International Sugar Journal

VOL. 68 *June 1966* No. 810

Published by
The International Sugar Journal Ltd.
23a Easton Street, High Wycombe,
Bucks.
Telephone: High Wycombe 29408
Cable: Sugaphilos, High Wycombe

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THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXVIII JUNE 1966 No. 810

NOTES AND COMMENTS

Sugar price improvement measures.

The International Sugar Council Exporters' Group met on 12–13th May for the second review of their scheme[1].

The Group considered the developments in the market since its meeting on 5–6th April and noted the considerable reduction in the volume of sugar in second hands. They received a report from the Marketing Advisory Committee on certain significant transactions that had been reported as having taken place outside the terms of the scheme. After having discussed these transaction with members concerned, the Group concluded that some of these reported transactions were entirely within the terms of the scheme and that, because of their special nature, some others had not had the effect of jeopardising the scheme. The Group also noted the existence of certain trade agreements and *bona fide* commercial contracts concluded before 4th March 1966 and that the scheme is intended to operate in consonance with such trading arrangements. Stress was laid on the need for prompt and precise information about any special conditions that might apply to individual transactions and the procedure for notification was agreed upon.

The Group agreed to meet to conduct a further review of the scheme in June, by which time it would be aware of the outcome of the meeting of the Sugar Consultative Group convened later in May by the Secretary General of UNCTAD to consider the next steps in the preparation of a new International Sugar Agreement.

* * *

Sugar stocks and the world market situation.

In a recent article, C. Czarnikow Ltd. have pointed out a way in which sugar importers might relieve the burden on sugar exporters and perhaps help raise world prices from their present depressed levels[2].

"During the past several months countries which are members of the International Sugar Agreement have been actively engaged in exploring measures aimed at raising sugar prices from the present very low levels. Discussions have covered both short and long-term schemes and there has been a common element of agreement that it is in the interest of all concerned to improve upon the prevailing conditions as soon as possible.

"Exporters are taking joint action and this is meeting with some modest success, but they are unlikely to attain their full objectives without an increase in the rôle presently being played by importers.

"There are many ways in which the latter may help. Some of the major importers are already giving a guaranteed return in line with production costs, but obviously any undertaking on the part of others not to buy at below an agreed price would be of assistance. Another way of strengthening the market would be for importers to guarantee to limit their purchases to producers who are taking part in joint efforts to improve prices. Most of all, however, we believe importers could help by releasing the pent-up pressure now being exerted on producers by reason of their current very heavy levels of stocks. We have examined the latest edition of the International Sugar Council's *Statistical Bulletin*[3] and have compared recent stock levels, where these are shown, with those in existence one year earlier. Taking as a group the twelve most important importing countries for which up-to-date details are given we find stock levels have remained almost unchanged during the twelve months' period. On the other hand stocks held in the twelve major exporting countries have risen by no less than 57%.

"This is the factor which is having the greatest depressing effect on the market. Warehouses in producing countries have to be emptied so that they can accommodate new season's output and this frequently results in the sugar being sold to trade houses at very low prices.

"If importers could shoulder some of the stock burden—perhaps in return for suitable safeguards in respect of production levels—it would ease the pressure on exporters to a corresponding extent. The realization that exporters had been released from their physical storage problems would surely encourage the market; indeed, in that the value of the stocks transferred to importers would also rise in value, such a measure might eventually turn out to be enlightened self-help!

[1] See *I.S.J.*, 1966, **68**, 129.
[2] *Sugar Review*, 1966, (762), 87.
[3] 1966, (3).

"The greatest difficulty in the way of action of this type is the growing tightening in credit facilities. Governments of many of the more highly developed countries have in recent years imposed financial restrictions which will hinder if not prevent refineries from establishing stocks above immediate requirements. Those who have the interest of sugar at heart might argue that a special case could be made for our commodity; it remains to be seen whether national governments will see the situation as we do but it would not be unreasonable if exporting countries were to look to the importers for some such indication of their desire to help when they meet for the UNCTAD discussions in Geneva in May."

* * *

Tate & Lyle/Raffinerie Tirlemontoise link.

Formalizing a 40 years-old relationship, the Tate & Lyle Group have established with Raffinerie Tirlemontoise S.A. a new company, European Sugars S.A., registered in Brussels with an initial capital of 150,000 Belgian Francs. This is the first step by the British firm into the Common Market and it expects to benefit strongly by integration of the U.K. into the E.E.C., hopes for which have improved of recent months.

Tate & Lyle Ltd., the largest British refiner, holds two-thirds of the capital while Raffinerie Tirlemontoise S.A., Belgium's biggest sugar company, holds the balance. Technical experts from both Companies are to examine possibilities for increased cooperation in production and marketing.

* * *

European beet area estimates, 1966.

In previous years, the German sugar statisticians, F. O. Licht K.G., have not published their first estimates of the European beet area until the second half of April. In response to requests for these estimates as early as possible, they have been published as at the 31st March[1]. Licht emphasizes, however, that in certain countries, final decisions had not been taken at that date as to the areas to be sown and other factors might affect areas planned but not yet sown, so that the earlier estimate is more likely to require correction than a later estimate.

The figures appear elsewhere in this issue; the grand total for Europe is only slightly less than for 1965, at 7,320,560 hectares against 7,331,100. However, this small difference masks a 20% reduction for France from 358,000 to 280,000 ha which is almost balanced by the smaller increases and decreases in other countries. It would be possible for a change in the area devoted to beets in the U.S.S.R. to change the total area picture completely, since the 4,200,000 ha of the Soviet Union is well over half the European total. In the absence of official figures for 1966, however, Licht has set the estimate for this year at the same level as for 1965.

U.S. sugar quotas, 1966[2].

The U.S. Dept. of Agriculture announced on the 8th April that the 1966 sugar requirements were increased by 200,000 short tons, raw value, to 10,000,000 tons. At the same time, the Honduras quota of 4439 tons was reallocated to other countries of the Central American Common Market. Of the 200,000 tons increase, Hawaii received 63,474 tons and the balance went to foreign countries as tabulated below. When the lower total requirements figure was set in December 1965, true requirements were estimated at 10,100,000 tons but the quota was set 300,000 tons lower as a means of maintaining sugar prices in line with the objectives of the U.S. Sugar Act at a level which would protect the domestic sugar industry.

Area	*Quota increase or decrease* (*short tons, raw value*)	*Current quota*
Domestic beet	—	3,025,000
Mainland cane	—	1,100,000
Hawaii	+ 63,474	1,173,474
Puerto Rico	—	1,140,000
Virgin Islands	—	15,000
Philippines	+ 21,720	1,082,580
Argentina	+ 2,143	45,877
Australia	+ 8,265	177,019
Bolivia	+ 207	4,439
Brazil	+ 17,415	372,933
British Honduras	+ 508	10,853
British West Indies	+ 6,956	148,976
Colombia	+ 1,843	39,463
Costa Rica	+ 3,332	45,186
Dominican Republic	+ 17,415	372,933
Ecuador	+ 2,534	54,263
Fiji	+ 1,814	38,846
French West Indies	+ 2,188	46,863
Guatemala	+ 2,809	38,078
Haiti	+ 967	20,718
Honduras	— 4,232	0
India	+ 3,306	70,808
Ireland	—	5,351
Malagasy Republic	+ 390	8,359
Mauritius	+ 759	16,227
Mexico	+ 17,805	381,318
Nicaragua	+ 3,332	45,186
Panama	+ 1,290	27,624
Peru	+ 13,889	297,458
El Salvador	+ 2,060	27,924
South Africa	+ 2,434	52,122
Swaziland	+ 298	6,392
Taiwan	+ 3,444	73,758
Thailand	+ 759	15,468
Venezuela	+ 876	18,745
	+ 200,000	10,000,000

West Germany sugar crop, 1965/66[3].—In the 1965/66 campaign deliveries of beets totalled 10,435,548 metric tons, harvested from 293,113 hectares. The corresponding figures in the 1964/65 campaign were 13,471,006 tons of beets from 330,231 hectares. Sugar content was lower at 15·76% as against 16·83% in 1964/65, and total sugar production, as refined sugar, raw sugar and syrup, amounted to 1,417,715 metric tons, refined value, compared with 1,947,009 tons in the previous campaign. Extraction was 13·69%, refined value, as against 14·39%.

[1] *International Sugar Rpt.*, 1966, **98**, (10), 1–4, 18.
[2] *Lamborn*, 1966, **44**, 57–58.
[3] F. O. Licht, *International Sugar Rpt.*, 1966, **98**,(5), 5.

TUBE SPACING IN HEATING APPARATUS

By L. A. TROMP, A.M.I.Mech.E.

PART I

VERTICAL tube arrangement is standard practice for heaters, evaporators and vacuum pans in the sugar industry and normally as many tubes are accommodated as the area of the tube sheets will allow with reasonable spacing.

Less attention has been paid, however, to the steam flow through the lanes within the bank of tubes and there is, in fact, no provision for a definite flow in most designs of tube spacing.

It is nevertheless understood that the principal object of the steam flow is to direct the incondensable gases towards the vents for these, which are generally arranged opposite the steam admission into the calandria or shell.

Although decreasing towards the end of the pass of travel, there is always a small flow through the gas venting pipes. The term "dead-end" adapted for non-compounded apparatus therefore does not apply exactly.

Because of uncertain flow of the steam between the tube rows, it may happen that incondensable gases are not pushed to the gas outlets and remain partly within the calandria, which reduces the heat transmission.

In general the heat transmission, here considered for evaporating apparatus, is subject to various conditions, such as the temperature of the heating steam, removal of condensate and incondensable gases, kind of metal and thickness of the tube walls, incrustations, Brix of the juice, juice level, steam flow, inert spaces and tube spacing; the effects of these conditions cannot be observed separately because of the difficulty of obtaining simultaneous data.

Authors such as CLAASSEN[1] have stressed the point that a steady flow of steam will improve the heat transmission, and others, including TEN BOSCH[2], HAUSBRAND[3] and NUSSELT[4], have observed that the heat transmission may vary in approximate proportion to the square of the steam velocity, while HONIG[5] does not pay attention to this steam velocity.

In evaporators where the juice rises inside the tubes with film formation, the heat transmission at the upper end of the tubes is greater than at the bottom end owing to the increased velocity of the juice/vapour mixture. The larger part of the heating steam therefore should be admitted at the upper end of the calandria.

Moreover it is interesting to note that in the design of surface condensers for steam turbine plants, novel alterations to the tube spacing have been applied by some designers, such as DELAS, STALL, WORTHINGTON, etc. who have departed from the conventional standard of accommodating the maximum number of tubes inside the shell confines so as to obtain a better steam flow to the total cooling surface for better heat transmission.

Notwithstanding the horizontal arrangement of the tubes in surface condensers, the inherent purpose of obtaining better cooling results is undeniable.

In this treatise we shall consider, by way of example, tubes of 32/35 mm (1·26/1·38 in) and a pitch of 47 mm (1·85 in) with a tube length between the tube sheets of 2300 mm (7 ft 6·55 in) within a calandria diameter of 2600 mm (8 ft 6·36 in).

The liberal pitch of 1·34 times the tube diameter is for better steam flow and increased tube sheet strength, the normal multiplication factor being around 1·3.

With reference to the bending or sagging strength of a tube sheet, it is proportional to the square of the tube plate thickness and to the distance between two adjacent tube holes, which are of a slightly larger diameter than the tubes for easy insertion.

Through the expansion of the tubes in the tube holes, the material around the latter is pre-stressed and its resistance against cracking reduced.

A more positive pushing of the incondensables towards the gas vents and a more lively steam flow is desirable so as to avoid near-stagnation at the end of the steam path.

INVOLUTE CONCENTRIC TUBE SPACING

To the best of the author's knowledge, involute tube spacing has not been applied in heating apparatus, although its advantages may be manifest.

This design is shown in Fig. 1 for the proposed shell diameter with the tubes arranged in 48 rows of 42 tubes each, having steam lanes of 12 mm from the outside periphery towards the downtake.

Although the heating surface on the inside of the tubes is 466 sq.m. (5020 sq.ft.), i.e. about 90% of the maximum obtainable for the rhombic tube spacing, as shown later in this paper, the following advantages obtain:

1. The steam lanes are continuously curved and equidistant, giving easy access to all the tubes in the same way.

2. The steam path length is about 75% of the conventional design with zig-zag flow.

[1] "Verdampfen und Verdampfer mit senkrechten Heizrohren." 1939, p. 74–76.

[2] Die Wärme-Übertragung, 1929, p. 107–110.

[3] Verdampfen, Kondensieren und Kühlen, 1918, p. 103.

[4] *Z.V.D.I.*, 1916, 570.

[5] Principles of Sugar Technology, Vol. II (Elsevier, Amsterdam). 1963, p. 50 *et seq.*

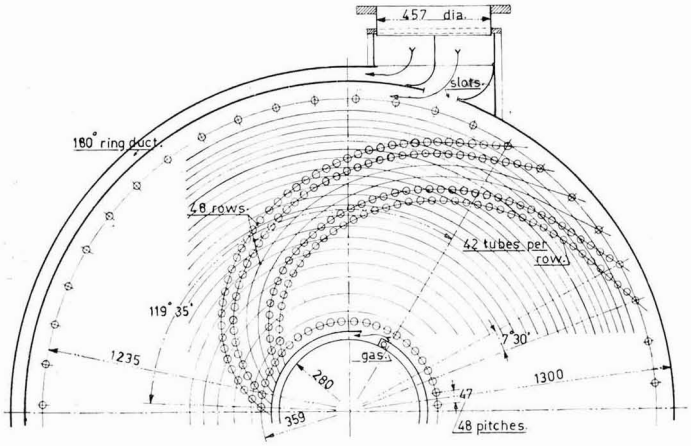

Fig. 1. Involute concentric (asymmetrical) tube spacing. Number of tubes = 2016; heating surface = 466 sq.m.; steam pass length = 1930 mm.

3. The heating steam is admitted through two opposed inlets on the shell periphery and enters all the steam lanes tangentially in the same way.

4. An increased velocity of flow of the steam is induced by the concentric whirl especially around the downtake, where normally the lowest steam velocities prevail.

5. Condensate and incondensable gases are forcibly and positively guided towards the downtake.

6. The marking or tracing of the tube centres for drilling is facilitated by means of a template for one row of tubes, gyrated around the tube plate centre after dividing the outer pitch circle into 48 pitches.

The withdrawal of condensate and gases around the downtake is similar to many of the present-day designs.

For the sake of convenience, the involute has been replaced by segments of circles and a tangential straight line at the outer periphery.

Other tube spacings are treated hereafter for comparison.

Rhombic Tube Spacing

This is the most usual spacing for heaters, evaporators and vacuum pans as shown in Fig. 2, the basic configuration being a rhombus composed of two equilateral triangles, having 60° angles between the sides.

Pitches are equal in all three directions, which means that there is no more compact arrangement possible.

Within the proposed shell diameter of 2600 mm, there can be located 2250 tubes, resulting in a heating surface of 520 sq.m. (5600 sq.ft.), the tube sheets and downtake surface being neglected.

There are 22 lanes between the tubes on each half of the calandria with a mean steam path length of about 2·60 m (8 ft 6 in), the outside lanes being longer than the ones closer to the downtake.

Incondensable gases as well as condensate are withdrawn on the side of the calandria opposite the point of steam admission, both withdrawal ports being on the shell of the calandria to avoid piping inside the evaporator.

When entering the 44 lanes between the tubes and assuming that the steam is equally distributed (which may or may not be true), the steam velocity is only about 13% of that in the arbitrarily chosen inlet pipe of 457 mm (18 in) diameter.

For the sake of simplicity, the steam inlet is drawn as a butt welded piece of pipe on the calandria shell omitting a steam chest or similar detail.

Steam flow through rhombic tube spacing

When not hampered, the steam flow will follow the path of least resistance, i.e. in a snake-line fashion as shown in Fig. 3, although in actual performance

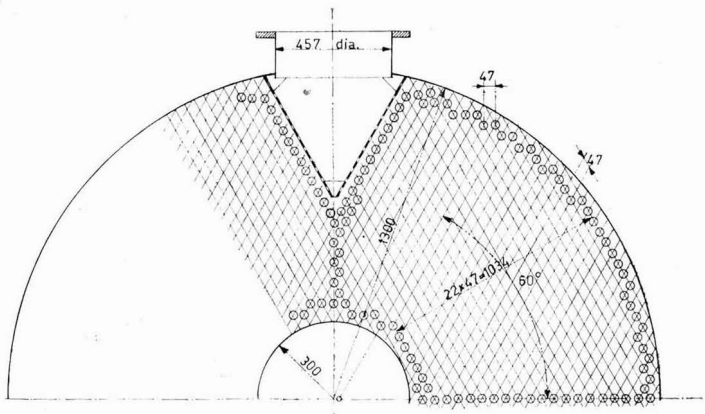

Fig. 2. Rhombic (symmetrical) tube spacing. Number of tubes = 2250; heating surface = 520 sq.m.

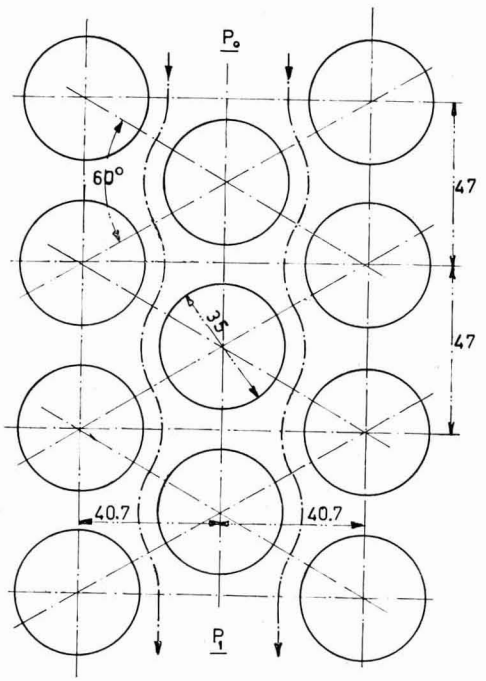

Fig. 3. Steam flow through rhombic tube spacing

of the evaporator the real course cannot be observed visually and may depart from the assumed one.

Obviously the inlet pressure P_0 must be slightly higher than P_i at the end of the path and the longer the latter, the greater will be the difference.

Behind each tube in the direction of flow there is a space which does not partake in the steam flow and where eddy currents will prevail, which several authors consider to be effective in heat transmission. These eddy currents are produced by and depend upon the velocity of the steam flow in the lanes between the tubes.

PENDENNIS WALLIS[6] carried out an experiment by guiding a water current containing aluminium dust through a bank of tubes; by photography he observed that a flow without eddy currents, which therefore contacts most of the periphery of the tubes, takes place only at a very low velocity of flow, about 3 cm/sec depending upon the relation between the tube diameter and the longitudinal and transversal pitches.

Because such a velocity of the heating steam prevails only at the very end of the steam path, eddy currents between successive tubes may thus be assumed to occur.

QUADRANGULAR TUBE SPACING

Quadrangular tube spacing is seldom to be found in evaporators but it is still applied in juice heaters.

