THE International Sugar Journal

FEBRUARY 1969

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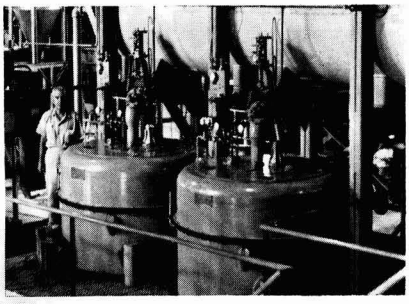

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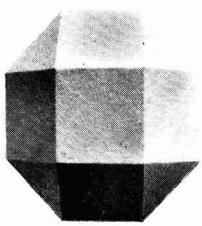

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'Medicinal Plants' Vol. 4, Bentley & Trimen, London, 1880

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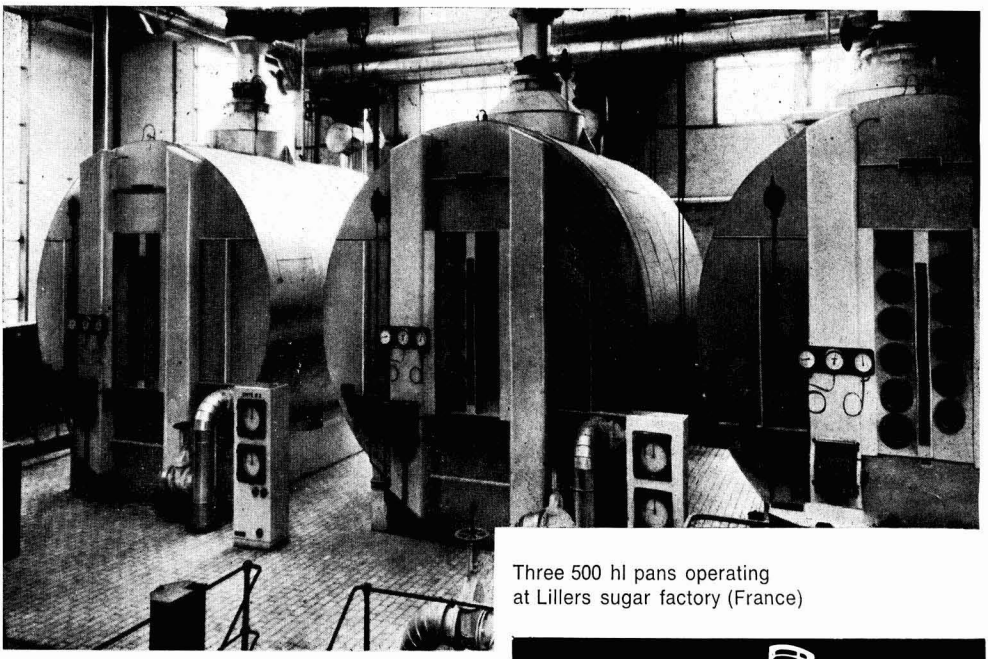

SAG - PARIS 3069-4

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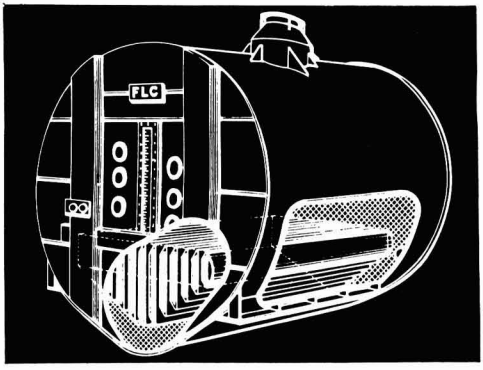

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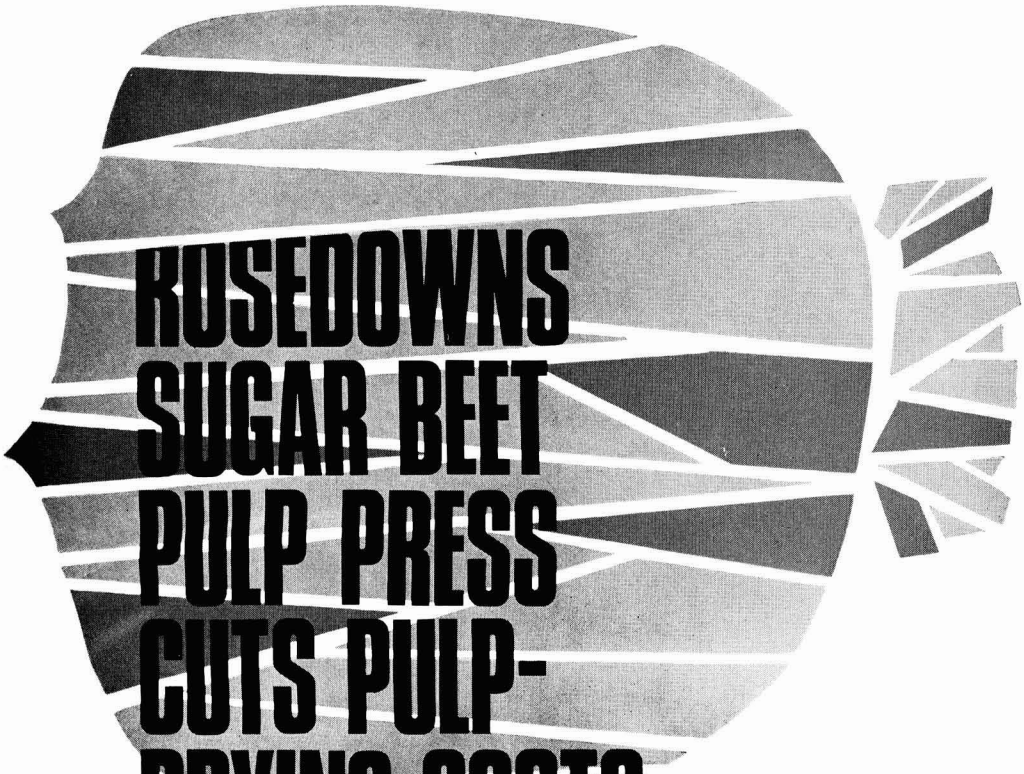

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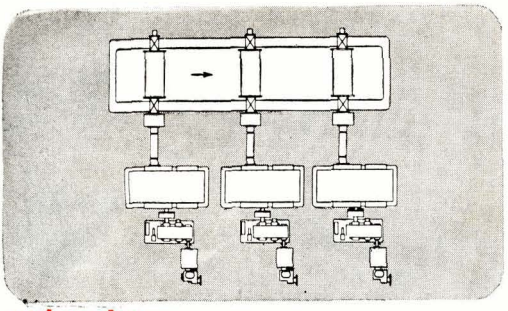
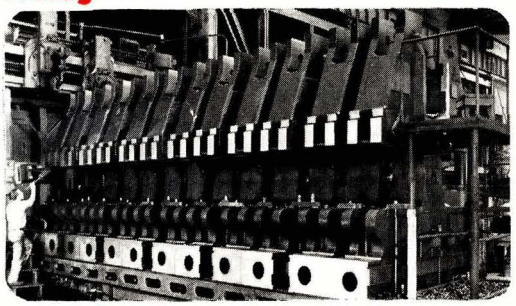


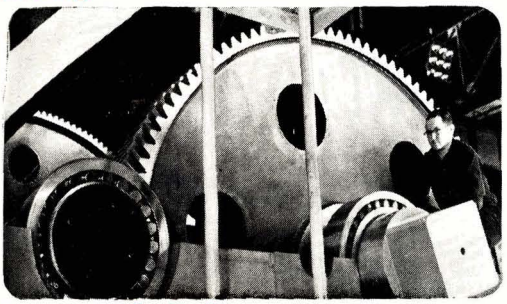
engineering

casting

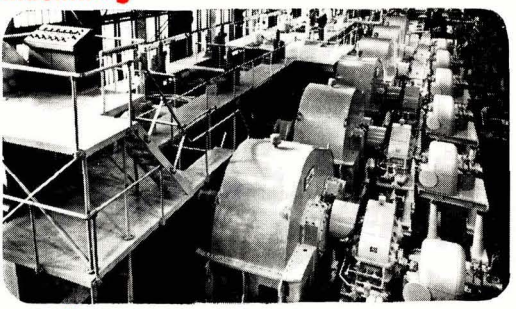
welding



machining



gear manufacturing



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Contents

SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

L'effet de brûlage et de stockage sur la détérioration de la canne. 2-ème partie. Les activités des invertases. T. Y. RIZK et W. C. NORMAND. *p.* 35–37

On a examiné les effets de brûlage et de stockage de canne sur l'activité des invertases dans différentes parties de la tige de trois variétés à la Louisiane. Les activités de l'invertase acide comme aussi l'invertase neutre étaient influées par les différences entre les variétés, par le brûlage et par les temps de stockage; on a trouvé des interactions fortes entre ces facteurs.

* * *

La circulation forcée dans des appareils à cuire. 1-ère partie. S. HILL, W. M. NICOL et P. D. FIFE. *p.* 37–40

Des essais étaient conduits avec des modèles à l'échelle pour detérminer l'effet d'agitateurs à helice de dessins différents sur la circulation de la masse cuite dans des appareils à cuire. Au commencement on a employé trois dessins basiques: un agitateur à helice à écoulement axuel, modifié, et deux types d'agitateurs à écoulement mixte. Dans la première partie de l'article, les auteurs décrivent le dessin des essais à l'aide d'équations théoriques, et donnent les détails de la méthode expérimentale employée et des dessins d'agitateurs à helice essayés.

* * *

Des mesures prises à l'Ile Maurice afin d'améliorer la filtrabilité de sucre brut. 1-ère partie. J. DUPONT DE R. DE SAINT ANTOINE. *p.* 40–44

L'auteur discute tour à tour des mesures prises dans les sucreries à l'Ile Maurice afin d'améliorer la filtrabilité du sucre brut. Dans la première partie de l'article, it traite de la réduction de la teneur en amidon dans le jus à l'aide d'un procédé enzymatique et l'adoption d'autres procédés de défécation afin d'obtenir une séparation de phosphate plus efficace aussi qu'une meilleure conservation du jus pendant son stockage.

Einwirkung von Brennen und Lagerung auf Rohrverschlechterung. Teil 2. Die Aktivatäten von Invertasen. T. Y. RIZK und W. C. NORMAND. *S.* 35–37

Die Wirkungen von Brennen und Lagerung von Zuckerrohr auf die Aktivitäten von Invertasen in verschiedenen Teilen des Stengels von drei Sorten in Louisiana wurden untersucht. Die Aktivitäten von sauerer wie auch von neutraler Invertase wurden von Sortenunterschieden, Brennen und Lagerungszeiten beeinflusst, und man hat beträchtliche Wechselwirkungen zwischen diesen Faktoren gefunden.

* * *

Zwangsumlauf in Kochapparaten. Teil 1. S. HILL, W. M. NICOL und P. D. FIFE. *S.* 37–40

Versuche wurden mit nach Massstab gebauten Modellen durchgeführt, um die Wirkung von Schraubenrührwerken verschiedener Arten auf die Füllmassezirkulation in Kochapparaten zu bestimmen. Anfangs hat man drei basische Arten Rührwerk angewandt: ein modifiziertes Schraubenrührwerk mit Achsenfliessen und zwei Konstruktionen mit gemischtem Fliessen. Im ersten Teil des Aufsatzes wird die Versuchsprojektierung an Hand theoretischer Gleichungen beschrieben, und Besonderheiten der angewendeten Versuchsmethode und der Rührwerk-Konstruktionen werden gegeben.

* * *

Einige in Mauritius ergriffene Massnahmen, um Rohzucker-Filtrierbarkeit zu verbessern. Teil 1. J. DUPONT DE R. DE SAINT ANTOINE. *S.* 40–44

Der Verfasser diskutiert nacheinanderfolgend einige in Zuckerfabriken auf der Insel Mauritius Massnahmen, die ergriffen worden waren, um die Filtrierbarkeit des Rohzuckers zu verbessern. Der erste Teil des Aufsatzes handelt sich um die Verminderung des Stärkegehalts im Saft durch ein enzymatisches Verfahren, und die Anwendung von anderen Klärungsverfahren, um die Leistungsfähigkeit der Phosphatabscheidung zu erhöhen und die Konservierung des Safts während der Lagerung zu verbessern.

El efecto de quemadura y almacenaje sobre deterioración de caña. Parte II. Sobre actividades de invertasas. T. Y. RIZK y W. C. NORMAND. *Pág.* 35–37

Se investigaron los efectos de quemadura y almacenaje de caña sobre el actividad de invertasas en diferentes partes de los tallos de tres variedades originado en Louisiana. Las actividades de ambas invertasas, ácido y neutral, estaban afectado por diferencias varietales por quemadura y por diferentes períodos de almacenaje, y fuertes interacciones se hallaron entre estos factores.

* * *

Circulación por fuerza en tachos. Parte I. S. HILL, W. M. NICOL y P. D. FIFE. *Pág.* 37–40

Experimentos se hicieron con modelos a escala para determinar el efecto de impulsores de varios diseños sobre la circulación de masa cocida en tachos. Tres básicos diseños se usaban inicialmente: un impulsor axial modificado, y dos tipos de impulsor mixto. En el primer parte del artículo, el diseño de los experimentos se describe con el ayuda de ecuaciones teóricas, y detalles se presentan sobre el método experimental empleado y de los diseños de impulsor que se ensayan.

* * *

Medidas adoptado en Mauricio para mejorar la filtrabilidad de azúcar crudo. Parte I. J. DUPONT DE R. DE SAINT ANTOINE. *Pág.* 40–44

Medidas adoptado en fábricas azucareras en Mauricio para mejorar la filtrabilidad del azúcar crudo se discuten en dos artículos consecutivos. En el primer parte de este artículo, el autor trata del disminución del contenido de almidón en el jugo por un proceso enzimático y adoptación de diferentes procesos de clarificación para obtener separación más eficiente del fosfato, y [illegible] de jugo mientras almacenaje.

THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXXI FEBRUARY 1969 No. 842

Notes & Comments

Commonwealth Sugar Agreement.

The 1968 talks between the parties to the Commonwealth Sugar Agreement took place between the 12th November and 3rd December. The Negotiated Price at which the UK will purchase the Negotiated Price Quotas under the Agreement during 1969, 1970 and 1971 has been fixed at the same level as for the three preceding years, i.e. £43 10s per long ton f.o.b. and stowed, bulk sugar 96° pol plus, for the less-developed exporting territories, a special payment which includes a fixed element of £1 10s and a variable element between nil and £2 10s depending on the average world price in the twelve months preceding the 31st March in the year concerned. This variable element is £2 10s if the average world price is less than £31, £2 5s for a price of £31–33, £2 for £33–35, £1 15s for £35–37, £1 10s for £37–39 and nil for an average price over £39.

The quotas for 1969, 1970 and 1971 will be at the level consolidated in 1965, i.e.

Australia	335,000	long	tons,	tel	quel
British Honduras	20,500	,,	,,	,,	,,
East Africa (Kenya, Tanzania, Uganda)	7,000	,,	,,	,,	,,
Fiji	140,000	,,	,,	,,	,,
India	25,000	,,	,,	,,	,,
Mauritius	380,000	,,	,,	,,	,,
Swaziland	85,000	,,	,,	,,	,,
West Indies and Guyana	725,000	,,	,,	,,	,,
	1,717,500	,,	,,	,,	,,

The Rhodesian quota of 25,000 tons remains suspended.

At the November 1966 talks, the Agreement was extended by one year until 31st December 1964. At the 1967 talks, in view of the British Government's application to join the EEC, it was agreed not to discuss the question of extension. At the opening session of the 1968 talks, the exporting parties to the agreement requested an extension for two years, i.e. until December 1976. During the talks, the parties to the agreement decided to review the whole question of its duration and revision, and agreed to amend the text of the relevant article of the agreement. This article, as [illegible] in 1967 reads: "This agreement shall [illegible] 1967 until [illegible] or in any subsequent year be successively extended by agreement for a further year. The above text is now replaced by the following:

"*Duration of Agreement and Provision for Review*

1. Subject to the following provisions of this Article the Agreement shall be of indefinite duration.

2. The Agreement shall be subject to triennial review, in discussion between the parties, to such extent as any party shall desire. The first such review shall be held in 1971.

3(a)(2). Changes in the Agreement, other than those which can be mutually agreed under paragraph 6 below, shall be subject to the following periods of notice given in the course of the year of review:—

(i) in respect of all provisions of the Agreement (as amended by agreement between the parties) except as detailed in sub-paragraph (ii) below: three years' notice;

(ii) in respect of Articles 4, 12 and 13* (as amended by agreement between the parties) in so far as they impose obligations on the less-developed Exporting Territories, and on the United Kingdom Government in regard to purchases of sugar of the quantities provided for from those Exporting Territories: six years' notice.

(b) The provisions of this article are subject to the understanding that the United Kingdom Government, if it successfully completes negotiations for the accession of the United Kingdom to the European Economic Community—

(i) cannot be committed to continuing contractual obligations under the Agreement after 31st December 1974;

(ii) shall, in the event that it does not accept such contractual obligations after 31st December 1974, consult with the other parties to the Agreement with a view to seeking means of fulfilling the objectives which those obligations would otherwise fulfil.

4. For the purpose of the provisions of paragraph 3(a) of this Article the period of notice given in the course of the year of review shall be deemed to

* Articles 4, 12 and 13 provide for the supply and purchase of negotiated price quotas.

commence on January 1st in the calendar year immediately following the year of review.

5. If in the course of any triennial review it has not been possible to reach agreement between the parties on any changes in the Agreement of which the United Kingdom Government has given notice in accordance with paragraph 3(a) of this Article, and such notice has not been withdrawn, such changes shall have effect on the expiry of the period of notice specified in that paragraph.

6. Notwithstanding any other provision in this Article any changes in the Agreement may be agreed between the parties at any time and any such changes shall have effect from such date as may be agreed.

7. In accordance with the spirit of co-operation in which the Agreement has been and will continue to be administered, full consultations shall take place between the parties in an endeavour to reach agreement on any proposed changes in the Agreement."

* * *

World sugar production estimates, 1968/69.

At the end of November F. O. Licht K.G. published their first estimates of world sugar production in 1968/69 which incorporates their second estimate of European beet sugar production in the current campaign[1]. Details appear elsewhere in this issue. The total is estimated at 68,826,200 metric tons, raw value, almost 2 million tons or 2·96% more than the 66,843,982 for 1967/68. In spite of an anticipated 680,000-ton increase for France, the West European estimate is slightly lower than 1967/68, while further reductions in East European crops bring the total European estimate down by a million tons. An increase of 750,000 tons in the US beet crop is the main factor outside Europe and the total beet crop for 1968/69 is expected to be some 200,000 tons less than in 1967/68.

Cuba is expected to produce a million tons more in 1968/69, while small changes elsewhere in North and Central America are almost self-balancing. Argentina is expected to produce 150,000 tons more and Brazil 100,000 tons, while other increases for South America raise the total for that subcontinent by a total of 200,000 tons. The African total is expected to be 210,000 tons lower, owing to a 280,000-ton reduction in South Africa and a 33,000–tons reduction in Mauritius, offset by increases in other areas.

The Indian crop is expected to recover partly with 275,000 tons more than in 1967/68, and Thailand is expected to produce 120,000–tons more, these two changes accounting for almost the whole of the increase expected in Asia. Australia is expected to produce 400,000 tons more than in 1967/68 while an increase of 100,000 tons is also expected for Fiji.

* * *

Sugar prospects in 1969.

In the year-end *Sugar Review*[2], C. Czarnikow Ltd. survey the events of 1968 as they affected the position of sugar as a market commodity, and discussed future trends:

"In 1969, it is probable that the more dramatic price fluctuations will be controlled; an International Sugar Agreement will be in operation and this in turn will be able to influence the statistical position.

"The overall supply and demand situation has shown signs of improving during the past year and it is our view that even without an Agreement this would have affected the world market price during 1969 so that the very depressed levels witnessed during recent years would not have been repeated. As it is, however, many of the major exporters will find their performance severely curtailed in 1969 by the operation of the quota provisions of the Agreement. This quantitative control on exports will act as a further factor strengthening the market and we anticipate that values will be maintained at least at their current levels."

The first meeting of the International Sugar Council was scheduled for 20th January 1969 but had not taken place when this issue went to press. One task will be to set the initial quotas for 1969 and the Council could set them at 85% of the basic quotas in the Agreement. However, Czarnikow reports that "it has been assumed by the market that initial quotas will be set by the ISC at 90% of basic export tonnages. Taking into consideration probable shortfalls, which are hardly likely to be declared early in the year, and so will not be redistributed for the time being, the surplus of supplies over requirements in 1969 will be brought to very manageable proportions and, should a crop failure occur in any of the major producing nations, quotas at 90% will not be sufficient. Saving intervention of a special vote of the ISC, quotas can only be increased after a rise in prices to 4·00 c per lb. It would therefore seem quite likely that exporting members will not only receive better average prices in 1969 than are indicated by current terminal market quotations, but by the time the year is out will also be permitted to sell in excess of 90% of basic export tonnages.

