementing a mill with a diffusion unit, control of factory cooling water pollution, and study of steam requirements.

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Addition of three-roller mill to the B-tandem. P. Y. CAPAY. *Sugar J.* (La.), 1966, **28,** (9), 30–34.—A detailed description is given of the unit added to a B-tandem. It is driven by a Murray turbine through a Wichita clutch and is fed by a rubber belt intermediate carrier. It has Edwards hydraulics and meehanite cast bearings with bronze liners, themselves lined with babbitt metal.

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Tate & Lyle adopts new ion exchange process for decolorization of sugar. ANON. *Sugar J.* (La.), 1966, **28,** (9), 35.—A brief description is given of the installation at Plaistow Wharf refinery for polish filtration of bone char-treated liquor over resins for removal of the last traces of colour before boiling to sugar.

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A study of the sugar cane shredder for increased sucrose extraction and greater mill capacity. T. T. OOMMEN and V. C. BAHREE. *Sugar J.* (La.), 1966, **28,** (9), 37–38.—Installation of a Searby shredder at Shimoga sugar factory raised capacity from 35 to 48 t.c.h. (maximum) and from 29 to 43 t.c.h. (average). At the same time reduced mill extraction rose from 91·73 to 92·88%, and the unit acted as a tramp iron alarm. Location of a shredder and the advantages to be expected from its use are discussed.

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Research at Taiwan Sugar Corporation. C. WU. *Sugar J.* (La.), 1966, **28,** (9), 46–48.—An account is given of the work of the T.S.C. Experiment Station in combating the problems of sugar cane cultivation and processing in Taiwan.

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Automatic feed of low-grade pans. G. ALEMAN. *Sugar y Azúcar*, 1966, **61,** (3), 29–31.—A low-head pan installed for the 1964/65 season at Glades Sugar House, Florida, for C-strikes is provided with a Webre mechanical circulator; the power consumption of the motor of this circulator is directly related to massecuite tightness, so that when the needle on the Fischer & Porter recording controller reaches a set point, it opens a motorized valve in the syrup feed line. For full grain seeding, the pan is provided with a Fischer & Porter supersaturation indicator based on B.P.E. Operation of the system is exemplified by a chart from the tightness recording controller showing the progress of strikes during a 24-hr period. Advantages of the scheme include strikes of almost identical Brix and crystal yield, thus eliminating massecuites having excessive or deficient molasses.

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Mexico's Los Mochis doubles capacity. ANON. *Sugar y Azúcar*, 1966, **61,** (3), 33–36.—Details are given of the equipment installed during expansion of the raw sugar factory, which now has an alcohol distillery and a refinery. The milling tandem comprises a 43 × 87 inch two-roller crusher and five 40 × 84 inch mills, the crusher and each mill being individually steam turbine-driven. Provision is made for future installation of a 6th mill. Cane is fed to a feeder conveyor at the bottom of the cane chute by an Edwards "Auto-Cane" drive. Steam is supplied at the rate of 950,000 lb/hr at 250 p.s.i. pressure by eight Babcock & Wilcox boilers. Four boilers are new, two operating at 125,000 and two at 165,000 lb/hr. The pH of the juice in the liming station is maintained automatically. The clarifier station consists of four 30-ft dia. and one 36-ft dia. "RapiDorr" clarifiers, while the evaporator station comprises a pre-evaporator cell and a quintuple-effect evaporator in which the first effect includes two bodies operating in parallel. Juice and condensate level is maintained automatically. The pan floor is at a height of about 63 ft, permitting massecuite gravity flow to the crystallizers and centrifugals and providing adequate height for the condenser seals. Three of the pans have a capacity of 1650 cu.ft. and the other two of 2250 cu.ft. The A-sugar centrifugals are automatic 48 × 30 inch

Western States machines, while the C-sugar is purged in a battery of 48-inch continuous and automatic machines. Automatic 48-inch Western States machines are also used in the refinery for white sugar curing. The new refinery equipment also includes two "Honiron" low-head vacuum pans of 2250 cu.ft. capacity. The expansion is based on a crop crushing capacity of 2 million tons of cane.

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Factory trial of the defeco-melt crystallization process for the manufacture of white sugar without sulphur. S. C. GUPTA, N. C. VARMA, N. A. RAMAIAH, J. P. BANSAL, N. C. JAIN and J. P. BAHADUR. *Indian Sugar*, 1966, **15**, 653–660.—Details are given of tests on the use of a simple lime defecation process, the raw sugar from which is melted and combined with syrup to give a so-called "*R*-massecuite". The sugar from this is bagged and the heavy molasses combined with syrup and boiled on double-cured C-sugar to give an *A*-massecuite. *B*-massecuite is single-cured and used as seed for *R*-massecuite, while C-massecuite is double-cured and used as seed for *A*- and *B*-massecuites. The white sugar obtained is claimed to be of high quality and is considered better in some respects than sulphitation sugar.

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Kinetic evaluation of continuous and discontinuous refining methods. I. Mean determined residence times of individual components in apparatus during continuous processing. J. BURIÁNEK. *Listy Cukr.*, 1966, **82**, 57–68.—The problem of determining the mean retention time of individual components from distribution curves for labelled substances is discussed theoretically. As an example, the retention time of sucrose and non-sugars in various parts of an evaporator are determined using labelled NaCl. Equations are given for calculating the amount of water evaporated in a given time in various sections of the evaporator. The mean retention time has been found to depend on the amount of material present in the vessel and on the amount in flow before and after it. The problem is regarded as an indispensable part of the general problem of determining the optimal dimensions of equipment and its capacity.

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Sucrose extraction and mill control. V. I. CHIAPPINO. *La Ind. Azuc.*, 1966, **71**, 19–22.—The low milling efficiency of Argentina's cane mills, most of which have not been renewed in fifty years, needs to be improved, and it is concluded that an effective measure would be the application of simple or compound imbibition, according to local facilities, in conjunction with systematic laboratory control of mill performance.

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Automation of a sugar cane extraction unit. M. BRUNKE. *Zucker*, 1966, **19**, 167–170.—Details are given of a system for automatic regulation of the speed of an auxiliary belt conveyor according to the speed of the main conveyor it precedes. The cane on each of these inclined conveyors passes under a knife set, the motor of the set above the auxiliary conveyor being provided with a safety switch. A stoppage of the auxiliary conveyor does not affect the main conveyor. The prepared cane is fed to a cane mill, in which approx. 55% of the juice in the cane is expressed. It is then fed by inclined conveyor to the counter-flow diffuser in which it is conveyed on a chain element. After diffusion the cane passes through a roller press which can be made to operate synchronously with the diffuser. The cane is then subjected to further pressing in two mills and the bagasse sent to the boiler-house unless otherwise required. The speed of the chain in the diffuser is maintained constant at uniform loading. The temperature of the diffusion juice is also automatically controlled as is the ratio of press juice to milk-of-lime used in the preparation of the diffusion water. A simple device for measuring the juice Brix consists of two identical cylinders, one filled with a liquid of s.g. 1 and the other with inlet and upper outlet for the juice sample. A bead tube passes down each tube but does not reach the bottom. The bead tubes are connected to air supplies. When the air feed is opened, a differential pressure is created (because of the difference in s.g. of the juice and the standard liquid) which is proportional to the Brix.

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A new concept for main cane carrier drives. R. P. HARPER and W. H. JOHNSTON. *Sugar J.* (La.), 1966, **28**, (10), 17–19.—Details are given of an eddy-current water-cooled coupling installed at Iberia as a main carrier drive. It comprises an inductor drum mounted on the shaft of a constant-speed A.C. squirrel cage motor, a stationary D.C. coil and a pole piece assembly acting as a variable-speed output member. The speed is regulated by varying the field excitation of the D.C. coil mounted in the pole piece. If the output member's speed varies from that set by a potentiometer, a built-in tachometer on the output shaft senses the variation and sends a corresponding signal which automatically changes the voltage on the D.C. coil. Overriding controls stop the carrier if the knife set becomes overloaded and provide uniform feed to the crusher or 1st mill. While the time taken to accelerate the carrier from rest to full speed was satisfactory at 2 sec, the deceleration time from full speed to rest was too long at 6 sec. This was, however, reduced to 2 sec by installing a lower power motor (1200 instead of 1700 r.p.m.). The feeler device for regulation of cane blanket depth does not measure cane density, so that it is proposed to make use of the current to the motor driving a kicker at the end of the carrier. Increase in the current would then be accompanied by deceleration of the coupling, and vice versa, the load on the kicker motor being a true indication of cane density.

Sugar manufacturing in Argentina. W. E. CROSS. *Sugar J.* (La.), 1966, **28**, (10), 27–37.—Recommendations based on the author's experience in Argentina are given for cane raw sugar production, covering all the processes up to boiling and emphasizing the significance of cane quality and harvesting.