In Fig. 4 this spacing is shown for an evaporator. Its advantage is that the lanes for passage of steam are equidistant in both perpendicular directions and the resistance to steam flow is less than with rhombic spacing.

Assuming the calandria diameter of 2600 mm, 2063 tubes can be located therein; these have a heating surface of 479 sq.m. (5150 sq.ft.), or 92% of that depicted in Fig. 2.

The mean length of the steam path between the tubes is about equal to that with rhombic spacing, but the zig-zag flow of the latter does not apply.

Condensate and gases are withdrawn opposite the steam entrance into the calandria, as is usually done for calandria shells with a single steam admission port.

Tube sheets are always drilled in pairs, but contrarily to the involute spacing, a template for a section or tube row cannot be used here and all the tube centres must be marked by tracing the complete pitch lay-out on the tube sheet.

At the steam entrance side there is a better defined steam flow than with the rhombic spacing, but after passing the centre line of the calandria, the flow becomes random.

(To be continued)

[6] *Proc. Inst. Mech. Eng.*, 1939, 379.

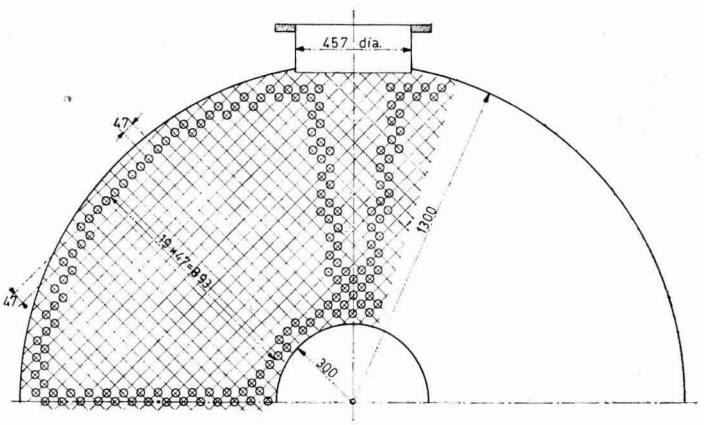

Fig. 4. Quadrangular (symmetrical) tube spacing. Number of tubes = 2063; heating surface = 479 sq.m.

EFFECT OF SOME VARIABLES ON THE QUALITY OF CRYSTALLIZED SUCROSE

By TOSHIO MORITSUGU and JOHN H. PAYNE

(Experiment Station, Hawaiian Sugar Planters' Association, Honolulu, Hawaii, U.S.A.)

Paper presented to the 12th Congress I.S.S.C.T., 1965.

INTRODUCTION

THIS paper concerns one phase in the general investigation of the sugar quality programme at the Experiment Station of the Hawaiian Sugar Planters' Association. It considers some of the more important variables which affect the quality of the crystallized sugar. Those studied during sucrose recrystallization were circulation, salt concentration, supersaturation, temperature, and crystal size. The effect of recrystallization on crystal quality has also been investigated.

PROCEDURES

Effect of circulation

A simple laboratory crystallizer was constructed for studying the effect of speed of circulation upon the rate of sucrose crystallization and upon the amount of salts included in the crystal. Agitation speeds of 250, 500, and 750 r.p.m. were realized with a folding propeller paddle driven by a variable-speed motor stirrer. In general, a weighed amount of granulated seed sugar was added to 650–660 g of syrup and crystallization continued at the specified temperature for a prescribed time. The sucrose crystals were washed with saturated sucrose syrup, dimethylformamide, methanol and ether, and then dried under vacuum. The screened sucrose fractions (expressed in Tyler screen classification) were analysed for salt content by conductivity measurement. Crystals from factory syrup were also analysed for colour. The crystallization rates were determined[1] by following the weight increase of ten sucrose crystals during crystallization under the various agitation speeds.

Effect of salt concentration and supersaturation

In studying the effect of salt concentration upon the amount of salt included in the sucrose crystal, the crystallization apparatus described in an earlier publication[1] was employed. The effect of increasing supersaturation, and hence crystallization rate, upon the amount of potassium chloride, sodium chloride and calcium chloride included in the sucrose crystal was also examined with this crystallizer. This effect was also studied for plantation syrups by (a) crystallizing sugars from syrups of a constant concentration but at different temperatures, and (b) crystallizing sugars from syrups of different concentrations but at the same temperature.

Effect of recrystallization and temperature

The effect of recrystallization of commercial and low-grade sugars was investigated in a laboratory vacuum pan. This pan was also utilized in studying the effect of temperature of crystallization on the crystal quality during factory syrup boiling. Except for the temperature controller and indicator, the laboratory vacuum pan was essentially the same as that described previously[2]. The temperature in the pan throughout the boiling process was sensed by a thermistor and controlled by a solenoid valve on the steam line to the heating coil. Feed also was controlled by a solenoid valve. An external water bath also aided in supplying and maintaining heat to the pan. The mechanical stirrer was set at a constant speed of 100 r.p.m.

The boiling scheme was generally the same for the various runs. Syrups were evaporated down at a constant vacuum to a fixed boiling-point elevation before a definite amount of ball-mill seed slurry in isopropyl alcohol was introduced. Boiling was continued at this B.P.E. for a prescribed time. This massecuite served as "cuts" for the subsequent strikes. A strike was started on a portion of "cut" mingled with the supersaturated syrup and completed on syrup feed only. This technique permitted the natural drop in purity without boiling any lower purity molasses back into the strikes.

EXPERIMENTAL RESULTS

Effect of circulation upon the rate of crystallization and salts included in the sucrose crystal

The rates of crystallization from sucrose solutions containing the various salts at three levels of agitation are shown in Table Ia. The extent of salt inclusion in the crystals when 650-g aliquots of supersaturated solutions were seeded with 2 g of (— 48 + 60)-mesh* granulated sugar and crystallized at 40·3°C for 24 hours is also shown in Table Ia.

This study was extended to factory evaporator syrup in which 660-g samples of syrup seeded with 5 g of (— 60 + 80)-mesh granulated sugar were crystallized by gradually dropping the temperatures from 73 to 31·5°C in 24 hours. The results showing the specific conductance and crystal colour of crystals obtained at the two agitation speeds of 250 and 500 r.p.m. are tabulated in Table Ib.

[1] MORITSUGU: *Proc. 10th Congr. I.S.S.C.T.*, 1959, 315–323; *I.S.J.*, 1961, **63**, 120.

[2] MORITSUGU and IWATA: *Rpts. 19th Meeting Hawaiian Sugar Tech.*, 1960, 131–135; *I.S.J.*, 1962, **64**, 52.

* (— 48 + 60)-mesh indicates crystals passing through 48-mesh but trapped by 60-mesh sieves.

Table Ia

Effect of circulation on the rate of sucrose crystallization and on the amount of salt included in the sucrose crystal

Stirrer speed (r.p.m.)	Crystallization rate (mg/sq.m./min)	Salt in crystals: —14 + 16 mesh (p.p.m.)	— 16 + 20 mesh (p.p.m.)	— 20 + 28 mesh (p.p.m.)	— 28 + 35 mesh (p.p.m.)
(a) Sucrose-KCl solutions: 5·00% KCl, 259·8 g sucrose per 100 g water					
*	539	51	48	45	29
250	727	—	39	29	27
500	802	40	32	27	25
750	†	43	28	25	37
(b) Sucrose-NaCl solutions: 4·00% NaCl, 253·5 g sucrose per 100 g water					
*	651	52	38	26	23
250	721	—	35	22	21
500	838	39	27	21	18
750	†	49	26	19	19
(c) Sucrose-$CaCl_2$ Solutions: 4·47% $CaCl_2$, 227·8 g sucrose per 100 g water					
*	586	—	—	36	30
250	688	—	—	26	20
500	780	37	27	22	19
750	†	44	30	21	19

* Results from crystallization without a stirrer, in which the flask[1] was rotated at 3 r.p.m.

† Although the final crystals were larger than those for 500 r.p.m., the rate values were not calculated since, at 750 r.p.m., the crystal edges were chipped off by the stirrer and the walls of the flask.

Table Ib

Effect of circulation on the crystal quality of sugar crystallized from factory syrup

Stirrer speed (r.p.m.)	Syrup and Molasses: Ref. solids Initial	Ref. solids Final	Ref. pol purity Initial	Ref. pol purity Final	Crystal: Spec. conductance (micromho†)	Crystal colour ($a^*_{420} \times 10$)
250	80·6	73·2	84·9	78·2	3·5	1·5
500	80·6	73·3	84·9	78·0	3·1	1·2

† 5 g of washed sugar dissolved in distilled water and made up to 100 ml.

Table IIa

Effect of salt concentration upon the amount of potassium chloride included in the sucrose crystal

Syrup concentration: KCl (%)	Syrup concentration: Sucrose (g/100 g water)	Crystallization rate (mg/sq.m./min)	KCl in crystals: (— 14 + 16) -mesh (p.p.m.)	(— 20 + 28) -mesh (p.p.m.)	(— 35 + 48) -mesh (p.p.m.)
1·00	250·1	536	9	—	—
3·00	254·6	582	18	15	9
4·00	257·4	588	29	23	20
5·00	259·8	539	34	26	35

Table IIb

Crystal quality of sugar from two strikes crystallized from factory syrup

Strike	Syrup and molasses: Ref. solids Initial	Ref. solids Final	Ref. pol purity Initial	Ref. pol purity Final	Crystal: Spec. conductance (micromho†)	Crystal colour ($a^*_{420} \times 10$)
1st	80·6	73·2	84·9	78·2	3·5	1·5
2nd	83·0	76·4	78·6	68·2	4·0	2·3

† 5 g of washed sugar dissolved in distilled water and made up to 100 ml.

Table IIIa

Salt inclusion in the sucrose crystal as influenced by supersaturation

Syrup concentration: Salt (%)	Syrup concentration: Sucrose (g/100 g water)	Crystallization rate (mg/sq.m./min)	Salt in crystals: (— 14 + 16) -mesh (p.p.m.)	(— 16 + 20) -mesh (p.p.m.)	(— 20 + 28) -mesh (p.p.m.)	(— 28 + 35) -mesh (p.p.m.)	(— 35 + 48) -mesh (p.p.m.)
(a) Sucrose-KCl solutions							
5·00	259·8	539	34	—	26	—	35
4·95	263·6	709	67	—	45	—	—
4·91	267·3	807	83	—	55	—	54
(b) Sucrose-NaCl solutions							
4·05	249·7	485	25	22	19	—	—
4·00	253·5	651	38	28	24	24	—
(c) Sucrose-$CaCl_2$ solutions							
4·52	224·0	423	33	26	25	—	—
4·47	227·8	586	52	39	35	—	—

Effect of salt concentration upon the amount of inclusion in the sugar crystal

Several supersaturated sucrose solutions (1·074) containing 1·00, 3·00, 4·00, and 5·00% potassium chloride were prepared according to the solubility values of WISE and NICHOLSON[3]. The crystallization rates in these supersaturated solutions were determined as described previously[1]. Table IIa shows the amount of potassium chloride included in the crystal when these sucrose solutions (650 g) were seeded with 1 g of (— 40 + 60)-mesh granulated sugar and crystallization contained at 40·3°C for 48 hours.

Two strikes of sugar were crystallized from 660 g of concentrated factory syrup by first seeding with 5 g of (— 60 + 80)-mesh granulated sugar and dropping the temperature from 73 to 31·5°C in 24 hours. The resulting molasses was concentrated, seeded, and crystallized in a similar manner. Stirring rate during both crystallization runs was maintained at 250 r.p.m. The results from these two crystallization tests are shown in Table IIb.

Effect of change in supersaturation on the amount of salts included in the sucrose crystal

Sucrose solutions (650 g) at different levels of supersaturation were seeded with 1 g of (— 48 + 60)-mesh sugar (2 g for the sucrose-NaCl solutions) and crystallized at 40·3°C for 48 hours. Table IIIa summarizes the extent of salts included in the crystallized sucrose from solutions of a constant salt to water ratio (1:5·28 for $KCl:H_2O$; 1:6·78 for $NaCl:H_2O$; and 1:6·52 for $CaCl:H_2O$) but with increasing sucrose concentrations.

Factory syrup (650 g) of constant concentration was seeded with 5 g of (— 60 + 80)-mesh sugar and crystallized at temperatures of 50 and 60°C for 48 hours, thereby varying the rates of crystallization. In another experiment, crystallization from factory syrup at two concentrations was performed at the same temperature of 50°C for 30 hours. The results from these are shown in Table IIIb.

Efficiency of recrystallization in improving crystal quality

In order to establish quantitatively the efficiency of recrystallization in improving crystal quality, sugars were recrystallized in the laboratory vacuum pan. The results from recrystallizing A-sugar, B-sugar, and low-grade sugar are tabulated in Table IV.

Effect of crystallizing temperature on crystal quality

Factory evaporator syrups (84·0 refractometer pol purity) were boiled in the laboratory vacuum pan at the same supersaturation but at absolute pressures of 100 and 200 mm. The boiling temperatures at these pressures corresponded to 62 and 78°C, respectively. Data showing the quality of sugar for the two boilings are given in Table V.

DISCUSSION AND CONCLUSIONS

Significant in Table Ia is the increase in rate of crystallization with rate of stirring. SMYTHE[4] has reported that the rate of crystallization increased with flow rate up to reasonably high velocities, and its relationship with supersaturation was nearly linear. Also of importance is the evidence that the amount of salt included in the crystal diminished as the rate of stirring increased. As shown in Table Ib, factory syrups gave similar results to those found with synthetic syrups. Circulation reduces the contribution of diffusion to the rate, thus minimizing the likelihood of variations in temperature and concentration of the syrup surrounding the crystals. Thus, optimum circulation is important in increasing the rate of crystallization and minimizing the inclusion of impurities.

[3] *I.S.J.*, 1956, **58**, 323–332.
[4] *Proc. 10th Congr. I.S.S.C.T.*, 1959, 323–336; *I.S.J.*, 1961, **63**, 120.

Table IIIb

Crystal quality of sugar crystallized from factory syrup as affected by temperature and supersaturation

Temp. (°C)	Relative crystallization. rate	Syrup and molasses — Ref. solids Initial	Ref. solids Final	Ref. pol purity Initial	Ref. pol purity Final	Crystal — Spec. conductance (micromho†)	Crystal colour ($a^*_{420} \times 10$)
50	Fast	78·9	72·9	84·9	81·0	31·3	2·3
60	Slow	78·9	74·2	85·9	81·8	12·8	1·5
50	Fast	79·9	75·0	82·3	76·3	17·7	3·5
50	Slow	76·2	74·0	82·3	79·0	5·1	1·6

† 5 g of washed sugar dissolved in distilled water and made up to 100 ml.

Table IV

Effect of recrystallization on crystal quality

	A-sugar before	A-sugar after	B-Sugar before	B-Sugar after	Low-grade sugar before	Low-grade sugar after
Pol, %	98·59	99·15	98·28	99·29	90·45	98·43
Moisture, %	0·39	0·29	0·45	0·26	2·75	0·39
Small grain, % retained on 28 mesh	11	15	16	17	100	9
Filtrability, g filtrate (pressure)	92	216	53	239	221	291
Crystal colour, $a_{420}^* \times 10$	7·2	2·5	10·4	2·3	7·3	4·8
Spec. conductance†, micromho:						
unwashed	166	80·5	204	57·5	1320	206
washed	28·3	6·3	49·3	7·5	123	18·2

† 10 g of sugar dissolved in distilled water and made up to 200 ml.

The amount of salt included in the sucrose crystal was found to increase with the concentration of the salt in the syrup from which the sucrose was crystallized (Table IIa). Results with factory syrup (Table IIb) demonstrate also that more impurities are included in crystals from lower purity liquor.

At a constant salt to water ratio, the amount of salt included in the crystal increased with the rate of crystallization (Table IIIa). The supersaturations of these synthetic solutions were changed by adding increasing amounts of sucrose, while maintaining the same salt to water ratio.

Crystals from factory syrups boiled at the same concentration but at a higher temperature crystallized at a lower rate because of reduced supersaturation. These crystals were of better quality than those boiled at a lower temperature, although crystallization at the lower temperature would normally be considered to favour better crystal quality; these results are shown in Table IIIb. The same conclusion was reached by crystallizing factory syrup at different concentrations but at the same temperature. The heavier concentrated syrup with a faster rate of crystallization gave crystals of poorer quality. Increasing supersaturation has an effect opposite to circulation, thus making it more difficult to minimize variations in concentration of the syrup surrounding the growing crystals.

As indicated in Table IV, significant improvement in quality of sugar resulted after recrystallization in the laboratory vacuum pan. This improvement, however, may not be as much as is generally expected in recrystallization.

The data shown in Table V demonstrate that boiling at a higher temperature, giving a higher crystallization rate, results in poorer quality crystal.

Table V

Influence of boiling temperature on sugar crystal quality from factory syrups

	Boiling temperature	
	62°C	*78°C*
Pol, %	97·68	97·05
Moisture, %	0·83	1·01
Small grain, % retained on 28 mesh	41	35
Filtrability, g filtrate (pressure)	264	264
Crystal colour, $a^*_{420} \times 100$	4·9	5·4
Spec. conductance†, micromho	11·4	15·0

† 10 g of washed sugar dissolved in distilled water and made up to 200 ml.

Previous investigation[5] on inclusion in raw sugar showed that the amount of non-sucrose constituents (colour, soluble ash, and substances insoluble in 85% methanol) was directly related to crystal size. Tables Ia, IIa, and IIIa show that in general the amount of salts included within the sucrose crystal increased with the size of the screened crystal.

SUMMARY

The conditions under which crystallization occurs influence the quality of the crystals. Higher circulation rate during crystallization resulted in better quality crystals in addition to a faster rate of crystallization. Faster rates of crystallization, achieved by increasing sucrose concentration, gave poorer quality crystals. Higher temperature produced crystals of poorer colour and higher ash. In general, the amount of included salts increased with the size of the sucrose crystals. Improvement in filtrability, pol, and crystal colour resulting from recrystallization was of lower magnitude than had been anticipated.

Correspondence

Active Carbon as an Adsorbent in Clarification of Raw Sugar Solutions

The Editor,

The International Sugar Journal.

Dear Sir,

I think you should be advised concerning a serious error that appeared in Mr. SAWYER'S article of the above title, published in the March 1966 issue of *The International Sugar Journal.* As has been mentioned to Mr. SAWYER in a separate letter, this has to do with the erroneous use of the words "established" and "standard" when referring to a certain method that has been proposed for adoption by ICUMSA for polarization of raw sugars. The method referred to is highly controversial, and it is unfortunate that the reference to it that appeared in Mr. SAYWER'S article gives it an apparent status that is wholly unrelated to the facts.

It would be highly desirable for *The International Sugar Journal* to point out this error in one of its subsequent issues.

Yours very truly,
E. J. CULP,
Chairman,
United States National Committee on Sugar Analysis.

The Editor,

The International Sugar Journal.

Dear Sir,

With regard to the above letter from Mr. CULP, I must admit that use of the word "established" in reference to the proposed ICUMSA method I was unfortunate in view of the present situation on agreement of the method. This was an oversight probably based on our internal laboratory usage of the technique as a referee method; we have, in fact, used similar phraseology in the text of previous articles published in the *I.S.J.* My apologies to ICUMSA for apparently pre-judging the deliberations at Copenhagen.

