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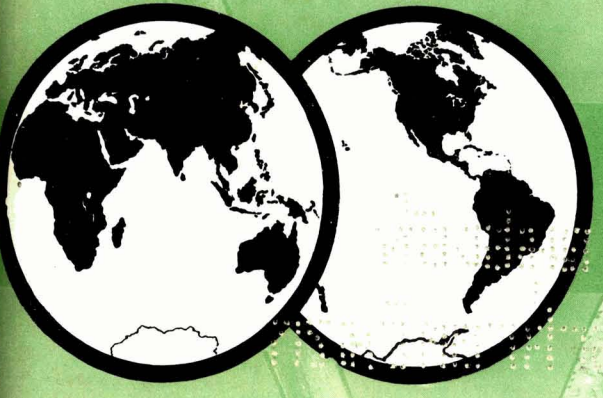

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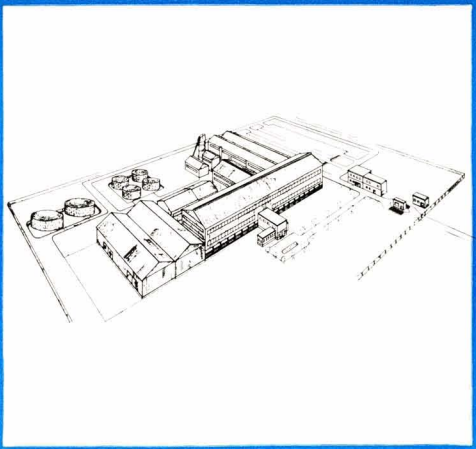

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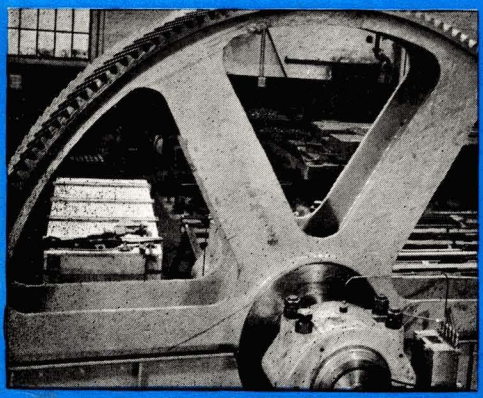

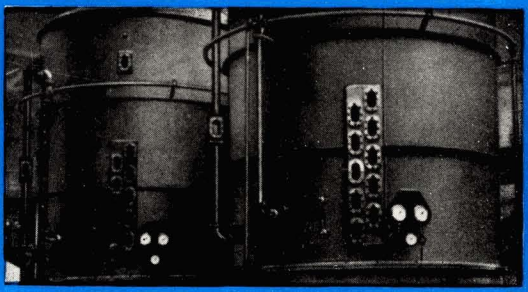

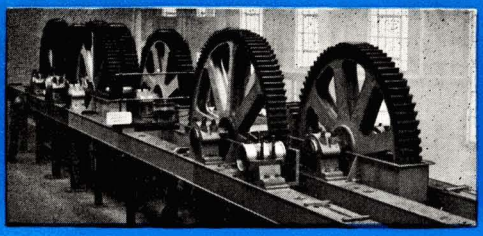

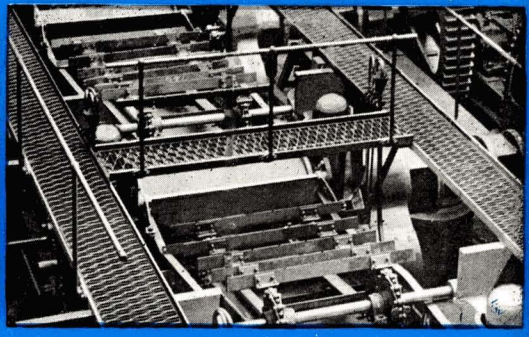

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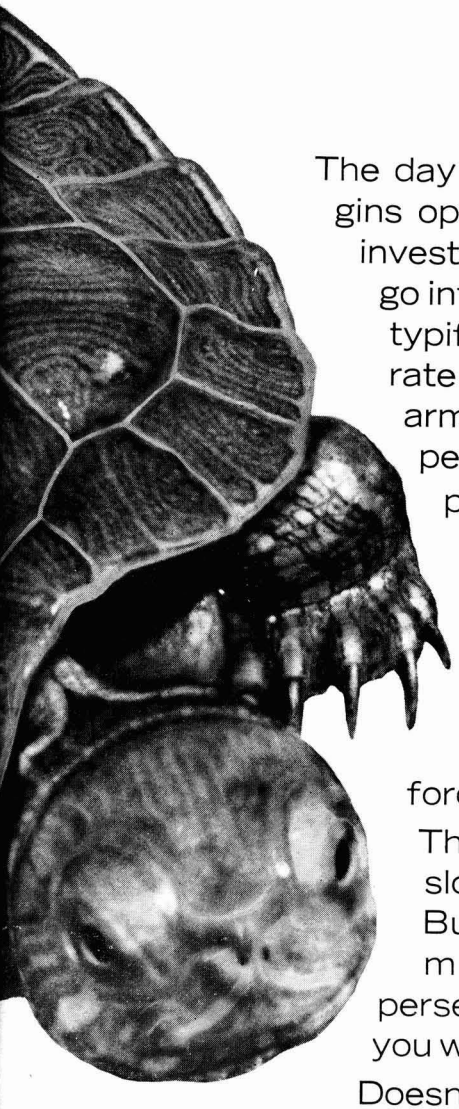

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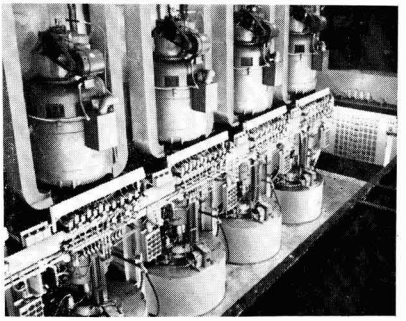

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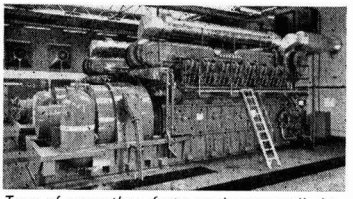

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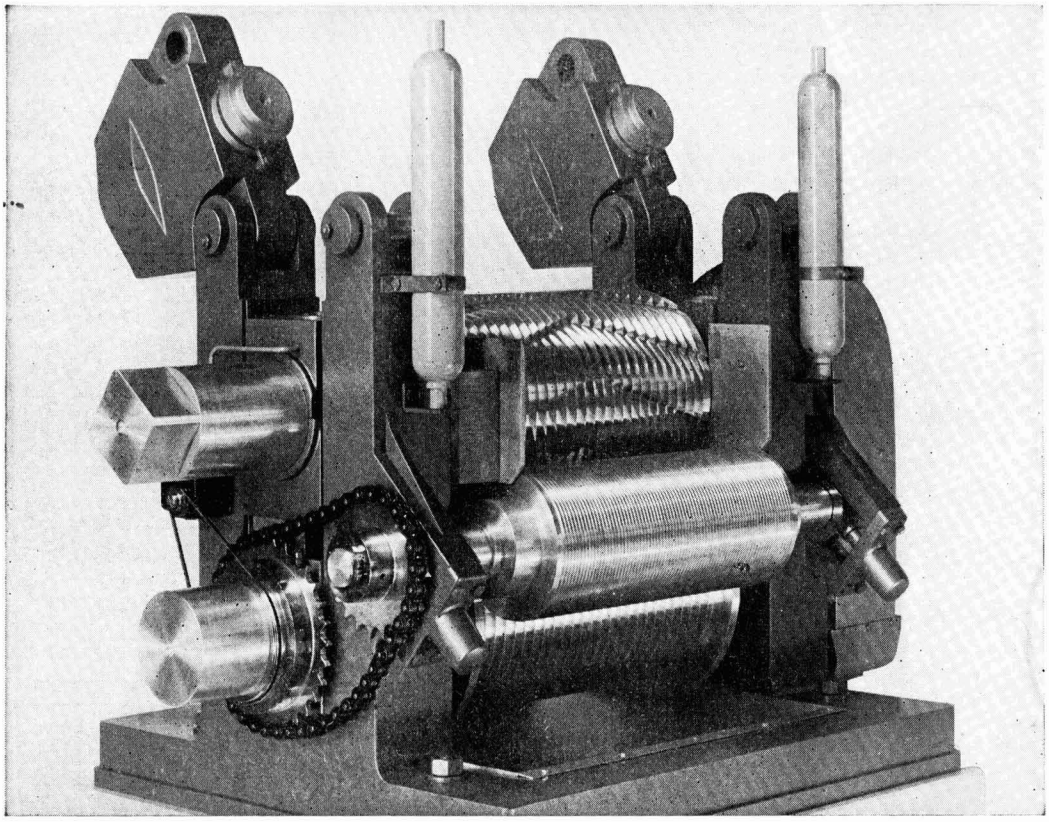

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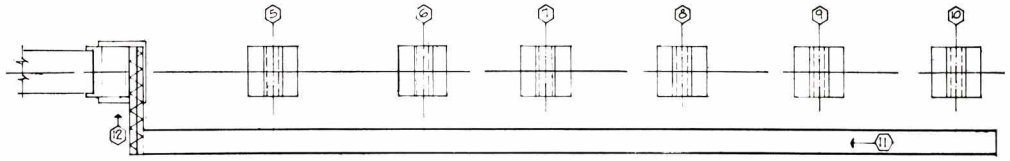
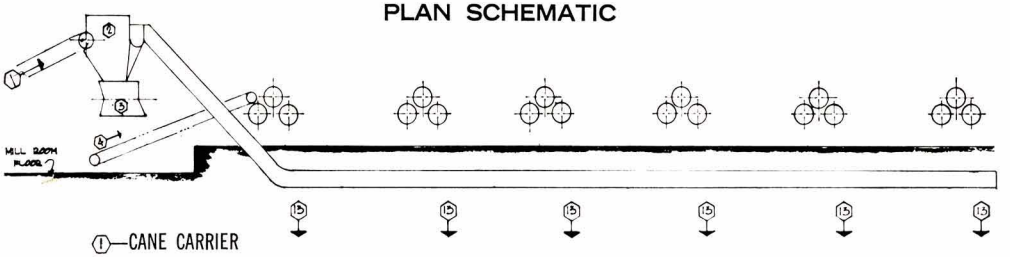


PLAN SCHEMATIC



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⑤ —MILL NO. 1
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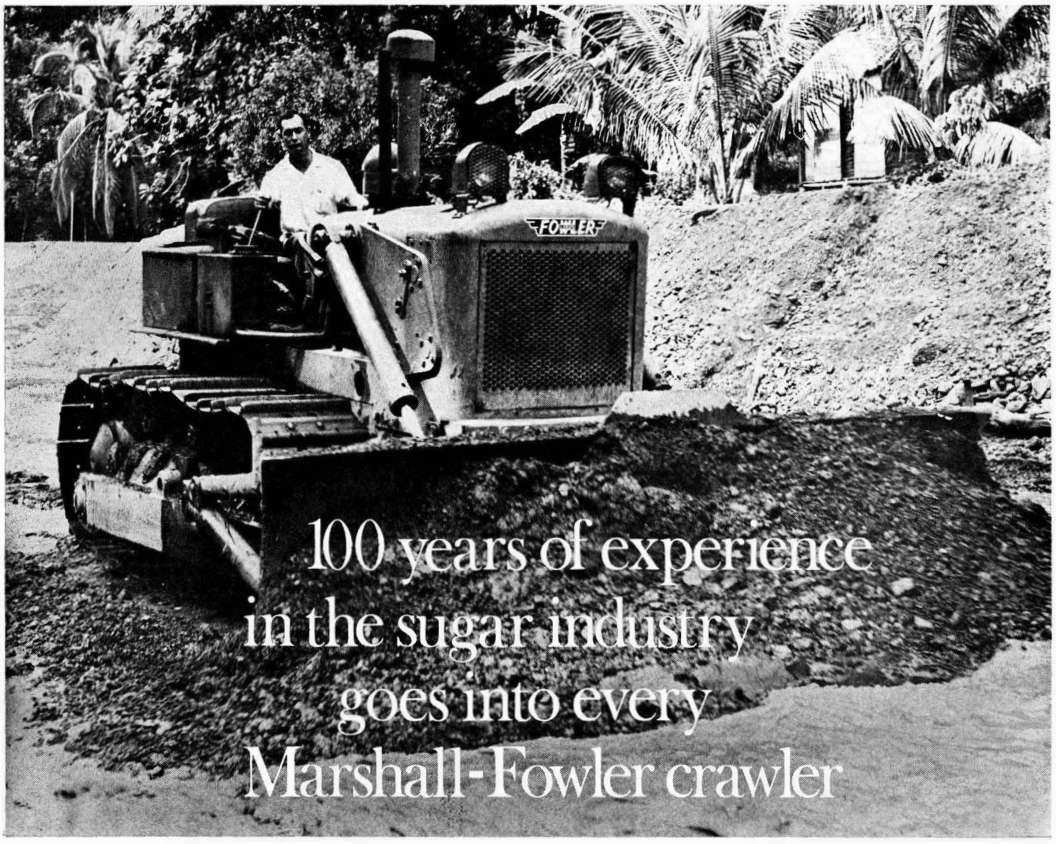

A Challenger 33 with hydraulic angledozer working on flood control on the perimeter of a sugar plantation

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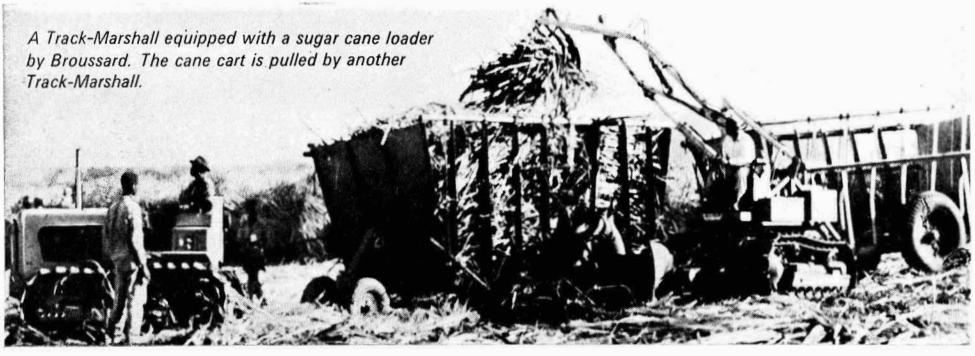

A Track-Marshall equipped with a sugar cane loader by Broussard. The cane cart is pulled by another Track-Marshall.

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"Our factories have used Pan Aid these past two years with easier massecuite boiling and improved massecuite centrifuging."—*Mr. Emile Hugot, Les Sucreries de Bourbon, Reunion.*

"Zuclar solved a serious clarification problem early last crop. Thereafter its regular use at ½ ppm on cane weight was very helpful especially considering the small quantity required." —*Mr. Henry Connolley, Seven Estate Ltd., Jamaica.*

"Drought conditions forced us to descale our beer column every 10 days. Then we used Fabcon I-12 at 2# or less/10,000# feed. The still has not required cleaning in six months." —*Mr. R. J. Cross de Chavanry, Innswood Estate Ltd., Jamaica.*

"This is our fourth year using Fabcon's Boiler Water Treatment Program and third year of Cooling Water Treatment. In both cases results have been excellent with minimum water testing and man hours required for effective use."—*Mr. George Mongol, Innswood Estate, Jamaica.*

"We authorize you to make use of this letter because it is very desirable that other alcohol distilleries learn about the excellent performance of Fabcon I-12, and will be able to obtain the higher efficiency we are having in our still." —*Mr. B. H. Escalon, Destileria La Central, S. A., San Salvador, C.A.*

"Cane Milling Aid applied by shock dosing and knapsack spraying has effectively reduced sugar losses on our mills for 2½ years." — *Mr. N. H. Donaldson, Gray's Inn Central, Jamaica.*

"Using slightly over 1 ppm Zuclar on cane weight as an average over two years, we have obtained excellent clarification and muds have filtered better than ever before." — *Mr. Frank Barker, Jr., Vice President, Valentine Sugar Co., Lockport, Louisiana.*

"The results obtained so far in the use of I-12 treatment for Evaporators have been impressive and encouraging. Favourable results obtained with I-12 in three factories indicate that I-12 may be a breakthrough." — *Mr. M. B. Floro, Rumsu Technical Service, Ltd., Jamaica.*

"Because of the easy purging characteristics of the massecuites using Pan Aid, we were able to discharge and purge 24 crystallizers, 750 cubic feet in 24 hours, instead of the usual 12 crystallizers, 750 cubic feet capacity without Pan Aid." — *Mr. Demetrio Balagso, Pampanga Sugar Development Co., Philippines.*

"The Fabcon Water Treatment Program effectively keeps boilers clean with a minimum of water testing and control. In fact, the chemicals are that powerful that dosage had to be reduced more than 50% to avoid taking old scale off too rapidly." — *Mr. J. E. Stark, Caymanas Estates, Jamaica.*

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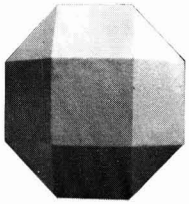
"We found this trial of Fabcon I-12 so good, in results obtained in keeping our still clean without any encrustation, that we decided not to start operation again until we secure the necessary I-12 to operate." — *Mr. Raul Morales V., Fabrica Nacional de Licores, San Jose, Costa Rica.*

"Zuclar used at 1 ppm on cane weight has provided excellent clarification and filtration characteristics this past year with less variation in clarifier and filter performance than previously." — *Mr. Ed Lui, Hutchinson Sugar Co., Hawaii.*

"Six ppm I-12 added to our evaporators enabled us to double throughput between cleaning last year over our best previous year." — *Mr. Wilton Roger, Glenwood Co-operative, Inc., Louisiana.*



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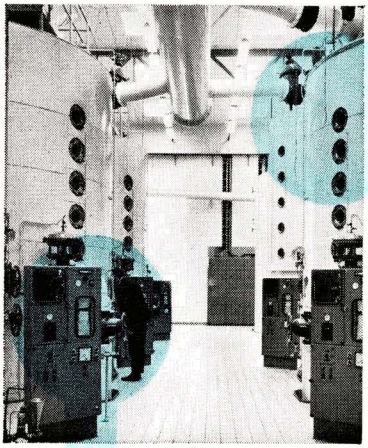

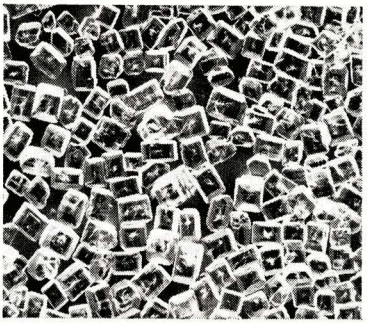

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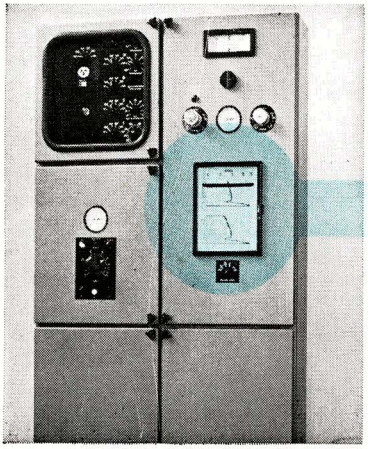

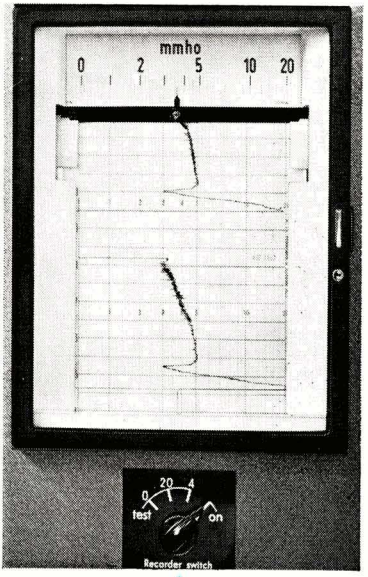

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Published by
The International Sugar Journal Ltd.
23a Easton Street, High Wycombe,
Bucks., England.
Telephone: High Wycombe 29408
Cable: Sugaphilos, High Wycombe

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Le broyage de canne par le renversement des coupes-cannes. G. K. CHETTY. *p.* 323–324

L'auteur décrit quelques essais dans lesquels on a opéré les coupes-cannes dans le sens contraire au normal et discute les avantages de cette technique.

* * *

L'effet du surchauffage sur la mesure de l'élévation du point d'ébullition. W. M. NICOL. *p.* 325–328

Les inclinaisons de température dans la masse cuite bouillante sont assez grandes pour être cause de difficultés dans la mesure des températures pour le contrôle de la sursaturation en fonction de l'élévation du point d'ébullition. Cependant, on peut employer les différences de température mesurées et les données de l'élévation du point d'ébullition dans le cas d'un cristalliseur de laboratoire pour le contrôle de ce même cristalliseur. Les erreurs possibles dans les données de l'élévation du point d'ébullition dans la littérature sont plus petites que celles-là dans la mesure des températures effectives.

* * *

L'analyse de la canne à sucre par la méthode à presse hydraulique. M. HOARAU. *p.* 328–333

On décrit une étude de l'analyse de la canne à sucre à emploi d'une presse hydraulique de laboratoire. Les résultats des analyses pour les facteurs différents sont discutés et une équation est dévelopée pour le calcul de la teneur en saccharose dans la canne.

* * *

Les caractéristiques agronomiques de clones de *Saccharum spontaneum* en culture à Houma, Louisiana. P. H. DUNCKELMAN et R. D. BREAUX. *p.* 333–334

Quelques essais étaient effectués en 1967 et 1968 pour trouver quelques clones de *S. spontaneum* qui étaient les plus résistants à la mosaïque et pour déterminer leur valeur comme parents dans la sélection pour les importantes caractéristiques agronomiques et pour la tolérance au froid.

Die Rohrschneidung mit umgekehrten Rohrmessersätzen. G. K. CHETTY. *S.* 323–324

Man bespricht einige Versuche, bei welchen Rohrschneider in entgegengesetzter Richtung als bei normaler Arbeit operiert wurden. Die Vorteile der Technik werden gegeben.

* * *

Die Wirkung von Ueberhitzung auf die Messung der Siedepunktserhöhung. W. M. NICOL. *S.* 325–328

Temperatur-Neigungen in der kochenden Füllmasse sind gross genug, um Schwierigkeiten bei der Temperatur-Messung für die Uebersattigung-Regulierung durch Siedepunktserhöhung zu verursachen. Jedoch kann man gemessene Temperatur-Unterschiede und Siedepunktserhöhungsdaten im Falle eines Laborkristallisators für die Regulierung desselben Kristallisators verwenden. Die mögliche Fehler bei veröffentlichten Siedepunktserhöhungsdaten sind kleiner als jene bei der Messung der effektiven Temperaturen.