"We anticipate that world sugar consumption will continue to expand at a rate in excess of 3%. Indeed, after examining the rate of growth on a country-by-country basis and then eliminating all the non-repetitive factors we consider 3½% would be realistic. This is far in excess of the indicated expansion in production and we expect the statistical position at the end of 1969 to be more encouraging than for many years."

* * *

Japanese molasses imports[3].—The Ministry of Industry and Trade in Japan has authorized the importation of 319,121 metric tons of molasses for feeding purposes and for industrial utilization for the current financial year up to 31st March 1969. Furthermore, it was announced that an additional import quota of 40,900 tons of high-test molasses has been granted for alcohol production.

[1] *International Sugar R*[illegible] 968, 90, [illegible]
1968, [illegible] ito, [illegible] ser[illegible]

Effect of burning and storage on cane deterioration

Part II. On invertase activities

By TAWAKOL Y. RIZK* and W. C. NORMAND
(Louisiana Agricultural Experiment Station, Baton Rouge, Louisiana, 70803 U.S.A.)

Introduction

DETERIORATION of sugar cane between harvest and grinding, especially with regard to loss of sucrose content, has been a subject of interest to many investigators. Many of these investigators have sought to explain observed differences in rate or degree of deterioration as influenced by variety, moisture, temperature, microbial activity, aeration, and various other environmental conditions.

While it is generally believed that the actual hydrolysis, or "inversion" of sucrose is catalysed by one or more enzymes, classed as invertases, there have been few studies of the effects of the above factors on the activity of these enzymes in harvested cane. In growing cane, where these enzymes presumably play a major rôle in metabolism, there have been more studies of invertase.

Some such studies[1–5] have shown that there are apparently at least two invertases of sugar cane, one being most active under acid conditions, while neutral conditions favour the other. These activities of these invertases are thought to vary relative to each other, as well as absolutely, in cane stalks or parts of stalks at different ages of growing plants. The present report concerns efforts to investigate some effects of burning and storage on invertase activity in different portions of stalks of three Louisiana varieties. A report of effects of the conditions of this experiment on cane quality has been made previously[6].

Methods by which the cane was harvested, stored, sampled, analysed, etc. have been previously outlined[6]. The procedure for determination of enzyme activity was by assessment of the rate of inversion of sucrose treated with a crude enzyme preparation from various samples, and has been previously published[4].

Results and Discussion

The results of this part of the study are summarized in Tables I and II. In these tables as well as in the

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1 ALEXANDER: *J. Agric.* (Univ. Puerto Rico), 1967, **51**, (1), 39–45.
2 HATCH *et al.*: *Plant Physiol.*, 1963, **38**, 338–343.
3 RIZK and NORMAND: *Proc. 63rd Meeting Assoc. Sou. Agric. Workers*, 1966, 301.
4 *idem*: *Sugar J.* 1968, **31**, (3), 11–12.
5 *idem ibid.*, 12–13.
6 *idem*: *I.S.J.*, 1969, **71**, 7–8.

Table I. Mean values for acid and neutral invertase activities†, and their ratio for treatments × varieties × periods of storage interaction

Treatments	*Variety*	*Days of storage* 1	3	8	15	21	*Treatments × varieties*
		A—Acid invertase					
Burned	CP 42-10	23·7	33·5	26·7	24·0	00·0	21·6
	CP 36-105	38·2	34·7	24·0	27·2	00·0	24·8
	CP 48-103	37·8	35·7	28·3	36·3	00·0	27·6
Burned × periods		33·2	34·6	26·3	29·2	00·0	
Unburned	CP 42-10	52·2	66·8	60·2	40·8	44·2	52·8
	CP 36-105	49·8	51·8	38·5	30·8	30·5	40·3
	CP 48-103	52·8	59·3	57·8	29·7	27·7	45·5
Unburned × periods		51·6	59·3	52·2	33·8	34·1	
		B—Neutral invertase					
Burned	CP 42-10	16·7	27·3	22·8	26·0	00·0	18·6
	CP 36-105	20·7	30·3	20·5	23·3	00·0	19·0
	CP 48-103	15·3	24·3	25·3	31·0	00·0	19·2
Burned × periods		17·6	27·3	22·9	26·8	00·0	
Unburned	CP 42-10	24·5	33·0	26·2	23·7	24·3	26·3
	CP 36-105	24·7	35·7	19·0	17·8	21·0	23·6
	CP 48-103	33·0	36·5	30·3	21·8	13·8	27·1
Unburned × periods		27·4	35·1	25·2	21·1	19·7	
		C—Acid/Neutral invertase activity ratio					
Burned	CP 42-10	1·44	1·22	1·16	0·94	00·0	0·95
	CP 36-105	1·91	1·17	1·17	1·11	00·0	1·07
	CP 48-103	2·37	1·48	1·12	1·20	00·0	1·23
Burned × periods		1·90	1·28	1·15	1·08	00·0	
Unburned	CP 42-10	2·13	2·04	2·30	1·73	1·84	2·00
	CP 36-105	2·02	1·44	2·02	1·81	1·44	1·74
	CP 48-103	1·67	1·66	1·95	1·41	2·03	1·74
Unburned × periods		1·94	1·71	2·09	1·65	1·77	

L.S.D. at 5%	*Acid invertase*	*Neutral invertase*	*A/N ratio*
Treatment × varieties × periods of storage interaction	5·2	3·5	0·19
Treatment × periods of storage interaction	3·2	2·0	0·11
Treatment × varieties interaction	2·5	1·5	0·08

† [illegible] hours by 0·1 ml dialysed juice.

Table II. Mean values for acid and neutral invertase activities and their ratio for treatments × parts of the stalk × periods of storage interaction

	Parts of the stalk	*Days of storage* 1	3	8	15	21	*Treatments × parts*
		A—Acid invertase					
Burned	Bottom	41·7	35·8	23·7	33·8	00·0	27·0
	Middle	45·3	34·7	28·0	31·7	00·0	25·9
	Top	22·7	33·3	27·3	22·0	00·0	21·1
Unburned	Bottom	50·5	50·2	51·8	30·5	30·0	42·6
	Middle	49·3	62·5	47·2	37·2	34·0	46·0
	Top	55·0	65·3	57·5	33·7	38·3	50·0
		B—Neutral invertase					
Burned	Bottom	20·3	27·2	20·0	28·7	00·0	19·2
	Middle	17·3	27·2	24·3	25·5	00·0	18·9
	Top	15·0	27·7	24·3	26·2	00·0	18·6
Unburned	Bottom	28·8	34·3	26·5	19·2	20·8	25·9
	Middle	28·3	33·7	25·5	21·7	18·7	25·6
	Top	25·0	37·2	23·5	22·5	19·7	25·6
		C—Acid/Neutral invertase activity ratio					
Burned	Bottom	2·07	1·33	1·18	1·19	—	1·15
	Middle	2·06	1·30	1·15	1·21	—	1·14
	Top	1·58	1·23	1·12	0·86	—	0·96
Unburned	Bottom	1·78	1·46	1·96	1·61	1·41	1·64
	Middle	1·84	1·88	1·87	1·71	1·93	1·84
	Top	2·20	1·79	2·44	1·63	1·98	2·01

L.S.D. at 5%	*Acid invertase*	*Neutral invertase*	*A/N ratio*
Treatments × parts of the stalk × periods interaction	5·2	3·5	0·19
Treatments × parts of the stalk interaction	2·5	N.S.	0·08

text which follows, the terms "acid invertase" and "neutral invertase" are applied to enzymes which catalyse the inversion of sucrose with optimum efficiency at either acid or neutral pH, respectively.

Burning may be seen to have reduced the activity of acid invertase in all varieties by varying degrees. This reduction was 59%, 38·5%, and 30% for CP 42-10, CP 36-105, and CP 48-103, respectively. The variety most affected, CP 42-10, was the one with the greatest concentration of acid invertase in unburned cane.

The acid invertase activity of burned cane differed significantly from that of unburned cane at various times of storage. When cane was stored unburned, acid invertase activity increase was highly significant for the first 3 days, followed by a decline in activity with time of storage. When storage was preceded by burning, this reduction of activity with time was greater and faster. For example, while after 3 weeks' storage there was still considerable acid invertase activity in unburned cane, there was no detectable activity in burned cane.

Acid invertase activity responded differently to burning and storage in different locations of the stalk (Table II). Location of activity in unburned cane was greatest at the top. With burning, however, different parts of the stalk responded differently, the trend reversed and activity decreased from bottom to top of the stalk, with a highly significant difference between the middle and top portions.

Neutral invertase activity was reduced in burned cane of all varieties and there were no significant differences in activity among varieties. On the other hand, there were significant differences in neutral invertase activity among the varieties if they were not burned.

The response of neutral invertase to periods of storage was affected by burning in much the same way as was acid invertase, i.e. there was an increase in activity for 3 days followed by a decline which was greater in burned cane. Again, there was no detectable activity in burned cane after three weeks.

Neutral invertase activity in unburned cane was not significantly different for different parts of the stalk. The response to burning and storage, however, was similar to that of the acid invertase, i.e. activity was diminished most in the top.

It is evident from Tables I and II that while burning and increased period of storage reduced the activities of both invertases, the rates of this reduction were different. The activity of acid invertase also appeared to be subject to more variation than that of neutral invertase among varieties, parts of stalk, and storage periods. It is therefore easier to assess the relation between the two invertases if their activity values are compared as the ratio of acid invertase activity to that of the neutral invertase. This has been previously defined by the authors as the A/N Ratio [3,5]. Data concerning the values of this ratio are presented in Tables I and II.

The A/N ratios of different varieties and also those of burned or unburned cane of each variety were significantly different, as may be seen from Table I. It is also apparent that the A/N ratio decreased with time of storage for both burned and unburned canes and that the reduction was faster in the burned.

It has been seen that burning affects acid invertase activity to a greater degree than it does neutral invertase activity and also that the distribution of neutral invertase activity is more uniform than that of acid

invertase. As would therefore be expected, the A/N ratio generally follows the trend of acid invertase. The advantage in the use of the ratio is that this value is subject to less fluctuation caused by environmental factors than is the acid invertase value alone. For this reason, the A/N ratio can be seen to be more closely correlated with sucrose concentration and other evaluations of cane quality than acid invertase activity alone. This has been shown to be true also as a means of evaluation of maturity[4].

Since the loss of sucrose through inversion is ultimately caused by at least two invertases, the effect of harvest methods on these invertases shown here should be of interest. It has been seen that their activities are affected by varietal differences, burning, and periods of storage and that there are strong interactions between these factors. The relationships between the activities of the invertases and sugar concentrations will be the subject of the final part of this report.

Forced circulation in sugar pans

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PART I

Introduction

THERE is general agreement[1] that rapid circulation of the massecuite in a vacuum pan increases the overall heat transfer coefficient and helps to prevent irregular crystal growth. Convection is rarely sufficient to ensure satisfactory operation of a pan. It is opposed by the high effective viscosity of the massecuite which, even in the case of crystallization from a relatively pure sugar solution, rises from about 1 poise at the beginning of the operation to about 50 poises at the end. With low purity feed solutions the final viscosity can exceed 1000 poises.

Natural convection can be supplemented by forced circulation, generated by a motor-driven impeller located in the downtake, the direction of rotation being such that the thrust on the massecuite is downwards. Many impellers have been installed in vacuum pans and the improvement of pan performance is well established[1,2].

Impellers demand considerable driving power, which increases rapidly as the increasing crystal content raises the effective viscosity of the massecuite towards the end of the crystallization operation. The power transmitted by the impeller shaft can easily rise to a value exceeding 100 h.p. One object of this investigation was to design an impeller which would achieve the required circulation at minimum horse power.

An equally important object was the observation of the radial and axial distributions of the flow lines. Ideally the upward flow would be uniformly distributed over any horizontal plane section (c-c in Fig. 1b) through the heating element and all of the downward flowing material would pass through the downtake. A minimum of stagnant volume is desirable; the flow pattern should extend substantially to the free surface of the massecuite.

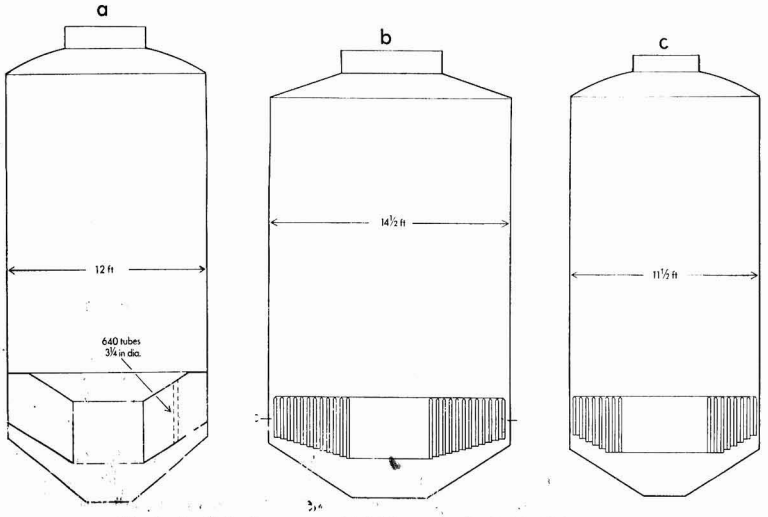

Fig. 1. (*a*) Calandria pan (*b*) Ribbon impeller No. 2, (*c*) Ribbon pan *B*

Design of the Experiments

In 1960 NICKLIN and BEALE[3] reported a series of observations at a viscosity corresponding to that of a raw sugar massecuite on ¼-scale models,

[1] WEBRE: "Principles of Sugar Technology" Vol. II. Ed. P. HONIG. (Elsevier, Amsterdam) 1959, pp. 394–451.
[2] RODGERS and LEWIS: *I.S.J.*, 1965, **67**, 9–12, 42–45, 72–79.
[3] *Proc. 27th Conf. Queensland Soc. Sugar Cane Tech.*, 1960, 217.

using three types of impeller—an axial-flow type, a "mixed flow" type and a "Webre"-type impeller. However, the environment in which their impellers were tested was not itself a scaled-down model of an actual vacuum pan. The downtake of the heating unit was simulated by a simple vertical cylinder of appropriate dimensions, and the remainder of the flow circuit was represented by a weir, the height of which determined a hydrostatic head which opposed the flow. The use of a model which was not geometrically similar to the full-scale system introduces an element of doubt into the conclusions reached by NICKLIN and BEALE. The results to be reported here were obtained with scaled-down models of actual vacuum pans, including the three white sugar pans shown in Fig. 1.

An investigation of the performance of proposed impellers in these vacuum pans was made by experimenting at 20°C with models ranging in scale from 1/13th to 1/6th of full size. Natural convection cannot be simulated on a reduced scale because some of the similarity conditions that would have to be observed are mutually incompatible. However, the similarity conditions for the measurement of impeller performance alone are easily met. Moreover, if forced circulation is to be justified it must substantially exceed natural convection, so only the minor component of the circulation is excluded by this limitation.

In addition to the need to operate with the correct full-scale value of the Reynolds number (R_e), the presence of a free massecuite surface imposes the necessity of operating with the correct full-scale value of the Froude number (F_r). The influence of the surface is indicated by the fact that the impeller can create a significant vortex round the shaft at the higher rotational speeds.

Table I. Notation

Symbols	*Quantity*	*Dimensions*
K	scale ratio	
g	gravitational acceleration	LT^{-2}
H	hydraulic head	L
L	linear dimension	L
N	rotational speed	T^{-1}
P	transmitted power	ML^2T^{-3}
Q	volumetric flux	L^3T^{-1}
v	velocity	LT^{-1}
η	viscosity	$ML^{-1}T^{-1}$
η_0	viscosity at zero crystal content	$ML^{-1}T^{-1}$
ρ	density	ML^{-3}
R_e	Reynolds number	
F_r	Froude number	

Using the symbols listed in Table I

$R_e = Lv\rho / \eta$

and $F_r = v^2 / Lg$.

Let $K_x = \dfrac{\text{Value of parameter } x \text{ in the model}}{\text{Full scale value of parameter } x}$

Then, at constant Reynolds and Froude numbers,

$K_L K_v K_\rho = K_\eta$ .....(1)

and $K_v = K_L^{\frac{1}{2}}$ .....(2)

$v \propto L N$, so $K_N = K_v / K_L = K_L^{-\frac{1}{2}}$ .....(3)

From (1) and (3)

$K_\eta / K_\rho = K_L^{1.5}$ .....(4)

Because at 20°C the kinematic viscosity of sucrose solution increases from 0·01 stokes at zero concentration to 1·65 stokes at saturation, the required values of K_η / K_ρ can be obtained by using such solutions. In Table II the values of K_η and K_ρ are shown separately.

The volumetric flux of material, Q, is proportional to vL^2 so:

$K_Q = K_v K_L^2 = K_L^{2.5}$ .....(5)

For geometrically similar rotating impellers:

$Q \propto L^3 N . f(R_e) \phi (F_r)$

Therefore, at constant R_e and F_r,

$K_N = K_Q K_L^{-3} = K_L^{-\frac{1}{2}}$

which is in agreement with (3).

The head generated by the impeller is proportional to $N^2 L^2$, so that $K_H = K_N^2 K_L^2 = K_L$ .....(6)

Under dynamically similar conditions the model and full scale pans have equal impeller efficiencies, and the useful power delivered to the massecuite is $Q H \rho g$.

So: $K_P = K_Q K_H K_\rho = K_L^{3.5} K_\rho$ .....(7)

In order to use the same 6-in diameter impellers the scaling factors for the models of the different refinery pans were adjusted to give a common downtake diameter. Factors 1/7·5, 1/10 and 1/13·6 were used. In one case a 1/6 scale model was also made, and it was compared with the corresponding 1/10 scale model to check the validity of the dimensional argument.

Sets of scaling factors for models made to scales of 1/13·6, 1/10, 1/7·5 and 1/6 are given in Table II.

EXPERIMENTAL METHOD

The vacuum pan shell was simulated by an open-topped, vertical cylinder A of transparent "Perspex" (polymethyl methacrylate resin) (Fig. 2) with a truncated conical brass bottom. The "heating elements" were fabricated from solid aluminium. Ribbon heaters were supported on six equally spaced vertical radial plates, while the calandria heater rested on a thin metal ring which fitted closely inside the pan shell. The impellers were mounted so as to permit vertical adjustment along the shaft B, which rotated in a

Table II. Scaling Factors

Scale	K_L	K_ρ	K_η	K_v	K_Q	K_N	K_H	K_P
1/13·6	0·0735	0·88	0·0175	0·275	0·00148	3·04	0·0735	0·000096
1/10	0·100	0·88	0·0279	0·316	0·00316	3·16	0·100	0·000263
1/7·5	0·133	0·89	0·0432	0·365	0·00549	2·74	0·133	0·000736
1/6	0·167	0·90	0·0614	0·408	0·01'3	2·4[illegible]	0·167	0·00[illegible]

steadying bottom bearing. Friction at the bearing was reduced to a negligible value by the lubricating effect of the sugar solution. The torque transmitted by the shaft was measured, according to the method of NICKLIN and BEALE[3], by allowing the cage D, containing the motor and its associated belt and pulley gearing, to swing in nearly frictionless bearings. Rotation of the motor mounting was limited by contact with a calibrated spring strip E which carried a strain gauge bridge F.

A photographic method was used to measure the distribution of velocities in the fluid throughout the pan. White globules of resin of the correct density and about 1 mm in diameter were thinly dispersed in the sugar solution. The globules in a thin vertical, diametral sheet (or occasionally in a horizontal sheet) were made visible by projecting through the pan an intense beam of light from a 500-watt spotlight G. The beam was collimated by two narrow slots H, only one of which is visible in the photograph, and the motions of the globules were viewed at eight angles to the plane of the beam. A camera C was used to record the flow paths. Suitably timed exposures of known duration were made of the vertical or horizontal planes. The magnitude of the local velocity in the indicated direction was given by the length of a track on the print. Checks on the exposure times were made by impressing a 25 cycles/sec vibration of very small amplitude on the camera from a synchronous motor. Figs. 5 and 6 are typical photographs of horizontal and vertical sections through the flow system. To reduce distortion by refraction the model pan was immersed in a transparent rectangular tank filled with sugar solution of the same concentration, and therefore of the same refractive index, as the solution in the pan.

