International Sugar Journal

* * *

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

Annual Subscription: 50s 0d or $8.00 post free
Single Copies: 6s 0d or $1 post free

Contents

PAGE

Notes and Comments 193

* * *

Milling Units for the Milling-Diffusion Process .. 195
By W. R. Crawford

Boiling Point Elevation of Pure Sucrose Solutions 199
By W. M. Nicol

The Suchem "Auto Diffuser" 203
By P. P. Strich

* * *

Sugar cane agriculture 206

Sugar beet agriculture 211

Cane sugar manufacture 212

Beet sugar manufacture 214

New books 216

Laboratory methods and chemical reports 217

Patents 219

Trade notices 222

US sugar quotas 1968 223

West Indies sugar production 224

French sugar imports and exports 224

Brevities 223–4

Index to Advertisers xxviii

SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

Installations de moulins pour le procédé moulage-diffusion. W. R. CRAWFORD. p. 195–199

On discute l'emploi de moulins à canne pour la préparation de la canne avant qu'elle soit introduite dans une diffusion aussi que pour l'extraction de l'eau contenue dans la bagasse sortie de la diffusion sur la base de l'expérience dans la sucrerie à Malelane, au Transvaal oriental. Cette sucrerie est équipée d'une diffusion De Smet précédée d'un moulin à trois cylindres ayant un alimentateur à pression à deux cylindres. On discute les avantages d'alimentateurs à pression par rapport à des travaux au Queensland.

* * *

Elévation du point d'ébullition de solutions du saccharose pur. W. M. NICOL. p. 199–203

On présente des tableaux montrant l'élévation du point d'ébullition pour des solutions de saccharose pur en fonction de la concentration et du la sursaturation à l'absence du surchauffage. Cettes données sont des valeurs revisées obtenues en considérant des données de la pression de la vapeur pour des solutions du saccharose et se basent sur un rapport entre la solubilité et la température. On donne des équations pour le calcul des facteurs variés aussi que des graphiques qui montrent les rapports entre la concentration, le rapport de la saturation, la température de la solution, la pression et l'élévation du point d'ébullition.

* * *

La diffusion type "Auto Diffuser" de la compagnie Suchem. P. P. STRICH. p. 203–205

L'auteur donne des informations sur la diffusion à canne type "Auto Diffuser", développée par Suchem Inc., et qui est actuellement le sujet d'essais à Porto Rico. L'appareil emploie la percolation pour extraire le jus et comprend 16 compartiments (arrangés tellement que former un anneau horizontal) remplis de la canne à travers de laquelle passent en séquence les fractions du jus, plus et plus dilué. La diffusion complète tourne tellement que permettre décharger la bagasse après l'extraction du jus et remplir le compartiment vide de canne fraîche.

Mühlanlagen für das Mühlung-Diffusionsverfahren. W. R. CRAWFORD. S. 195–199

Man bespricht die Anwendung von Rohrmühlen für die Vorbereitung vom Rohr bevor es in einen Diffusionsapparat geht, auch für die Entwässerung von der aus dem Diffusionsapparat austretenden Bagasse in Hinblick auf die Erfahrung in der Zuckerfabrik Malelane in Osttransvaal. Diese Zuckerfabrik hat einen Diffusionsapparat De Smet mit einer hervorgehenden Dreiwalzenmühle; die letztere ist mit einem Zweiwalzendruckspeisevorrichtung versehen. Die Vorteile von Druckspeisevorrichtungen werden in Hinblick auf Arbeit in Queensland besprochen.

* * *

Siedepunktserhöhung von reinen Saccharoselösungen. W. M. NICOL. S. 199–203

Der Verfasser stellt Tabellen von Siedepunktserhöhung für reine Saccharose-Lösungen in Abhängigkeit von Konzentration und Übersättigung in der Abwesenheit von Überhitzung dar. Diese sind verbesserte Werte, mit Betrachtung von Dampfdruckdaten für Saccharoselösungen erhalten, und beruhen auf einer Beziehung zwischen der Lösbarkeit und der Temperatur. Man gibt Gleichungen für die Berechnung der verschiedenen Faktoren, auch Diagramme, welche die Beziehungen zwischen der Konzentration, dem Sättigungsverhältnis, der Temperatur der Lösung, dem Druck und der Siedepunktserhöhung zeigen.

* * *

Der "Auto Diffuser" von Suchem. P. P. STRICH. S. 203-205

Man gibt Informationen über den "Auto Diffuser", einen Diffusionsapparat für Rohr, der von der Firma Suchem Inc. entwickelt wurde; jetzt ist der Apparat bei Versuchen in Puerto Rico. Er wendet das System von Durchsintern für die Extraktion von Saft an, und besteht aus 16 mit Rohr gefüllten Sektionen (so angeordnet, um einen waagerechten Ring zu bilden), in den immer mehr verdünnte Saftfraktionen durch das Rohr aufeinanderfolgend fliessen. Die ganze Diffusionsanlage dreht sich um eine Achse, um die Entladung von erschöpfter Bagasse und die Wiederfüllung der leeren Sektion mit frischem Rohr zu gestatten.

Unidades de molienda para el proceso molienda-difusión. W. R. CRAWFORD. *Pág.* 195–199

Una discusión del uso de trapiches para la preparación de caña antes de su entrada en un difusor y para deshidratación del bagazo descargado del difusor se presenta contra un fondo de experiencia a la azucarera de Malelane en el Transvaal Oriental. Esta azucarera se equipa con un difusor marca De Smet, precedido por un trapiche a tres mazas con un alimentador a presión con dos mazas. Las ventajas de alimentadores a presión se discuten con referencia a trabajo efectuado en Queensland.

* * *

Elevación del punto de ebulición de soluciones de sacarosa pura. W. M. NICOL. *Pág.* 199–203

Se presentan tablas de elevación del punto de ebulición de soluciones de sacarosa pura como función de concentración y sobresaturación en la ausencia de sobrecalefacción. Estos son valores revisados obtenido por consideración de dados de presión del vapor de soluciones de sacarosa, y se basen sobre una relación entre solubilidad y temperatura. Ecuaciones se presentan para la calculación de los varios factores así como gráficos que demuestran las relaciones entre concentración, razón de saturación, temperatura de la solución, presión, y elevación del punto de ebulición.

* * *

El "Auto-Difusor" marca Suchem. P. P. STRICH. *Pág.* 203–205

Detalles se presentan del "Auto-Difusor" para caña, desarrollado por Suchem Inc. y actualmente sometido a ensayo en Puerto Rico. Utiliza la sistema de percolación para extracción del jugo, y incluye 16 compartamientos (colocado en la forma de un anillo horizontal) llenado con caña, vía que pasan en serie fracciones de jugo, más y más diluido. La asemblea completa del difusor gira do modo que el bagazo agotado puede descargarse y el compartamiento vido puede rellenarse con caña fresca.

THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXX JULY 1968 No. 835

Notes & Comments

International Sugar Conference.

The UN sugar conference in Geneva ran its 6-week course and closed at the end of May without successfully concluding a new agreement. No date was initially set for a resumption of negotiations, but it was announced on the 5th June that the Conference would reconvene on the 23rd September provided sufficient progress had been made in private consultations during the summer months. These private meetings are being held between the main sugar exporting countries (Australia, Brazil, Cuba, Czechoslovakia, the EEC and South Africa) and Dr. PREBISCH, Secretary-General of UNCTAD.

During the conference broad agreement was reached on many of the clauses in the Draft. However, the stumbling block has been the question of quotas, as might be expected. At one stage the Cuban delegate walked out when the initial quota offer was made of 1,750,000 instead of the 2,500,000 requested; however he returned later, as did the delegates of the EEC countries who earlier had walked out on the question of their acting as a bloc or as individual members of the UN.

The Conference Chairman, R. C. LIGHTBOURNE of Jamaica, blamed the exporting countries for being too rigid in their demands. He said that a broad measure of agreement had been reached by the importing countries who, in exchange for a package deal committing exporters to a constant supply of sugar to the free market, offered a minimum-maximum price range of 3·25 to 5·25 US cents per pound. "It is true that I have been asking them to increase these figures slightly but, bearing in mind the actual stages reached in the conference on other relevant matters, I certainly cannot regard the attitude of importers as either unreasonable or ungenerous", Mr. LIGHTBOURNE said[1].

Delegation sources said the question of Cuba's quota allocation, which at one point threatened to break up the conference, was no longer a formidable obstacle by the end[2]. The conference's quota fixing panel is believed to have offered Cuba a free market export total of 3·8 million tons, which is within 100,000 tons of a figure acceptable to the Cubans. Of this 2·15 million tons would be direct sales to the free market, while 1·65 million tons of Cuban sugar re-exported by the Soviet Union and other Communist countries would be added to the total.

However, other exporters such as Australia, South Africa and Czechoslovakia are understood to have considerable reservations about their proposed quotas. Australia is being offered a free market export total of 1·1 million tons, which is 20% below her actual exports of sugar for 1966. In addition, the Common Market has informed the conference that its sugar surplus is estimated at 1·2 million tons, and it has already said that a proposed quota of one-sixth of this amount is not a basis for negotiations.

There have been no negotiations at all to date on the question of fixing a total for EEC exports, and the delegation sources pointed out that a difference of one million tons would take some whittling down.

* * *

US sugar quota, 1968.

On the 15th May the US Department of Agriculture announced an increase of 200,000 tons in the 1968 Overall Supply Quota, bringing it to 10·6 million short tons[3]. Of this amount 130,000 tons will be met by mainland cane sugar producers and the rest from foreign sources. An 8296-ton deficit in the Hawaiian quota has also been redistributed to foreign suppliers, the changes being tabulated elsewhere in this issue.

At the beginning of June, the Department declared deficits of 400,000 short tons, raw value, in respect of the quota for Puerto Rico and the entire quota for the Virgin Islands of 15,000 tons[4]. The Philippines have declared that they will be unable to take up any reallocation of deficits from other areas this year and therefore the 415,000 tons has been distributed among Western Hemisphere suppliers; details of the amounts are also given elsewhere in this issue.

The Dominican Republic was awarded a special allocation of 75,000 tons in addition to its normal share, which in this case amounts to 64,095 tons; a

[1] *The Times*, 4th June 1968.
[2] *Public Ledger*, 8th June 1968.
[3] C. Czarnikow Ltd., *Sugar Review*, 1968, (866), 98.
[4] *ibid.*, (869), 110.

report began circulation that the Dominican Republic was interested in re-purchasing sugar in view of this substantial additional quota. The Executive Director of the State Sugar Council denied this, however, and said his country could meet her quota without any doubt; he added that, if it were necessary to re-acquire sugar, 40,000 tons committed to Morocco could be taken back under the terms of an 80,000-tons sale which included a provision for the cancellation of half the amount if the seller found it necessary.

* * *

Booker Group 1967 report.

After grave years of civil strife and consequent industrial unrest, and of droughts and low world prices, a heartening record sugar crop of 283,000 tons is reported by the estates in Guyana for which Bookers are responsible; this rewards the confidence of the Company through uncertain days and continuance of steady expansion. Sugar exports, of over 20% higher than in 1966, were sold without any reduction in average receipts owing to a greater share of the West Indies quota under the US Sugar Act. Sugar sold on the world market has averaged 20% of production over the past five years.

In Nigeria the Bacita factory's third crop produced 20,900 tons of refined sugar but rainfall during the year was only half the normal level and only 20,000 tons is expected from the 1968 crop instead of the former estimate of 23,000 tons.

Following rapid expansion, Innswood factory in Jamaica produced a record crop of 24,300 tons in a year when the island's total level fell disastrously. Holland Estate made only 4800 tons of sugar owing to great difficulties in factory operation; the factory expansion is now largely completed and its 1968 target is 10,000 tons.

Sales of sugar machinery by Fletcher & Stewart Ltd. held up reasonably well in tough market conditions and in the last quarter of 1967 many traditional cane sugar producing areas were showing signs of increasing production capacity.

* * *

US mainland cane sugar supplies.

The Louisiana cane sugar industry faces an economic blow worse than two hurricanes combined, according to J. M. DUHE, President of the American Sugar Cane League[1]. The 1967/68 crop in Louisiana and Florida has produced 1,450,000 short tons of sugar, against a quota of 1,100,000 tons (raised since his speech to 1,230,000 tons). The League asserts that this quota is much too small and, if it is not increased, will result in a forced reduction of cane area by Louisiana's 5000 cane farmers to 40% below that of the unrestricted plantings of 1964. Many growers will be put out of business, according to Mr. DUHE, and some of the State's 46 sugar factories may have to close. Economic repercussions would include loss of jobs by farm workers and employees in local businesses, and increased migration from the land to the cities.

Earlier, Congressman S. LONG of Louisiana had disclosed that he planned to introduce legislation to allocate entirely to other domestic producers any deficits in the Puerto Rican or other domestic sugar quota[2]. Under the Sugar Act, any Puerto Rican deficit is re-allocated half to the Philippines and half to Latin American producers. Congressman LONG'S views naturally met opposition among representatives of the Latin American and Philippine producers, and was rejected at a meeting of mainland cane interests and those of US beet sugar producers and refiners. Claims of the mainland cane area were again pressed at a further informal meeting of the House Agriculture Committee on the 14th May but again met strong opposition and failed to obtain the backing of the Committee[3].

* * *

Beet yields in Western Europe.

F. O. Licht K.G.[4] have recently published tables of comparative beet yields which draw attention to the remarkable achievements of recent years and particularly during the past campaign. Yields for individual countries are given below with comparative data from 1961/62 and 1937/38.

	(metric tons per hectare)		
	1967/68	1961/62	1937/38
Austria	47·58	33·69	26·38
Belgium	51·95	43·66	32·54
Denmark	41·94	36·69	37·03
Finland	17·89	27·12	26·49
France	42·99	36·68	28·53
Germany, West	46·22	35·41	35·38
Greece	57·18	—	—
Holland	51·63	47·79	36·66
Ireland	37·49	28·35	23·77
Italy	40·50	31·21	26·21
Spain	24·69	24·17	14·12
Sweden	43·57	40·15	37·55
Switzerland	48·82	44·27	36·04
Turkey	34·76	21·43	12·12
UK	39·03	36·35	20·69
Yugoslavia	34·52	25·72	21·83
Average West Europe	40·80	33·25	25·86

Average yields for West Europe quoted for the campaigns of 1947/48 to 1959/60 range from 20·08 to 32·74 tons per hectare, while in 1960/61 which was an especially good crop year, 38·02 tons were obtained for the first time. The average fell again to 33·0 tons in 1961/62 and 29·87 tons in 1962/63 but thereafter climbed to 35·41 tons in 1963/64, 36·74 in 1964/65, 34·71 in 1965/66, 38·95 in 1966/67 and passed the 40-tons mark in 1967/68 for the first time. This remarkable progress may be attributed to better beet seed, better cultivation of the soil, more efficient fertilization and also to the use of spray irrigation, since weather was not a greatly variable factor during these recent years.

[1] *Willett & Gray*, 1968, **92**, 162.
[2] *Public Ledger*, 16th March 1968.
[3] C. Czarnikow Ltd., *Sugar Review*, 1968, (866), 98.
[4] *International Sugar Rpt.*, 1968, **100**, (7), 1.

Milling Units for the Milling-Diffusion Process

By W. R. CRAWFORD
(Walkers Limited, Maryborough, Queensland)

Introduction

TWO types of so-called diffuser have been put to work in the cane sugar industry during the past few years. They are, respectively, the immersion counterflow type introduced by De Danske Sukkerfabrikker, and the percolation bed type, four designs of which are known to the writer, namely De Smet, BMA, Burnett and Silver Ring. All have been described in the technical press and elsewhere. The Silver Ring diffuser does not usually work in conjunction with conventional crushing mills, but all others do. This article is concerned with mills to be used in this manner.

Most suppliers of diffusers for milling-diffusion call for a preliminary sucrose extraction of at least 65%, and, following the diffuser, a reduction of bagasse moisture to about 50%.

While it is possible to obtain a 65% extraction with a single mill, even at fairly high crushing rates, it has been found necessary (with one exception) to install two dewatering mills. The exception is in the world's largest milling-diffusion plant at Malelane in the Eastern Transvaal. This plant belongs to Transvaalse Suikerkorporasie Beperk and a general description of it appeared in the *I.S.J.* in August 1967. The designed throughput is 223 long tons of cane per hour.