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The technological scheme and apparatus used in processing cane raw sugars at Odessa refinery (U.S.S.R.). Z. NITSCHKE, A. JARZECKI, B. KUERMANKIEWICZ and S. PRZYBORO. *Gaz. Cukr.*, 1966, **74**, 59–62.—Full details are given of the processes and equipment used at this refinery, which is one of seven Soviet refineries processing imported cane raws. Odessa produces crystal refined sugar, 1st and 2nd powdered sugar for cubes, powdered sugar from the residue of the refined sugar massecuite and 1st-, 2nd- and 3rd-strike powdered sugar.

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Back-flow filtration. J. LEKAWSKI. *Gaz. Cukr.*, 1966, **74**, 62–64.—A description is given of an "A1" filter of American design, which is widely used in the Japanese and U.S. food industries, including the sugar industry, and which incorporates the technique of mixing of filter-aid with the juice being filtered, repeated removal of filter sludge and subsequent back-flow of the juice through the filter. Comparison is made with conventional filters.

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Heat transfer measurements aid cleaning evaluation. E. DELDEN. *Sugar y Azúcar*, 1966, **61**, (4), 35–36. Measurement of heat transfer in the final evaporator effect as a means of determining scale removal efficiency is discussed with particular mention of the work of HONIG[1]. The best and cheapest method is considered to be the use of a simple vertical tank placed before the pump in the condensate line, whereby the time taken for the condensate to reach a pre-set level in a sight glass is measured and hence the volume per min calculated. This value, together with juice, vapour and condensate temperatures and heating surface of the effect, will give the heat transfer coefficient.

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The use of macroporous ion exchangers in the sugar industry. Laboratory and pilot-scale experiments. K. ČÍŽ. *Listy Cukr.*, 1966, **82**, 84–88.—Comparative tests were carried out with standard and macroporous anion and cation exchange resins used for softening thin juice and decolorizing remelt liquor. The effective exchange capacity of "KP-1" macroporous cation exchanger was some 25% lower than that of two standard resins, the mechanical properties of which were approximately identical. There was little difference between the colouring matter adsorption capacities of standard and macroporous anion exchangers. The best colouring matter desorption was from "Amberlite IRA-168" anion exchanger, which retained far less colouring matter when re-

generated with 8% NaCl solution than did the other resins. The mechanical properties of the macroporous resins were somewhat better than those of the standard types. "Amberlite IRA-168" resin is considered to have good prospects for application in the sugar industry, although the mechanical properties and the stability of the resin over long periods of use require investigation.

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Manufacture of white sugar without sulphur in carbonatation factories by (the) D.M.C. process. I. Production of raw sugar in carbonatation factories. S. C. GUPTA, N. A. RAMAIAH and N. C. JAIN. *Indian Sugar*, 1966, **15**, 707–717.—To enable carbonatation factories to adopt the defeco-melt crystallization (D.M.C.) process developed by S. C. GUPTA, a modified single-carbonatation process was developed in which the juice is heated to 50–55°C, limed with 5% 18°Bé milk-of-lime by volume and gassed with CO_2, filtered on filter-presses, gassed with CO_2 to pH 7·6–7·8, heated to 75°C, filtered and sent to the evaporators. Among the advantages of the scheme is a lower "clarified" juice colour content than in defecation juice treated by the D.M.C. process, although the colour content was about the same as that of juice from conventional double carbonatation. Purity rise from mixed to "clarified" juice was of the order of 2 units, while about 20% reducing sugars were destroyed compared with 25% in double carbonatation. While filtration presented no difficulties, it was found that with use the presses built up pressure faster than in the conventional process. The colour of the 97·5–98·8 pol raw sugar produced from the juice was 10–15°St compared with 25–30°St with the defecation process. Double-curing of the *A*- and *B*-massecuites gave fairly good quality white sugar.

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Study of the suitability of (a) vapour cell for superior white sugar manufacture. J. M. SAHA, G. S. LAL and V. SINGH. *Indian Sugar*, 1966, **15**, 719–721.—Investigation of the performance of a 5000-sq.ft. h.s. vapour cell at one factory is discussed. The vapour cell, preceded by a 1000-sq.ft. h.s. juice heater, generally supplies all the vapour for the three vacuum pans as well as the juice heater. The exhaust steam fed to the vapour cell is of 10 p.s.i. pressure, whereas the studies showed that a maximum pressure of 5 p.s.i. is preferable to avoid inversion or colour formation as a result of reducing sugar destruction. The pH of the juice entering the vapour cell should be 6·9–7·0, and its temperature 100°C. The Brix rise in the vapour cell was in the range 11·49–15·65%, i.e. to a Brix in the range approx 14–20°. Juice retention in the vapour cell should be as short as possible. Provided the requirements are met, the vapour cell is suitable for high quality white sugar manufacture.

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[1] Principles of Sugar Technology. Vol. III. (Elsevier, Amsterdam.) 1963. Ch. 15.

The quality of pulp from a DDS continuous diffuser. K. Pietroniuk. *Gaz. Cukr.*, 1966, **74**, 7–10.—Laboratory and factory-scale experiments were conducted on beet pulp to determine the effect of formalin added to the diffuser on its value as fodder and to compare the results for pulp from a DDS continuous diffuser and a Robert battery. The results are tabulated in some detail, and show that the DDS diffuser pulp was better than that from the battery.

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Invert sugar degradation and coloration of sugar juices under factory conditions. K. Vukov. *Zucker*, 1966, **19**, 87–94.—If the value of B_λ (the extinction coefficient corresponding to the decomposition of 1 g of invert sugar per ml) is known[1], it is possible, using the rate constants of sucrose hydrolysis and invert sugar decomposition, to determine the amount of invert sugar decomposed under various factory conditions and evaluate the extent of colour formation in the juices. On this basis, relations have been derived for calculation of juice coloration at varying temperatures and pH values. These are used for mathematical determination of the effect of various combinations of pre- and main liming, carbonatation and simultaneous carbonatation and liming. It is shown that in the case of cold or hot pre- and main liming, invert degradation and coloration are parallel, whereas in the case of carbonatation, coloration is much greater than invert degradation, since most of the invert is decomposed before carbonatation or at least before adsorption by $CaCO_3$ i.e. in the first 1—2 min of carbonatation. The invert in raw juice should preferably be decomposed before 1st carbonatation to permit removal of the degradation products by precipitation. The quantity of invert sugar decomposed and the extent of coloration in the various processes following carbonatation and in evaporation have also been determined. Maximum degradation occurs in clarification and in evaporators where the retention time is prolonged.

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Physiologically active substances in the protection of stored beet. J. Zahradníček, L. Schmidt and A. Havránek. *Listy Cukr.*, 1966, **82**, 1–6.—Tests are reported in which various forms of lime were applied to stored beet at 0·5% on weight of beet. The forms were: 2°Bé and 6°Bé milk-of-lime, slaked lime and unslaked lime. During the 3 years of the tests, the losses in the treated piles were lower than in the control, and the treated beet were in better condition. The best results were obtained with the 6°Bé milk-of-lime, the losses in the piles being one-third less than in the control. It was better than V-K chalk, which did not contain active chlorine. Tests are to be conducted on V-K chalk activated with chlorine. Preliminary experiments with respiration inhibitors (chloroform applied on an aerosol base, and nitrogen as an inert gas) gave favourable results.

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Electric counters in the sugar industry. P. Motejl. *Listy Cukr.*, 1966, **82**, 10–13.—Various possible combinations of Czechoslovak electric counters and ancillary equipment for automatic control and measurement applications in the sugar factory are briefly discussed.

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Waste water treatment studies at Tracy, California. L. W. Norman, J. E. Laughlin and L. O. Mills. *J. Amer. Soc. Sugar Beet Tech.*, 1965, **13**, 415–424.—Waste water effluents at Tracy sugar factory—essentially beet flume water—after settling had a BOD load of 200–600 (average 400) mg/litre. Laboratory experiments showed that this could be reduced (by an average of 85%), by using an activated sludge technique, to 55–145 (average 100) mg/litre. With a trickling filter, BOD reductions of 33–50% could be achieved on a single pass. Combined techniques are considered for reduction of BOD and COD. To obtain optimum bio-oxidation, nutrients—N and P in the form of commercial fertilizer—were needed.

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Continuous processing at American Crystal's Drayton factory. Anon. *Sugar y Azúcar*, 1966, **61**, (2), 52–54.—An illustrated description is given of this new 5000 tons/day sugar factory in North Dakota, U.S.A. Beets are sliced and treated in a Silver-DDS trough diffuser and the factory plant is provided with automatic controls where practical, e.g. in the pans and centrifugals.

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French beet sugar practice. J. Dubourg. *Sugar y Azúcar*, 1966, **61**, (2), 55–56.—Modern developments in sugar beet cultivation, delivery and processing in France are surveyed.

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Recent advances in Japanese beet sugar. M. Kamoda and T. Ando. *Sugar y Azúcar*, 1966, **61**, (2), 57–59, 77.—The rapid expansion of beet sugar production in Japan, with increase in sugar factories from 3 in 1959 to 10 in 1966, is described, with an account of the plant and processes employed. The use of ion-exchange resins for beet juice purification is described in some detail.