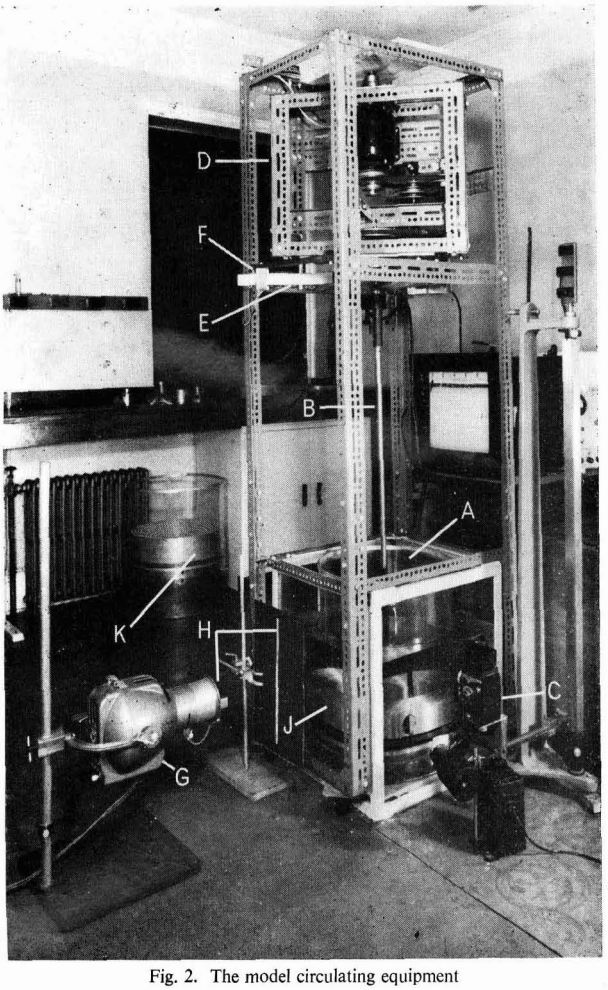

Fig. 2. The model circulating equipment

This method of flow visualization shows only that part of the flow pattern which is above the heating element, and it is reliable only when there is a substantial quantity of fluid above the heating element—i.e. when the level of the solution corresponds to the elevated massecuite level near to the end of the crystallization. However, little information is lost. The direction of the flow past the heating surfaces must be substantially vertical and its magnitude can be accurately inferred from the visible flow pattern. Besides, the important phase of the operation, with respect to shaft horse power and also to the avoidance of stagnant volume, is the later stage of the crystallization.

Total volumetric flux was derived by integrating the normal component of the flow velocity, weighted according to distance from the central axis, along a line extending from a point on the upper rim of the downtake to a point on the axis—for example the line *a-a* in Fig. 20a.

In Fig. 2 the model J installed in the measuring equipment is that of a ribbon element pan (No. 2 Pan). In the background there is a model K of a calandria pan (G Pan).

DESIGN OF THE IMPELLERS

Initially three basic designs of impeller were selected for test—an axial-flow impeller of the type recommended by WEBRE[1], a simple mixed-flow impeller as used in some of the vacuum pans of the British Sugar Corporation[2], and a mixed-flow impeller as specified by NICKLIN and BEALE[3].

Axial-Flow Type (Fig. 3a)

The blades of this impeller constitute a six start helicoid. They are equally spaced on a dome-shaped boss the diameter of which is half the overall diameter

of the blades. The angles of inclination of the blade to a (horizontal) plane perpendicular to the axis of rotation are 44° at the root of a blade and 25½° at the tip. Thus the ratio of the pitch of the helicoid to the overall diameter is 1·5. When projected on to a horizontal plane the limiting radii of a blade enclose a 60° sector.

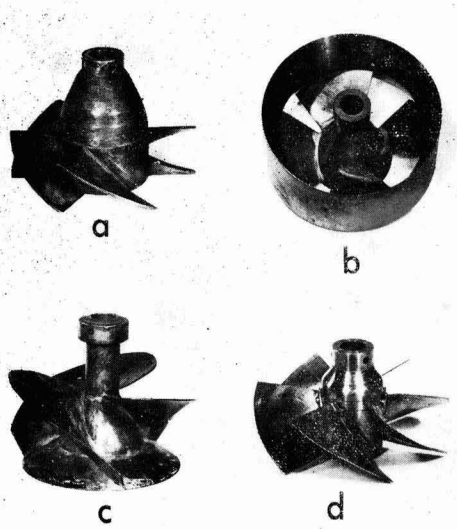

Fig. 3. (*a*) Axial-flow impeller. (*b*) Simple mixed-flow impeller with shroud. (*c*) Mixed-flow impeller. (*d*) Small hub axial-flow impeller

Modified Axial-Flow Type (Fig. 3d)

In a later design the diameter of the boss was reduced to ⅓ of the overall diameter and six detachable blades having similar geometry to those of the original impeller were mounted. The reduction in the diameter of the boss increased the angle of inclination at the root of a blade to 55°.

The two axial-flow impellers, nominally 6 inches in diameter, were machined to allow $\frac{1}{16}$ in clearance from the walls of the 6-inch downtakes.

Simple Mixed-Flow Type (Fig. 3b)

In this impeller four plane 60° sectors are mounted on a conical boss of 55° vertical angle. The centre line of each blade is set perpendicular to the surface of the cone and the plane of the blade is rotated through 22½° from the position of zero pitch. A circular shroud with a double conical internal surface was provided.

Mixed-Flow Type (Fig. 3c)

This impeller is described by NICKLIN and BEALE[3]. It has three broad blades fixed to a dome and cone boss, which was designed to exert a certain amount of radial thrust. The leading edges of the blades are strongly curved while the trailing edges are sealed to the boss. Radial thrust is also provided by the narrow lower ends of the blades, which are twisted upwards for this purpose.

(*To be continued*)

Measures adopted in Mauritius to improve raw sugar filtrability

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Paper presented to the 13th Congr. I.S.S.C.T., 1968

PART I

INTRODUCTION

UNTIL fairly recently Mauritius sugars had always enjoyed a good reputation amongst refiners. So much so that Sir OLIVER LYLE[1] could write in his well-known book "Technology for Sugar Refinery Workers": "Mauritius (raws) and British beet are easy to work. The recovery house is lightly loaded and filtration easy. . . . All that we can do is to try to keep a silo full of Mauritius or beet to help things out a bit when Natal or Australian is being particularly cumbersome". Unfortunately in the early nineteen-fifties the situation started to deteriorate and a first complaint on filtrability was received from a refiner. Several timid measures were initiated by the industry but with little success. Sugar filtrability deteriorated further, and in 1963 one refiner[2] could even write: "Unless there is a financial advantage in buying Mauritius, I can only say that if it can possibly be avoided we would prefer to refine no more of it". The Mauritius Sugar Syndicate and the Mauritius Sugar Producers' Association, alarmed by the possibility of losing some of their customers, then reacted most vigorously. Within a short period the situation was fully redressed, with the result that the same refiner who in 1963 did not want to process

[1] "Technology for sugar refinery workers" (Chapman and Hall, London) 1941, p. 329.
[2] W. PEACE: Private communication, 1963.

any more Mauritius raws could write in 1966[3]: "The four cargoes of Mauritius sugar which have been received this year have all proved to be entirely satisfactory. This represents a marked improvement over sugars received from Mauritius in previous years".

The object of the present paper is to review the measures which have led to this marked improvement. Its object is not to determine the exact and true causes of poor filtrability nor the relative influence of the various factors or non-sugars that may affect filtrability. However, an account of the measures adopted to produce better filtering sugars, coupled with certain observations made in the course of various recent investigations will, it is hoped, help to throw some light on the subject.

As pointed out by DUPONT DE R. DE ST. ANTOINE[4], the improvement in the filtrability of Mauritius raws in 1966 was due mostly to the following causes:

1. Reduction in the starch content of sugars by the enzymatic process of starch removal.
2. Adoption of more efficient clarification processes and more thorough phosphate precipitation.
3. Improvements in boiling house work.
4. Initiation of strict quality control on all the raws produced.

Each of these will now be considered in some detail.

REDUCTION IN STARCH CONTENT

Many authors believe that starch is one of the main causes of poor filtrability and numerous papers have been published on the subject. Thus DOUWES DEKKER[5], in a paper presented to the 1964 Meeting of Sugar Industry Technicians, said that "the most important filtration impeding impurity is doubtless starch, but the effect of gums is also appreciable". KAGA, SUZUKI and YAMANE[6] after measuring the C.S.R. filtrability index of carbonated liquors produced from affined sugars of various origins concluded that "starch is the most detrimental impurity in affined sugars, so far as the filtrability of carbonatation slurries is concerned". C. W. DAVIS[7], ICUMSA Referee for Subject 27, "Refining Quality of Raw Cane Sugar", reported at the 14th Session of the Commission (1966) in the following terms: "The British National Committee has concentrated on the effects of some impurities thought by them to bear on filtrability of carbonatated liquor slurry. The tests they chose were for starch, silica, waxes, phosphorus, M.A. and C.V. . . . The affined raw samples were carbonatated in an experimental plant and the filtrabilities of the carbonatation slurries determined . . . . These filtrabilities were found to correlate for the most part with the starch content of the sugars".

In 1966 the excellent refinery filtration rates reported by JENNINGS[8] with sugars produced at Umzimkulu sugar factory, Natal, after adoption of the Rabe clarification process which moves about 90% of the starch present in the juice, were correlated mostly with the low starch content of the sugars. This has led DOUWES DEKKER[9] to say that "we now have sufficient evidence that starch is the main cause of poor filtrability and all our efforts go into the direction of removing starch from mixed juice".

It would appear that in Australia, where less importance seemed to be attributed to the influence of starch on filtrability, views have somewhat changed since N. J. KING, Director of the Bureau of Sugar Experiment Stations, reported[10] that "the development in sugar mills of certain processing techniques has been very successful in reducing the starch in juices to such a level that the raw sugar has been able to meet the standards which were set for permissible starch content".

The processing technique mentioned by KING is the NICHOLSON and HORSLEY enzymatic process of starch removal which, as mentioned above, was adopted in a number of factories last crop. Fig. 1, drawn from the results obtained by VIGNES[11] at Britannia factory, illustrates clearly the close correlation obtaining between the filtrability of Britannia raws and their starch content. The results from which the graph was drawn gave a correlation coefficient of 0·88 for 19 pairs of comparisons. This is significant at the 0·1% level. It is also pertinent to point out that average filtrability of Britannia sugars in 1966 exceeded that of 1965, when the enzymatic process was not in operation, by 23 points or 110%.

The enzymatic process of starch removal is a simple process which calls for little extra equipment.

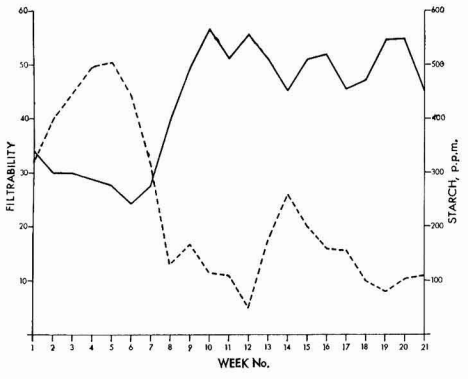

Fig. 1. Filtrability and starch content of raw sugar, Britannia Factory, 1966 crop

[3] *idem.*: Private communication, 1966.
[4] *Rpt. Mauritius Sugar Ind. Res. Inst.*, 1966, 139–145.
[5] *Rpt. 23rd Meeting Sugar Ind. Tech.*, 1964, 159–170.
[6] *I.S.J.*, 1966, **68**, 3–6.
[7] *Proc. 14th Session ICUMSA*, 1966, in press.
[8] *Proc. 40th Congr. S. African Sugar Tech. Assoc.*, 1966, 199–204.
[9] Private communication, 1967.
[10] *Producers' Review*, 1966, **56**, (6), 3.
[11] VIGNES and MARIE-JEANNE: *Rpt. Mauritius Sugar Ind. Res. Inst.*, 1966, 127–135.

Table I. Starch balance, kg

Factory	Duration of test	Mixed juice	Filter cake	Raw sugar	Final molasses	Total	Balance
A	2 weeks 1965	2600	37 (1·5)	913 (35·9)	1590 (62·6)	2540	−60
B	Entire crop 1966	17200	415 (2·4)	4245 (24·4)	12710 (73·2)	17370	+170

The amount of sucrose lost by inversion is small, whilst the amount of starch removed is large, amounting to about 70% under good conditions.

Since many refiners themselves, particularly in Britain and Canada, claim that raw sugars slow down filtration rates in the refinery as soon as their starch content exceeds 150–200 p.p.m., it is strongly recommended that the enzymatic process of starch removal be adopted in those factories where juices rich in starch are processed.

Before proceeding to another topic, it may be of interest to mention briefly another aspect of the question, namely the starch balance, or starch distribution in various factory products. A number of such balances were calculated for various factories in Mauritius and the results obtained in two cases are given in Table I.

It will be observed from this table that:

(i) the amount of starch eliminated during clarification is very small;

(ii) the starch content of the sugar will be governed mostly by the amount eliminated in the final molasses, which amount may vary somewhat considerably from factory to factory as shown by the figures in brackets which give the percentages eliminated in each product.

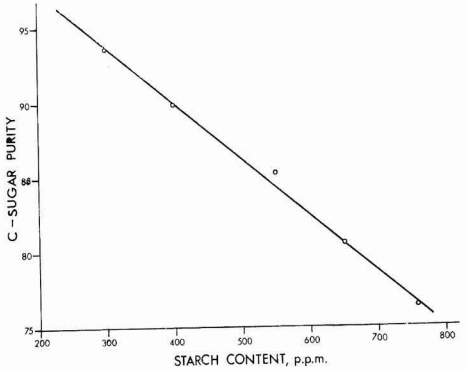

Fig. 2. Influence of *C*-sugar purity on starch content

Hence it is important to eliminate as much starch as possible in the final molasses. This can be obtained in practice by ascertaining that the low-grade massecuites are properly centrifugalled and yield clean *C*-sugars, as shown in the following laboratory experiment conducted in 1965. *C*-massecuite collected in a nearby factory was centrifugalled and a sample of the *C*-sugar obtained was analysed for refractometer Brix (dilution 1:6), pol and starch content; the remainder was made into a magma with a saturated sucrose solution, centrifugalled, and the sugar washed with a spray of cold water delivered under a constant pressure of 50 p.s.i.g., with the help of a special sprayer. The experiment was repeated five times, but the duration of spinning and amount of wash water was varied each time, so as to obtain *C*-sugars of different purities. Fig. 2 shows the results obtained with massecuite collected from Solitude factory. The experiment was also repeated with massecuite from five other factories and the average results obtained show that by increasing the *C*-sugar purity from 83 to 92 the starch content of the sugar is reduced by 45% on average. In other words, so far as starch is concerned, double-curing of *C*-sugars is better than single curing, whether the *C*-sugar is used as footing for the shipment strikes, or, preferably, remelted. But it is most important that the first curing be properly carried out, as otherwise the amount of starch eliminated in the final molasses will decrease whilst that present in the *C*-wash which is recirculated to the *C*-massecuite pan will increase.

Clarification

This is doubtless a process which has a great impact on raw sugar quality and every effort should be made to improve its efficiency if good filtering sugars are to be produced. In Mauritius the clarification processes followed until 1965 were crude, as they consisted in straight cold liming or, at the best, liming at about 60°C. Shortly after the 1966 crop had started, Savannah factory adopted boiling juice liming, as practised in many Queensland mills, and reported excellent results. The process adopted was as follows: the acid raw juice was heated to 70–75°C, submitted to enzymatic action for a limited period of only about five minutes, brought to boiling and limed, with the help of a dosing pump, just ahead of the flash tank, directly in the juice line. Filtrability immediately went up but improved still further when, as from the 12th September (week 10 in Fig. 3) mixing of lime and juice, which had so far been inadequate, was improved. Mostly as a result of these changes the filtrability index of Savannah raws in 1966 exceeded that of the previous crop by 18 points.

Liming of boiling juices was experimented with in a number of other factories in 1966, with good results in many cases, particularly in those factories where clarification was originally poor. But as a result of

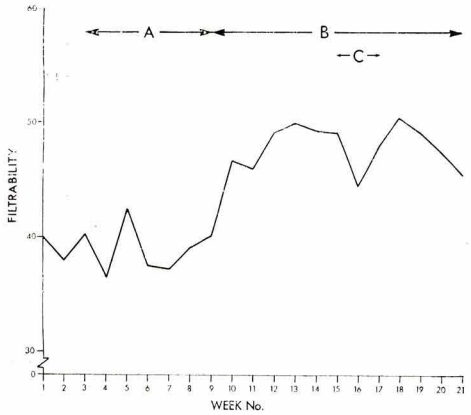

Fig. 3. Weekly filtrability indices, Savannah Factory, 1966 crop

A—Flash tank liming, incomplete mixing.
B—Flash tank liming, mixing improved.
C—Milk-of-lime dosing pump out of order and double-curing of *C*-sugar stopped.

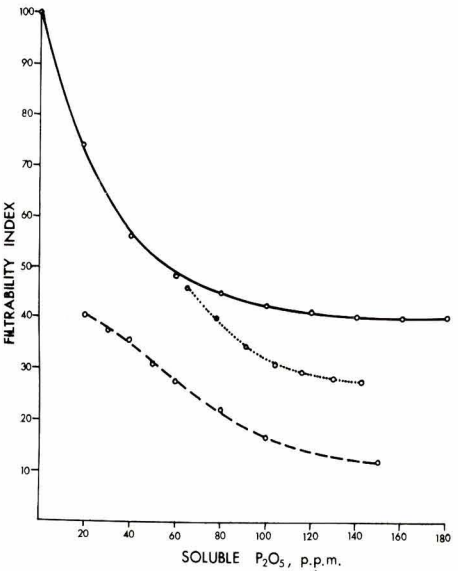

Fig. 4. Influence of soluble phosphate on filtrability indices of various sugars

the lighter muds produced, the process could not be followed continuously in certain factories where clarifier capacity proved inadequate, for example at Mon Désert-Alma. There, the process could only be followed in an on-and-off manner, but yet with excellent results. However, when "Separan AP-30", which in this factory is normally added to the juice at the rate of 2 p.p.m., was increased to 4 p.p.m. the duration during which boiling juice liming could be followed was increased from 12 to 24–30 hours. But polyectrolytes do not always work and are expensive. Hence, if clarifier capacity is inadequate to cope with full boiling juice liming, it could be advisable to lime partially the hot juice and complete the liming at or near the boiling temperature.

However, it was only in 1967 that the true merits of boiling juice liming could be properly assessed under Mauritius conditions. Many of the installations rigged up in 1966 during the crop could not be well designed and suffered from certain drawbacks, particularly improper mixing of juice and lime and inadequate pH control. In many cases, however, clarifier capacity may prove inadequate for the adoption of the process. Thus, whereas in Queensland the capacity recommended is 700–750 gallons per t.c.h., in Mauritius only seven factories have equivalent capacities whilst in seven others it is less than 500 gallons. However, conditions in Mauritius, where all the cane is harvested manually, may call for smaller capacities as compared with Queensland where varieties are different and where a larger proportion of the cane is mechanically harvested.

Another factor which has doubtless contributed towards the improvement of raw sugar filtrability in 1966, as measured by the C.S.R. test filter, is more thorough phosphate precipitation. Thus, whereas in 1965 only 8 factories registered clarified juice pH values of 7·2 or more, measured at room temperature, the figure rose to 15 in 1966. The influence of phosphates on the C.S.R. filtrability index of sugars is shown in Fig. 4 which is a plot of filtrability index versus soluble phosphate. The solid curve is of a sample of caster sugar from Tate & Lyle Ltd. which at zero phosphate had a filtrability index of 100. The dotted curve is of a sample of semi-refined white sugar, produced by remelting *A*-sugar followed by phospho-defecation, polarizing about 99·7 and containing 65 p.p.m. soluble phosphate. The broken curve is of a raw sugar containing 20 p.p.m. soluble P_2O_5. The filtrability indices of the sugars at different phosphate levels were measured after addition of increasing quantities of sodium dihydrogen phosphates It will be observed from the curves that there is initially a considerable drop in filtrability index with increasing phosphate content, but that the effect is much less marked when the phosphate content exceeds about 100 p.p.m. This drop is due to precipitation of the phosphate by the calcium present in the calcium acetate-triethanolamine-glycerol buffer solution used in the C.S.R. test, and subsequent blocking of the test filter by the calcium phosphate particles. In a refinery using carbonatation, it was found that calcium phosphate will also clog filters, as pointed out by DAVIS[12], but is the effect as marked on the filtration rate as it is in the test filter? Probably not, as the results of preliminary investigations carried out at the Mauritius

[12] *I.S.J.*, 1959, **61**, 300–302.

Sugar Industry Research Institute seem to indicate. In other words the C.S.R. test may not be as reliable as believed for judging the filtrability of a raw sugar. But this is another problem which is outside the scope of the present paper.

It should also be pointed out that clarified juice strainers have been installed in practically all the factories. Most of the installations consist of stationary screens but in a few cases vibrating screens are used. The impurities removed consist mainly of bagacillo and although the amount strained off during normal operation is relatively small, that removed during the first few hours when crushing is resumed after the week-end stoppage is rather considerable. The influence of bagacillo on filtrability is probably small. WELLS[13] is of opinion that "it must be considered as one possible cause of low filtrability" because" under the conditions of the filtrability test fine bagacillo particles would swell and become gelatinous in nature". On the other hand, if the juice is not strained the raw sugar produced will contain more bagacillo and will be more hygroscopic. Further, as pointed out by HONIG and CHEN[14], "bagacillo is very difficult to remove in the affination; it practically all remains in the affined sugar". For these various reasons, and bearing in mind that the cost involved is small, especially when a stationary screen is used, it is believed that clarified juice screening is a sound practice.

Another practice followed in most of the Mauritius factories that may have contributed towards improving raw sugar filtrability is better preservation of juice in clarifiers during shutdowns. BOYDEN[15] and SESTERO[16] both claim that raws produced from juice stored over the week-end have a lower filtrability than those produced from fresh juices. Thus in the case of Mourilyan factory, Queensland, an average filtrability of 44·6 was recorded for Mondays during the 1963 crop as against an average figure of 49·0 for the other days of the week. A similar observation was made by the author at Mon Désert-Alma factory in 1965, but no attempt was made to correlate the effect statistically with the presumed cause. Hence, although it is not possible to assess the effect of juice storage on filtrability under Mauritius conditions where the week-end shutdown is shorter than in Australia, yet it should be pointed out that, following recommendations made by DUPONT DE R. DE SAINT ANTOINE and VIGNES[17], juice deterioration in clarifiers has been considerably curtailed in Mauritius.