Yours faithfully,
R. SAWYER.

[5] ONNA *et al.*: *Rpts. 18th Meeting Hawaiian Sugar Tech.*, 1959, 111–112; *I.S.J.*, 1961, **63**, 57.

THE EFFECT OF SOME NEW CHEMICAL HERBICIDES ON SEEDLINGS OF SUGAR CANE, SOYBEANS AND PEANUTS*

By SHENG Y. PENG, Sc.M., and WEN B. SZE

(Agronomist and Assistant Agronomist, Taiwan Sugar Experiment Station, Tainan, Taiwan, China)

PART I

INTRODUCTION

THE effect of pre-emergence herbicides is known to be subject to climatic conditions, physical and chemical composition of soils and activity of micro-organisms in soils as well as characteristics of crops and weeds to which the herbicides are applied. For evaluating new herbicides WOODFORD[1] described a technique that proceeds in three stages, testing the toxicity of herbicides first to the crop, second to the weeds and third to the crop and weeds in association. WILLARD[2] pointed out the merits of visual rating of weed control plots against using counting alone and suggested a visual rating scale of from zero to ten to be used as a reasonably satisfactory system. By considering both relative abundance of different weed species and mortality of weeds by a herbicide at the same time, ROCHECOUSTE[3] described a method by which the average overall killing effect of a herbicide on weed population present in the plots could be measured. HANSON[4] employed "weed control index" and "cane effect index", which were also primarily visual estimations, to evaluate the effect of herbicides on weeds and cane.

It was intended in this experiment that measurements of plant growth be made in order to determine toxicity of the chemical herbicides to the crop plants which were grown in different types of soil. It was also intended to make a preliminary evaluation of the chemicals to kill weeds present with different crops in pots. Not all the chemicals tested have so far been used for weed control in sugar cane and other intercrops in this cane-growing region and it is therefore especially worthwhile to determine their actual value for future large-scale field use.

Besides sugar cane the test crops used were soybeans and peanuts, both of which are extensively grown in association with sugar cane in parts of this region. To utilize arable land intensively, a cultivation system of inter-planting short-season crops such as soybeans and peanuts between rows of sugar cane has been prevalent in recent years in southern parts of Taiwan. A practical means of weed control must therefore be developed for this special system of cultivation.

MATERIALS AND METHODS

Six new chemical herbicides—"Linuron", 50% 3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea; "Afalon" (with the same quantity of active ingredients as, but slightly lower surfactant content than, "Linuron"); "Ametryne",50% 2-ethylamino-4-isopropylamino-6-methylmercapto-*s*-triazine; "Fenac", 40% 2,3,6-trichlorophenylacetic acid; "Tok E-25", 25% 2,4-dichlorophenyl-4-nitrophenyl ether and "Triherbide CIPC", based on chloro-isopropyl-N-phenylcarbamate—were used for this evaluation test. Three of the chemicals, i.e. "Linuron", "Afalon" and "Ametryne", were originally placed in the plan of experiments and were thus tested with crops planted 15th April, 1965, while the other three, i.e. "Fenac", "Tok E-25" and "Triherbide CIPC" as a group were entered into the test later owing to delayed arrival from shipping. These were thus sprayed to crops planted 6th May the same year. For chemicals "Afalon", "Linuron", "Ametryne" and "Fenac", which were in the form of wettable powders, concentrations in water of the active ingredients of 2500, 5000, 10,000 and 20,000 p.p.m. by weight were used in the tests. For "Tok E-25" dilutions of 10, 20 and 40 litres and for "Triherbide CIPC" 10, 25 and 50 litres of the emulsifiable concentrates in 600 litres of water were used according to label recommendations for each chemical. This and other conditions under which the chemicals were directed are tabulated in Table I:

*Completion of this research programme is through assistance from the National Council on Science Development, Taiwan, China.

[1] *N.A.A.S. Quarterly Review*, 1950, **9**, 1.
[2] *Weeds*, 1958, **6**, 327.
[3] *Proc. 10th Congr. I.S.S.C.T.*, 1959, 549.
[4] *ibid.*, 538.

Table I

Herbidices	*Concentrations in water*	*Types of soils for crops*	*Crops tested*	*Types of application*
"Afalon" "Linuron" "Ametryne"	2,500, 5,000, 10,000, 20,000 p.p.m. active ingredients by weight	clay, sandy loam and sandy soils	sugar cane (F148, N:Co 310) soybeans and peanuts	pre-emergence, post-emergence, pre- and post-combined
"Fenac"	—ditto—	sandy soil	sugar cane (F148), soybeans and peanuts	pre-emergence
"Tok E-25"	10, 20, 40 litres in 600 litres of water/ha	sandy soil	—ditto—	—ditto—
"Triherbide CIPC"	10, 25, 50 litres in 600 litres of water/ha	sandy soil	—ditto—	—ditto—

All the crop plants were planted in earthen pots 28 cm in diameter × 30 cm in height. Soils to fill the pots were taken from the fields and it was presumed that weeds were present. Before filling the pots, the soils were thoroughly mixed to ensure uniform composition within each type. Three seed pieces of sugar cane (2 varieties F148 and N:Co 310) and five seeds of soybeans (variety Palmetto) and peanuts (variety TA 7) were each planted in pots. Each pot received either pre-emergence or post-emergence or both (double dosage) applications of one chemical at one concentration as a treatment. Each treatment was replicated three times. A power sprayer machine specially designed for spraying pot cultures was employed to spray herbicidal solutions on pots which were tightly encased in a glass chamber and were rotated during spraying. For each soil type unsprayed crop plants were also entered as controls. All the pots were then placed on the ground under open sky and crop plants were measured at intervals to compare toxicity of herbicides. Weeds in the soils of each pot were also recorded for species and degree of mortality by herbicides.

Results

Minimum effective concentrations of pre-emergence herbicides

The minimum effective concentrations (MEC) of herbicides used as pre-emergence application (sprayed within two days after planting) to achieve nearly complete mortality of weeds and to cause visible phytotoxicity on crop plants were first observed for all treatments. It was noted that for "Afalon", "Ametryne" and "Linuron", which were tested in three different soil types, the average MEC to achieve nearly complete kill of weeds in pots was the highest (8300 p.p.m.) in clay soil, medium (6100 p.p.m.) in sandy loam and the lowest (2500 p.p.m.) in sandy soils. In other words, more herbicide was needed to kill weeds in heavy soils than in light soils. Since it is generally known that heavy soils contain more organic matter than light soils, this result seemed roughly in agreement with findings by Upchurch and Mason[5] in which they found soils with higher contents of organic matter reduced effectiveness of soil-applied herbicides at higher rates, though soils used for this experiment were not analysed for organic matter. However, the average MEC to cause visible phytotoxicity on crop plants did not show the same steady trend where difference in tolerance to herbicides of crop plants seemed to outbalance the soil factor. For example, soybeans and peanuts did not survive even the lowest concentrations used for all three above chemicals in all soils. Sugar cane varieties N:Co 310 and F148 also showed different degrees of tolerance to these chemicals applied within the same soil type, with the former being more sensitive than the latter. For individual chemicals it was found that "Tok E-25", "Triherbide CIPC", "Afalon" and "Ametryne" demonstrated a wider range of safety to crop plants at higher rates of application than did the other chemicals. As mentioned before, with the exception of "Triherbide CIPC" and "Tok E-25", all other chemicals killed seedlings of soybeans and peanuts even at the lowest concentrations used. This should therefore rule out the possibility of using "Afalon", "Ametryne", "Linuron" and "Fenac" as either pre- or post-emergence herbicides (as additional evidence showed in next section) for soybeans and peanuts, at least under present conditions. If comparison between individual chemicals of the capacity to kill weeds is taken, it was found through all soil types that "Fenac" (MEC under 2500 p.p.m.), was the most toxic to weeds, with "Linuron" (3600 p.p.m.), "Ametryne" (5000 p.p.m.), "Afalon" (8300 p.p.m.), "Tok E-25" (15 l/ha) and "Triherbide CIPC" (40 l/ha) being successively lower in rank. This could be explained not only by their individual MEC to kill weeds but also by their estimated effective periods of persistence in soils. It was estimated from re-emergence of weeds in pots that, except for "Triherbide CIPC" which lasted only 30 days, all chemicals at the above MEC remained active in soils at least for 90 days.

As to what weed species the pre-emergence herbicides could control, these could be deduced from the unsprayed control pots in which the following species common in cane fields were found: *Cyperus rotundus* L., *Digitaria sanguinalis* L., *Dactyloctenium aegyptiacum* Willd., *Eleusine indica* Gaertn., *Amaranthus viridis* L., *Portulaca oleracea* L., *Ageratum conyzoides* L., *Cyperus compressus* L., *Echinochloa crusgalli* Beauv., and *Euphorbia serrulata* Reinw. Thus "Linuron" was ranked the number one chemical which could control at MEC all except two weed species, *Dactyloctenium aegyptiacum* Willd. and *Eleusine indica* Gaertn. "Tok E-25" could kill all except three species, viz.: *Dactyloctenium aegyptiacum* Willd., *Portulaca oleracea* L. and *Ageratum conyzoides* L. "Fenac", "Afalon", "Triherbide CIPC" and "Ametryne" were ranked in this order of capacity to control a narrower spectrum of weed species.

MEC of herbicides used post-emergence

Post-emergence application of herbicides was conducted on 10th May, 25 days after planting, when young crop plants had grown to about 10 cm high and most weeds had emerged. MEC of foliar-sprayed chemicals "Afalon", "Ametryne", and "Linuron" to cause effects on both weeds and cane were also observed. It was noted that soybeans and peanuts showed little tolerance to the three herbicides even at the lowest rate (2500 p.p.m.) and death of seedlings eventually resulted. On the other hand, the appearance of visible scorching effects on cane seedlings due to herbicides applied after emergence seemed irregular. In about one half of the cases, necrotic toxicity of leaves produced in plants of variety N:Co 310 was observed at first on most cases where 2500 p.p.m. of herbicide was applied. This had disappeared, however, by the second observation. In the case of variety F148, the behaviour of the herbicidal effect seemed much more erratic. Generally speaking, "Linuron" and "Ametryne" were more

[5] *Weeds*, 1962, **10**, 9-14.

Table II. Herbicidal effects on plants of cane variety N:Co 310

Types of application:	*pre-emergence*					*post-emergence*					*pre- and post- combined*				
Types of effects:	*leaf scorching*		*retarded growth of plants*		*reduction of tillering*	*leaf scorching*		*retarded growth of plants*		*reduction of tillering*	*leaf scorching*		*retard d growth of plants*		*reduction of tillering*
	heavy soil	*light soil*	*heavy soil*	*light soil*		*heavy soil*	*light soil*	*heavy soil*	*light soil*		*heavy soil*	*light soil*	*heavy soil*	*light soil*	
Herbicides															
"Afalon"															
2,500 p.p.m.	–	*	*	*	–	*	*	*	*	–	*	*	*	*	–
5,000 p.p.m.	–	*	*	*	–	*	*	*	*	–	*	*	*	*	–
10,000 .p.m.	–	*	*	**	–	*	*	*	*	–	**	**	*	*	*
20,000 p.p.m.	*	*	**	**	–	**	*	*	*	–	**	**	*	*	*
"Ametryne"															
2,500 p.p.m.	–	*	*	*	–	*	*	*	*	–	*	*	*	*	–
5,000 p.p.m.	–	*	*	*	–	*	*	*	*	–	*	*	*	*	–
10,000 p.p.m.	*	*	*	**	–	*	*	*	*	–	**	**	*	*	*
20,000 p.p.m.	*	*	**	**	–	**	*	*	*	–	**	**	**	*	*
"Linuron"															
2,500 p.p.m.	*	*	*	*	–	*	*	*	*	–	*	*	*	*	*
5,000 p.p.m.	*	*	*	*	–	*	*	*	*	–	**	**	**	**	*
10,000 p.p.m.	*	*	*	**	*	**	**	**	**	*	**	**	**	***	**
20,000 p.p.m.	*	*	**	***	**	**	**	**	**	**	***	***	***	***	***

Symbols denote extent of effects: (–) negative, (*) light, (**) medium, (***) severe.

toxic to cane seedlings than "Afalon" if applied as a foliar spray. Variety F148 again showed less sensitivity to herbicides than variety N:Co 310. In terms of the MEC of these herbicides to kill emerged weeds, "Linuron" which was required at the lowest rate (2500 p.p.m.) was the most toxic. "Ametryne" and "Afalon", required at rates of 5,000 and 10,000 p.p.m., respectively, were less toxic. It is assumed that the difference in soil types did not play a conspicuous rôle in influencing the effect of these post-emergence herbicides on cane and weeds. Under this type of application, weeds in all pots were allowed to germinate freely until spraying of chemicals was carried out to control them. Weed species *Cynodon dactylon* Pers. and *Amaranthus spinosus* L. were also found in addition to those mentioned in the preceding section. "Linuron" was found to be able to kill all weed species when applied to the emerged weeds while "Afalon" and "Ametryne" did not control below MEC the hard-to-control *Eleusine indica* Gaertn., *Echinochloa crusgalli* Beauv. and *Dactyloctenium aegyptiacum* Willd.

Effect of pre-emergence herbicides on growth of crop seedlings

Observations of the plant growth of cane seedlings treated with pre-emergence chemicals were made five times at intervals of two weeks after sprouting. Substantially all observations demonstrated the same trend in which increased concentrations of herbicides were followed by decreased growth rate of cane plants. The results of measuring fresh weights of plants and the number, weight and average length of permanent roots also confirmed the above conclusion, while counting number of tillers for cane seedlings revealed that, except in the case of spraying by "Linuron" and "Fenac" at higher rates, pre-emergence chemicals did not appear to influence tillering of cane seedlings any more. The effect of herbicides on cane plants of variety N:Co 310 when used as pre-emergence, post-emergence and combined pre- and post-emergence applications can be summarized as in Table II.

Further facts were noted as follows:

(*a*) Without exception, growth of cane seedlings was affected by pre-emergence herbicides at all concentrations used. This effect was pre-eminent at very high concentrations of all herbicides, particularly "Linuron". However, scorching of leaves caused by toxicity of these pre-emergence chemicals appeared to a lesser degree and did not parallel the retarding effect on plant growth at all levels of spray.

(*b*) Retarded growth of seedlings occurred more significantly in sandy and sandy loam soils than in clay soils.

(*c*) Cane variety F148 was less susceptible to herbicides than variety N:Co 310. However, tillering was affected less in N:Co 310 than in F148.

(*d*) Neither "Tok E-25" nor "Triherbide CIPC" affected growth of seedlings much, even at higher rates.

(*e*) Tillering of young cane was not affected by all chemicals at all levels of spray except "Linuron" at very high concentration.

"Triherbide CIPC" and "Tok E-25" appeared to be practical pre-emergence compounds for weed control in soybeans and peanuts. Compared with control plants, the two crops grew normally after being sprayed with the two chemicals at all concentrations.

Effect of foliar-applied herbicides on growth of cane seedlings

When "Afalon", "Ametryne" and "Linuron" were sprayed onto sugar cane seedlings after emergence and the plants examined afterwards, it was found that, for all rates of application, the leaves receiving the spray became somewhat necrotic but the growth of seedlings remained fairly normal for variety F148 and uniformly affected a little for variety N:Co 310. No differences due to soil types were noted. Again tillering of both varieties was unaffected except by "Linuron" at very high rates.

Effect of herbicides in combined pre- and post-emergence applications

Compared with single applications, plants receiving this type of application did show combined effects by herbicides on scorching of leaves, retarding growth of plants and reduction of tillering roughly in proportion to the double dosage of concentrations used.

(*To be continued*)

REDUCING SUGARS ESTIMATION
using an electrometric end-point detector

By J. H. DEFRATES and J. L. CASTLE

IT is well known that the estimation of reducing sugars in dark coloured solutions presents certain difficulties in detecting visually the endpoint when employing methylene blue as internal indicator in the Lane & Eynon technique. In order to overcome these, a method giving satisfactory results was developed by BELL & GRAHAM[1]; this was an electrometric technique using copper and platinum electrodes instead of the two copper electrodes employed originally by COALSTAD[2].

A commercial instrument* using the same type of electrode system was tested in order to obtain data on its behaviour and to establish conditions for suitable operation. The instrument under test comprised a battery-powered circuit embodying an on-off switch, a potentiometer which permitted a range of mV potentials to be applied across two electrode terminals, a sensitive galvanometer with centre zero, a switch with "calibration" and "test" positions, and a calibrated knob for standardizing the meter against the battery output.

A copper electrode in the form of a $\frac{1}{8}$ in dia. rod was connected to the positive terminal while a platinum wire electrode was connected to the negative terminal. The electrodes were located in a 250 ml flat-bottomed boiling flask by means of a rubber bung which was also provided with a bent glass tube as a steam exit and a jet through which invert solutions could be added from a burette. The lengths of the electrodes were such that they could be immersed in the solution by adjustment of their position in the bung.

Experience with this unit showed that the copper/platinum electrode system was capable of giving very satisfactory results provided certain precautions were taken. Initially in the investigation, the indicating meter needle tended to oscillate violently during boiling, rendering the end-point impossible to determine. This oscillation was due to the temperature effect on dissimilar metals in the same hot liquid which was subjected to intermittent superheating. Once this effect had been eliminated by the addition to the flask contents of pumice ground to about $\frac{1}{16}$-in grist, the end-point determinations were found to be sharp.

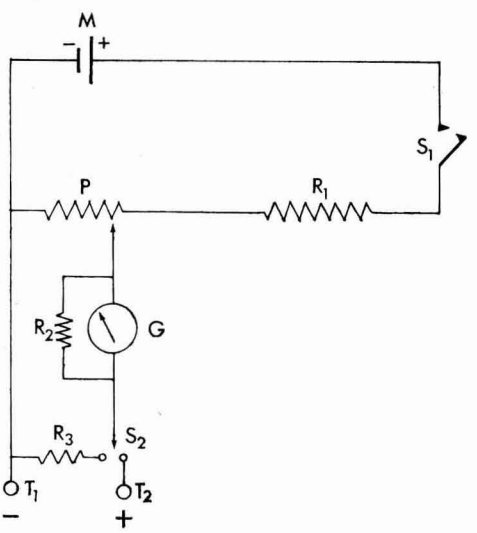

Fig. 1. Titration apparatus circuit.
G = S 20 galvanometer; M = Mallory cell 2 M—401, 14 volts; P = 15-ohm potentiometer, calibrated 0–5 mV; R_1 = 4185-ohm resistance; R_2 = approx. 300-ohm resistance; R_3 = approx. 110-ohm resistance to suit; S_1 = on-off switch; S_2 = micro-switch pressed for battery check; T_1, T_2 = terminals for titration electrodes.

[1] *I.S.J.*, 1950, **52**, 90–92.
[2] *I.S.J.*, 1946, **48**, 296.
*Supplied by The Sugar Manufacturers' Supply Co. Ltd., 196–204 Bermondsey Street, London S.E.1.