* * *

Zuckerrohranalyse durch die Methode mit einer hydraulischer Presse. M. HOARAU. *S.* 328–333

Der Verfasser beschreibt eine Rohranalysestudie mit Anwendung einer hydraulischen Laborpresse. Die Ergebnisse der Analysen für die verschiedenen Faktoren werden diskutiert und eine Gleichung für Rohrsaccharosegehalt wird gegeben.

* * *

Agronomische Besonderheiten von *Saccharum spontaneum*-Klonen in Anbau in Houma, Louisiana. P. H. DUNCKELMAN und R. D. BREAUX. *S.* 333–334

In 1967 und 1968 wurden Versuche durchgeführt, um Klone von *S. spontaneum* zu finden, die meist widerstehend der Rohrmosaik sind, und ihre Wert als Mutterpflanzen bei der Züchtung für wichtige agronomische Besonderheiten und Kalte-Toleranz zu bestimmen

---

Desfibradación por inversión de las cuchillas de caña. G. K. CHETTY. *Pág.* 323–324

Se discuten ensayos en que las cuchillas de caña se operan en march invertida, relativa a normal, y las ventajas de esta técnica se ponen en una lista.

* * *

El efecto de sobrecalefacción sobre medida de elevación del punto de ebullición. W. M. NICOL. *Pág.* 325–328

Pendientes de temperatura en una masa cocida ebulliente estan tan grandes que pueden causar dificultades en la medida de temperaturas para control de sobresaturación por medio de elevación del punto de ebullición. Diferencias medidas de temperatura y dados de elevación del punto de ebullición para un tacho de laboratorio pueden usarse para control del tacho individuo, sin embargo. Los posibles errores de los dados publicados de elevación del punto de ebullición son menos que ellos de la medida de las temperaturas efectivas.

* * *

Análisis de caña de azúcar por el método empleando una prensa hidráulica. M. HOARAU. *Pág.* 328–333

Se presentan detalles de un estudio de análisis de caña empleando una prensa hydráulica de laboratorio. Las resultas de los análisises se discuten y un ecuación se desarrolla para determinar el contenido de sacarosa en caña de azúcar.

* * *

Caracteristicos agronómicos de clones de *Saccharum spontaneum* cultivado a Houma, en Louisiana, E.U.A. P. H. DUNCKELMAN y R. D. BREAUX. *Pág.* 333–334

Los autores hacían ensayos en 1967 y 1968 para descubrir clones de *S. spontaneum* que tienen la más resistencia a mosaico y para averiguar su valor como progenitores en la crianza de caña con tolerancia al frío y de otros importantes característicos agronómicos.

THE
INTERNATIONAL
SUGAR JOURNAL

VOL. LXXI NOVEMBER 1969 No. 851

Notes & Comments

European beet sugar prospects, 1969/70.

First estimates for beet sugar production in Europe in the current campaign were recently published by F. O. Licht K.G.[1] and are reproduced below, together with the final figures for the 1968/69 crop.

	1969/70 (*metric tons, raw value*)	1968/69
WEST EUROPE		
Belgium-Luxembourg	600,000	588,000
France	2,535,000	2,433,289
Germany, West	2,000,000	2,016,085
Holland	730,000	734,806
Italy	1,450,000	1,322,000
Total EEC	*7,315,000*	*7,094,180*
Austria	320,000	299,234
Denmark	306,000	347,777
Finland	52,000	50,056
Greece	146,000	97,919
Ireland	153,000	160,944
Spain	745,000	707,916
Sweden	222,000	303,551
Switzerland	64,000	69,210
Turkey	562,000	721,613
UK	925,000	996,021
Yugoslavia	524,000	398,691
Total West Europe	*11,334,000*	*11,247,112*
EAST EUROPE		
Albania	16,000	16,000
Bulgaria	285,000	260,000
Czechoslovakia	800,000	880,000
Germany, East	500,000	505,550
Hungary	448,000	446,666
Poland	1,585,000	1,707,000
Rumania	495,000	415,000
USSR	10,200,000	9,925,000
Total East Europe	*14,329,000*	*14,155,216*
TOTAL EUROPE	25,663,000	25,402,328

The 1969/70 estimate is 260,672 tons or 1·02% higher than the 1968/69 figure. Sowing of crops was delayed in many parts during the spring and it was initially expected that the crop would consequently be well below the average; however, with good weather, the beets have made up for their late start in some countries and an increased forecast has resulted. These increases have just more than balanced the falls in production anticipated in countries where bad conditions have continued, giving the net result of an almost unchanged European crop.

Increased production prospects in the EEC are principally due to improved crop yields expected in France and Italy, and, elsewhere in Western Europe, increases in beet areas in Greece, Spain and Yugoslavia are expected to lead to higher sugar outturns while the converse applies in Ireland and Turkey. Poor growing conditions have occurred in Eastern Europe and are reflected in lower crops forecast for Czechoslovakia and Poland. Concerning the USSR, C. Czarnikow Ltd.[2] write: "As always, assessing the the output in the Soviet Union proves the greatest difficulty. Several widely diverging estimates have recently been in circulation ranging from a little over nine million tons to just over ten million tons. Licht have chosen to accept a figure from the top of the range; this may well eventually to prove correct, but the difficulties of the professional statistician can be appreciated when it is realised that there is a range of about one million tons in the estimates of output in one country alone". To which it might be added that if the final figure for the USSR were at the middle of the range instead of the upper end, it would convert the 260,000-ton *increase* expected for Europe as a whole into a *decrease* of the same amount.

* * *

Sucrose conference.

A conference on sucrose was held at Queen Elizabeth College, University of London, during the 23rd–25th September. It was organized by JOHN YUDKIN, LESLIE HOUGH and JACK EDELMAN, respectively Professors of Nutrition, Chemistry and Botany in the College and, as might be expected, the papers presented fell into these three categories.

Of the first and much the largest group, it might be said that many who attended the Conference left it in a more confused state than before since, except for a reasonably certain association between sucrose consumption in food and dental caries, the associations between sucrose and other bodily ailments were

[1] *International Sugar Rpt.*, 1969, **101**, (26), 1.
[2] *Sugar Review*, 1969, (938), 167.

founded on insubstantial statistical grounds which were the result of experiments carried out under conditions which would not be considered adequately standardized in other scientific disciplines and which, one worker admitted, could be manipulated to obtain any desired statistical result. For those who were determined to blame sucrose consumption for e.g. heart disease, this factor was all-important when comparing poorer societies with richer, but was dominated by other factors when comparing e.g. two developed societies (Germany and the UK) with equivalent heart disease incidence but different sugar consumption habits, or a developed society (the US) where heart disease has increased in spite of falling sugar consumption.

An interesting group of papers was concerned with the chemical reactivity peculiar to sucrose and its utilization as a chemical raw material; abstracts of these papers will appear in this *Journal* in due course, while the third group described the rôle, formation and transport of sucrose in plants, including the problems facing those who have to try to explain these phenomena.

* * *

Brazil sugar statistics, 1968/69[1].

Statistics are now available showing details of sugar movement in Brazil during the crop year 1968/69 and these, together with comparisons with previous seasons, are set out elsewhere in this issue.

Exports, at 1,021,006 tons, have been maintained at almost exactly the same level as in 1967/68 with the United States naturally maintaining the position of the largest outlet for Brazilian sugar. There was a substantial recovery in shipments to Chile which in the previous season had fallen off sharply. Conversely, shipments to Morocco have followed the reverse trend and the high quantity achieved in 1967/68 fell by over 100,000 tons to some 25,000 tons in 1968/69.

Production declined slightly but nevertheless managed to top four million tons. This is some 250,000 tons below the authorized limit of 4·3 million tons, mainly because there is no system laid down for reallocation of shortfalls in production quotas awarded to individual mills. Consumption, on the other hand, has shown a further increase and at 3,283,779 tons represents a per caput offtake of more than 35 kilos per annum.

The combined effect of lower production and an increase in consumption has resulted in the first sizeable reduction in carry-over stock levels since they were more than doubled in 1965/66. At 1,305,915 tons, stocks at the end of May this year were 234,000 tons below the level obtaining twelve months earlier. This must be heartening for the Brazilian authorities who now face the first full crop year bound by the obligations of the new International Sugar Agreement.

In the case of Brazil the export quota restrictions of the ISA are unlikely to pose a severe handicap during 1969/70. Authorized production for the current season amounts to some 4·6 million tons. An outlet of around 600,000 tons can be anticipated in the United States while, even if ISA quotas are maintained at 90% of basic export tonnages next year, total Brazilian exports of sugar will be at least up to the levels achieved during the past two seasons. Consumption can be expected to maintain its upward trend and it should show an increase of around 200,000 tons over offtake in 1968/69.

* * *

International Sugar Organization.

The Executive Committee of the International Sugar Organization met in London on the 9th–10th October but at the time of writing no announcement had been made on the results of the meeting. It had been reported, however that the meeting was to discuss the current market situation and to prepare for the meeting of the full Council of the Organization in November. It was also stated that a sub-committee was discussing a proposal by the New York Coffee & Sugar Exchange that, in certain circumstances, deliveries made under the New York No. 8 Futures Contract should be counted against the export quota of the country of origin.

After their meeting in September, the Executive Committee had announced that quota shortfalls would probably be of the order of 700,000 metric tons, raw value. The final date for notification of such shortfalls was 30th September, and the Committee announced the quantities concerned early in October; they amounted, in fact, to 796,000 tons. The basic, reduced and hardship quotas have been tabulated with shortfalls and current quotas by C. Czarnikow Ltd.[1] and are reproduced below.

	Basic Export Quota	*Reduction to 90% where applicable*	*Notified shortfall*	*Hardship Quota*	*Current Quota in effect*
	(*Thousands of metric tons, raw value*)				
Argentina	25	23	—	—	23
Australia	1,100	990	—	—	990
Bolivia	10	10	—	—	10
Brazil	500	450	—	—	450
British Honduras	22	20	4	—	16
Colombia	164	148	37	—	111
Cuba	2,150	1,935	—	—	1,935
Czechoslovakia .	270	243	90	—	153
Denmark	41	37	—	—	37
Dominican Rep.	75	68	68	—	—
Fiji	155	140	—	—	140
Guatemala	22	22	—	—	22
Honduras	11	11	—	—	11
Hungary	51	46	3	—	43
India	250	225	225	—	—
Malagasy	41	37	37	—	—
Mauritius	175	158	—	35	193
Mexico	96	86	86	—	—
Nicaragua	11	11	11	—	—
Peru	50	45	45	—	—
Poland	370	333	—	—	333
South Africa ..	625	563	—	—	563
Swaziland	55	50	—	—	50
Taiwan	630	567	70	—	497
Uganda	39	35	—	7	42
West Indies	200	180	120	—	60
	7,138	6,433	796	42	5,679

[1] C. Czarnikow Ltd., *Sugar Review*, 1969, (932), 143–144.
[2] *Sugar Review*, 1969, (939), 171.

Cane shredding by reversal of cutter knives

By G. KRISHNAMOORTHY CHETTY
(Chief Engineer, Palakol Cooperative Sugar Factory, West Godavari, Andhra Pradesh, India)

EXPERIMENTS were carried out at the end of the 1965/66 season at Amadalavalasa Cooperative Sugar Factory (Andhra Pradesh) and throughout the 1966/67 and 1967/68 season at Thiru Arooran Sugars Ltd. (Madras) on operation of cutter knives in the opposite direction to the usual one, i.e. with the cutting edge of the knife moving against the flow of cane when the knife is at its lowest point of rotation. The leveller knives were operated as usual. Amadalavalasa factory is equipped with a 12-roller tandem (28 × 56 in), while the other factory has twelve 30 × 60-in rollers.

The cutter hood was modified in stages to its final form (the lowest stage in Fig. 1), which provided highly satisfactory feeding and had the lowest power consumption. The diameter of the cutter over the knife tips was 1500 mm and it rotated at 585 r.p.m.

With this arrangement the cane is subjected to the cutting action of the knife more than once, and at the same time the pieces of cane are virtually lifted up and dropped on the other side of the cutter through the space between the cutter knives and the hood. The modified hood acts as an anvil bar at its throat, and the cane is shredded to a veritable lint (Fig. 2) in contrast to that obtained with the conventional knifing process (Fig. 3).

The load on the cutter increased from an average of 70 amp with conventional forward running to 150 amp with reverse running. Normally 20–25 h.p. is provided for a leveller and 25–30 h.p. for a cutter per ton of fibre/hr, so that there will be no difficulty in reversing the knives. Knives having cutting edges on both sides need not even be re-installed.

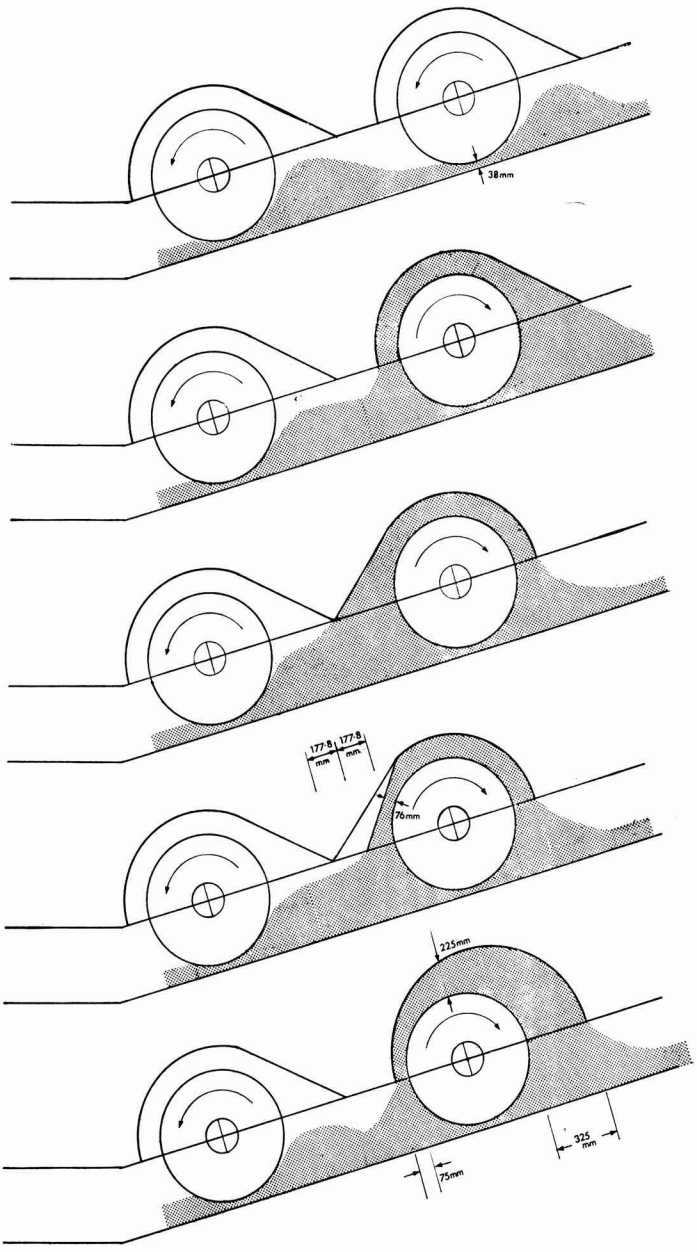

Fig. 1

The following observations were made during the tests:

(1) The load on the motor can be reduced without any detriment by reducing the number of knives,

i.e. by increasing the pitch. This was first tried at Amadalavalasa factory, where the cutter had 40 knives for a 56-in wide carrier and the average load was 160–170 amp[1]. By comparison, at Thiru Arooran the cutter had only 36 knives for a 60-in wide carrier and the average load was 150 amp.

(2) Preparation was not affected by the wider pitch of the knives.

(3) Reversal did not increase wear and tear on the knives.

(4) Load does not increase with knife bluntness nor decrease with sharpness of the knives, since their action is more one of hammering than of cutting.

In the past, knives which had little of their cutting edge left were sharpened and fixed in the leveller, and new or re-hardened knives were fixed in the cutter. The same procedure has been used in 1967 and 1968, but only after the end of the season.

Where a cutter has little reserve horsepower, the number of knives can be reduced or the leveller used as a cutter with the knives reversed. The cutter can then be used as a leveller with the knives rotating forwards. If this is not possible, a higher h.p. motor should be installed. The advantages will be even greater than those achieved by installing a shredder, which would require heavy capital investment, especially if the power plant is not able to cope with the additional load of a shredder.

Fig. 2

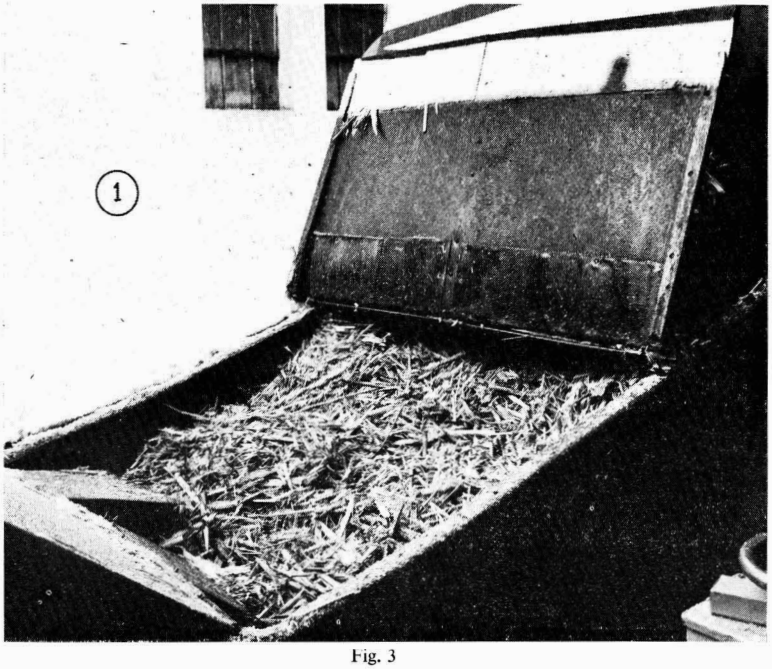

Fig. 3

Application has been made for patent rights to this process in India.

ACKNOWLEDGMENT

The author is grateful to Mr. D. K. BRAHMA for his encouragement and guidance in this work.

[1] CHETTY: *Proc. 21st Conv. Deccan Sugar Tech. Assoc. (India)*, 1966, (1), 187–192.

The effect of superheating on B.P.E. measurement

By W. M. NICOL

(Tate & Lyle Ltd. Research Centre, Westerham Road, Keston, Kent)

Introduction

THERE are practical difficulties in the measurement of boiling point elevation in both industrial and laboratory crystallization equipment. It is possible that the measurement could result in a fallacious estimate of the supersaturation of the solution.

To maintain boiling conditions during crystallization a heat flux is necessary and, unless this is spread over a large heating surface area, the thermal gradients are large. The siting of the B.P.E. thermometers in the crystallization vessel and in the water boiling pot is therefore of importance.

Resulting from a combination of poor fluid circulation, large heat flux and the effects of hydrostatic head on boiling temperature, variations at any one time of as much as 10°C in temperature have been reported in industrial vacuum pans. It is not surprising therefore, that anomalies occur when B.P.E. is used to measure sucrose concentration.

The effect of heat flux on the measurement of temperature

The apparent higher solubility of sucrose under boiling conditions reported by BENNETT and FENTIMAN[1] arises from the heat flux necessary to maintain ebullition. The influence of the thermal gradient is so important that its discussion in their paper must now be amplified in the light of further experiments.

The magnitude of the thermal gradient generated by the flux is not always appreciated. JAKOB and FRITZ[2] measured the temperature profile for water boiling on a plane surface and found that with a heat flux of approximately 3 watts/sq.cm. there was bulk superheating of about 0·5°C while temperatures close to the wall indicated a superheat of nearly 10°C. In the case of sucrose solutions the higher viscosity and lower thermal conductivity should tend to increase the effect. The following experiment confirmed this.

A saturated solution of sucrose in the presence of excess crystal was boiled under continuous reflux in a flask under vacuum. Heat was provided by an electric mantle heater which enclosed the lower half of the flask (Fig. 1). Temperature differences between a central reference point in the body of the solution and points along the vertical radius from the glass wall to the reference point were measured using a pair of 38 gauge wire copper-constantan thermocouples. The temperature profile was very steep as shown in Table I. The mean heat flux was 1·5 watts/sq.cm. through the glass-walled flask.

The effect of extensive air bubbling in the region of the measuring thermocouple was investigated and this is also shown in the table. As expected, the temperature differences were smaller in this case as the

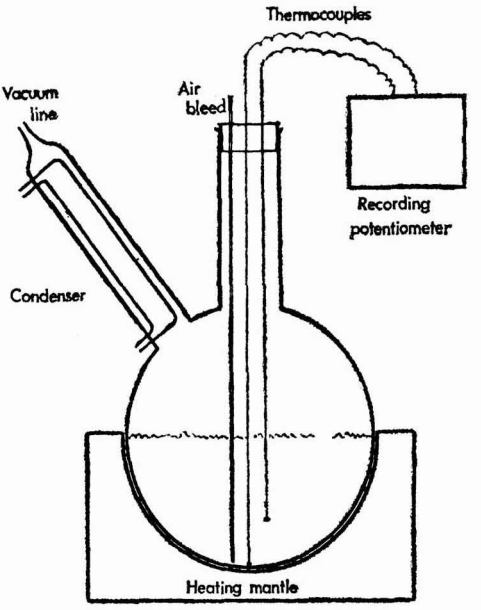

Fig. 1

air bubbles assist in the nucleation of vapour bubbles. The corresponding solubility experiments of BENNETT and FENTIMAN in which air was bubbled very slowly through the boiling solution lie between the extreme cases investigated here. In their boiling flask of radius 62 mm, the ebullition temperature, T_m, was effectively constant over 80% of the volume and the measured sucrose saturation concentration was 28 g/100 g water greater than that indicated by the non-boiling equilibrium solubility data of VAVRINECZ[3] for that temperature. A mechanism for this effect is provided by consideration of the difference between crystallization and dissolution rates.

Table I

Distance from glass wall, mm	*Temperature difference, °C*	
	without air bleed	*with extensive air bleed*
0·5	14·5	10·0
1·5	12·5	9·0
2·5	1·1	0·9
3·5	1·0	0·8

The crystallization rate V_c is defined by $V_c = K_c\ (C - C_o)$ where K_c is the crystallization rate coefficient. The concentrations C in the flask and C_o at saturation at the same temperature are expressed

[1] *I.S.J.*, 1968, **70**, 9.
[2] *Forsch. Gebiete. Ing.*, 1931, **2**, 434.
[3] *Zeitsch. Zuckerind.*, 1962, **87**, 481.

in g/100 g water. Similarly for the dissolution rate V_s we have $V_s = K_s (C_o - C)$ where K_s is the dissolution rate coefficient.