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[1] *See I.S.J.*, 1965, **67**, 346.

Thermal calculation of pulp drying. II. Exergetic analysis of drying. T BALOH *Zucker*, 1966, **19,** 135–144.—By means of material, exergy and enthalpy balances, using a Mollier diagram and an *e,x* diagram for moist air, a furnace gas-heated pulp dryer is compared with a flue gas-heated dryer. Sankey diagrams, showing the exergy flow, are also presented for both types, as well as an *e,t* diagram for the furnace gas-heated type. It is shown that flue gas drying will offer no real saving in fuel, in contrast to furnace gas drying. Analysis of the heat losses in separate sections of the dryer demonstrates why hot gases will permit a reduction in fuel consumption.

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Flame cleaning in the sugar industry. E. LIPSKI. *Zucker*, 1966, **19,** 144–147.—The advantages of flame cleaning for scale and rust removal and cleaning and drying of steel surfaces are discussed As an example is quoted the lime kiln at Wierthe sugar factory, which was flame cleaned to remove rust and subsequently painted. After four campaigns, the paintwork is stated to be in a spotless condition. For flame cleaning of new structures, the author advocates delivery of the component parts in an unpainted state.

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Formulae for the calculation of filters. B. BRUKNER. *Zucker*, 1966, **19,** 147–148.—The formulae derived for calculation of filtration factors[1] are presented in a convenient form for practical application.

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Pressing and drying of (beet) pulp at Notre-Dame refinery, Oreye (Belgium). J. DELCOURT and J. HUBERLANT. *Sucr. Belge*, 1966, **85,** 249–263.—Full details are given of the pulp pressing and drying plant. To increase the dry solids content of the pressed pulp, five vertical presses were replaced in 1965 by three Stord BS 64 S presses capable of handling the pulp from 900 tons of beet per day. The drying plant consists of a horizontal drum in which the pulp is dried by hot furnace gases. The dry solids content in this was raised to 88·4% from 15·85% (average of 43 days in 1964) and from 21·9 (average of 30 days in 1965). It has proved possible to press to 22% dry solids content (instead of 16% formerly), permitting a 50% increase in the capacity of the drying plant and a 33% saving in fuel.

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Aggregation of $CaCO_3$ particles in sucrose solutions. R. KOHN. *Listy Cukr.*, 1966, **82,** 49–57.—The formation of aggregates with three different carbonatation methods was studied. The procedures used were: batch saturation after a single addition of $Ca(OH)_2$, simultaneous batch liming and gassing, and continuous simultaneous liming and saturation with return of $CaCO_3$ mud. The settling rate, final mud volume, filtration coefficient, dynamic flow limit and the plastic viscosity of the thickened suspension were determined. Na^+, Ca^{++}, Cl^- and OH^- ions, added after saturation, had only very slight effect on $CaCO_3$ aggregation. It was found necessary to differentiate between the method of aggregation, where the dielectric constant of the disperse medium or of the polyelectrolyte added to the suspension was reduced, and that of simultaneous liming and gassing with $CaCO_3$ particle recirculation. In the former method, the primary particles are regularly distributed in the mud and the relationships between the various aggregation parameters are completely unambiguous, whereas with the latter method the repeated simultaneous gassing and liming lead to the formation of large aggregation units with a large deposit of primary particles. The strength of their structure is quite high, and the aggregates are not dispersed even under a vacuum of 400 mm Hg. They are not regularly distributed in the mud, so that the relationships between the aggregation parameters are not always simple. In the alkalinity range up to 0·08 g CaO/100 ml, fluctuation in the values prevented determination of the effect of the aggregation parameters on alkalinity. Aggregation in sucrose solution occurred to a lesser extent than in saturated juice, mainly because of the slight effect of the hydrophilic character of the $CaCO_3$ particle coupled with the electrokinetic potential. With the batch process, settling and filtration were much poorer than expected. The particle size with both simultaneous processes was about double that with the other process. Temperature of the suspension had effect on aggregation only when liming was followed by gassing, and then only at low alkalinity. In all other cases, increase in temperature was accompanied by an improvement in the settling and filtration properties. Over the range 50–80°C, temperature increase also caused increase in the size of the mud particles.

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Studies on filter cloths. M. FRIML. *Listy Cukr.*, 1966, **82,** 69–76.—Official Czechoslovak standard methods were used to evaluate new filter cloths. The procedure includes evaluation of cloth appearance and properties of the material, determination of efficiency under factory conditions, and laboratory tests on the cloth when new and after use. Recommendations based on the results are given.

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Reference fuel consumption for drying pressed (beet) pulp and cossettes. Z. KARLACH. *Listy Cukr.*, 1966, **82,** 76–80.—Examples of material balances in two factories using Büttner pulp dryers are given as an indication of economical methods of drying pulp and cossettes for animal fodder.

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Sugar factories—modern and rich in tradition. W. LYZWA. *Polish Machinery News*, 1965, **1,** (2), 46–48. An illustrated account is given of the factories and equipment supplied by Poland to various countries.

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[1] *I.S.J.*, 1966, **68,** 247.

As for instance Werbkowice. Z. KAIMIERCZUK. *Polish Machinery News*, 1965, **1**, (2), 49–50.—A description is given of the processes and equipment used in this Polish white sugar factory, which has a daily slicing capacity of 3000 tons of beet and produces approx. 45,000 tons of sugar annually with storage capacity of 35,000 tons. All processes are controlled from a central panel.

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Before building a sugar factory. Z. CHARKIEWICZ. *Polish Machinery News*, 1965, **1**, (2), 51–52.—The various factors to be determined before a factory is planned and built are discussed.

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Investigation of the effect of mixing on heat exchange during massecuite boiling. E. A. NEDUZHKO and V. D. POPOV. *Sakhar. Prom.*, 1966, **40**, (4), 23–36. Massecuite of known Brix and sugar content was boiled for 10 min in an experimental 90-litre coil vacuum pan in which a propeller-type mixer rotated at speeds of up to 85 r.p.m. Heat exchange at low heat flow (q) was found to increase considerably with increase in the speed of the mixer, but with increase in q the effect of the mixer on heat exchange diminished. This is explained by the fact that at low values of q the circulation velocity W_o and not the evaporation rate is decisive. With increase in q, however, the reverse applies. In a graph of heat exchange *vs.* heat flow during mixing, the experimental points fall near the mean line (angular coefficient of 0·6) with a maximum scatter of $\pm$ 15%.

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Purification of molasses by electrodialysis using ion exchange membranes. R. TS. MISHCHUK and I. M. LITVAK. *Sakhar. Prom.*, 1966, **40**, (4), 26–30.—Molasses diluted to 28–32°Bx was passed at 39–40°C through a 40-chamber electrodialyser containing heterogeneous MA-40 anion and MK-40 cation exchange membranes of high selectivity and relatively low resistivity. Optimal demineralization was 65%, above which further ash removal required much greater current throughput (1·8–2·0 amp/hr/litre compared with 0·7–0·9 amp/hr/litre up to 65% removal). The sucrose concentration in the treated molasses rose sharply as a result of transfer of water accompanying the non-sugar ions passing from a dialysate cell to an electrolyte cell. For multi-stage demineralization it was found desirable to use a higher electrolyte concentration at the start and a lower electrolyte concentration subsequently. Normal passage of ions through the membranes was prevented by build-up of Ca and Mg salts on the membrane surfaces as a result of increase in pH of the molasses solution to 11. Adjustment of the electrolyte solution to pH 2 is therefore desirable. Current usage per g of ash removed is demonstrated in graph form.

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The Giprosakhar beet washer (test results). I. I. PRILUTSKII. *Sakhar. Prom.*, 1966, **40**, (4), 30–35. Details are given of a Soviet combined beet washer, consisting of a low water level compartment preceding a high water level compartment, which is designed to wash 1500 metric tons of beet daily but which has handled 1650 tons/day. The U-shaped trough is double-bottomed, the first bottom being perforated. Beets in the 4·5 cu.m. low-level compartment flow into a pocket at the side and end of the compartment and are transferred by a paddle arrangement to the 17·1 cu.m. high-level compartment, which is a conventional Dobrovol'skii KMZ-57 beet washer. Both compartments are provided with rotating elements in almost continuous scroll form. In the first compartment the "paddles" are of metal, while in the high-level compartment they are wooden. Impurities floating on the water surface are pushed by water jet to a rake conveyor at the side, where there is also an overflow. A second water jet is used to remove impurities still clinging to the beets. Before the wall separating the washer from the final transfer element is an opening down which the beet pass to the transfer paddle. The opening is provided with a slide-gate fixed at a pre-set level to control the rate of flow of beet. The washer's performance has proved better than that of other washers in the Soviet Union, although some faults are noted.