EXPERIMENTAL

Results obtained with the instrument were compared with those obtained using the standard Lane & Eynon technique (constant volume modification[3]). Very dilute solutions of both standard invert sugar (0·2%) and molasses (0·3%) were used so that clarification was not necessary. Titrations were made against 10 ml of mixed Fehling's solution.

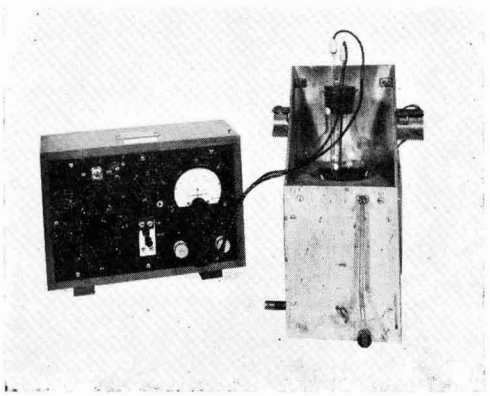

Fig. 2.

Preparation of solutions

Molasses.—After thorough mixing of the sample, 75 g of molasses was dissolved in water and made up to 1000 ml in a volumetric flask, mixing thoroughly to ensure complete solution of any sugar crystals present. A 50 ml aliquot was placed in a 250 ml volumetric flask and made up to volume and 50 ml of this solution transferred to a 400 ml boiling flask. To this was added 15 ml of N/1 hydrochloric acid and 85 ml of distilled water and the whole heated to boiling and boiled gently for two minutes. After cooling to room temperature the solution was washed into a 250 ml volumetric flask, nearly neutralized with approx. 14·5 ml of N/1 sodium hydroxide and made up to the mark. This 0·3% solution was used for estimations by both methods.

Standard invert sugar.—This solution was prepared from pure, dry sucrose under the same hydrolysis conditions as used for the molasses solution. This involved weighing of 0·95 g of sucrose which was dissolved in 50 ml of distilled water in a 400 ml boiling flask, adding 15 ml of N/1 hydrochloric acid and boiling as above, cooling and transferring to a 500 ml flask, adding 14·5 ml of N/1 sodium hydroxide, making up to the mark and shaking thoroughly.

Estimation procedure

The Fehling's solution equivalent of the invert solution is determined initially by the original Lane & Eynon method[4] which gives an approximate value. To 10 ml of mixed Fehling's solution in a 250 ml boiling flask is added an amount of the invert solution which is approx. 0·5 ml less than that required to reduce it. The solution is then titrated to the end-point using the constant volume modification[3] of the Lane & Eynon technique.

To a second flask is added 10 ml of mixed Fehling's solution and the same quantity of the invert solution. Sufficient distilled water is added to bring the volume to 60 ml and a few pieces of $\frac{1}{16}$-in grist pumice. The flask is placed over the pressure controlled gas flame† as used for the Lane & Eynon determination and the electrodes connected to their respective terminals on the panel of the instrument, which is previously calibrated against the battery.

The potentiometer is adjusted to apply a 4 mV potential across the electrodes. When the flask contents come to the boil the instrument is switched on with the "test" position selected. Additions of the invert solution are made at intervals from a burette connected to the jet by a piece of small-bore tubing. A few drops are added at a time, allowing sufficient interval for completion of the reaction between each addition. The titration is ended when the meter needle returns to zero, and is completed within one minute. The instrument is switched off and the flask washed out thoroughly before the next determination.

Results

Titration using the electrometric method required 26·35 ml of the standard invert sugar solution, which gives a factor of 0·05270. Thus % total sugars as invert is calculated from an electrometric end-point as $\frac{0{\cdot}05270 \times 100}{\text{titre} \times 0{\cdot}003}$. For the Lane & Eynon method the usual factor of 0·05260 is employed, the copper solution concentration having been adjusted to permit the results to be read direct from standard tables.

Using the Lane & Eynon factor of 0·05260 instead of the electrometric factor of 0·05270 reduces the % total sugars as invert value, as indicated in the Table of results.

	Electrometric Method			*Lane & Eynon Method*	
		% *Total sugars as invert*			% *Total*
Molasses sample	*Titre (ml)*	*Factor* 0·05270	*Factor* 0·05260	*Titre (ml)*	*sugars as invert*
1	29·05	60·47	60·35	29·10	60·25
2	30·70	57·20	57·10	30·70	57·10
3	32·15	54·64	54·55	32·10	54·60
4	31·70	55·42	55·30	31·80	55·15
5	30·95	56·75	56·65	30·85	56·85
Ave.	30·91	56·89	56·79	30·91	56·79

CONCLUSION

The instrument was found to be suitable for this type of estimation; however, owing to the temperature effect produced by superheating it is advisable that some preliminary experimentation be undertaken to ascertain conditions for even boiling by addition of varying amounts of pumice or other material. Even boiling is essential for satisfactory end-point determinations.

[3] *I.S.J.*, 1950, **52**, 185; 1953, **55**, 270–273.
[4] *I.S.J.*, 1923, **25**, 143.
†Equipment designed by Tate & Lyle Refineries Ltd., Plaistow Wharf, London E.16.

Induction of flowering in sugar cane by light and temperature control. H. ANTONI. *Rev. Ind. Agric. Tucumán*, 1965, **43,** (1), 47–70.—Results are presented of 18 months' work on flowering induction by means of photoperiodic and controlled temperature treatments with several varieties at the Agricultural Experiment Station, Tucumán, Argentina. Successful results were obtained. Low night temperatures were detrimental.

* * *

Stimulation of the germination of sugar beet seed by acetate. W. RATHJE. *Zeitsch. Pflanzenernahr. Dung. Bodenk.*, 1965, **108,** 1–4; through *Field Crop Abs.*, 1965, **18,** 247.—Calcium acetate solution applied to seeds of rye, rape and red clover had no effect nor was harmful. With monogerm sugar beet seed, however, it proved beneficial. At a concentration of 2000 mg/l, it increased speed of germination, germination capacity, number and dry weight of seedlings, and yields in pot trials.

* * *

Sugar beets will grow in Pennsylvania. A. S. HUNTER and C. S. BRYNER. *Sci. Fmr.*, 1965, **12,** (3), 14; through *Field Crop Abs.*, 1965, **18,** 246.—The average yield from trials on 14 sites was 15·4 tons/acre with sugar content 16·4%. Sugar beet is not currently grown in in Pennsylvania but results show that it could be.

* * *

Moisture characteristics of some Natal sugarbelt soils. J. N. S. HILL. *S. African J. Agric. Sci.*, 1965, **8,** 767–774.—With the extensive developments in cane irrigation now taking place in Natal it was felt that more information on the moisture holding characteristics of the cane soils should be sought. In this paper the moisture characteristics of nine soil series in Natal are discussed.

* * *

Importance of sugar beet hybrid development. R. K. OLDEMEYER and P. B. SMITH. *J. Int. Inst. Sugar Beet Research*, 1965, **1,** (1), 16–27.—Modern trends in sugar beet breeding in the United States, which are somewhat similar to those with hybrid maize, are outlined. Hybrid beets have shown a 10–20% increase in production over open-pollinated varieties. This, combined with monogerm seed, spring mechanization, and chemical weed control, points to a prosperous future for the sugar beet industry in North America.

* * *

The effect of various analytical factors on the germination test results obtained on some British sugar beet seeds. D. HIBBERT and W. WOODWARK. *J. Int. Inst. Sugar Beet Research*, 1965, **1,** (1), 28–50.—In germination tests sand gave unsatisfactory results for both processed and natural seed. The "on top of paper" system (Method 6), in closed trays to minimize moisture loss, gave the best results. The early stages in germination tests are of critical importance.

* * *

Improved cane crops in Louisiana. L. L. LAUDEN. *Sugar Bull.*, 1966, **44,** 112.—The belief is put forward that the most important single factor in the increased yields now obtained is better drainage. This has allowed other factors to become more effective.

* * *

Efforts to improve harvesting of lodged and recumbent sugar cane. G. J. DURBIN. *Sugar Bull.*, 1966, **44,** 114–117.—Various makes of mechanical harvester designed for dealing with lodged cane are described, but it is pointed out there does not seem to be any answer to the problem of how to harvest recumbent sugar cane. Much time and money is being devoted to the problem.

* * *

Three new varieties now ready for distribution. ANON. *S. African Sugar J.*, 1965, **49,** 905–909.—Official sanction has now been given for distribution of the varieties C.B.36/14, C.B. 38/22 and N55/805. Indications of their disease resistance are given in tables, notably for mosaic, chlorotic streak, red rot, smut, gumming and ratoon stunting disease tolerance. Details of yield and sucrose content, recorded over a wide area, are also given.

* * *

A study on planting time and spacing of sugar cane in summer. H. C. FU, T. P. SOO and Y. H. HSIEH. *Rpt. Taiwan Sugar Expt. Sta.*, 1965, (38), 1–12.—Experiments in summer planting and intercropping, to meet the needs of peasant cultivators, were carried out. Planting is usual in May or June and harvest the following February. It was concluded that varieties used must have rapid growth, early maturity, vigorous tillering, typhoon resistance and stout stalks. Only fertile land that can be irrigated should be used, and planting should be before May, since a month's delay can reduce yields by 30%.

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A study on the interplanting of the sugar cane variety F.146 with other crops. C. C. TSE and Y. S. SHIUE. *Rpt. Taiwan Sugar Expt. Sta.*, 1965, (38), 13–31. Sweet potato, peanut and soy bean are regarded as suitable food plants for intercropping with the autumn planted cane. Maize, cotton and sesame are not satisfactory and depress cane yield severely. Mung bean has also been successful.

The function of transpiration in the growth of sugar cane plants in soils. T. T. YANG. *Rpt. Taiwan Sugar Expt. Sta.*, 1965, (38), 33–41.—A study was carried out using radioactive tracer elements and other means to determine the significance of transpiration in the cane plant which had variously been considered very important and insignificant by different authors. As a result of the studies, transpiration is shown to be indispensable to normal growth, the amount of transpiration needed depending on the concentration of nutrients in the transpiration stream which in turn depends on their concentration in the solution outside the roots, on the velocity of the transpiration stream and on the concentrating power of the roots.

* * *

A study of the effect of soil fumigation on the growth of sugar cane roots. T. T. YANG and T. K. TSAI. *Rpt. Taiwan Sugar Expt. Sta.*, 1965, (38), 43–52.—Experiments on the effects of soil fumigation on the subsequent growth of sugar cane roots are described. Rectangular pots made of bricks and lined with plastic sheet were used. Steam treatment and fumigation (with DD), or a combination of both, resulted in improved root development and growth of the plant.

* * *

The application of bagasse furnace ash to sugarcane fields. L. H. LEE, Y. S. CHAN, H. T. CHUNG and S. Y. LIAO. *Rpt. Taiwan Sugar Expt. Sta.*, 1965, (38), 53–79.—Experiments are reported in which bagasse furnace ash (approx. 75% SiO_2) was applied as a soil conditioner on cane fields of varying soil types from clay to sand. Cane yield was raised in all cases irrespective of application method. Ploughed in as a layer 5–16 cm thick, the ash resulted in a 11–28% increase in plant cane yield, while the increase in successive ratoons was still greater. Root development and stalk growth were increased significantly. The physical properties of the ash were found to be more important than the chemical properties. Of the former, porosity (67·3%) was considered the major factor in increasing the yield.

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Relationship between some environmental factors and cane yield with ratoon stunting disease. I. Soil moisture content. C. S. WANG. *Rpt. Taiwan Sugar Expt. Sta.*, 1965, (38), 81–89.—Field experiments with plots of healthy cane (variety N:Co 310) and diseased cane confirmed the belief that differences in yield were greater under dry conditions than conditions where adequate soil moisture prevailed.

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Studies on chemical control of soil insects in ratoon cane. II. Effect of "Heptachlor" on sugar cane wireworm. S. T. LEE. *Rpt. Taiwan Sugar Expt. Sta.*, 1965, (38), 91–97.—In cane fields in Taiwan 18 species of wireworm have been recorded; four are known to cause severe damage to cane. Experiments are described of applying "Heptachlor" dust for the control of the wireworm *Melanotus tamsuyensis*. It was concluded that 45 kg/hectare was sufficient to give satisfactory control.

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35 tons per acre—possibility by 1970's. ANON. *Sugar J.* (La.), 1965, **28**, (5), 41.—Reasons are given for the view that early in the 1970's the average sugar cane yield in Louisiana may be about 35 tons/acre. Better weed control, better varieties and better fertilizers are considered important factors, as is the fact that cane growers will be working better land and leaving out the marginal lands under a quota system.

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New mechanical cane harvesters for 1966. ANON. *Australian Sugar J.*, 1965, **57**, 639.—Some details are given of the five new cane harvester models to be released for the 1966 season by Massey-Ferguson.

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New self-propelled whole-stalk harvester. L. G. VALLANCE. *Australian Sugar J.*, 1965, **57**, 651–653. A new mechanical harvester recently released by Toft Bros. Industries Ltd. is described. One real advance claimed for this new single row harvester is the fact that it will enter straight into a block of cane without the necessity to cut out one or more rows to permit its entry. The ability to do this has led to its being called "Slim Jim".

* * *

Weed control in sugar beets. W. MEGGITT. *Sugar Beet J.*, 1966, **29**, (2), 11.—In Michigan in the 1965 season "Pyramin" plus TCA proved to be an effective combination for pre-emergence control of annual broad-leaved and grass weeds, recommended rates being 3–4 lb "Pyramin" and 6–8 lb TCA per acre.

* * *

Sprays for aphid control increase sugar beet yields in Davis tests. F. J. HILLS *et al. Calif. Agr.*, 1965, **19**, (3), 6–7; through *Biol. Abs.*, 1965, **46**, 8850.—For the third year "Metasystox-R" sprays for aphid control in sugar beets decreased yellow virus infection and substantially increased root production. Three sprays applied to beets planted in March-May increased yield by 5–9 tons/acre.

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Sugar beet culture in south eastern province of Buenos Aires, Argentina. *IDIA*, 1964, **203**, 15–32; through *Biol. Abs.*, 1965, **46**, 8850.—The successful cultivation of 700 ha of sugar beet near a new factory and without fertilizer is referred to. Estimated yields so far range from 17·5 to 22·5 short tons per hectare, with a 17–18% sugar content.

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The question of opposing growth influences in sugar beet placed in double or treble growing positions. W. SCHRÖTER. *Albrecht-Thaer-Arch.*, 1965, **9**, (6), 563–573; through *Field Crop Abs.*, 1966, **19**, (1), 44.—To find the importance of accidentally having 2 or 3 sugar beet plants in one sowing position, 1, 2 or 3

beets per hill were sown at a spacing of 41·7 × 24 cm and single beet plants at 41·7 × 12 cm. In general, the yield of roots per hill was not affected by doubling or trebling. The proportion of light-weight roots increased as the number of plants per hill increased.

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Competition of annual weeds and sugar beet. P. B. BRIMHALL *et al. Weeds*, 1965, **13,** (1), 33–35; through *Field Crop Abs.*, 1966, **19,** (1), 44.—Results are given of experiments to determine the effects of five densities each of rough pigweed (*Amaranthus retroflexus*) and green foxtail (*Setaria viridis*) on yield of roots and tops and sucrose content of the sugar beet. Green foxtail proved to be much less competitive or harmful to the beet than rough pigweed.

* * *

Selective weeding of sugar beet. R. OLIMPIERI and G. R. CAMERINI. *Progresso Agric.*, 1965, **11,** 821–832; through *Field Crop Abs.*, 1966, **19,** (1), 45.—"Pyramin" applied at 2·4 and 3·2 kg/ha (active ingredient) before sowing sugar beet and before emergence gave good control of many weed species (listed) and partial control of *Chenopodium* spp.

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Sucrose translocation in the sugar beet. D. R. GEIGER and C. A. SWANSON. *Plant Physiol.*, 1965, **40,** 685–690; through *Field Crop Abs.*, 1966, **19,** (1), 46. The time course of ^{14}C translocation was studied using plants pruned to a simplified translocation system. The rapid turnover of labelled-C in the sucrose pool of the supply leaf confirmed the hypothesis that sucrose is the principal source of the material entering the translocation system.

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Residual chemicals and new formulations of chemical herbicides for weed and grass control in Louisiana sugar cane. E. R. STAMPER. *Proc. 18th Southern Weed Conf.*, 1965, 200–201; through *Weed Abs.*, 1965, **14,** 321.—Present uses of chemical weedkillers in cane fields are summarized and results given of recent experimental work. A mixture of "Fenac Na" + 2,4-D low-volatile ester was more effective than "Fenac Na" used alone for selectively controlling broad-leaf weeds and grasses. "Irocil" and "Bromacil" were toxic to cane at rates sufficient to control weeds, but "Picloram" ± TCA or "Dalapon" showed promise for the control of broad-leaf weeds and grasses.

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Evaluation of "Bromacil" for weed control in sugar cane. R. W. MILLHOLLON. *Proc. 18th Southern Weed Control Conf.*, 1965, 194–199; through *Weed Abs.*, 1965, **14,** 321.—Results are given of trials in which "Bromacil" was applied in the autumn in 3-ft bands over the rows immediately after planting and in spring in 2-ft bands (post-emergence) before weed emergence. Optimum selectivity was achieved with a dose of 2 lb/acre in the autumn followed by 1 lb/acre in the spring. This gave excellent control with several weeds. With autumn application increased to 3 lb/acre and spring application to 2 lb/acre, chlorosis resulted in the form of bronzing with stunted growth.

Sugar beet trials, 1957-63. L. A. WILLEY. *J. Nat. Inst. Agric. Botany*, 1965, **10,** 204–210.—Extensive field trials of sugar beet varieties at several centres in England are reported, results being presented largely in tabular form. Sharpe's Klein E was used as control. Assessments included percentage of bolting, yields of roots, sugar and tops, sugar content and purity of the juice. The varieties Anglo Maribo N, Anglo Maribo Polyploid, Camkilt, Gartons 632, Triplex and Zwaanpoly were recommended for growing in Great Britain.

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Mechanical harvesting grows apace. ANON. *Producers' Review*, 1965, **55,** (12), 9–11.—The amount of cane harvested mechanically in Australia in 1964 was double that of 1963 and the trend continues. The chopper type harvester continues to be the most popular sort. In 1964 73% of the harvesters operating were of this kind.

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Raising cane the modern way. ANON. *Producers' Review*, 1965, **55,** (12), 25.—The simpler methods employed in earlier days of sugar cane cultivation are compared with modern methods where special measures are essential to restrict damage from pests and diseases.

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Demonstration tour of "Harvestall" machine and "Loadermaster" loader. ANON. *Australian Sugar J.*, 1965, **57,** 729.—The manufacturers of the "Harvestall" single and double row harvesters and of the new all-hydraulic 4-wheel drive "Loadermaster" loader arranged a 6 weeks' demonstration tour of three harvesters (plus an accommodation caravan and a car) to numerous cane growing centres, from Mackay to Cairns. A brief description of this successful tour is given.

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New Crichton harvester. L. G. VALLANCE. *Australian Sugar J.*, 1965, **57,** 733–735.—A new model of this well-known machine is described. The basic difference is that it is a complete self-propelled unit rather than a harvester attachable to a tractor. There are other modifications.