Suppose that in the spherical flask of radius 62 mm the temperature profile shown in Fig. 2 is radial and

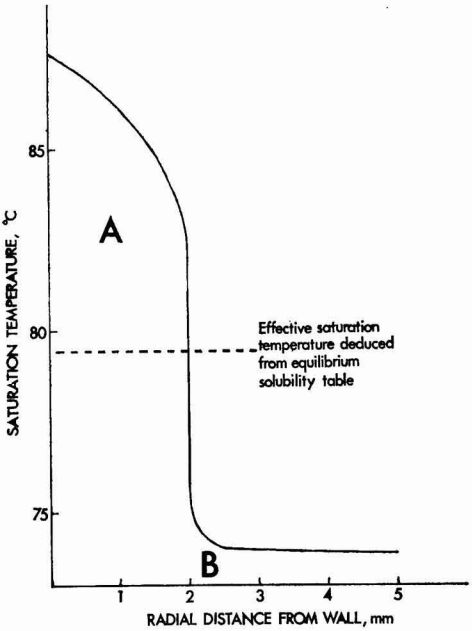

Fig. 2

symmetric. When an excess of crystals in solvent is boiled under total reflux, crystals will dissolve in the hot undersaturated regions A and grow in the cooler regions B until a dynamic steady state is reached.

At this point dissolution and growth of the crystals balance and the solution is apparently saturated. Assuming that the crystals are uniformly distributed, then,

$$\Sigma V_s t_s \text{ (dissolution in regions } A) = \Sigma V_c t_c \text{ (growth in regions } B) \quad (1)$$

With good mixing in the flask, the time, t, spent by the crystals in the different regions is proportional to the volume of the regions, v, so that

$$\Sigma V_s v_s \text{ (dissolution)} = \Sigma V_c v_c \text{ (growth)} \quad \ldots\ldots\ldots (2)$$

If now the ratio of the rate of dissolution to the rate of growth is R, its value can be calculated from the last equation. Using the crystal growth data of SMYTHE[4] and the experimental data of BENNETT and FENTIMAN which show an apparent saturation temperature of 79·4°C from the equilibrium solubility table compared with the measured temperature (T_m) of 73°C, $R = 5{\cdot}1$.

This is in broad agreement with the few published determinations of the dissolution rates for sucrose. KUKHARENKO[5] showed that at 10% deviations from saturation the ratio of the rates of dissolution and growth was about 5. CHARLES[6] in his solubility work studied the approach to equilibrium from over- and undersaturated solutions at 15·25°C. By comparing the gradient of his graphs it can be deduced that the ratio of the rates is nearly 10. On the other hand the results of MANTOVANI[7], after taking into account his surface area hypothesis, show a ratio of only 3·5. From a recent study of nucleation and growth of sucrose crystals at 40°C in these laboratories it has been shown that the dissolution rate at a saturation ratio of 0·9 is about six times the growth rate at a saturation ratio of 1·1. Clearly more work is required to elucidate the ratio of the coefficients for crystallization and dissolution of sucrose, but the present analysis shows that there is no need to postulate that the solubility of sucrose is other than a single-valued function of temperature. The anomalies reported under ebullition conditions can be attributed to the incomplete analysis of the temperature variations in the boiling vessel. For example, if the boiling temperature is measured in the liquid phase at the heating surface, say with a thermocouple, then the solubility of sucrose would be apparently lower than the non-boiling equilibrium values. The heat flux supplying the latent heat to promote boiling is the cause; while temperature gradients, superheating, apparently higher solubility and vapour pressure changes are the effects.

It is clear from the foregoing that in vacuum pan boiling if the solubility of sucrose and consequently the supersaturation are deduced from an arbitrarily positioned thermometer they will depend on the nature of the heating surface, the rate of heat input and the mechanical and thermal properties of the massecuite. They will vary from pan to pan and with changing conditions in the same pan.

In addition to uncertainties caused by hydrostatic head, the system of crystallization control using boiling point elevation therefore suffers from two main disadvantages:

(i) The published B.P.E. tables cannot be applied if some arbitrary pan temperature T' is measured instead of the equivalent temperature T, which for a saturated solution is related to concentration by the solubility temperature function.

(ii) Because the extent of superheating in the vacuum pan and in the reference water boiling pot might be different, the temperatures recorded by the thermometers in the vacuum pan and in the water boiling pot are not necessarily related absolutely in terms of boiling point elevation.

A laboratory application of B.P.E.

A simple laboratory application of B.P.E. shows how these disadvantages might by overcome. The method uses only one thermometer but requires precise pressure control and initial calibration. Application to industrial vacuum pans might be difficult.

[4] *Australian J. Chem.*, 1967, **20**, 1087.
[5] *Planter Sugar Manfr.*, 1928, **80**, (26), 504.
[6] *I.S.J.*, 1960, **62**, 126.
[7] *Zucker*, 1967, **20**, 198.

(i) *Calibration.* For a given set of conditions (liquid level, heating rate, stirring, pressure) in a particular vacuum pan, boiling excess sucrose crystals and water under total reflux generates a saturated solution. When the steady state has been obtained, characteristically after several hours, the sucrose concentration can be measured by refractive index and reference to the VAVRINECZ[3] solubility table* enables the corresponding equilibrium solubility (saturation) temperature, T_o, to be determined. The pan thermometer will read some arbitrary temperature, T'_o, which serves only as a datum from which the saturation ratio can be measured.

(ii) *Application.* It is assumed that when condensate is removed from the boiling solution which thus becomes supersaturated, the relative temperature pattern in the vessel does not change appreciably. Thus when the temperature of the supersaturated solution measured by the pan thermometer is T'_s the temperature difference

$$\delta T = T'_s - T'_o \quad \ldots (4)$$

is equal to the temperature difference measured on an equilibrium non-boiling solution of the same supersaturations, i.e.

$$\delta T = T_s - T_o \quad \ldots .(5)$$

where T_o is the saturation temperature defined in the calibration. Note that δT is not the conventionally defined B.P.E.

Fig. 3, showing the saturation ratio as a function of δT and T_o, has been constructed from the recently published B.P.E. data[8]. It can be used as shown above for boiling solutions, provided the boiling conditions remain the same as at calibration. It is seen that the pan thermometer is only used as a differential instrument and that the thermodynamic temperature is determined

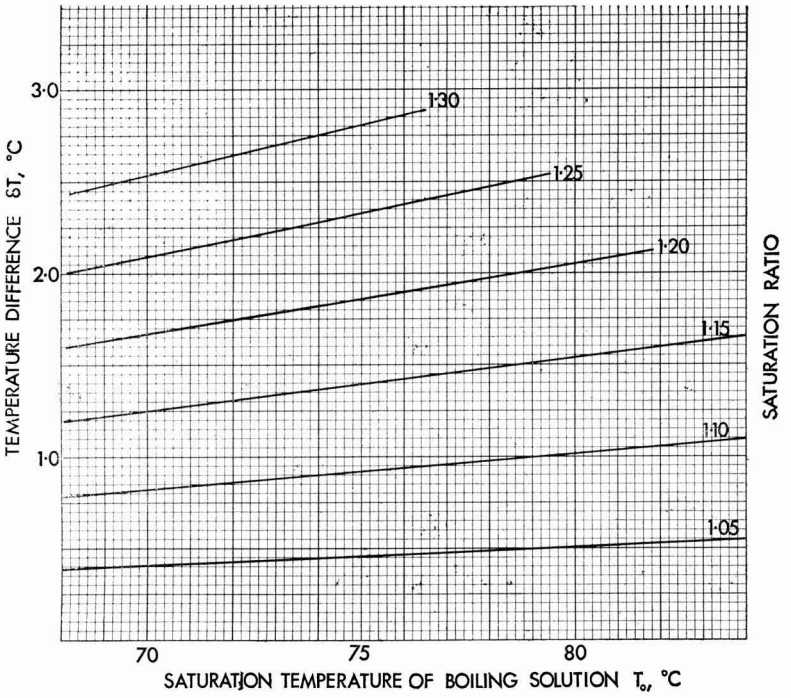

Fig. 3

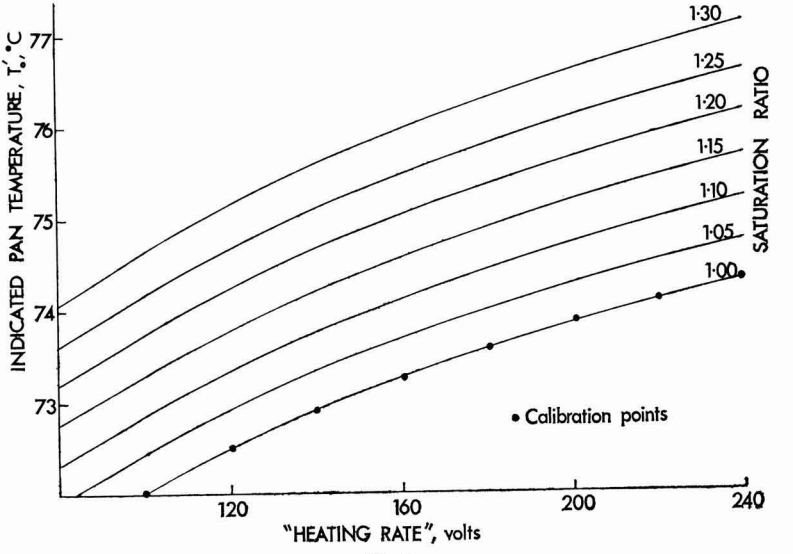

Fig. 4

through the solubility relation and solution concentration.

As a particular example, however, a more practical diagram is shown in Fig. 4. It has been constructed from Fig. 3 and the calibration experiments for a glass vacuum pan in this laboratory. Naturally it is only valid for this vacuum pan. In this case the course of a crystallizing experiment in terms of supersaturation can be closely followed from the rate of heating and the indicated pan temperature.

In conclusion it is clear that there are many practical difficulties in using boiling point elevation to control crystallization. To take better advantage of the accuracy of the published B.P.E. data, an improved method allowing more accurate measurement of the supersaturation has been indicated.

Summary

The difficulties in measuring vacuum pan temperatures for boiling point elevation control of supersaturation are outlined. The magnitude of the thermal gradients in the boiling massecuite are shown to be great enough to account for the higher solubility reported by BENNETT and FENTIMAN.

An alternative application of boiling point elevation data is reported for a laboratory crystallizer. It is concluded that the possible errors in the published B.P.E. data are smaller than those in the measurement of the effective temperatures.

* The basic solubility concentration values tabulated by VAVRINECZ have been expressed as a polynomial over the range of temperature 0°C to 100°C, viz.:

$$T_o = 1{\cdot}38717\,Z^5\,10^{-2} - 5{\cdot}14609\,Z^4\,10^{-2} + 7{\cdot}63298\,Z^3 - 565{\cdot}878\,Z^2 + 20974{\cdot}8\,Z - 311065 \quad \ldots\ldots\ldots (3)$$

The correlation coefficient is 0·99987 and the standard error of an estimate of temperature is 0·4° over the whole range. However in the concentration range 60 to 80 g sucrose/100 g solution the error in the estimate is less than 0·1°C.

[8] NICOL: *I.S.J.*, 1968, **70**, 199.

Sugar cane analysis by the hydraulic press method

By MICHEL HOARAU (Ingénieur Agronome I.N.A., Plant Pathologist, Institut de Recherches Agronomiques Tropicales (I.R.A.T.), Saint-Denis, Réunion)

INTRODUCTION

SUGAR cane analysis by the hydraulic press method has been studied extensively, among others in Hawaii by TANIMOTO[1], in Guadeloupe by JAMOIS[2], in Réunion by CAZAL[3] and BOYER DE LA GIRODAY[4].

Several formulae have been proposed for the determination of sucrose % cane. However, the conditions for correct use of these formulae have not always been made quite clear; on the other hand, all the formulae have been derived using an arbitrary value of the coefficient linking pol % absolute juice with pol % extracted juice, so that it was difficult to make a choice between the various formulae to fit one's own conditions.

For these reasons, it was considered desirable to survey the whole field of study, endeavouring to determine with precision the various factors entering into the derivation of the sucrose %. Such was the purpose of the present study.

In the present study, juice extraction is defined as the ratio of the juice extracted with the press % cane to the absolute juice % cane. From the definitions contained in the International Society of Sugar Cane Technologists' publication (1955) on the System of Cane Sugar Factory Control, absolute juice means all the solids in solution together with the *total water* in the cane, including the so-called Brix-free water.

In a basic research on extraction, it would have been interesting to pay special attention to the Brix-free water, but such a research would have been outside the scope of the present study which is based only on practical aspects.

EQUIPMENT

The press used for this study was the Carver laboratory press, made in the USA. The maximum power of this hand press is 24,000 lb. It is fitted with a pressure gauge graduated from 0 to 24,000 lb in 200 lb steps.

The pressure is applied in a grooved and perforated stainless steel cylinder, of 3½ inches diameter and 7½ inches long, with a capacity slightly over 1100 ml. The ram fits the cylinder, which rests on a special base-plate. The latter is an important part; it separates the bottom of the pressed material from the extracted juice, preventing reabsorption of this juice in the bagasse when pressure is released.

For further reduction of juice reabsorption, two other improvements were effected. First, the whole press was slightly tilted forward by means of ½-in blocks placed under its rear legs. Second, the cylinder

[1] *Hawaiian Planters' Record*, 1964, **57**, (2), 133–150.
[2] *Notes et Inform. Centre Tech. de la Canne et du Sucre de la Guadeloupe*, 1967, (67/5), 20–25.
[3] *Comm. Assoc. Réunionnaise Tech. Ind. Sucr.*, June 1967, 14 pp.
[4] *Rpt. Ann. Station d'Essai de la Bretagne*, 1967, 79–90.

and base-plate were placed, when in use, in a rectangular tray of galvanized iron, locally-made, provided with an outlet opening and a plastic tube leading to the juice receiving container. Thus, the juice flowed as soon as extracted.

Experimental Method

The experiment included a total number of 166 analyses spread out over the 1967 grinding season, from July to November, involving 8 cane varieties with different sucrose and fibre contents and earliness in maturing.

The cane was prepared by means of a Jeffco cutter-grinder. The pulp supplied by this machine was thoroughly mixed and a 500-g sample pressed at 100 kg/sq.cm. pressure (1422 p.s.i.). This pressure was maintained until the moving needle of the gauge came to a standstill.

For every analysis, the following determinations were made:

Bagasse % cane	b
Fibre % cane	F
Pol extracted by the press % cane ..	Se
Pol left in the bagasse % cane	Sr

Pol % cane R, measured by determining Se and Sr separately and adding them together, is designated R_d, i.e. $R_d = Se + Sr$.

Se Determination

The bagasse was weighed and the refractometric Brix of the press-extracted juice was determined. The juice was clarified with dry lead acetate, filtered and polarized in a 200 mm tube. From the polarimeter reading and Brix, the pol % extracted juice was determined using Schmitz's table.

Let: Pol = pol % press extracted juice, and b = bagasse % cane

We then have: juice extracted with the press % cane $= 100 - b$,

hence: $Se = \frac{Pol}{100}(100 - b)$.

Sr Determination

Bagasse corresponding to 500 g of cane was mixed for 4 minutes with 1000 g of water in a Rietz "Varigrator", and was then filtered through a cloth bag. The refractometric Brix of the filtrate was determined, and the filtrate clarified with dry lead acetate, filtered and polarized in a 400 mm tube. Schmitz's table gave pol % filtrate from the Brix and one-half of the polarimeter reading.

The whole cane pulp from the "Varigrator", was washed into the cloth bag. The bag was placed in cold running water for 2 hours, during which it was squeezed by hand six times. The bag was then removed, the surplus water squeezed out, and the bag dried to constant weight in a hot air-current oven at 100°C. Fibre % cane was determined from the original and final weights.

Let: Pol' = pol % filtrate, and F = fibre % cane.

We have:

absolute juice % cane $= 100 - F$; undiluted non-extracted juice % cane $= (100 - F) - (100 - b)$; weight of filtrate % cane $= b - F + 200$*

hence: $Sr = \frac{Pol'}{100}(b - F + 200)$

Results

Let R = pol % cane, Pol_A = pol % absolute juice, Pol = pol % extracted juice, and F = fibre % cane.

We have:

$$R = Pol_A\left(\frac{100 - F}{100}\right) = C.Pol\left(\frac{100 - F}{100}\right) \quad \ldots\ldots(1)$$

where $C = \frac{Pol_A}{Pol}$ $\ldots\ldots(2)$

C is thus the ratio of pol % absolute juice to pol % extracted juice.

Firstly, a high positive rectilinear correlation ($r = + 0{\cdot}98$) was observed between pol % cane $= R$ and the factor $Z = Pol \times \left(\frac{100 - F}{100}\right)$, the equation of the regression line being: $R = 0{\cdot}939\,Z$. Values of R determined from the factor Z are designated R_c, i.e.

$$R_c = 0{\cdot}939\,Pol \times \left(\frac{100 - F}{100}\right) \quad \ldots\ldots(3)$$

From a comparison between the calculated values R_c of pol % cane obtained by formula (3), and the R_d values found, it was concluded that they were not significantly different. But when arranging the 166 analyses in increasing order of fibre % cane, it appeared that:

(*a*) for the lowest values of fibre % cane (from 10·5 to 13), R_c was generally smaller than R_d;

(*b*) for the intermediate values of fibre % cane (from 13 to 15), R_c was quite close to R_d;

(*c*) for the highest values of fibre % cane (from 15 to 17), R_c was generally greater than R_d.

Consequently, dividing the whole series of analyses into two sub-series separated by the value 14 of fibre % cane, it was observed that, in the two sub-series, R_c was significantly different from R_d. It was concluded that C was a function of F, fibre % cane, and that studying the factor C might lead to interesting results.

Factor *C*

For this purpose, another equation for pol % cane was established.

Let S_e = pol % cane extracted by the press, and b = bagasse % cane.

Then pol extraction % is, by definition,

$$E_e = \frac{S_e}{R} \times 100$$

* For 500 g of cane 1000 g of water were added, corresponding to 200 g of water per 100 g of cane.

As $S_e = Pol \times \left(\frac{100 - b}{100}\right)$,

we have $E_s = \frac{Pol\,(100 - b)}{R}$

Whence: $R = \frac{Pol\,(100 - b)}{E_s}$ .....(4)

Equations (1) and (4) give:

$$C = \frac{1}{E_s}\left(\frac{100 - b}{100 - F}\right) 100$$

But the factor $\left(\frac{100 - b}{100 - F} \cdot 100\right)$ is, by definition, the percentage extraction of juice, E_j. Whence:

$$C = \frac{Pol_A}{Pol} = \frac{E_j}{E_s} \quad \text{.....(5)}$$

The ratio of Pol % absolute juice to Pol % extracted juice is equal to the ratio of juice extraction to pol extraction.

It is plain that it could be demonstrated in the same manner that the ratio of Brix of absolute juice (B_A) to Brix of extracted juice (B) is equal to the ratio of juice extraction (E_j) to total dry matter extraction (E_{ms}):

$$C' = \frac{B_A}{B} = \frac{E_j}{E_{ms}}.$$

In this paper, the pol ratio only has been studied; the results may be applied to the Brix ratio.

Thus, the study of the factor C amounts to the study of juice and pol extraction.

Between the values found for the percentage extraction of pol E_s and those found for the percentage extraction of juice Ej, there is a high positive rectilinear correlation ($r = +0{\cdot}91$), the equation of the regression line being:

$$E_s = 0{\cdot}685\,E_j + 31{\cdot}5 \quad \text{.....(6)}$$

This formula makes it possible to calculate the pol extraction from the juice extraction with a relative error smaller than $\pm$ 2%, which is acceptable.

If the extraction is total, we have: $E_s = E_j = 100\%$ and it will be seen that formula (6) gives $E_s = 100$ when $E_j = 100$. On the other hand, it is reasonable to assume that the same pol extraction always corresponds to a given juice extraction, whatever may be the way this juice extraction was obtained. For instance, a juice extraction of 86% may be obtained either under 100 kg/sq.cm. pressure with a fibre % cane of 11·5 or under 200 kg/sq.cm. with a fibre of 16·5. It is reasonable to assume the same pol extraction in both cases. If such is the case, formula (6) may be considered as general and applies whatever the pressure, at least from 100 kg/sq.cm. upwards.

Equations (5) and (6) give:

$$C = \frac{E_j}{0{\cdot}685\,E_j + 31{\cdot}5} \quad \text{.....(7)}$$

so that C may be calculated from the percentage juice extraction value.

In the present work, it was observed that, at a pressure of 100 kg/sq.cm. and with cane finely prepared by means of the Jeffco cutter-grinder, the fibre % cane F is always quite close to half the bagasse weight % cane b, the exact relation being:

$$b = 1{\cdot}99\,F + 0{\cdot}87\ \dagger$$

The % extraction of juice obtained at a pressure of 100 kg/sq.cm may then be expressed in terms of fibre by the formula:

$$E_{j100} = \frac{99{\cdot}13 - 1{\cdot}99\,F}{100 - F} \times 100\ \dagger \quad \text{.....(8)}$$

Under a pressure of 200 bars ($\simeq$ 200 kg/sq.cm, 2,900 p.s.i.), and with cane finely prepared by means of a WADDELL-type shredder, CAZAL[3] found between the non-extracted juice % cane and fibre % cane a fairly constant ratio of 0·7. Under these conditions, one has:

$$b = 1{\cdot}7\,F\ \dagger$$

and the percentage extraction of juice may be expressed by the formula:

$$E_{j200} = \frac{100 - 1{\cdot}7\,F}{100 - F} \times 100\ \dagger \quad \text{.....(9)}$$

From the value of E_j given by formulae (8) and (9), the value of C may be calculated in terms of fibre % cane for pressures of 100 kg/sq.cm. and of 200 bars. Table I gives the values of C for these two pressures, and for the fibre content range of 9 to 18 % cane. Fig. 1 shows the values of C in terms of fibre % cane; curve 1 corresponds to the pressure of 100 kg/sq.cm, curve 2 to the pressure of 200 bars.

Table I. Factor C in terms of fibre % cane

Fibre % cane	*C*		
	100 *kg/sq.cm.*		200 *bars*
	calculated	*observed*	*calculated*
9·0	0·963		0·977
9·5	0·961		0·976
10·0	0·959		0·974
10·5	0·956	0·956	0·972
11·0	0·954	0·955	0·971
11·5	0·952	0·952	0·969
12·0	0·949	0·950	0·968
12·5	0·947	0·944	0·966
13·0	0·944	0·942	0·965
13·5	0·942	0·942	0·963
14·0	0·939	0·937	0·961
14·5	0·936	0·934	0·959
15·0	0·933	0·931	0·957
15·5	0·930	0·932	0·956
16·0	0·927	0·925	0·954
16·5	0·924	0·925	0·952
17·0	0·921	0·922	0·950
17·5	0·918		0·948
18·0	0·915		0·946

It is seen that C increases as a function of pressure; the values of C are higher for a pressure of 200 bars than for a pressure of 100 kg/sq.cm. But for a given pressure, C decreases as a function of fibre % cane. Also, the influence of fibre % cane decreases when the pressure increases; the slope of the curve is steeper for 100 kg/sq.cm pressure than for a pressure of

† These formulae are valid only if there is no juice reabsorption in bagasse when the pressure is released.