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Automation of milk-of-lime dosing. A. L. ANTONOVICH. *Sakhar. Prom.*, 1966, **40**, (4), 35–39.—Details are given of two automatic control schemes for regulating milk-of-lime dosing in the main liming tank. In one, a sequence control system, the dose is based on maintenance of a constant raw juice: milk-of-lime ratio with time while in the other, a cascade in-line system, the principle of a varying raw juice:milk-of-lime ratio with time is used.

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Cleaning juice heaters before 2nd carbonatation. L. P. SOFRONYUK. *Sakhar. Prom.*, 1966, **40**, (4), 40–41. A 3% solution of HCl is heated to 70–80°C and used to descale 1st carbonatation juice heaters, which are then rinsed with water. The scheme used is shown in diagram form.

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Losses in beet mass and sugar in the section between the beet pile and the automatic weigher. G. V. ERESHCHENKO. *Sakhar. Prom.*, 1966, **40**, (4), 57–63.—In the section mentioned in the title, losses in beet mass and sugar in 1963/64 at Alma-Ata factory, as a result of injury and abrasion, constituted 4·85% and 0·93% on mass of beet, respectively. These were lower in the 1964/65 campaign as a result of modifications to equipment handling the beet. The losses are lower in the first four months of a campaign, when fresh beets are handled. It was found that exclusion of a beet washer from normal schemes reduces losses considerably. The techniques used to determine mass losses and the amount of water adhering to beet are described.

LABORATORY METHODS AND CHEMICAL REPORTS

New laboratory instruments. S. F. MOKHORT. *Sakhar. Prom.*, 1966, **40**, (3), 33–34.—Among the new Soviet instruments discussed are the RTS-1 beet comminuting apparatus for cold water digestion, the SU-2 modified saccharimeter and a three-prism refractometer. Serious faults in the design of an automatic refractometer and an automatic saccharimeter are discussed.

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A study of the method of sucrose estimation by the action of boron salt (borax). S. C. SHARMA and H. C. SIKRI. *Proc. 33rd Conv. Sugar Tech. Assoc. India*, 1965, 109–124.—Depending on concentration, the presence of borax was found to reduce the polarization of glucose and fructose to zero. It also reduces the polarization of sucrose solutions, however, and, having an alkaline reaction, can modify the polarization of asparagine, glutamic acid and other amino acids. Consequently, the LÓPEZ HERNÁNDEZ method of sucrose determination[1] is considered suspect until these other influences have been sufficiently investigated.

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Studies on sugar crystals: nucleation and growth of crystals of deformed shape in (the) khandsari industry. S. K. D. AGARWAL. *Proc. 33rd Conv. Sugar Tech. Assoc. India*, 1965, 125–135.—In khandsari production most of the crystal growth occurs in crystallizers, into which the juice, concentrated in open pans, is fed. There is no proper circulation or temperature control and the temperature and concentration of the massecuite varies considerably. The supersaturation consequently is very irregular, which varies the crystallization rate and can give false grain, etc., so accounting for the irregular grist and deformed crystals.

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A formula for the purity of final molasses. S. C. GUPTA, S. L. PHANSALKAR, M. SINGH and H. S. SRIVASTAVA. *Proc. 33rd Conv. Sugar Tech. Assoc. India*, 1965, 149–161.—A series of 24 molasses samples from various parts of India were analysed and a number of relationships observed. From these a new formula was calculated, viz. Tpy (true purity) $= \dfrac{120}{OE}$ (28·57 − $g/a + 0·4\ s/ns$), where OE is the overall extraction of the factory, $g/a =$ glucose:ash ratio and $s/ns =$ sucrose: non-sugars ratio.

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Nomogram for quantitative determination of (the) colour of raw sugars for (the) export market. S. C. GUPTA, N. A. RAMAIAH and K. KUMAR. *Proc. 33rd Conv. Sugar Tech. Assoc. India*, 1965, 163–170.—A series of solutions were made up with varying contents of caramel; the colour was then measured using a variety of instruments, including a Stammer color-imeter. The results were converted into a series of scales for conversion of measurements by the instruments into degrees Stammer; this is so that factories with instruments other than a Stammer colorimeter can determine if their sugar colour comes within the limit of 28°St set by the Refiners' Association.

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"Instubes" for estimation of colour of raw juice. S. G. GUPTA, N. A. RAMAIAH and K. KUMAR. *Proc. 33rd Conv. Sugar Tech. Assoc. India*, 1965, 171–174. For raw sugar solution colour assessment by visual comparison with standards, the National Sugar Institute developed the idea of filling test tubes (so-called "Instubes") with caramel solution and grading them from 20°St to 40°St after checking them against a Stammer colorimeter and a Klett-Somerson apparatus for colour index accuracy. The interval between each standard is 4°St. The caramel solution is, however, unstable so that the colour value falls by 0·8–1·0°St in a month.

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Studies on the solubility of calcium sulphite in sugar solutions. S. C. GUPTA, N. A. RAMAIAH and K. KUMAR. *Proc. 33rd Conv. Sugar Tech. Assoc. India*, 1965, 175–179.—Pure calcium sulphite was added to pure sucrose solution and its solubility determined, after a 6-hour equilibrium period, by titration with EDTA solution. The solubility decreased with increase in temperature in the range 30°–60°C and fell with increase in sucrose concentration. In the pH range 7–11, the solubility in 10% sucrose solution increased initially (at pH increase from 7 to 8) after which it fell slowly.

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Effect of inorganic salts on the destruction of reducing sugars. S. C. GUPTA, N. A. RAMAIAH and M. B. KUMAR. *Proc. 33rd Conv. Sugar Tech. Assoc. India*, 1965, 193–203.—The effects of inorganic constituents of clarified juice on reducing sugar destruction were studied in laboratory tests, in which the extent of destruction with time at constant pH and temperature was determined. The reducing sugars were determined by the IONESCU method[2] and the colour by measuring the absorption at 420 mμ. While carbonates were found to increase destruction, sulphites and phosphates reduced or inhibited reducing sugar destruction. The anion appeared to play an important part in reducing sugar destruction but not the cation.

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Some observations on the keeping quality of carbonatation sugars and (the) rôle of sulphur dioxide. N. A. RAMAIAH and B. I. NEMADE. *Proc. 33rd Conv. Sugar Tech. Assoc. India*, 1965, 217–222.—The effect of

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[1] *I.S.J.*, 1963, **65**, 46, 72, 107.
[2] *Bull. Soc. Chim. Romania*, 1920, **2**, 38.

decrease in the sulphur dioxide content of carbonatation sugars on their deterioration during storage was determined in tests in which the SO_2 contents of sugars and syrups were estimated iodometrically and the colour of the sugar determined spectrophotometrically at 420 and 550 mμ. Samples of sugars from different factories were maintained in a vacuum oven at 50°C for up to 42 hr. While the colour content increased in all cases with time, the SO_2 content remained almost constant. Passage of nitrogen through a 40°Bx solution of the sugar crystals failed to liberate the SO_2, even after 2 hours. The SO_2 content of syrups made from deteriorated sugars was deliberately increased, but the colour content was not materially altered. Since the colour content rose with temperature without any change in SO_2 content, deterioration of stored sugar is attributed to low temperature caramelization of the reducing sugars.

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Kinetic studies on some fundamental processes occurring in the crystallization of sucrose. N. A. RAMAIAH and R. C. GUPTA. *Proc. 33rd Conv. Sugar Tech. Assoc. India*, 1965, 223–230.—See *I.S.J.*, 1966, **68**, 60.

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Ash and conductivity of sugar samples. R. E. BOWLES, J. BRUIJN and W. S. GRAHAM. *S. African Sugar J.*, 1966, **50**, 163–167.—Measurements were made of the sulphated ash content and of the electrical conductivity of solutions of raw, refined and mill white sugars in deionized distilled water. Relationships between the ash and conductivity at two concentrations (5 g and 26 g per 100 ml) were established by applying linear regression analysis to the data obtained. The standard error for the ash estimation and the correlation coefficient were calculated. It is recommended that no correction should be applied for the conductivity of the water used, provided its specific conductance is low enough. For refined and mill white sugar samples, however, the water conductivity should preferably be less than 2·0 microsiemens/cm, and conductivity is preferably measured at a concentration of 5 g/100 ml rather than 26 g/100 ml. The constant terms in the expressions for all the sugars analysed were much lower than the standard error and can be neglected, when the relevant C ratios become 0·001684, 0·00128 and 0·001585 (% sulphated ash per microsiemens/cm) for raw sugar, refined sugar and mill white sugar solutions of 5 g/ml concentration.