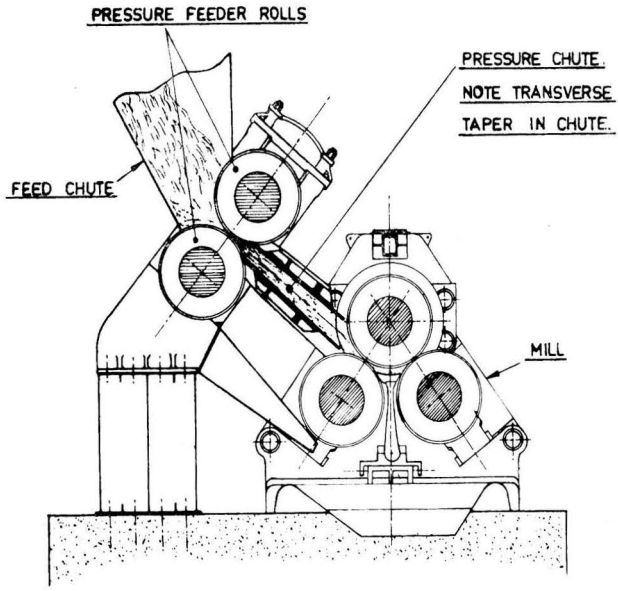


Fig. 1. Pressure feeder attached to a three-roller mill.

Mill Units at Malelane

At Malelane the De Smet diffuser is preceded by a 42 in × 84 in three-roller mill, equipped with a 42 in × 84 in two-roller pressure feeder. The diffuser is followed by an identical unit. Both units are to the design of Walkers Limited, of Maryborough, Queensland, the mills being manufactured under licence in South Africa, and the pressure feeders in Australia.

The three-roller mills are of the most modern triangular stress type, with bottom roller loads transmitted directly to cheek facings which are normal to the planes joining the axes of top and bottom rollers. The milling units at Malelane have top roller hydraulics and hydraulics below the delivery roller, which is Walkers' current practice. This makes the mill virtually self-setting.

Construction of these milling units is massive and, with the exception of the roller shells, bearings and other non-ferrous parts, of steel throughout.

The addition of a pressure feeder to such a mill endows it with unique qualities for the extraction of juice from cane and reduction of the moisture content of bagasse.

The continuous pressure feeder, an Australian invention, originated as an outstanding contribution by the Colonial Sugar Refining Co. Ltd. to the technology of the Australian sugar industry. It has been developed to its present high efficiency by Walkers Limited.

Briefly, a continuous pressure feeder comprises a pair of circumferentially grooved rolls mounted in front of, and somewhat higher than, the feed and top rolls of the three-roller mill, after the fashion of a two-roller crusher. These rollers are connected to the mouth of the mill by a heavily constructed, totally enclosed chute. This chute has a constant width equal to the roller length, but its transverse depth tapers slightly outwards from the feeder rollers to the mill rollers. The arrangement is shown diagrammatically in Fig. 1.

The feeder is driven through additional gearing incorporated in the mill drive final gearing, and in normal circumstances it is possible to fit a pressure feeder to an existing mill.

The chute is kept as short as possible in order to minimize the frictional

forces between the bagasse and the walls of the chute.

In early pressure feeders the feeder rollers had a diameter somewhat less than that of the mill rollers, but the modern tendency is to make the diameter of the feeder rollers at least equal to, and sometimes greater than, that of the mill rollers. This greatly enhances the feeding ability of the pressure feeder.

Pressure feeders are not normally fitted with hydraulics.

Fig. 2 shows a 42 in × 84 in pressure feeder-mill unit identical with those supplied to Malelane.

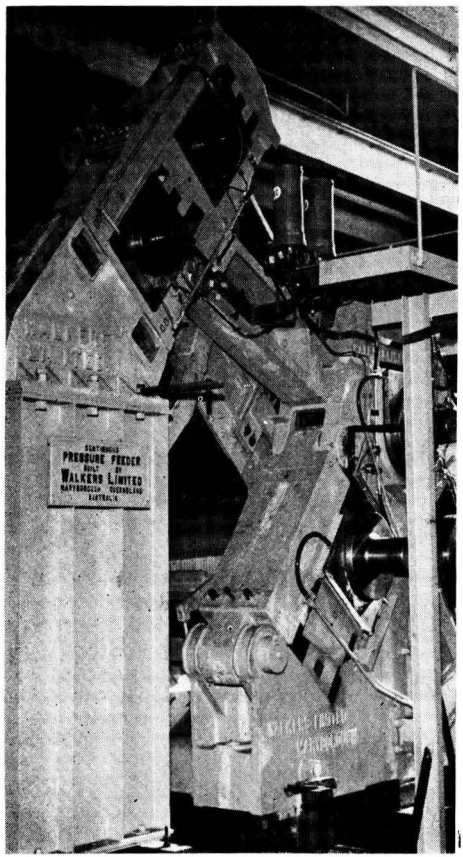


Fig. 2. Pressure feeder and mill.

The primary extraction milling unit

To obtain a high extraction from a cane mill it is first of all necessary that the preparatory devices achieve a high percentage of breakage of juice cells. This implies a finely-divided feed material and the mill must be capable of accepting this with zero or minimum slip at the higher roller speeds associated with high crushing rates. As it expresses juice, the mill should continue to prepare the cane, in its passage through the mill, by further cell breakages.

The pressure feeder-mill unit is very efficient in these respects, and in Queensland, and other places where these units are used, No. 1 mill pol extractions in excess of 80% have been obtained at high fibre rates. Table I gives No. 1 mill extractions for some Queensland factories during the early part of September, 1967. All these factories use 42 in × 84 in pressure feeder-mill units.

Table I. Pol extraction at No. 1 unit

Factory	A	B	C	D	E	F	G	H	I
Crushing rate (long tons/hour)	240	237	303	228	127	247	202	209	219
Fibre rate (long tons/hour)	28·9	28·6	37·1	31·9	18·4	33·7	27·2	28·9	31·6
Pol extraction (%)	74·41	77·72	70·40	71·26	76·46	81·24	76·53	70·97	70·78

Most suppliers of diffusers for milling-diffusion claim that the high degree of preparation necessary for high extractions, such as in Table I, is a disadvantage to the subsequent diffusion process, and call for a coarser preparation. Various reasons are given for this, but there is little published information on experiments to determine the influence of degree of preparation. FOSTER and HILL[1], in simulated percolation bed experiments, have shown that the finest possible preparation consistent with a reasonable bed permeability, should be used in a commercial diffuser in order to obtain the highest extraction.

This seems to cover the matter, since it seems obvious that there should be maximum cell breakage in the material entering the diffuser because, after all, the process is in reality one of almost 100% lixiviation. On the other hand, low permeability due to very fine preparation will clearly result in large, slow, and expensive moving beds, accompanied by increased danger of inversion of sucrose in the diffuser.

However, it is of interest to set down a simple expression which relates the cane mill extraction to the diffuser extraction for a given overall extraction.

Thus, let the overall extraction required be 97·5% and let E = % pol extraction of No. 1 unit, and e = % pol extraction of diffuser based on pol in No. 1 bagasse.

It is now easy to write down $e = 100\,\dfrac{(97{\cdot}5 - E)}{(100 - E)}$ and this value is given in Table II for four values of E.

Table II. Diffuser extraction

Pol extraction at No. 1 mill, E%	65	70	75	80
Diffuser pol extraction, e%	92·5	91·7	90·0	87·5

It is seen that as No. 1 extraction increases the required diffuser extraction decreases, and *vice versa*.

Now it is known that in bagasse mills the higher the pol in feed the higher will be the percentage extraction. The same may be true of diffusion. Never-

[1] *Proc. 33rd Conf. Queensland Soc. Sugar Cane Tech.*, 1966, 111.

theless FOSTER and HILL, working with Pleystowe No. 1 bagasse, after an initial pol extraction of about 65%, have recorded simulated bed extractions of only 82·8% to 89·9%. Although it may be somewhat difficult to relate these experiments to practice, the results do suggest that it may be difficult to obtain the high overall extractions often quoted for bed diffusers with moderate No. 1 extractions.

At Malelane, as in Queensland, high No. 1 mill pol extractions can be obtained, values in excess of 77% having been recorded at high fibre rates. Because of this, Malelane presents a magnificent opportunity for the determination of the effect of variation in No. 1 extraction on the diffuser extraction.

Dewatering with the pressure-feeder-mill unit

The conception of the continuous pressure feeder stemmed originally from the necessity to handle hot, wet bagasse in the days when intermediate carriers with immersion boots, and very hot imbibition water, were used in Queensland. As a consequence, the pressure feeder is eminently suitable for use with a dewatering mill.

Hot and very wet bagasse, such as that from a diffuser, has poor feeding qualities which result in roller slip. This in turn causes polishing of rollers which accentuates the slip.

The pressure feeder reduces mill slip by a preliminary reduction in moisture content of the material entering the feeder rollers, followed by the presentation to the mill feed opening of a compact, partially dried bagasse blanket of controlled thickness.

In order to demonstrate the ability of the pressure feeder-mill combination to handle diffuser bagasse, and to yield low values of final bagasse moisture, reference will be made to a very comprehensive series of performance tests carried out by the Queensland

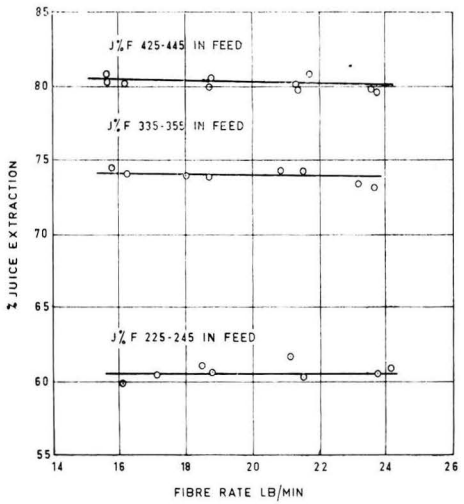


Fig. 3. Juice extraction *vs.* fibre rate

Sugar Research Institute, some years ago, on what was then the fourth and final unit at Plane Creek Mill in the Central Queensland sugar area. These tests have been reported previously[2,3], but in the light of diffuser development they warrant some recapitulation.

Before doing so, however, it is thought advisable to review the general performance characteristics of hydraulically loaded bagasse mills.

Fig. 3 is based on tests carried out with the Sugar Research Institute Experimental Mill[4] and shows percentage juice extraction in terms of dry fibre rate. It is evident that this extraction is virtually independent of fibre rate for all levels of "wetness of feed" considered.

Wetness may be defined as juice % fibre in the feed material.

The range of fibre rate is wide, although these tests were on pilot plant scale.

This result is a characteristic of a bagasse mill in which the hydraulically loaded roller floats freely. It has been confirmed for full sized factory mills in Queensland[2] and Hawaii[5].

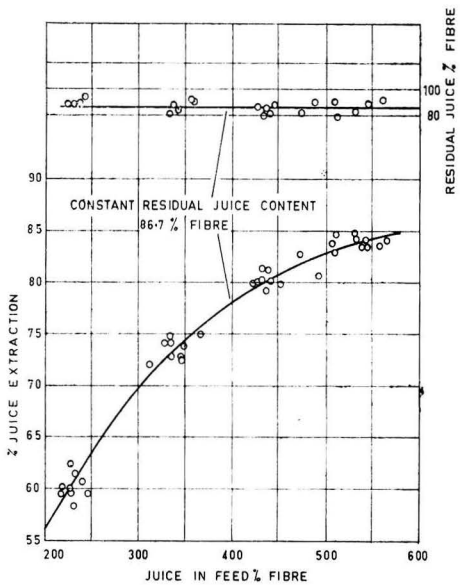


Fig. 4. Hydraulic mill characteristics

Since the fibre rate has not much influence on percentage expression of juice, we now examine the influence of the only other variable in the composition of the feed material, i.e. the wetness of the feed.

[2] ANON.: *Tech. Rpt. Sugar Research Inst.*, 1954, (16).
[3] CRAWFORD: *Proc. 21st Conf. Queensland Soc. Sugar Cane Tech.*, 1954, 127.
[4] CRAWFORD: *Proc. 11th Congr. ISSCT*, 1962, 1030.
[5] HAINES and HUGHES: *ibid.*, 1013.

Fig. 4, also prepared from the same test results as Fig. 3, shows how the juice extraction varies with the juice: fibre ratio of the feed material. The higher the juice:fibre ratio, the higher is the percentage juice extraction. It has been shown[4] that, although this result may appear to be axiomatic, it is not so, since the shape of the extraction characteristic depends upon the relationship between liquid in feed and liquid in bagasse per unit of fibre.

In the experimental mill tests and in practice it has been found that liquid % fibre is virtually independent of wetness of feed, and has a constant value which of course depends on hydraulic load and roller speed. This is also shown in Fig. 4.

It is easily seen that, if the juice % fibre in bagasse has a constant value k, and the juice % fibre in feed has a variable value J, the % juice extraction is—

$$100\ (1 - \frac{k}{J}).$$

The characteristics illustrated above apply equally to the pressure feeder-mill combination, provided the hydraulically loaded roller floats freely.

The Plane Creek unit already referred to was one of early design with mill rollers of 35 in × 72 in, top roller hydraulics, and pressure feeder rollers of 30 in × 72 in.

Its characteristics, obtained by very extensive measurements and analyses during normal factory operation, are shown in Fig. 5. During the period of testing the fibre rate varied between 14·0 and 16·5 long tons/hour.

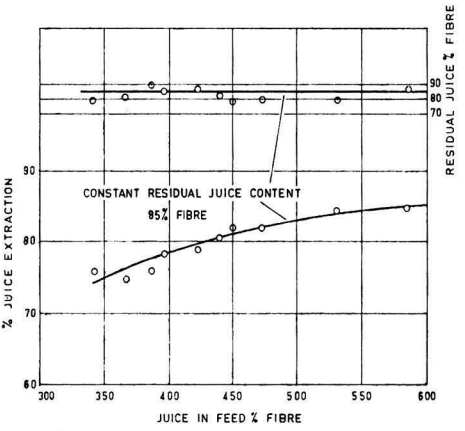


Fig. 5. Pressure feeder-mill characteristics

It is seen that the pressure feeder-mill unit was capable of handling, successfully, feed material with a liquid content of up to 600% on fibre, and yielding a final bagasse with the very low juice content of 85% on fibre. The latter value corresponded to a bagasse moisture of about 44%. The top roller of the mill was heavily loaded to about 96 long tons/ft.

The feed wetness of 600% fibre is about the value expected with bed diffusers, and in these tests was limited only by evaporator capacity. There was no indication that this value could not be exceeded.

It will be noted that a wet feed of 600% fibre was also handled successfully by the Sugar Research Ltd. three-roller mill and it may be wondered why a full sized mill cannot do likewise. The reasons are, first, the tests reported were on No. 1 mill bagasse so that the preparation was still coarse enough to promote good feeding. Secondly, the total throughput of cane or bagasse in the experimental mill in any one season was very small compared with a factory throughput, and consequently the roller surfaces always remained in a "rough" condition.

In subsequent experiments simulating a four-mill tandem[6] feeding difficulties were encountered in the third and fourth simulations. These were attributed to severe disintegration of the bagasse with each pass through the mill, and could only be overcome by roughening the entire surfaces of the feed and top rollers, by cratering with a carbon arc.

In recent years fibre rates, and hence roller speeds, have increased enormously in Queensland so that it is hardly to be expected that the very low bagasse moisture of 44% would be maintained. Juice extraction always falls as roller speed increases owing to increase in reabsorption. In addition roller diameters have been increased and it has been proved experimentally in Queensland that to obtain the same percentage extraction with larger rollers, the roller load must be increased in the ratio of roller diameters.

Thus for 42-inch dia. rollers, the roller load required to produce the quoted moisture of 44% obtained with 35-in rollers would be:

$$96 \times \frac{42}{35} = 115 \text{ long tons/ft},$$

a load which might pose shaft design problems.

Nevertheless relatively low moistures can still be obtained, and in one Queensland factory using a 42 in × 84 in final pressure feeder-mill unit, a moisture value of 47% has been obtained at rates around 30 tons fibre/hour from a feed of wetness about 600% fibre. This is not a diffuser factory, but experiments are being carried out with a long recirculation carrier placed after the penultimate mill.