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Observations on different types of sugar beet defoliators in Belgium. M. MARTENS. *Pub. Tech. Inst. Belge pour Amél. Betterave*, 1965, **3,** 85–104.—An account is given of several different makes of machine, some new, and of their performance in the field.

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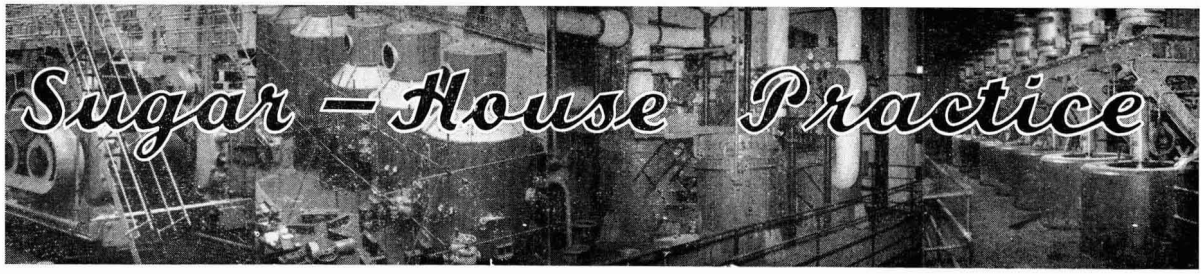
Brazil wants to raise the production of sugar cane. ANON. *Int. Fertilizer Correspondent*, 1966, **7,** (2), Item 1041.—It is claimed that Brazil is the world's largest sugar producer and, to meet internal and export requirements, needs to double production by 1971. This could be achieved mainly by the use of improved planting stock, more and better pesticides and greater use of fertilizers.



Economic and other advantages of increasing mill capacity. M. J. McNULTY. *Proc. Amer. Soc. Sugar Cane Tech.*, 1964, **11**, 61–67.—See *I.S.J.*, 1965, **67**, 115.

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Studies in gur manufacture. Time-temperature relationship in the boiling of juice for gur manufacture. A. J. DANGRE. *Proc. 32nd Ann. Conv. Sugar Tech. Assoc. India*, 1964, 45–51.—As juice is heated, its temperature rises steadily to 99·5°C at which it remains for a considerable time. It then rises again to 105°C and then rather sharply to 120–125°C, when it should be removed from the heat source to avoid caramelization. The time-temperature relationship is considered by the author to indicate the existence of endothermic and exothermic reactions taking place during the boiling.

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Steam contamination in a sugar factory. M. N. RAO. *Proc. 32nd Ann. Conv. Sugar Tech. Assoc. India*, 1964, 59–62.—The analysis of scale in a steam turbine, resulting from carry-over from the boiler, is presented with a list of causes of such carryover. The probable causes of the carryover in the author's factory are discussed in somewhat greater detail.

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Examination of (the) activated sludge process for the treatment of sugar factory effluents. J. P. SHUKLA and N. K. VARMA. *Proc. 32nd Ann. Conv. Sugar Tech. Assoc. India*, 1964, 63–72.—Experiments are reported in which activated sludge was used to reduce the B.O.D. of an artificial sugar factory effluent prepared by suspending 1 g of sulphitation press mud in a solution of 1·5–2 g of molasses in 1 litre of water. It was found that use of activated sludge can reduce pollution load by as much as 70%; the optimum load applied is approx. 3000 p.p.m. B.O.D., and sewage (as a source of nitrogen) should be added in a proportion of 1:15. The sludge should be used in a ratio of 1:4 by volume and retention time should be 30-45 min. The sludge should be kept active by pre-aeration and recirculation.

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Reduction of loss of sugar in molasses—case studies. I. Pan boiling technique. S. C. GUPTA, S. L. PHANSALKAR and M. SINGH. *Proc. 32nd Ann. Conv. Sugar Tech. Assoc. India*, 1964, 73–78.—A survey of eight sugar factories revealed deficiencies in the pan boiling techniques and equipment and a series of recommendations are made which, when followed by the factories, resulted in better working and greater exhaustion.

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New concept for the design of (a) vacuum pan. B. B. PAUL. *Proc. 32nd Ann. Conv. Sugar Tech. Assoc. India*, 79–85.—See *I.S.J.*, 1966, **68**, 118.

Facts about the continuous BMA centrifugals. P. L. FREUND. *Proc. 12th Conv. Philippines Sugar Tech.*, 1964, 12–17.—The continuous cone-type centrifugal was first proposed in a patent dated 1892; however, it was not adopted because of rapid wear of screens and severe abrasion of crystals to produce fines which passed through into the molasses. Abrasion in the BMA machine is prevented by feeding the massecuite eccentrically—close to the wall of the acceleration pot—so that the distance to the wall and hence energy of impact are low. The screen aperture is also chosen so that only 5% of the syrup is separated at the lowest part of the screen, leaving sufficient for lubrication and reducing screen wear and crystal destruction. Screens are made of pure nickel plated with a hard chromium surface to reduce wear. Some crystal damage does occur, however (15% in model K750 and 5% in model K1000) when the crystals are ejected from the basket rim into the casing, but this does not affect molasses purity. It is pointed out that a lower *g* factor but longer residence can give an overall greater throughput because compaction is eliminated and the thin layer of massecuite can revolve, whereby separation of molasses is assisted. Special devices in the BMA machine include introduction of steam into the molasses chamber, which heats the syrup, lowering the viscosity and aiding separation. An iris diaphragm valve varies feed rate in accordance with the load on the motor, so giving uniform power requirement and sugar quality. Comparative data from one factory in Guadeloupe show the improved performance of a continuous machine over a batch-type centrifugal, and other advantages include lower initial and installation costs as well as virtual elimination of operating labour.

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The influence of low temperature corrosion in oil-fired boilers. F. M. FUGRAD. *Proc. 12th Conv. Philippines Sugar Tech.*, 1964, 18–23.—Low temperature corrosion of boiler tubes due to attack by sulphurous and sulphuric acids arising from sulphur in the fuel can be prevented by: (i) washing the surface at intervals and ensuring that the flue gas temperature is maintained above the dew point of the acids, (ii) using corrosion-resistant construction materials, and (iii) adding neutralizing agents, e.g. magnesium oxide or carbonate, in the combustion chamber, dissolving magnesium naphthenate in the oil fuel, or injecting ammonia into the flue gas.

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Mechanical cleaning of evaporator tubes. C. M. MADRAZO. *Proc. 12th Conv. Philippines Sugar Tech.*, 1964, 29–31.—The heavily scaled tubes at

San Carlos sugar factory were cleaned satisfactorily with a saving in time and elimination of chemicals cost by using a mechanical scraper head [Flexible Drives (Gilmans) Ltd., Warwick, England, Type TE tool head].

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Extraction of cane in the DDS diffuser. H. BRÜNICHE-OLSEN. *Proc. 12th Conv. Philippines Sugar Tech.*, 1964, 151–159.—An account is given of the Tanganyika Planting Co. installation[1], and the selective extraction mechanism, whereby high throughput, high extraction and high purity are achieved simultaneously, is explained.

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Automatic combustion control of bagasse-fired steam generators for sugar mills. H. A. SANTOS. *Proc. 12th Conv. Philippines Sugar Tech.*, 1964, 160–170.—The Riley automatic boiler control system is described as installed on two modern Riley steam generating units at Victorias Milling Co. Inc. Fuel, air, flue gas and feed water are measured and correlated by means of flexible controls which can operate over wide ranges of variation.

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Foundry operation in a sugar mill. A. E. BUGÁY. *Proc. 12th Conv. Philippines Sugar Tech.*, 1964, 171–174 —See *I.S.J.*, 1966, **68**, 55.

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Evaluation of the tremendous losses in milling cane trash. T. R. ANCHETA. *Proc. 12th Conv. Philippines Sugar Tech.*, 1964, 175–185.—The sugar lost when milling trash as well as cane is calculated and the economic consequences emphasized; for one million metric tons of cane, 1·5% trash would result in a loss of more than one million Philippine pesos.

* * *

Quantities of molasses in process and relative pan floor capacities of several systems of massecuite boiling. D. I. BALAGSO. *Proc. 12th Conv. Philippines Sugar Tech.*, 1964, 186–199.—Calculations are made of molasses, massecuite and sugar quantities for five boiling systems which include two 2-boiling systems ("old" and "new"), two 3-boiling systems ("old" and "new") and a 4-boiling system. The calculations show that for syrup purities of 74–85 the new 2-boiling system is best and above 85 the new 3-boiling system is best. The systems are illustrated by diagrams.

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Some technological advances in the 50-year operation of the San Carlos sugar factory. C. M. MADRAZO. *Proc. 12th Conv. Philippines Sugar Tech.*, 1964, 200–204.—Developments introduced include cold *vs.* hot liming, change from filter presses to the Petree-Dorr process and then adoption of the Oliver-Campbell continuous rotary vacuum filter, use of locally-produced rather than imported lime, elimination of stock in process at the end of the season, and the use of electrometric pH determination instead of litmus papers, colour comparators, etc.

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Additional three roller mill to the "B" tandem. P. Y. CAPAY. *Proc. 12th Conv. Philippines Sugar Tech.*, 1964, 323–327.—See *I.S.J.*, 1966, **68**, 54.

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Meehanite in the sugar industry. P. MILES. *Proc. 12th Conv. Philippines Sugar Tech.*, 1964, 328–339. An account is given of the various types of Meehanite metal and of the applications for its use in castings for sugar factories.

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Towards self-sufficiency. A. M. HAIN. *Proc. 12th Conv. Philippines Sugar Tech.*, 1964, 340–344.—Examples are given of equipment constructed by Victorias Milling Co. personnel which produce savings compared with the same items purchased by the Company; these include cane cars, bronze journal bearings, cane knives and centrifugal pumps.

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Loss caused by inversion of sucrose during sugar manufacture: How to avoid this loss. C. K. CLONINGER and J. W. APPLING. *Proc. 12th Conv. Philippines Sugar Tech.*, 1964, 345–350.—See *I.S.J.*, 1966, **68**, 54.

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Electric and turbine drive of cane mills. ANON. *Bol. Azuc. Mex.*, 1965, (195), 18–24.—Advantages and disadvantages of the use of electric motors to drive cane mills are listed and briefly discussed, and a comparison made of power obtained from the same weight of bagasse using steam engines under various conditions and using electric motors. Electric drive control is discussed, with information on A.C. systems with variable frequency. The use of individual turbines is reviewed, and their advantages listed. Control, power developed and speed of such turbines are considered separately, as is the range of types of turbine from which a choice would be made.

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Bulk plants expanded. ANON. *Hawaii's Sugar News*, 1965, **15**, (6), 1.—An illustrated account is given of the new 32,000-ton bulk sugar warehouse built at Kahului to raise the total storage capacity to 68,000 tons, making this the largest bulk storage unit in Hawaii. Total bulk storage capacity in Hawaii will be 250,000 tons when work at other plants is completed.

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Dry cleaning cane. ANON. *Hawaii's Sugar News*, 1965, **15**, (6), 3.—Brief details are given of the experimental plant at Laupahoehoe Sugar Co. which comprises a conveyor feeding to a peg-tooth drum which cards out the cane and trash. The cane is thrown by the drum onto a sloping plate to the side of and below the drum. A jet of air directed at the underside of the drum also removes trash. Small stones,

[1] *I.S.J.*, 1964, **66**, 187–189.

mud, gravel and soil not removed by the drum or air stream pass with the cane from the sloping plate onto a downward sloping conveyor moving against the flow of the cane. The conveyor's surface is covered by "buckets" 6 inches square and 2½ inches deep. The stones and soil settle into these buckets, while the cane passes freely over the surface. Any trash remaining is removed on a further conveyor studded with small V-shaped teeth. Indications are that an extra 1·5 tons of sugar per acre is attainable, i.e. a 16% increase at Laupahoehoe.

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Losses in milling trash. T. R. ANCHETA. *Sugarland*, 1965, **2,** (6), 8–10.—See *I.S.J.*, 1966, **68,** 179.

* * *

A comparison of raw sugar boiling systems. G. R. SERBIA. *Sugar y Azúcar*, 1965, **60,** (11), 52–55.—Two three-boiling systems (in one of which a "mixed *A*-massecuite" is boiled on a mixture of *A*-molasses and syrup) are discussed and illustrated by diagrams and tabulated data. Similar treatment is given to two two-boiling systems in one of which some *A*-molasses is returned to the *A*-strike. The straight two-boiling system would be the ideal but it requires a purity drop of 23·4 units in the *A*-strike, which is not likely without controlled crystallization. In order to lower the extent of this purity drop to 20·6 units, the other two-boiling system involves nearly 40% recycling of non-sugars to the *A*-strike and increases the total volume of massecuite on cane to the same as in a three-boiling system. Both three-boiling systems have greater flexibility than the two-boiling systems and, while the straight three-boiling system involves smaller total massecuite volume on cane, the option of varying proportions in the "mixed *A*-massecuite" to give the required mixed *A*-molasses purity permits smoother operation of the low-grade station.

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Converting a manual double tank juice scale to automatic operation. R. J. MARTINEZ and R. LABIOSA. *Sugar y Azúcar*, 1965, **60,** (11), 63–64.—An account is given of the conversion of the scale to automatic operation. Only one tank is used, the other acting as an emergency reservoir. A surge tank above the scale receives the juice and has sufficient capacity for juice flowing when the scale tank is discharging. A system of switches operates the feed and discharge valves so that the feed is cut off and the tank empties. The empty tank is automatically tared and the feed re-starts.

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Investigation of a rocker gear mechanism with stopping and reverse motion in an automatic cube sugar (production) line. V. M. LOBUSOV. *Izv. Vyssh. Ucheb. Zaved., Pishch. Tekhnol.*, 1965, (2), 121–126; through *S.I.A.*, 1965, **27,** Abs. 715.—An unusual gear train employed to drive the cube conveyor in the drying section of a Chambon plant is described and mathematically analysed. The conveyor alternately advances and reverses, the forward movement being greater than the reverse movement. The mechanism involves a large gear wheel carrying a crank pin near its outer edge. The free end of the crank slides in a swivelling housing fixed at a stationary point within the perimeter of the large gear wheel, so that the crank is always directed inwards. A sector of a small gear wheel, with its centre at the crank pin, is fixed to (and bisected by) the crank; this sector meshes with a "sun" gear wheel concentric with the large wheel, and imparts an alternating rotation to the sun wheel. It is shown how the dimensions may be chosen to prevent disturbance to the sugar cubes when the movement of the conveyor is reversed.

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The BMA-Egyptian cane diffusion system. P. L. FREUND. *Proc. 12th Conv. Philippines Sugar Tech.*, 1964, 8–11.—A brief account is given of the history of cane diffusion with especial reference to Egyptian experience, and the results are described of tests carried out at Nag Hamadi which led to development of the BMA-Egyptian system. This is described[1] and its advantages discussed.

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Decolorization of sugar liquor through fixed beds of granular activated carbon. S. ASAI. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1965, **16,** 1–10. A study was made of the effect of bed depth, liquor flow rate and carbon particle size on the decolorization of a sugar liquor in a 4-column unit. The results, expressed in graph form, show that the ratio of effluent colour to inflowing liquor colour increased somewhat rapidly in the initial transient stage but did not increase much further in the steady state. The ratio increased rapidly again when the adsorption of colouring matter on the carbon had increased. The ratio was affected by sugar liquor-carbon contact time and by carbon particle size, i.e. the longer the contact time and the smaller the particles, the higher was the decolorizing efficiency. The results have been applied to the basic design of a decolorizing column.

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Cane variety juice clarification experiment, 1964 crop. E. E. COLL, W. F. GUILBEAU, J. T. JACKSON and S. J. CANGEMI. *Sugar Bull.*, 1965, **44,** 30–33.—Results of tests, in which juice from three cane varieties—CP 55–30, CP 52–68 and L 60-1—were clarified under standard conditions, are reported with tabulated data on the clarified juice quality. The two CP varieties were about equal in clarified juice quality but CP 55-30 produced about 20% less mud. Conditions of harvesting and milling of the L 60-1 cane produced about 20% less mud. Conditions of harvesting and milling of the L 60-1 cane preclude comparison with the others; however, it was found to respond favourably to lime clarification if received in good condition.

[1] *See also I.S.J.*, 1966, **68,** 87.

BEET FACTORY NOTES

Application of chemical anti-foam agents. V. A. NAGORNAYA and YU. D. GOLOVNYAK. *Sakhar. Prom.*, 1965, **39**, 732–737.—Laboratory and factory tests are reported in which natural and synthetic anti-foaming agents were added (in emulsified and un-emulsified forms) to raw and carbonatation juice, syrup and press water. The effects of the various agents (expressed in the laboratory tests as reduction of foam height and in the factory tests as the amount required to extinguish 50% of the foam) are discussed in some detail. All the agents tested were more effective as emulsions. While the organo-silicon compounds tested proved effective, one of the most effective agents was found to be animal fat, which was somewhat less effective than the two best agents, "Rhodorsil 426" and "Rhodorsil 3320" (of French origin). "Witten 748" (produced in West Germany) and the Soviet 21-A were also found to be highly suitable.

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Examination of "Stellar" candle filters. V. A. ZAMBROVSKII. *Sakhar. Prom.*, 1965, **39**, 743–749.—The "Stellar" candle filter is described and details are given of the station of six filters, each having 15 sq.m. filter surface, installed at Timashevskii factory for clarified 2nd carbonatation juice treatment. The system used at the clarification and filter stations is described and information is given on the filter throughput and cycle. Tests on Soviet-built "Stellar" filters demonstrated the considerably higher filtration rates obtainable with them compared with e.g. leaf filters and filter presses. The results obtained with 1st and 2nd carbonatation juice and a syrup-remelt liquor mixture (25, 55 and 16 litres/sq.m./min, respectively) were similar to those obtained in Czechoslovakia. By making slight alterations to the filters, a yet higher efficiency is thought possible. In a study of the effect of pressure on turbidity, it was found that during the first 40 min of a 8-hr cycle the turbidity of all products fell as pressure increased sharply (1st carbonatation juice) or only very slightly (from $<0{\cdot}5$ atm), after which turbidity remained constant or fell very slightly during approx. the next hour (1st carbonatation juice), 3 hours (syrup) or $6\frac{1}{2}$ hours (2nd carbonatation juice). Turbidity then rose abruptly with continued pressure increase to 2·5–3 atm. The economics, particularly regarding use of kieselguhr as pre-coat, are discussed.

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Design of a carbonatation juice clarifier. V. N. PELETMINSKII. *Sakhar. Prom.*, 1965, **39**, 751–754.—The author defends his views on clarifier design[1] and compares these with the ideas put forward by CHUGUNOV[2]. By means of calculations and references to factory results, he aims to show that settling surfaces in 700–800 mm high trays will have little utilization with a central juice feed and peripheral discharge, while it is claimed that as great a distribution as possible of untreated juice into each compartment and discharge of clarified juice from each compartment will permit total utilization of the settling surface and occupation of the same volume of clarifier by a greater number of trays. Close coordination between the number of discharge annuli, their position, the internal diameter of the pipes and pattern of change in dia. and spacing of holes in the inlet and discharge pipes is necessary to avoid having turbid juice.