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Determination of raffinose in molasses. A. DRABIKOW-SKA. *Prace Inst. Lab. Badawczych Przem. Spoz.*, 1965, **15**, (1), 1–11; through *S.I.A.*, 1966, **28**, Abs. 39. The development of a paper chromatographic method is reported. Beet molasses is clarified with lead and is then treated with acid, in order to hydrolyse raffinose to melibiose. The solution is neutralized with NaOH to pH 8·5 in order to precipitate lead hydroxide. Melibiose is then separated by paper chromatography with 7:1:2 *n*-propanol: ethyl acetate: water, in which

its R_f value is relatively small. The melibiose is eluted with 6 ml of 2% *m*-aminophenol in acetic acid which is heated at 100°C for 30 min. The colour of the cooled sample, proportional to the melibiose concentration and hence to raffinose, is measured at 543 mμ. The mean error was $\pm$ 3·3%, the results being lower than those of polarimetric determination.

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Thin layer chromatography of some sugars and sugar alcohols. D. WALDI. *J. Chromatog.*, 1965, **18**, 417–418; through *S.I.A.*, 1966, **28**, Abs. 40.—A method using phosphate-impregnated layers of kieselguhr G, 250μ thick, is described. 5–25 μg amounts of 20 sugars (including sucrose) and sugar alcohols were separated using *n*-butanol:acetone:phosphate buffer as solvent, in a supersaturated atmosphere. Development to 10 cm required 30–35 min. The spots were revealed by spraying first with sodium metaperiodate, then with benzidine, and finally (after standing the plates in ammonia vapour for 5 min) with silver nitrate. R_f and R_g values are tabulated, the latter representing displacement with reference to that of glucose, and having better reproducibility.

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Separation of carbohydrates on borate-impregnated silica gel G plates. H. JACIN and A. R. MISHKIN. *J. Chromatog.*, 1965, **28**, 170–173; through *S.I.A.*, 1966, **18**, Abs. 41.—Six mixtures of 4–7 sugars each, three including sucrose, D-glucose or D-fructose, were separated by ascending chromatography on plates coated with 0·25–0·275 mm layers of silica gel G impregnated with a 0·02M borate buffer of pH 8·0. The solvent was 5:4:1 1-butanol: acetic acid: water and the spots were revealed with an α-naphthol spray regent. The method was effective for 1–30 μg amounts of the individual sugars and is claimed to be particularly useful in the usually difficult separation of D-glucose from D-galactose. The latter were best separated by developing the plate twice to the 10 cm mark with intermediate drying. Silica gel G in water or 1:1 silica gel G and kieselguhr impregnated with the borate buffer gave poorer separations.

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Determination of the moisture content of crystal sugar using the DDS angle of repose measuring instrument. H. J. DELAVIER and R. KRÖCHER. *Zeitsch. Zuckerind.*, 1966, **91**, 134–136.—The instrument is based on the fact that the tangent of the natural angle of slope of crystal sugar is linearly related to the moisture content in the range 0·025–0·080%. In Denmark it has been found that this is valid for white sugar of about 0·5 mm grist. The instrument comprises a vessel with a front wall of clear transparent plastic on which is a scale of 100 $\times$ tan (angle of slope). The sugar sample, of about 320 g, is fed into the vessel through a funnel at the top until the overflow in the funnel is covered. The excess sugar is removed and the height of the sugar showing on the scale is read. The mean

of five readings is then taken and the water content read off a standard curve. Comparison of results with those obtained using a method, in which the sample is dried in a tank containing $CaCl_2$ under vacuum at 70°C for 20–30 hr to constant weight, gave satisfactory agreement in the moisture range 0·030–0·060%. Crystal size was found to have no significant effect in the range 0·75–0·30 mm. The DDS instrument is simple to use and one measurement requires about 3 min.

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Sucrose inversion in solutions at different water and acid contents. K. VUKOV. *Ind. Alim. Agric.*, 1966, **83**, 113–116.—An expression is derived for calculation of the sucrose inversion rate k_a (min^{-1}). This takes the form

$$k_a = 10^{\left(16·91 - \frac{5670}{T}\right)}.W.a_{H^+}$$

where T = absolute temperature (°K), W = water concentration (g/nl), and a_{H^+} = hydrogen ion activity, (pH = —log a_{H^+}). The relation is valid for temperatures in the range 20–130°C and pH 1–7·2 at ambient temperature and pH 1–6·3 at approx. 130°C. Equations derived from this expression permit calculation of the proportion of sucrose inverted when pH varies linearly with time and also when temperature varies linearly.

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Factory research in Hawaii. *Rpt. H.S.P.A. Expt. Sta.*, 1965, 40–44.—Investigations at Pioneer on the Silver cane diffusion plant are reported[1]. A study of the feasibility of producing high pol sugars (approx. 99·4 purity) has shown that conventional boiling systems would be adequate, although the washing and drying cycles in automatic batch centrifugals would have to be increased. Continuous machines are, however, not practical for such sugars, which must be conditioned before storage. Laboratory investigations of low-grade massecuite reheating, to determine the rate and extent of sugar dissolution at temperatures above saturation, showed that the rate is directly proportional to the difference between actual and saturation temperature. Increase in molasses purity becomes very rapid if the reheating temperature exceeds the saturation temperature by more than 5°F. Since the dissolution is generally considered to be diffusion-controlled, the rate will be influenced by molasses viscosity, so that a more viscous molasses can probably be processed at a higher temperature than a less viscous one. Although massecuite viscosity increases with crystal content, the crystal surface is also greater, so that the rate of dissolution will be higher with increased crystal content. Light-scattering studies indicate that the insoluble particles in the sugar crystal are essentially spherical with an average dia. of 1–3 μ. A significant proportion of the particles having a uniform dia-

meter of 0·3–0·4 μ is included. Fractionation of the particles revealed the presence of lipids, low M.W. substances and N- and methoxyl-containing compounds. Several polysaccharide fractions were identified, containing glucose, arabinose, galactose, and xylose units. Starch was present in only one fraction. The polysaccharides are thought to be cell wall constituents. An oligosaccharide isolated from the sugar crystal was identified as a trisaccharide, which upon hydrolysis yielded two fructose units and one glucose unit; a possible structure is proposed. A fraction having a U.V. absorption maximum at 281 mμ was found to contain more than 6 different reducing substances, some of which appear to be precursors of colouring complexes and are probably produced by thermal degradation of reducing sugars. Conductivity studies on massecuites have shown that values vary with electrode configuration. The results suggest that if the electrodes are separated by less than the minimum crystal dimension, the conductivity values for the mother liquor are approachable. The difference in conductivity between electrode spacing which is equivalent to 30–50% of crystal size (i.e. the crystal separation found in commercial massecuite), and conventional spacing may offer a means of determining crystal volume. A continuous device for juice refractometric dry solids and pol determination employs a Waters in-line refractometer and a Bendix-Ericsson automatic polarimeter. The pol % and purity are computed from the R.D.S. and pol readings by a special analogue computer. Since turbidity was found to affect the accuracy of both measurements, a sample preparation device incorporating a ceramic filter for removal of sub-micron particles was developed to provide clear juice for the two instruments. The system has been installed at the Pioneer diffusion plant. Insoluble solids in cane factory products cause R.D.S. measurements to err on the high side, so that the corresponding calculated purities are lower. The insoluble matter can be removed by filtration using a filter-aid or by centrifuging for 10 min at 18,000 g. Differences between the original and filtered or centrifuged samples vary according to the amount and type of material present. No general correlation has been found throughout the Hawaiian industry between poor filtrability and high phosphate content in sugar. Fluid amplifiers (signal-amplifying devices depending entirely on the flow of a fluid, usually air) have proved of interest for factory control applications, and a control circuit using turbulence amplifiers is being designed for a feeder table application at Ewa. It is to be installed experimentally in parallel with a conventional relay-switching system, either of the units being applicable to feeder table control. "Pan-Aid" (dioctyl sodium sulphosuccinate) was laboratory-tested and found to give no improvement in crystallization rate, pol, crystal colour or filtrability and to have no effect on molasses exhaustibility and viscosity; low-grade crystallization tests on a factory scale confirmed the laboratory tesults.

[1] *See I.S.J.*, 1966, **68**, 229–231.

UNITED STATES

Preparing L-glutamic acid. H. OKADA, K. TAKINAMI, H. TSURI and T. TSUNODA, *assrs.* AJINOMOTO CO. INC. and SANRAKU OCEAN CO. INC., of Tokyo, Japan. **3,164,531.** 12th October 1962; 5th January 1965. L-Glutamic acid-producing micro-organisms (*Brevibacterium spp.*) are cultured on fermentation media containing a carbohydrate (raw sugar, juice or molasses of beet or cane origin), a nitrogen source, and an effective amount of a non-ionic surface-active agent [a polyoxyethylene derivative of a monoester of sorbitan with a C_{12}–C_{18} fatty acid (lauric, palmitic, oleic or stearic acid), an ester of a polyhydric aliphatic alcohol with a C_{12}–C_{18} fatty acid, the alcohol having free hydroxyl groups (glyceryl monostearate, sucrose stearate, polyoxyethylene palmitate, polyoxyethylene stearate), polyoxyethylene octadecyl ether] smaller than the amount of this surface-active agent which inactivates the glutamic acid-producing enzyme in the micro-organism.