At Malelane final bagasse moistures of between 49 and 50% are being achieved at high fibre rates.

For the crushing period ended 2nd September 1967, the Malelane final bagasse moisture, then given as 49·77%, was the lowest value listed in the Sugar Milling Research Institute summary of laboratory reports. For this period the crushing rate was 177 short tons per hour and the fibre content 15·16%.

There is no doubt in the mind of the writer that the 49 to 50% moisture figure will be improved upon

[6] McGINN: *Proc. 30th Conf. Queensland Soc. Sugar Cane Tech.*, 1963, 101.

as the millers become more conversant with the operation of the equipment.

Table III shows the order of final bagasse moistures achieved in Queensland in conventional milling tandems using a pressure feeder-mill combination as the final unit.

Table III

Factory	1	2	3	4	5	6	7	8
Crushing rate (long tons/hr)	240	237	303	228	127	247	202	209
Final bagasse moisture (%)	48·0	47·4	48·7	48·6	42·0	44·2	51·0	51·3

The variation in these final bagasse moistures reflects the methods of operation adopted by the several factories, but it will be seen that all are satisfactory as regards fuel value of bagasse.

So far as milling-diffusion is concerned, there is little of interest in the pol extraction of the dewatering mill. If there has been a sufficiently high initial cell breakage, and if the diffuser is doing what is required of it, then with the high juice extraction in the dewatering unit the pol % bagasse will be low.

Conclusion

It has been shown above that a modern pressure feeder-mill combination, in which the mill is hydraulically loaded, makes an efficient unit for the preliminary extraction of cane juice preceding a diffuser, and also an efficient dewatering unit following a diffuser. A single unit of this type may be used instead of two three-roller mills for the dewatering of very wet and hot bagasse, and at the highest fibre rates yet envisaged.

It is necessary only that the hydraulic load be correctly chosen and that the three squeezes be correctly graduated.

The capital cost and maintenance economy of a single dewatering unit instead of two conventional mills will appeal to those about to venture into the field of diffusion.

The condition of the rollers of any milling unit is of utmost importance when the feed material contains large percentages of liquid, and this applies also to pressure feeder rollers. The use of transverse grooving and arcing has often vastly improved the performance of a milling unit.

Boiling point elevation of pure sucrose solutions

By W. M. NICOL (Tate & Lyle Ltd., Research Centre, Westerham Road, Keston, Kent, England)

Introduction

THE elevation of boiling point is frequently used to determine the concentration of sugar solutions. The present paper presents a revision of the tables of boiling point elevation for pure sucrose solutions as functions of concentration and supersaturation in the absence of superheating. Attention is drawn to vapour pressure data for sucrose solutions, which previously were not widely known. Mathematical smoothing has been effected and the magnitude of the probable errors in the tabular values has been estimated. In deriving the supersaturation, the solubility-temperature relationship for sucrose is required and this will be considered first.

The Solubility-Temperature Relationship

VAVRINECZ[1] has critically reviewed many of the experimental determinations of pure sucrose solubility. He has applied statistical weighting to the data according to their experimental merit and derived "Fundamental Values". To describe these mathematically, the accuracies of eight different equations were examined. It was concluded that of these a quartic polynomial was best. His recommended function for the temperature range —13°C to 100°C was

$$Z = 64{\cdot}447 + 8{\cdot}222\,T \times 10^{-2} + 16{\cdot}169\,T^2 \times 10^{-4} - 1{\cdot}558\,T^3 \times 10^{-6} - 4{\cdot}63\,T^4 \times 10^{-8} \quad \ldots.(1)$$

where Z is the concentration of sucrose in g/100 g solution and T °C is the temperature. The standard deviation of all the experimental results from the above curve is 0·208g/100g and the correlation coefficient is 0·9992. It is considered that for most practical purposes the above function provides an adequate interpretation of all the existing accurate experimental data.

The Boiling Point Elevation

Whereas the solubility of sucrose has been the subject of many investigations, the boiling point elevation of sucrose solution has been sparsely treated. The classical determination of CLAASSEN[2], used for many years as the standard, suffers from the fact that all the experiments were conducted at a pressure of 760 mm Hg, while sucrose crystallization is effected in the main at sub-atmospheric pressures.

[1] *Zeitsch. Zuckerind.*, 1962, **87**, 481.
[2] *Zeit. Ver. deut. Zuckerind.*, 1904, **54**, 1161.

SPENGLER, BÖTTGER and WERNER[3] measured the boiling points elevation directly for sucrose concentrations ranging from 15 to 90 g sucrose/100 g solution and for pressures in the range 0·25 to 2 atmospheres. No measurement was made of the amount of sucrose inversion which must have occurred at the higher temperatures. Since superheating of the solution would certainly be present in the steam-heated boiling vessel, there is some doubt also concerning the measured solution temperature. BENNETT and FENTIMAN[4] reported a mean superheat in the solution of 0·5°C when the temperature difference between the heat source and the boiling sucrose solution was 25°C. SPENGLER states that temperature differences between the heating steam and the boiling solution were as much as 15°C. SPENGLER's solution temperatures might therefore be expected to be high because of superheating of the solution.

BATES *et al*[5]. fitted a polynomial to SPENGLER's experimental data, and derived an equation for calculating the boiling point elevation at pressures other than atmospheric. It should be noted, however, that the polynomial has been fitted only to the 16 experimental points measured at 1 atmosphere. Furthermore, the function derived by BATES to enable the elevation to be calculated at other pressures depends on the assumption that sucrose solutions are ideal and that the vapour is an ideal gas. Both of these assumptions are approximate. As a result, it is not surprising to find a significant difference between the experimental values of SPENGLER and the calculated values of BATES at 0·25 atmosphere as shown in Table I. At this pressure the graphically smoothed values of SPENGLER are considerably closer to his experimental data than the calculated values, despite a contrary assertion by BATES.

Table I. B.P.E. (°C) at 190 mm Hg.

Concentration of sucrose g/100 g solution	60	73·2	75·2
SPENGLER *et al.*	2·49	5·22	5·78
BATES *et al.*	2·35	4·88	5·51

JACKSON[6], in extending the work of DUNNING, EVANS and TAYLOR[7], has measured the vapour pressures of sucrose solutions, the concentrations of which varied between 27·5 and 82·5 g/100 g solution at 60°C and 90°C. The experiments, which were conducted under equilibrium non-boiling conditions, are among the most accurate in determining vapour pressures of sucrose solutions. The standard deviation of an observation, with all the necessary corrections applied, amounted to 0·1 mm Hg.

Starting from the equilibrium relative humidity of sugar solutions and the relative partial molal heat of solution, NORRISH[8] derived boiling point elevations thermodynamically. However the heat of solution is not an easy measurement and there is some uncertainty on the effect of temperature.

From the thermodynamic point of view, the work of JACKSON is to be preferred because of its basic approach and because there are no doubts about superheating in the solution.

Evaluation of the Data

In JACKSON's analysis, the temperature T_w of the water vapour in equilibrium (at the same vapour pressure) with the solution, at a fixed concentration was compared with the solution temperature T_s. By considering the 25°C values of SCATCHARD, HAMER and WOOD[9] together with the 60°C and 90°C values of JACKSON, it was found that at constant concentration there is a linear relationship between T_s and T_w. This, the Dühring rule, was also confirmed by HOLVEN[10]. Thus

$$T_w = a\,T_s - b \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

[3] *Zeit. Wirtsch. Zuckerind.*, 1938, **88**, 521.
[4] *I.S.J.*, 1968, **70**, 9–13, 36–39.
[5] "Polarimetry, Saccharimetry and the Sugars." *Nat. Bureau Standards Circular*, 1942, (C440).
[6] Thesis, University of Bristol, 1950.
[7] *J. Chem. Soc.*, 1951, 2363.
[8] *Brit. Food Manuf. Ind. Research Assoc. Tech. Circular*, (331).
[9] *J. Amer. Chem. Soc.*, 1938, **60**, 3061.
[10] *Ind. Eng. Chem.*, 1942, **34**, 1234.

Table II. Data of Jackson

Molality	*Concentration, sucrose (g/100 g solution)*	*Vapour pressure of solution at 60°C (mm Hg)*	*Temperature of water vapour at same pressure (°C)*	*Vapour pressure of solution at 90°C (mm Hg)*	*Temperature of water vapour at same pressure (°C)*	*a*	*b*	*A*	*B*
4·5	60·64	133·95	57·68	473·21	87·23	0·9850	1·42	0·01523	1·442
5·0	63·12	131·93	57·36	466·20	86·85	0·9830	1·62	0·01729	1·648
5·5	65·29	129·88	57·02	459·16	86·47	0·9816	1·88	0·01868	1·915
6·0	67·25	127·83	56·68	452·21	86·06	0·9793	2·08	0·02110	2·124
6·5	68·99	125·79	56·34	445·21	85·67	0·9776	2·32	0·02284	2·373
7·0	70·56	123·77	55·99	438·30	85·27	0·9760	2·57	0·02459	2·633
7·5	71·97	121·75	55·64	431·41	84·86	0·9740	2·80	0·02669	2·875
8·0	73·25	119·71	55·29	424·65	84·46	0·9723	3·05	0·02845	3·137
8·5	74·42	117·73	54·95	417·96	84·06	0·9703	3·27	0·03057	3·370
9·0	75·49	115·76	54·59	411·28	83·65	0·9686	3·53	0·03235	3·644
9·5	76·48	113·84	54·25	404·71	83·24	0·9663	3·73	0·03484	3·860
10·0	77·39	111·95	53·90	398·23	82·85	0·9650	4·00	0·03663	4·147
10·5	78·23	110·08	53·56	391·78	82·45	0·9630	4·22	0·03842	4·382
11·0	79·02	108·20	53·20	385·34	82·03	0·9610	4·46	0·04058	4·641
11·5	79·74	106·33	52·83	378·95	81·60	0·9590	4·71	0·04275	5·911
12·0	80·42	104·45	52·47	372·56	81·19	0·9573	4·97	0·04457	5·192

Table III. Boiling Point Elevation and Sucrose Concentration

Vapour pressure	*Vapour temperature*	*Sucrose Concentration g/100 g solution*										
		70	71	72	73	74	75	76	77	78	79	80	81
(*mm Hg*)	(°C)	*Boiling Point Elevation* (°C)											
175	63·46	4·07	4·31	4·58	4·87	5·18	5·51	5·88	6·29	6·74	7·23	7·77	8·37
187·5	65	4·10	4·35	4·62	4·91	5·22	5·56	5·94	6·34	6·79	7·29	7·84	8·44
190	65·29	4·11	4·36	4·63	4·92	5·23	5·57	5·95	6·36	6·81	7·30	7·85	8·46
200	66·46	4·14	4·39	4·66	4·95	5·26	5·61	5·98	6·40	6·85	7·35	7·90	8·51
209·6	67·5	4·16	4·42	4·69	4·98	5·30	5·64	6·02	6·43	6·89	7·39	7·95	8·56
225	69·13	4·20	4·46	4·73	5·02	5·34	5·69	6·07	6·49	6·95	7·46	8·02	8·63
233·7	70	4·22	4·48	4·75	5·05	5·37	5·72	6·10	6·52	6·98	7·49	8·05	8·67
250	71·57	4·26	4·52	4·79	5·09	5·42	5·77	6·16	6·58	7·04	7·56	8·12	8·75
260·1	72·5	4·28	4·54	4·82	5·12	5·45	5·80	6·19	6·61	7·08	7·59	8·16	87·9
275	73·82	4·31	4·57	4·85	5·16	5·48	5·84	6·23	6·66	7·13	7·65	8·22	8·85
289·1	75	4·34	4·60	4·89	5·19	5·52	5·88	6·27	6·70	7·17	7·70	8·27	8·91
300	75·89	4·36	4·63	4·91	5·22	5·55	5·91	6·30	6·73	7·21	7·73	8·31	8·95
320·6	77·5	4·40	4·67	4·95	5·26	5·59	5·96	6·36	6·79	7·27	7·80	8·38	9·02
355·1	80	4·46	4·73	5·02	5·33	5·67	6·04	6·44	6·88	7·36	7·90	8·49	9·14

The approximation to linearity was such that when the coefficients a and b (which vary with sucrose concentration) were determined from the 60°C and 90°C data of JACKSON, there was a difference of the order of only 0·1°C when applied to the data of SCATCHARD at 25°C. The coefficients are shown in Table II for a range of concentrations from 60 to 80 g sucrose/100 g solution.

The boiling point elevation $\Delta T = T_s - T_w$ in conjunction with equation 2 leads to

$$\Delta T = A\,T_w + B \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

It is seen from Table II that the values of A and B are functions of concentration, so that

$$T = A(Z)\,T_w + B(Z) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

By fitting a polynomial function to the values of A and B it was found that

$$A(Z) = 4{\cdot}43355\,Z^4 \times 10^{-8} - 10{\cdot}5170\,Z^3 \times 10^{-6} + 9{\cdot}51766\,Z^2 \times 10^{-4} - 3{\cdot}82363\,Z \times 10^{-2} + 0{\cdot}579709$$

the correlation coefficient of which is 0·99972; and

$$B(Z) = 1{\cdot}45282\,Z^4 \times 10^{-5} - 3{\cdot}85810\,Z^3 \times 10^{-3} + 3{\cdot}88278\,Z^2 \times 10^{-1} - 1{\cdot}74178\,Z \times 10 + 293{\cdot}734$$

the correlation coefficient of which is 0·99988.

Taking into account the deviation of the calculated values of A and B from the values given in Table II, and also considering the accuracy of measurement of the sucrose concentration and that of the water boiling temperature, the estimated error in ΔT as calculated from Equation 4 should be $< 0{\cdot}8\%$.

Equation 4 has been used to determine the boiling point elevation of sucrose solutions over a range of concentrations and at a number of vapour pressures. Results are presented in Table III.

Using the solubility-temperature relationship in Equation 1 and the boiling point elevation from Equation 4, the boiling point of a saturated sucrose solution at a number of vapour pressures and temperatures has been determined by the following procedure. First an estimate is made of the boiling temperature which, when inserted into Equation 1, yields the concentration of the saturated solution. The temperature T_w at which the water vapour pressure equals the selected pressure can be abstracted from the standard tables. Substitution of the concentration in Equation 4 then yields the boiling point elevation ΔT, and the sum $(T_w + \Delta T)$ is thus a closer approach to the required solution boiling temperature. The cycle of calculation is repeated until adequate convergence has been attained. Conversely the boiling point elevations and vapour temperatures for a number of saturated solution temperatures has been calculated from Equation 5.

$$\Delta T = A/(A + 1)\,T_s + B/(A + 1) \quad \ldots\ldots\ldots (5)$$

Results are presented in Table IV.

Table IV. Boiling points of Saturated Sucrose Solutions

Vapour pressure (*mm Hg*)	*Vapour temperature* T_w (°C)	*Concentration at saturation* (*g*/100 *g solution*)	*Boiling point elevation* (°C)	*Temperature of boiling solution* T_s (°C)
175	63·46	76·37	6·03	69·49
178·67	63·92	76·48	6·08	70·00
187·54	65·00	76·76	6·24	71·24
190	65·29	76·83	6·28	71·58
197·03	66·11	77·03	6·39	72·50
200	66·46	77·12	6·45	72·91
209·55	67·50	77·39	6·61	74·11
216·80	68·28	77·59	6·72	75·00
225	69·13	77·80	6·86	75·99
233·71	70·00	78·03	7·00	77·00
238·10	70·44	78·14	7·06	77·50
250	71·57	78·42	7·26	78·83
260·10	72·50	78·66	7·41	79·91
260·98	72·58	78·68	7·42	80·00
275	73·82	78·99	7·64	81·46
285·40	74·70	79·22	7·80	82·50
289·13	75·00	79·29	7·86	82·86
300	75·89	79·52	8·02	82·92
311·54	76·81	79·74	8·19	83·00
320·60	77·50	79·92	8·33	85·83
339·60	78·90	80·26	8·60	87·50
355·10	80·00	80·53	8·83	88·83
369·26	80·97	80·77	9·03	90·00

Equations 1 and 4 have been used to construct Figs. 1 and 2 which show the relation between concentration, saturation ratio*, solution temperature, pressure and boiling point elevation.