200 bars (Fig. 1). As the pressure increases, the curve giving C in terms of fibre % cane rises and tends towards the horizontal straight line $C = 1$.

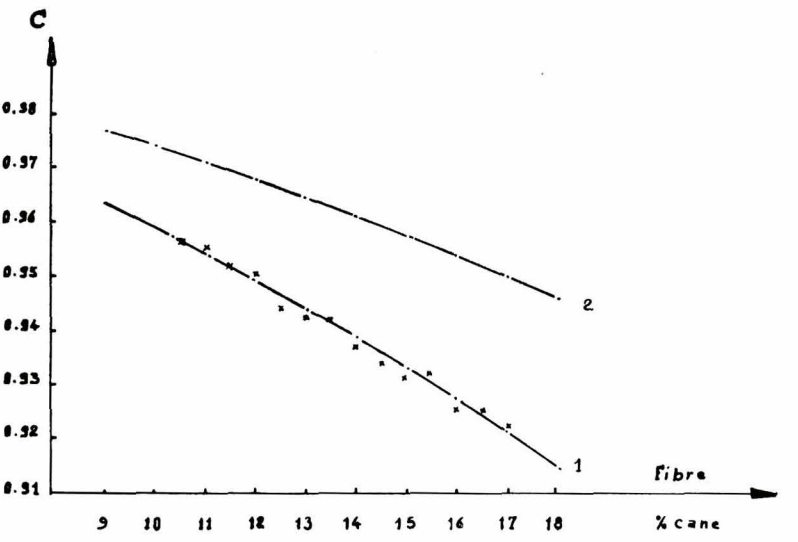

Fig. 1

Table I shows that there is a nearly perfect agreement between the calculated values of C and the average values found, for the various values of fibre % cane, at 100 kg/sq.cm. pressure.

In his study of the press analysis method, BOYER DE LA GIRODAY[4], using a pressure of 200 bars upon cane prepared by means of a Jeffco cutter-grinder, found for C an average value of 0·968 for an average fibre % cane of 12·5. It may be seen in Table I that a calculated value of C of 0·966 corresponds to a fibre % cane of 12·5 when the pressure is 200 bars.

From formula (7), it is thus possible to calculate C with satisfactory precision, since the discrepancies between calculated and observed values are under $\pm$ 0·35% (Table I).

POL % CANE

In equation (1), the factor $n = C\frac{100 - F}{100}$ depends only on fibre % cane. It is easy to draw up a table giving the values of n for all possible values of the fibre % cane. Table II gives the values of n for pressures of 100 kg/sq.cm. and 200 bars when the fibre % cane varies from 9 to 18.

The determination of the pol % cane is then quite simple: one has only to multiply the pol % extracted juice by the value of n read in Table II on the same line as the fibre % cane corresponding to the weight of bagasse % cane recorded. For further simplification, Table II might be modified and replaced by another table giving directly the values of n in terms of the weight of the bagasse cake corresponding to the weight of the cane sample.

In the present experiment, it was observed that, at a pressure of 100 kg/sq.cm., the discrepancy between pol % cane calculated as shown above and pol % cane found was always under 3%. This discrepancy was under $\pm$1% for 81% and under $\pm$2% for 97% of the analyses. The maximum difference was 2·81% for only one of the 166 analyses.

These discrepancies result from the fact that, on account of the elasticity of the pressed material, there is some lack of precision in the pressure actually applied. By working at pressures above 100 kg/sq.cm., lower discrepancies between calculated and observed pol % cane would obtain.

It may be noted that, from equation (4), we could also write: $n = \frac{100 - b}{E_s}$

The factor n is the ratio of the weight of juice extracted % cane to the percentage sugar extraction.

COMMENTS AND SUMMARY

The present study has shown that the ratio C, i.e. pol % absolute juice to pol % extracted juice, is equal to the ratio of juice to pol extraction, and that C increases as a function of pressure, but, at a given pressure, decreases as a function of fibre % cane. However, the higher the pressure, the smaller is the effect of fibre on C.

Thus, when one adopts for C an average arbitrary value, as is the case for all pol % cane formulae so far used or proposed, the systematic error made on C and therefore on pol % cane is to be added to the errors resulting from the analysis method itself. This systematic error varies with the fibre % cane, and also with the pressure, and its variations in terms of fibre % cane increase when the pressure decreases. This error may reach a rather high level as shown by the following examples.

If, with a pressure of 100 kg/sqc.m. (which is the case of the present study) the value chosen for C is the average value of 0·939 (formula 3), the systematic error is low as long as the fibre % cane is around 14 (Table I). But this error increases steeply as the fibre % cane differs more and more from 14, either above or under this value, and reaches —2·55% when the

Table II. n **in terms of fibre % cane**

n = ratio of weight of juice extracted % cane to % pol extraction
n_{100} = values of n for 100 kg/sq.cm. pressure.
n_{200} = values of n for 200 bars pressure.

Fibre % cane	n_{100}	n_{200}	*Fibre % cane*	n_{100}	n_{200}	*Fibre % cane*	n_{100}	n_{200}
9·0	0·8767	0·8892	12·0	0·8354	0·8517	15·0	0·7932	0·8138
1	0·8753	0·8879	1	0·8340	0·8504	1	0·7918	0·8125
2	0·8740	0·8867	2	0·8326	0·8491	2	0·7904	0·8113
3	0·8726	0·8854	3	0·8312	0·8479	3	0·7889	0·8100
4	0·8712	0·8842	4	0·8298	0·8466	4	0·7875	0·8087
5	0·8698	0·8829	5	0·8284	0·8453	5	0·7861	0·8075
6	0·8685	0·8817	6	0·8270	0·8441	6	0·7847	0·8062
7	0·8671	0·8804	7	0·8256	0·8428	7	0·7833	0·8049
8	0·8657	0·8792	8	0·8242	0·8416	8	0·7819	0·8037
9	0·8644	0·8779	9	0·8228	0·8404	9	0·7804	0·8024
10·0	0·8630	0·8767	13·0	0·8214	0·8391	16·0	0·7789	0·8011
1	0·8616	0·8754	1	0·8200	0·8379	1	0·7775	0·7998
2	0·8603	0·8742	2	0·8186	0·8366	2	0·7761	0·7986
3	0·8589	0·8729	3	0·8172	0·8353	3	0·7746	0·7973
4	0·8575	0·8716	4	0·8158	0·8341	4	0·7732	0·7960
5	0·8561	0·8704	5	0·8144	0·8328	5	0·7718	0·7948
6	0·8547	0·8691	6	0·8130	0·8315	6	0·7704	0·7935
7	0·8534	0·8679	7	0·8116	0·8303	7	0·7689	0·7922
8	0·8520	0·8667	8	0·8102	0·8290	8	0·7675	0·7909
9	0·8506	0·8654	9	0·8088	0·8277	9	0·7660	0·7897
11·0	0·8492	0·8642	14·0	0·8074	0·8265	17·0	0·7646	0·7884
1	0·8478	0·8629	1	0·8059	0·8252	1	0·7631	0·7871
2	0·8464	0·8617	2	0·8045	0·8239	2	0·7617	0·7859
3	0·8450	0·8604	3	0·8031	0·8227	3	0·7602	0·7846
4	0·8436	0·8592	4	0·8017	0·8214	4	0·7588	0·7833
5	0·8423	0·8579	5	0·8003	0·8201	5	0·7574	0·7820
6	0·8409	0·8567	6	0·7989	0·8188	6	0·7559	0·7807
7	0·8395	0·8554	7	0·7975	0·8176	7	0·7545	0·7795
8	0·8381	0·8542	8	0·7960	0·8163	8	0·7530	0·7782
9	0·8368	0·8529	9	0·7946	0·8151	9	0·7516	0·7769

fibre % cane falls to 9, and +2·55% when the fibre rises to 18 (Table I).

BOYER DE LA GIRODAY[4], using a pressure of 200 bars, found for C an average value of 0·968 for an average value of fibre % cane of 12·5. He used C = 0·97 for calculating pol % cane. Table I shows that, so doing, the systematic error made is low in the range 9 to 14 of fibre % cane, varying between —0·7 and +0·7%. But, for fibre values above 14%, it increases steeply and reaches +2·47% for 18 fibre % cane.

In Guadeloupe, JAMOIS[2] applied the principle of the press analysis method developed in Hawaii by TANIMOTO[1]. This method is based on the assumption that the residual juice has the same Brix and pol as the extracted juice. Such an assumption amounts to setting $C = 1$, and therefore over-estimates systematically the pol % cane. As a matter of fact, JAMOIS points out that "the press method over-estimates the result" and he gives a graphical explanation of the fact. He worries about detecting whether "this discrepancy is constant and could be estimated".

The present study answers these questions; the difference can be estimated but is not constant. First, the lower the pressure, the greater the difference and, second, for a given pressure, the higher the fibre % cane, the greater the difference. Table I shows that, when the fibre % cane varies from 9 to 18, the error made on C, or on the pol % cane when C is assumed to = 1, is in the range +3·7% to +8·5% when the pressure is 100 kg/sq.cm. and in the range +2·3% to +5·4% when the pressure is 200 bars.

CONCLUSION

The main point of the present study is that the ratio C of the pol % absolute juice to the pol % extracted juice is equal to the ratio of juice to sucrose extraction.

$$C = \frac{Pol_A}{Pol} = \frac{E_j}{E_s}$$

This point is important, because it demonstrates how the factor C varies in terms of extraction, and makes it possible to apply the press analysis method generally, whatever the conditions.

If, in this study, the author has voluntarily restricted himself to the calculation of C for pressures of 100 kg/sq.cm. and 200 bars and to the case of finely prepared cane (by means of the Jeffco cutter-grinder or of the WADDELL shredder, both machines, it must be added, giving a very similar division of the cane), there is, however, no reason not to undertake a comprehensive study of extraction, from which could be developed a general formula of juice extraction in

terms of: fibre % cane, pressure, and fineness of cane preparation. The factor C could then be determined for any condition whatsoever.

It might also be possible to improve the formula connecting sugar extraction and juice extraction. In this study, we have assumed this connexion to be linear (Formula 6). But we consider that the influence of this improvement would be quite small and would have an effect only upon at most the third decimal figure of factor C, i.e. a variation smaller than $\pm 0{\cdot}5\%$.

The results of the present study are thus of general purpose and may be applied, after adaptation, to sugar cane press analysis as well as to the first mill in factory mill control.

Agronomic characteristics of Saccharum spontaneum clones in culture at Houma, Louisiana

By P. H. DUNCKELMAN and R. D. BREAUX

(Crops Research Division, Agricultural Research Service, US Department of Agriculture, US Sugarcane Field Station, Houma, La., USA)

LOUISIANA'S commercial sugar cane varieties can be traced to only two "wild" ancestors—*S. spontaneum* Coimbatore, and *S. spontaneum* Glagah through the natural hybrid Kassoer[1]. A serious mosaic epidemic in Louisiana has focused attention on other clones of the wild species more resistant than the original wild parents. We have screened 262 clones of *S. spontaneum* for resistance to mosaic at the US Sugarcane Field Station, Houma, La., and found differences among them ranging from apparent immunity to complete infection[2]. We next tested the most resistant of these *S. spontaneum* clones to ascertain their value as parents in breeding for important agronomic characteristics and cold tolerance. This report summarizes the data from experiments in 1967 and 1968.

Materials and Methods

Thirty-two mosaic resistant *S. spontaneum* clones were used. Two wild control varieties, Kassoer and *S. spontaneum* Coimbatore, and two commercial control varieties, C.P. 48-103 and C.P. 52-68, were included. Two plants of each of the 36 clones were grown in 15-gallon cans, outdoors. The plants were first established in 6-inch pots in the greenhouse. After 2 months, the plants were transplanted singly to cans and placed on racks outdoors. Field tests were deemed inadvisable because of excessive rhizome production. We felt that some clones might become weed pests and therefore grew the plants in cans, removing seed heads before maturity to prevent spread of seedlings.

Stalk counts per can for each clone were made when the stalks reached maturity. Pith content, expressed as pith diameter % stalk diameter, was determined by cutting crosswise through the middle of the internodes of six random stalks. Brix was determined by a hand refractometer on juice from the middle internodes of five random stalks from each can.

Cold resistance ratings for dead leaf tissue, dead terminal buds, and stalk damage were based on maximum cold damage after two freezes in the winter of 1967–68 and three freezes in 1968–69. Low temperatures of 24°F and 25°F for up to 5 hours' duration were recorded during the winter of 1967–68. In 1968–69 we recorded lows of 25°F, 26°F and 28°F with a maximum of 11 hours duration on 5th January 1969.

Results

An analysis of variance of the data showed significant differences among the clones for stalk number, pithiness, Brix, and dead leaf tissue.

All of the selected *S. spontaneum* clones were significantly higher in number of mature stalks per can than the commercial control varieties C.P. 48-103 and C.P. 52-68 (Table I). With the exception of Kinggoerang Oewis, Krakatau and S.E.S. 327, all the wild clones tested were significantly superior to Kassoer in stalk number. Six clones in the test, Okinawa No. 2, S.E.S. 114, S.H. 246, U.S. 60-4-6, U.S. 61-2-1, and U.S. 61-4-1 had significantly more stalks per can than *S. spontaneum* Coimbatore.

Pith diameter varied from 0 in three *S. spontaneum clones* to 75% of stalk diameter in S.E.S. 351. In *S. spontaneum* Coimbatore, 20% pith was recorded. Twenty-three of the wild clones did not differ significantly from *S. spontaneum* Coimbatore in ratio of pith to stalk diameter, and 9 had significantly more pith. U.S. 56-8-2, U.S. 56-15-2, U.S. 56-15-8, Kassoer, C.P. 48-103 and C.P. 52-68 had solid stalks.

Wide differences in Brix were also found among the *S. spontaneum* clones tested. Brix ranged from 4·6° in Mandalay to 14·5° in U.S. 56-8-2. *S. spontaneum* Coimbatore averaged 7·5°Brix. Fourteen *S. spontaneum* clones significantly exceeded *S. spontaneum* Coimbatore in Brix. One *S. spontaneum* clone, U.S. 56-8-2, was significantly higher in Brix than the F_1 hybrid, Kassoer. Of course C.P. 48-103 and C.P. 52-68 were significantly higher in Brix than the wild clones.

[1] DUNCKELMAN: *Sugar Bull.*, 1965, **44**, 25–29.
[2] DUNCKELMAN and BREAUX: *Sugar y Azúcar*, 1969, *in press.*

Table I. Agronomic and cold resistance data on selected mosaic-resistant *S. spontaneum* clones grown in can cultures at Houma, Louisiana, 1968 and 1969 seasons

Clone	Number of mature stalks per can	Pith diameter % stalk diameter	Hand refractometer Brix	Cold resistance rating†		
				% Dead leaf tissue	% Dead terminal buds	% Stalk damage
C.P. 48-103*	4	0	20·9°	95	100	1
C.P. 52-68*	4	0	19·9°	100	100	16
Kassoer*	12	0	12·0°	100	100	5
Coimbatore*	39	20	7·5°	95	100	1
Djatiroto	22	55	13·0°	95	100	10
Kinggoerang Oewis	16	55	12·0°	100	100	3
Krakatau	18	55	8·2°	100	100	35
Mandalay	23	15	4·6°	80	5	0
Okinawa No. 2	47	25	9·5°	15	0	0
S.E.S. 6	42	30	9·0°	80	0	0
S.E.S. 50	40	20	9·2°	95	100	5
S.E.S. 114	56	30	7·8°	90	50	0
S.E.S. 147 B	40	40	12·2°	100	100	2
S.E.S. 189	26	30	12·4°	40	60	0
S.E.S. 196	42	30	10·0°	40	50	0
S.E.S. 205 A	28	15	4·8°	50	100	15
S.E.S. 205 B	32	5	9·1°	25	70	0
S.E.S. 208 A	39	5	9·0°	20	100	0
S.E.S. 231	33	5	10·7°	20	75	0
S.E.S. 278	44	40	6·0°	30	0	0
S.E.S. 297 B	23	60	9·0°	20	0	0
S.E.S. 304	22	25	9·8°	40	75	5
S.E.S. 327	18	25	10·9°	80	70	15
S.E.S. 343	42	20	10·8°	75	100	10
S.E.S. 351	33	75	9·0°	80	0	0
S.E.S. 577	22	50	12·2°	90	75	5
S.H. 246	50	40	6·4°	80	50	0
Soembawa	29	25	9·7°	90	100	40
Tainan 2 n = 96	26	20	11·2°	80	100	10
U.S. 56-8-2	33	0	14·5°	50	100	10
U.S. 56-15-2	33	0	9·6	80	100	30
U.S. 56-15-8	21	0	11·5°	85	100	30
U.S. 59-1-1	29	50	8·2°	95	80	5
U.S. 60-4-6	153	25	11·4°	40	0	0
U.S. 61-2-1	160	50	11·0°	60	0	0
U.S. 61-4-1	141	50	8·0°	40	0	0
L.S.D. (·05)	7	21	2·4°	22·8	—	—

* Commercial and wild control varieties.
† Figures based on maximum cold damage incurred.

Among the wild clones tested under natural exposure to cold at Houma, Okinawa No. 2 was outstanding for cold tolerance. Other wild canes, tolerant in two or more cold resistance factors, were Mandalay, S.E.S. 6, S.E.S. 278, S.E.S. 297B, S.E.S. 351, U.S. 60-4-6, U.S. 61-2-1, and U.S. 61-4-1. *S. spontaneum* Coimbatore incurred 95% dead leaf tissue, death of all terminal buds, and slight stalk damage. Because of pithiness in the top internodes of most clones of *S. spontaneum*, it was very difficult to rate stalk and bud damage.

Discussion

Many sugar cane breeders and cytogeneticists believe that new developments in sugar cane variety improvement can be expected from the use of unexplored germ plasm in the World Collection of Sugar Cane. In Louisiana, we are particularly interested in the species *S. spontaneum*. Among the five species used in breeding of contemporary commercial hybrids, *S. spontaneum* is the most genetically diverse[1]. The species is not as universally resistant to mosaic as was once thought; however, there are many clones apparently immune even to our newest mosaic strains. Some of these clones are superior to those used in breeding our present varieties.

We are identifying the *S. spontaneum* clones that combine this disease resistance with better agronomic quality and cold tolerance. *S. spontaneum* Coimbatore was a good original choice for nobilization to increase stalk numbers. However, six of the clones we tested were superior. Two of these clones were significantly better in cold tolerance and Brix, and two others were better in cold tolerance and equal in Brix.

Breeders should encounter less difficulty in recovering acceptable sucrose content from backcross progeny of many of these *S. spontaneum* clones than with *S. spontaneum* Coimbatore. In fact, 14 of the 32 clones were equal in Brix to the F_1 hybrid Kassoer.

Okinawa No. 2 was outstanding in cold tolerance, and eight other clones appear more tolerant to cold than Coimbatore or Kassoer. Several generations of backcrossing and intercrossing will be required to separate the desirable characteristics from the undesirable ones in this species. It appears quite obvious that important new characteristics can be bred into Louisiana commercial varieties with *S. spontaneum* clones.

Sugar cane agriculture

Massey rotary elevator. L. G. VALLANCE. *Australian Sugar J.*, 1968, **60,** 325.—The development of the elevator was initiated by a practical cane farmer. It is described and illustrated in action in the field. The success of this rotary throwing device may, it is thought, foreshadow a radical change in the method of elevating into the bin cane billets from the chopper knives of mechanical harvesters.

* * *

Drainage work is vital in the Moreton District. C. L. TOOHEY. *Cane Growers' Quarterly Bull.*, 1968, **32,** 43–44.—The need for more drainage work on cane lands in this part of Queensland is discussed. The evils of poor drainage are considered to be: loss due to poorly developed cane, loss due to weed competition, and loss due to disease, notably chlorotic streak which thrives under poor drainage conditions.

* * *

Usage of insecticides for grub control. G. WILSON. *Cane Growers' Quarterly Bull.*, 1968, **32,** 46.—The extent to which insecticides are used in Queensland for grub control is discussed, as are experiments to ascertain whether strains of the grey-back grub are evolving which are resistant to BHC (benzene hexachloride). Results so far have proved to be negative.

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Weed control trials with "Ametryne". C. M. MCALEESE. *Cane Growers' Quarterly Bull.*, 1968, **32,** 47. Trials with "Gesapax" ("Ametryne") at 3 lb active ingredient per acre gave good control of all weeds present; at a rate of 1 lb per acre there was control of broad-leaved species but only variable control of summer grass.

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Johnson grass in the Lower Burdekin—past, present and future. I. T. FRESHWATER. *Cane Growers' Quarterly Bull.*, 1968, **32,** 61–64.—The history of this bad cane weed in this part of Queensland is discussed. Successful control in cane fields by mechanical means (dry ploughing) is recorded. "Hyvar X", although costly, gives good control in waste places, road sides, along tram or train lines, etc. The existence of a dry season in the area assists control.

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The association among experimental varieties of sugar cane between stand or shoot counts during the growing season and number of mature stalks at harvest. B. L. LEGENDRE, D. P. VIATOR and M. T. HENDERSON. *Sugar Bull.*, 1968, **46,** (24), 5–7.—Discussion revolves round the best time to make shoot counts in Louisiana as an indication of the number of millable stalks in the mature cane. In some varieties there are shoots that never develop into mature stalks. Late tillering varieties may not produce shoots until comparatively late. It was considered that, under prevailing conditions, shoot counts should be delayed until late April.

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Growth, rainfall and temperature: the effects on sugar cane in Louisiana. J. E. IRVINE, R. L. TIPPETT and R. E. COLEMAN. *Sugar Bull.*, 1968, **46,** (24), 7–13. The short growing season for cane in Louisiana and extremes of temperature, compared with most cane growing countries, are pointed out. A summary of growth, temperature, rainfall and soil moisture data in Louisiana for the period 1957–67 is presented. The greatest growth rates take place from June to the end of September. Growth is influenced by the previous month's growth. The climatic factor most closely associated with growth was mean air temperature.

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Flowering, its consequences on yield and quality of sugar cane. E. LALITHA, K. C. RAO, T. N. KRISHNAMURTHY and R. NARASIMHAN. *Proc. 1st Conv. S. Indian Sugar Cane and Sugar Tech. Assoc.*, 1968, (2), 38–41.—Reference is made to the fact that the Sugar Cane Breeding Institute, Coimbatore, is concerned with the problem of producing sparse or non-flowering commercial varieties, particularly for peninsular India. In this article data collected from flowered and non-flowered stalks from 4 important commercial varieties are presented. Stalks were tested at fortnightly intervals for juice quality, fibre content and weight.