* * *

Application of a PM density meter for checking syrup concentration. B. A. EREMENKO, A. I. TSENZURA, K. F. GERBUT and B. G. SUSOROV. *Sakhar. Prom.*, 1965, **39**, 755–760.—The PM flow-through density meter is described. While it covered a range of 0–1·3 g/c.c. (equivalent to 0–62°Bx) its accuracy was considered inadequate ($\pm 2{\cdot}5$°Bx). The error was reduced to $\pm 1{\cdot}2$°Bx by altering the range to 1·162–1·349 g/c.c. (equivalent to 37–70°Bx) by replacing the differential manometer of 400 mm H_2O overall pressure drop with one having an overall pressure drop of 160 mm H_2O. Modifications made to the indicator element to eliminate error due to the presence of air bubbles in the syrup are also described. The modified instrument is recommended for syrup Brix measurement, the water in the calibration tube being replaced once a week and the sediment at the bottom of the tube being withdrawn at the same interval.

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Compensation for the effect of scale formation in the automation of multiple evaporators. V. D. POPOV, V. G. TREGUB and K. A. UTKINA. *Sakhar. Prom.*, 1965, **39**, 760–764.—To compensate for scaling of evaporator walls in automatic maintenance of a material balance based on the amount of water to evaporate for a given target Brix, the effective temperature difference between the steam chest and the vapour space Δt and the amount of water evaporated at any given moment W are measured and the latter measurement is fed to a converter which gives the relationship between W and Δt_o (effective temperature difference with a clean surface). The values of Δt_o and Δt are fed to a summator which transmits a signal corresponding to the degree of scaling and which is proportional to Δt_N (the increase in effective temperature difference necessary to compensate for scale formation), where $\Delta t_N = \Delta t - \Delta t_o$. The signal from the summator is fed to a circuit breaker which also receives the value of Δt via a differentiator and comparator. When the value of Δt is at equilibrium, the signal from the summator is transmitted to a computer for determination of the temperature difference required for scale compensation in the other effects.

[1] *I.S.J.*, 1963, **65**, 210.
[2] *I.S.J.*, 1965, **67**, 86.

Occurrence of undetermined sugar losses in diffusion. M. I. DAISHEV. *Sakhar. Prom.*, 1965, **39**, 764–765. Undetermined losses in diffusion (L_n) can be evaluated from the following formula derived by SILIN:

$$L_n = (D - L_d)\frac{P_1 - P_2}{P_1}$$

where D = initial cossette sugar content, L_d = determined losses in diffusion, and P_1 and P_2 = purities of purified press juice and raw juice, respectively. A worked example is presented. A difference of 1 between P_1 and P_2 is shown to correspond to an L_n value of at least 0·20%.

* * *

Wet air filter for sugar dust collecting. M. K. STEPANOVA. *Sakhar. Prom.*, 1965, **39**, 777–778.—A simple wet air filter is described. This is used to collect sugar dust, which is periodically pumped to the mingling tanks as a 40°Bx solution. During 9 months' operation no sugar dust has reached the atmosphere at the factory in question.

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Modernization of the drive of a scroll-type diffuser. G. T. RYBKA. *Sakhar. Prom.*, 1965, **39**, 780–782. Modifications to the scroll drive of a Soviet-built DDS-type diffuser included the installation of a car differential and differential axle between two reduction gears and replacement of the differential pulley with an all-metal pulley of the same dimensions with six grooves for V-belts.

* * *

Ion exclusion applied to molasses. J. B. STARK. *Amer. Chem. Soc. 145th Meeting, Abstr. of Papers*, Sept. 1963, 22D.—Molasses solutions of 40°Brix were applied to columns of 50–100 mesh "Dowex 50W" resin (K^+ form) at 25° or 90°C. At 25°C separation of sucrose from reducing sugars was obtained, but not from ionic impurities. At 90°C large proportions of the chloride ash, colour and N compounds appeared in the effluent before sucrose, whereas reducing sugars and some other N compounds appeared later. The concentrations of sucrose and of some impurities were higher in some effluent fractions than in the original solution. Only water was required for rinsing and regeneration. The influences of temperature, degree of cross-linking, flow rates and recycling are discussed.

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Refining of beet molasses by ion exclusion. K. TAKAHASHI and T. TAKIKAWA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1965, **16**, 51–63.—Using a "Dowex X-4" exchanger in Na^+ form it was possible to recover about 90% of the sucrose in beet molasses of 20°Bx at a feed volume of about 10% on resin, a flow rate of 1·3 S.V. (space velocity), a temperature of 80°C and a feed of 15 g apparent sucrose/litre of resin. An attempt was made to determine the optimum conditions of recycling, whereby the best separation was achieved, with a method developed by SIMPSON and PRIELIPP, the sucrose concentration in the separated product being greater than its initial concentration in the starting solution. The volume of rinsing water also decreased. Increasing the number of recyclings improved separation but also raised the volume of resin required.

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Instrumentation within the British Sugar Corporation. J. E. A. RICH. *J. Amer. Soc. Sugar Beet Tech.*, 1965, **13**, 287–295.—An account is given of the post-war attention given to instrumentation and control engineering in the British Sugar Corporation with particular reference to thick juice flow measurement, raw juice flow control and milk-of-lime density and tank level control.

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Operation of juice softeners in a beet sugar factory. L. P. ORLEANS, W. A. HARRIS, L. W. NORMAN and H. W. KELLER. *J. Amer. Soc. Sugar Beet Tech.*, 1965, **13**, 296–303.—An account is given of the ion-exchange resin installation at Carlton sugar factory, California, for softening of high lime-salts juice, together with difficulties encountered. The softeners—10 ft dia. columns of resin, 4 ft high—reduced lime salts in thin juice from 0·066% to 0·029% on average. Evaporator boil-out requirements were cut by 65%. Brine cost for resin regeneration was three times that for evaporator cleaning chemicals, but better flow control should reduce salt consumption by more than half. Better evaporator performance probably contributed to the ability to increase the slicing rate by 12%.

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Purification of diffusion juice from beet of varying quality grown in Rumania. F. DOMSA. *Ind. Alimentara*, 1965, **16**, 162–173; through *S.I.A.*, 1965, **27**, Abs. 644.—Juice purification schemes are reviewed, and experiments on the treatment of Rumanian beets by different schemes are summarized. A laboratory installation was used which enabled 9 combinations of Brieghel-Müller pre-defecation, juice recirculation, 1st carbonatation with external circulation and 1st defeco-saturation to be compared. The best results ($F_k < 5$, $S_k > 6$) were obtained with progressive pre-defecation to pH 10·8–11·5, heating to 85°C, main defecation with 1·5–2% of CaO, and 1st carbonatation to pH 10·8–11·2 with 8-fold circulation. With beets from dry southern regions or beets stored for a long time, poorly sedimenting juices were obtained although the F_k values were usually satisfactory. The use of more complicated schemes to improve S_k often led to a deterioration in F_k. In such cases the use of a mud thickener is recommended, using a normal purification scheme, instead of a clarifier. Flow diagrams of 17 generally-known schemes are given.

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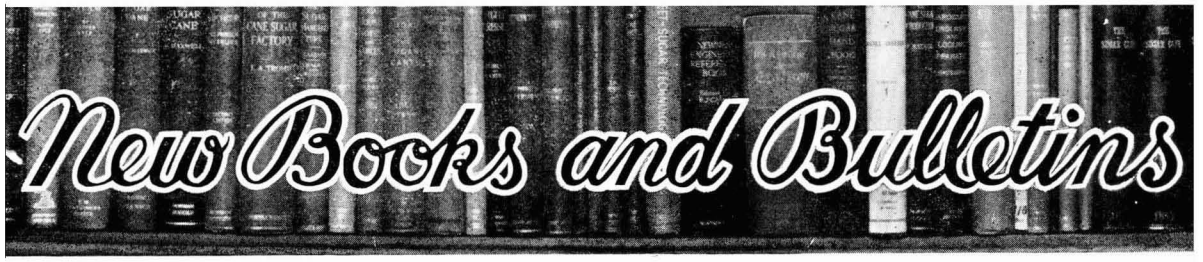
Pneumatic ash removal. H. ANDERS. *Zucker*, 1965, **18**, 606–608.—A brief survey is given of techniques and equipment used to remove furnace ash, in the light of present-day requirements for larger boiler units.



Manual of Cane Growing. N. J. KING, R. W. MUNGOMERY and C. G. HUGHES. 375 pp.; $5\frac{3}{4} \times 8\frac{3}{4}$ in. (American Elsevier Publishing Co. Inc., 52 Vanderbilt Ave., New York, N.Y., U.S.A.) 1965. Price: $11.00.

The first edition of this useful book appeared in 1953 and soon became the standard reference book on most matters relating to sugar cane agriculture in Australia. This new revised edition, written by N. J. KING, the Director of the Bureau of Sugar Experiment Stations (and a member of the Panel of Referees of this Journal) and two senior members of his staff, brings the book up to date. It incorporates the results of a wide range of research carried out since the first edition appeared.

The manual has been written for Australian cane growers, who are in the main relatively small producers averaging about 1000 tons of cane and who are without the facilities provided by the large plantation systems of other countries, with trained technical staff. The book has actually been distributed (gratis) by the Bureau to all cane growers in Queensland. It should undoubtedly prove of value to both old and newly established cane farmers in Queensland. It will also interest cane agronomists in other lands, for the fundamental requirements of the sugar cane plant remain the same wherever it is grown.

A notable feature about this new edition is the large number of well chosen and instructive photographs that have been included, some in colour. Most of these illustrations are new and there are 40% more than in the earlier edition. Many of them illustrate graphically the results of certain cultural practices, of the effect on cane of bad management or of certain pests and diseases that are liable to be troublesome in Queensland. These photographs are just what the practical grower will appreciate and derive benefit from. For instance, the extraordinary effects of copper deficiency in causing "droopy top" are shown in one photograph. Another picture shows the poor germination resulting from applying fertilizer in contact with the sett. Among the colour photographs are some showing the effects of chlorotic streak and mosaic disease on the leaves, and of ratoon stunting disease on the internal nodal tissue of the stem. Some of the important insect pests of sugar cane in Queensland are also shown in colour.

All aspects of cane cultivation and harvesting are covered in the book, with special emphasis on mechanization which has become such an important feature of the Queensland sugar industry. Various types of mechanical harvester now in use are illustrated. Separate chapters are devoted to such subjects as soils, land preparation, irrigation, drainage, soil conservation, weed control, effects of frost, hail and windburn, etc., all of which may interest cane growers in other regions.

The book is well produced and well written in a pleasant, easy style. Australian cane growers are indeed fortunate to have had such a good book prepared for, and presented to, them.

F.N.H.

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Sugar in Puerto Rico and Florida. 107 pp.; 8 × 10 in. (British West Indies Sugar Association Inc., P.O. Box 170, Barclays Bank Building, Bridgetown, Barbados, W.I.) 1965.

This report on the 12th I.S.C.C.T. Congress by members of the B.W.I. delegation is divided into three sections. Section I contains two articles by Dr. H. EVANS (Director of Research, Bookers Sugar Estates Ltd., British Guiana) entitled "Sugar Cane Cultivation in Puerto Rico" and "Field Tours of Puerto Rico during 12th I.S.S.C.T. Congress". D. I. T. WALKER (Senior Geneticist, British West Indies Central Sugar Cane Breeding Station) contributes a paper on variety work in Puerto Rico, and the section ends with a factory report on Puerto Rico submitted by G. T. WARREN (General Manager of St. Kitts (Basseterre) Sugar Factory). Section II contains two articles: one by Dr. H. EVANS on the post-I.S.S.C.T. Congress tour of Florida and the other, very brief, by G. T. WARREN on the post-Congress tour of Glades and Clewiston sugar factories, Florida. Section III refers to the 12th I.S.S.C.T Congress (held in Puerto Rico) and includes "Some Highlights of the Agricultural Papers" by Dr. H. EVANS, "Fundamental Research" by A. J. VLITOS (a discussion of the papers on cane research), reports on the entomological and pathological papers, by J. F. BATES and J. T. MILLS, respectively, "Some of the More Interesting Points in Cane Breeding from Papers and Discussions" by D. I. T. WALKER. and "Factory Papers and Discussions and ICUMSA Meeting" by G. T. WARREN. The report concludes with resolutions submitted at the Congress. The papers are clearly presented with a number of illustrations.

West Indies Sugar Co. Ltd., 1965 report.—Sugar production at Monymusk in 1965 totalled 80,574 tons, as against 79,074 tons in 1964. At Frome, production amounted to 106,049 tons, compared with 96,387 tons in 1964. More favourable seasons and better juices were experienced at both estates than for some years past, enabling the Company to hold down costs. In view of misgivings about the price of sugar, the demands of the Trade Unions for wages increases and bonuses were resisted and as a result strikes took place on both estates. The employees showed no animosity, and eventually returned to work.

A jacketed cell for the Bendix NPL polarimeter. L. K. DALTON. *J. Sci. Instruments*, 1965, **42**, (5), 353–354; through *S.I.A.*, 1965, **27**, Abs. 558.—A cell suitable for use with the Bendix NPL automatic polarimeter 143 is described with a diagram. It is constructed from a stainless steel block, enabling it to be thermostatically controlled, and is filled by a hypodermic needle. Measurements can be made on a small volume (1 ml) of solution.

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Current activities of the Cane Sugar Refining Research Project. F. G. CARPENTER. *Proc. 24th Meeting Sugar Ind. Tech.*, 1965, 132–136.—The Cane Sugar Refining Research Project was set up to continue the work originally done by the Bone Char Project. Three of the principal projects are discussed. In work on the evaluation of the individual reducing sugars a carbon column was developed with an alcohol gradient for separation of the reducing sugars from sucrose, the effluent from the column being monitored using an ETL-NPL automatic polarimeter. The separated sugars were collected in a single fraction which was then analysed for glucose by an improved glucose oxidase method. The total reducing power was determined by the HEIDT modification of the SOMOGYI method[1], and the optical rotation measured. Some preliminary results are tabulated showing the glucose, fructose and mannose contents in the reducing sugar fraction of various molasses samples, and the method is claimed to be sufficiently sensitive for application to raw sugar and other lower purity products. High-voltage paper electrophoresis[2] is being used to separate the colouring substances in sugar, but so far results have been discouraging, 8–10 fluorescent zones being easily separable but the visible colour being distributed somewhat evenly with very little separation. Studies of phosphate clarification have shown that in solutions of pH lower than 5, to which lime and phosphoric acid have been added, the stable solid phase is anhydrous dicalcium phosphate (DCPA) while in more alkaline solutions it is hydroxyapatite (HAP), while octacalcium phosphate pentahydrate (OCP) is never the most stable phase, its occurrence being the result of more rapid formation on precipitation than that of HAP.

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Studies on betaine. II. Determination of betaine by colorimetry. S. IWASHINA and Y. YAMAMOTO. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1965, **16**, 38–42.—The quantitative method described is a modification of that developed by BARABANOV *et al.*[3] but using acetone as solvent for the betaine reineckate, as in the method used by FOCHT *et al.*[4] For beet juices, the following technique is used: 50 ml of thin juice is pipetted into a 100-ml beaker and brought to pH 1 by adding HCl. After addition of 0·25 g of active carbon, the beaker is heated to 80°C and the solution kept at this temperature for 30 min with constant swirling. The active carbon is filtered and the cake washed with hot water. The filtrate is cooled to 20°C and brought to pH 1 by adding HCl. The resulting solution is transferred to a 100-ml volumetric flask and made up to mark by adding distilled water. Ammonium reineckate (5 ml) is dripped slowly to 5 ml of the solution in a 10-ml beaker during constant swirling. After standing at room temperature for 1 hr for formation of betaine reineckate precipitate, the latter is filtered and allowed to dry for 15–20 min before dissolving by washing with three successive 5-ml portions of 70% aqueous acetone. The solution is collected in a 25-ml volumetric flask and made up to mark by adding 70% aqueous acetone. The absorbancy is then measured at 525 mμ using the acetone solution as a blank and the betaine content read from a standard curve. In the case of molasses, 10 g is diluted to exactly 200 ml and 50 ml of the solution used. The estimated standard deviation is ± 0·06 mg/ml of betaine on juice.

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Studies on the odour of molasses. II. Volatile carbonyl compounds in refinery molasses. T. SHIRASAKI, H. ITO and M. KAMODA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1965, **16**, 43–50.—The volatile carbonyl compounds in refinery final molasses diluted to 50°Bx were converted to 2,4-dinitrophenylhydrazones after steam distillation. These were then fractionated by thin-layer chromatography after filtration, washing and drying, 3:1 toluene:ethyl acetate being used as developer and 10% KOH as spray reagent. The chromatogram was divided into 12 fractions and the 2,4-dinitrophenylhydrazones eluted with chloroform. Thin-layer and paper chromatography were used for identification of the isolated spots. Of the 44 spots, only 8 could be clearly identified. The substances identified were: isovaleraldehyde, butylaldehyde, formaldehyde, furfural (both *cis* and *trans* forms), acetaldehyde, methylglyoxal, glyoxal and 5-hydroxymethylfurfural. Thirteen spots turned purple when sprayed with KOH solution, indicating the existence of dicarbonyl compounds.

[1] *J. Amer. Chem. Soc.*, 1949, **71**, 2190.
[2] GROSS: *J. Chromatog.*, 1961, **5**, 194–206.
[3] *I.S.J.*, 1962, **64**, 247.
[4] *I.S.J.*, 1957, **59**, 106.

The inversion of sucrose by strongly acidic cation exchange resins. S. OIKAWA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1965, **16**, 64–69.—The rate of sucrose inversion by a cation exchanger was found to be affected by certain factors connected with the resin (contact time, expressed as space velocity, the resin H^+ concentration, the degree of its cross-linkage and its porosity) as well as by the free acids formed when the sugar solution is passed through the resin and by the sugar solution temperature. It was observed that the lower the space velocity and the higher the H^+ concentration, which was doubled by a 5°C increase in solution temperature, the higher was the inversion rate. The inversion rate was reduced by increase in the degree of cross-linkage and by a reduction in the level of porosity caused by contamination of the resin by organic substances. The rates caused by the free acids were found to be in close agreement with values calculated by the ANDERSSON formula[1]. However, under factory conditions (an S.V. greater than 5 and a temperature below 20°C), the effect of the free acids is negligible.

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The properties of beet juice demineralized by ion exchange process. Effects of ash and raffinose on the crystal form of beet sugar products. T. KATAGIRI and S. HAYASHI. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1965, **16**, 81–86.—The effects of raffinose and inorganic salts on sucrose crystal form and crystal growth rate were studied in a laboratory vacuum pan. It was found that in the presence of raffinose alone, the growth rates along the *a* and *c* axes of sucrose crystals were reduced, giving thin and narrow plates. In the presence of both raffinose and inorganic salts, the sucrose crystal became more square as the concentration of added inorganic salts increased. The depressing effect of raffinose on the overall crystal growth rate was greater than that of inorganic salts, which must therefore reduce the raffinose effect. Hence, it is inadvisable to remove by ion exchange all the inorganic salts present in beet juice.