* Saturation ratio S at temperature T°C is defined for a pure sucrose solution as

$$S = \frac{\dfrac{\text{mass of sucrose}}{\text{mass of water}} \text{ in the solution at } T°\text{C}}{\dfrac{\text{mass of sucrose}}{\text{mass of water}} \text{ in a saturated solution at } T°\text{C}} = c/c_o$$

where c_o is occasionally called the solubility number.

A relatively recent correlation is that of COLE[11] who used the BATES equation for SPENGLER'S boiling point elevation and the solubility table of TAYLOR[12]. In Fig. 2 are the 65°C curves corresponding to the SPENGLER-VAVRINECZ and the SPENGLER-TAYLOR data. It is seen that over most of the saturation range the SPENGLER values lead to a higher boiling point elevation than the JACKSON data, probably resulting from superheating in the solution as discussed earlier; while the TAYLOR solubility leads to a lower boiling point elevation than the VAVRINECZ correlation.

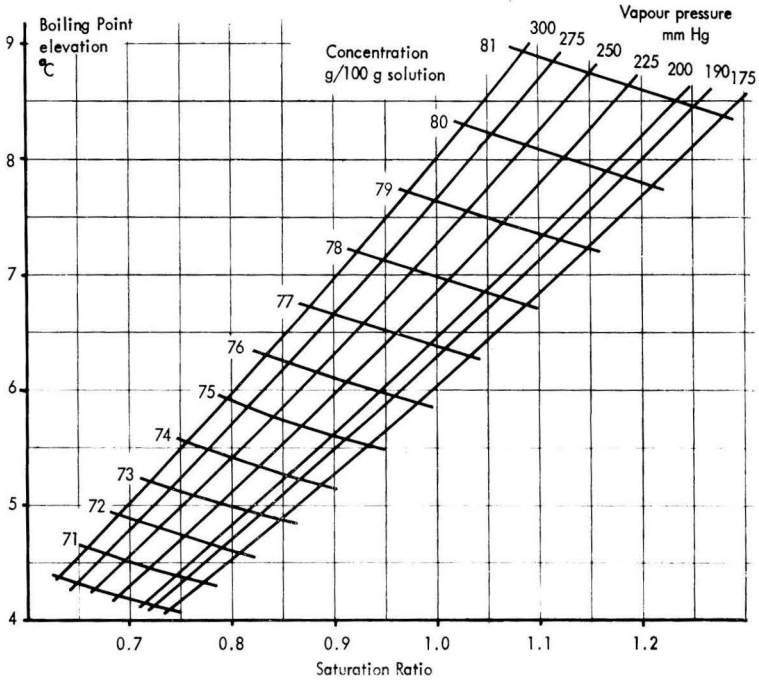


Fig. 1

Conclusion

It is claimed that the accuracy of the tables and equations presented here is such that the error in boiling point elevation is less than 0·8% and consequently it should be possible to determine the saturation ratio by this method with an error of less than 0·01.

It should be noted that the boiling point elevation given by Figs. 1 and 2 is the correct value when the boiling solution has no superheat. However, when boiling at practical rates, solutions will be superheated and concentrations can no longer be determined from Equation 1[4].

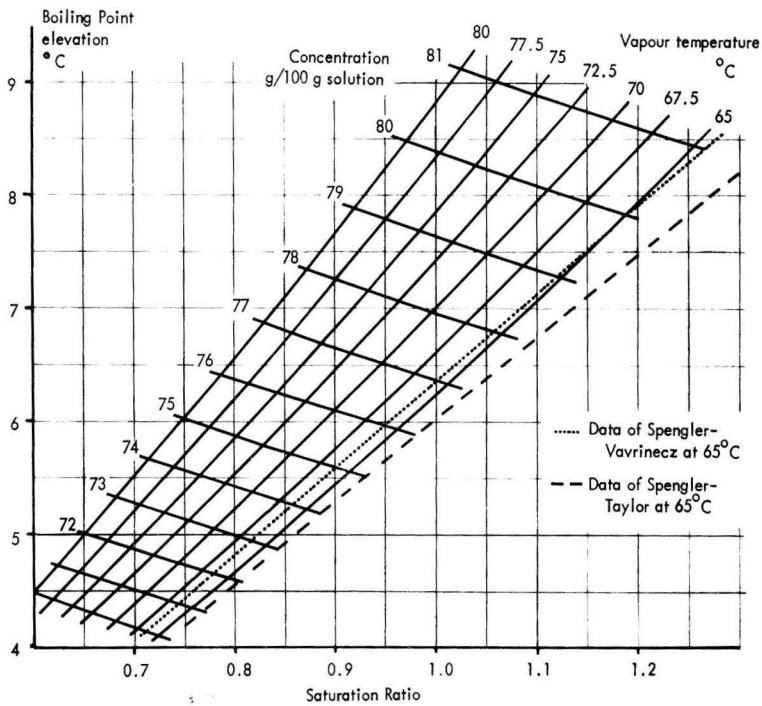


Fig. 2

[11] *J. Amer. Soc. Sugar Beet Tech.*, 1956, **9**, 258.
[12] *J. Chem. Soc.*, 1947, 335, 1678.

The Suchem "Auto Diffuser"

By P. P. STRICH
(President, Suchem Inc., Ponce, Puerto Rico)

A NEW company, Suchem Inc., was incorporated in Puerto Rico in May 1966 to develop a reliable low-cost sugar cane diffuser adapted to economic conditions in the sugar industry, particularly of Puerto Rico. The prototype diffuser has been installed at Central Cortada, near Ponce, and is under test during the 1968 crop. The prototype unit is capable of handling 3000 short tons of cane per day, which will allow it to deal with the whole of the cane supply of Central Cortada which is a 2400 tons/day factory owned by Central Aguirre Sugar Company. The diffuser has been supplied under a trial purchase agreement based on guarantees of less than 0·4% sugar loss on cane weight at a draft of not more than 100 lb juice per 100 lb of cane.

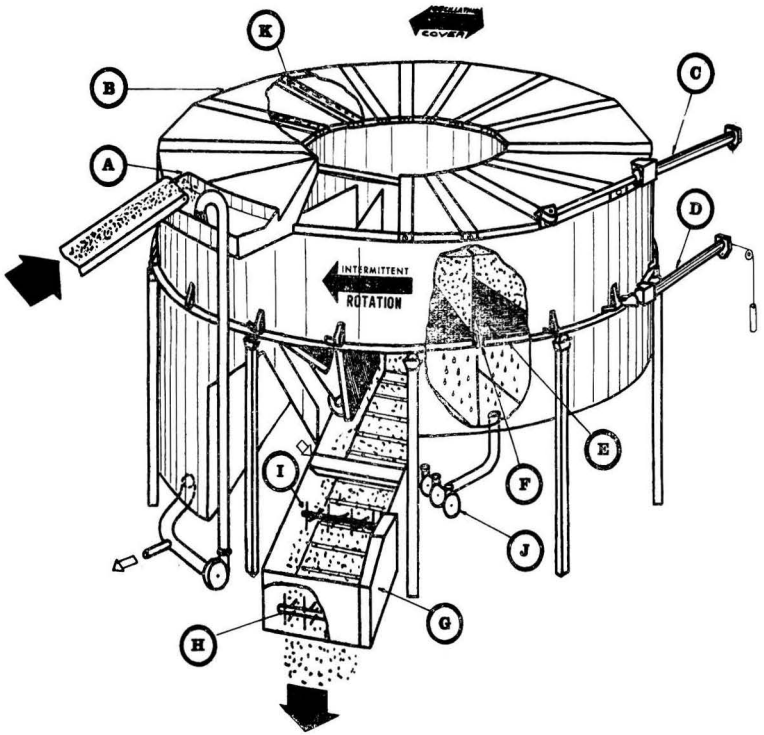


Fig. 1

The "Auto Diffuser" uses the percolation system of juice extraction, in which a moving layer of cane is sprayed with a counter-current flow of juice, with no mechanical action on the cane itself. In order that the diffuser could be used without any special cane preparation or dewatering equipment, the dimensions of the filtration area and zone of recirculation are calculated using a permeability rate of 10 g.p.m. per sq.ft., the average rate for cane which has passed through a standard shredder at normal setting. As well as simplifying the equipment, the use of cane of high permeability has the advantage of reducing the amount of juice in the system.

It should be pointed out that cane and juice do not necessarily stay in the diffuser for the same length of time; the juice retention is a function of the rate at which it filters through the cane bed and how many times it is pumped through the bed, and of the time it stays in the various tanks where it is collected. The cane retention is a function of the time needed to extract its sugar content and is usually 40–60 minutes; under the conditions chosen for the Suchem "Auto Diffuser", juice retention can be reduced to approximately half this time, reducing the risk of colour formation which can occur at its temperature of 165°F.

Shredded pieces of cane less than 2 in long are elevated by a belt conveyor and mixed in the feed hopper A (Fig. 1) with a large amount of hot juice

to produce a slurry. The feed hopper, part of a rigid cover B, mounted on castors, is rotated back and forth by a pivoting hydraulic cylinder C linked to this assembly. The cover-oscillating action around the axis of the diffuser, together with the specially designed slope of the feed hopper, give uniform cane distribution and also ensure effective spraying of the top layers after filling.

The cane is received sequentially by a minimum of 16 compartments formed by radial partitions between two flanged rings, all made of mild steel and closed at the bottom by pivoting frames E covered by stainless steel screens. The frames hinged on one side of each compartment have a latch mechanism F protected from the dripping juice by means of an overlapping cover plate attached to the adjacent radial partition.

The diffuser assembly containing the cane rotates on rollers which support the gusseted flanges of the inner and outer rings. Rotation of the diffuser ring is intermittent and occurs in normal operation only after each compartment has been filled. This motion is obtained by a single hydraulic cylinder D which pushes against shoulders welded onto the periphery of the outer ring. During this rotation the cover oscillation is stopped in order to maintain the same relative speed between the cane and sprayer.

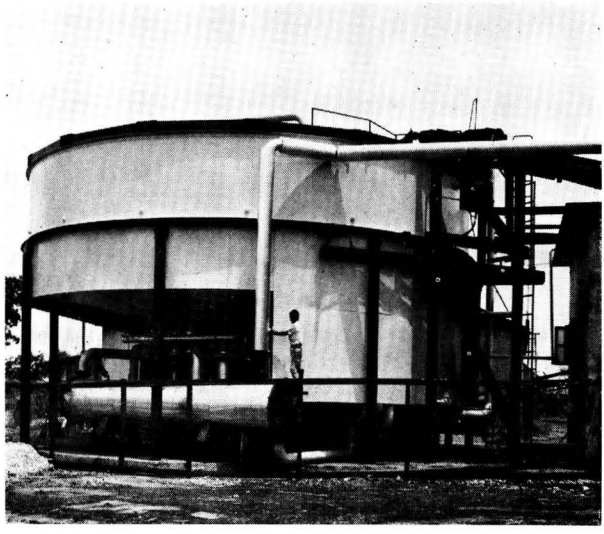


Fig. 2. Side view showing juice heater

After the cane has travelled almost a complete circle round the diffuser the latches holding the bottom of the compartment are disengaged by a stop when the cane, now "wet bagasse", falls onto a flight conveyor G. It is rearranged into an even, relatively thin layer by a leveller I and discharged uniformly onto a belt conveyor, a beater H preventing the formation of any lumps.

Water and juice circulation

Pure water is sprayed over the layer of cane as it is discharged by the flight conveyor. After percolation through the layer it is collected and pumped through a flexible hose into the moving trough over the compartment next to the discharge point. The water flow from points along each of the troughs is proportional to their distance from the centre of rotation, i.e. to the quantity of cane beneath. The liquid percolating through the cane collects in a stationary tank below the compartment from which it is pumped to the adjacent trough, to be sprayed onto the cane in the next compartment and so to collect in the next tank. This is repeated around the diffuser until the filling stage when part of the juice from the tank below is used to make the cane slurry and part is sent to the evaporator.

The temperature within the system is maintained at 165°F by means of a large heat exchanger (Fig. 2) to bring the cold cane quickly to this temperature and a series of small heat exchangers along the juice piping to compensate for heat losses. The water recovered from the bagasse, which contributes at least 60% of that in the system, is also re-heated and its pH automatically adjusted before re-use.

The pH is maintained between 6 and 7 throughout the system; lime is added at the feed entrance for even distribution throughout the compartment depth and the juice leaving the diffuser does not need to be clarified since it is filtered by its passage through the cane bed.

Automatic controls

A limit switch moving with the diffuser cover controls the filling of the compartment receiving fresh cane and gives a volumetric measure of the cane entering the system. Taken on a succession of compartments, this measure is accurate enough, on an average basis, to eliminate the need for a special check weigher to proportion the water added to the diffuser as a function of the cane feed. Consequently, a pre-set amount of water may be added by a batch meter for each moving compartment.

In the case of a cane shortage the compartment is not filled and the diffuser stops moving. A limit switch sensing the flow of incoming cane on the elevating feed conveyor will also stop the diffusion pumps in the case of a prolonged shortage of cane. The pumps on the first two compartments—those for scalding and recirculating—continue to work, regardless of the feed, to prevent cooling and to be ready for the resumption of the cane supply, which restarts the diffusion pumps automatically.

Capacity of the diffuser

The diffuser can be used for cane which has been prepared only by passage through a shredder or, alternatively, by cane which has passed through a shredder and crusher. In the latter case, 60% of the juice has been extracted before the cane enters the diffuser and a smaller unit (Type PM) is then required. The crusher juice can still be filtered through the cane bed in the diffuser when the advantages of clarity and extraction are retained. It is also possible to convert such a unit to a diffuser to handle only shredded cane (Type WM) where all the extraction takes place in the diffuser.

A Type PM40 diffuser, of 40 ft. diameter, has a capacity of 3000 short tons per day when the bed depth is 4–5 ft high, while at the same bed depth, the Type WM48, of 48 ft diameter, will handle 2000 short tons of shredded cane per day.

Tests by Suchem Inc. have shown that, between 2 ft and 10 ft, the permeability of a cane bed varies only with its preparation. Since extraction in a percolation-type diffuser is affected by cane retention, temperature, permeability, and the amount and concentration of liquid, it is possible to vary the throughput of the diffuser by varying the depth of the cane bed. Thus provision is made for extending the height of the partitions and annular rings and to operate at a bed height of 8–9 ft. The capacity can be doubled at low cost without increasing the diameter of the unit. This could not be done with a continuous bed percolation diffuser because the lateral overlapping of juice flow patterns would cause mixing of juices of different concentrations. In the Suchem diffuser this is prevented by the partitions which compartment the cane bed. Using the doubled-height Suchem diffuser, the juice flow is divided into two parallel circuits, which requires no additional pump.

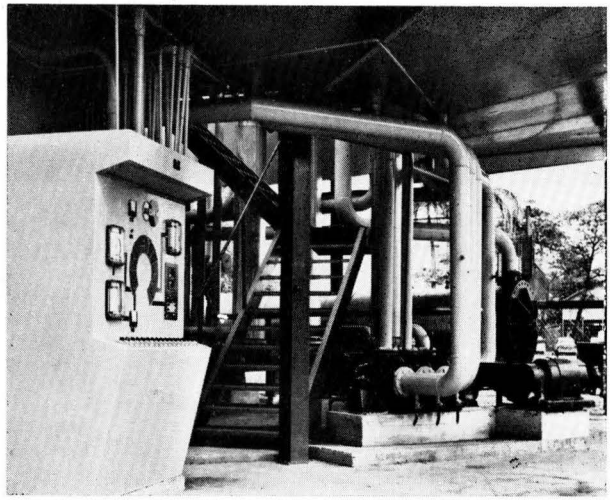


Fig. 3. Control panel with access stair to centre of diffuser

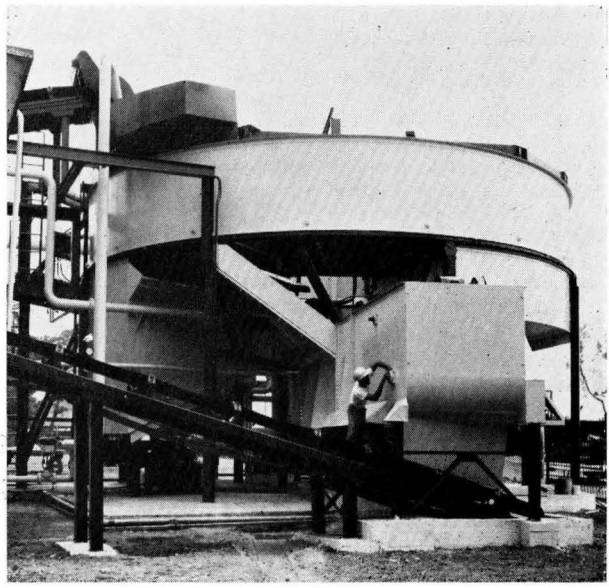


Fig. 4. Loading and discharge side

Brevities

Demerara Co. Holdings Ltd. 1967 report.—Better results came from sugar in 1967 and were largely attributable to production higher than forecast earlier. Production was 14% more than in 1966, due almost entirely to better yields per acre. Diamond factory was able to crush cane to help other estates and as a result reached a record output of 42,250 tons. Factory lands have almost reached their maximum output and further yield improvement is likely to be difficult so that the main contribution toward increasing cane supply must come from farmers.