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Varieties in cultivation and promising for the southern States (India). U. VIJAYALAKSHMI and J. T. RAO. *Proc. 1st Conv. S. Indian Sugar Cane and Sugar Tech. Assoc.*, 1968, (2), 34–41.—The performance of a number of the newer varieties of sugar cane cultivated in different parts of southern India is discussed, including Co 658, Co 740, Co 853, Co 997, Co 1287, Co 62174 and Co 6806.

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The "cigarrhinas" of sugar cane plantations in Brazil. P. GUAGLIUMI. *Brasil Açuc.*, 1968, **72,** 296–307. Two serious insect pests of sugar cane in Brazil known as "cigarrhina", *Mahanarva postica* (syn. *indicata*) and *M. fimbriola*, are described and their

seriousness to the sugar industry discussed. Information is given on what is known of their biology, life history and habits. A notable feature of this paper is the excellent illustrations of the insects, some of them large and in colour.

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Aspects of cane cultivation in Piracicaba. J. L. BASSINELLO and E. GUIMARAES. *Brasil Açuc.*, 1968, **72,** 314–322.—There are five sugar cane factories or mills in the State—Costa Pinto, Modêlo, Santo Antônio, Monte Alegre and Piracicaba (SSP). Areas under cane and production figures for the years 1963–67 are given. The economics of the industry is discussed, as is the possibility of increased fertilizing and the cane varieties at present cultivated. About 80% of the cane area is occupied by two varieties—CB 41-76 and Co 419.

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Effect of soil acidity and liming on yields and composition of sugar cane growing on an ultisol. F. A. RODRIGUEZ, J. JUÁREZ, R. P. ESCOLOR and J. C. VICENTE CHANDLER. *J. Agric.* (Univ. Puerto Rico), 1968, **52,** 85–100.—Increased acidity of many Puerto Rican sugar cane soils has taken place as a result of continued application of acid-residue fertilizers (e.g. ammonium sulphate). This study was undertaken to determine the relationship between pH, base, and aluminium status of an ultisol and yields and quality of cane. Heavy applications of limestone on the very acid soils resulted in greatly increased yield and also in reduction of the harmful exchangeable aluminium content.

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Effect of variable "Diuron" on the sugar production and enzyme activity of sugar cane grown on clay and sandy loam soils in Puerto Rico. A. G. ALEXANDER. *J. Agric.* (Univ. Puerto Rico), 1968, **52,** 126–139. "Diuron" is a much-used herbicide with sugar cane in Puerto Rico. Results of glasshouse experiments lasting 16 months are reported and summarized. "Diuron" severely suppressed sugar production by two-month-old plants. At six months the effects had lessened and it was no longer evident at 12 to 16 months. Soil type had an important bearing on the effects of "Diuron", which also caused abnormal enzyme behaviour.

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Effects of foliar combinations of gibberellic acid and silicon on sucrose production of sugar cane. A. G. ALEXANDER. *J. Agric.* (Univ. Puerto Rico), 1968, **52,** 218–226.—Recent work in both Hawaii and Australia has shown conclusively that gibberellic acid and silicon affect sucrose production by sugar cane. The study here reported was undertaken to explore further the combined effects of gibberellic acid plus silicon upon sugar synthesis and storage. It was concluded that gibberellic acid and silicon when combined increase sugar production to a greater extent than when similar amounts of the two substances are used separately. Relatively small amounts of the two constituents are needed and these can be combined readily with a single foliar application.

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Controlled temperature studies of growth, enzymology and sucrose production by two sugar cane varieties in Puerto Rico. A. G. ALEXANDER and G. SAMUELS. *J. Agric.* (Univ. Puerto Rico), 1968, **52,** 204–217. This paper summarizes some initial controlled-climate or phytotron studies with sugar cane, the objective being to evaluate growth, enzymology and sugar production in two varieties of cane maintained under continually high and low temperatures. Enzyme activity varied greatly with temperature and with variety of cane.

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Growth, enzyme and sugar responses of immature sugar cane to foliar treatment with 6-azauracil and gibberellic acid. A. G. ALEXANDER. *J. Agric.* (Univ. Puerto Rico), 1968, **52,** 295–310.—Reference is made to the desirability of finding a practical growth inhibitor with cane in Puerto Rico where rain in the middle of the harvest season may cause serious reduction in sugar content of cane as growth is stimulated or resumed. This paper summarizes studies of 6-azauracil as a potential growth inhibitor and ripening agent. Evidence suggested that combined azauracil and gibberellic activity promoted physiological maturity more effectively than either agent acting alone.

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***In vitro* effects of silicon on the active patterns of sugar cane acid invertase.** A. G. ALEXANDER. *J. Agric.* (Univ. Puerto Rico), 1968, **52,** 311–322. Recent work in Hawaii, Mauritius and elsewhere has shown that silicon plays an important part in sucrose production in sugar cane. It may also affect manganese uptake by the plant. This paper summarizes experiments which have further clarified the nature of invertase action and have revealed an extensive capacity of silicon to affect sugar transformations.

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Studies in late metaxylem vessels in the genus *Saccharum* and allied genera. S. S. SHAH, M. R. VENKATARAMAN and S. RAJASEKARAN. *Phytomorphology*, 1968, **18,** (1), 102–103.—Reference is made to recent anatomical studies in rice (variation in length, obliqueness of end wall and nature of perforations in xylem) and its bearing on evolution of the crop. From the evidence obtained with sugar cane and described here, the same may apply.

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Nutrient status of sugar cane in relation to leaf nutrient concentration. I. C. R. HOLFORD. *Exp. Agric. and Animal Husb.* (Australia), 1968, **8,** 606–614.—This study was carried out to determine the relation between the nutrient requirement of sugar cane and the concentration of nitrogen, phosphorus and potassium in the leaf tissue of the plant, data having been collected from fertilizer field experiments

harvested in the sugar growing area of Fiji during the period 1959–1963. Results are summarized in tables. The major conclusion was that leaf nutrient concentration gave a reasonable indication of the nutrient status of a sugar cane crop, but that it could not be used to estimate the amount of fertilizer required to correct a deficiency.

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Rat baits incorporating paraffin wax. ANON. *Papua and New Guinea Agric. J.*, 1967, **19**, 88.—One of the main problems in rat control under local conditions is to preserve baits from weather damage. Trials demonstrated the value of paraffin wax incorporated in the bait. The following basic recipe was used and was the cheapest available—1 lb 0·5% "Warfarin" (or 0·08 oz 100% "Warfarin") : 10 lb wheatmeal : 1 lb sugar : 7 lb paraffin wax. The dry ingredients are mixed together and stirred into melted commercial-grade paraffin wax, keeping the temperature as low as possible.

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A root squash technique for counting somatic chromosomes in sugar cane. N. S. SISODIA. *Stain Technology*, 1968, **43**, 129–134; through *Hort. Abs.*, 1968, **38**, 1104.—The technique is described. There is also a description of an appropriate procedure for germinating setts to obtain suitable roots, developed at the West Indies Central Sugar Cane Breeding Station, Barbados.

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Micro-nutrients increase sucrose content. R. V. TAMHANE. *Plant Fd. Rev.*, (Bombay), 1967, **8**, (11–12), 1–4; through *Hort. Abs.*, 1968, **38**, 1107.—The rôles of B, Zn, Mn, Fe and Mo in plant metabolism and their effect on improving juice quality and yield in sugar cane are briefly discussed.

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Possible boron toxicity in sugar cane. C. M. BRAVO. *Turrialba*, 1968, **18**, 72–73; through *Hort. Abs.*, 1968, **38**, 1107.—In experiments in Peru, samples of cane leaves affected by marginal necrosis, taken from 4 localities, were analysed for B, Na and Cl. The B content of the necrotic portions was 8·4 times that of the green parts in one locality and more than 10 times as high in 3 other places. The necrotic areas were also considerably higher in Na and lower in Cl than the normal tissue.

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A disease of sugar cane in the Ivory Coast. C. GOLATO and E. MEOSSI. *Riv. Agric. Subtrop.*, 1968, **62**, 41–45; through *Hort. Abs.*, 1968, **38**, 1108.—The disease is caused by *Leptosphaeria sacchari*. It is considered that it cannot be economically controlled by fungicides.

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Studies on the incidence of sugar cane smut (*Ustilago scitaminea*) in relation to ratooning. N. J. AHMED and D. PADMANABHAN. *Madras Agric. J.*, 1967, **54**, 651–652; through *Hort. Abs.*, 1968, **38**, 1108.—Five cane varieties were tested in their ratoon crops. Smut incidence was generally low, being only 8·88%, even in the 3rd ratoon of the most susceptible variety. It is considered that a resistant variety can be ratooned once or twice, provided good planting material is used.

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Some effects of root knot nematodes on sugar cane. J. A. WINCHESTER. *Nematologica*, 1968, **14**, 18–19; through *Hort. Abs.*, 1968, **38**, 1109.—Inoculation experiments with *Meloidogyne arenaria* and *M. incognita* in sandy and organic soils are recorded and the influence of soil on gall size noted. The favourable effect of various nematocides is recorded.

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Some effects of the big-headed ant on populations of the pink sugar cane mealy bug. S. S. FLUKER, E. W. HUDDLESTON and J. W. BEARDSLEY. *J. Econ. Ent.*, 1968, **61**, 474–477; through *Hort. Abs.*, 1968, **38**, 1110.—The presence of the ant *Pheidole megacephala* resulted in larger populations of the mealybug *Saccharicoccus sacchari* on sugar cane although it was not detrimental to the parasitization of the mealy bug by *Anagyrus saccharicola*.

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Floral differentiation in sugar cane and the subsequent rate of development of the differenciated tissues. T. T. TANIMOTO. *Agron. J.*, 1968, **60**, 275–278; through *Hort. Abs.*, 1968, **38**, 1111.—It was found that with the sugar cane variety H 37-1933 floral buds were initiated within a 10-day period beginning about 7th September and that the photoperiod of this 10-day period determined the time of initiation of the flower bud. The rate of development of these buds and the final emergence of the tassels depend upon the strength of the flowering stimulus, which can vary in adjacent stalks.

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Photosynthesis in sugar cane varieties under field conditions. J. E. IRVINE. *Crop Sci.*, 1967, **7**, 297–300; through *Hort. Abs.*, 1968, **38**, 1112.—Details are given of leaf characters and rate of photosynthesis per unit area of leaf (P) for 10 varieties of sugar cane. P values of 4 *Saccharum officinarum* hybrids were lower than those of several interspecific hybrids. Correlations were found between P and both leaf thickness and porosity within a variety. These characters may be useful indicators of high photosynthetic potential in new varieties. There was no correlation between P and stomatal number, stomatal length or leaf density.

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Inflorescence rot of sugar cane. N. VAZQUEZ DE RAMALLO. *Rev. Ind. Agric. Tucumán*, 1967, **45**, (2), 89–93; through *Rev. Appl. Mycology*, 1968, **47**, 641.—The disease caused by *Fusarium moniliforme* was newly recorded on unopened inflorescences in Argentina, possibly an advanced stage of pokkah boeng.

Sugar beet agriculture

Sugar beet in France. *Publ. Inst. Tech. Franç. Betterave Industrielle*, 1967, 216 pp.—The work carried out by the Institute in 1967 is summarized under three main sections: spring work, harvesting, and agronomy. The first two sections include information on mechanization and modern labour-saving devices, a number of French beet harvesters being illustrated. The third section contains reports on the following subjects: seed treatment experiments; beet spacing tests; dusting seed beet with "Cyocel" in tests to diminish plant heights with the aim of facilitating mechanical harvesting; weed control tests; study of a new post-emergence herbicide (Sch. 4072) which contains 20% 6-methoxycarbonylaminophenyl-N-(3'-methylphenyl)-carbamate ("Phenmedipham"); work on irrigation; and work on fodder beet in Normandy and Brittany.

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Invertase inhibitors from red beet, sugar beet and sweet potato roots. R. PRESSEY. *Plant Physiology*, 1968, **43**, 1430–1434.—The discovery of protein inhibitors of invertase in these three crop plants is recorded and discussed. The isolation and partial purification of the three new invertase inhibitors is described. For most invertases, red beet and sugar beet inhibitors are most effective at pH 4·5.

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Suitability of sugar beet for saline and saline-alkali soils of northern India. I. Adaptability. J. S. KANWAR and N. T. SINGH. *Ind. J. Agric. Sci.*, 1968, **38**, 115–121. Experiments to assess the possible value of sugar beet as a crop for the vast areas of saline and saline-alkali soils of northern India are discussed. It was found that sugar beet would tolerate fairly high degrees of salinity during germination, compared with other crops grown (e.g. sweet clover and berseem). Yields were only slightly affected at the higher salt levels. It was concluded that sugar beet was a promising crop to fit into crop rotations followed on saline and saline-alkali soils of northern India.

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The effects of potassium fertilizers on quality of sugar beet. A. P. DRAYCOTT and G. W. COOKE. *Potass. Symp.*, 1966, 131–135; through *Soils and Fertilizers*, 1968, **31**, 460–461.—Nearly 30 years of experiments (Broom's Barn Exp. Sta., Bury St. Edmunds, England) showed that K applications slightly increased the sugar content of roots, decreased noxious N, but had little effect on juice purity. The effects of K on sugar beet quality were much smaller than those of N.

Structural anomalies in the flowers of F_2 hybrids of sugar beet × *B. maritima*. L. WACHOWIAK-DALKE and B. JASSEM. *Biul. Inst. Hodowla Aklimatyz. Róslin*, 1967, (3–4), 9–11; through *Plant Breeding Abs.*, 1968, **38**, 841.—Progeny of sugar beet × wild beet (*Beta maritima*) crosses revealed some sterile plants which had certain abnormalities in floral structure. Although development of normal pistils may be hindered, the gametes (or chromosome production) are not affected.

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Italian sugar beet cultivation: the Common Market prospects. A. DONÀ DALLE ROSE. *Agricoltura* (Rome), 1968, **17**, (5), 41–51; through *Plant Breeding Abs.*, 1968, **38**, 841.—Reference is made to the contribution of a correct choice of varieties in reducing costs and increasing yield and quality. Selection criteria of particular relevance to Italian conditions are fully described.

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Italian sugar beet cultivation. Cultural technique in the South. L. CAVAZZA. *Agricoltura* (Rome), 1968, **17**, (5), 52–62; through *Plant Breeding Abs.*, 1968, **38**, 844.—Changes in the technique of growing sugar beet seed, resulting from the use of male sterility, are described. As from 1st July 1969, seed production became subject to Common Market regulations.

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The practical fertilizer value of leaves and crowns of sugar beet. A. CROHAIN and L. RIXHON. *Bull. Rech. Agron. Gembloux*, 1967, **2**, 397–428; through *Field Crop Abs.*, 1968, **21**, 360.—The manurial value of ploughed-in sugar beet tops was investigated in 3 following crops of cereals. There was a notable beneficial effect on the first year's wheat, a slight one in the second and little benefit in the third. The total nitrogen manurial value was 50–55 kg N/ha.

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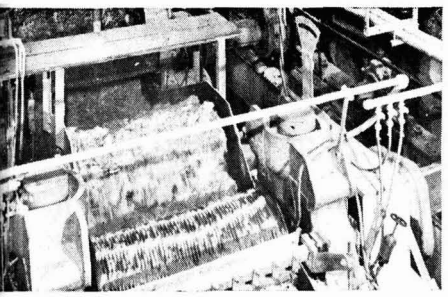
Sugar beet trials (in Greece): results of 1965. J. KLAVANIDIS. *Publ. Min. Agric. Cotton Res. Inst.* (Sindos, Greece), 1967, 7 pp.; through *Field Crop Abs.*, 1968, **21**, 358.—In autumn-sown trials Zwaan-poly was the most promising variety and K.W.S. "AA" was very resistant to bolting. Sowing between 11th and 31st October gave the best results. Sowing in shallow furrows was better than sowing on ridges (cold wind protection). Delaying harvesting until the end of October gave increased yield of roots and sugar. Irrigation at 7-day intervals was better than 14- or 21-day intervals.



Cane sugar manufacture

Review of recent diffuser development. H.S.WU. *Taiwan Sugar*, 1968, **15**, (5), 10–15.—See *I.S.J.*, 1969, **71**, 83.

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Observations on the DDS process of cane milling-diffusion. ANON. *Brasil Açuc.*, 1968, **72**, 459–461. A brief account is given of the adaptation of the DDS diffuser design to sugar extraction from cane, and a list is presented of seven units in operation in various parts of the world. The function of the diffuser is discussed as are aspects of its construction and performance.

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Introduction to the cane sugar industry. U. C. UPADHIAYA. *Indian Sugar*, 1968, **18**, 441–446, 517–524. The processes and equipment used in the cane sugar factory are described stage by stage.

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Chemicals used in white sugar manufacture. A. C. CHATTERJEE. *Indian Sugar*, 1968, **18**, 605–608.—See *I.S.J.*, 1969, **71**, 242.

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The economics of the application of (the) ion exchange process for demineralization of sugar cane juice in India. S. MUKHERJEE, S. K. GHOSH and S. K. SRIVASTAVA. *Indian Sugar*, 1968, **18**, 667–671.—The economics of ion exchange treatment of cane juice are tabulated for the monobed (mixed-bed) system, found most suitable for sulphitation factories, and for the direct bed system, which is considered the best system for carbonatation factories. The data are based on a juice throughput equivalent to 1000 t.c.d. and on deionization results obtained at various Indian sugar factories. Economic data are also presented based on laboratory experiments with the direct bed method. The figures indicate the practicality of using ion exchange demineralization in India.

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Milling in (the) open pan sugar industry—imbibition and its rôle towards higher extraction. V. M. BHALWAR. *Indian Sugar*, 1968, **18**, 673–675.—Single milling and double milling, with and without 10% imbibition, are compared for small-scale khandsari production.

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Who needs bulk cane handling? J. KINABREW. *Sugar J.*, 1968, **31**, (7), 9–10.—Conditions under which a bulk cane handling system could be used to advantage are discussed.

Pressure filtration for raw house cachaza. J. C. P. CHEN. *Sugar J.*, 1968, **31**, (7), 20–24.—See *I.S.J.*, 1969, **71**, 51.

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Venezuela's new Central Portuguesa. ANON. *Sugar y Azúcar*, 1968, **63**, (12), 17.—Details are given of the equipment in the new cane sugar factory of Central Portuguesa, at Acarigua, Venezuela. The factory was supplied by A. & W. Smith & Co. Ltd. and The Mirrlees Watson Co. Ltd. and is designed for an initial crushing capacity of 3000 t.c.d., to be expanded to 6000 t.c.d. in 1973. A refinery is attached to the sugar factory.

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Improved two-boiling system operating in Florida. G. F. FUNDORA. *Sugar y Azúcar*, 1968, **63**, (12), 22. *A*-massecuite is cooled from 155–160°F to 125–130°F in 12 crystallizers connected in series. The molasses produced, of 60–61 purity, is used for boiling *C*-massecuite, giving a *C*-sugar of high quality and 0·250 mm grain size. Grain is uniform with no conglomerate or twins. The *C*-sugar is mingled with syrup and the grain allowed to grow to 0·800 mm in seed tanks, after which it is used for *A*-massecuite, *A*-molasses being added for purity adjustment. Advantages of the scheme compared with a 3-boiling system used previously include higher purity drop from syrup to final molasses, lower pol loss in final molasses, lower pan station steam consumption, and less dilution water for molasses. The yield of 96° sugar per ton of cane is higher.

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A scientific view regarding fixation of cane price on quality basis. M. BASHIR and J. AHMAD. *Proc. 7th Conv. Pakistan Soc. Sugar Tech.*, 1968, (1), 49–58. After a survey of the cane analysis techniques used in various countries, the problem of replacing the present system in Pakistan of payment on a basis of weight alone is considered. In view of difficulties associated with considerable numbers of analyses necessary, the author advocates analysis on a zonal basis as a temporary measure until a more rational system of analysing individual cane lots is developed.

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Performance of D-C clarifier in Setabganj Sugar Mills. G. A. MATIN. *Proc. 7th Conv. Pakistan Soc. Sugar Tech.*, 1968, (1), 65–74.—Details are given of a three-tray Dorr clarifier with mud discharge from the bottom chamber, which, because of unsatisfactory performance, was converted to a four-tray continuous mud

discharge model. Conversion and performance data are given, showing the improvements brought about, i.e. increased throughput, higher pol and purity rise from raw to clarified juice, juice of brilliant clarity (compared with occasional turbidity with the original clarifier), and a maximum allowable retention time of 40 hr compared with 20 hr.

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Light-duty two-roll feeder developed for Queensland sugar mills. D. S. SHANN. *Proc. 7th Conv. Pakistan Soc. Sugar Tech.*, 1968, (1), 59–64.—See *I.S.J.*, 1966, **68**, 55.

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Carbonatation equipment in Charsadda. F. H. ARBAD. *Proc. 7th Conv. Pakistan Soc. Sugar Tech.*, 1968, (1), 75–79.—Information is given on modifications made to the double carbonatation system at the sugar factory of Charsadda Sugar Mills Ltd., erected by Buckau R. Wolf A.G. in 1956.

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Behaviour and performance of filter presses at Adamjee Sugar Mills Limited, Darya Khan. H. A. NAQVI. *Proc. 7th Conv. Pakistan Soc. Sugar Tech.*, 1968, (1), 80–88.—Modifications to the BMA filter-presses at this Pakistan sugar factory are described in detail. The alterations have tended to eliminate troubles encountered during the factory's trial season.

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Continuous centrifugals for low-grade massecuites. K. M. SHEIKH. *Proc. 7th Conv. Pakistan Soc. Sugar Tech.*, 1968, (1), 114–116.—The performance of BMA K-1000 continuous centrifugals used as fore- and after-workers on *C*-massecuite at Adamjee Sugar Mills Ltd. is discussed, and the advantages of the machines listed.

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Final molasses measurement and storage. W. R. DUNFORD. *Proc. 7th Conv. Pakistan Soc. Sugar Tech.*, 1968, (1), 117–120b.—See *I.S.J.*, 1968, **70**, 83.

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Trouble-shooting in electrical motors and centrifugal pumps. A. AHMAD. *Proc. 7th Conv. Pakistan Soc. Sugar Tech.*, 1968, (1), 121–129.—Guidance is given on diagnosing faults in electric motors and centrifugal pumps.

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Filling of rotating suspended centrifugals with sugar massecuite. K. PAUSE. *Bol. Azuc. Mex.*, 1968, (224), 30–35, (225), 8–13.—Aspects of the filling of batch centrifugals with massecuite are considered, including the paraboloid shape taken up in relation to the filling speed and the opposing requirements of adequate speed to maintain a near-vertical wall while avoiding premature separation of molasses with a loss of massecuite fluidity. With the introduction of automatic machines, faults in filling arrangements become obvious because no remedial action can be taken by a human operator, and a number of ways of avoiding this are outlined; these include use of a hopper with a deflector, a distribution plate with a side filling spout or with a central annular spout, multiple filling spouts on a vertical manifold within the basket, or of frustro-conical discharge-opening covers which serve as deflectors for massecuite during filling and are raised for discharge of the sugar after curing. Control of filling by massecuite volume and by weight is discussed and methods for their measurement are described.