(To be continued)

International Sugar Agreement, 1968

From the official communications received from the Office of Legal Affairs of the United Nations, New York, the membership of the International Sugar Agreement, 1968, on 1st January 1969, the date on which the Agreement entered provisionally into force, was as follows:

Exporting countries: Australia, Argentina, Barbados, Brazil, China, Cuba, Czechoslovakia, Denmark, Dominican Republic, Guatemala, Guyana, Indonesia, Jamaica, Malagasy Republic, Mauritius, Mexico, Nicaragua, Peru, Poland, South Africa, Swaziland, Trinidad and Tobago, Venezuela.

Importing countries: Canada, Kenya, Portugal, Japan, New Zealand, Union of Soviet Socialist Republics, United Kingdom.

Of the above countries, the following have completed their constitutional procedures by depositing, with the United Nations in New York, their instruments of ratification, acceptance or approval:

Exporters: Jamaica, Mauritius, South Africa, Trinidad and Tobago.

Importers: Canada, Kenya, New Zealand, Union of Soviet Socialist Republics.

All the other countries have submitted the notifications referred to in Articles 61(1) and 62(1) i.e. to the effect that they would seek ratification, acceptance or approval of the Agreement as rapidly as possible, and in any case not later than 1st July 1969; and that, in the meantime, they would apply the Agreement provisionally.

In accordance with the provisions of Article 63(2), all the countries listed at the beginning of this Press Release are provisional Members of the Agreement.

In addition, the information from the Legal Office of the United Nations indicates that Hungary and Sweden signed the Agreement and submitted the first of the notifications referred to above. Hungary and Sweden have, accordingly, the status of observers under the terms of Article 61(2) until such time as they indicate that they will apply the Agreement provisionally or deposit their instruments of ratification with the United Nations.

Furthermore, the Agreement was signed on behalf of Colombia and Honduras. By supplementing their signature in accordance with Article 61(1), these countries would automatically acquire the status of observers; if in addition they comply with Article 61(1), they would also become provisional Members.

The Agreement is open for accession, in accordance with the provisions of Article 64, by any other Government which was invited to the United Nations Sugar Conference, 1968, or any Government not so invited which is a Member of the United Nations or of any of its Specialized Agencies.

[13] *Proc. 27th Conf. Queensland Soc. Sugar Cane Tech.*, 1960 97–103.
[14] HONIG and CHEN: *Proc. 23rd Meeting Sugar Ind. Tech.*, 1964, 130–145.
[15] *Proc. 31st Conf. Queensland Soc. Sugar Cane Tech.*, 1964, 219–222.
[16] *ibid.*, 227–232.
[17] *Proc. 12th Congr. ISCT*, 1965, 1769–1777.

Sugar cane agriculture

Notes on the introduction of mechanical harvesting. S. W. D. BAXTER. *Paper presented to the* 13*th Congr. ISSCT*, 1968.—The importance of having or establishing the right field conditions for mechanical harvesting is stressed and it is pointed out that careful attention may have to be given to the levelling of cane fields as a long-term measure. All aspects of possible field work are discussed. The value of a preliminary or pilot scheme is stressed. This leads to an appreciation of ground condition requirements, the development of suitable transport and mill handling facilities, training of operators and managerial staff, etc.

* * *

Experience in the use and development of plantation scale fully-mechanized harvesting in the Caribbean. ANON. *Paper delivered to the* 13*th Congr. ISSCT*, 1968. The need for full-scale mechanical harvesting on estates associated with the Tate & Lyle Group in the West Indies and the increasing labour difficulties are discussed. Problems that have to be met in regard to field lay-out and cultivation practice are pointed out and reasons for the selection of the chopper-loader type of harvester given. Experience with two makes of chopper-harvester in the West Indies and British Honduras are considered.

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Harvesting, loading and transport systems of sugar cane in the Philippines. F. Y. PANOL and T. R. ESCOBER. *Paper presented to the* 13*th Congr. ISSCT*, 1968.—This paper discusses the harvesting, loading and field transport systems at present practised in the Philippines, as well as the development work now being undertaken by the Victorias Milling Co. Inc. towards the mechanization of loading and field transport of cut cane. Trials with mechanical harvesters so far have not been very successful, largely because of the prevalence of recumbent or lodged cane and the amount of cane that is left in the field.

* * *

Other papers presented to the Agricultural Engineering Section of the 13*th Congress of the ISSCT*, 1968, *were:*

I.I.S.R. tractor drawn sugar cane planter [Indian Inst. Sugarcane Research]. R. G. MENON.

* * *

The fundamental basis of costing of road transport of sugar or cane. ANON.

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A study of the transport of cane by light gauge railway to some Queensland factories. C. R. MURRY.

Notes on the mechanization of the sugar cane harvest. J. K. GAUNT and J. J. ZAGORSKI.

* * *

A consideration of chopper and whole-stalk mechanical harvest in Australia. R. A. PRICE and K. A. BLYTH.

* * *

Technology and cost of handling sugar cane from field to mill elevator. R. O. PETERSEN.

* * *

Development of some types of whole-stalk mechanical harvesters in Queensland. C. B. TOFT.

* * *

Experimental results with biological control of sugar cane borers in Taiwan. C. B. CHEN and T. H. HUNG. *Paper presented to the* 13*th Congr. ISSCT*, 1968. Six species of moth borer attack sugar cane in Taiwan. Results obtained with various parasites are outlined; some give efficient control, others prove unsatisfactory owing to poor establishment and maintenance under conditions prevailing in Taiwan. Egg parasites are considered superior to larval and pupal parasites and can easily be mass-produced in the laboratory at low cost. The ideal would be to have several parasites each attacking a different stage of the host.

* * *

Further records of insects collected from *Saccharum officinarum* in the Territory of Papua and New Guinea with notes on their potential as pest species. T. V. ROURKE. *Paper presented to the* 13*th Congr. ISSCT*, 1968.—This paper records the results of the Markham Valley sugar cane surveys and collecting carried out on cane in the area. Some notes are given on the insects concerned.

* * *

Important insect pests affecting sugar cane and problems of their control in the Ryukyu Islands. T. TAKARA. *Paper presented to the* 13*th Congr. ISSCT*, 1968.—Sugar cane is the most important crop in the Ryukyu Islands where it has been grown for the last 340 years. Results are given of a recent intensive study of the sugar cane insects of the islands. They are listed in order of importance and notes given on some of the more important.

* * *

The nature of injury to sugar cane ratoons caused by the nymphs of *Mogannia hebes*. Y. S. PAN and S. L. YANG. *Paper presented to the* 13*th Congr. ISSCT*, 1968.—Poor ratoon development with sugar cane

in Taiwan in recent years has been due in large measure to attack by the underground insect *Mogannia hebes*. This paper presents the results of a study of the feeding process of the nymphs, the incidence of injury and the effects of salivary secretions on cane growth.

* * *

Recent investigations on the biological control of *Diatraea* spp. in Trinidad, the Lesser Antilles and Barbados. F. D. BENNETT and H. PSCHORN-WALCHER. *Paper presented to the 13th Congr. ISSCT*, 1968. The authors, members of the Commonwealth Institute of Biological Control, have studied the question of biological control of sugar cane borers in the West Indies and present their up-to-date information in this paper. The various islands are discussed in turn —Trinidad, Grenada, St. Vincent, St. Lucia, Guadeloupe, Antigua, Montserrat, St. Kitts.

* * *

Recent developments in insecticidal control of the sugar cane borer in Louisiana. S. D. HENSLEY, E. J. CONCIENNE, W. J. MCCORMICK and L. J. CHARPENTIER. *Paper presented to the 13th Congr. ISSCT*, 1968. Changes in spraying methods for borer control have taken place in recent years in Louisiana for various reasons. These are discussed. Resistance of populations of the sugar cane borer, *Diatraea saccharalis*, to chlorinated hydrocarbon insecticides ("Endrin" and "Endosulfan") have necessitated their replacement with organophosphorus compounds for control of the cane borer in Louisiana. "Azinphosetyl" and "Azodrin" provided 78–86% control in several field tests.

* * *

Other papers presented to the Entomology Section of the 13th Congress of the ISSCT, 1968, were:—

Chemical control of sugar cane froghopper infestations from the air in Trinidad. D. W. FEWKES and D. A. BUXO.

* * *

Statistical estimation of sugar losses due to borer attack. M. A. RUÍZ, A. MARTÍNEZ and S. FLORES.

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The cicada, *Mogannia hebes*, a pest of ratoon sugar cane in Taiwan and its control. C. B. CHEN and T. H. HUNG.

* * *

Distribution and sampling of sugar cane internode borer (*Proceras indicus*) damage. P. N. AVASTHY and T. N. KRISHNAMURTHY.

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Two years rearing of the Javanese tachinid, *Diatraeophaga striatilis*, a parasite of the cane moth borer *Proceras sacchariphagus* in Réunion Island. J. ETIENNE.

Funnel ant control in Queensland cane fields. B. E. HITCHCOCK.

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Effect of post-planting application of gamma-BHC on the incidence of shoot borer of sugar cane and crop yield. Z. A. SIDDIQI and M. M. SINHA.

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Integrated control schedule against sugar cane pests. S. PRADHAN.

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Progress of earth pearl studies in Queensland. B. E. HITCHCOCK.

* * *

Host suitability experiments with three tachinid parasites of *Diatraea* spp. in Barbados and Trinidad, West Indies. H. PSCHORN-WALCHER and F. D. BENNETT.

* * *

Cicadas as pests of sugar cane in Queensland. G. WILSON.

* * *

Components of aggregate crop loss caused by the sugar cane borer. R. MATHES, W. J. MCCORMICK and L. J. CHARPENTIER.

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The utilization of *Trichogramma* spp. in the biological control of sugar cane borers: a review and some suggestions for future lines of work. B. R. S. RAO and A. K. SHARMA.

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Earthing up as a measure of control against early shoot borer, *Chilotraea infuscatellus*. M. Q. KHAN.

* * *

Sugar cane and animal fodder. O. LOPES. *Brasil Açuc.*, 1967, **70**, 395–397.—An account is given of the growing of fodder cane in certain parts of Brazil, with notes on planting, fertilizers, varieties, chemical composition, etc.

* * *

Use of antibiotics with plants. L. G. DO PRADO F. *Seminario Inst. Zimotécnico* (São Paulo), 1966, (5), 18 pp.—Aspects discussed include: methods of application, stability and persistence of antibiotics, compatibility with other chemical products in agricultural use, biological tests, antibiotic additives and formulations, phytotoxicity, and mode of action.

* * *

The use of herbicides in sugar cane cultivation. P. DE OLIVEIRA LIMA. *Brasil Açuc.*, 1968, **71**, 139–143. The use of chemical weedkillers in sugar cane cultivation in Brazil is discussed with particular reference to rates of application and costs per hectare. Herbicides considered are "Tropotox", "Gesatop", "Gesaprim" and "G

Brief note on sugar cane soils of the Gandevi tract. K. V. JOSHI, M. N. HASABNIS and K. J. BINDU. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), 242–250.

* * *

Note on trials on earthing-up and no earthing-up operations done in adsali cane in Walchandnagar Farm. D. S. DESHPANDE. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), 251–252.

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Note on the use of artificial N fertilizers. J. R. KAKDE and R. A. KALE. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), 261–267.

* * *

Agronomical research conducted on the estate of Bhopal Sugar Institute, Sehore. R. D. REGE. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), 268–274.

* * *

Physico-chemical changes in (the) major soil types of the Nira Canals under (the) prevailing system of sugar cane cultivation. II. Exchangeable calcium, magnesium, sodium, total nitrogen, available phosphate, available potash, organic carbon and C/N ratio. K. S. PHARANDE. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (2), 51–75.—Numerous profiles from the five major soil types in the area were examined[1]. Results are tabulated for the exchangeable bases and other constituents mentioned in the title.

* * *

Spring recommendations for the control of Johnson grass and other weeds and grasses in Louisiana sugar cane, 1968. ANON. *Sugar Bull.*, 1968, **46,** (10), 16–23. It is pointed out that fallow ploughing, several times, is still essential for the control of Johnson grass. There are at present no chemicals that are a substitute for fallow ploughing. A combination of mechanical and chemical control is needed. The correct use of herbicides such as TCA, "Fenac", and "Terbacil" ("Sinbar") for Johnson grass is dealt with. For control of Bermuda grass (*Cynodon dactylon*) two applications of a mixture of 2 lb/acre of TCA plus 1 lb/acre of "Dalapon" plus ½ to ¾ lb/acre of "Silvex" is suggested.

* * *

New varieties (in Malagasy). ANON. *Doc. Inst. Recherches Agron. Madagascar*, 1968, (140), 1–9.—An account is given of the introduction of new varieties of sugar cane during 1967, planting material being subjected to heat treatment (2 hours at 50°C). A list is given of varieties selected for multiplication and an assessment made of the present position in regard to disease resistance, notably to Fiji, leaf scald, and gummosis.

* * *

Studies on the germination of sugar cane. P. S. GILL. *Indian Sugar*, 1967, 17, 681–684.—Experiments on the treatment of sugar cane setts with "Aretan" to improve germination are reported. It was concluded that the above [illegible] are set with polyethylene film for two days (to conserve moisture) followed by dipping in 0·2% solution of "Aretan" is as effective as soaking fresh setts in the same solution and that the soaking of setts in water could therefore be dispensed with. The method is cheap and easy to adopt in commercial practice.

* * *

The loss of sugar in sugar cane after harvest. Part I. A. P. GUPTA, I. S. JUNEJA and M. NARAIN. *Indian Sugar*, 1967, **17,** 685–693.—Experiments were carried out on sugar loss after harvest with 4 commercial varieties of sugar cane, including an early, mid-season and late variety. Loss was negligible for the first 24 hours. Subsequent loss was related to atmospheric temperature and humidity. Loss varied with different varieties.

* * *

Problems of the sugar industry in Bihar. C. S. KOTHARI. *Indian Sugar*, 1967, **17,** 705–707, 710.—Problems discussed include inadequate irrigation and fertilizer supplies, high price of insecticides, non-availability of tractors and other agricultural implements, lack of soil research and credit facilities.

* * *

Ratoon stunting disease and drought, a disastrous combination. G. M. THOMSON. *S. African Sugar J.*, 1968, **52,** 201–203.—An account is given of trials comparing yields from heat-treated and untreated planting material infected with ratoon stunting disease, several varieties being used. The value of heat treatment was amply demonstrated. The advent of drought showed that r.s.d.-infected plants were much more severely affected by drought than healthy plants.

* * *

Nitrogen fertilizer use for cane. I. Amounts of N required. R. A. WOOD. *S. African Sugar J.*, 1968, **52,** 225–241.—The whole subject of nitrogen fertilizer for cane is discussed at some length. Experience in other countries is quoted. In South Africa N usage averaged only 21 lb N per acre in 1952. By 1965 this figure had risen to 119 lb N per acre and cane yield had increased by about 54%. Factors affecting the response of cane to N fertilizer, notably soil and soil moisture, are discussed. It is considered important to ascertain how efficiently the amounts of N currently applied to South African cane fields meet the cane's needs both under rain-fed and irrigated conditions.

* * *

Preliminary performance data for potentially promising commercial varieties. F. A. GUMBS and R. H. STRANG. *Proc. 1966 Meeting B.W.I. Sugar Tech.*, 29–33. Details are given of the selection and testing methods for Guyana conditions of the more promising selections from the 1956–58 breeding programme. Six new selections showing promise of being potential commercial varieties are indicated. A summary is given of relative performance and agronomic characters of 1959–61 selections grown for over 12 months in observation plots on sugar estates.

[1] *See also I.S.J.*, 1966, **68,** 238.

Brauns

Planning a
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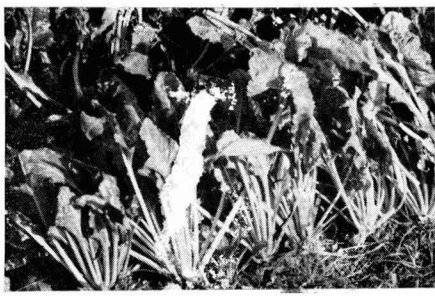
Sugar beet agriculture



Seedling cutting in sugar beet seed production. I. TODORIC. *Savr. Poljopr.*, 1966, **14,** (10), 809–822; through *Field Crop Abs.*, 1968, **21,** (1), 46.—Sugar beet seedlings cut in two lengthwise produced appreciably lower seed yields than uncut seedlings, especially at low seedling weights (300–500 g). Cut seedlings produced seed of inferior value, but differences were not significant. Their stems were shorter and weaker and the plants more subject to lodging and the effects of weeds.

* * *

Sugar beet root maggot control. ANON. *Research Rpt., Research Station, Winnipeg*, 1965–66, 23.—Reference is made to successful control of the sugar beet root maggot (*Tetanops myopaeformis*) in the past with "Carbophenothion" or "Ethion", but increased cost deters more widespread use. Investigations have been carried out on methods to minimize phytotoxicity in applying organophosphorus insecticides. Unfortunately these increase cost. A non-phytotoxic organocarbamate insecticide is under study. It is effective in root maggot control and if it becomes commercially available could simplify protective procedures.

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The spray warning scheme for control of sugar beet yellows in England: summary of results between 1959 and 1966. R. HULL. *Plant Pathology*, 1968, **17,** (1), 1–10.—Sugar beet growers in England have been advised since 1959 to spray their crops with systemic insecticide to control spread of yellows viruses when infestation with the vector aphids (mainly *Myzus persicae*) in May and June reaches 0·25 aphids/plant. The data collected up to 1966 show that aphid infestation at any one time is not proportionally related to eventual yellows incidence. Graphs of mean aphid infestation and yellows incidence in different areas are presented, which are a guide to issuing spray warnings.

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Laboratory experiments on sugar beet downy mildew (*Peronospora farinosa*). W. J. BYFORD. *Ann. Appl. Biol.* 1968, **61,** (1), 47–55.—The optimum conditions for spore production were : temperature 8–10°C and relative humidity (R.H.) 90% or more. However, many spores were produced between 5 and 20°C and between 80 and 90% R.H. Most spores were formed in darkness after leaves were exposed to light for 6–8 hours. Spores survived exposure to 60% R.H. for up to 5 days, but were soon killed by temperatures above 20°C. The germination capacity of spores collected from the field was often very small, but this could not be related to the weather. Most seedlings were infected when inoculated at the growing point and incubated in a saturated atmosphere between 3 and 15°C for at least 8 hours.

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Sugar beet production in the Peshawar valley as affected by different levels of nitrogen and plant population. O. JAN-MIAM. *Agr. Pakistan*, 1966, **17,** (2), 179–184; through *Biol. Abs.*, 1968, **49,** (1), 422–423.—Trials at the Sugarcane Research Station, Mardan, are reported in which 4 levels of nitrogen on 4 plant populations of sugar beet were tested. Application of 60 lb nitrogen per acre gave better yields than the remainder of the treatments but further work is proposed.

* * *

Sugar beet trials, 1961-66. L. A. WILLEY. *J. Nat. Inst. Agric. Bot.*, 1967, **11,** (1), 165–172.—Results are given of sugar beet variety trials carried out at four centres in England, one being on gravelly loam, one on sandy clay and two on peaty soils. The variety Sharpe's Klein E was used as control. The varietal assessments included percentage of bolting, yields of roots and sugar, sugar content, purity of juice and incidence of downy mildew. The monogerm varieties Amono, Bush Mono and Hilleshög Monotri were recommended for growing in Great Britain.

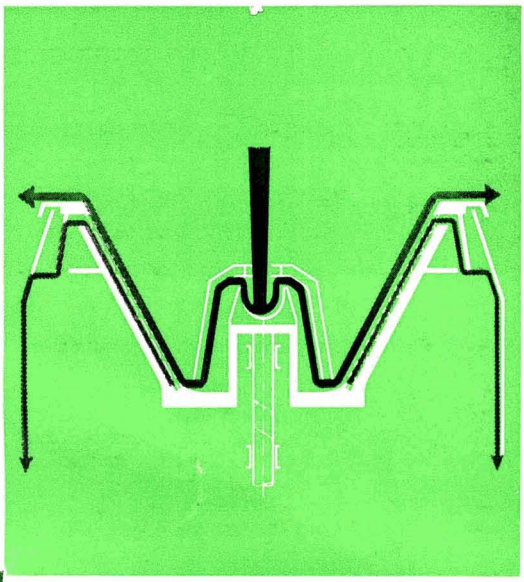
* * *

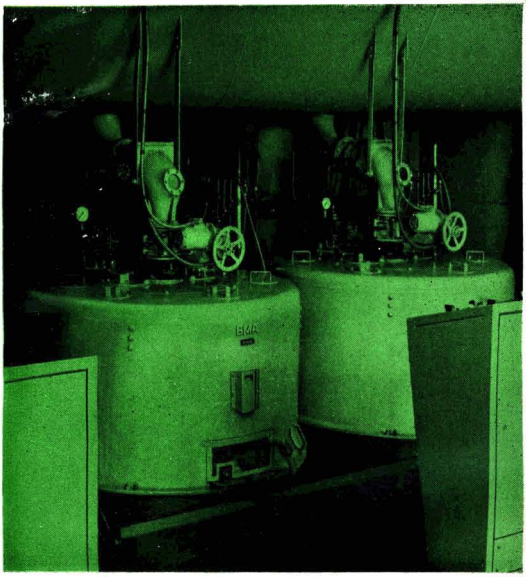
Studies on a new post-emergence herbicide with sugar beet. L. A. DURGEAT and P. DOZIER. *Paper presented to Int. Congr. Plant Protection*, 1967, 23 pp.—Results of trials or experiments with the new herbicide "Phenmedipham" are given, notably concerning its effect on various common sugar beet weeds. Sugar beet seedlings were not injured.