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Clarifying defecated raw sugar melt liquor. J. B. DUKE, *assr.* MINERALS & CHEMICALS PHILIPP CORP., of Menlo Park, N.J., U.S.A. **3,166,442.** 23rd May 1963; 19th January 1965.—Melt liquor is treated with lime and phosphoric acid, as for the Williamson process, to form a flocculent precipitate of calcium phosphate, and a small amount (0·1–2 lb/ton of sugar solids) added of an organic amine. A multiplicity of finely divided gas bubbles (air, CO_2) is introduced at elevated temperature (at high speed, to give a creamy appearance) and the liquor then maintained in a quiescent state at this temperature, whereby the calcium phosphate, with occluded impurities, rises as a scum and is removed. Incorporation of the amine [a water-soluble (acetate salt of a) primary fatty amine containing 7–18 (18) carbon atoms] produces a significant reduction in the colour of the clarified liquor.

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Purification of sugar juice. F. GALÉ, *assr.* DORR-OLIVER INC., of Stamford, Conn., U.S.A. **3,168,419.** 24th July 1961; 2nd February 1965.—Raw beet juice is limed and carbonatated to produce a precipitate which is separated, mixed with wash liquor to form a suspension and the latter subjected to a classification process (in a hydrocyclone) to produce a fraction containing fine particles and a fraction containing relatively coarse particles; at least part of the second fraction is returned to the liming station so that it is present when the juice is carbonatated.

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Beet thinner. H. J. THUROW, of Ault, Colo., U.S.A. **3,169,583.** 7th December 1962; 16th February 1965.

Crystal sugar tablet manufacture. J. D. RYAN and P. F. SCHUHMANN, *assrs.* AMERICAN SUGAR CO., of New York, N.Y., U.S.A. **3,169,888.** 5th March 1962; 16th February 1965.—A homogeneous mixture is prepared from 100 parts by weight of a tablet sugar, all of which will pass a 20-mesh U.S. Tyler screen (sieve analysis: 4% 20-mesh, 34% 28-mesh, 45% 35-mesh, 15% 48-mesh and 2% 65-mesh) and contains 0·8–1·5% water (0·9–1·2% water), 100 parts of a substantially moisture-free medium granulated sugar, substantially all of which will pass a 20-mesh screen (sieve analysis: 7% 10-mesh, 36% 14-mesh, 45% 20-mesh, 10% 28-mesh, 1% 35-mesh and 1% 48-mesh), and 5–30 parts of a colourless sucrose syrup of about 64°Bx. The mixture is pressed into tablet form and dried.

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Beet thinner. G. M. GUCCIONE, of Taber, Alta., Canada. **3,172,482.** 29th July 1963; 9th March 1965.

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Process for separating sugars. J. B. STARK, of Berkeley, Calif., U.S.A., *assr.* U.S. SECRETARY OF AGRICULTURE. **3,174,876.** 6th March 1963; 23rd March 1965.—Sucrose is separated from monosaccharides (glucose) in the same solution by applying the latter to an ion-exchange resin in the alkali metal salt form, substantially immediately washing the resin, collecting a first effluent fraction having an increased sucrose:monosaccharide ratio and then a second fraction having a reduced sucrose:monosaccharide ratio.

* * *

Decolorizing sugar by extracting colouring matter with a methanol solution of a hydrocarbon. B. B. BOHRER, *assr.* SUN OIL CO., of Philadelphia, Pa., U.S.A. **3,174,877.** 16th May 1963; 23rd March 1965. Solid raw sugar is contacted at 0°–100°C with a single-phase liquid mixture consisting of methanol and 0·25–30% (1–5% of) an aliphatic or *cyclo*-aliphatic hydrocarbon containing at most one double bond (containing 5–10 C atoms) and miscible in methanol to the extent of at least 0·25% (at least 1%), which extracts colouring matter from the sugar which is then separated.

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Preparation of L-glutamic acid by fermentation. T. MATSUI, Y. NISHIMURA, I. IDE, H. OKADA, I. KAMEYAMA and T. TSUNODA, *assrs.* AJINOMOTO CO. INC. and SANRAKU DISTILLERS CO. INC., of Tokyo, Japan. **3,174,908.** 6th June 1962; 23rd March 1965.—A glutamic acid-producing micro-organism (*Brevibacterium lactofermentum, Br. kawasakii, Br. divaricatum, Br. ammoniagenes, Br. saccharolyticum, Br. flavium,*

Bacillus megaterium, *B. subtilis*, *B. circularis*, *B. cereus*, *Escherichia coli*, *Micrococcus varians*) is cultured at 27–32°C on a medium containing a nitrogen source and 10–15 g/litre of a carbohydrate (glucose, sucrose, etc.) until 5–8% of the carbohydrate is consumed. An additional amount of carbohydrate (molasses, a 44–49% solution of sucrose) is added to raise the carbohydrate concentration to give a total of 20–23 g/100 ml, and culturing continued at 34°–35°C.

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Beet thinner. P. A. BEZZERIDES, of Orosi, Calif., U.S.A. **3,176,778.** 16th March 1962; 6th April 1965.

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Beet harvester digging wheel. H. C. OPPEL, of Boise, Idaho, U.S.A. **3,181,616.** 14th August 1961; 4th May 1965.

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Process for purifying sugar juices. V. SIMONI, *assr.* THE EIMCO CORP., of Salt Lake City, Utah, U.S.A. **3,182,665.** 15th February 1962; 11th May 1965. Beet juice is reacted with a lime-bearing material to effect precipitation of solid particles, and then contacted in a second reaction zone with CO_2. The resultant mixture is passed to a cyclone and separated into a first fraction, comprising juice and fine solids, and a second fraction, containing coarser solids. The second fraction is filtered while at least a part of the first fraction is returned to the liming reaction.

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Beet harvester row finder and steering mechanism. E. C. ROLLINS, of Ogden, Utah, U.S.A. **3,183,976.** 16th July 1962; 18th May 1965.

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Citric acid fermentation. L. B. LOCKWOOD and M. A. BATTI, *assrs.* MILES LABORATORIES INC., of Elkhart, Ind., U.S.A. **3,189,527.** 7th November 1963; 15th June 1965.—Citric acid is produced by submerged fermentation, with *Aspergillus niger*, of a medium prepared with organic nutrient derived from an impure source, e.g. decationized defecated cane syrup, high-test cane syrup, refined sugar/invert syrup, etc. The nutrient, while less costly than purer raw material, includes impurities in an amount effective normally to promote, during fermentation, a cellular metabolism of at least some mycelium of inferior citric acid-producing capacity. This is countered, and production of an efficient citric acid-producing mycelium favoured, by incorporation into the medium, before inoculation, of an agent toxic to the *A. niger*, but in sub-lethal concentration, this toxic agent being 3,4-xylenol, 2,6-xylenol, 2,5-xylenol, *p*-cresol, *m*-cresol, *o*-cresol, 1-naphthol, 2-naphthol, hydroquinone, resorcinol, phenol, salicylic acid, 3-hydroxy-2-naphthoic acid, 4-methylumbelliferone, *iso*-phthalic acid, phthalic acid, terephthalic acid, diphemic acid, trimesic acid, 2-anthraquinone carb-oxylic acid, 1-naphthoic acid, 2-naphthoic acid, phenyl acetic acid, benzoic acid, 1-chloronaphthalene, bromobenzene, chlorobenzene, phenylrosindulene trisulphonate, hexamethyl pararosaniline chloride, *p*-aminobenzoic acid, sulphanilamide, pyridine, tribenzylamine, dibenzylamine, gentisic acid, 2,4-dinitrophenyl hydrazine, 1-naphthalene acetic acid, cyclohexane carboxylic acid, anisaldehyde, 1-naphth-aldehyde, benzaldehyde, chlorothymol, heptamethyl pararosaniline chloride or triphenylmethane.

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Beet harvester. C. V. EVERETT and E. M. CLARK, *assrs.* INTERNATIONAL HARVESTER CO., of Chicago, Ill., U.S.A. **3,191,686.** 26th September 1962; 29th June 1965.

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Purification of sugar solutions. W. M. GROSVENOR and W. MARCY, *assrs.* AMERICAN SUGAR CO., of New York, N.Y., U.S.A. **3,194,683.** 10th July 1963; 13th July 1965.—Sugar solution is purified by sequential passage through a series of columns containing adsorbent (bone char, activated carbon or ion exchange resins). When the first of the series is exhausted, the sugar solution is directed to the second column and the adsorbent discharged from the first column. It is first passed downwardly through a sweetening-off column, against a continuous counterflow of water which removes the sugar present. The sweetened-off adsorbent is withdrawn from the bottom of this column and added to the top of a de-ashing column. It passes downwardly against a counterflow of water which removes the ash. The adsorbent is then withdrawn from the column, revivified and returned to the sugar-treatment system for further service.