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Instrumentation for sugar mills and refineries. G. P. TREARCHIS. *Sugar J.*, 1968, **31**, (5), 28–32.—Instruments and components for measuring pressure and temperature are described by the senior engineer of The Foxboro Co.

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A new maceration system. R. RODRIGUEZ C. *Sugar J.*, 1968, **31**, (5), 34–36.—In a maceration scheme proposed by the author, the first three mills in a six-mill tandem each receive 50% maceration juice (on cane), while the 4th mill receives 30% (water). This compares with a conventional scheme where the 1st, 2nd, 3rd, 4th and 5th mills receive 40%, 37%, 34%, 31% and 30%, respectively. The aim is to obtain a bagasse liquid content about the same as is in the original cane without increasing the diluted juice going to process. Certain measures are described which are necessary for proper distribution of the maceration liquor (installation of an overthrow kicker or intermediate belt conveyor at each mill to disperse the bagasse into a thin stream) and to handle the extra bagacillo at the last mill (elimination of Messchaert and lateral grooves on the cane and bagasse rollers of the last mill and use of grooved heels on the trash plate). Theoretical data for the proposed scheme are compared with figures for a conventional scheme.

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Industrial engineering work at Victorias (Milling Co. Inc., Philippines). J. P. STO. DOMINGO. *Sugar News*, 1968, **44**, 488–502.—The use of industrial engineering techniques at Victorias to increase efficiency and control or reduce sugar production costs is discussed and lists given of the studies carried out since the inception of the programme in 1959.

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Automatic cane carrier at La Carlota sugar central. M. R. GALEON and E. F. DALIPE. *Sugar News*, 1968, **44**, 512–514.—The automatic feeding of cane to the crusher at La Carlota is based on a system comprising four sensing devices: electro-solenoid valves; mechanical swinging bars; a rotary feed drum; and auxiliary controls for the first three components, each of which controls the carrier drive speed. The controls were installed on a 14-roller 36 × 78-inch tandem having a rated capacity of 3000 t.c.d. Satisfactory results have been obtained, including an improvement in the grinding capacity and mill extraction and elimination of choking of the cane knives and of breakdowns in the carrier drive. Voltage fluctuations were minimized.

Division of Mill Technology. J. H. NICKLIN and P. G. ATHERTON. *Ann. Rpt. Bur. Sugar Expt. Sta.*, 1968, (68), 81–90.—Work carried out by the Queensland Bureau of Sugar Experiment Stations during 1968 is reported. This covered evaluation of a new clarification process involving the use of phosphoric acid, which is considered worth further investigation in order to reduce its costs, which are much higher than conventional clarification, chiefly because of the phosphoric acid; cane deterioration tests at Fairymead on whole-stalk and chopper-harvested cane; fibre determination with new cane varieties; comparison of the ATV and Bach subsiders; laboratory tests of flocculation aids, in which only one of six tested, "Magnafloc LT 26" proved to be as effective as the most suitable of recognized agents; condenser tests; and experiments on the effects of feeder carriers and tables on knife and shredder motor loads.

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Entrainment in vacuum pans. H. E. SERNER. *Sugar y Azúcar*, 1969, **64,** (1), 32–36.—A brief survey is given of entrainment separators, and the curved-baffle type designed by the author is described in more detail. It is emphasized that design of an entrainment separator depends on knowledge of calandria and pan design and operation and that no type can be 100% efficient, since some of the entrainment will be a fine mist which is an integral part of the vapour. stream.

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Water treatment at Innswood, Jamaica. G. MONGUL *Sugar y Azúcar*, 1969, **64,** (1), 38.—Boiler feed water treatment since 1966 has involved the use of various chemicals supplied by Fabcon Inc.; they include "Fabfos" sodium polyphosphate (containing 65% P_2O_5), "Fabcol" (which combines colloids, oxygen scavengers and defoaming agents in a single stable liquid), "Fabox" catalysed sodium sulphite, and "Fabchem C" anti-scale and -corrosion agent. Soda ash is also used. Effects of the chemicals have proved fully satisfactory.

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New concept for main carrier drives. R. P. HARPER and W. H. JOHNSTON. *Proc. Amer. Soc. Sugar Cane Tech.*, 1966, **13,** 1–8.—See *I.S.J.*, 1966, **68,** 340.

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A progress report on the filtration of raw and limed cane juice using the Hayward filter. J. M. KINABREW. *Proc. Amer. Soc. Sugar Cane Tech.*, 1966, **13,** 9–20. See *I.S.J.*, 1967, **69,** 144; 1969, **71,** 19.

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The use of magnesium oxide to prevent evaporator scaling in sugar factories. M. S. HOFFMAN, M. F. SMITH and D. J. TWIGG. *Proc. Amer. Soc. Sugar Cane Tech.*, 1966, **13,** 80–104.—The application of "Magox" magnesium oxide in clarification and its beneficial effects, particularly reduction of evaporator scaling, are discussed[1].

Some operating aspects of ring diffusion. J. DORNIER. *Proc. Amer. Soc. Sugar Cane Tech.*, 1966, **13,** 71–79. See *I.S.J.*, 1967, **69,** 177.

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Why convert your clarifier to a "Poly-Cell"? A. L. WEBRE. *Proc. Amer. Soc. Sugar Cane Tech.*, 1966, **13,** 105–111.—See *I.S.J.*, 1967, **69,** 341.

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Mechanized feed table. J. COPES, W. R. HESTER, C. MATENS and S. F. LITTLE. *Proc. Amer. Soc. Sugar Cane Tech.*, 1967, **14,** 33–40.—See *I.S.J.*, 1968, **70,** 19.

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Mechanical seals for sugar mill service. J. C. COPES. *Proc. Amer. Soc. Sugar Cane Tech.*, 1967, **14,** 41–47. The application of mechanical seals in centrifugal pumps and their advantages over packings are discussed.

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Operation of Edwards "AutoCane" system at Valentine factory, 1966. F. L. BARKER and H. P. DORMAN. *Proc. Amer. Soc. Sugar Cane Tech.*, 1967, **14,** 48–59. See *I.S.J.*, 1968, **70,** 19.

* * *

What Louisiana raw sugar mills can do to improve the quality of their raw sugar. J. N. FORET. *Proc. Amer. Soc. Sugar Cane Tech.*, 1967, **14,** 71–74.—See *I.S.J.*, 1968, **70,** 146.

* * *

The De Smet cane diffusers. J. P. LAMUSSE. *Sugar J.*, 1969, **31,** (8), 26–27.—Modifications to De Smet TN cane diffusers and TS bagasse diffusers (the new series is now designated TNC and TSC, respectively) are described. Standardization of the design permits conversion of a TS diffuser to a TN unit, the basic difference between the two being in the number of washing stages, which is 17 for the TN and 11 for the TS, and hence in the diffuser length.

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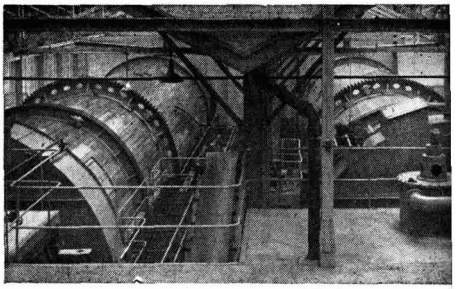
Application of the two-boiling system to Louisiana. T. R. RAY. *Proc. Amer. Soc. Sugar Cane Tech.*, 1968, **15,** 1–16.—See *I.S.J.*, 1969, **71,** 117.

* * *

Automated bagasse bale handling. A. I. GUIDRY. *Proc. Amer. Soc. Sugar Cane Tech.*, 1968, **15,** 17–23. Experience with the bagasse bale handling system at South Coast Corp. sugar factories in Louisiana[2] has shown that jams occur which often cause 10–15 minute stoppages in the mills, although the systems have eliminated the possibility of serious labour problems. The present aim is to improve the equipment so as to minimize the interruptions.

[1] See *I.S.J.*, 1966, **68,** 157.
[2] *I.S.J.*, 1968, **70,** 90.

Beet sugar manufacture



Improving the removal of sand from milk-of-lime. N. F. DOMASHENKO. *Sakhar. Prom.*, 1968, **42,** (11), 38.—Brief mention is made of a supplementary stationary unit in which the suspension from a hydrocyclone is washed with water to remove the sand which is then transferred by screw to a conveyor belt for disposal.

* * *

Tests on thin juice decolorization with "Lewatit MP 500 A" at Enns sugar factory (Austria). E. MOEBES. *Zucker*, 1969, **22,** 1–13.—Full details are given of tests in which thin juice was treated with "Lewatit MP 500 A" quaternary ammonium anion exchanger in Cl^- form. Decolorization efficiency ranged from 84·0% to 92·5% with thin juice having an initial colour content in the range 5·98–13·94°St/100°Bx. There was also considerable non-sugar removal and some N removal in the form of amino compounds (80 and 2–3 kg/cu.m. resin, respectively). The consumption of NaCl for regeneration was reduced by using counter-current regeneration. $MgCl_2$ recovered from the Quentin process is equally suitable as regenerant. The quality of sugar was raised by juice decolorization.

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Design development of evaporators in the sugar industry. F. BONACKER. *Die Lebensmittelind.*, 1968, **15,** 419–422.—A survey is presented of the types of evaporator used in the sugar industry, including circulation, through-flow, the semi-Kestner and Kestner types, and film evaporators.

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Automation of juice feed to vacuum pans. S. BOUČEK and V. VALTER. *Listy Cukr.*, 1968, **84,** 246–252. Details are given of an automatic control system developed at the Sugar Research Institute (VÚC) in Czechoslovakia and tested in a sugar factory and refinery. It is based on conductivity measurements using two-step control over a selected conductivity range. At the lower limit a signal is transmitted through a solenoid valve to the pneumatically-operated feed valve which opens and remains open until conductivity reaches the upper limit. The valve may be opened if required from a manual control panel. Results demonstrate the advantages of the system, expressed in the higher quality and yield of sugar compared with conventional boiling controls.

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Experiments in the operation of steam pre-heaters. J. VLASÁK. *Listy Cukr.*, 1968, **84,** 256–262.—Conditions for trouble-free operation of steam pre-heaters are discussed and causes of breakdowns in their operation at Czechoslovakian sugar factories during recent campaigns are analysed.

* * *

Transference of quantum calculation of production schemes to the solution of linear equation systems. J. BURIÁNEK. *Listy Cukr.*, 1968, **84,** 262–270.—A system of linear equations for calculating the amount of sucrose in individual factory processes is obtained by deriving equations for the sucrose balance in process (a_i) and for the amount of a given non-sugar component in process (b_i) and substituting $b_i = Z_i.a_i$ in these equations, where Z_i is the ratio between the concentration of the non-sugar component and the sucrose concentration in a given intermediate product after establishment of equilibrium in a given section i ($i = 1,2, \ldots$.). The result is expressed as a dimensionless quantity of sucrose in process which, for a given scheme, is a function of the composition of the individual intermediate products but which is independent of the quantity of sucrose produced by the factory.

* * *

Purification of sugar factory waste waters in quiescent tanks. A. F. CHEKURDA and A. P. PARKHOMETS. *Sakhar. Prom.*, 1968, **42,** (12), 21–25.—Equations are given for calculating quiescent tank capacity for a given volume of waste water and effluent BOD, the values being for the end of the month and based on treatment of the effluent during that month. Tables are given of values for these and other factors.

* * *

Efficient automatic control system for a multiple-effect evaporator in a sugar factory. G. N. KOSTENKO, L. I. KON, A. M. KOZAK, A. M. MYNTYAN and V. S. KOVALENKO. *Sakhar. Prom.*, 1968, **42,** (12), 26–29. Details are given of the scheme used at Faleshtskii sugar factory (USSR) for automatic control of evaporation rate, juice concentration and other parameters required for supply of vapour to other units. The system is claimed to have reduced steam consumption of the quadruple-effect evaporator by 6%.

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Setting-up and operating a system of pH measurement at Zasel'skii sugar factory (USSR). E. V. ROZYMENKO, YA. E. KOSHEVATSKII and I. I. LAZAREVICH. *Sakhar. Prom.*, 1968, **42,** (12), 29–31.—Details are given of the system for pH measurement in 1st and 2nd carbonatation, including temperature compensation and juice diversion devices.

Improving the performance of units for ventilation of beet in piles. M. Z. KHELEMSKII. *Sakhar. Prom.*, 1968, **42**, (12), 34–38.—Experience within the USSR and in other countries with the use of forced ventilation of beet piles is discussed and ways of improving the efficiency at Soviet sugar factories are suggested.

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The behaviour of products from electrodialysis purification of green syrup during heating. L. D. BOBROVNIK and A. P. KOZYAVKIN. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (5), 76–78.—While heating up to 1 hr at 100° and 110°C caused a slight increase in sucrose decomposition, reducing matter content and colour of electrodialysates after green syrup demineralization, the increase was greater and at a higher rate with heating at 120°C and was considerable at 130°C. In all cases, the pH fell, the drop being greater the higher was the heating temperature, as was the case with amino-N content.

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Thermal stability of beet sugar products. L. I. TREBIN and K. D. ZHURA. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (5), 79–81.—The thermal stability of molasses solutions to which sugar had been added and of 1st and 2nd green and wash syrups was determined at 80–120°C. Those products of 90–95 purity had greatest heat stability; with fall in purity there was increase in the catalytic effect of non-sugars on sucrose destruction, while the stability of pure products was reduced by their poor buffering capacities. Since the sucrose destruction rate rose by 200–300% with rise in heating temperature from 80 to 90°C, low-grade massecuite should be boiled at a temperature no higher than 75–80°C, falling to 70–75°C at the end of the strike

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Determination of the parameters of dynamic models of temperature paths in a diffuser. V. G. OMEL'NITSKII and E. K. SHIGIN. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (5), 135–138.—From the mathematical model described earlier[1] the authors have derived equations for calculating parameters involved in DDS diffusion. Acceleration curves are plotted for temperature of juice-cossette mixture *vs.* time. The method is accurate to within $\pm$ 2·5%.

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Start-up of two new sugar factories in Morocco. G. BAUMGARTEN. *Zucker*, 1969, **22**, 35–38.—Information is given on the equipment and processes at the two beet raw sugar factories built by BMA, Buckau R. Wolf A.G. and Lucks & Co. G.m.b.H. for Sucreries Nationales du Gharb at Mechra-bel-Ksiri and Sidi-allal-Tazi, both in Gharb province, Morocco. Both factories have a daily slicing capacity of 4000 tons of beet.

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Sugar beet and beet sugar in Jordan. J. JASKOLSKI. *Zeitsch. Zuckerind.*, 1969, **94**, 12–19.—The possibility of setting up a beet sugar industry in Jordan has been studied by an Austrian team, who have found the area in the vicinity of the Deir Alla experiment station, in the eastern Jordan Valley, to be the most promising for beet growing. Various aspects of beet sugar production, including production and capital costs and potential markets, are considered as well as the agricultural aspects, and the layout of a proposed sugar factory is reproduced. The political situation prevents the project being put into effect at present.

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The type Z multi-purpose centrifugal pump for special application in the sugar industry. H. KISSINGER. *Zeitsch. Zuckerind.*, 1969, **94**, 20–26.—Potential applications of this single-stage, single-suction centrifugal pump in the beet sugar factory cover products ranging in viscosity from condensate up to 65°Bx syrup. The various impeller designs and construction materials available are described. The variants cover both horizontal and vertical applications.

* * *

The heat economy in a sugar factory with a quintuple-effect evaporator. S. ZAGRODZKI. *Gaz. Cukr.*, 1968, **76**, 305–311; 1969, **77**, 1–7.—Efficient heat economy in a beet sugar factory is discussed, and optimum heating schemes and material balances are given for all processes. The schemes described permit a 25% cut in steam, while a heating scheme for a quintuple-effect evaporator permits the steam consumption to be kept to a level corresponding to a coal consumption of 4% on beet. A detailed balance is given for each of the five effects.

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Regeneration of anion exchange resin after beet syrup decolorization. I. F. ZELIKMAN, N. M. KODENKO and D. M. LEIBOVICH. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (6), 32–37.—Tests with AV-16G anion exchange resin showed that it could be regenerated, after a syrup decolorization cycle, with 11·5 cu.m. of 2% NaOH solution (or 14 cu.m. of 10% NaCl solution at pH 13) plus 3 cu.m. 1·5% NH_4Cl solution per cu.m. of resin. Treating the regenerant solution in a dialyser to alter the pH was tested and found promising as a means of giving optimum regeneration conditions. Conditions for reducing fresh water consumption in regeneration were also established.

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Dynamic model of a DDS diffuser based on the hydraulic path. V. G. OMEL'NITSKII and E. K. SHIGIN. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (6), 124–127.—A method is described for constructing a dynamic model based on physical factors in a DDS diffuser. This has been used to give a mathematical description of the dynamic process along the material flow path.

* * *

Stabilization of the evaporation process. P. VALENTIN. *Zucker*, 1969, **22**, 73–86.—Attempts are made to evaluate the effects of heating steam consumption, water introduced into the vessel, and thin juice Brix on evaporator regulation. The pronounced

[1] *I.S.J.*, 1969, **71**, 119.

effects of juice water content and resulting thick juice Brix are discussed. It is concluded that measurement of the condensate quantity (total or partial) will give an estimate of the evaporation process. Although the Robert evaporator takes a much larger juice volume than modern high-speed evaporators, this technological disadvantage is offset by the advantage of the high heat accumulation capacity. For high-speed evaporators collection of condensate in a special double accumulator connected to the evaporator is recommended. This will allow steam production to be adjusted, so eliminating irregularities. The more important differences between the classic circulation evaporators and the modern downflow evaporators are indicated.

* * *

Use of polyacrylamide in beet sugar manufacture. M. YA. VERSKAYA, V. I. KOFANOV and S. E. KATAEVA. *Sakhar. Prom.*, 1969, **43**, (1), 11–13.—Studies showed that although all the polyacrylamide (PAA) used as flocculant for 1st carbonatation juice passes into the mud, it is possible for free acrylamide, which is more toxic than the polymer and is highly soluble, to dissolve in the clear juice and hence enter the final sugar product. Dilute PAA solutions of less than 1% concentration were found to be unstable even at room temperature, with partial destruction of the polymer. However, 0·1% PAA solutions injected into white mice over a 12-month period did not adversely affect their activity. Nevertheless, it is recommended that only PAA free from impurities should be used with a free monomer content no greater than 0·5% by weight of polymer, since no increase in monomer content occurred when such solutions were treated with hot alkali solution.

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Effectiveness of juice purification with mud removal after preliming. S. P. OLYANSKAYA and K. D. ZHURA. *Sakhar. Prom.*, 1969, **43**, (1), 13–16.—Laboratory tests showed that by separating the mud after preliming, it was possible to achieve almost the same purification efficiency at a lower lime usage as was obtainable in the classical scheme without mud removal after preliming and using more lime, e.g. 2·5% CaO compared with 1·5% CaO in the proposed scheme.

* * *

Effect of design features of evaporators on change in sugar solution colour. N. YU. TOBILEVICH, O. N. SIRYI and V. T. GARYAZHA. *Sakhar. Prom.*, 1969, **43**, (1), 20–26.—Tests were conducted on juice evaporation in a single- and a multi-pass (circulation) evaporator. Juice coloration and reducing matter content were lower in the single-pass evaporator, but the thermal efficiencies of the evaporators were about equal. The question of immersion of the upper tube plate and of modifications to specific Soviet evaporator designs for juice expansion when converting from multi- to single-pass working are discussed. A graph of the relationship between boiling juice level and coloration is discussed.

Improvement in the APN-1250 centrifugal. A. P. PARKHOD'KO. *Sakhar. Prom.*, 1969, **43**, (1), 27–29. The mechanical performance of the Soviet-built APN-1250 automatic centrifugal, used in a number of sugar factories for 1st, refined sugar and low-grade massecuites, is discussed in detail.

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White sugar bulk transport in Krasnodar Territory. M. A. DOBROVA. *Sakhar. Prom.*, 1969, **43**, (1), 30–32. The economic aspects of bulk transport of white sugar are considered, including the capital costs of small warehouses. In the USSR it is considered more economical to deliver in bulk by rail rather than by road.

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Operation and installation of rotary flowmeters for measuring the flow rate of beet sugar products. I. I. LAZAREVICH and YA. E. KOSHEVATSKII. *Sakhar. Prom.*, 1969, **43**, (1), 33–34.—A simple scheme used at a Soviet sugar factory for calibration of imported rotary and other flowmeters is described.

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Repair and operation of steam turbines. V. I. BREZHNEV. *Sakhar. Prom.*, 1969, **43**, (1), 35–37.—Causes of damage to Czechoslovakian-built AP-2,5 steam turbines in Soviet sugar factories are discussed and means of preventing excessive wear are described.

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Operation of disc-type water separators. A. P. PONOMARENKO. *Sakhar. Prom.*, 1969, **43**, (1), 39–40. Tests with disc-type water separators for removal of water and foreign matter from beets showed that they are highly reliable and efficient.

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Technological evaluation of sugar beet. K. I. MUSOLIN. *Sakhar. Prom.*, 1969, **43**, (1), 40–42.—Tests were carried out in 1966 and 1967 to determine the technological value of beet of different varieties (including syrup quality, standard molasses purity, sugar yield and losses). Values of K (coefficient of technological sugar output) are also given based on the formula $K = (1 - P_m/P_s)/(1 - 0{\cdot}01P_m)$ where P_s and P_m are, respectively, syrup and molasses purities. Thus K is inversely related to molasses purity. When K is in the range 0·750–0·815 the beet value is poor and molasses sugar is 3·5–4·0% on weight of beet. With average beet quality $K = 0{\cdot}830$–$0{\cdot}870$ and molasses sugar is 2·5–3·0%, while with good beet quality $K = 0{\cdot}890$–$0{\cdot}915$ and molasses sugar is 1·5–2·0%.

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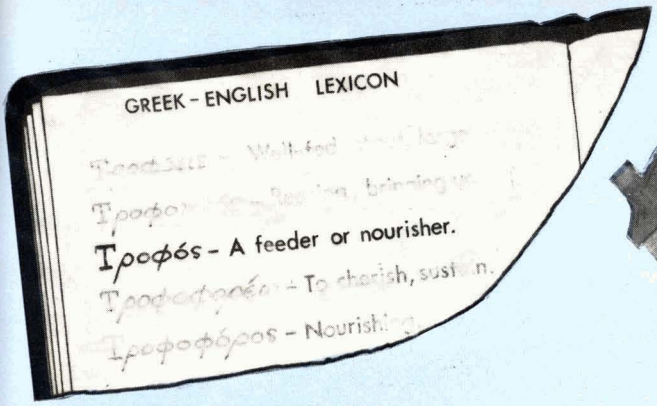
Effect of beet root topping method on its storage. E. V. PANFEROVA. *Sakhar. Prom.*, 1969, **43**, (1), 43–44. Results of investigations showed that the beets of highest quality after storage were those that had their crowns removed during harvest. The daily sugar losses and reducing matter content were greater in those beets with only petioles and leaves removed, but even greater in low-topped roots.