* * *

Sugar beet breeding and seed production in the Soviet Union. A. L. MAZLUMOV. *Sakhar. Svekla*, 1967, (10), 28–29; through *Plant Breeding Abs.*, 1968, **38,** 369. An account is given of the achievements of the 22 institutions in which research is carried out and the system of variety testing. Of 105 varieties tested in 1965, 87 were bred in the Soviet Union, each being adapted to a given area. The proportion of monogerm varieties grown has risen to 40·3%. Varieties with resistance to leaf spot, storage rot, mildew, bolting and other defects are mentioned.

Do you know the advant: ges of the K 850 continuous BMA centrifugal?





- higher capacity and lower price
- Less screen wear
- even less maintenance due to simplified design
- electrical control of oil circulation lubrication
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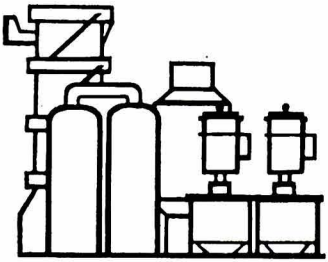
- remarkably smooth run of centrifugal

This machine was successfully put into operation in several countries during the last campaign.



Braunschweigische Masch inenbauanstalt

BMA

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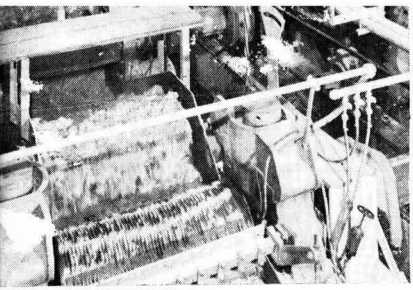
Planning and co uctic con ete be and r ne sugar factories as well as of chemical plants, among others for the production of alcohol, yeast, acetaldeh glac , aceti acid, etone, glutamat, starch, glucose, starch sugar (Dextrose).



Cane sugar manufacture

A successful trial of (the) D.M.C. process to produce white sugar without sulphur. A. C. CHATTERJI. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (ii), 73–77.—The results obtained at Aruna Sugars Ltd. with the defeco-melt crystallization process are compared with those obtained using double sulphitation, showing the advantages of the former over the latter. Savings are estimated at 3 rupees per bag of white sugar, all of which was of E-30 grade, while only 91% was of this quality with double sulphitation.

* * *

White sugar without sulphur. (A full season's trial of D.M.C. process.) A. C. CHATTERJI. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (ii), 78–81.—See *I.S.J.*, 1968, **70**, 371 and preceding abstract.

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The factory trial of (the) D.M.C. process and the views. A. C. CHATTERJEE. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (ii), 82–86. Letters are presented in support of the D.M.C. process and congratulating the author on success in obtaining E-30 grade white sugar without sulphur.

* * *

Phosphate treatment of clarified juice. A method of reducing losses in waste molasses. T. T. OOMMEN and B. S. GURUMURTHY. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (ii), 87–90.—See *I.S.J.*, 1968, **70**, 371.

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Use of phosphates in sugar manufacture. D. P. KULKARNI. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (ii), 147–160.—Experiments to establish the relative merits of single superphosphate, triple superphosphate and ammonium phosphate in clarification are discussed. Results mainly concern the last two, which contain nearly 3 times as much P_2O_5 as the first (45–47% compared with 16–17%). While triple superphosphate and ammonium phosphate gave identical purity rises and mud volumes when defecation and sulphitation juices were clarified, ammonia given off by the ammonium phosphate caused corrosion of brass tubes in the last effect of a quadruple-effect evaporator, so that ammonium phosphate is not recommended. In regard to the procedure to adopt in adding phosphate to clear juice before evaporation, it is emphasized that the juice pH should not be permitted to drop so low that inversion occurs, and juice retention in the [illegible] not be excessive.

The Buckau continuous centrifugals. Trials at Krishna Sakhar Karkhana. M. ANAND and D. B. SABNIS. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (ii), 161–173.—Results are given of the performance of 2200 r.p.m. Buckau-Wolf conical basket continuous centrifugals used for *C*-massecuite treatment. Used as fore-workers, the machines gave a molasses of 94·50°Bx and 36·45 purity compared with 91·13°Bx and 35·11 purity using 30 × 40-in 1440 r.p.m. batch machines of Indian manufacture. A stainless steel screen having 0·09 mm apertures handled greater quantities of massecuite than did a screen with 0·06 mm apertures, differences in molasses Brix and purity and sugar purity with the two screens being only slight. Used as after-workers, the continuous machines gave a sugar purity of 91·79 compared with 76·50 using the batch machines. Lubrication of the massecuite was advisable in order to prevent increased crystal breakage, molasses being preferable to water as lubricant since it permitted greater capacity without increase in final molasses purity. The massecuite feed rate and lubrication effect were increased by heating the massecuite to 50°C before purging. Advantages of the continuous machine are listed.

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Recent trend of provision of lesser drainage area to centrifugal baskets. A. D. PATHAK. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (ii), 201–204.—Calculation of the drainage capacity of a 24 × 48-in centrifugal basket at 720 and 1470 r.p.m. supports the view of centrifugal manufacturers that reduction of the drainage area will not adversely affect the performance of the machine, while giving the basket greater strength and durability.

* * *

Battle with corrosion. (Some thoughts on corrosion.) H. P. MUTHA. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (ii), 219–228.—The author draws on his experience in this discussion of causes of corrosion in sugar factory equipment and means of combating it.

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Trisodium phosphate addition to clear juice. M. ANAND and S. P. MAGON. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (ii), 229–235.—Tests are described in which trisodium phosphate was added to clear juice. Addition of 4 c.c. of a 10% phosphate solution (50 g trisodium phosphate per 500 c.c. solution) to 100 c.c. of juice halved the CaO content. Parallel factory tests gave similarly good

results, the syrup from the treated juice being of higher quality than without phosphate addition, massecuites being less viscous and evaporator scale being reduced, while the deposit was easily removable. Reasons for preference of trisodium phosphate to triple superphosphate are listed.

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Maximizing evaporator rating and capacity with "splitting" and other measures. K. S. R. RAO and S. H. RAO. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (ii), 237–241.—By coupling one pre-evaporator of 5000 sq.ft. h.s. with two evaporator cells, each of 900 sq.ft. h.s., and the 1st effect (1500 sq.ft. h.s.) of a quadruple-effect evaporator and operating all four as the 1st effect of the quadruple-effect evaporator, considerable reductions were obtained in firewood consumption for steam production, despite a much increased crushing rate.

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Burning bagasse on the step-grate furnaces and the importance of (the) air-fuel ratio. M. V. RAO and R. RAMACHYARULU. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (ii), 275–278.—Certain measures for ensuring efficient boiler operation are listed and experience at the authors' sugar factory with three water-tube boilers using step-grate furnaces is discussed. The importance of maintaining a suitable air:fuel ratio as a means of achieving optimum boiler performance is emphasized. A flue gas CO_2 content of 12–14% and an excess air rate of 40–60% are advocated.

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Displacement method of extracting sucrose. J. H. PAYNE. *Sugar J.*, 1968, **30**, (9), 26–28.—See *I.S.J.*, 1968, **70**, 245.

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Vacuum pan design—conventional and exceptional. D. E. WARNE. *S. African Sugar J.*, 1968, **52**, 138–149. A survey is presented of vacuum pan development in the sugar industry, starting with the design patented by HOWARD in 1813 and including the Fives Fille-Cail horizontal pan, of comparatively recent development.

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A study on the demineralization of sugar cane juice in India. S. MUKHERJEE, S. K. GHOSH, P. C. NIGAM and S. K. SRIVASTAVA. *Sharkara*, 1967, **9**, 40–50.—Pilot scale experiments were conducted on treatment of sulphitation juice by ion exchange using a strong cation exchanger in a mixed bed with "Duolite A-7" anion exchanger. The process gave 10% more crystal sugar than did conventional sulphitation, the sugar from the first two massecuite being superior to I.S.S. Grade 29. The purity of molasses from a 4-boiling scheme was about 35. The economics of the process are considered. Although there are difficulties concerning foreign exchange for the imported sulphur from which is obtained sulphuric acid used as regenerant for the cation exchanger, Indian pyrite deposits are considered sufficient to overcome the problem, and use of a closed cycle would necessitate only small amounts of sulphuric acid as make-up.

The continuous bagasse press increases milling efficency. B. STARRETT. *Bol. Azuc. Mex.*, 1967, (220), 18–21.—The French Oil Mill Machinery Co.'s bagasse press and its operation are described, with reference to its use at Grove Farm mill in Hawaii, Clewiston mill in Florida, and elsewhere.

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Control systems for sugar vacuum pans. J. G. ZIEGLER. *Paper presented to the 13th Congr. ISSCT*, 1968. During automatic boiling control experiments massecuite surface temperature could be adequately measured in terms of the temperature of vapour leaving the pan, consistency could be measured by the load on the circulator motor or that of a probe inserted below the calandria, while microscopes of 30× magnification proved better than proofsticks for examining the strikes. Conclusions reached on optimization of the process are discussed in respect of absolute pressure, levels, supersaturation, seeding and consistency. Important considerations for maximum production of good grain are listed and the sequence of operations in an automatic boiling scheme is described.

* * *

The capability of present-day control systems to achieve process control objectives. J. J. QUINTERO. *Paper presented to the 13th Congr. ISSCT*, 1968.—Systems of control for processes in a raw sugar factory are described and include mill tandem instrumentation, pH control in liming, temperature control in juice heaters, continuous in-line Brix measurement and control of boiling and crystallization, multiple-effect evaporator control, molasses dilution systems, crystallizer programming, and bagasse furnace combustion control.

* * *

Some techniques for the creation of control system designs. W. MCWHINNEY and C. R. MURRY. *Paper presented to the 13th Congr. ISSCT*, 1968.—Determination of performance data by calculation, checking and extension of mathematical models and by collection and analysis of operating records is illustrated by the description of an evaporator and a crushing train project.

* * *

Developments in automation of cane sugar factories. K. C. HU. *Paper presented to the 13th Congr. ISSCT*, 1968.—After describing closed-loop automatic control, the author discusses automation of the mill house, clarification, multiple-effect evaporators, vacuum pans, crystallizers, centrifugals and power production.

* * *

Future developments in factory automation. G. E. SLOANE and E. J. LUI. *Paper presented to the 13th Congr. ISSCT*, 1968.—Potential future developments in the automatic control of cane sugar factory processes are considered under three groups: measurement instrumentation, unit process control, and overall factory control. Items under each of the three headings are discussed.

Vacuum pan automation. S. RUY, K. TAKEUCHI and K. NAKAJIMA. *Paper presented to the 13th Congr. ISSCT*, 1968.—Full details are given of the Yamatake-Honeywell Co. Ltd. automatic boiling system tested at Kawasaki, Japan, which is claimed to be applicable to the production of various types of sugar in the same pan by exchange of cam plates which are used with a time-pattern transmitter for control of the boiling programme.

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Surface-active chemicals in low-grade boilings. J. C. P. CHEN. *Paper presented to the 13th Congr. ISSCT*, 1968.—Tests with two unnamed surface-active chemicals showed that they shortened the boiling time in low-grade pans to different extents and also had other beneficial effects on massecuite purging, sugar ash content and recovery. However, with normal cane quality and massecuite viscosity, these effects were smaller than with abnormal cane and highly viscous massecuites. The change in conductivity of massecuites when surface-active materials are used is emphasized.

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Pressure filtration for raw house cachaza. J. C. P. CHEN. *Paper presented to the 13th Congr. ISSCT, 1968.*—Details are given of trials, lasting 600 days, with "Fas-Flo" pressure leaf filters used to treat clarifier mud. At Casa Grande sugar factory, where the tests were conducted, the filters have proved superior to vacuum filters as regards initial cost, maintenance and performance.

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The use of materials balances for milling train calculations. P. G. ATHERTON. *Paper presented to the 13th Congr. ISSCT*, 1968.—The use of materials balances for calculating weights and volumes of mill feed, bagasse and juice in a milling train and of volumetric data, based on these balances, for calculation of escribed volume ratios, compression ratios, reabsorption factors and volumetric coefficients, etc., together with other analytical data for cane and bagasse, is exemplified by a sample calculation for a tandem of four mills with three pressure feeders. The calculated figures are presented in tabular form.

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Automatic measurement and adjustment of phosphate levels in mixed juice. V. C. M. NOTHDURFT. *Paper presented to the 13th Congr. ISSCT*, 1968.—Details are given of a semi-automatic system for adjusting the level of phosphate in juice to an optimum for clarification, which has been developed and installed at an Australian sugar factory where superphosphate is added to the juice. Adjustment to the target level takes about 5 minutes.

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Development and operation of the continuous filtration process for first carbonatation juice in a cane sugar factory. W. CHEN, Z. H. HSU and M. T. TSAI. *Paper presented to the 13th Congr. ISSCT*, 1968.—Details are given of a continuous system in which 1st carbonatation juice was treated in four subsiders in parallel, the muddy juice from these being sent to an "EimcoBelt" filter. The clear juice and filtrate went to second carbonatation without further treatment. Tabulated data show the beneficial effects of the subsiders as thickeners and of the advantages of the "EimcoBelt" filter over filter-presses, as regards juice and cake analysis.

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Post-harvest deterioration losses in sugar cane in Queensland. B. T. EGAN. *Paper presented to the 13th Congr. ISSCT*, 1968.—The deterioration in chopped cane and in juice from it when the cane is stored for more than one day is discussed. Although chopper harvesters have economic and operational advantages, it is emphasized that the harvested cane should be crushed as soon as possible after harvesting, which is not so essential with whole-stalk cane.

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Heat balance determination and heat utilization in the sugar cane mill. C. J. LU, T. W. HUNG and C. M. HWANG. *Paper presented to the 13th Congr. ISSCT*, 1968.—The heat economies at seven Taiwan sugar factories are examined, heat consumption being expressed in KBTU/TC (thousands of B.Th.U. per ton of cane), for comparison between the factories. Heat distribution in the mills averaged 10–12% for power, 70–78% for the boiling house, 1·2–3·3% for heat loss, 0·1–7·3% for curing, filtering, etc., and the balance of 9·7–13% was in condensate. The carbonatation process required 19·8% more heat than simple defecation, of which 13·8% arose from the more complicated boiling scheme. It was found that an increase of grinding capacity of 100 tons/day decreased the total heat consumption per ton of cane by 2–3%. Most opportunity for heat economy lies in evaporation; a 1% increase in mixed juice Brix decreases steam demand by 1%. The two most important factors affecting the heat economy of a mill are the grinding rate and sugar content of the cane.

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Automation in (a) cane sugar factory. C. J. LU. *Paper presented to the 13th Congr. ISSCT*, 1968.—Details are given of the centralized control scheme designed for cane unloading, mill operation, clarification, evaporation, boiling and boiler combustion control at Kaohsiung sugar factory. Three control levels are involved: feedback, level efficiency and balance, and supervision control.

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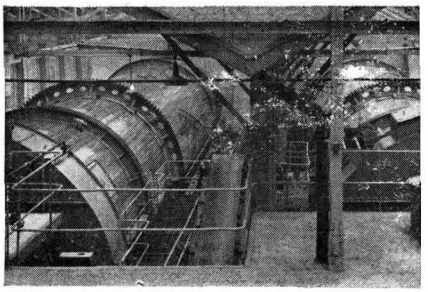
Process engineering, kinetic and stress-technical basic principles for the construction of modern large baskets for sugar centrifugals. P. FREUND. *Paper presented to the 13th Congr. ISSCT*, 1968.—The significance of centrifugal basket dimensions and proportions on performance are considered and the effects of stress on the basket discussed. The design of large baskets is considered in the light of the knowledge of stress and deformation. Excessive perforation of basket linings is deprecated.

Beet sugar manufacture



Improving the organization of calculation and control of the purity of raw material (beet). O. V. BRAUN. *Sakhar. Prom.*, 1968, **42**, (1), 27–28.—The author calls for more efficient overall supervision of the beet tarehouse and factory laboratory in Soviet sugar factories so as to remove discrepancies arising because of changes in beet composition during prolonged storage in the beet yard.

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Experience in working with S-17 diffusers. V. M. PEREVERZEV. *Sakhar. Prom.*, 1968, **42**, (1), 43. Fracture of the scroll shaft in a S-17 sloping trough diffuser has occurred at a number of Soviet sugar factories. Experience at one factory has shown the fault to lie in inaccurate location of the shaft at its fulcrum. Guidance is offered on establishing the fulcrum using a theodolite.

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Cover-less method of beet storage. A. A. BORISOVICH and N. V. SAMCHUK. *Sakhar. Prom.*, 1968, **42**, (1), 49–51.—Spraying of beets with milk-of-lime when first stored and then at approximately monthly intervals during 2 months reduced beet sprouting and mould formation by 60% compared with beets covered with rush matting, cut beet weight losses by 1·2% and average daily sugar losses by 0·005% to 0·010–0·0115%. Natural ventilation was used, giving a pile temperature 4–6°C lower than in the covered piles. The milk-of-lime concentrations were 12–14 kg/100 litres water for the first dose, 14–16 kg/100 litres for the second, and 16–18 kg/100 litres for the third. Other advantages of the system include a reduction in man-power and in materials.

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Reduction of maintenance and repair costs in sugar factories through efficient use of welding techniques. P. LUESCHER. *Sucr. Franç.*, 1968, **109**, 49–53.—See *I.S.J.*, 1968, **70**, 374.

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Studies on the filtration of carbonatated juice by Oliver filter. T. KOJIMA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1967, **19**, 18–28.—Details are given of investigations carried out at the author's factory with the aim of reducing losses in filter cake formed on Oliver rotary drum filters. These involved the juice lines (diameter, distance between vacuum receiver and pump, occurrence of elbows and bending, and scaling), cracks in the cake (eliminated by spraying with water immediately after filtration), and temperature of the wash water, which should be as low as possible to present cavitation in the juice pumps.

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The purification of beet sugar solution by means of (a) continuous ion exchange process. M. SUGAWARA, T. MATSUOKA and K. YAMAMOTO. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1967, **19**, 47–61. Details are given of experiments with a continuous ion exchange process using IR-120 B exchange resin and IRA-93 anion exchange resin to treat sugar solution. Although the results are not considered satisfactory (95% demineralization, 80–95% nitrogen compound removal and 80% decolorization giving a purity of 97·5), the process is thought to be a practical proposition in view of other advantages, although the cation exchanger was of low mechanical strength, while the anion exchanger was of high mechanical strength but had a low reaction rate. Dilution of the sugar solution was only 4–5%. The continuous process was found to be more economical than fixed bed treatment.

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Quality of condensates for steam boiler feed. J. VALASÁK and K. Číž. *Listy Cukr.*, 1968, **84**, 33–38. Experiments were conducted on the use of condensate from a pre-evaporator and 1st vapour for modern high-pressure boilers (operating at 38 atm to produce 50 tons of steam/hr). Apart from hardness and sugar, it was also found that ammonia and aliphatic impurities could be removed by cation exchange on a Na^+ cycle. Silicon dioxide in make-up water can be removed cheaply by means of aluminium sulphate. The possibility of systematic control of the conductivity of feed water and saturated steam has been confirmed. Diagrams are given of flow schemes for medium- and high-pressure boilers and standard feed water analyses are quoted from Czechoslovak Standard Specification 077401.

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Ion exchange operation at two beet sugar factories in Japan. K. SANO and M. YAMAHA. *J. Amer. Soc. Sugar Beet Tech.*, 1967, **14**, 377–388.—Details are given of the ion exchange process developed by Ebara-Infilco Co. Ltd., of Tokyo, Japan, for thin juice demineralization and decolorization[1], which is used at the Aomori beet factory of Fuji Seito (Sugar

[1] KAMODA & VON PROSKOWETZ: *I.S.J.*, 1967, **69**, 376.

Refining) Co. Ltd. and at the Honbetsu beet factory of Dai-Nippon Sugar Manufacturing Co. Ltd. At Aomori factory the cation exchanger waste regenerant is passed through a further cation exchanger to recover betaine. Some differences between the processes at the two factories are noted. Detailed tabulated data indicate the high performances of the stations. The juice stream is split and one stream cooled and deionized, while the other is passed through decolorizing resins without cooling. Deionization was found to remove more colour than the decolorizing resins at Aomori factory, although blending of the two streams after treatment provided a desirable buffering effect and prevented any adverse effect on evaporation. The "Duolite C-25" cation exchanger used was effective in adsorbing ammonia, amino compounds and betaine, although pyrrolidone carboxylic acid was removed by the "Duolite A-30B" anion exchanger. Because of a certain amount of attrition loss in the case of the anion exchanger, its replacement with "Duolite ES-57" epoxy-polyamine resin is to be tested. The latter has proved promising in pilot-scale tests.