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The oxidative decomposition products of sucrose by ozone. T. SHIGA, S. NOMURA, H. OKUYAMA and N. NOSAKA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1965, **16**, 87–97.—In decolorization tests with ozone it was found that the decolorized sugar solutions underwent strong browning reactions when heated and subsequent experiments have revealed that sucrose oxidation products brown easily. The oxidation products have been identified as formaldehyde, acetaldehyde, glyoxal, glucosone and 3-deoxyglucosone. 5-Hydroxymethylfurfural was not found, possibly, it is suggested, because it can be easily oxidized by ozone. Several organic acids were formed: gluconic, 2-ketogluconic, glucuronic, glycollic, formic, acetic and oxalic acids and CO_2. The browning abilities of these substances were studied singly and after addition of amino acids to each. The glucosone on its own exhibited moderate browning by caramelization; glyoxal alone showed weak browning, but with amino acid added the browning was considerable. While these two are considered the most important substances causing browning, 3-deoxyglucosone is also important among ozone-oxidized sucrose products. There was found to be no selectivity of point at which ozone acts on the sucrose molecule, and several oxidation reactions occurred simultaneously. Glucuronic acid was formed as a result of ozone oxidation of glucose. Oxidation did not involve conversion of sucrose to 5-hydroxymethylfurfural and then to levulinic acid.

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Determination of the free amino acids in sugar beets during growth period and in the factory process juices. H. TAMIYA and M. SHIMO. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1965, **16**, 98–100.—The chromatographic method of MOORE *et al.*[2] was applied using two columns of "Amberlite IR-120" resin. The total N and amino acid contents of beets were determined during the August-November period. To do this, the beet were topped, pressed and the press juice clarified with basic lead acetate before analysis. The total N in September was lower than during the other months, while the amino acid contents increased slightly in September, continued to increase in October and decreased slightly in November. Of the amino acids identified (aspartic acid, asparagine, threonine, serine, glutamic acid, glutamine, glycine, alanine, valine, *iso*-leucine, tyrosine, γ-amino butyric acid, tryptophane, lysine, histidine and arginine) glutamine was quantitatively the most prominent, being present to the extent of 34% in August and 61% in November. Next to glutamine came γ-amino butyric acid (average of 10%). The amino acids in raw juice, 2nd carbonatation filtrate, "Amberlite IR-120" (Na^+) effluent, thick juice, "Amberlite IRA-401" (Cl^-) effluent and high green liquor were absorbed by "Amberlite IR-120" (H^+) and, after washing the resin with water, were eluted with 0·15N aqueous ammonia. The most prominent amino acids were glutamine + glutamic acid, asparagine + aspartic acid and γ-amino butyric acid.

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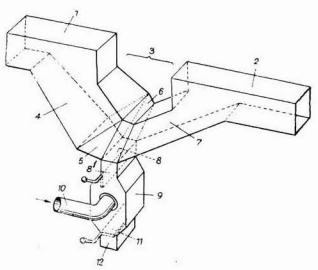
Factory-scale tests on qualities of Australian raw sugars. THE TECHNICAL COMMITTEE, JAPAN SUGAR REFINERS' ASSOCIATION. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1965 **16**, 122–123.—Tests in 20 refineries in 1964 showed that Australian raws imported into Japan had pol and moisture contents almost the same as those of Taiwan raws, but had a higher ash content, smaller grain size and higher C.V. than the Taiwan sugar. The colour after affination was higher than that of affined Taiwan sugar. The general filtrability was higher than that of the Taiwan raws, although filtration difficulties were reported at three refineries.

[1] DEVILLERS & LOILIER: *I.S.J.*, 1959, **61**, 121.
[2] *Anal. Chem.*, 1958, **30**, 1185–1190.

UNITED KINGDOM

System for separating stones from beet. TULLNER ZUCKERFABRIK A.G., of Tulln, Austria. **987,908.** 3rd October 1962; 31st March 1965.—At the end of a beet flume 1 the floor slips away at an angle of 45° and the flume section 4 is frustrum-shaped, becoming wider in one direction and then narrowing again in parts 5 and 6. The section then slopes up at an angle of 45° to the subsequent flume section 2, the ascending branch being a prismatic section 7 having a constant cross-section which is greater than that of the flume 2.



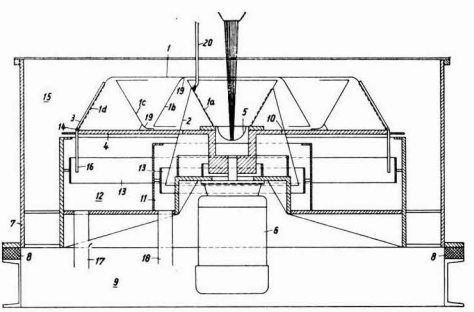
The axes of section 4 and 7 are practically perpendicular to each other and flume section 2 is somewhat lower than section 1 to overcome head loss resulting from the flow resistance in the siphon section 3. At the lowest point of section 6 of the siphon is an outlet aperture 8 for stones, which extends over the entire width and also serves an as inlet for further water. The aperture, which can be sealed off by a flap 8′, leads into a stone-collecting chamber 9 into which the additional water is fed through pipe 10. An outlet socket 12, sealed off by a flap 11, serves to release the stones from chamber 9 as and when required. When the beets pass through the siphon section 3 their speed is reduced as a result of the increased cross-section, the beets move farther apart while remaining suspended, and the stones and other impurities of higher density than the beets sink to the flume bottom and fall into the orifice 8, even the water slowly fed in from below pipe 10 being insufficient to carry them back up into the ascending branch.

* * *

Purifying sugar (beet) juices. THE EIMCO CORPORATION, of Salt Lake City, Utah, U.S.A. **989,468.** 15th February 1962; 22nd April 1965.—Lime is added to raw beet juice in a pre-defecator (together with carbon dioxide), additional lime added in a defecator and the mixture saturated with CO_2. The saturated mixture is separated in a hydrocyclone into a coarse component which passes to a filter, and a fine component which is returned to the pre-defecator.

* * *

Continuous centrifugals. BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT A.G., of Braunschweig, Germany. **990,490.** 28th February 1963; 28th April 1965.—For curing higher purity massecuites with wash water addition, a continuous vertical-shaft centrifugal has a conical basket 1 consisting of a number of basket sections, i.e. 1a, 1b, 1c and 1d, which together provide a zig-zag cross-section thus greatly extending the path that the massecuite must traverse without increasing basket height. Between section 1a and 1b is a wall 2 to catch the molasses spun off, similar walls being possible between other sections. A catching jacket 3 surrounds the outermost section 1d. All the basket sections may be screened, or one or other of them may be unperforated, or unperforated zones may be provided in the screen surfaces of any of the sections. The basket sections are secured to a common disc 4 and rotate together. Central section 1a has a central feed or acceleration chamber 5, formed in the hub of disc 4, which is coupled directly to electric motor 6, although it can be indirectly driven by a motor. The disc has escape holes 10 for molasses spun off and caught by wall(s) 2 and jacket 3, spaces 11 and 12 under disc 4 receiving this molasses.



The outer catching jacket 3 also has escape holes 14 for the cured sugar, which then passes into sugar compartment 15, while residual liquid, etc., retained by jacket 3, drains through pipes 16 extending from holes 10 at the edge of disc 4 into space 12 below. Spaces 11 and 12 have drain pipes 17 and 18 for removal of the material and possible recirculation of the material. The inner edges 19 of the basket sections 1a-1d are rounded so that they overlap at the transfer points and ensure shock-free transfer of the massecuite. Feed devices 20 (only one is shown) are provided at these transfer points for introduction

Copies of Specifications of United Kingdom Patents can be obtained on application to The Patent Office, Sale Branch, Block C, Station Square House, St. Mary Cray, Orpington Kent (price 4s 6d. each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. 20231 U.S.A. (price 50 cents each).

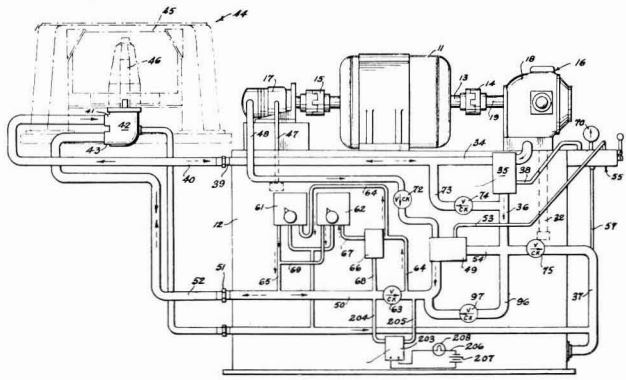
of wash liquid. These may rotate with the basket. The number of basket sections may be greater than four and the centrifugal may be mounted horizontally or inclined.

* * *

Hydraulic centrifugal drive. THE WESTERN STATES MACHINE CO., of Hamilton, Ohio, U.S.A. **990,984.** 30th January 1962; 5th May 1965.—A hydraulic centrifugal drive includes an electric motor 11 which may be mounted on the top of a hydraulic fluid storage tank 12, and which has the opposite ends of its shaft 13 connected, by couplings 14 and 15, respectively, to a main hydraulic pump 16 and to an auxiliary hydraulic pump 17, also mounted on top of tank 12 so as to provide a compact power unit. The relatively large main pump 16 is intended to supply the hydraulic fluid under pressure for effecting the high-speed forward rotation of the associated centrifugal basket. It is provided with an inlet which receives fluid to be pumped from tank 12 by way of an inlet pipe 32 in the tank and it has an outlet for delivering the hydraulic fluid under pressure. The outlet of pump 16 is connected to a pipe or conduit 34 which has a piloted relief valve 35 interposed therein. This serves the dual function of limiting the pressure within pipe 34 and of unloading the related pump 16 when the output of the latter is not required for driving the associated centrifugal basket through a return pipe 37 extending back to tank 12. A pilot line 38 extends from valve 35 and loads the latter to limit the pressure in pipe 34 to a pre-determined value when the pilot line is blocked.

Pipe 34 is connected, for example, by a coupling 39, to a flexible pipe or hose 40 which extends to the inlet 41 of a hydraulic, positive displacement motor 42. This has a relatively small mass and dimensions in terms of the power that it can deliver and so is ideally suitable for direct coupling to the shaft of the basket 45 of the centrifugal. The basket is rotatably mounted on shaft 46 supported so as to permit gyratory movement of the basket when the loading of the latter is unbalanced, and the shaft of motor 42 is directly coupled to shaft 46 below the basket 45 in order to leave the curb top clear and to reduce the overall height of the centrifugal, while the small dimensions of motor 42 avoid any interference with the downward discharge of solids from the basket and the small mass of the motor avoids any adverse influence on the conditions of the gyratory movement of the basket.

The inlet of pump 17 is connected to an inlet pipe 47 extending into tank 12 for withdrawing hydraulic fluid from the latter, while its outlet is connected to pipe 48 which communicates with a piloted relief valve 49, similar to piloted relief valve 35, but set to relieve the pressure in pipe 48. Valve 49 communicates with a pipe 50 which is connected, at a coupling 51, to a flexible pipe or hose 52 extending to the outlet 43 of motor 42, and a pilot line 53 extends from valve 49 and causes the latter to limit the pressure in pipes 48 and 50 to the adjusted value for which valve 49 is set when pilot line 53 is blocked, whereas piloted relief valve 49 is effective to dump the output of pump 17 into return pipe 37, by way of a pipe 54, when pilot line 53 is open. Pilot lines 38 and 53 are connected to control valve 55 which can be so adjusted to select the circuit through which the hydraulic fluid flows and also rate of flow, so governing the direction and speed of basket rotation for spinning and ploughing.



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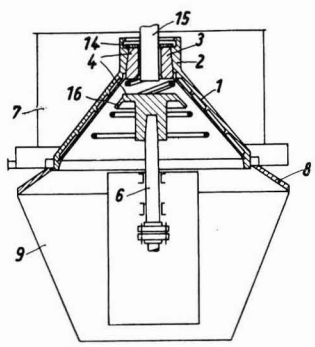
Centrifugal. D. POHL and J. POHL, of Bad Salzdethfurth, Germany. **991,502.** 10th July 1963; 12th May 1965.—A bottom-driven conical centrifugal basket 1 has a hub 2 at the top for receiving an upper part 3 of a coupling element 4, the lower part 5 of which is detachably connected to a rotary drive shaft 6 of the basket. Between the upper part 3 and lower part 16 of the coupling element 4 are deflecting helical



elements. The upper part 3, which is a hollow cylinder with a slightly conical exterior, has an upper port through which passes inlet tube 15 for sugar feed. A

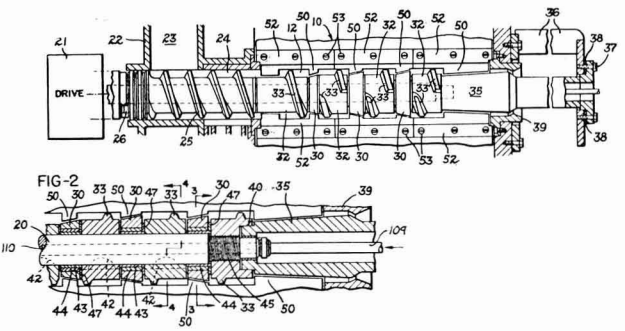
safety plate 14 connected to the upper part 3 and to hub 2 prevents the coupling element 4 becoming detached from the hub. The top surface of part 16 is provided with a downwardly diverging drip cone which prevents sugar falling into receiving funnel 9 for the spun sugar instead of onto the basket wall when the speed falls.

* * *

Liquid expressing press (for sugar cane or beet). THE FRENCH OIL MILL MACHINERY CO., of Piqua, Ohio, U.S.A. **992,396.** 2nd August 1961; 19th May 1965. The screw press includes a main cage body 10 which is made up of complementary halves forming a generally cylindrical elongated chamber 12. The drainage spaces are provided by a series of screen bars which are suitably supported in the cage sections and separated by spacers which provide minute spaces between the bars at their inner surfaces through which expressed liquid may pass to the exterior of the cage where it is collected.

A main shaft 20 extends coaxially through the press cage and is rotated by a suitable drive mechanism indicated at 21. At the inlet end of the cage is a housing 22 including an opening 23 for cane or beet, and also including a feed chamber 24 of generally cylindrical shape which is aligned with and opens into the inlet end of the main cage. Surrounding the shaft 20 in this area is a feed worm 25 which is rotatable independently by a separate, usually faster rotating, connexion with the drive, including at least one driving lug or dog 26. Within the body of the cage, mounted on shaft 20, are alternately arranged collars 30 and feed or pressure worm bodies 32 each having a worm flight 33 extending into close proximity with the interior wall of the cage. Adjacent the discharge end a discharge collar 35 is mounted through a supporting bracket 36 which is fastened to the cage structure and includes adjusting bolts 37 and spacers 38 providing a means for adjusting the position of the tapered discharge collar along the length of the shaft to vary the cross-sectional area of the discharge opening which is defined by the collar and surrounding ring 39 mounted also on the cage body. Relative movement between collar 35 and the preceding worm body is accommodated by an inter-fitting telescoping arrangement.

Each of the collars 30 and pressure worm bodies is a separate element; the collars may be of constant diameter or may have a tapered outer configuration, increasing in cross-sectional area toward the discharge end of the press to decrease accordingly the cross-sectional area through which the material must pass. The worm bodies 32 are connected for driven movement with shaft 20 by means of keys 42, there being one key for each worm. Surrounding the shaft within each collar 30 is a cylindrical spacer 43 which abuts the worm bodies to maintain proper spacing



between them for free relative rotation between the worm bodies and collars 30. Also, on the inside of each collar is a bearing, which may be formed on the inside of the collar, or be a separate element, for example in the form of a separate sleeve 44. Thus, each of the collars 30 is capable of independent rotation on shaft 20, but is essentially confined against axial movement by reason of its mounting between worm bodies 32. The last worm body is maintained in a position by a threaded connexion at 45 to the end of the shaft 20, and this holds the entire assemblage axially on the shaft. Preferably, the end of the collars toward the discharge are engaged with hardened thrust washers 47 which abut the following worm body 32 and provide a bearing surface accommodating relative movement between the adjacent worm and collar.

Accordingly, when shaft 20 is rotated by the drive, the worm bodies 32 will rotate with it, and the worm flights 33 will force the material toward the following collars and succeeding worms. Owing to the tapered configuration of the worm bodies and/or collars, the downstream areas will be of smaller cross-section so that the feeding action by the worm flights will produce an essentially sustained high mechanical pressure on the material, expressing liquid contained in it, and the liquid will flow through the openings between the screen bars to the exterior of the cage.

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.

Automatic cane carrier control. Fletcher & Stewart Ltd., Masson Works, Derby.

This new system incorporates a coarse control through hydraulic load cells carrying a section of the auxiliary carrier which transfers the cane from the feed table to the main carrier. The cells record the weight of the cane on the floating section and transmit a signal to the variable-speed control of the feed table, so that the cane weight on the auxiliary carrier is maintained at a constant rate slightly above the pre-set datum. The scheme's fine control is through "depth sensers" mounted on the main carrier; these transmit a trimming signal to the variable-speed control of the auxiliary carrier. An over-load control incorporated in the levelling knives automatically stops the auxiliary carrier if the knives are in danger of stalling. A similar control stops the main carrier if there is danger of the heavy-duty knives stalling.

* * *

Internal cleaning of tubes. Hodge Clemco Ltd., Darnall Road, Sheffield 9.

"Holloblast" grit blasting equipment is an entirely new development in the field of internal pipe cleaning designed to remove scale, rust, etc. from tubes *in situ* from 2 to 12 in i.d. and lengths up to 40 ft. The equipment is connected to any conventional air shotblasting machine in place of the normal nozzle and nozzle holder and can be used with all conventional abrasives of 25 B.S. mesh or less. The air-abrasive blast mixture blasts against a conical diverter which directs the abrasive against the inside wall of the tube. Spent abrasive is discharged through the far end of the tube and the tube is left completely free of dust.

* * *

New valve actuator. Saunders Valve Co. Ltd., Blackfriars Street, Hereford.

The new diaphragm-operated pressure opening or closing valve actuator—D.O.P.O. (M) or D.O.P.C. (M)—announced incorporates an "air sprihg". Compressed air is stored in the return chamber of the top-works and acts as a normal spring. As the operating pressure overcomes the pre-determined air pressure in the return chamber the valve operates in the direction for which it is set, and when the operating pressure falls the air spring returns the operating diaphragm to its original position. The actuator may be fitted to M and MS types of the "Sabal" ball plug valve.

* * *

Magnetic level switches. Ronald Trist Controls Ltd., Bath Road, Slough, Bucks.

Details are announced of a range of level switches which are designed to meet continental or American flanging standards. Constructed on the composite flange principle, the "Mobrey" switches incorporate a float-holding fork assembly and a main mounting flange (both variable according to flange size requirements) secured together with the switch head body by three studs and nuts arranged eccentrically to ensure that the head can be mounted only in the correct position. "Wet" parts of the switch are of stainless steel and the body is made of aluminium alloy. Maximum working pressure is 500 p.s.i. (35 kg/sq.cm.) and the switches are suitable for operation in liquids having a minimum s.g. of 0·5.

PUBLICATIONS RECEIVED

SPEED REDUCERS. Link-Belt Company, Prudential Plaza, Chicago, Ill., 60601 U.S.A.