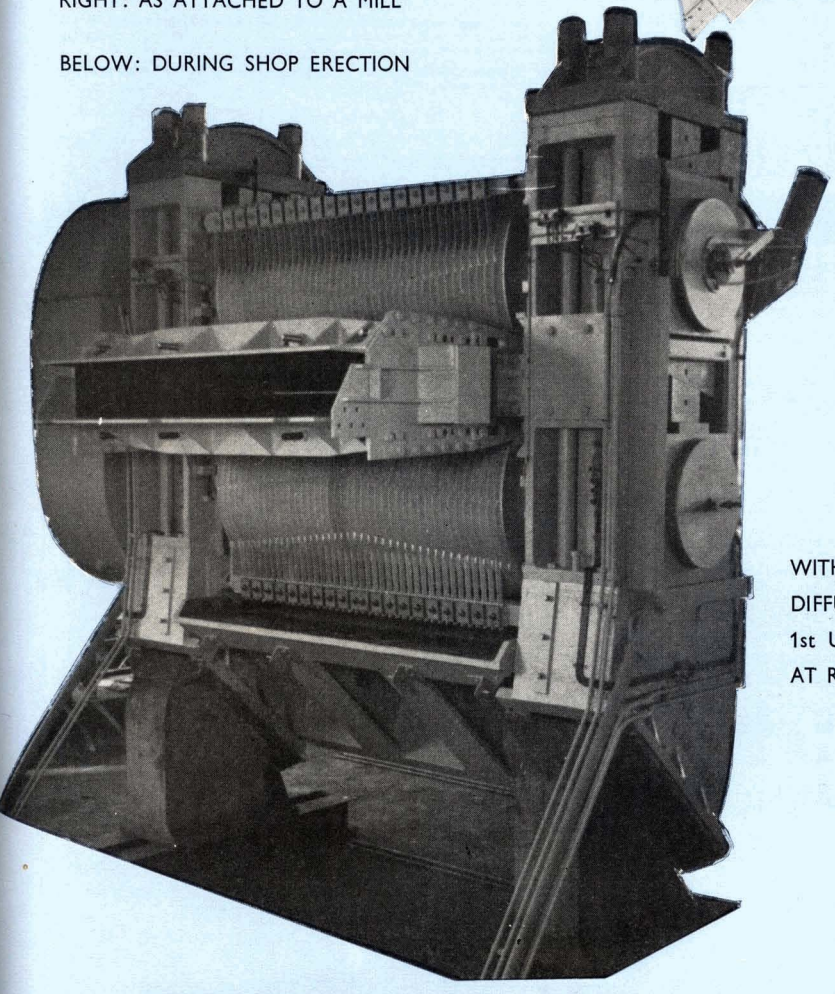
THE GREEKS HAD A WORD FOR IT

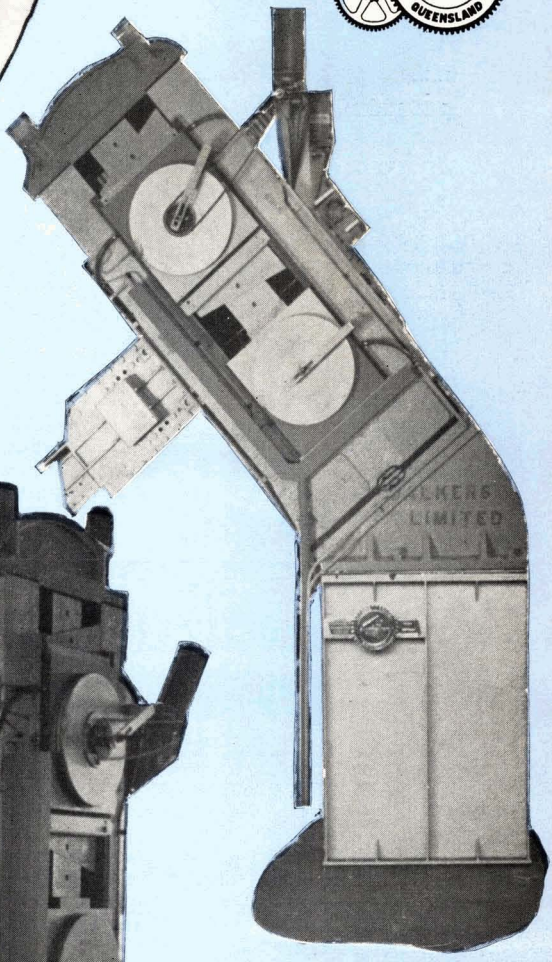


A 42″ x 84″ PRESSURE FEEDER

RIGHT: AS ATTACHED TO A MILL

BELOW: DURING SHOP ERECTION





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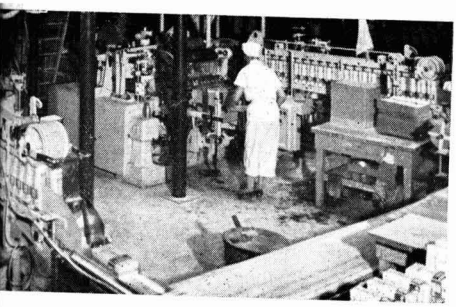

Sugar refining

Modifications to the cube sugar presses at Turhal sugar factory and their results. M. MUTLUAY. *Seker*, 1966, **16**, (61), 11–15.—Moulds for slabs of sugar 180 × 180 × 180 mm in size were fitted with partitions to produce cubes having sides 18 mm long. The converted moulds and discharge blocks are illustrated by photographs and drawings, and have operated successfully.

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The use of anion exchangers at Tul'skii refinery. V. P. MELESHKO, M. B. STARODUBTSEVA, G. A. CHIKIN, E. I. LYALIN, V. S. PAVLENKO, N. T. SHTANDAROVA and S. Z. IVANOV. *Sakhar. Prom.*, 1968, **42**, (4), 10–14.—Details are given of the ion exchange unit for syrup decolorization at Tul'skii refinery. The unit comprises 12 vessels and uses AV-16G anion exchanger. This is regenerated with NaOH and NH_4Cl to give it a combined OH^-/Cl^- form and hence buffering properties. Throughput of the unit is equivalent to 400 tons of refined sugar per day.

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The adsorption capacity of decolorizing resins in relation to resin type, specific load and number of cycles. F. SCHNEIDER, D. SCHLIEPHAKE and J. PALEOS. *Zucker*, 1968, **21**, 268–278.—See *I.S.J.*, 1968, **70**, 67–69, 77.

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Unit for cooling white sugar in a fluidized bed. S. I. TEMPER, V. V. ZVORYKIN, A. D. BRUSILOVSKII and F. A. SHUL'GA. *Sakhar. Prom.*, 1968, **42**, (5), 15–19. Details are given of a fluidized bed cooler system in which white sugar was cooled from 44·4 to 25°C and its moisture content reduced from 0·12 to 0·086% at a throughput of 13·6 tons/hr compared with a temperature reduction from 45 to 31°C and a moisture reduction from 0·31 to 0·12% in a twin-drum unit, in which crystal damage was also greater than in the fluidized bed cooler. Details are also given of the performance of a wet film cyclone used to trap sugar dust and return it to process.

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Investigations of white sugar drying in an externally-heated air tube. I. L. LYUBOSHITS, I. F. PIKUS and N. G. ALKHANASHVILI. *Sakhar. Prom.*, 1968, **42**, (5), 20–22.—In tests in a 4-m high air tube, white sugar was dried from 1·3 to 0·125% moisture in a stream of drying air of 15–70°C. The temperature of the heating surface was 70–140°C. Crystal size and appearance were scarcely affected. Optimum flow rates were 10–16 m/sec., depending on sugar concentration and fractional composition.

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Relationship between pressure in pressing and density of refined sugar tablets. A. N. STEPANOV. *Sakhar. Prom.*, 1968, **42**, (5), 23–26.—A linear relationship between the pressure exerted in refined sugar tabletting and the density of the sugar was established theoretically and confirmed experimentally. A graph of log P *vs.* relative volume is presented.

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White sugar bulk transport. M. S. SABANSKII and A. I. KATANA. *Sakhar. Prom.*, 1968, **42**, (5), 27–28. The economic potential of bulk storage, handling and transport of white sugar in the USSR is discussed with reference to some practical experiences.

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Adsorption of some non-sugars from syrups in sugar refining. I. L. ZDANOVICH and I. F. ZELIKMAN. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (2), 66–70.—Details are given of decolorization tests involving refinery syrups and three Soviet active carbons, two of them granular. All had better adsorptive capacity than bone char but the carbon with the largest granules only slightly so.

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Bahamas site of new refinery. P. F. TRIVIZ. *Sugar y Azúcar*, 1968, **63**, (5), 44.—Details are given of some of the equipment for the refinery, of 50 tons/day melt capacity, to be installed adjacent to the raw sugar factory under construction on Great Abarco[1]. The refinery will use a lime-phosphate clarification system with a Jacobs-type clarifier and will treat the liquor with vegetable carbon for colour removal.

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Crockett's new bone char furnace. ANON. *Sugar y Azúcar*, 1968, **63**, (5), 48–49.—Characteristics of a new Nichols-Herreshoff multiple-hearth furnace for bone char revivification at Crockett refinery in California are described and illustrated.

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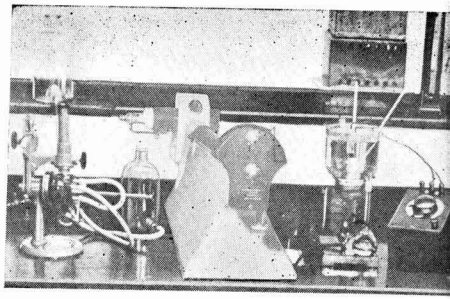
Cube sugar manufacture by the vibration process. ANON. *Bol. Azuc. Mex.*, 1968, (227), 17–19.—A description is given of the Höweler process for cube sugar manufacture developed by the Swedish Sugar Corporation and Maschinenfabrik Buckau R. Wolf AG.

[1] *I.S.J.*, 1967, **69**, 352.

Laboratory methods & Chemical reports



Thermo-physical characteristics of sugar beet. A. A. MOVCHAN and V. Z. ZHADAN. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (4), 26–28.—The temperature and heat conductivities, specific heat and specific weight of the sugar beet were determined and found to depend on the dry solids content. No effect of purity on the thermal properties was established, while they were also found to be unaffected by the physical state of the roots, even after storage and cell structure damage. This is attributed to the close similarity between the values of the thermo-physical properties of the cell juice components and the intact tissue.

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Effect of the buffering capacity of sugar products on the kinetics of sugar decomposition. Z. A. MIL'KOVA and S. Z. IVANOV. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (4), 36–38.—Tests showed that the autocatalytic destruction of sucrose when heated in solution in the presence of molasses was inhibited by buffering components in the molasses non-sugar complex, the effect being greater the lower was the purity of the solution. The non-sugars also retarded the fall in pH, which fell more slowly the lower was the solution purity, when the solution was heated for 32–54 hr under reflux on a water bath. The non-sugars having buffering capacity were mostly alkaline salts of weak organic acids; their buffering effect rose with fall in the purity of the product, i.e. with increase in the non-sugar concentration.

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The coefficient of form of the kinetic curve for increase in the crystal content of a massecuite. V. G. TREGUB and V. D. POPOV. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (4), 88–92.—An equation obtained earlier[1] gave a generalization of the basic S-shaped curves for the kinetics of growth in the solid phase during sugar crystallization in pans and crystallizers, where the form coefficient was greater than unity. The coefficient is a function of temperature and supersaturation and can vary within wide limits for massecuites of the same purity. It is also affected by the initial crystallization surface and, hence, the crystal formation rate.

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The effect of filtration and centrifugation on raw sugar polarization analysis. R. A. M. WILSON, C. G. SMITH, R. H. JAMES and R. R. WALLACE. *Analyst*, 1968, **93**, 773–781.—Experiments have shown that when a raw sugar solution is clarified with basic lead acetate and filtered through a single filter paper that has a moisture content in equilibrium with that of the atmosphere, polarization is significantly increased by as much as 0·013°S as a result of preferential water absorption by the paper. Although the effect continues until at least 50 ml of filtrate are collected, it is negligible for most practical purposes after the first 10 ml have been filtered, so that the initial 10 ml should be discarded. However, even when the effect is minimized by using a filter paper having an optimum 9–10% moisture content (6–8% is considered more convenient), evaporation will still cause a steady increase in the polarization of small consecutive aliquots of filtrate apart from the preferential absorption effect, the difference being greater at 60% relative humidity than at 70% R.H. at 20°C. Hence, under tropical conditions errors as large as 0·05°S could be expected, so that it is recommended that not more than 10 ml of the initial filtrate be discarded and only as much as is required for polarization (50–60 ml) collected thereafter. Neither of the effects mentioned is found, however, when the raw sugar is clarified by centrifuging after basic lead acetate has been added, so that centrifuged solutions give a better pol value as defined and specified by ICUMSA.

* * *

A new dipping reagent for the location of sugars on paper chromatograms. H. ZENTNER. *Chem. & Ind.*, 1968, 1836.—The reagent used was 1 g of malonic acid and 1 ml of aniline dissolved in 100 ml of methanol (dried over quick-lime for about 3 days and then distilled). After development of the chromatograms and of the sugars, the papers were dried and drawn quickly through the location solution. The methanol was allowed to evaporate for a few min before the chromatograms were heated to 100–110°C in a drying oven. Spots appeared after about 10 min, those for dextrose, galactose, fructose, maltose and lactose being yellowish brown, while xylose and arabinose gave greyish spots. On prolonged heating sucrose gave a yellowish spot. No colour change occurred on prolonged heating and the background was very light, even after 1 hour's heating or more. The spots showed strong fluorescence when exposed to u.v. light.

* * *

Rapid method for determination of invert sugar content. A. EMMERICH and E. LAUDIEN. *Zucker*, 1968, **21**, 675–681.—The method described is a modification of the LANE & EYNON method. It is called the "constant velocity" method because the boiling time

[1] SKRIPKO & POPOV: *I.S.J.*, 1964, **66**, 230.

and end volume are not maintained constant, unlike the titration rate. The aim is to eliminate error caused by increase in the boiling (reaction) time, as a result of increase in the titration period when the invert sugar concentration falls, and by a simultaneous increase in the volume, and hence dilution, of the reaction mixture; although opposed to each other, the two effects do not balance. Only one titration is thus needed instead of two with the standard method. However, the modified method assumes that the purity (% total sugar content as R.D.S.) of the mixture to be analysed is known. Comparison of the method with the "constant volume" method of MALTBY[1] showed a mean relative error of $\pm$ 1·6% for the new method where the total sugar content had to be determined indirectly, compared with $\pm$ 1·4% for the constant volume method, so that the proposed method is considered sufficiently accurate for factory control.

* * *

Trace elements in molasses at Ukrainian beet sugar factories. E. A. GRIVTSEVA, A. A. GERASIMENKO and L. A. ORLOVA. *Sakhar. Prom.*, 1968, **42**, (11), 20–21. Analysis of beet molasses from Ukrainian sugar factories showed that one group of trace elements varied only very slightly between samples, while the remainder fluctuated so widely as to suggest that they did not originate from the beets but came from other sources, particularly limestone and factory equipment. However, on analysis of samples during 3 campaigns at one factory, the two groups were found to be slightly different, although the same general trends were observed.

* * *

Effect of dilution and water pH in determination of the pH of refinery products. A. YA. ZAGORUL'KO, T. P. KHVALKOVSKII and L. K. IVANOVA. *Sakhar. Prom.*, 1968, **42**, (11), 33–37.—pH measurements of refinery products and refined sugar showed quite wide differences between the value according to the treatment of the dilution water: distillation only, distillation followed by boiling and cooling, distillation plus treatment with anion and/or cation exchange resin, distillation plus addition of 0·01N NaOH to pH 7·0, 7·07 and 7·5, respectively, and double distillation. Because of the discrepancies, it is recommended that dilution should be omitted for liquid products and minimized (1:1) for solid products.

* * *

A method suitable for routine determination of pectin and accompanying impurities in sugar-containing plant juices. F. SCHNEIDER, A. EMMERICH and E. LAUDIEN. *Zucker*, 1969, **22**, 13–20.—Details are given of a method for isolating pectin from sugar-containing juices, in which the colloids are precipitated by adding 10 volumes of methyl alcohol and boiling for a very short period. The precipitates filter easily and give good reproducibility. Pectin, araban and galactan are then determined by the method of ZITKO & ROSIK[2]. Constants have been re-calculated for evaluating the results from the spectrophotometric measurements, and corrections have been introduced.

* * *

Quantitative determination of sucrose, invert sugar and glucose (or levulose) in various mixtures. F. TATEO. *Ind. Alimentari*, 1968, **7**, 67–71.—The method involves separate determinations of levulose and total reducing sugars in the sample, from which the proportions of sucrose, dextrose and levulose are calculated. The levulose is determined iodometrically after inhibiting the reducing power of the dextrose by means of phosphate, while the total reducing sugars is determined by a Fehlings titration.

* * *

Experimental examination of individual suggestions for improving the precision of chemico-technical control. A. YA. ZAGORUL'KO, T. P. KHVALKOVSKII, A. A. PONOMARENKO and L. A. KOROBEINIKOVA. *Sakhar. Prom.*, 1968, **42**, (12), 31–33.—The techniques tested include pulp sugar determination using a juice press (found to be subject to systematic error and therefore not recommended), cane raw sugar colour determination with a colorimeter (recommended subject to some modifications), and determination of the total alkalinity and free CaO contents on milk-of-lime by back-titration with NaOH after HCl addition and using methyl orange as indicator, and titration with HCl using phenolphthalein indicator, respectively (both recommended).

* * *

Examination of the composition of Cuban cane raw sugar. N. A. ARKHIPOVICH and B. A. KUTSENKO. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (5), 12–14.—Details are given of methods used to determine the basic non-sugars in Cuban raws. Analyses of 4 samples are reproduced.

* * *

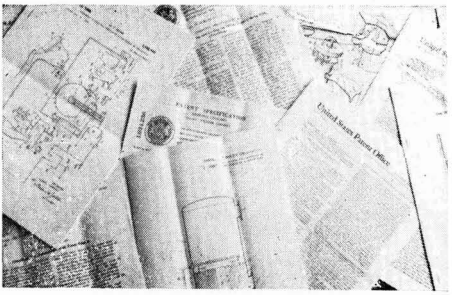
Estimation of slip in the region of the wall during massecuite flow. A. I. GROMKOVSKII. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (5), 139–142.—Since slip in the region of the wall in a capillary viscometer causes lower reader readings and since it cannot be eliminated in any type of viscometer, it is considered better to use a rotary viscometer in which the effect can be calculated more easily.

* * *

Determination of the granulometric composition of sugar crystals in a massecuite. YU. D. KOT and L. G. BELOSTOTSKII. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (5), 168–169.—After measuring crystal dimensions and determining the fractional distribution in a photomicrograph of a massecuite sample washed with glycerine and saturated with sucrose, the effective crystal diameter is calculated from the data, and the C.V. and mean crystal size are determined by POWERS' method, the results then being expressed in the form of a graph on arithmetic probability paper[3].

[1] *I.S.J.*, 1953, **55**, 270–272.
[2] *ibid.*, 1962, **64**, 341.
[3] *ibid.*, 1948, **50**, 149–150.

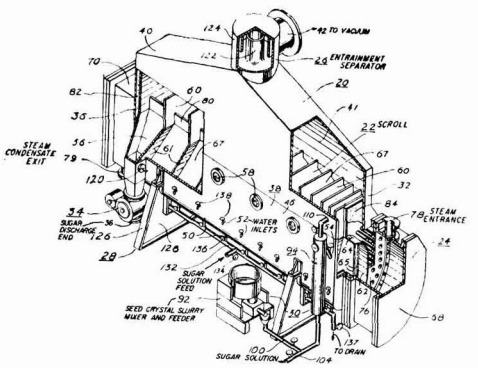
Patents



UNITED STATES

Continuous vacuum pan. G. W. LUCE, of New Orleans, La., USA. **3,424,221.** 6th June 1966; 28th January 1969.

The vessel 20 contains a stationary scroll 22 and a heating element 24 in the form of tubes passing from one end to the other between steam chests 68 and 70. It is connected to a vacuum source and is provided with an entrainment separator 26. A tubular core, 62 passes through the vessel and all the steam tubes are located on one side of this. The stationary scroll is in the form of plates surrounding this core; on the steam tube side the plates 60 are vertical while on the unheated side the plates 61 are slanting and connect the top of one vertical plate 60 with the bottom of the adjacent vertical plate. Feed slurry supplied from the mixer 30 enters at one end of the vessel and fills the compartment 67 formed between the end wall and the first plate 60. Here it is heated by the steam in the tubes and partly evaporated, sugar being deposited on the feed slurry crystals.



With continuing feed, the compartment is filled and the slurry overflows the dam 80 mounted on the top of the core and is directed by the slanting plate 61 to the bottom of the second compartment formed by the adjacent plates 60. It thus passes through the length of the vessel continuously being subjected to heating by the tubular heating element under vacuum so that crystallization takes place. The plates 60, 61 are located so that the compartments 67 become progressively bigger from the feed to the discharge end of the vessel, and the last compartment is provided with a discharge port to the pump through which the massecuite is removed from the vessel.

* * *

Beet harvester. E. W. PARRISH, of Westmont, Ill., USA, *assr.* INTERNATIONAL HARVESTER CO. **3,425,494.** 1st November 1966; 4th February 1969.

* * *

Beet thinner. H. B. REEVE, H. J. BRETTRAGER and E. A. RADER, of Saginaw, Mich., USA. **3,425,495.** 15th September 1965; 4th February 1969.