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Planning of thin juice de-liming stations. II. P. STRÁNSKÝ. *Listy Cukr.*, 1968, **84**, 38–42.—Detailed balances are given for a proposed continuous deliming station for thin juice at a factory with a daily beet slicing capacity of 4000 tons. The station uses "Wofatit KPS-200" cation exchanger in Na^+ form. Regeneration with NaCl can be reduced to 3 hr by suitable automatic control. A method of liquidating spent eluate and recovering the salt brine without the problems of effluent discharge into open waters is proposed.

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Beet sugar in India. ANON. *Sharkara*, 1967, **9**, 11–12. Results obtained during a trial period at Saraswati Sugar Mills Ltd. indicated that sugar recovery from beets at 11·90% on beet can be expected to exceed that from cane in the Punjab region. At a draught of 114·19% in the DDS diffuser used, pulp pol content was 2·1 and extraction was 90·99% on beet pol. Total losses were estimated at 3·86% on beet.

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Observations in low raw crystallization. K. W. R. SCHOENROCK. *J. Amer. Soc. Sugar Beet Tech.*, 1967, **14**, 413–423.—The performances of the low-grade stations at the five beet sugar factories of The Amalgamated Sugar Co. were investigated on the basis of findings from previous studies[2]. The nomograms and alignment charts established earlier for optimization of low-grade raw sugar crystallization had to be recalibrated on the basis of occasional sucrose solubility tests. The greatest effect on sucrose solubility in molasses was exerted by the alkali and raffinose concentration, respectively, whereby the solubility rose with decrease in the potassium and sodium contents and fell with increase in the raffinose content. Observations at individual factories are noted.

Establishment and development of the Greek sugar industry. P. H. NELSON and J. ANDERLEI. *Zeitsch. Zuckerind.*, 1968, **93**, 110–113.—A survey is presented of the Greek beet sugar industry, which centres around three white sugar factories at Larissa, Platy and Serres, and which has raised production from 2,975 metric tons of sugar in 1962, when the industry started, to 110,723 metric tons in 1967. Sugar yield per ha in 1967 was 8·661 tons, the total beet area being 16,180 ha and the average root yield 57·60 tons/ha.

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Sugar silo at Sucreries Réunies de Quévy-Péronnes. J. LADMIRANT and J. BLAUDE. *Sucr. Belge*, 1968, **87**, 357–366.—Details are given of a white sugar silo constructed by Ateliers Belges Réunis S.A. in collaboration with Raffinerie Tirlemontoise S.A. The sugar is fed from the factory by a covered belt conveyor to the top of the central tower in the silo and falls through two rotating chutes, diametrically opposite each other, into two vertically telescopic chutes down which the sugar falls to the required height, forming two diametrically opposed piles near the tower. The sugar is then slowly distributed over the width of the silo by a system of two rotating rakes, formed by a beam equivalent in length to the radius of the silo and a series of suspended baffle plates presenting an inclined vertical face to the direction of travel. The angle of the beam's trajectory is adjustable to give minimum effort, and the speed of the rakes is about 2 r.p.h. Sugar is reclaimed by reversing the direction of the rakes and scooping the sugar through openings in the tower wall and down to an underfloor conveyor. On the basis of this prototype, a range of silo sizes is now available covering 10,000–40,000 tons of sugar. Results with the silo have proved highly satisfactory, reclaimed sugar having the same condition as when first stored. Air blowing is not required, and reclaiming has presented no difficulties, one sweeping of a layer of sugar a few millimetres thick being sufficient to obtain a silo completely free of sugar.

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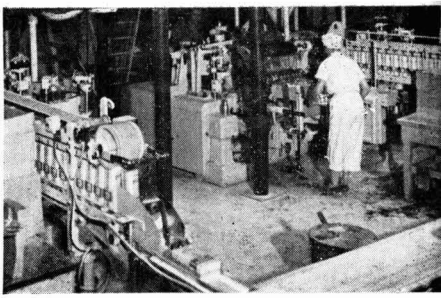
Some relationships in 1st carbonatation juice filtration. S. M. ZAGRODZKI. *Gaz. Cukr.*, 1968, **76**, 34–36.—The effects of filtration pressure and temperature, raw juice purity, diffusion temperature and pH, and 1st carbonatation juice CaO content on filtration of 1st carbonatation juice were studied and the relationships expressed in graph form. The rate of filtration was found to increase with increase in the amount of lime added and is proportional over a wide range to the ratio between $CaCO_3$ and non-sugars contents in the mud. The filtration rate fell with reduction in juice purity. With prolonged campaigns it is important to use much greater quantities of lime than normally, in order to maintain satisfactory filtration and ensure good juice settling. A reduction in the final alkalinity of 1st carbonatation juice was found to reduce the quantity of non-sugars removed and hence increases the lime salts content.

[2] SCHOENROCK & JOHNSON: *I.S.J.*, 1967, **69**, 148.

Sugar refining



Kinetic evaluation of continuous and batch refining methods. IV. J. BURIÁNEK. *Listy Cukr.*, 1967, **83,** 106–114.—On the basis of earlier work[1] dimensions are worked out for a continuous vacuum pan containing seven sections and having a capacity of 8000 kg of sucrose (in 1st remelt liquor) per hr. Equations are presented for calculation of the various parameters.

* * *

Storage and preparation of sugar. H. GERICKE. *Susswaren*, 1966, **10,** 1030–1036; through *S.I.A.*, 1967, **29,** Abs. 127.—Sugar storage installations and ancillary equipment supplied by Bericke & Co., Regensdorf-Zürich, are described. The layout of an installation for bulk storage of direct consumption sugar is shown. Short illustrated descriptions are given of preparation machines for breaking up sugar which has hardened in storage, sieving machines and a mill for producing powdered sugar. The reduction in crystal size caused by screw and pneumatic conveyors and by an "Econ-o-Lift" hanging bucket conveyor is compared. The latter causes little size reduction or dulling of the crystals, and is therefore recommended for sugar to be used in cube manufacture.

* * *

Continuous cold sterilization of liquid sugar in storage tanks markedly reduces cleaning frequency. K. ROBE. *Food Process. Market.* (Chicago), 1965, (11), 178–179, 182; through *S.I.A.*, 1967, **29,** Abs. 144.—Liquid sugar in storage tanks at a Californian sugar factory is circulated through a continuous U.V. sterilizer outside the tanks. The liquid flows around four U.V. tubes in series through a pipe containing a helical baffle. Turbulent flow ensures thorough exposure of the liquid to the rays; the process is not suitable for coloured products. The frequency of tank cleaning has been reduced 12 times by the treatment, which is normally carried out for 6 hr per day per tank. Cleaning is carried out by spray rinsing for 3 hr with water at 170°F, followed by a fog spray of a quaternary ammonium solution.

* * *

Quick dissolving sugar cubes by new process. ANON. *Food Process. Market.*, 1966, **35,** 471–474; through *S.I.A.*, 1967, **29,** Abs. 269.—The production of cubes at Tate & Lyle's Thames Refinery, London, is described. In the Chambon process now used the cubes are individually moulded; they are relatively soft and dissolve quickly. Sugar from the dryer is automatically weighed and mixed with water to give a moisture content of 2·3%. It falls into moulds on the surface of the drum of a Chambon machine, and is pressed into cubes. As the drum rotates, plungers eject the cubes onto plates. After drying in a stove for 25–30 min, the cubes are picked up by pneumatic devices and packed into 1-lb boxes. Two sizes of cube are produced; the capacity of each of the three machines is 2 tons/hr.

* * *

Production of powdered sugar and use of a 262-D mill. T. RZESZEWSKI and A. SZULC. *Gaz. Cukr.*, 1967, **75,** 120–121.—The production, marketing and packing of powdered sugar are briefly discussed and an East German 262-D pulverizer is described.

* * *

Clarification in the refineries. M. S. CASTELLÓ. *Bol. Ofic. A.T.A.C.*, 1966, **21,** (4, 5, 6), 4–13.—The development of the phosphatation-aeration system of clarification is surveyed, and descriptions given of the equipment used. Other factors are discussed, including liquor temperature, aeration, pH, density and quantities of reagents required.

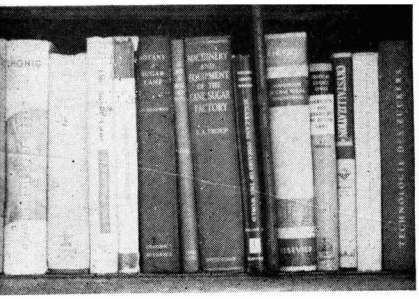
* * *

Asepsis and bacteriological control in refineries. A. VERA Z. *Bol. Ofic. A.T.A.C.*, 1966, **21,** (4, 5, 6), 74–83. Measures recommended for avoidance of infection in refineries annexed to raw sugar factories include external and internal painting of equipment, daily cleaning to eliminate dust and spillage accumulation, good ventilation and sufficient light. The various micro-organisms encountered in sugar manufacture are listed and an account is given of infection of mills, clarifiers, syrup and molasses storage tanks and raw sugar. Control of infection in the refinery is discussed with mention of the principal points where contamination occurs.

* * *

Plate-type evaporator. S. UCHIKUGA. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1967, **18,** 33–39. Tests were carried out with a horizontal plate-type evaporator used to concentrate refinery fine liquor. The overall heat transfer increased with higher liquor feed rate, Brix and process temperature, but decreased with increase in the difference between the heating vapour temperature and the boiling point of the liquor. Values of the coefficient can be used to calculate the number of plates required for a given duty.

[1] *I.S.J.*, 1966, **68,** 340; 1967, **69,** 247; 1968, **70,** 87.



New books

Sugar crystallization. (Proceedings of the 13th General Assembly of the Commission Internationale Technique de Sucrerie, Falsterbo, Sweden, 1967.) 623 pp.; 6 × 9½ in. (General Secretariat of the CITS, Aendorenstraat 1, Tienen, Belgium.) 1968. Price: 850 Belgian Francs; £7 2s 0d.

This edition contains the texts and discussions of the 35 papers presented at the 13th CITS General Assembly held in Sweden in 1967. The main theme, as the title suggests, was sugar crystallization, but other subjects were also covered. The papers are published in the language in which they were presented, German, French and English being used. Details are also given of members of the Administrative and Scientific Committees and a list and photograph are presented of those members participating in the 1967 Meeting. Copies of the Proceedings may be obtained from the General Secretariat, payment to be made to C.C.P. 18.180 of the "Caisse Tirlemontoise de Dépôts", Account C.I.T.S. No. 061/1652, Tienen, Belgium.

* * *

El hambre y el hombre. (Hunger and man: agricultural programme for 1965-75). J. CH. RAMÍREZ. 90 pp. (J. Ch. Ramírez, Eugenio Sué No. 316, México, D.F.) 1967.

The diverse agricultural activities that abound in Mexico and future programmes are discussed. Sugar cane cultivation is considered to be at the crossroads and great changes may be expected, although much may depend upon economic considerations.

F.N.H.

* * *

F. O. Licht's Internationales Zuckerwirtschaftliches Jahr- und Adressbuch 1968. (International sugar economic yearbook and directory.) H. AHLFELD. 390 + 64 pp.; 8½ × 11½ in. (F. O. Licht K.-G., P.O. Box 90, 2418 Ratzeburg, Germany.) 1968. Price: DM 46.--; £4 18s 6d.

Among the changes in the layout of the latest edition of this well-known directory is the arrangement of factory and refinery data under each country in single- as opposed to double-column form. It seems to the reviewer easier to find the information, mostly because of greater spacing between entries. The arrangement of the 11 main sections into which the Directory is divided is otherwise unchanged, with information on EEC sugar marketing regulations, German and other sugar organizations, sugar importers and exporters, sugar machinery manufacturers, a Buyers' Guide, an English-German glossary of sugar machinery terms, and details of some sugar publications and their publishers' addresses. A 64-page supplement gives statistical information covering Germany and the world. Included in the technical article section is a study of modern analytical methods in the sugar industry, by W. MAUCH & H. BOURZUTSCHKY, and a survey of cane diffusers by H. J. DELAVIER. As always, the bulk of the book is devoted to addresses and details of beet and cane sugar factories and refineries throughout the world. Most of the information has been brought up to date, but it is confusing to find, for instance, duplication of some sugar factories under "factories" as well as "refineries". This, however, is not so important as the information on some countries, which, through no fault of the publishers, is out of date and has evidently been repeated from previous editions, owing to a lack of response to requests for more recent data. This is a pity after all the work that has been put in by the compilers, and it is to be hoped that eventually sugar manufacturers throughout the world will come to realise that they do a disservice to the world industry by failing to provide information which need not remain a commercial secret. All credit, then, to F. O. Licht for providing an excellent directory to the world sugar industry. It deserves to be appreciated by all requiring the comprehensive information it contains.

* * *

Sudan. 35 pp.; 6 × 8 in. (Barclays Bank D.C.O., 54 Lombard St., London E.C.3, England.) 1967.

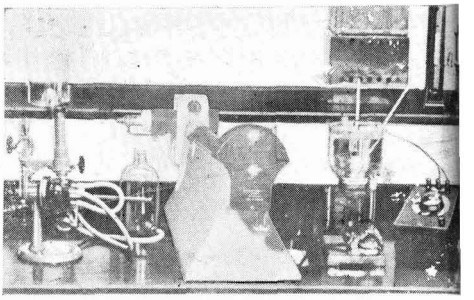
Unfortunately only a few lines go to make up the section on sugar in this survey, the Guneid and Khashm-el-Girba sugar factories being mentioned. The other information that may be of interest to readers covers climate, geography and particularly the irrigation schemes.

* * *

La tierra, lo humano y el azúcar. (The land, the human, and sugar.) J. CH. RAMÍREZ. 474 pp.; 5¼ × 8 in. (J. Ch. Ramírez, Ingenio "El Modelo", Villa Cardel, Ver., Mexico.) 1967.

The author presents a series of essays, illustrated with photographs, quotations and statistics, in which a large number of aspects of the Mexican cane sugar industry and its relation to the sociology and economy of his country are discussed.

Laboratory methods & Chemical reports



Some aspects of composition of evaporator condensates. D. P. KULKARNI. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (ii), 205–212.—Condensate from each effect in a quadruple-effect evaporator at Yeshwant sugar factory, India, was analysed for pH, ammonia and oxidizable matter. pH varied from 6·8 to 9·5 when defecation was used and was in the same approximate range when sulphitation was used. Ammonia varied widely in the range 2·5–40 p.p.m. The organic matter content ranged from 34·6 to 337·6 mg/litre. No correlation was established between pH and ammonia content, nor between oxidizable matter content, pH and ammonia content.

* * *

Unknown pol losses: certain observations. M. ANAND and A. N. AGARWAL. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (ii), 213–218.—Unknown losses are divided into two categories: (i) those caused by errors in weighing, sampling and analysis, and (ii) "true" unknown losses. Difficulties in arriving at an accurate pol balance are discussed, whereby it is pointed out that it is useless to aim at an accuracy greater than 95–97% in establishing a pol balance. It is suggested that if a pol unknown loss less than 0·42 is claimed by a sugar factory, this figure will probably be the result of a number of "mutually complementary errors".

* * *

Determination of some saccharide acids by thin-layer chromatography. D. VESELKOVÁ and B. KOPŘIVA. *Listy Cukr.*, 1968, **84**, 30–33.—In thin-layer chromatographic separation of organic acids occurring after sucrose oxidation by nitric acid, a mixture of 4 g silica gel, 1·7 g "Celite 545" and 0·7 g plaster of Paris proved the best carrier, while 3:2:1:2 benzyl alcohol: *iso*propanol:*tert.*butanol:water plus 2% formic acid was the best solvent of those tested. Detection of the acids presented no difficulties using bromophenol blue in an ethanol-acetone mixture. R_f values are given for gluconic, glucuronic, glucaric, tartaric, oxalic and hydrochloric acids as well as for lactones of the first three acids.

* * *

A rapid and practical method of determining extractable white sugar as may be applied to the evaluation of agronomic practices and grower deliveries in the sugar beet industry. S. T. DEXTER, M. G. FRAKES and F. W. SNYDER. *J. Amer. Soc. Sugar Beet Tech.*, 1967, **14**, 433–454.—To give a press juice having exactly the same composition as juice in the beet, a technique has been used in which about 600–800 g of beet brei were placed in the centre of a large piece of unbleached muslin and the brei then hand squeezed to give about 200 ml of juice after the first 40–50 ml had been discarded. A modification of the C' ERS & OLDFIELD method[1] for purity determination was used, in which milk-of-lime equivalent to 1·5 g CaO is added with stirring to 75 ml of the expressed juice, which is then stood for 4–5 min. The pH is then adjusted to 11·6 by adding 8–12 drops of 95% H_3PO_4 with constant and vigorous stirring, and then to 11·2 with 1:10 dilute H_3PO_4. After heating with occasional stirring to 67°C for about 8 min, the juice is filtered under vacuum and adjusted to pH 9·2 with 1:40 dilute H_3PO_4 before heating to 37°C. It is then gravity-filtered into test tubes placed in a cold water bath, so that the temperature is 19–20°C by the end of filtration. The solution is then mixed and the RDS and pol determined (the latter in a 50-mm tube). The values obtained were used, together with raw juice purities and marc contents, to give factors applicable to the pol of lead-clarified press juice for determining beet sucrose content. Tables showing the derivation of these factors are presented. The table of sucrose contents was applied to comparison of the Sachs-le Docte method with the expressed juice method. Correlation was very high ($r = 0·99$ or higher). Advantages of the proposed method are listed.

* * *

High-voltage paper electrophoresis of sugars: a comparison with thin-layer chromatography. D. GROSS. *Proc. Soc. Analyt. Chem.*, 1968, **5**, 51–52.—A summary is given of a paper in which high-voltage paper electrophoresis is compared with thin-layer chromatography for separation of sugars. As regards resolving power, speed and reproducibility, electrophoresis is preferred, since in many cases it is better and simpler than thin-layer chromatography, as it does not require preparation and activation of plates. On the other hand, it is far more expensive and elaborate. A number of references are made to work conducted by sugar chemists.

* * *

Enzymatic-photometric determination of D-glucose and D-fructose in consumption sugar. J. TSCHERICH and W. MAUCH. *Zeitsch. Zuckerind.*, 1968, **93**, 107–110. A method for determining glucose and fructose,

[1] *I.S.J.*, 1961, **63**, 72–74.

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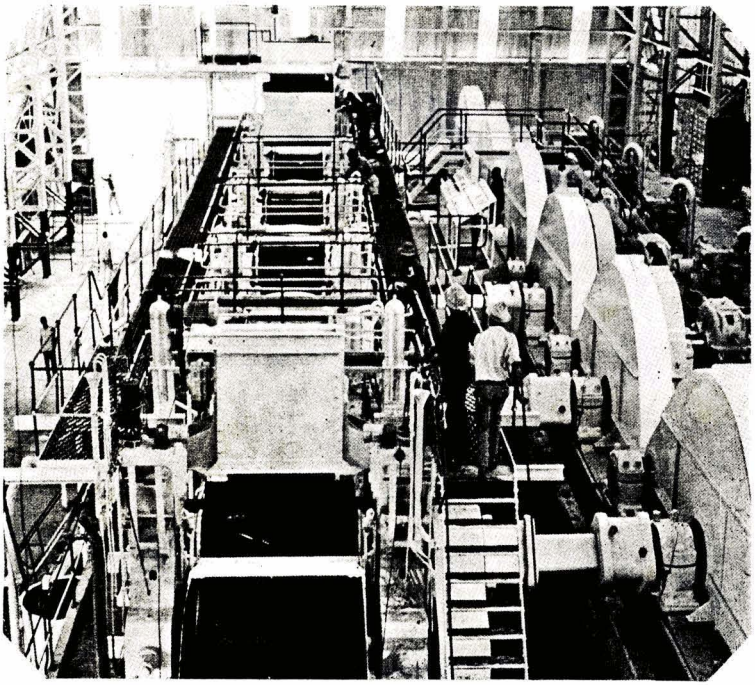

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separately or together, is described. It is based on catalysis by hexokinase of the transfer of a phosphate residue from adenosine triphosphate to glucose or fructose to form glucose-6-phosphate or fructose-6-phosphate and adenosine diphosphate. Glucose-6-phosphate is oxidized by giving up hydrogen under the catalytic action of glucose-6-phosphate dehydrogenase and in the presence of nicotinamide adenine dinucleotide phosphate (NADP), which is reduced to NADPH by accepting the hydrogen. The quantity of NADPH, which can be measured photometrically at 340 or 366 nm, is equivalent to the quantity of glucose-6-phosphate and hence glucose. Fructose-6-phosphate is converted to glucose-6-phosphate by phosphoglucose isomerase. Model tests with sucrose solutions, to which known quantities of invert sugar were added, showed high recoveries, e.g. 98·3% recovery of 0·006% invert sugar in 20 g of sucrose with a standard deviation of 2·5%. The lower limit is 0·005% invert sugar.