Book 3051 is a new publication giving details of the company's in-line helical gear speed reducers. In double, triple and quadruple reductions, these offer practically any combination of speed and torque, with ratios ranging from 6:1 to 2217:1 and h.p. in the range 0·012–314. The book explains how to select the best combination for any application, giving complete mounting data and dimensions.

* * *

CANE MECHANIZATION. J & L Engineering Co. Inc., Jeanerette, La., U.S.A.

A leaflet released by the company gives details of various pieces of cane machinery, all of which are mounted on Caterpillar tractors. The S5000 whole-stalk harvester has an average capacity of 10 acres in 8 hr under Louisiana conditions, piling three cane rows on one heap row, while the T2000 harvester piles four rows on one heap row. Both operate with infinitely variable row widths. The R1000 continuous loader handles up to 200 tons of cane per hr. It has rubber-tyred conveyors which can be hydraulically raised for road travel, and a separate drag-type cross conveyor as well as five removable 42-inch saws mounted 20 inches apart. The N3000 portable drag conveyor receives and transfers 5-ton loads of cane into a semi-trailer in 45 sec. It is 34 feet long and operates at 130–140 f.p.m., raising the cane 17 ft. It can hydraulically dump a field cart with a 7000-lb load in 20 sec and the conveyor can be tilted.

Brevities

Polish equipment for Spanish beet sugar factory.—A contract has been signed by CEKOP with the Spanish sugar undertaking, Cooperativa Azucarera "Onesimo Redondo", for the supply of equipment for a factory with a daily production of 200 tons of sugar. CEKOP will also assemble installations produced by a local Spanish firm under Polish supervision. The building work will be carried out by the customer under the supervision of Polish engineers.

* * *

Water treatment at Corozal.—Paterson Candy International Ltd. have been awarded contracts to supply water treatment plant to the Tower Hill factory of Corozal Sugar Factory Ltd. in British Honduras. The plant will treat water for boiler feed make-up supply, boiler feed and domestic supply. The raw water has a total hardness of 586 p.p.m. of which 386 p.p.m. is temporary hardness. The temporary hardness will be removed in an "Accentrifloc" softener and the water then passed through a base-exchange plant, after which it will have zero hardness and a low alkalinity. Since the treated make-up water will be mixed with recovered boiler condensate which is usually acidic, dosing pumps will be used to inject chemicals for pH correction and residual oxygen removal. The domestic water supply will be chlorinated.

INTERNATIONAL SOCIETY OF SUGAR CANE TECHNOLOGISTS

XIII Congress, Taiwan

THE I.S.S.C.T. XIIIth Congress is scheduled to start on 2nd March 1968 with the opening ceremony and to wind up on 16th March with the Farewell Banquet. It will be a solid two-week programme. An orientation talk on the Taiwan Sugar Industry—its background and present operation—will be offered after the ceremony on 2nd March. The same afternoon a Garden Party will be arranged in the most sttractive spot—Yangmingshan Park—in Taipei suburb. The week from the 3rd to the 9th is scheduled for sugar factory visits. The delegates will be divided into groups—the factory group and the field group. The visiting routes will be so arranged that while one tours around the island in one direction the other group will travel in the opposite direction. The two groups will probably not meet each other on the way. The highlights of the visits for the field group will be intercropping, river bed reclamation, a cooperative farm, a hog farm, a high yield farm, a farm machinery demonstration, the work of the Cane Growers' Association, Sugar Experimental Station etc. The highlights of the visits for the factory group will be new diffusers, automation in a sugar mill, plantation white sugar manufacture, diversification projects, Sugar Experimental Station, etc.

The ladies' programme is such that they will travel along with the group to which their husbands belong but will only visit more interesting places. Sightseeing to attractive and unique spots will be included in the visiting programme for ladies and gentlemen alike to avoid rushing delegates to exhaustion. The sightseeing trip is programmed with ample time that they will find pleasant moments for relaxation. Most of the trips will be made by comfortable sightseeing bus except the visit to Hwalien which will be made by air. Almost all roads over which the delegates and ladies will travel are paved and surfaced. Adequate modern hotel accommodation is available in Taipei and in the South of the island.

In the second week, there will be a general session, symposia, section sessions and plenary sessions, the details of which will be published later. All the above meetings will be held in Taipei. This metropolis is densely populated with 1,200,000 people. It is connected with the big cities of the world by various international airlines. It abounds in culture centres, beautiful scenery, recreation clubs within the city limits and in its suburban areas, and plenty of places worth visiting. After 16th March 1966, an interesting post-congress tour in their country is to be arranged by the Philippines section of the Society.

The Congress Organizing Committee includes General Chairman M. H. YUAN, General Vice-Chairman C. R. FLORCRUZ, General Secretary-Treasurer Dr. H. S. WU, and the Chairmen of the four Sub-Committees: P. C. YANG (Entertainment Sub-Committee), Dr. S. C. WANG (Programme Sub-Committee), Y. CHEN (Itinerary Sub-Committee) and Dr. K. C. LIU (Publication Sub-Committee).

Enquiries should be addressed to:

I.S.S.C.T. XIII Congress,
c/o Taiwan Sugar Corporation,
P.O. Box 35, Taipei,
Taiwan, Republic of China.

Attention: Dr. H. S. WU.

BREVITIES

New Cuban yeast plant[1].—What is claimed to be the largest torula yeast factory in the world has been built at a cost of 6,655,000 pesos at the Ciro Redondo sugar mill, 25 kilometres from the city of Morón in Camagüey Province. This modern plant will be a great aid in developing cattle and poultry breeding and will eventually become an important source of foreign exchange since the yeast is in great demand in several European countries. The factory is highly automated and has machinery which is almost entirely French-made. With a total of 85 workers, operating three shifts, it can reach a daily production of 30 tons of dry fodder yeast, using molasses as its main raw material.

* * *

New sugar factory for Iraq[2].—A new cane sugar factory is to be built in Majar Al-Kabir. It is to have a capacity of 35,000 tons of sugar per year and construction costs are estimated at some 6 million dinars.

Argentina sugar crop, 1965/66[3].—The 1965/66 sugar season in Argentina finished recently when Ingenio Santa Lucía in Tucumán Province ceased crushing. A total of 13,112,317 metric tons of cane were crushed to give a record production of 1,211,480 tons of sugar, raw value.

* * *

Brazilian sugar mill for Argentina[4].—It is reported that the Banco do Brasil is to make a loan equivalent to U.S.$2,000,000 to the mixed-capital Company Ingenio Azucarero General San Martín, to finance purchases of machinery from Brazil for a sugar mill and alcohol distillery to be installed in the Province of Chaco.

[1] *Cuba Economic News*, 1966, **2**, (8), 12.
[2] F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (4), 19.
[3] *La ind. Azuc.*, 1966, **71**, 44.
[4] *Fortnightly Review* (Bank of London & S. America Ltd.), 1966, **31**, 176.

European Sugar Beet Area Estimates, 1966[1]

	(hectares) 1966	1965
WEST EUROPE		
Austria	52,000	38,204
Belgium-Luxembourg	70,000	66,400
Denmark	53,500	56,401
Finland	18,500	18,500
France*	280,000	358,000
Germany, West†	294,000	293,113
Greece	15,800	16,028
Holland	93,500	91,894
Ireland	22,300	26,175
Italy	290,000	275,000
Spain	150,000	130,000
Sweden	43,000	42,600
Switzerland	8,360	8,460
Turkey	166,600	160,690
United Kingdom	177,000	177,285
Yugoslavia	80,000	80,000
	1,814,560	1,838,750
EAST EUROPE		
Albania	6,000	6,000
Bulgaria	70,000	70,000
Czechoslovakia	220,000	219,800
Germany, East	230,000	216,700
Hungary	110,000	112,850
Poland	450,000	475,000
Rumania	220,000	192,000
U.S.S.R.	4,200,000	4,200,000
	5,506,000	5,492,350
Total Europe	7,320,560	7,331,100

* Excluding sugar beet area for alcohol production.
† Excluding foreign beet area.

Indian sugar exports, 1965[2].—Exports of sugar from India n 1965 totalled 276,518 metric tons, tel quel, made up as follows: 91,896 tons to the U.S.A., 75,716 tons to the U.K., 52,762 ons to Canada, 35,900 tons to Malaysia/Singapore, 9725 tons o South Vietnam, 9519 tons to South Korea and 1000 tons to Persian Gulf countries. The figure represents an increase above :he 234,301 tons exported in 1964 but is still far below the 478,592 tons exported in 1963.

* * *

New sugar factory for South Africa[3].—A new sugar factory is to be constructed at Hoedspruit in the Transvaal. A contract has recently been signed between the Société de l'Atlantique and Letaba Suiker-Mij. Beperk. The plant, which is to start operations in May 1967, will have an annual capacity of some 150,000 tons of sugar and will cost some R.13,000,000 (£6,500,000). It will be equipped with the most modern machinery.

* * *

West Indies sugar production, 1965[4].—Sugar production in :he West Indies totalled 1,297,355 long tons, according to the West Indies Sugar Association[1], including 14,040 tons in Antigua, 195,973 tons in Barbados (this figure includes "fancy molasses"), 309,445 tons in British Guiana, 488,861 tons in Jamaica, 38,450 tons in St. Kitts and 250,586 tons in Trinidad. Estimated production for 1966 is 1,335,800 tons.

* * *

Sugar factory for Malawi[5].—A R26 million (£13,000,000) sugar factory, financed by aid from the South African Industrial Development Council and built by South African engineers, is to go into production soon in Malawi. The mill is for the Sucoma project at Chikwawa, near Blantyre, which is intended to meet all Malawi's sugar needs and provide a considerable quantity for export.

BREVITIES

Italy sugar beet area, 1966[6].—The area to be sown to sugar beet in Italy this spring is put at some 300,000 hectares according to the National Beet Growers' Association, of Bologna. This compares with 275,000 ha drilled for the 1965/66 campaign.

* * *

New sugar factory for Colombia[7].—The manager of the Distribuidora de Azucares has announced that the Company Manuelita S.A. was to open a new sugar mill (Ingenio del Norte) in March which will have an annual production capacity of 60,000 metric tons.

* * *

Polish sugar crop, 1965/66.—Official results of the campaign in Poland have been reported by a press agency[8]. Production of sugar is put at 1,490,000 metric tons, raw value, from 12·3 million tons of beets, compared with 1,795,000 tons of sugar made from 12·6 million tons of beets in the 1964/65 compaign.

* * *

Rumania sugar crop, 1965/66[9].—Sugar production in the 1965/66 campaign totalled 402,000 tons from 3,330,000 tons of beets. Beet production is to be expanded in 1966 to 4,000,000 tons and sugar production to 600,000 tons.

* * *

Refining of cane raws in the Soviet Union[10].—In 1965 approximately 2·3 million tons of raw cane sugar was refined, yielding 2·1 million tons of granulated sugar. This represents 19% of the total amount of sugar produced in the U.S.S.R. in 1965. However, the average yield of 91·6% on weight of cane raws is considered inadequate and is attributed to simultaneous processing of beet juice and cane raws and to inadequate preparation of beet sugar factories for inter-campaign refining. A target of about 28,000 tons of raws refined per day has been set. The concomitant problem of bulk handling, transport and storage is to receive urgent attention.

* * *

Tunisian beet campaign, 1965/66[11].—In the 1965/66 campaign, 37,495 tons of beets were harvested in Tunisia, against 48,785 tons in 1964/65. Sugar production reached 4668 tons as compared with 5809 tons in the previous campaign.

* * *

Indian sugar factory for Nigeria[12].—According to a spokesman of the Indian Embassy in Lagos, the plan for a sugar factory to be set up by India in Nigeria is to be implemented as soon as possible.

* * *

Uganda sugar production, 1965[13].—In 1965 production of sugar reached 115,669 tons as compared with 124,266 tons in 1964. Consumption increased by 15% from 82,042 tons in 1964 to 95,874 tons in 1965. The fall in production in 1965 was due to drought and it is expected that this will also slightly affect production in 1966.

* * *

Bagasse paper for Pakistan[14].—The Commonwealth Development Finance Corporation Ltd. has agreed to make a secured loan of £750,000 to the Pakistan Paper Corporation Ltd., accompanied by a partial conversion option, towards the foreign exchange costs of erecting and commissioning a pulp and paper mill near Peshawar. The mill will use bagasse as a major raw material and will be the first large-size paper mill in West Pakistan.

[1] F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (10), 1–4, 18.
[2] C. Czarnikow Ltd., *Sugar Review*, 1966, (752), 46.
[3] F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (4), 19.
[4] C. Czarnikow Ltd., *Sugar Review*, 1966, (752), 47.
[5] *The Times*, 26th February 1966.
[6] C. Czarnikow Ltd., *Sugar Review*, 1966, (753), 50.
[7] *Fortnightly Review* (Bank of London & S. America Ltd.), 1966, **31**, 136.
[8] Through C. Czarnikow Ltd., *Sugar Review*, 1966, (753), 51.
[9] F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (7), 9.
[10] *Sakhar. Prom.*, 1966, **40**, 1–3.
[11] F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (7), 15.
[12] *Indian Sugar*, 1965, **15**, 590.
[13] F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (7), 15.
[14] *C.D.F.C. Ltd., Ann. Rpt.*, 1965/66, 20.

BREVITIES

New Cuban agricultural laboratory[1].—The Central Laboratory of the Sugar Cane Institute of the Academy of Sciences was recently opened near Havana. Ing. FRANCISCO DÍAZ BARREIRO, Director of the Institute, explained at the opening ceremony that the Laboratory will carry out research on soil and sugar cane and will conduct studies on phytopathology and entomology, contributing to fertilizer studies and the struggle against pests and diseases.

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New Brazilian sugar factory[2].—A new sugar factory, Usina Jaciara, is to be built in the São Lourenço valley in the Mato Grosso. It will have a capacity of 150,000 sacks (9000 metric tons).

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Malaysia sugar factory[3].—A cane sugar factory valued at 45 million dollars is to be constructed soon in the state of Johore. An area of 8000 hectares is to be planted to cane in the vicinity.

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Bulk sugar store for Cuba[4].—A large bulk sugar store is being built in Cárdenas, in Matanzas Province, near the Jose Antonio Echeverría sugar refinery. It will have a capacity of 32,000 metric tons and will supply the refinery during the 3 months off-season, the supply of raw sugar coming from other sugar mills in the Cárdenas area.

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Bahamas sugar industry possibility[5].—The Owens-Illinois Co., a U.S. concern, has engaged Arthur D. Little Inc. to study the possibility of industrial development on the island of Great Abaco, Bahamas, including the possibility of a sugar mill.

Stock Exchange Quotations

London Stocks (*at 17th May*, 1966)	CLOSING MIDDLE s d
Anglo-Ceylon (5s)	5/4½
Antigua Sugar Factory (£1)	10/–
Booker Bros. (10s)	21/4½
British Sugar Corp. Ltd. (£1)	21/4½
Caroni Ord. (2s)	1/9¾
Caroni 6% Cum. Pref. (£1)	16/3
Demerara Co. (Holdings) Ltd.	3/1½
Distillers Co. Ltd. (10s units)	22/4½
Gledhow Chaka's Kraal (R1)	15/–
Hulett & Sons (R1)	16/3
Jamaica Sugar Estates Ltd. (5s units)	3/1½
Leach's Argentine (10s units)	9/3
Manbré & Garton Ltd. (10s)	32/6
Reynolds Bros. (R1)	19/–
St. Kitts (London) Ltd. (£1)	15/–
Sena Sugar Estates Ltd. (5s)	9/1½
Tate & Lyle Ltd. (£1)	29/6
Trinidad Sugar (5s stock units)	2/0¾
West Indies Sugar Co. Ltd. (£1)	7/3

New York Stocks (*at 16th May*, 1966)	CLOSING MIDDLE $
American Crystal ($5)	17¾
Amer. Sugar Ref. Co. ($12.50)	28¼
Central Aguirre ($5)	30⅝
Great Western Sugar Co.	40¼
North American Sugar ($10)	14
South P.R. Sugar Co.	22¼
United Fruit Co.	24½

JAPAN SUGAR IMPORTS[6]

Metric tons, tel quel	1965	1964	1963
Australia	376,055	430,254	327,866
Brazil	23,109	—	5,053
Cambodia	—	—	200
China	1,402	533	—
Colombia	10,394	—	—
Cuba	379,783	335,695	163,664
Hong Kong	—	124	—
India	—	60,810	91,233
Indonesia	29,015	10,197	10,830
Korea, South	24	5	25
Mauritius	—	—	9,855
Peru	—	—	5,732
Philippines	1,180	—	110
Ryukyu Islands	296,262	142,582	164,853
South Africa	238,156	216,089	179,052
Taiwan	364,142	314,472	477,391
Thailand	3,082	2,962	34,949
United Kingdom	49	130	310
U.S.A.	298	159	79
Other Countries	5	62	94
	1,722,956	1,541,074	1,471,296

Sugar refinery for Tanzania[7].—A £1,500,000 sugar refinery is planned for the Morogoro area at Mtibwa Sugar Estate and should be operating by 1970. The estate's present 2500 acres of cane are expected to expand to 5000 acres and local farmers are to be encouraged to plant at least 1 acre of cane to feed the refinery. The National Development Corporation is expected to have a financial interest.

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Dutch distillery plans[8].—The Dutch sugar industry is negotiating with the port authorities of Delfzijl in the Province of Groningen, for the establishment of a large distillery. If the negotiations are successful, molasses will be used as raw material, some being brought to Holland by sea, and production could start in the autumn of 1967.

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Venezuela sugar factory plans[9].—Provided the agreement of the Corporación Venezolana de Fomento is obtained, a new sugar factory is to be built at Piedritas Blancas, at a cost of 53 million Bolivars.

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Spanish sugar factory proposals[10]—The Ministry of Industry in Spain is inviting proposals for the construction of a beet sugar factory in the Badajoz area, according to the Board of Trade. Minimum slicing capacity for the proposed plant is set at 2000 tons of beet per day.

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Argentina sugar production restriction[11]—The Argentine State Secretariat has recently announced new regulations for sugar production from the 1966 crop. Production is to be reduced to a quantity corresponding to domestic requirements and export liabilities, and quotas have been fixed for the individual factories. At the same time, sugar producers in the so-called marginal districts have been requested to change to other products. These measures are a consequence of the unusually high sugar production of the year 1965, the surplus production having given rise to political, economic and social difficulties in the Province of Tucumán.

[1] *Cuba Economic News*, 1966, **2**, (8), 8.
[2] *Brasil Acuc.*, 1966, **67**, (3), 5.
[3] F. O. Licht, *Journal Européen des Sucres*, 25th March 1966.
[4] *Cuba Economic News*, 1966, **2**, (8), 13.
[5] F. O Licht, *International Sugar Rpt*, 1966, **98**, (11), 14.
[6] C. Czarnikow Ltd., *Sugar Review*, 1966, (751), 43.
[7] *Overseas Review* (Barclays D.C.O.), April 1966, p. 45.
[8] *Sucr. Belge*, 1966, **85**, 300.
[9] *Zeitsch. Zuckerind.*, 1966, **16**, 226.
[10] C. Czarnikow Ltd., *Sugar Review*, 1966, (760), 80
[11] F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (11), 16.