Japan beet sugar production[1].—Beet sugar production in Hokkaido for the 1967/68 campaign was 265,638 metric tons, which is an increase of 27% over that of the previous campaign. The area harvested was not much greater, at 58,407 hectares, as compared with 54,000 ha in 1966/67, but the beet crop was much higher at 1,942,990 tons compared with 1,503,486 tons. The sugar yield on beet was somewhat lower at 13·96% compared with 14·27% in 1966/67.

[1] *Willett & Gray*, 1968, **92**, 133.

Sugar cane agriculture

La Margarita sugar estate (Mexico). ANON. *Bol. Azuc. Mex.*, 1967, (214), 10–27.—An account is given of recent developments at this large Mexican sugar estate, including new planting, factory equipment, social and other amenities provided for the workers.

* * *

Los Mochis, an up-to-date and progressive sugar estate. ANON. *Bol. Azuc. Mex.*, 1967, (216), 14–27. An account is given of activities and recent progress of this large and well known sugar estate in Mexico. Special mention is made of the amenities and facilities provided for the hundreds of agricultural and other workers on the estate. These include modern housing with up-to-date labour-saving equipment, supermarkets and a good library.

* * *

CP 61-37, a new cane for Louisiana. L. L. LAUDEN. *Sugar Bull.*, 1967, **45,** 272, 278.—The recent release of this new variety is announced and its good points described. It is moderately resistant to mosaic disease; gives good stands of plant and ratoon cane; has erect growth and is not brittle (i.e. is suitable for mechanical harvesting); is adapted to both light and heavy soils; gives good yield of cane and sugar; and has fairly good cold tolerance, although not as good as N:Co 310.

* * *

Beneficial arthropods inhabiting sugar cane fields and their effects on borer infestations. L. J. CHARPENTIER, W. J. MCCORMICK and R. MATHES. *Sugar Bull.*, 1967, **45,** 276–277.—There is much variation in the degree of borer attack (*Diatraea saccharalis*) in Louisiana, even under apparently similar conditions. It was thought that soil fauna might have a bearing on this, and hence this fruitful study. Ants, especially the imported fire ant (*Solenopsis saevissima richteri*), beetles, earwigs and spiders made up the predator complex for the sugar cane borer. Ants were observed attacking the borer. Elimination of fire ants and spiders from small plots by application of granular "Heptachlor" to the top of the soil increased the percentage of bored joints at harvest from 11% to 36%, 2½ times the state average of 14% for 1966.

* * *

Mosaic found in Johnson grass in the Louisiana sugar cane area. I. L. FORBES, M. GIAMALVA and B. FALGOUT. *Sugar Bull.*, 1967, **45,** 278.—Mosaic disease was first found in Johnson grass in May, 1967. Tests to ascertain whether or not the mosaic in Johnson grass will produce symptoms in sugar cane are referred to.

Combating the cigarrinha cane pest. ANON. *Brasil Açuc.*, 1967, **70,** (1), 29–31.—The seriousness of the cigarrinha sugar cane pest (*Mahanarva indicata*) in Brazil, especially in the State of Pernambuco, is discussed. It is also troublesome in Sergipe, Bahia, Estado do Rio (Campos), Paraná and Alagoas.

* * *

A sampling method for measuring yields of sugar cane in replicated trials. D. M. HOGARTH and J. C. SKINNER. *Tech. Comm. Bureau Sugar Expt. Stas.*, (Queensland), 1967, (1), 24 pp.—In the past replicated trials have been on farms occupying a small part of a farmer's field, harvested by hand and weighed separately. The advent of mechanical harvesting has made this difficult or impossible, and a new method is described. Plot weight is estimated from weight per stalk (calculated from a sample of 45 or 60 stalks cut from the middle of a plot) multiplied by the number of stalks in a plot. Weight per unit area was also measured from this type of sample, but it gave a higher coefficient of variation than the standard method. A sample consisting of every tenth stalk in the plot was slightly more precise than the standard method, but it was not adopted because of practical difficulties.

* * *

Minimizing sugar losses in harvesting and transplanting cane. J. R. ALLEN. *Australian Sugar J.*, 1967, **59,** 25–29.—In an address to the Australian Sugar Producers' Association, the author discusses the various factors that may cause sugar loss or deterioration in harvested cane. Comparisons were made of burned cane left standing with burned cane cut and left to lie on the ground. After two days, cane left standing held its sugar 3% better than cane cut and left lying on the ground. Sugar loss with whole-stick cane was markedly lower than with cane chopped by chopper harvester. Comparisons of burned cane with green chopped cane showed, after two days, a loss of 5% with the former and 3% with the latter. The importance of efficient transport to the mill, minimizing delay, is stressed.

* * *

Some aspects of the harvested cane deterioration problem. N. J. KING. *Australian Sugar J.*, 1967, **59,** 31–32.—Cane harvesting and transport problems in some other cane growing countries of the world are referred to and the problems facing Queensland growers discussed at some length. The difficulty of cut cane being held up through week-end closing of mills (not the case in other countries) is a serious

obstacle. The solution of the problem lies in the managerial rather than the technical field. It is urged that all possible methods should be taken to eliminate or reduce to a very low tonnage the amount of cane held in trucks at week-ends.

* * *

Wide choice of cowpeas. ANON. *Australian Sugar J.*, 1967, **59**, 167.—For cover cropping in Queensland cane lands the cowpea (*Vigna sinensis*) is much used. Several different varieties of cowpea grown in Australia are discussed. The advantages of the newer varieties bred in Queensland, such as "Meringa" and "Mulgrave", are pointed out. They have now been grown commercially and are increasing their popularity as fast as seed supply will allow.

* * *

Johnson grass can be eradicated. I. T. FRESHWATER and J. WRIGHT. *Cane Growers' Quarterly Bull.*, 1967, **31**, (1), 8–10.—Several Queensland cane farms are referred to where the owners have successfully eradicated Johnson grass (*Sorghum halepense*) from their cane lands. The methods adopted are described. On waste land "Hyvar X" at 20 lb/acre was effective but expensive. Other herbicides are being tested. Among these DSMA (disodium methylarsonate) shows promise.

* * *

Control of *Rhopaea* cane grubs in southern Queensland. C. L. TOOHEY. *Cane Growers' Quarterly Bull.*, 1967, **31**, (1), 12–15.—Reasons for the increased incidence of this pest (*Rhopaea sanguinea*) in southern Queensland (mainly the changed pattern of cultivation) are discussed. Possible methods of cultural control, e.g. avoidance of standover crops and prolonged ratooning, and of chemical control (use of crude BHC) are pointed out.

* * *

Select pre-emergent herbicides carefully. P. J. NIELSEN. *Cane Growers' Quarterly Bull.*, 1967, **31**, (1), 16. There is now greater awareness among Queensland cane growers of the possible benefits of residual herbicides, especially for application at or soon after harvesting. The function of long-term and short-term herbicides and the care necessary in selecting which to use, especially if another crop is to follow the cane, are discussed.

* * *

Ten years of leaf scald resistance trials in north Queensland. B. T. EGAN. *Cane Growers' Quarterly Bull.*, 1967, **31**, (1), 23–24.—An account is given of the progress made in testing new varieties against leaf scald disease (*Xanthomonas albilineans*). A table shows the number of seedlings tested since 1964, the total number now exceeding 500. A list is given of new varieties approved for the north.

* * *

Mosaic disease in the Moreton area. R. W. MUNGOMERY. *Cane Growers' Quarterly Bull.*, 1967, **31**, (1), 31–32.—Recent research in Queensland shows that very little, if any, spread of mosaic disease takes place from grasses to sugar cane, the source of spread being diseased sugar cane itself. This disease has been eradicated from some cane growing districts. Its presence in others reflects the efficiency of the supervisor and his gang and the degree of co-operation from growers.

* * *

A method of applying nitrogen through irrigation water. W. J. DRAPER. *Cane Growers' Quarterly Bull.*, 1967, **31**, (1), 33–34.—An ingenious method of applying nitrogen fertilizer through spray irrigation plant designed by a Queensland cane grower is described; it employs a 44-gallon drum, in which fertilizer is placed or dissolved, a float valve and a centrifugal pump. A diagram illustrates the layout.

* * *

Heat-treated cane. L. L. LAUDEN. *Sugar Bull.*, 1967, **45**, 288.—Attention is drawn to a recent decline in Louisiana in the amount of seed cane subjected to heat treatment for control of ratoon stunting disease. Shortage of labour and weather conditions are considered responsible. Those varieties that should certainly be heat treated are indicated; small growers without heat treating units can hire them.

* * *

The cane variety N:Co 310. L. L. LAUDEN. *Sugar Bull.*, 1967, **45**, 288.—Some Louisiana cane growers have indicated a desire to return to the variety N:Co 310. This would be unwise because of this variety's susceptibility to mosaic disease and its liability to spread the disease to other varieties.

* * *

Sugar cane variety outfield experiments in Louisiana during 1966. T. J. STAFFORD. *Sugar Bull.*, 1967, **45**, 314–323.—The results of outfield experiments or cultivation of new varieties in large stands under replicated conditions are presented and briefly discussed. In 1966 there were no less than 42 new varieties in replicated experiments. Much of the information obtained regarding yields, sugar content, etc. is presented in tables. L60-25 was an outstanding variety. Some varieties presented problems for machine harvesting, brittleness being the main trouble.

* * *

Cane hauling. ANON. *Sugar Bull.*, 1967, **45**, 323.—It is time-wasting and costly for cane vehicles to wait in line at the factory for their turn to be unloaded. In Louisiana 15 mills planned special measures to eliminate or reduce this waiting. Cane shippers or transporters were allocated specific times for delivery during the day.

* * *

Performance of several new cane varieties for a 10-month crop (planted in summer) during 1961-66. B. C. MOK and N. S. CHEN. *Taiwan Sugar*, 1967, **14**, (3), 9–13.—It is pointed out that owing to economic considerations and shortage of arable land,

Taiwan farmers prefer short-season crops and 10 months for a cane crop is preferred to 18 months. The results of trials with early maturing cane crops are given and discussed. Resistance to typhoon damage was considered important. Two of the most promising varieties, giving high yields of 10-month old cane and of sugar, were F 154 and F 156.

* * *

A study of juice analysis as a diagnosis for sugar cane nitrogen nutrition. I. Nitrogen composition of sugar cane parts. C. S. YEH. *Taiwan Sugar*, 1967, **14,** (3), 21–26.—Plant tissue or juice analysis is considered superior to foliar analysis in nitrogen studies in sugar cane. Reasons are given. Material used in this study was from the variety N:Co 310. In leaf blades a strong gradient was found to exist in N content. The N content of the lamina was always higher than that of the petiole. In the stems the elongating parts showed the highest N content. Nodes showed a higher N content than internodes.

* * *

Rearing sugar cane seedlings. W. B. MAY. *S. African Sugar J.*, 1967, **51,** 664–667.—A detailed and informative account is given of the various stages involved in raising sugar cane seedlings from "fuzz" or true seed, so successfully practised at the Experiment Station at Mount Edgecombe in Natal. A notable feature is the care given to sterilization of soil and containers used at different stages of the seedling's growth. Eventually some 75,000 seedlings have to be transplanted into pots, an operation taking 3 to 4 weeks. A team of 3 experienced workers can transplant 5000 to 6000 seedlings in a day.

* * *

Irrigation control during spring. G. TURCK. *S. African Sugar J.*, 1967, **51,** 683.—Information is given to assist cane growers to assess the average water requirements of their crops during the spring months.

* * *

Plastic water saver. ANON. *S. African Sugar J.*, 1967, **51,** 689.—What are claimed to be the world's first floating plastic water covers for preventing evaporation from large and small expanses of water are described. The aim is to save 100% of water normally lost by evaporation. These were demonstrated at Johannesburg, having been entirely developed in South Africa. The manufacturers claim that the floating covers cannot be lifted by whirlwinds and are immune against damage by hailstones of over 2 inches in diameter. They might well prove of value on some reservoirs used for cane irrigation.

* * *

Aerial baiting ban lifted. ANON. *Australian Sugar J.*, 1967, **59,** 232.—The Queensland Minister of Health has conditionally withdrawn the ban on aerial application of rat baits in cane growing areas. This follows some very successful experiments in aerial rat baits. It is explained that the ban was imposed because a plane accidentally dropped thallium baits in a farmyard and it was feared that children might eat them. It is mentioned that the hopper control mechanism in aircraft, operated by the pilot, is now better than it was.

* * *

Herbicides for sugar cane in Hawaii. H. W. HILTON. *Sugar y Azúcar*, 1967, **62,** (9), 37–38.—The economics of chemical weed control in sugar cane in Hawaii are discussed and present practices described. Present research includes testing of new herbicides, improving mechanical application, pre-emergence seedling control, and control of certain troublesome weeds requiring special treatment.

* * *

Machinery for sugar cane fertilization. M. M. MAYEUX. *Sugar y Azúcar*, 1967, **62,** (9), 47–48, 53.—The greatly increased use of liquid fertilizers, mainly nitrogen and to a less extent phosphorus, in Louisiana cane fields is referred to. Handling and application of this type of fertilizer to the soil and the machinery involved are fully discussed.

* * *

Controlling Johnson grass seedlings and annual weeds in sugar cane planted in Louisiana in summer and fall, 1967. ANON. *Sugar Bull.*, 1967, **45,** 338–339.—The effectiveness of residual pre-emergence herbicides, such as "Fenac" and "Terbacil" ("Sinbar"), is discussed. Herbicide programmes for the benefit of cane growers are given. These vary according to soil—light or heavy.

* * *

The 1967 sugar cane variety census for Louisiana. R. J. MATHERNE. *Sugar Bull.*, 1967, **45,** 339–341. The annual variety census is analysed and discussed. CP 52-68 remained the dominant variety, being grown on 44·24% of the acreage. Other leading varieties were: CP 44-101 (12·77%); CP 48-103 (11·7%); CP 55-30 (11·64%) and N:Co 310 (8·99%). The last mentioned dropped 27% from 1966 to 1967. It is the most cold-tolerant of the commercial varieties, but susceptibility to mosaic and the mosaic problem it presents to other varieties is a serious drawback.

* * *

Ridging for winter protection of young sugar cane in organic soils of Florida. G. ARCENEAUX. *Sugar J.*, 1967, **30,** (4), 18–19.—Poor stands in newly planted cane on peaty soils in Florida are mainly due to cold or freeze injury having taken place during the winter months. The value of ridging to protect the buds with soil is discussed, as is the rôle of ridging in diverting cold air away from the shoots.

* * *

Cattle diversification in sugar cane farms. ANON. *Sugarland*, 1967, **4,** (1), 46–47.—The great need for increased meat production in the Philippines with its rapidly increasing population is discussed. The advantages of greater cattle production in sugar cane areas, making use of the cheap feed provided by sugar cane, are dealt with. Silage storage of cane tops is one of the recommendations.

Variety test results in East Visayas. R. ARANETA, A. ALBA, F. CARBALLO and E. GEOLINGO. *Sugarland*, 1967, **4**, (1), 48–49.—An account is given of recently concluded variety trials in four different districts of East Visayas in the Philippines. Varieties are recommended for these districts. The highest yielding varieties were found to be MPR 275, Phil 55-392 and B34-49.