* * *

Molasses exhaustion. Cane sugar refining 1967. R. CAROLAN. *Rpt. Research & Dev. Dept. Irish Sugar Co. Ltd.*, 1968, (213), 6 pp.—Analyses of refinery molasses from Carlow sugar factory, where cane raws were refined during 1967, show amounts of crystallizable sugar to be similar to the quantities found in molasses from the previous beet campaign. Reduction in sucrose purity in a crystallizer was of the order of 10% after 1 day and about 21% after 4 days, while the averages for the 1966/67 beet campaign were 12% and 18%, respectively. Although the ratios of total sugars expressed as (sucrose + reducing sugars) and of total sugars expressed as sucrose (assuming two molecules of reducing sugar equivalent to one of sucrose) to the number of mg-atoms of (K + Na + Ca + Mg) in the molasses were equally close to unity, expressing total sugars as sucrose resulted in greater scatter than adding reducing sugars to sucrose, and the ratio of sucrose to non-sugars is therefore considered more suitable as a criterion for refinery molasses. According to the tests, the value should be 0·9–1·0 in well-exhausted molasses.

* * *

Methods for determining sugar cane quality before beginning the complete milling. M. CAZAL. *La Ind. Azuc.*, 1967, **73**, 341–344.—Two methods of analysis of cane are briefly described and their usefulness explained. The first employs either a small shredder for breaking up the cells of the cane sample, after which it is extracted with cold water in a ball mill, and the Brix and purity of the sugar solution measured. The sucrose % cane can be calculated simply by using a number of empirical values for terms in the calculated formula, but the operation is a rather slow one. The second method is much more rapid and can also give the fibre content % cane, but it involves the use of an expensive hydraulic press which is used to separate almost all the juice from the cane sample, from which the richness is determined by measuring juice weight and Brix.

Microbiological research on thick juice storage. N. TAYGUN. *Seker*, 1967, **16**, (62), 5–9.—Tests are described in which thick juices of 61·4–71·95°Bx were stored, both out-of-doors and in the laboratory, in open, plugged or sealed flasks, sterilized and unsterilized. Moulds developed naturally only on the lower Brix juices which had not been treated with formalin although, where previously inoculated, they grew on thick juice of even 70·2°Bx. Where micro-organisms developed, the pH fell and inversion occurred, while raffinose and kestose were also formed.

* * *

Gravimetric and conductimetric ash determination and the C-ratios of products (of purity >90) of Ankara sugar factory. S. SUBAYGIL. *Seker*, 1967, **16**, (62), 10–14.—C-ratios (gravimetric ash/specific conductivity) were measured for 5°Bx solutions of a large number of samples of thin juice, thick juice, massecuite, remelt liquor and low-grade sugar from Ankara sugar factory. The data are tabulated.

* * *

Determination of lime and hardness in sugar factory products with complexon. N. SENDÖKMEN. *Seker*, 1967, **16**, (63), 1–5.—A review is presented of methods described in the literature for determining calcium and magnesium in sugar factory products using EDTA instead of soap solution.

* * *

Analysis of crystal sugar produced during the 1964 and 1965 campaigns. S. SUBAYGIL. *Seker*, 1967, **16**, (64), 11–16.—Tables are presented of colour, turbidity, ash, SO_2, invert sugar, moisture, pH buffering power, odour and floc data for sugar from the 17 Turkish sugar factories, as well as ratings by the Braunschweig points system. Methods used were those recommended and adopted by ICUMSA.

* * *

Determination of invert sugar in clarified and unclarified beet and raw juice samples by the Berlin Institute method. S. SUBAYGIL. *Seker*, 1967, **16**, (65), 11–14. Invert sugar measurements by the Berlin Institute method on beets and raw juices from seven Turkish sugar factories showed values of 1·27—2·48 and 1·05–1·47, respectively, for the ratio between unclarified and clarified samples. The ratio was virtually unity for white and raw sugars. To obtain accurate results, the samples should be clarified with lead acetate followed by de-leading with sodium phosphate and potassium oxalate.

* * *

Homogeneity of crystal sugar and determination of average crystal size and crystal form. Y. SARAY. *Seker*, 1967, **16**, (65), 15–22.—The MA-CV method of indicating crystal size and regularity is explained and Turkish sugar data are recorded. Freedom from

conglomerates is assessed by photographic comparison of a sample of not less than 25 crystals with standard photographs. Eight such photographs from Turkish factories are illustrated.

* * *

Influence of heat and pH on deterioration of molasses. N. TAYGUN. *Seker*, 1968, **17**, (66), 1–5.—Decrease in molasses stored at Susurluk sugar factory was at first thought to be due to microbiological action, but on investigation was shown to be a chemical loss due to heat and pH factors.

* * *

Dependence of sugar purity on E.R.H. and the water absorbed by sugar from a moist atmosphere. Y. SARAY. *Seker*, 1968, **17**, (66), 10–16.—Experiments are described in which sugar from the 17 Turkish sugar factories was subjected to atmospheres of known relative humidities, where they achieved equilibrium after 24–48 hours, in order to learn the conditions under which they could be safely stored and which was the best sugar in this respect.

* * *

Development of an automatic sampler and a system for direct analysis of sugar cane consignments. E. J. BUCHANAN. *Paper presented to the 13th Congr. ISSCT*, 1968.—An automatic cane sampler is described. Developed in South Africa, the device has shown promise in preliminary tests, giving an unbiased cane sample which is sub-sampled and prepared for analysis. The system is at present being assessed against the Java Ratio system for all cane consignments entering the sugar factory in question.

* * *

Correlation of rind hardness and fibre in sugar cane. L. G. DAVIDSON. *Paper presented to the 13th Congr. ISSCT*, 1968.—Tests at Houma have shown a high degree of correlation between the hardness of the rind at the centre of the cane section between the 4th and 6th internodes, counting from the butt, and the fibre content. The technique for determination of rind hardness, using a modified soil penetrometer with a $\frac{1}{8}$-in dia. flat-faced rod and a gauge calibrated in pounds, is described.

* * *

An analytical method for oligosaccharides in sugar cane products. R. STAKER. *Paper presented to the 13th Congr. ISSCT*, 1968.—A method is described which involves gradient elution with aqueous ethanol from a carbon-"Celite" column, the eluate fractions being hydrolysed to hexoses with sulphuric acid and determined colorimetrically with anthrone reagent. It is applicable for routine detection of oligosaccharides in massecuite, refined sugar, raw sugar, cane juice, molasses, etc., down to 0·01% on solids. Complete analysis takes 5 hours and good results for most products are obtained using 200-mg samples.

Filtration characteristics of cane juice. A. C. RAHA. *Paper presented to the 13th Congr. ISSCT*, 1968.—It was found that the specific resistance of filter cake from cane juices treated by the DE HAAN and middle-juice carbonatation processes, respectively, was governed by the size distribution of particles in the cane juice. Particle size distribution was in turn dependent upon alkalinity and on liming tank diameter, increase in which prolonged the mixing time and hence increased the local alkalinity. The effects of these factors on particle size distribution were so great that the effect of juice quality could be neglected.

* * *

Aspects of the chemistry of the browning reaction of reducing sugars. M. FLEMING, K. J. PARKER and J. C. WILLIAMS. *Paper presented to the 13th Congr. ISSCT*, 1968.—Comparison of the u.v., visible and i.r. spectra of the colour compounds formed by thermal degradation of dextrose and levulose in aqueous solution with that of the colour compounds in raw sugar showed close similarity, so that it is suggested that the browning polymers may be derived from a common precursor, which is possibly an enolic dideoxytriketohexose having an absorption maximum at 265 nm at pH 4. The formation of a chromophore, reacting specifically with iron, during reducing sugar decomposition would account for the apparent positive catalysis of the browning reaction by iron salts.

* * *

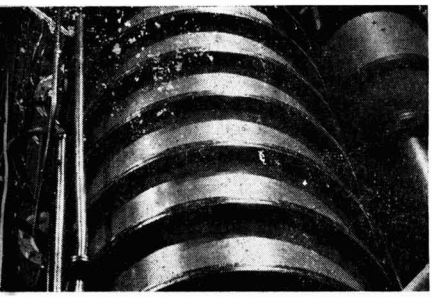
Formulae for the exhaustibility of final molasses. S. C. GUPTA and N. A. RAMAIAH. *Paper presented to the 13th Congr. ISSCT*, 1968.—By applying the law of mass action to the mechanism of formation of a sucrose-salt complex, the authors consider it preferable for molasses exhaustibility to be calculated in terms of the glucose:ash ratio rather than in terms of the separate glucose and ash contents. Formulae for molasses exhaustibility calculation are surveyed.

* * *

Some behaviour of the browning matter isolated from cane final molasses by ion exchange. S. S. TSAI, T. S. SHIH and P. T. HSIEH. *Paper presented to the 13th Congr. ISSCT*, 1968.—Various aspects of the behaviour of browning matter isolated from cane molasses by adsorption on "Amberlite IRA-410" anion exchange resin in Cl^- form are discussed. When added to a sugar solution, considerable removal of the browning matter by active carbon or a carbonatation process was found possible.

* * *

An evaluation of analytical error on pol recovery. S. L. SANG. *Paper presented to the 13th Congr. ISSCT*, 1968.—Three methods of determining pol recovery were compared. The most accurate was that involving direct weighing of the various items and calculation of the bagasse weight as $(C + T - W)$ where C = total cane weight, T = total imbibition water weight and W = total juice weight



By-products

Rum, an old product for a new state. H. E. CROSSLEY. *Rpts. 1966 Meeting Hawaiian Sugar Tech.*, 1–4.—The various stages in rum manufacture are briefly described and notes given on the types of rum produced in various countries.

* * *

Production of dextran in Cuba. A. BELL G. *Cuba Azúcar*, 1967, (Jan./Feb.), 14–20.—The history of dextran production by *Leuconostoc* fermentation is briefly surveyed and the characteristics of native dextran produced at a pilot plant at Central España are examined. Effects of various chemicals on dextran solutions are discussed, and a list of potential uses is presented.

* * *

Oxidation of carbohydrates. I. Oxalic acid from sucrose by oxidation. K. I. LU and R. D. LUO. *Chemistry* (Taiwan), 1966, (2), 76–84; through *S.I.A.*, 1967, **29**, Abs. 952.—High purity oxalic acid was produced by oxidation of sucrose with HNO_3 in the presence of sodium metavanadate. The mean yield was 70% of the theoretical. Although 1·6–1·8 kg of 100% HNO_3 are required to produce 1 kg of oxalic acid, 80% of the acid can be recovered by means of oxidation of the evolved NO_2 with pure O_2, thereby halving the acid consumption compared with the normal process.

* * *

Polyhydric alcohols produced by yeasts. H. FALANGHE. *Seminario Inst. Zimotécnico* (São Paulo), 1966, (1), 14 pp.—A review of the literature is presented covering fermentation of yeasts of various species which form polyols, including glycerol, arabitol and erythritol, from glucose or sucrose.

* * *

Development of the genetics of micro-organisms. R. N. NEDER. *Seminario Inst. Zimotécnico* (São Paulo), 1966, (3), 11 pp.—The genetics discussed are generally those of *Aspergillus* and other types of fungi concerned in fermentations.

* * *

Improvements in the method for removal of calcium from molasses. S. A. KHAN, S. AHMAD and M. IKRAM. *Sci. & Ind.* (Karachi), 1967, **5**, 41–44; through *S.I.A.*, 1967, **29**, Abs. 1017.—The effects of dilution, heating and addition of calcium superphosphate and/or H_2SO_4, HCl or H_3PO_4 on the precipitation of calcium from cane molasses, in order to reduce scaling of rectification columns in distilleries, was investigated. The weight of precipitate was maximum when 5 ml of 10°Bx calcium superphosphate solution was added to 100 g of 40°Bx molasses at pH 3·3 and the solution was heated to 90°C. A factory process based on these results is described.

* * *

Testing mixed feeds containing raw sugar in fattening pigs for pork. B. V. CHESHMEDZHIEV and P. DEYANOV. *Zhivotnovud. Nauki*, 1967, **4**, (1), 3–8; through *S.I.A.*, 1967, **29**, Abs. 1019.—Pigs fed on diets containing 5, 10 or 15% of raw cane sugar (replacing maize meal) had improved appetites and gave meat and fat of unchanged or (with 10% or 15% sugar) slightly improved quality. There was no adverse effect on digestion or growth, and no alimentary hyperglycemia. Such use of sugar would depend on prices.

* * *

Micro-emulsion process for the preparation of sucrose esters. L. I. OSIPOW and W. ROSENBLATT. *J. Amer. Oil Chem. Soc.*, 1967, **44**, 307–309; through *S.I.A.*, 1967, **29**, Abs. 1020.—A new process for the production of sucrose esters of fatty acids is described. Sucrose and methyl stearate were reacted in the form of a micro-emulsion prepared at 130–135°C in the presence of sodium stearate and a catalyst (K_2CO_3). The molar ratio of the first three components was 1·5:1·0:0·9. It was necessary first to dissolve the the sucrose in propylene glycol, which was distilled off the emulsion under reduced pressure. The methyl ester was completely converted to the sucrose ester, and the yield/100 g of reactants (47·2 g of sucrose) was 53·9 g of sucrose stearate (85% monoester, 15% diester), which was separated from the unreacted sucrose (19·5 g) and sodium stearate by redissolving it in methyl ethyl ketone.

* * *

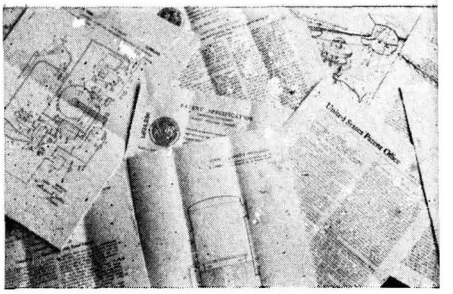
Use of beet tails for fodder yeast production. J. OBOJSKI. *Gaz. Cukr.*, 1968, **76**, 40–41.—The use of beet tails for fermentation to produce fodder yeast is suggested, particularly at those sugar factories in Poland which produce citric acid, since such factories have a large amount of effluent from the fermented mash as well as beet tails.

* * *

New equipment produces ammoniated beet pulp. ANON. *Sugar y Azúcar*, 1968, **63**, (2), 39.—Details are given of a patented tower installation for ammoniation of beet pulp[1].

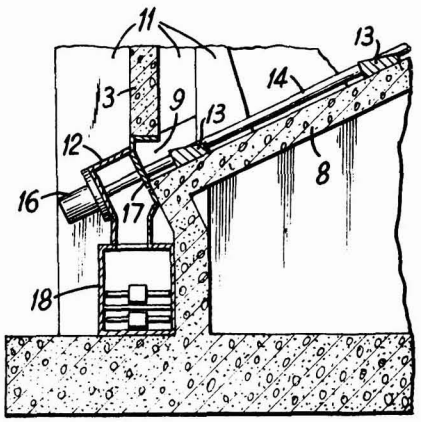
[1] STOBIECKI & SZYBALSKI: *I.S.J.*, 1967, **69**, 218.

Patents



UNITED STATES

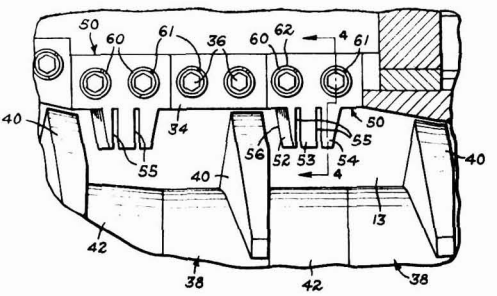
Silo unloading means. O. ZUBER, S. SEMADENI and P. MOLLER, *assrs.* GEBRÜDER BUHLER, of Uzwil, Switzerland. **3,357,575.** 9th August 1965; 12th December 1967.—The bottom of the silo is provided with a rectangular discharge chamber having vertical walls 3 and a roof-shaped floor 8. Vertical ribs 11 support the walls and between these ribs on two



opposite sides are a series of openings 9. A collector conduit 12 connects these openings which are closed by plate 17 mounted on shafts 14. These shafts carry wedge-shaped scrapers 13 and pass through the walls of the conduit 12. Under the action of the hydraulic cylinders 16 the shafts reciprocate, the wedges aiding passage of the silo contents toward the openings 9 which are simultaneously unsealed by withdrawal of plates 17 with the shafts. The silo contents thus are able to fall through the opening on to conveyors 18 which are located on each side of the chamber and which carry them away from the silo.

* * *

Screw press. A. W. FRENCH and F. J. STARRETT, of Piqua, Ohio, U.S.A., *assrs.* THE FRENCH OIL MILL MACHINERY CO. **3,366,039.** 20th June 1966; 30th January 1968.—The breaker bars 50 of the screw



press (which prevent the bagasse revolving with the worm conveyor 38/42 which carries flights 40) are divided by slots 55 into three portions 52, 53, 54. They are thus not likely to break off completely when a piece of tramp iron enters the press, and a single piece is more likely to pass through the press without causing the further damage to other breaker bars which would be likely with a larger complete broken-off bar. The outer housing of the press is in two hinged halves and the breaker bars are so mounted that they may be left in a hardened mass of bagasse surrounding the worm conveyor while the halves are separated during a shut-down.

* * *

Crystallization of sugar. A. R. GRANDADAM, of St.-Maur, France, *assr.* A. P. O. BIZET. **3,356,532.** 7th January 1964; 5th December 1967.—See UK Patent 1,053,042[1].

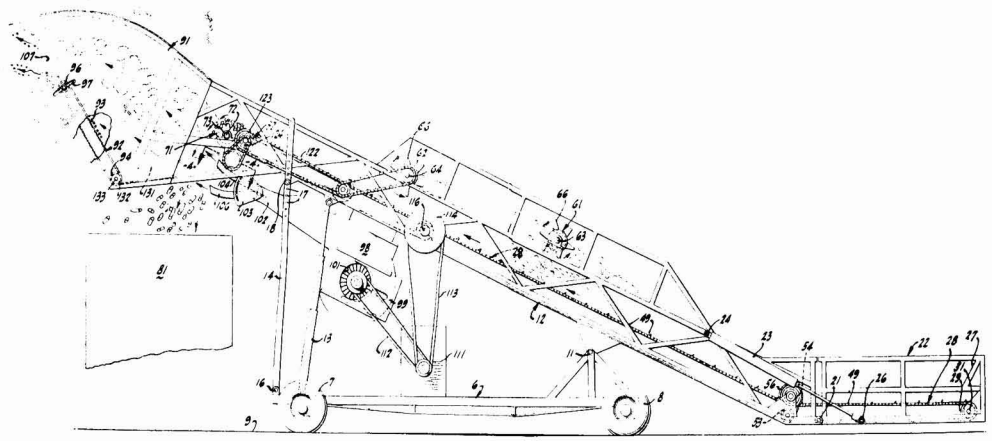
* * *

Cane transloader and dry cleaner. R. A. DUNCAN, of Lafayette, La., U.S.A., *assr.* THE THOMSON MACHINERY CO. INC. **3,358,830.** 9th December 1964; 19th December 1967.

Harvested sugar cane and accompanying debris is dumped on the horizontal upper run of the conveyor 28 and carried up the incline to pass successively under two combing rollers 61 and 62 each of which carries teeth 66 arranged in reverse helices symmetrical centrally of the rollers so that their rotation tends to retard and distribute the cane transversely across the

[1] *I.S.J.*, 1967, **69**, 186.

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

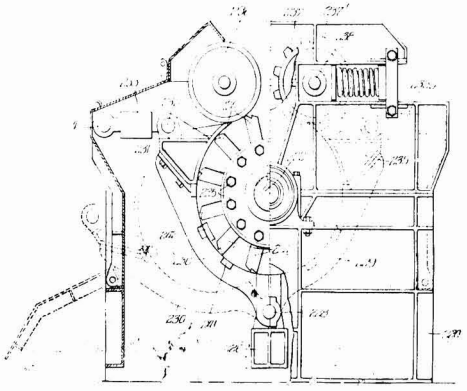


conveyor, to give a uniform layer, that leaving the second combing roller 62 being thinner than that leaving roller 61. The cane passes over the head shaft roller 32 and over a small gap 74 to the open-work discharge drum 71 mounted on cross shaft 72 parallel to roller 32. This drum is made up of toothed discs in pairs, separated by cross bars, and it catches the cane, throwing it across and into bin 81.

Small heavy material such as earth, rocks, etc., falls through the framework and gap 74 into a trough below fitted with a screw conveyor for its removal. Mounted on the frame and belt-driven from prime mover 11, as are the conveyor and various rollers, is a blower 98 which feeds air blasts through adjustable jet tubes 104, 106 against the falling cane, carrying light trash, leaves, etc., up against the trash screen 92. This is inclined at an adjustable angle and carries entrained trash up over roller 96, where it is discharged.

* * *

Apparatus for breaking sugar cane (for diffusion). H. F. SILVER, C. F. STEELE and F. B. PRICE, of Denver, Colo., U.S.A., *assrs.* AMERICAN FACTORS ASSOCIATES LTD. **3,370,797.** 4th March 1966; 27th February 1968.



The main rotor shaft 222 of the cane buster is carried by bearings at opposite ends of the main frame 220. The shaft carries a rotor on which are mounted the hinged hammers 224 carried on pins 225. Below the rotor is a beam support 226 on which are mounted hinge pins 228 supporting the anvil sections 229 and 230 which surround the rotor, and these sections are connected to beams 231, 235 which have pivots 232 connected to pivots 234 on the main frame by turnbuckles 233, 233a.