* * *

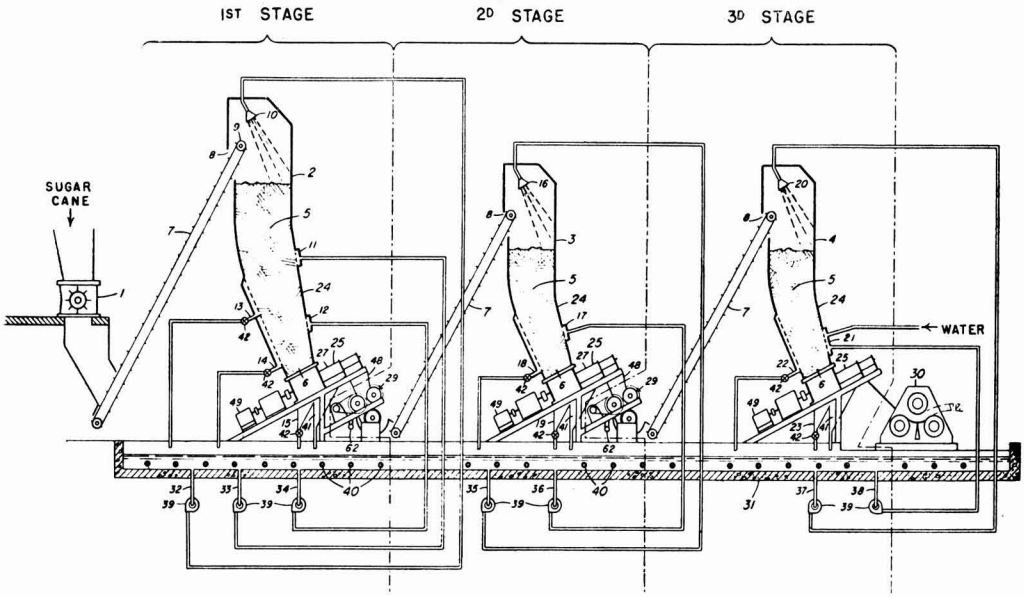
Centrifugal basket. C. R. STEELE and N. F. ALLEN, *assrs.* AMERICAN FACTORS ASSOCIATES LTD., of Honolulu, Hawaii, USA. **3,425,561.** 13th November 1967; 4th February 1969.—In order to prevent corrosion, the supporting baskets for continuous conical centrifugals are constructed from stainless steel, and their production from metal plate is an expensive procedure with much waste of metal. The basket covered by this patent is made more quickly and cheaply by the use of spirally wound flat stainless steel wire with the loops spaced at predetermined intervals to suit the requirements of the particular centrifugal and providing a basket of simplified design and increased strength, able to support internally a perforated screen.

* * *

Cane juice extraction. J. FARMER, of Honolulu, Hawaii, USA. **3,425,869.** 4th November 1964; 4th February 1969.

Cane is prepared by the use of a pre-breaker or chopper, followed by a shredder 1, and then treated in three stages by soaking, rinsing and removal of excess liquid. The three hoppers 2,3 and 4 are filled with bagasse which, as it is removed continuously through the discharge openings 6 of each hopper, is continuously replenished at the top at a controlled rate, by means of suitable elevators 7 through hopper inlet ports 8. Liquid is injected into the hopper through the nozzles 10, 16, 20, above the bagasse, and lower injectors 11, 12 in the first hopper (which has a higher bed than the others) and 17 and 21 in the second and third hoppers. The upper injectors introduce liquid by which the bagasse is soaked while the lower injectors introduce liquid for rinsing out residual juice.

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).



The juice drains out of the column of bagasse under gravity into the collection ducts from which it passes by way of pipes 13 and 14 in hopper 1 and pipes 18 and 22 in hoppers 2 and 3. The bagasse meanwhile is directed by the shape of the hopper to the openings 6 and delivered to multiple screw presses 25. The first two of these deliver the pressed bagasse to teasing and scrubbing machines 29 to prepare it for the next hopper; the last press delivers the bagasse to a three-roller mill 30 to remove the last of its juice content. As shown, all the juices are discharged to a single reservoir 31 heated by steam coils 40 to maintain a temperature of 175–185°F, and the juice for dilution and rinsing is withdrawn from this reservoir, water being supplied to injector 21 in the 3rd hopper.

* * *

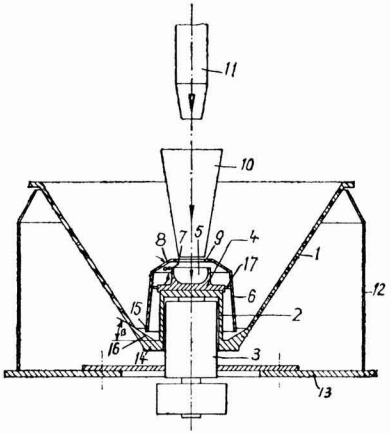
Beet topper. A. F. BARNES, of Longmont, Colo., USA. **3,426,514.** 29th September 1965; 11th February 1969.

* * *

Continuous centrifugal. H. HILLEBRAND, of Braunschweig, Germany, *assr.* BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT. **3,428,182.** 4th April 1967; 18th February 1969.

In order to achieve a uniform distribution of massecuite over the basket 1 of the continuous centrifugal, it is directed by a conduit 11 into a funnel 10 and thence into the trough 5 of disc 4 which is mounted, with the basket, on the hub 2 and the assembly rotated with the under-driven shaft 3.

Also mounted on the disc 4 and supported by struts 17 as an accelerator cone 6 which has a section 8 of lesser inclination at the level of the rim 7 of the trough 5. Similarly, a section 16 of lesser inclination is provided at the bottom of the basket 1 at the level of the rim 15 of the cone 6. In this way, the massecuite feed into trough 5 is directed over its rim 7 to the cone 6 and thence as a homogeneous layer over the rim 15 to the basket 1.



* * *

Bagasse press. H. F. SILVER and F. B. PRICE, of Denver, Colo., USA, *assrs.* AMERICAN FACTORS ASSOCIATES LTD. **3,431,839.** 27th October 1965; 11th March 1969.—See UK Patent 1,095,108[1].

[1] *I.S.J.*, 1968, **70**, 220.

Bulk transport of refined sugar

ON 25th September a demonstration was staged jointly by C. Czarnikow Ltd. and Tate & Lyle Refineries Ltd. at Zuckermühle Rupperswil near Aarau, Switzerland, of the delivery in bulk of UK refined sugar.

The sugar is carried in 20-ton bulk sugar tipping containers built to ISO (International Standards Organization) standard and designed specifically for dry granulated sugar transport by N. Tamplin Ltd., of Chichester, Sussex, England, and Tate & Lyle, following an idea put forward by C. Czarnikow Ltd. The containers measure 20 × 8 × 8 ft, have a payload of 20 tons, and can be transported by road, rail or ship. Unit-Loads Ltd., a Tate & Lyle subsidiary, act as the container-operating company.

For loading and gravity discharge the containers are end-tipped by a hydraulic ram incorporated in the container frame, power being supplied by a portable pack comprising a pump and oil reservoir. For loading, the containers are positioned on road trailers and elevated to maximum height. Sugar feeds into the containers from a holding hopper through a screw conveyor until the container is full. The filling operation is totally enclosed. After weighing, the containers are taken by road from Plaistow Wharf to the freight liner terminal at Stratford, E. London, a few miles away. They then travel by freight liner wagon to the British Rail container port at Harwich and thence by British Rail container ship to Zeebrugge in Belgium. They are transferred to special rail trucks each carrying two containers back-to-back for through-routing to Switzerland. At destination the trucks are shunted into the customer's sidings and warehouse, and the sugar is discharged by elevating the containers into the receiving hoppers.

At present most of the sugar exported to Switzerland from the UK goes in 50-kg paper sacks by sea via the London-Rotterdam-Rhine route. British sugar will now travel regularly to Switzerland by container and it is hoped that more and more sugar will be carried in bulk as the storage advantages and possible saving in bulk handling are realized.

Fig. 1. Tamplin container filling at Plaistow Wharf

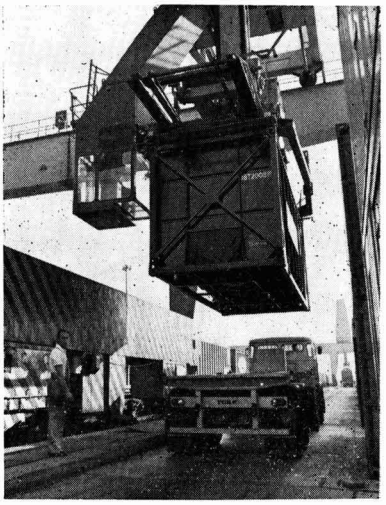


Fig. 2. Tamplin container transfer from road to rail at Stratford Freight Liner Depot

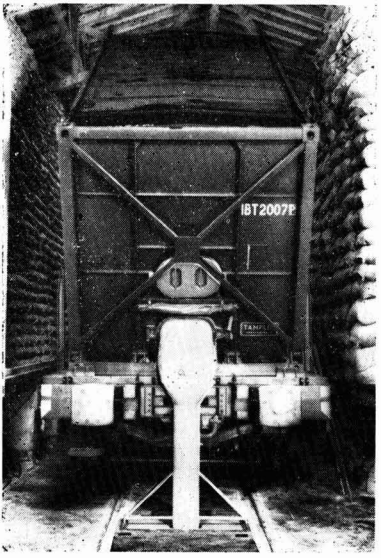


Fig. 3. Bulk sugar container discharge at customer's warehouse at Rupperswil, Switzerland

C. W. Murray award

FLETCHER and Stewart commemorate their late President, Mr. C. W. MURRAY, by making an annual award for the best essay submitted on a subject connected with beet or cane sugar technology. The editorial panel consists of Mr. N. M. ADAMS, Technical Director of the British Sugar Corporation Ltd., Mr. R. R. FOLLETT-SMITH, Vice-Chairman, British Section, International Society of Sugar Cane Technologists and lately Chairman of Booker Sugar Estates, and Mr. C. R. D. SHANNON, Consulting Engineer, Jamaica.

Their recommendation is that no award be made in 1969, but that an award of £500 be made in 1970 and that this should be given for any outstanding contribution dealing with the operation of beet and cane sugar factories and refineries, including the application of any modern techniques which may improve operating performance.

Details regarding the preparation and submission of papers for the 1970 award can be obtained from Fletcher and Stewart Ltd., Bucklersbury House, 83 Cannon Street, London, E.C.4, England.

The late Dan Gutleben

WE regret to report the death, on the 5th September, of Dan Gutleben who had established a unique reputation as a sugar engineer-cum-historian. He was 90 years old, having been born in Germany in 1878. He came to the United States as a child and graduated from the University of Nebraska, entering the sugar industry in 1899 when he was employed in the construction of a beet sugar factory near Ames, Nebraska. He was subsequently employed for eight years by Oxnard Construction Co. in the erection of other beet sugar factories while from 1907 to 1921 he was independently concerned with factory erection as a partner in the company he established with his brother.

In 1921 he joined Pennsylvania Sugar Refining Co. of Philadelphia as chief engineer and remained with this company until his retirement in 1945 both under the original management and under National Sugar Refining Co. Following his retirement, he devoted his time to the assembly and republication of historical data and anecdotes on the US sugar industry and its personalities in the form of his "Sugar Tramp", an intermittently produced series of volumes which were of great interest and often entertainment to those fortunate to be counted among Gutleben's friends who received copies. In the collection of this information he travelled widely and read innumerable journals and newspapers, etc., as well as carrying on a lively correspondence with an army of sugar men who are the poorer for his going.

Brevities

Sugar Technology Reviews **from Elsevier.**—The Elsevier Publishing Company will shortly commence publication of a new series of *Sugar Technology Reviews*, to be edited by G. H. JENKINS of Brisbane, Australia, with the assistance of an international advisory board of leading sugar technologists. The reviews, to be published at irregular intervals, will summarize systematically and critically the developments which have taken place in the technology of manufacturing and refining sugar in recent years, and will deal with both cane and beet sugar. Free specimen copies will be available on request from Elsevier Publishing Co., P.O. Box 211, Amsterdam, Holland. Each volume will contain approximately 400 pages, 6½ in × 9½ in, and will cost 76·50 Dutch florins including postage (US $21.25 or £8.18.6d).

* * *

UK sugar surcharge.—In view of the movement of the world price of raw sugar the UK Minister of Agriculture, Fisheries and Food made orders under the Sugar Act, 1956, reducing the surcharge from 3d per lb (28s 0d per cwt) to 2¾d per lb (25s 8d per cwt) from the 7th October 1969.

* * *

Antigua sugar factory fire[1].—A fire was caused at Antigua's only sugar factory in May following a lightning strike which sparked off electrical connexions in the building. The island had been suffering from torrential rains, said to be the heaviest in ten years.

* * *

Puerto Rico sugar assistance programme[2].—The Governor of Puerto Rico has announced a programme under which equal instalments of $20,000,000 will be spent during five years in an effort to help the sugar industry to mechanize, to plant new cane varieties with high sugar yields and to apply new techniques in field operations. Funds will be used to finance technological studies and control flooding in cane lands. Tax exemption will be provided for mills which close, in an effort to prevent their dismantling and in the hope that they can resume operation later.

* * *

British Honduras sugar crop, 1968/69[3].—Cane crushing operations by Belize Sugar Industries Ltd. for the 1968/69 crop ceased on the 23rd June. There was a considerable shortfall in production compared with the previous crop, caused by a scarcity of cane especially in the Corozal district. Sugar outturn amounted to 52,138 tons from 528,720 tons of cane, compared with 63,588 tons of sugar from 643,776 tons of cane in the 1967/68 crop. Molasses production amounted to 18,656 tons against 24,161 tons in the previous crop. Domestic consumption will take 2261 tons of sugar and the remaining 49,876 tons is earmarked for export.

* * *

Bagasse board survey in Barbados[4].—A preliminary survey on the conversion of bagasse into particle board has been carried out for the Barbados Government by two visiting experts from Venezuela.

* * *

Philippines sugar factory[5].—The Board of Directors of the Batangas Sugar Central recently announced the inauguration of a new sugar central in Balayan, Batangas. The new factory is to have a diffusion system and will have a capacity of 4000 tons of cane per day. It will be constructed on a turn-key basis by Marubeni-Iida Co. of Japan and Honiron Philippines Inc.

[1] *The Cane Farmer* (Trinidad), 1969, 111.
[2] *Sugar y Azúcar*, 1969, **64**, (8), 30.
[3] *Barclays Overseas Review*, August 1969, 71.
[4] *The Cane Farmer* (Trinidad), 1969, 91.
[5] *Sugarland* (Philippines), 1969, **6**, (3), 26.

Brevities

Argentina sugar production quota raised[1].—The maximum limit of 800,000 tons originally set for 1969[2] has been raised to 850,000 tons; the additional quantity will be for export.

* * *

New Indian sugar factory[3].—The new cooperative sugar factory in Bundi is expected to commence crushing in November, its capacity being 1250 metric tons per day.

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New US cane variety[4].—The Chairman of the Contact Committee of the American Sugar Cane League recently announced that a new variety of cane is to be made available to cane growers in Louisiana. The new variety L 62–96 is a high sucrose cane but is very susceptible to mosaic.

* * *

Trinidad sugar production, 1969[5].—Total sugar production for the 1969 crop was 237,231 tons, which is 2325 tons less than the 1968 figure of 239,156 tons.

* * *

Iran sugar production[6].—During the Iranian year 1343 (21st March 1968 to 20th March 1969) 3,400,000 metric tons of sugar beets were harvested, an increase of 19% on the previous year's crop. About 200,000 tons of beets could not be harvested, owing to cold weather and heavy rainfall. The beets yielded 438,000 tons of sugar, while cane sugar produced during the year amounted to 48,000 tons and imported raw sugar was refined to supply a further 107,000 tons. Beet sugar production was 18% more than in the previous year and cane sugar production 13·5% higher. It is expected that Iran will be self-sufficient in sugar by the end of 1973.

* * *

Italian sugar factory closures[7].—The Eridania Zuccherifici Nazionali S.p.A. has announced that the factories at Parma, Fontanellato and Casalmaggiore are to close and production is to be concentrated in the new factory at San Quirico. The Montagnana factory is also to be closed. The Società Italiana per l'Industria degli Zuccheri S.p.A. is also closing its 800 tons/day factory at Battipaglia; the company is erecting a 9000 tons/day factory at Argelato.

* * *

Turkey sugar exports[8].—Exports of sugar from Turkey in 1968 totalled 26,328 metric tons, refined value, and included 800 tons to Cyprus, 2800 tons to Israel and 22,728 tons to South Vietnam. In 1967 exports had totalled 76,204 tons and included 1600 tons to Cyprus, 14,500 tons to Israel, 20,104 tons to South Vietnam and 40,000 tons to Iraq. In 1969 Turkey, not a member of the International Sugar Agreement, is expected to have 100,000–125,000 tons of sugar available for export[9].

* * *

Algeria sugar factory/refinery contracts[10].—Two contract have just been signed, the first with the French company IMPEX, which will supply the necessary equipment for the Guelma sugar factory and refinery[11] which will produce 180,000 tons of sugar per year including that from 150,000 tons of beets per year. The second contract has been concluded with Société Fives Lille-Cail for the construction of a refinery by the port of Mostaganem, with a capacity of 100,000 tons of raw sugar per year. The two plants should enter into service at the end of 1971 and will produce sufficient sugar to cover Algeria's requirements.

* * *

Poland beet crop, 1968[12].—The Polish Central Statistical Office has now published final data for sugar beet cultivation in 1968. Total beet area was 414,000 hectares, compared with 433,900 hectares in 1967. About 87% of this area was cultivated by private farmers. The average beet yield amounted to 35·7 tons/ha, compared with 35·8 tons/ha in 1967 and 31·3 tons/ha in 1966. About 14 million tons of beet were delivered to the factories by 620,000 beet growers.

Brazil sugar statistics[13]

Crop year (June/May)	1968/69	1967/68	1966/67
	(*metric tons, tel quel*)		
Initial stocks	1,539,992	1,545,183	1,603,205
Production	4,070,708	4,173,515	4,074,760
	5,610 700	5,718,698	5,677,965
Consumption	3,283,779	3,156,571	2,993,679
Exports	1,021,006	1,022,135	1,139,103
Final stocks	1,305,915	1,539,992	1,545,183
Exports			
Chile	163,588	41,764	117,532
Finland	29,146	10,723	—
France	24,358	58,646	56,207
Germany, West	1,001	—	—
Holland	1,500	—	—
Iraq	24,730	20,858	9,519
Japan	—	13,049	—
Malaysia	24,354	21,428	30,318
Morocco	25,275	134,788	—
Syria	8,536	—	—
Tunisia	37,175	50,916	55,083
UK	12,083	12,292	104,948
USA	598,801	581,293	671,406
Uruguay	40,616	35,986	73,126
Vietnam, South	29,843	29,761	—
Zambia	—	10,631	20,964
Total	1,021,006	1,022,135	1,139,103

Malagasy Republic sugar situation[14].—Sugar production reached 98,000 metric tons in 1968 against 96,000 tons in 1967. Exports fell, however, from 76,742 tons in 1967 to 56,053 tons in 1968. In 1969 it is expected that exports will include 45,000-50,000 tons to the O.C.A.M. countries, particularly Senegal, about 36,000 tons under the new International Sugar Agreement, 9600 tons to the US and 1000 tons to the Comores. Local consumption rose from 34,000 tons in 1964 to 40,000 tons in 1968.

* * *

Refinery addition for Usine Ste. Madeleine[15].- A new £3,000,000 sugar refinery is being constructed at the Ste. Madeleine factory of Caroni Ltd. in Trinidad. The refinery is being built to meet the increasing local demands which have grown from 2900 tons in 1963 to 13,000 tons in 1968. The liquor refining plant is due for completion early in 1970 while the pan house and ancillary equipment, together with the packaging and bagging station will be installed and become operational during the succeeding crop.

* * *

Ghana sugar imports, 1968[16].—Imports into Ghana during 1968 totalled 86,364 long tons, tel quel, compared with 58,971 tons in 1967. Suppliers included the USSR who provided 49,812 tons (18,532 tons in 1967), France with 13,604 tons (18,214 tons in 1967), the UK with 11,470 tons (20,960 in 1967), Poland with 3520 tons (14 in 1967), Hungary with 3136 tons (530 in 1967), East Germany with 2409 tons (30 in 1967) and Yugoslavia with 1661 tons (none in 1967). Other countries provided the remaining 752 tons (671 tons in 1967).

[1] *Bank of London & S. America Review*, 1969, **3**, 439.
[2] *I.S.J.*, 1969, **71**, 31.
[3] *Indian Sugar*, 1969, **19**, 79.
[4] *Sugar y Azúcar*, 1969, **64**, (8), 30.
[5] *Barclays Overseas Review*, August 1969, 59.
[6] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (22), 6.
[7] *Zeitsch. Zuckerind.*, 1969, **94**, 358.
[8] *Lamborn*, 1969, **47**, 115.
[9] C. Czarnikow Ltd., *Sugar Review*, 1969, (927), 123.
[10] *Agence France-Presse*, 17th May 1969.
[11] *I.S.J.*, 1967, **69**, 95.
[12] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (20), 5.
[13] Instituto do Açúcar e do Alcool; through C. Czarnikow Ltd., *Sugar Review*, 1969, (932), 144.
[14] *Agence France-Presse*, 31st May 1969.
[15] *Tate & Lyle Times International*, 1969, (3), 14–15.
[16] C. Czarnikow Ltd., *Sugar Review*, 1969, (933), 148.

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I.S.J.

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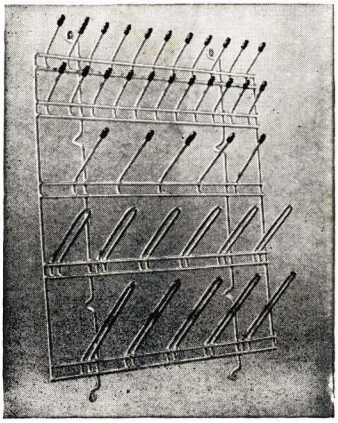
LABORATORY EQUIPMENT



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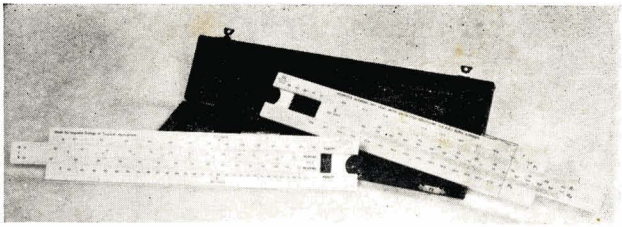

For Pol determinations by Hornes dry lead method using undiluted solution. This slide rule is based on Schmitz's Table 36 in Spencer & Meade's "Cane Sugar Handbook" 8th edition and covers ranges of 10 to 30° Brix and 9.5 to 21 pol.

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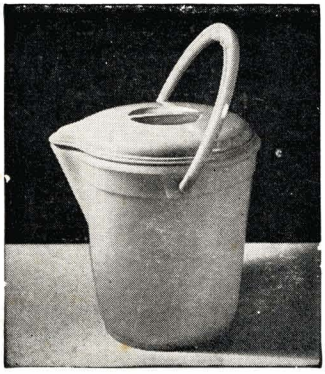

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Printed by JOHN ROBERTS & SONS, Salford, Manchester; and published by the Proprietors, THE INTERNATIONAL SUGAR JOURNAL LTD., at 23a Easton Street, High Wycombe, Bucks. Entered at the New York Post Office as Second-Class Matter.
PRINTED IN GREAT BRITAIN