* * *

Breeding and flowering research in sugar cane at Canal Point, Florida, in 1966-67. N. I. JAMES. *Sugar Bull.*, 1967, **45**, 353–355.—The technique employed with the crossing work at Canal Point, Florida, is briefly described. The harmful effects of using the wrong type of water in the weak acid solutions used for maintaining the cut flowering stalks are described and the advantages of using deionization equipment outlined. Synchronization of flowering of early- and late-flowering clones through the use of photoperiod chambers or alternating day length and using low temperatures is discussed.

* * *

Level of ratoon stunting disease in unreleased sugar cane varieties at increase stations in 1967. R. J. STEIB and S. J. P. CHILTON. *Sugar Bull.*, 1967, **45**, 356–358. Figures are given of the level of RSD infection of 4 sugar cane varieties at 3 increase stations in Louisiana. These were high, especially in the variety CP 61-37. Growers will be advised to subject seed cane to heat treatment.

* * *

The Philippine sugar industry today. M. ELIZALDE. *Sugar News*, 1967, **43**, 361–364.—Various statistics are given relating to the industry, the earnings from which represent from 18 to 20% of the total dollar income. Recommendations of a Hawaiian body for improving the industry are given. These involve a gradual shift from the Java short-cropping concept to the Hawaiian concept through changes in cultural practices. These include use of later maturing varieties, larger cropping cycles, extended irrigation and improved cultural practices.

* * *

Design, construction, installation and performance of prefabricated reinforced concrete channels ("canaletas"). A. P. AGLIBUT. *Sugar News*, 1967, **43**, 366–373.—The enormous loss of water that takes place in earth irrigation channels, which are usually used in the Philippines, is discussed. A plea is put forward for more extended use of concrete channels, as used in many other countries, in spite of their relatively high initial cost. The construction of prefabricated reinforced concrete sections for irrigation canals is dealt with in detail.

* * *

Trials with aerial spreading of rat bait in cane crops. R. BARRINGHAM and D. DAVIS. *Producers' Review*, 1967, **57**, (8), 13–16.—Rats are the major pest in Macknade cane crops in Queensland. A large-scale trial (560 acres) of aerial spreading of rat bait is reported and comparisons made with the present methods of hand baiting which face many difficulties. Aerial spreading proved much more efficient than the traditional methods and costs were favourable. The number of rat-damaged stalks per lot for the normal hand or perimeter baiting was 17·3, while the figure for aerial baiting was 8·7. The equipment carried by the aircraft (a Piper "Pawnee 235") for spreading the bait is described in detail.

* * *

Giant sensitive plant investigation: chemical control in out-of-hand cane. G. H. WHITAKER. *Producers' Review*, 1967, **57**, (8), 33.—Trials are reported involving 15 treatments with several different herbicides applied as foliar sprays, the cane being out-of-hand ratoon Pindar. Four treatments gave 100% control of giant sensitive plant (*Mimosa invisa*). These were: 3 lb "Karmex" + 0·5 gal "Trysben 300"; 1 lb "Daxtron" + 1 oz "Tordon 22K"; 0·5 lb "Daxtron" + 1 oz "Tordon 22K"; and 1·5 pints "Tordon M2962."

* * *

Concern over mud on bitumen roads. ANON. *Producers' Review*, 1967, **57**, (8), 75.—The question of mud and clay being brought on to bitumen roads by vehicles carrying sugar cane is considered, having been raised at Bundaberg in Queensland. Apart from causing skidding, clay shrinks on drying and has a tendency to cause the bitumen suface to lift, eventually causing potholes. Spreading cane tops for a distance of 50 to 60 yards from the main road, to be renewed when necessary, is suggested as a means of alleviating the trouble.

* * *

Reason for cane arrowing. G. A. CHRISTIE. *Producers' Review*, 1967, **57**, (8), 77.—Free flowering or arrowing in many Queensland cane crops is referred to and various factors that may encourage it discussed. Cane areas nearer to the coast and on slopes with an easterly aspects tend to arrow more freely than localities away from the coast or on a westerly aspect.

* * *

Sugar cane in North India—in prospect and retrospect. C. N. BABU. *Indian Sugar*, 1967, **17**, 173–174.—Today there are some 6 million acres under sugar cane in India, about 70% of which is in northern India. The urgent need for more food grains is admitted but the writer considers this need not be at the expense of sugar cane production.

* * *

Studies on incidence and behaviour of some major sugar cane pests in relation to weather and climatic conditions. A. N. KALRA. *Indian Sugar*, 1967, **17**, 175–180.—Recent observations are recorded on the effects of weather conditions (temperature, rainfall and humidity) on the activities of certain sugar cane pests in India, these being the shoot borer (*Chilotraea infuscatellus*), top borer (*Scirpophaga nivella*), stalk borer (*Chilotraea auricilia*) and leaf hopper (*Pyrilla perpusilla*).

Heat therapy of sugar cane. K. SINGH. *Indian Sugar*, 1967, **17**, 181–186.—Experiments are reported which illustrate the value of hot air treatment of cane setts of stalks used for planting in controlling both ratoon stunting disease and grassy shoot disease, both troublesome diseases in India and both due to virus. In transmission tests conducted by the author it was found that diseases referred to as "yellowing", "stunting" and "albino disease" are in fact identical with grassy shoot disease. The loss of chlorophyll in "albino disease" is now known to be associated with disorders of manganese metabolism and is not a typical symptom of grassy shoot disease.

* * *

Optimum requirements of three-budded setts under normal spacing of cane planted during autumn and spring. U. S. SINGH and L. SINGH. *Indian Sugar*, 1967, **17**, 275–281.—Spacing trials carried out at the Sugarcane Research Station, Shahjahanpur, for 3 years are reported. Conclusions were that a low planting rate (20·6 thousand setts/ha) was the optimum level for both autumn and spring planting under normal weather conditions. Under drought conditions in the spring, however, with a variety giving less than 40% germination, the medium planting rate of 37·1 thousand setts/ha is to be preferred.

* * *

Growth of sugar cane in relation to soil moisture stress during the elongation phase. S. SINGH. *Indian Sugar*, 1967, **17**, 283–285.—In Uttar Pradesh the active growth of the sugar cane stalk or the elongation phase takes place mainly (to the extent of 85%) in the monsoon period—about 15 weeks. If drought occurs, restoration of adequate soil moisture does not make up for the loss of growth. The two varieties studied (Co 1266 and Co 1158) showed differences in sensitivity to soil moisture stress. About 12% soil moisture in the upper active root zones appeared to be the optimum for growth during the elongation phase.

* * *

Mechanization of sugar cane cutting at San Jacinto estate, Peru. J. J. NIEMANN. *Zeitsch. Zuckerind.*, 1967, **17**, 532–534.—The use of a push-rake mounted on a Caterpillar tractor for cane harvesting was tested and the results are described, the effect being a combined operation of breaking, pushing, pulling and cutting. 3–10% of the cane remained uncut. Roots pulled out were 3–4% on heavy dry soils, 6–8% on sandy dry soils and 60% on wet soils. Compared with handcutting, subsequent ratooning was inferior but costs per ton of cut sugar cane only about a third of that with hand-cutting.

* * *

Importance of choosing most suitable cane varieties. J. H. BUZACOTT. *Australian Sugar J.*, 1967, **59**, 281–282.—Queensland cane growers are urged to pay careful attention to the selection of a cane variety from among those approved for their district. Reasons why this is so important are given. Every cane farm is a unit which should be considered separately, as locations, soil types and farm practices all vary. Planting programmes should be discussed with an appropriate officer of the experiment station or the mill.

* * *

Reliance on cane varieties. ANON. *Producers' Review*, 1967, **57**, (9), 23.—Poor sugar content of cane in the wet belt or far north of Queensland is discussed. Reasons for it are considered to be excessive cloud cover and drainage factors, which a change of variety would be unlikely to remedy.

* * *

Problems of saline soils and their management. E. VON DER MEDEN. *S. African Sugar J.*, 1967, **51**, 750–751.—Saline or brackish soils, as they affect the sugar cane grower in South Africa, are discussed. It is pointed out that sugar cane is a fairly sensitive crop in this respect. The causes of severe soil salinity and the best remedial measures for the cane grower to adopt are dealt with.

* * *

Numicia. ANON. *S. African Sugar J.*, 1967, **51**, 755. Reference is made to the introduction of the predator or parasite *Tytthus mundulus* from Mauritius for trial against *Numicia* (*Numicia viridis*) in a newly constituted insectiary at the Experiment Station, Mount Edgecombe.

* * *

Fertilizer in Taiwan. T. J. CHEN. *Taiwan Sugar*, 1967, **14**, (4), 11–14, 24.—The development and greatly increased production of the fertilizer industry in Taiwan in recent years is discussed. Present fertilizer factories or plants and the nature of the products are described, special attention having been given to the manufacture of nitrogenous fertilizers. Taiwan now supplies all her own fertilizer needs. Possible future trends are discussed.

* * *

Water management and irrigation control in sugar cane fields in Taiwan. H. CHANG. *Taiwan Sugar*, 1967, **14**, (3), 16–20, (4), 15–17.—Current surface irrigation practices, as carried out on the Taiwan Sugar Corporation's plantations, are described and discussed. Results of different trial irrigation treatments and of evapotranspiration studies are given. Comparisons are made with similar work carried out in Hawaii.

* * *

Liming and fertilization of sugar cane. ANON. *Sugarland*, 1967, **4**, (2), 39–41.—The need and reasons for applying lime to some Philippine cane soils is discussed and growers are recommended to submit soil samples to their experiment station for recommendations in regard to the use of lime and fertilizers. Instructions are given on the correct method of taking soil samples.

* * *

"Diquat" controls tasselling in Victorias. ANON. *Victorias Milling Co. Exp. Sta. Bull.*, 1967, **14**, (5 & 6), 3.—The results of experiments in controlling flowering or tasselling with "Diquat" are discussed, the varieties of cane being Phil 54-60, Co 440 and Phil 58.260. Rate of application by aerial spraying was 1·5 litres per hectare. This low level of application substantially cut the cost. The spraying effectively controlled tasselling and increased sugar yields.

Sugar beet agriculture

Survey shows less spring labour on beet. ANON. *British Sugar Beet Rev.*, 1963, **35,** 163–164, 188. Sugar beet farmers in the eastern counties of Great Britain have been able to cut their labour requirements for the crop appreciably, according to a recent survey. In 1961 and 1962 spring labour for thinning and handhoeing averaged about 41 man-hours per acre. In 1965 it was 36 man-hours. It is explained this has come about by the greater use of precision drills and band spraying. There was no change in the average total of man-hours for harvesting.

* * *

Trials of commercial varieties of sugar beet. L. A. WILLEY. *British Sugar Beet Rev.*, 1967, **35,** 165–170. Results are discussed and tabulated. Two monogerm varieties, Amono and Hillshog Monotri, were included in the trials for the first time following their earlier successful performance. The virus yellows-tolerant variety, Maris Vanguard, was also included in the trials for the first time and did well but showed rather low sugar content. It is urged that growers should be alert to changes in the relative performance of varieties and to the introduction of new varieties.

* * *

Factory waste lime: experience in Lincolnshire. H. MACKENZIE. *British Sugar Beet Rev.*, 1967, **35,** 177–178.—The value to the farmer of filter cake from sugar beet factories, or "waste lime" as it is called, is discussed.

* * *

What determines sugar beet yield? Part II. Plant population and leaf area index. P. J. GOODMAN. *British Sugar Beet Rev.*, 1967, **35,** 171–172.—Experiments in sugar beet cultivation have shown that an optimum population exists for root size as well as for yield. It seems likely that such an optimum will vary with different environmental conditions. Different seasons or sowing dates may alter the optimum.

* * *

Sugar beet. M. V. DAHIPHALE and D. G. MALI. *Indian Sugar*, 1967, **16,** 889–893.—Some general information about sugar beet is given followed by recommendations for cultivation in India, based on trials at the Research Station at Padegaon. It must be grown in the cool season, 10–15 irrigations being needed and frequent hand weeding. Five German varieties were grown giving yields that compared favourably with those in Europe.

Experiments in different spacing in sugar beet. M. MARTENS, J. M. BELIEN and A. NOLF. *Publ. Techniques Inst. Belge pour l'Amél. Betterave*, 1966, **4,** 137–146. The results of drilling with spacings from 12·6 to 26 cm and the effects on emergence, size of roots and yields are discussed.

* * *

Results of variety comparative trials carried out in Belgium from 1962 till 1966. N. ROUSSEL and R. VAN STALLEN. *Publ. Techniques Inst. Belge pour l'Amél. Betterave*, 1966, **4,** 147–168.—Trials with 19 varieties at 3 different centres in Belgium are reported, the results being summarized in 14 different tables.

* * *

Insecticide tests for control of the sugar beet root maggot in southern Idaho. W. E. PEAY and C. E. STANGER. *J. Amer. Soc. Sugar Beet Tech.*, 1966, **14,** 214–217.—The maggot (*Tetanops myopaeformis*) is indigenous in North America and attacks some other plants including some field weeds. Information on the insect's life history and nature of the injury it causes to sugar beet is supplied. Results of trials with various insecticides are given. "Ethion" was the most promising.

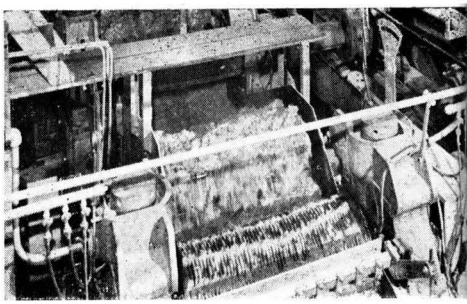
* * *

Competitive relationships in virus-infected sugar beet fields. R. S. LOOMIS and C. W. BENNETT. *J. Amer. Soc. Sugar Beet Tech.*, 1966, **14,** 218–231.—The research here reported was a study of competition in sugar beet fields infested with beet yellows virus. Hand inoculation was effected with a virulent strain of the beet yellows virus on healthy plants. There was a slight tendency for yield compensation only at low frequencies of disease.

* * *

Evaluation of fungicides for the control of *Cercospora* leaf spot of sugar beets. R. E. FINKNER, D. E. FARUS and L. CALPOUZOS. *J. Amer. Soc. Sugar Beet Tech.*, 1966, **14,** 232–237.—Results are given of three years of trials in which commercially available and experimental fungicides were compared for their ability to control leaf spot (*Cercospora beticola*) of sugar beet. About a dozen different substances were tested. It was found that fungicidal applications were economically beneficial to the grower when abundant leaf spot is present. The most effective compounds were the organo-tin fungicides. These also appeared to reduce damage caused by *Rhizoctonia* root rot and by army worm infestation.

Cane sugar manufacture



The struggle in the factory and in the field for greater retention of sugar. M. CANO R. *Bol. Ofic. A.T.A.C.*, 1966, **21,** (4, 5, 6), 37–55.—While the Brix of cane juice has been raised with agricultural development, the purity has fallen, and this leads to difficulties in the boiling house. Examples of calculations of sugar, molasses and syrup quantities and ratios are presented for various types of boiling schemes; these illustrate the higher quantities of *B*- and *C*- or final massecuites which have to be boiled when the syrup purity is reduced, and also show that the two-strike system, while involving less total massecuite, produces more final massecuite. Other points briefly discussed include the capacity of pans, size of seed, and colour formation during boiling.

* * *

The "Pneumercator" apparatus. J. M. YAÑEZ. *Bol. Ofic. A.T.A.C.*, 1966, **21,** (4, 5, 6), 56–64.—A description is given of the installation and use of the pneumercator gauge[1] for measuring e.g. the contents of a molasses tank, and a table of temperature corrections is included.

* * *

Precision and cleaning of the pan equipment. J. CORNIDES. *Bol. Ofic. A.T.A.C.*, 1966, **21,** (4, 5, 6), 84–96.—Boiling of sugar syrup to massecuite and boiling systems are defined in simple terms, and the requirement and maintenance of pan and liquor cleanliness are discussed.

* * *

New Malelane mill in production. ANON. *S. African Sugar J.*, 1967, **51,** 374–379.—Information is given on the equipment used at the Malelane cane factory of Transvaalse Suikerkorporasie Beperk[2].

* * *

Some aspects of roller bearings in the cane sugar industry. K. DETZER. *Sugar News*, 1967, **43,** 212–216. Advantages of roller bearings are discussed and their use exemplified by applications in a cane shredder and in cane mills.