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Purifying sugar solutions. K. MIHARA, T. YAMASHIKI and K. KONDO, *assrs.* ASAHI KASEI KOGYO K.K., of Osaka, Japan. **3,196,045.** 14th December 1962; 20th July 1965.—Sugar solution is passed through a column of strongly basic anion exchange resin on the OH^- cycle, and the effluent passed through a bed of weakly acidic action exchange resin on the H^+ cycle. The anion exchange resin, with adsorbed colouring matter, is sent to a column where it is treated with NaCl solution which removes the colour and converts the resin to the Cl^- form. It is then passed to a further column and treated with NaOH solution, giving a resin in the OH^- form. Part of the purified sugar solution is passed through this resin, so increasing the pH, and this solution of high pH mixed with the remainder of the sugar solution in such proportions as to give a product of pH 7–8. The OH^- form resin is then returned for service in anion exchange of the untreated sugar solution. The effluent from the column in which the resin is treated with NaOH is treated with fresh NaCl and sent to the colour de-adsorption column. The cation exchange resin is withdrawn continuously from its column and sent to a regenerating column where it is treated with mineral acid before recycling.

TRADE NOTICES

Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.

Laboratory filters. British Filters Ltd., Cox Green, Maidenhead, Berks.

The illustration shows a new all stainless steel jacketed laboratory filter designed to treat difficult fluids including thick syrups. It consists basically of two concentric cylinders with the annulus sealed at both ends. The volume of the jacket is 1½ pints (860 c.c.) and that of the inner vessel 3 pints (1770 c.c.) and two nozzles are provided on the outside to permit the introduction of steam or hot water at 20 p.s.i. max. pressure. The top of the vessel is closed by a thick plate carrying a filling funnel, pressure gauge and 3-way cock fitted with a nozzle, which provides a connexion for air or gas introduction and permits venting during filling. The filter operates at a maximum working pressure of 40 p.s.i. The bottom end of the vessel is closed by a plate carrying the outlet nozzle. The inner face of the plate is slightly concave and the filter medium support plate is located in this recess, the filter medium being trapped between the support plate and a flange on the container body. The filter medium is replaced by removing the bottom plate and support plate.

Also announced is an all-glass vertical filter press of 18–288 sq. in. filtration area suitable for clarification, polishing and sterilizing. It carries from 1 to 16 glass plates, of 5½ in (14 cm) diameter, with $\frac{3}{16}$ inches deep chambers suitable for collection of solids. A transfer plate is available for two-stage filtration.

[PUBLICATIONS RECEIVED

STAINLESS STEEL REACTORS. The Taylor Rustless Fittings Co. Ltd., Ring Rd., Lower Wortley, Leeds 12.

Product Data Bulletin No. 6 describes stainless steel reaction vessels with mild steel shell jackets, stainless steel half-coil jacket and stainless steel channel section jacket.

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"NULLMATIC" CONTROLLERS, RECORDERS AND INDICATORS. Associated Electrical Industries Ltd., Instrumentation Divn., Process Control Dept., P.O.Box 1, Harlow, Essex.

Details are given in a brochure of AEI "Nullmatic" controllers, recorders and indicators for process control systems. These pneumatic devices operate on a range of 3–15 p.s.i. and will receive signals from all types of AEI pneumatic process transmitters. A separate brochure gives details of "Nullmatic" pneumatic liquid level controllers and switches in the 2025, 2026 and 2027 Series. The 2025 is a direct level controller, the 2026 is an electric level switch with high-low indicator on the housing, while the 2027 is an electric level switch in an explosion-proof housing.

* * *

INDICATORS AND CONTROLLERS. O.B.S.A. S.p.A., Lomagna, Italy; Drayton Controls Ltd., West Drayton, Middx.

A brochure is available giving details of OBSA indication, recording and controlling instruments. The 3000 Series includes general instruments, all of which are suitable for wall or panel mounting and may be used for indicating, recording and control of pressure, vacuum, absolute pressure, temperature, level and flow, or any other variable from a 3–15 p.s.i. signal received from a transmitter. The Series 3000 indicator is available with all the measuring elements used in the other instruments in the Series and may be used to indicate the same variables, while the circular chart recorder/controller is suitable for automatic control and recording of one to two variables. With only one controlled variable it is also possible to record a further two parameters by additional pens, special charts and auxiliary direct-reading indicating scales. Also described are the 3000 circular and the 3000 strip chart recorders. Data sheets for OBSA instruments are also available.

* * *

CONTROL VALVES. Flowsheet Instruments Ltd., Oaklands House, Oaklands Drive, Sale, Cheshire; Ekkehard & Georg Exner Mess- und Regeltechnik/Apparatebau, Neuss/Rh., Quienheimerstr. 56–58, Germany.

Leaflets are available illustrating a range of various types of solenoid valves, diaphragm valves and pneumatic or electrically-operated valves, all of which are made of hard PVC.

* * *

Sugar dryers/coolers for refineries.—Five "Rotary Louvre" sugar dryers/coolers manufactured by Dunford & Elliott Process Engineering Ltd., of Surbiton, Surrey, have been ordered by the Polish organization, CEKOP, for new refineries which they are supplying.

* * *

Dorr-Oliver equipment for Okinawa cane factory.—The new 2500 t.c.d. factory being built for Hokubu Seito in Okinawa by Mitsubishi Heavy Industries includes a 22-ft dia. "RapiDorr" clarifier and an 11 ft 6 in dia. Dorr-Oliver horizontal filter. This filter will handle the press juice under-flow and recycle the filtrate to the Silver ring diffuser. The filter is claimed to effect a high degree of mud sweetening-off and give a low solids content. Four DSM screens are to be used for defibering process juice and juice from the dewatering press.

International Society of Sugar Cane Technologists

XIII CONGRESS, 1968, TAIWAN

New Cane Mechanization Section

Following on a recommendation from the XII Congress, the Administrative Executive of the XIII Congress in Taiwan have inaugurated a new Section to cover papers dealing with Mechanization of Harvesting, Loading and Transport.

The Chairman of the new Section will be Mr. NORMAN J. KING, Director of Sugar Experiment Station, 99 Gregory Terrace, Brisbane, Queensland, Australia.

Mr. KING will be communicating with workers in sugar cane countries who may be prepared to contribute papers for the new Section; and he would appreciate hearing from any potential contributors who can submit papers for presentation at the Congress.

Mechanization of harvest and transport has advanced considerably in some countries, and must be the pattern of progress in other countries in the future. The subject is one of vital concern to many industries, and the new I.S.S.C.T. section can provide the forum for technical discussions.

The deadline for submission of papers is 30th June 1967, and rules for their preparation appeared in this Journal in September 1966[1].

All papers, in triplicate, must be forwarded by the deadline date to Dr. CHEN WEI, Taiwan Sugar Experiment Station, 1 Sheng Chan Road, Tainan, Taiwan, Republic of China.

European Beet Sugar Production Estimates[2]

	1966/67	1965/66	1964/65
	(metric tons, raw value)		
WESTERN EUROPE			
Germany, West	1,975,000	1,594,600	2,181,273
Austria	315,000	240,190	339,965
Belgium	370,000	421,000	556,938
Denmark	320,000	245,887	436,508
Finland	55,000	36,300	60,987
France	1,900,000	2,395,600	2,455,344
Greece	110,000	105,319	68,867
Ireland	95,000	117,660	142,089
Italy	1,475,000	1,273,332	1,100,853
Netherlands	535,000	607,752	663,432
Spain	500,000	531,216	492,182
Sweden	242,700	201,961	305,845
Switzerland	50,000	45,795	56,965
Turkey	625,000	579,929	794,922
U.K.	960,000	956,959	1,047,496
EASTERN EUROPE			
Germany, East	790,000	672,000	818,333
Albania	15,000	12,000	15,573
Bulgaria	175,000	175,000	160,000
Czechoslovakia	980,000	720,000	1,113,580
Hungary	461,000	458,000	495,600
Poland	1,780,000	1,504,892	1,833,332
Rumania	440,000	425,000	468,220
Yugoslavia	480,000	370,629	367,903
U.S.S.R.	10,000,000	9,400,000	10,450,000
Total Europe	24,648,700	23,091,021	26,426,207

BREVITIES

New Queensland Government Office in London.—The new offices of the Queensland Government in the Strand, London, were opened on the 5th October by the Premier of Queensland, the Hon. G. F. R. NICKLIN. The Premier spoke of the building as proclaiming to the British people and to the world at large of the close and abiding links between Great Britain and Queensland and emphasized the natural resources and achievements of the State, which is large and productive, with ample room and a need for skilled immigrants. The new office is directed by the Agent-General for Queensland, Dr. W. A. T. SUMMERVILLE, LL.D., D.SC., who transacts the business of the Queensland Government in London, including the representing of Australia at negotiations and meetings in relation to the Commonwealth Sugar Agreement and the International Sugar Agreement, Queensland producing 94% of Australia's sugar.