The beam 226 is adjustable for height so that this adjustment, and the lateral adjustment afforded by the turnbuckles, provide the opportunity of ensuring the proper relative positions of the hammers with the breaker lugs 242 which are mounted on the ribs which also carry tie-bars 241. Cane is supplied to the buster by means of feed rollers 236 and 237, either or both of which may carry feeding teeth 237′, and one of which is mounted on a spring-backed bearing 238.

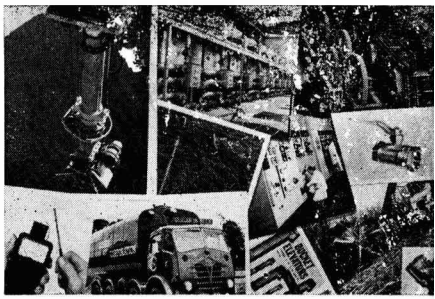
* * *

Making citric acid by fermentation. W. GOLD and R. KIEBER, *assrs.* STEPAN FERMENTATION CHEMICALS INC., of Keyport, N.J., U.S.A. **3,372,094.** 19th May 1966; 5th March 1968.—A fermentable carbon source, e.g. sucrose or cane molasses, is fermented with a citric acid-producing organism, e.g. *Aspergillus* spp., while maintaining as a cool, sterile medium containing ferri- or ferrocyanide salts, at pH 6–9, fatty material (free C_3–C_{21} fatty acids, their metal salts or alkyl esters) being added during the fermentation so that the concentration is maintained at at least 0·1% v/v (0·1–0·2% v/v).

* * *

Cane harvester. H. A. WILLETT, of Thibodaux, La., U.S.A., *assr.* THOMSON MACHINERY CO. INC., **3,375,642.** 18th January 1965; 2nd April 1968.

Trade notices



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

Continuous cane diffusion. Maschinenfabrik Buckau R. Wolf A.G., 4048 Grevenbroich, P.O. Box 69, Germany.

The Buckau-Wolf/Burnett cane diffuser is a development of the long, slow-moving, heated maceration carriers used in Queensland. Developed at Fairymead sugar factory, the diffuser consists of a relatively long rectangular tank with a moving bottom composed of specially perforated slats. Hot water is fed at the bagasse discharge end and percolates through the bagasse into a tank beneath the slatted bottom. The liquid from this tank is then pumped up and allowed to percolate through the bagasse into the next tank, and so on; thus the fluid from the last tank will have the highest sugar concentration, and the bagasse sugar content will become progressively lower as it proceeds towards the discharge end. Data from Fairymead for 1966 and 1967 show a reduced extraction of 97% and 97·22%, respectively, with a bagasse sugar content of 3·41% and 3·27% and a first pressed juice apparent purity of 87·79 and 87·94, respectively, while overall boiling house performance was not affected. Sizes range from 1000 to 6000 metric tons/day of cane.

* * *

Moisture control in warehouses. Shaw Moisture Meters, Rawson Road, Westgate, Bradford, England.

The Shaw Climatic Control System lowers the dewpoint of the air in any closed storage space, such as warehouses, by admitting drier air from the outside and then maintaining the dewpoint at a pre-set low level by admitting, by means of an automatically-controlled fan, only air which is drier than that already in the store, thus obviating the need for heating or air conditioning. The air from outside is pumped through a PTFE pipe to a solenoid valve operated by an electric clock. The valve passes a sample of the outside air to a Shaw hygrometer sensing element during 2 min to allow the moisture content to be recorded and memorized by a servo-motor coupled to a solid-state amplifier. During the next 59 min the valve then admits air from the storage space into the hygrometer element. If the storage atmosphere is wetter than the outside air, an alarm indicator lights up and the air inlet fan is switched on until the inside air is dried to the level of the outside air. The inlet fan should have self-closing louvres to avoid the admission of wet air when it is not working.

* * *

Ditching implement. Thomson Machinery Co. Inc., Thibodaux, La., USA.

The new Thomson "Ditch CleanAll", designed primarily for use in the Louisiana cane area, is claimed to be suitable for any area requiring drainage or irrigated areas where ditch cutting and maintenance is necessary. The unit will cut a 2-ft wide ditch as deep as 38 in, soil being dispersed evenly as much as 70 ft from the ditch by means of a movable shield. The unit uses tractor p.t.o. through a chain drive assembly and is attached to a 3-point hitch on most standard tractors. The cutting head consists of four hardened steel blades with a "rudder" at the bottom of the cutting unit for accurate alignment.

* * *

PUBLICATIONS RECEIVED

CANE HARVESTERS. Massey-Ferguson (Aust.) Ltd., Lester St., Bundaberg, Queensland, Australia.

Brochures are available describing the "MF 81" cane harvester, which is an improved version of the "MF 61" and "MF 71" models, the "Crichton" whole-stick cane harvester, and the Massey-Ferguson cane harvesting system, which uses a harvester unit mounted on a conventional "MF 165" or "MF 175" tractor.

* * *

"THIS IS PERMUTIT". The Permutit Co. Ltd., 632/652 London Rd., Isleworth, Middx., England.

This is the title of No. 2 in the series of news folders published by Permutit. The folder gives information of the Engineering Division's facilities for production of plant for water and effluent treatment.

* * *

"WELTEXA" SPIRAL FORMED STAINLESS STEEL TUBE. Welding Technical Services Ltd., Hurst Mill, Pershore Rd. South, Kings Norton, Birmingham, England.

A 13-page brochure explains the advantages of "Weltexa" stainless steel piping systems and describes the process used in its manufacture. Weights, dimensions and working pressures of standard tube are tabulated as well as some material specifications.

* * *

"SKATOSKALO" FLEXIBLE DRIVES. Flexible Drives (Gilmans) Ltd., Skatoskalo Works, Millers Rd., Warwick, England.

A new catalogue has been prepared giving details of the flexible shaft-driven, rotary-powered mechanical tube descaling and brushing equipment manufactured by Flexible Drives for the cleaning of a wide variety [illegible] inches in diameter. In the sugar industry the equipment is applicable to evaporators, juice heaters and [illegible].

World sugar production estimates 1968/69[1]

	Estimate 1968/69	1967/68*
BEET SUGAR	*(metric tons, raw value)*	
EUROPE		
Belgium-Luxembourg	600,000	578,744
France	2,450,000	1,766,250
Germany West †	2,025,000	2,105,055
Holland	740,000	772,286
Italy†	1,322,000	1,671,187
Total EEC	*7,137,000*	*6,893,522*
Austria	300,000	306,890
Denmark	336,700	336,666
Finland	51,800	63,740
Greece	98,000	122,822
Ireland	158,000	145,487
Spain	600,000	599,786
Sweden	270,000	264,999
Switzerland	66,700	65,464
Turkey	600,000	727,908
United Kingdom	990,000	985,700
Yugoslavia	389,000	508,212
Total West Europe	*10,997,200*	*11,021,196*
Albania	16,000	15,555
Bulgaria	260,000	285,000
Czechoslovakia	815,000	823,000
Germany, East	570,000	566,666
Hungary	439,000	451,110
Poland	1,745,000	1,913,100
Rumania	415,000	460,000
USSR	9,925,000	10,665,000
Total East Europe	*14,185,000*	*15,179,431*
Total Europe	*25,182,200*	*26,200,627*
OTHER CONTINENTS		
Afghanistan	8,500	8,339
Algeria	4,000	4,000
Azores	12,000	12,000
Canada	150,000	139,147
Chile	185,000	180,600
China	600,000	600,000
Iran	455,000	422,218
Iraq	5,000	4,500
Israel	40,000	41,110
Japan	260,000	295,153
Lebanon	8,000	8,000
Morocco	90,000	60,000
Pakistan	5,000	5,000
Syria	25,000	25,000
Tunisia	7,000	6,865
United States	3,190,000	2,438,467
Uruguay	60,000	28,000
Total Other Continents	*5,104,500*	*4,278,399*
TOTAL BEET SUGAR	30,286,700	30,479,026
CANE SUGAR		
EUROPE		
Spain	45,000	42,862
NORTH AND CENTRAL AMERICA		
British Honduras‡	68,000	64,605
Costa Rica	140,000	136,000
Cuba	6,000,000	5,000,000
Dominican Republic	800,000	710,000
Guadeloupe‡	145,000	140,553
Guatemala	180,000	158,445
Haiti	65,000	63,000
Honduras	55,000	54,430
Martinique‡	45,000	50,000
Mexico	2,400,000	2,327,175
Nicaragua	122,000	120,000
Panama	73,000	69,406
Puerto Rico	662,000	585,554
Salvador	140,000	136,539
USA—M[illegible]	1,180,000	1,321,761
Ha[illegible]	1,09[illegible]0	1,115,000
West I[illegible]	5[illegible]0	1 130
	[illegible]	[illegible]23
Jamaica‡	500,000	465,632
St. Kitts‡	40,000	35,389
Trinidad‡	245,000	243,389
Total North and Central America	*14,150,000*	*12,959,631*
SOUTH AMERICA		
Argentina	947,000	799,907
Bolivia	115,000	106,294
Brazil‡	4,350,000	4,250,488
Colombia	700,000	670,000
Ecuador	205,000	204,355
Guyana‡	340,000	340,360
Paraguay	38,900	39,644
Peru‡	650,000	730,000
Surinam	20,000	19,500
Uruguay	5,000	3,000
Venezuela	360,000	360,000
Total South America	*7,730,900*	*7,523,548*
AFRICA		
Angola‡	80,000	80,000
Congo (Brazzaville)	100,000	99,000
Congo (Kinshasa)	45,000	45,000
Ethiopia	85,000	85,000
Ghana	20,000	12,000
Kenya	80,000	71,940
Madeira	3,000	3,000
Malagasy	115,000	112,000
Malawi	22,000	20,000
Mauritius‡	605,000	638,322
Mozambique‡	215,000	215,000
Nigeria	25,000	21,861
Réunion‡	253,000	229,862
Rhodesia	150,000	140,000
Somalia‡	35,000	31,335
South Africa	1,540,000	1,822,256
Sudan	110,000	103,649
Swaziland‡	160,000	161,770
Tanzania	90,000	88,860
Uganda	160,000	155,691
UAR (Egypt)	400,000	392,045
Zambia	25,000	—
Total Africa	*4,318,000*	*4,528,591*
ASIA		
Afghanistan	10,000	10,000
Burma	85,000	82,000
Ceylon	10,000	7,999
China	1,900,000	1,900,000
India, excluding khandsari	2,775,000	2,497,703
Indonesia	600,000	600,000
Iran	55,000	44,445
Japan & Ryukyu Islands	310,000	307,400
Nepal	10,000	10,000
Pakistan	450,000	450,000
Philippines‡	1,650,000	1,588,000
Taiwan	870,000	873,000
Thailand‡	308,600	188,777
Total Asia	*9,033,600*	*8,559,324*
OCEANIA		
Australia	2,850,000	2,438,000
Fiji	412,000	313,000
Total Oceania	*3,262,000*	*2,751,000*
WORLD CANE SUGAR PRODUCTION	38,539,500	36,364,956
WORLD BEET SUGAR PRODUCTION	30,286,700	30,479,026
TOTAL WORLD SUGAR PRODUCTION	68,826,200	66,843,982
Increase (+) or decrease(–)	+1,982,218	+1,500,856
	2·96%	2·29%

[1] F. O. Licht, *International Sugar Rpt.*, 1968, **100**, (33), 1–5.

* Partly estimated.

† Including production from desugaring of molasses.

‡ *tel quel.*

Brevities

ICUMSA—United States National Committee on Sugar Analysis.—The Secretary-Treasurer of the USNC reports that there are available now a limited number of ICUMSA and USNC Proceedings as listed below. A shipment of the latest 1966 ICUMSA Copenhagen Proceedings has been received. The 1966 ICUMSA Review is an excellent adjunct to the final published 1966 ICUMSA Proceedings. Copies of the Proceedings may be ordered by addressing orders to (and making cheques payable to): Mr. WARREN L. REED, Secretary-Treasurer, USNC, c/o Revere Sugar Refinery, 333 Medford Street, Charlestown, Massachusetts, 02129 U.S.A.

1954	ICUMSA Proceedings	$3.50
1962	,, ,,	4.00
1966	,, ,,	12.00
1966	ICUMSA Review	2.00
1958	USNC Proceedings	10.00
1962	USNC ,,	10.00
1966	USNC ,,	10.00

* * *

UK sugar surcharge reduction.—In view of the rise in the world price of raw sugar on the London Market, the 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 24th December 1968. This was the eighth change in the rate of surcharge during 1968.

* * *

US sugar supply quota, 1969.—The US Department of Agriculture has now set the 1969 quota at 10,600,000 short tons as proposed in November 1968[1]. Imports for the first quarter of the year are to be limited to 850,000 tons, which is 100,000 tons more than the Department's original proposal, and the limit for imports during the first half of the year will be 2,000,000 tons.

* * *

Sugar rationing in Cuba[2].—In his address in Havana on the 10th anniversary of the revolution, Dr. CASTRO, the Prime Minister, announced that sugar is to be rationed to make more of the country's production available for export. A ration of 6 lb a month in Havana and a rather larger one in the provinces would save 200,000 tons of sugar a year worth $10,000,000. Dr. CASTRO said that this was "more than the people generally consume" and that putting a rational limit to sugar consumption would make possible a quicker enjoyment of the fruits of development.

* * *

Mauritius sugar crop, 1968[3].—Harvesting of the 1968 crop started on the 25th June and ended on the 23rd November 1968. The 23 mills crushed 5,071,098 long tons of cane, i.e. about 652,000 tons less than in 1967. Average cane yield reached the figure of 25·6 tons as against 28·6 tons per acre in 1967. The average sugar recovery was 11·58 and the yield of sugar per acre amounted to 2·96 tons, resulting in a total sugar output of 587,155 long tons, as against 628,270 tons in 1967.

* * *

Government intervention in Italy factory closures dispute[4]. The Italian sugar giant, Eridania Zuccherifici Nazionali S.p.A., had intended to reorganize, closing sugar factories and involving the dismissal of the workers. The consequence of this decision was a strike in the Italian sugar industry lasting 24 hours, and it is now reported that the Italian Government is to intervene. A further 48-hour strike started on the 17th December[5].

* * *

New Spanish sugar factory.—A new sugar factory is to be constructed at Jedula, Arcos de la Frontera, Cadiz, Spain at the cost of £3·75 million. Planned slicing capacity is set at 3000 tons per day.

Sugar and artificial sweeteners.—It has been suggested in recent years that sugar may be associated with various illnesses and artificial sweeteners have also been encroaching on markets such as soft drink manufacture. C. Czarnikow reports[6] that a scientific meeting held in Paris in early December under the auspices of the European Committee of Sugar Manufacturers was informed by leading authorities from many parts of the world of researches which gave reason to believe that, so far as world health is concerned, sugar is not so guilty nor artificial sweeteners so blameless as has been indicated. Copies of the papers presented may be obtained from the Committee, 41 Avenue de Friedland, Paris 8e, France.

* * *

UK sugar surcharge remission.—The Minister of Agriculture, Fisheries and Food has made an order specifying goods, in the manufacture of which undenatured sugar is used, where surcharge may be remitted or repaid; these include: antimicrobial substances produced by the culturing of living micro-organisms (e.g. penicillin), dextrans, dyestuffs, fructose, gibberellic acid and its salts, griseofulvin, itaconic acid and its salts, mannitol, polyols, sodium glucoheptonate, sorbitol, and water-soluble textile size. Sugar which has been denatured is already obtainable free of surcharge but is not suitable for use in the preparation of the above products.

* * *

Cooperative sugar factories in India.—It is reported that Mysore will have four more cooperative sugar factories in the next year or two, in addition to the existing four[7]. The new factories are to be located at Bidar, Malarprabaha, Vanivilas, and at Kollegal. The Bidar cooperative sugar factory is expected to have been completed late in 1968.

* * *

Indian National Sugar Institute experimental sugar factory[8]. In 1931 an experimental sugar factory, of 35 tons/day crushing capacity, was established at the then Imperial Institute of Sugar Technology at Nawabganj, now the National Sugar Institute. This factory was dismantled following the removal of the Institute to new premises at Kalyanpur in 1963 and, as the machinery was then old and worn-out, it was decided to build a modern plant of 100 tons/day capacity. Owing to a ban at that time on all constructional activities, the project had to be shelved but it has now been decided to implement it in a phased manner over the next few years.

* * *

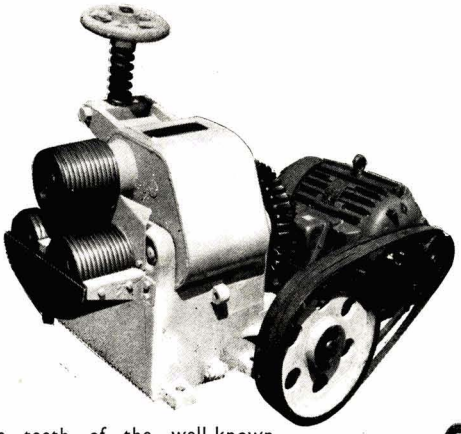
World press survey.—Over a number of years, a Belgian company, Société pour la Diffusion de la Presse S.A., has been gathering a steady supply of information on the periodical press published all over the world, including daily papers, reviews and periodicals of all kinds, and puts this information at the disposal of the public, free of charge. Thus it is possible to obtain a list of publications covering a particular field, to learn the subscription price, and if desired take out subscriptions. This service has been started by SODIP because they feel that most press directories are incomplete or out-of-date when they appear and are not within the reach of all, whereas the new service is kept up currently and is available free to all. For further information, interested readers should write to SODIP S.A., 66 rue de Marteau, Brussels, Belgium.

[1] *I.S.J.*, 1969, **71**, 2.
[2] *The Times*, 3rd January 1969.
[3] *Mauritius Sugar News Bull.*, 1968, (11).
[4] F. O. Licht, *International Sugar Rpt.*, 1968, **100**, (34) 5.
[5] *ibid.*, (36), 7.
[6] *Sugar Review*, 1968, (896), 229.
[7] *Indian Sugar*, 1968, **18**, 301.
[8] *N.S.I. News*, 1968, [illegible], (1 2.

Index to Advertisers

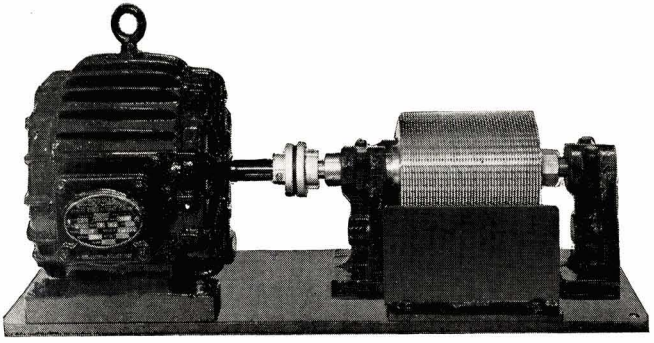
FOR BUYERS' GUIDE SEE JANUARY ISSUE pp. xxvii-xliv

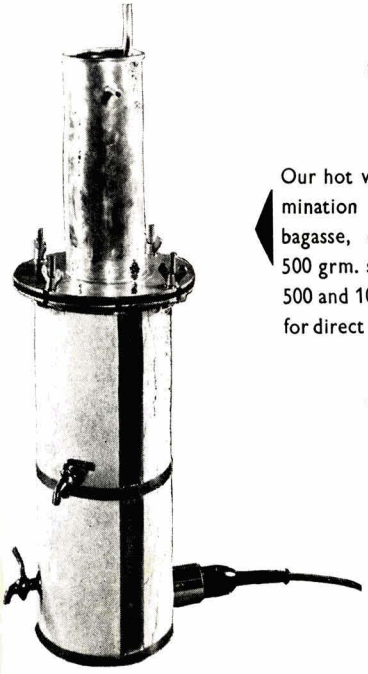
CANE AND BAGASSE ANALYSIS



Our **ROLEX** laboratory three-roller mill is provided with 5 in. × 5 in. rollers of Meehanite cast iron, while the spur gears and casting which carries the adjustable top roller are of steel. This top roller is fitted with a compression spring while scrapers are provided for both bottom rollers. Oilite bearings are fitted, and the juice tray and scrapers are removable for cleaning. The illustration shows a **ROLEX** mill belt-driven by a 3 h.p. electric motor.

The teeth of the well-known **CUTEX** laboratory cane shredder are cut from a solid piece of steel and are driven inside their housing by an electric motor mounted on the same bed-plate and connected by a flexible coupling. For the illustration the coupling and shredder housings have been removed.





Our hot water digester for determination of the sucrose lost in bagasse, electrically heated, for 500 grm. samples. Other types for 500 and 1000 grm. samples include for direct heating or steam heating.

Our high-speed mixer for analysis of fibre in bagasse has knives of improved design with two speeds of 7000 and 14,000 r.p.m. and a special feeder-type lid to prevent spillage. Its metal goblet is of 2000 ml. capacity. It is provided with a motor designed to take only single-phase A.C.

The Sugar Manufacturers' Supply Co. Ltd.

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