* * *

50 years of San Carlos Milling Co. Inc. C. M. MADRAZO. *Sugarland*, 1966, **3,** (8), 28–31.—Changes in the processes at this 4500 t.c.d. factory are described. They include adoption of hot instead of cold liming, replacement of the filter presses by the Petree-Dorr process in 1924, which was subsequently replaced in 1954 by continuous vacuum filters, abandonment of the factory lime kiln (which used local limestone of high calcium content) because of high labour costs, and use of a Beckman "Zeromatic" pH meter for juice measurements. Unsolved problems include the presence of salt crystals in *B*-molasses.

* * *

Cane diffuser. C. EBELING. *Brasil Açuc.*, 1967, **70,** 389–394.—The circumstances in which a diffuser might be installed are listed—a new factory, an old factory with obsolete mills, or a factory with insufficient milling capacity—and the preferability of a "large" diffuser for the first two and a "small" diffuser (inserted between the first and subsequent mills) for the last explained. The advantages of the diffuser are listed and brief descriptions given of the BMA, DDS, De Smet and Silver equipment, with a comparative table.

* * *

Diffusion: observations of a journey. G. INOJOSA and C. H. ALVIM. *Brasil Açuc.*, 1967, **70,** 402–405.—The authors visited the Tanganyika Planting Company's DDS diffuser installation in Tanzania[1] which they describe together with an account of visits to DDS beet diffusion plants in Denmark and the DDS cane diffuser at Usine de Stella, in Réunion, 1966 operational data from which are quoted. The plant seen at the works of Soc. Fives Lille-Cail are also briefly mentioned.

* * *

The "magic" of reason and efficiency. ANON. *Bol. Azuc. Mex.*, 1967, (214), 14–19.—The nominal daily milling capacity of Ingenio La Margarita in Mexico is only 2000 tons but it has reached a record throughput of 3500 tons in a day. The factory is described and its high production attributed to a large number of minor factors, including convenient layout, continuous efforts by the workforce to maintain maximum output, good cane preparation, etc.

* * *

40 rules for preventive maintenance of centrifugal pumps. I. J. KARASSIK and R. CARTER. *Bol. Azuc. Mex.*, 1966, (215), 20–23.—The authors, employees of Worthington Corporation, present 40 rules classified under selection, installation, operation and maintenance, to ensure proper working and long life for centrifugal pumps.

[1] *See I.S.J.*, 1968, **70, 83.**
[2] *See also I.S.J.*, 1967, **69,** 227–230.
[3] *I.S.J.*, 1964, **66,** 187–189.

The 1000-kg centrifugal. H. EICHHORN. *Bol. Azuc. Mex.*, 1967, (214), 37–40.—An illustrated description is given of the design and operation of the 1000-kg Salzgitter automatic batch centrifugal.

* * *

Industrial modernization in Los Mochis. ANON. *Bol. Azuc. Mex.*, 1967, (216), 22–27.—In the third stage of a 6-year expansion plan for Ingenio Los Mochis in Mexico, which started in 1962, milling capacity from 1966/67 was to be raised from one to two million tons of cane per season. The expansion involves installation of a new milling tandem, boilers, power plant, clarifiers, evaporators, pans, mixers, crystallizers and centrifugals as well as a refinery. An illustrated account is given of some of this equipment.

* * *

Sugar processing chemicals. ANON. *Sugar y Azúcar*, 1967, **62**, (8), 27–28.—A survey is presented of chemicals used in cane and beet factory and refinery processes, and a selection of suppliers and brand names are given under each of the following headings: carbons, ion exchange resins, anti-enzyme and bactericidal compounds, surface-active agents, descaling products, flocculating agents, magnesium compounds, and filter aids.

* * *

Sugar mill use and consumption of chemicals. ANON. *Sugar y Azúcar*, 1967, **62**, (8), 28–30.—Information supplied by various sugar factories in the US, Latin America and the Philippines on the quantities and types of chemicals used for various processes is presented.

* * *

Chemicals increase factory efficiency. ANON. *Sugar y Azúcar*, 1967, **62**, (8), 31–40.—The use of certain specific chemicals in sugar factory processes is surveyed, each chemical being considered in some detail. The report includes Wyandotte "Steri-Chlor 4X" mill bactericide, Fabcon "Pan-Aid" surface-active agent for massecuite boiling and lubrication in crystallizers, magnesium oxide for clarification, granular active carbon, Hodag "CB-6" surface-active agent for massecuite boiling and magma treatment in the mingler, and Drew "Biocide 280" mill juice bactericide. Details are given of fixed bed ion exclusion tests with "Dowex 50X4" cation exchange resin in Na^+ form, in which the purity of diluted thick juice was raised. Process temperature and degree of dilution were important factors. Brief mention is also made of ion exchange and ion retardation.

* * *

Recent advances in sugar technology in India (1966). S. C. GUPTA. *Indian Sugar*, 1967, **17**, 129–134.—A survey is presented of important work carried out in India in 1966, with 26 references to the literature.

* * *

Economics of the defecation melt carbonatation process. B. B. GAIROLA. *Indian Sugar*, 1967, **17**, 135–142.—It is calculated that adoption of the defecation melt-carbonatation process[1] should permit greater sugar yields than are obtained with juice sulphitation or carbonatation, apart from other advantages. An overall extra profit is claimed to be possible, which would vary according to crushing rate and length of season.

* * *

Review of the factors affecting the exhaustibility of molasses. H. S. SRIVASTAVA. *Indian Sugar*, 1967, **17**, 211–220.—The various factors affecting molasses exhaustion are discussed, with 65 references to the literature, and means of obtaining maximum possible exhaustion are listed.

* * *

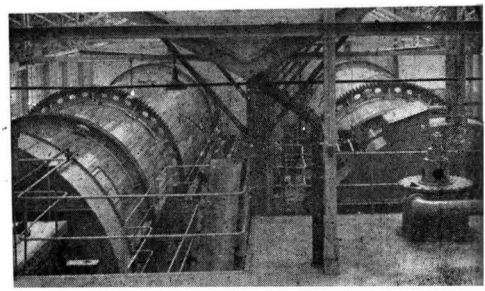
Clarifier investigations at Isis mill. I. Mud concentrations within a tray of the A.T.V. clarifier. II. Juice movement within the A.T.V. clarifier. ANON. *Queensland Bur. Sugar Expt. Sta. Operations Rpt.*, 1966, (1), 67 pp.; through *S.I.A.*, 1967, **29**, Abs. 546.—Tests on the variation in mud concentration within the 3rd compartment of the clarifier[2] are reported in greater detail. Juice movement within this compartment and through the whole clarifier was traced by adding a red dye to the clarifier feed. The optical densities of samples withdrawn from points within the 3rd compartment, and of juice overflow and mud from all compartments, were measured after filtration. Analysis of the results showed that at low mud levels the juice moved across the compartment before rising to the outlet; at high mud levels, the juice rose above the jud before moving outwards. Dye appeared in the clarified juice after 5–10 min; the maximum juice velocity, 2 ft/min, was higher than expected. Residence time was only 12–28 min, depending on mud level and juice flow rate; owing to decomposition of the dye, the value found may be too low. Dye appeared in the primary mud after 0·3–5·4 min, confirming that short-circuiting of feed occurred.

* * *

Clarifier investigations. I. Capacity of the A.T.C. clarifier at Fairymead mill. ANON. *Queensland Bur. Sugar Expt. Sta. Operations Rpt.*, 1966, (2), 59 pp.; through *S.I.A.*, 1967, **29**, Abs. 545.—The 59,500 gal clarifier at Isis factory handled juice from 94–141 tons of cane/hr during tests. Its normal capacities with and without the use of flocculating agents would correspond to 160 and 115–120 tons of cane/hr, respectively (assuming 93% clarified juice on cane). The primary mud contained 0·5–10·3% of solids (average 5·5%). The clarified juice had rather high turbidity, probably owing to poor pH control. The juice overflow rate was at times much less than that expected from the head of liquid in the tray. The 105,000 gal clarifier at Fairymead factory produced clarified juice of low turbidity when handling juice from 200 tons of cane/hr. If 3 p.p.m. of "Separan AP-30" was added, capacity could be increased to the equivalent of 240 tons of cane/hr. The primary mud contained only 2·1–4·3% of solids, but was handled satisfactorily by the filter station. At both factories there were differences in the solids contents of the feed liquors to individual trays of the clarifier.

[1] *I.S.J.*, 1963, **65**, 50.
[2] NIX: *I.S.J.*, 1966, **68**, 371.

Beet sugar manufacture



The performance of beet pilers. S. P. VEREVKIN. *Sakhar. Prom.*, 1967, **41**, (7), 50–53.—Various operational aspects of certain Soviet beet pilers are discussed, including their campaign beet handling capacities and their performances under varying weather conditions.

* * *

Examination of beet weight and sugar losses at individual sections in the beet feed line to the factory. A. E. POPOV and I. I. NAGORNOVA. *Sakhar. Prom.*, 1967, **41**, (7), 53–56.—Details are given of the proportional beet weight and sugar losses between beet reception and the beet slicers at Lopandino sugar factory.

* * *

Sugar in the Soviet Union. H. HIRSCHMÜLLER and H. J. DELAVIER. *Zeitsch. Zuckerind.*, 1967, **92**, 407–416.—Information is given on beet agriculture, sugar manufacture and the sugar economy of the USSR.

* * *

Influence of temperature on crystallization of pure massecuites. H. THIELE. *Zeitsch. Zuckerind.*, 1967, **92**, 416–419.—White sugar massecuite boiling at 79·5–86°C and 0·24–0·29 atm pressure took 10 min less (at a total of 86 min) than did an otherwise identical boiling at 74–76°C and 0·16–0·18 atm pressure. The crystallization process proper (from opening of the syrup feed valve after seeding to maximum charging of the pan) took 49 min at the higher temperature and pressure compared with 65 min in the other strike. Continuous measurement and control of the massecuite consistency at a pre-set value was carried out with a Pfeifer & Langen "Rheometer". There was no difference in crystal quality or grain size distribution between the two strikes, and the high-temperature boiling gave a sugar virtually free of fine grain and conglomerates. Colour and bulk weight were also equally good with both strikes.

* * *

Automatic preparation of samples of industrial solutions for measuring sugar content. L. P. VEIN and A. K. FROLOV. *Mekhaniz. Avtomatiz. Proizvod.*, 1966, (9), 29–30; through *S.I.A.*, 1967, **29**, Abs. 515. The EAO automatic device is described (with a diagram) for controlling sugar losses in diffusers by determining sucrose in the press water. The sample is taken from a falling stream of the press water and automatically transferred to a vertical rotating wheel with attachments, on which the operations of lead defecation and filtration are cyclically performed. The filtrate flows to an automatic polarimeter. Four samples are treated per hr. The device consumes one cu.m. of water per day.

* * *

Automatic control of pH. C. SCHOEDLER. *Mesures Regul. Autom.*, 1966, **31**, (May), 90–96; through *S.I.A.*, 1967, **29**, Abs. 518.—The theory of automatic pH control in industrial processes is outlined, and some factors involved in its practical application are described. Examples of the use of pH control are given, including the carbonatation process in a sugar factory.

* * *

Some aspects of the 1966/67 campaign (in West Germany). F. SCHNEIDER. *Zucker*, 1967, **20**, 454–461. Among the features discussed are the weather conditions, molasses composition, the adverse effect of high beet storage temperatures on juice quality, the superiority of juice from topped beet over that from whole beet, certain aspects of pulp pressing, carbonatation, mud filtration, micro-organisms in raw juice preliming, sugar-house work, particularly pre-centrifugalling of low-grade massecuites, and micro-organisms in white sugar.

* * *

New methods of biological purification of difficult effluents. K. SEIDEL. *Zucker*, 1967, **20**, 466–470. Tests were carried out on purification of effluent from various industries using a lichen (*Scirpus lacustris* L.). A 75% reduction was obtained in the BOD_5 of sugar factory effluent after 14 days, while the $KMnO_4$ consumption fell to a very low level after 10 days. In all cases the pH was brought almost to neutral after 1–2 days.

* * *

Experiments on a V-D vertical counter-current liming column. J. VAŠÁTKO and A. DANDÁR. *Listy Cukr.*, 1967, **83**, 171–174.—Tests with the column described earlier[1] are discussed. Results showed that it is particularly suitable where raw juice is discharged from a diffuser at rather high temperatures and permits gradual increase in alkalinity at any temperature. No foaming occurred even where centrifugal pumps were used to transfer the juice to the column.

* * *

Comparison of the performance of different diffusion systems. P. M. SILIN. *Gaz. Cukr.*, 1967, **75**, 157–160. See *I.S.J.*, 1967, **69**, 146.

[1] *I.S.J.*, **1968**, **70**, 148.

Comparison of Silver-type DDS diffusers with the DDS diffuser used in the beet sugar industry in European countries. J. WAJS. *Gaz. Cukr.*, 1967, **75**, 161–163. Comparison of the structural and performance data for Silver and European DDS diffusers shows the main difference to lie in the considerably shorter trough of the former (15 metres compared with 22 metres in the case of a diffuser handling juice from 1500 tons of beet daily). The Silver diffuser is, however, heavier and incorporates dearer materials. It permits the use of thinner cossettes and a retention time of about 50 min compared with about 90 min in a European model. On the other hand, at a draught of 118–120% on beet, losses in the Silver diffuser are given as 0·29% on beet and juice purity 87·2–88·70 compared with losses of 0·27% on beet and juice purity of 86·9–89·6 for a draught of 110–115% with the European diffuser.

* * *

ZPU 303 isotope density meter for milk-of-lime density measurement in sugar factories. C. TARASZEWSKI. *Gaz. Cukr.*, 1967, **75**, 163–166.—Information is given on the density meter, which uses γ-rays from a ^{137}Cs source. Covering a milk-of-lime density range of 1–1·9 g/c.c., it is claimed to have an accuracy better than 0·009 g/c.c.

* * *

Effect of water overflow from a water tower on the waste water economy of a sugar factory. K. SKALSKI. *Gaz. Cukr.*, 1967, **75**, 167–168.—The water consumption at two factories is compared. At one the average water usage is 1250% on beet, while at the other it is 1800% on beet. The higher consumption is shown to be a result of sending water tower overflow to the effluent tank instead of returning it to the fresh water source as recommended.

* * *

Direct bagging and loading of different grades of white sugar with a movable charging station. G. HEYER and H. VOLLBRECHT. *Zucker*, 1967, **20**, 501–502.—Information is given on a unit manufactured by FMW-Förderanlagen u. Maschinenbau GmbH for the filling of sacks with white sugar. It permits four sacks to be filled at a time from the sugar hoppers above, and can be positioned beneath any required hoppers. A belt conveyor takes the filled sacks to road or rail trucks at the rate of 700–800 sacks/hr according to certain variables.

* * *

Physical, chemical and microbial changes in sugar beet during freeze storage. F. X. KAMMERER and H. J. DELAVIER. *Zeitsch. Zuckerind.*, 1967, **92**, 349–357, 419–427, 464–469.—Ninety-seven references are given in a survey of the literature on changes occurring in frozen beet. The material changes and alterations in the condition of beet stored at temperatures between −6°C and −30°C were studied and the results expressed in graph form. These showed that healthy beet can be stored for 2–3 months at a temperature no higher than −12°C, although a sucrose loss of 3% can be expected. To maintain beet in a fresh condition for 8 months with small sucrose losses, the temperature should be no higher than −24°C.

* * *

Calculations concerning the most suitable method of cooling low-grade massecuites. G. VAVRINECZ. *Zeitsch. Zuckerind.*, 1967, **92**, 357–360, 470–473. The effects of cooling rate and duration on sugar yield from low-grade massecuites were studied with the aim of finding the economically optimum method. Formulae are presented for calculating the variables involved in massecuite cooling and re-heating. Data from the literature are evaluated and the values obtained for temperature, Brix and purity tabulated for determination of the crystal growth rate. Further tabulated data correlate weight, volume, diameter and surface area of the crystals, while corresponding values of the saturation coefficient or viscosity of the mother syrup of average non-sucrose composition are also given. Results of theoretical strikes are discussed as regards the following factors: (i) effect of different constant cooling rates; (ii) effect of varying cooling rates; (iii) effect of keeping the massecuite warm for 1 hr before cooling; (iv) effect of crystal size at constant composition; and (v) effect of grain size at constant crystal content. The results are evaluated in terms of supersaturation, viscosity and time requirements.