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Trinidad 1966 sugar crop[3].—At the close of grinding operations, the 1966 crop had yielded 209,718 tons, which is 40,868 tons less than the record production of 1965. Adverse weather conditions, which caused heavy losses of cane, and the low sugar content of the cane reaped were the factors basically responsible for the setback in production.

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Czechoslovakia-Greece trade agreement[4].—Under a trade agreement reached between Greece and Czechoslovakia, to cover the period July 1966–June 1967, Czechoslovakia is to supply refined sugar to a value of up to $1,000,000 to Greece.

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Zambian sugar project[5].—The Zambian Sugar Company, part of the Tate & Lyle Group, has raised £2,000,000 in equity capital to establish a sugar estate 100 miles south of Lusaka at Nkambala on the banks of the Kafue river, where a factory is to be built for producing raw sugar. The Zambian Government provided £250,000 of the capital and it is reported that Tate & Lyle plan to raise £5,500,000 to complete the capitalization of the project in the next few months. The first sugar is expected to be produced at the Nkambala estate in October and it is hoped that by the middle of 1968 production will go up to 30,000 tons a year which should be sufficient to meet all Zambia's needs. The new project is in addition to the £250,000 sugar refinery 200 miles north of Lusaka at Ndola.

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Chile sugar expansion[6].—Industria Azucarera Nacional S.A. (IANSA) has announced that its beet sugar factory at Cocharcas in the Province of Nuble is to begin production next year. It is planned to instal new plants in the Provinces of Valdivia and Curicò by 1970, when it is hoped to meet 80% of local demend for refined sugar.

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Congo (Brazzaville) sugar factory[7].—The new cane sugar factory[8] was inaugurated on the 21st July by the President of the Republic. The factory is located at Jacob on the railway line from Brazzaville to the port of Pointe-Noire, and will produce eventually 100,000 metric tons of sugar per year, tripling the sugar output of the Congo. The factory will be the second largest in Africa and has required a total investment of 450m francs. It will employ more than 8000 workers. Molasses storage tanks are to be built at the port of Pointe-Noire, the finance being provided by the Société Sucrière du Niari, owners of the sugar factory.

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East German sugar factory for Syria[9].—An economic aid agreement was signed recently by the governments of Syria and East Germany. Among the projects provided for under the terms of the agreement, East Germany has undertaken to supply Syria with a sugar factory.

[1] *I.S.J.*, 1966, **68**, 286–7.
[2] F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (26), 1.
[3] *Overseas Review* (Barclays D.C.O.), September 1966, p. 69.
[4] F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (26), 10.
[5] *Commonwealth Producer*, 1966, (415), 137.
[6] *Fortnightly Review* (Bank of London & S. America Ltd.), 1966, **31**, 542.
[7] *Agence France-Presse*, 23rd July 1966.
[8] *I.S.J.*, 1965, **67**, 32, 127.
[9] C. Czarnikow Ltd., *Sugar Review*, 1966, (785), 197.

BREVITIES

Guyana sugar crop, 1965.—The Guyana Sugar Producers' Association has recently released data on the 1965 sugar crop. Total sugar cane ground amounted to 3,405,046 tons, as against 3,002,979 tons in 1964, yielding 309,445 tons of sugar compared with 258,378 tons in 1964. Recovery was equivalent to 10·77 tons of cane per ton of 96° sugar in 1965, as against 11·40 tons in the previous year, and yield per acre was 2·97 tons of 96° sugar as compared with 2·78 tons in 1964.

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The Canadian Sugar Institute.—The Board of Directors of the Canadian Sugar Institute recently announced in Montreal the election of officers and the appointment of Mr. JOHN T. J. SWEENEY as permanent executive secretary, subsequent to receiving a Dominion charter earlier this year. The Institute is a non-profit association of cane sugar refining and beet sugar manufacturing companies, established along the lines of similar industrial organizations.

* * *

Paraguay export promotion[1].—Under the terms of a resolution approved recently by the authorities in Paraguay, a fund has been set up for the promotion of sugar exports. Following the record production of 48,267 tons for the 1964/65 crop, surpluses accumulated which the domestic market was unable to absorb, and it is hoped to reduce this excess by exporting a total of 12,500 tons of sugar during the course of the 1966/67 campaign. The same resolution, according to the Bank of London and South America Ltd., also sets a limit of 40,000 metric tons of sugar to be produced during the 1966/67 season, with compares with an actual figure of 35,040 tons produced during 1965/66.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at* 17*th October* 1966)   s d

Anglo-Ceylon (5s)	4/10½
Antigua Sugar Factory (£1)	6/3
Booker Bros. (10s)	17/9
British Sugar Corp. Ltd. (£1)	21/10½
Caroni Ord. (2s)	1/6
Caroni 6% Cum. Pref. (£1) ..	14/- (x.d.)
Demerara Co. (Holdings) Ltd.	2/6
Distillers Co. Ltd. (10s units)	19/3
Gledhow Chaka's Kraal (R1)	13/9
Hulett & Sons (R1)	11/10½
Jamaica Sugar Estates Ltd. (5s units) ..	3/9
Leach's Argentine (10s units)	11/-
Manbré & Garton Ltd. (10s)	27/6
Reynolds Bros. (R1)	16/3
St. Kitts (London) Ltd. (£1)	15/-
Sena Sugar Estates Ltd. (5s)	9/3
Tate & Lyle Ltd. (£1)	26/3
Trinidad Sugar (5s stock units)	1/9
West Indies Sugar Co. Ltd. (£1)	7/6

CLOSING MIDDLE

New York Stocks (*at* 15*th October* 1966) $

American Crystal ($5)	14⅜
Amer. Sugar Ref. Co. ($12.50)	23½
Central Aguirre ($5)	25¾
Great Western Sugar Co.	37⅜
North American Ind. ($10)	10⅝
South P.R. Sugar Co.	18¼
United Fruit Co.	32⅝

Indian sugar factories[2].—The State Government of Andhra, India, is reported to be proposing to set up 13 new sugar factories, 8 of them to be cooperatives. The Government is also taking steps to double the production of cane. Another mill is to be set up in the Zira sub-division of Punjab state.

* * *

New sugar factory for Rumania[3].—One of the country's largest sugar factories is presently under construction near Oradea. The cost of this factory, which will have a capacity of 58,000 tons of sugar per year, will amount to some 345 million lei. Cultivation of sugar beet in the region is to be considerably extended in order to secure the supply of sufficient raw material for the factory.

* * *

Honduras sugar factory plans[4].—It is reported by the Bank of London and South America Ltd. that application has been made to the authorities in Honduras for permission to erect a sugar mill in the Choluteca area. The daily crushing capacity of the new mill is planned eventually to reach 1800 tons of cane. In addition, a new cane sugar factory is already under construction near San Pedro Sula in northern Honduras[5]. The initial daily crushing capacity of this mill is reported to be 3000 tons of cane, although this is expected to be increased to 6000 tons by 1968.

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Russian sugar crop prospects[6].—At a session of the Council of Ministers of the R.S.F.S.R. it was recently announced that crop prospects for the 1966 campaign are good. However, at several sugar factories repairs have not yet been completed and many places are not yet ready for beet deliveries which are, moreover, to commence earlier than usual this year. Six new sugar factories are being put into operation this year in the R.S.F.S.R.

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Bagasse newsprint plant for India[7].—The first cooperative newsprint-cum-paper factory in India is to be set up soon at Sangli in Maharashtra, with an initial capacity of 100 tons per day, to be raised eventually to 300 tons. The project has been sponsored by the Sangli, Warana, Kopargaon and Panchganga cooperative sugar factories which are to supply the bagasse to be used as raw material.

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Cane payment in Brazil[8].—New legislation has been passed in Brazil, according to which sugar cane will in future be paid for on the basis of sugar content instead of only the delivered weight.

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Bagasse pulp for rayon manufacture[9].—A process has been evolved at the Cuban Institute for Research on Sugar Cane By-products (ICIDCA) whereby bagasse is converted into pulp suitable as raw material for the Gonzalo de Quesada rayon plant in the city of Matanzas, where high quality rayon has been produced from bagasse pulp in the Technology Department.

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Jamaican sugar production, 1966.—Final production figures for the 1966 crop in Jamaica amounted to 482,377·7 tons, or 23,970·5 tons less than the 1965 crop[10]. The average yield was equivalent to 9·98 tons of cane per ton of 96° sugar, as compared with 9·18 tons in the 1965 crop. The estimated total crop for 1967 is 514,300 tons.

[1] C. Czarnikow Ltd., *Sugar Review*, 1966, (776), 154.
[2] *Indian Sugar*, 1966, **16**, 241.
[3] F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (23), 13.
[4] C. Czarnikow Ltd., *Sugar Review*, 1966, (775), 151.
[5] *ibid.*, (777), 159.
[6] F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (23), 13.
[7] *Indian Sugar*, 1966, **16**, 241.
[8] F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (23), 18.
[9] *Cuba Economic News*, 1966, **2**, (12), 14.
[10] *Willett & Gray*, 1966, **90**, 406.