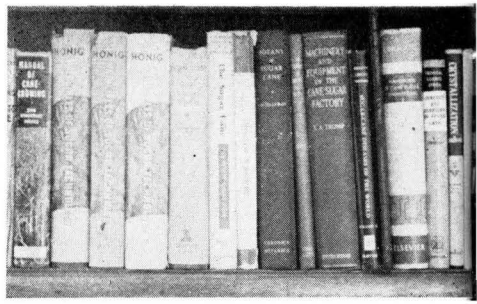
* * *

Theory of the juice purification process in beet sugar manufacture. P. M. SILIN. *Sakhar. Prom.*, 1967, **41**, (8), 10–11.—The facets discussed include optimum liming pH (11), the reasons why recirculation of unfiltered 1st carbonatation juice accelerates settling and filtration, the pros and cons of recycling oversaturated 1st carbonatation juice or carbonatation mud, the advantages of simultaneous liming and carbonatation, and optimum 2nd carbonatation conditions (including addition of 0·25–0·50% lime, juice recirculation, heating the juice to 100°C and holding the 2nd carbonatation juice for 10–15 min with mixing before filtration). For defecation the lime should be added to unheated juice.

* * *

Review of existing schemes for diffusion juice purification. A. K. KARTASHOV. *Sakhar. Prom.*, 1967, **41**, (8), 12–16.—The survey includes (i) the Dorr-Oliver system, involving carbonatation juice recirculation, which under Soviet conditions has proved suitable only for juice from badly deteriorated beet, (ii) the VNIISP scheme, which incorporates hot pre-liming but is unsuitable for mechanically-harvested and/or long-stored beet, (iii) BMA schemes, including three-stage carbonatation, and other methods. The use of anti-foaming agents, particularly where cold liming is practised, and the application of hydrocyclones are also mentioned.

New books



The Growing of Sugar Cane. R. P. HUMBERT. 779 pp.; 6 × 9 in. (Elsevier Publishing Co. Ltd., 22 Rippleside Commercial Estate, Ripple Rd., Barking, Essex, England.) 1968. Price: £14 10s 0d.

The author of this comprehensive work on the cultivation and production of sugar cane (a revised edition) was at one time the Chief Agronomist of the Hawaiian Sugar Planters' Association and is familiar with cane growing in many countries, especially those of the New World. In writing this book he has been able to draw on the experience and achievements of planters, technologists and other experts in the major cane growing areas of the world. There are over 300 illustrations in the book, mainly photographs, and many of these have been supplied by collaborators in other countries. Some idea of the content of the book may be obtained from the chapter headings, which are as follows, the figures in brackets referring to the number of pages in each chapter: "Factors affecting the growth of sugar cane" (48); "Seedbed preparation" (39); "Planting of sugar cane" (27); "The nutrition of sugar cane" (168); "Irrigation of sugar cane" (85); "Drainage" (60); "Weed control" (55); "Control of flowering" (24); "Ripening and maturity" (59); "Harvesting and transport of sugar cane" (45); "Control of pests and diseases" (81). A useful feature of the book, which may appeal to many readers in Latin-American countries, is the Spanish summary which accompanies each chapter.

The author lays emphasis on the fact that research in recent decades has resulted in higher or more disease-resistant varieties, improved cultural practices, better control of pests and diseases, mechanization in both field and factory and improvements in processing the cane. The rapid strides in production in the last thirty years are due not only to the results of research but to their adoption in field practices. Hawaii is quoted as a good example of a cane growing country where the results of research are quickly accepted and incorporated into plantation practices. Some of the less developed cane growing countries may not be so fortunate in this respect.

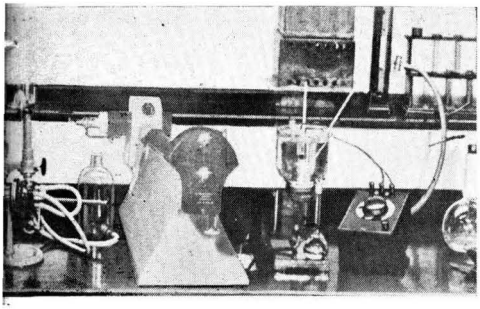
Aspects of sugar cane cultivation that have become important in recent years such as field mechanization, notably mechanical harvesting, irrigation and chemical weed control are discussed at considerable length. Interesting observations are recorded on the evils of soil compaction due to the use of heavy field equipment under wet soil conditions. The author has himself made comprehensive field and laboratory studies on soil compaction. Under dry or relatively dry conditions 5 to 6 inches of soil may become compacted as a result of heavy traffic. Under wet conditions this increases to 20 inches. This soil compaction results in greatly increased soil density, in decreased water infiltration, poor aeration and restricted root development. Results are given of the striking effects of artificially compacted soil blocks on the development of sugar cane roots.

The longest chapter in the book is that on the nutrition of sugar cane; this is sufficient for a book in itself. On the all-important subject of nitrogen the author explains how ammonium sulphate came to be rapidly replaced in Hawaii by "aqua ammonia" (aqueous ammonia solution) with savings in cost. Its application in the field, especially through the medium of irrigation water, is fully discussed.

It is probably inevitable in a work of this kind that some omissions should occur. The number of insect pests and diseases that are known to attack sugar cane runs into many hundreds and all could not of course be dealt with. Most of those of major importance are discussed. Notable exceptions however include the soldier fly of Queensland (*Altermetoponia rubriceps*) and the green leaf sucker of South Africa (*Numicia viridis*). Both these pests are now of major concern in their respective countries, the soldier fly having caused a loss of over 81,000 tons of cane in Queensland in 1966 according to a reliable estimate. It is true they do not occur as cane pests outside these countries—as yet. But with modern air travel and transport as it is today there is always the risk that they may suddenly appear in another cane growing country and a brief mention or description of them in the book would have been appropriate. As an instance of how easily a cane pest may be transported by plane one need only quote from the author's own words (p. 691): "In Hawaii, live Fiji sugar-cane leafhoppers, *Perkinsiella vitiensis* Kirk, have been found by inspectors on commercial planes from Fiji. As this insect is a known carrier of Fiji disease, it is understandable why the Hawaiian sugar industry encourages the spraying of all planes from foreign ports, and why they maintain light traps around the international airports for evidence of establishment of new insects."

A useful map-inset showing the sugar cane growing areas of the world is inserted at the back of the volume. A slight inaccuracy occurs here in regard to South Africa where sugar cane is shown as extending well into the Cape Province whereas in fact sugar cane is not grown south of southern Natal.

F.N.H.



Laboratory methods & Chemical reports

Some technical improvements in the paper chromatography of sugars. A method of sample desalting and a sensitive staining reagent. A. S. SAINI. *J. Chromatog.*, 1966, **24**, 484–486; through *S.I.A.*, 1967, **29**, Abs. 414. The salts in the sample were precipitated with pyridine in the cold, to avoid chemical changes in the sugars. After centrifuging, the supernatant liquid was spotted on filter paper, which was immersed in ether and dried in cold air. The sugars were eluted with water before chromatographic separation. Complete recovery of sucrose and other di- and monosaccharides was obtained. Spots were revealed with a solution of 3 g of *p*-aminobenzoic acid and 5 ml of phosphoric acid in 300 ml of 10:5:2 *n*-butanol:acetone:water.

* * *

Separation of sugars by centrifugal chromatography. J. DAVÍDEK and J. HRDLIČKA. *Sborník Vys. Školy Chem. Technol. Potr.* (Prague), 1966, **E9**, 113–116; through *S.I.A.*, 1967, **29**, Abs. 416.—A method of separation of sugars by chromatography on circular paper in a centrifugal field is described. The separation is completed in 80–120 min at 700 r.p.m. using 4:1:5 *n*-butanol:acetic acid:water, with full resolution of the common sugars. Sugars of close R_f value are effectively separated. The method is recommended for routine control in the food industry.

* * *

Volatile amines isolated from beet molasses. J. HRDLIČKA and G. JANÍČEK. *Sbornik Vys. Skoly Chem. Technol. Potr.* (Prague), 1966, **E9**, 117–120; through *S.I.A.*, 1967, **29**, Abs. 386.—The volatile amines were separated by paper chromatography and identified by their R_f values in different solvents. A total of 14 amines containing 1–5 C atoms were distinguished, of which one was not identified. The principal components were glutamine, *iso*butylamine and *iso*amylamine. The amines are believed to originate from the degradation of amino acids in the later stages of manufacture. Other components included ethanolamine, dimethylamine, 1,4-diaminobutane, 1,5-diaminopentane, and the polyamine *N,N'*-di-1,4-diaminobutane.

* * *

Physico-chemical study of beet juice non-sugars precipitated with ethanol. D. IVANČENKO and K. HEINRICHOVÁ. *Sbornik Prác Chem. Fak. Slovenskej V.Š.T.*, 1964, 49–55; through *S.I.A.*, 1967, **29**, Abs. 434.—The alcoholic precipitate obtained from beet press juice before or after predefecation, main defecation and/or carbonatation was analysed for total N and individual amino acids following acid or alkaline hydrolysis. The precipitate from thin juice contained 0·21% N on dry solids and the following amino acids: lysine, arginine, asparagine, glycine, aspartic acid, alanine, valine, *iso*leucine, tyrosine, tryptophane. The defecated juice precipitate (0·48% N) contained these amino acids in addition to the above: cysteic acid, glutamic acid, threonine, leucine; the predefecated juice precipitate (1·0% N) also contained serine, phenylalanine; the press juice precipitate (7·6% N) also contained histidine, proline, methionine. Short-chain peptides were prepared from the precipitate by hydrolysing with 6N HCl at 105°C for 8 hr. The absorption spectrum of the copper complex formed at pH 5 with cupric acetate (about 20 mg/10 mg of protein) was measured. An absorption maximum was present at 620 nm in all cases, with a minimum at 460 nm in press juice rising at 520 nm in defecated juice.

* * *

Causes and remedies of unknown losses in a sugar factory. B. L. MITTAL. *Indian Sugar*, 1967, **17**, 33–37.—The various possible sources of unknown losses in a cane sugar factory are listed and means of preventing them are suggested.

* * *

Kinetics of dextran hydrolysis. S. A. BOGDANOV. *Sbornik Pishchev. Prom.*, 1967, (5), 25–33.—Optimum conditions of dextran hydrolysis, determined as a basis for a possible method of determining dextran in sugar factory products, were found to be 60 minutes' hydrolysis at 100°C in 4N H_2SO_4. No apparent decomposition of glucose occurred.

* * *

Light attenuation by solutions of granulometric fractions of white sugar. S. KH. SHEREMET'EV. *Sakhar. Prom.*, 1967, **41**, (6), 20–24.—White sugar crystals were classified into five size ranges and the light absorption of each fraction measured spectrophotometrically in the U.V. and visible regions of the spectrum. The curves show that the two fractions containing the smallest crystals (0·2–0·5 mm and $< 0·2$ mm, respectively) had individual colour contents greater than that of the total white sugar sample and far exceeding the standard for consumption sugar. Hence, removal of these fractions (in the case examined constituting 7·33% by weight of the total white sugar sample) is advocated, as is further detailed work on the problem.

The betaine content in molasses at Kuban' sugar factories. K. P. ZAKHAROV and T. N. MRYKHINA. *Sakhar. Prom.*, 1967, **41**, (7), 20–21.—Analysis of molasses samples from four factories in the Kuban' region of the USSR showed that betaine constituted just over one-third of the total Kjeldahl nitrogen and made up about 6% of the molasses weight. The total nitrogen content was 6% on weight of non-sugars.

* * *

Micro-organisms in refinery products. E. K. POPOVA and G. M. PETRETITE. *Sakhar. Prom.*, 1967, **41**, (7), 32–37.—Bacterial counts were determined in white sugar for refining, refinery products, water and air. The tabulated data cover mesophiles (determined on wort agar and meat-infusion agar), heat-tolerant micro-organisms, and thermophiles (aerobic, acid-forming, and anaerobic).

* * *

Phase equilibria in sugar solutions. XII. Ternary systems: sucrose-maltose/lactose-water. F. H. C. KELLY. *J. Appl. Chem.*, 1967, **17**, 223–224.—At 30°C maltose and lactose monohydrates were in equilibrium with sucrose-maltose-water and sucrose-lactose-water systems, respectively, up to the saturation concentration of sucrose. While sucrose had a substantial "salting-in" effect on lactose up to the invariant point, when the effect became somewhat diminished, and lactose had a slight salting-out effect on sucrose, maltose and sucrose appeared to have little effect on each other's solubility except at the invariant point, when significant salting-in was apparent in each case. Although both maltose and lactose behaved somewhat like glucose, it is thought likely that fructose would have less effect on the equilibrium composition than in the case of glucose, since maltose and lactose monohydrates are thermally more stable than glucose monohydrate.

* * *

Sucrose crystallization from low quality solutions under the action of an electric current. L. M. DAISHEVA and I. F. ZELIKMAN. *Izv. Vuzov, Pishchev. Prom.*, 1967, (3), 61–63.—The yield of crystal sugar from an artificial massecuite containing 30% white sugar and 70% molasses was increased by subjecting it in a crystallizer to the action of an electric current (0·5–4 milliamp/sq.cm.). The yield and crystallization rate were higher than obtained with the use of high frequency vibrations (3000 per min). The increase is attributed to the reduction in "free" water in the solution, with the result that the amount of sugar needed to saturate the solution falls.

* * *

Potential conductivity of beet pulp. M. G. PARFENOPULO. *Izv. Vuzov, Pishchev. Prom.*, 1967, (3), 68–70. The potential conductivity of beet pulp was determined in terms of moisture content and temperature during drying under controlled laboratory conditions. The results are expressed in graph form showing moisture content distribution *vs.* temperature and height of sample in the insulated cylinder, and potential conductivity *vs.* average moisture content after drying. It is shown that the potential conductivity decreased with average moisture content as a result of increase in the resistance of the moisture to movement with increase in the thickness of the evaporator surface.

* * *

Theory of nucleation. A. V. ZUBCHENKO. *Izv. Vuzov, Pishchev. Prom.*, 1967, (3), 118–121.—The fluctuation theory of nucleation[1] was verified by experimental crystallization in refined sugar solutions at 1·3 supersaturation and 30–70°C. A graph of supersaturation *vs.* time at varying absolute temperatures demonstrates the staggered change in concentration associated with phase transfer. The latent crystallization period decreased with increase in absolute temperature, and the rate at which nuclei formed in a new phase was proportional to the reciprocal of the latent period. The radii of nuclei of critical size and the number of molecules they contained rose with increase in solution temperature at constant supersaturation.

* * *

The filtrability of Mauritius raws in 1966. J. DUPONT DE R. DE ST. ANTOINE. *Ann. Rpt. Mauritius Sugar Ind. Research Inst.*, 1966, 139–145.—The general improvement in Mauritius raw sugar filtrability in 1966 is attributed to more efficient clarification, the best results being obtained where the boiling juice was limed, and to boiling house modifications, i.e. remelting of *C*-sugar and some *B*-sugar, and reducing *B*-sugar production, apart from remelting, by slightly modifying the boiling process. Although production of finer grain sugar appears to have improved filtrability, no reliable data are available.

* * *

Spectrophotometry in the sugar factory laboratory. H. GRUSZECKA. *Gaz. Cukr.*, 1967, **75**, 137–140.—The use of spectrophotometers is exemplified by measurement of iron in white sugar and of turbidity in white sugar solution using a "Unicam SP-700" instrument manufactured by Carl Zeiss Jena. Iron content in 20 samples ranged from 1·1 to 4·8 mg/kg of sugar (average 2·1 mg/kg). The turbidity was determined at 425 nm in saturated and unsaturated solutions and is expressed in graph form for 18 samples.

* * *

Separation of sugars on new chromatographic media: glass microfibre sheets for thin layer chromatography. E. GAROFALO. *Minerva Pediat.*, 1966, **18**, 1424–1427; through *S.I.A.*, 1967, **29**, Abs. 295.—Separation of six sugars including sucrose was achieved in about 1 hr by ascending chromatography on glass microfibre sheets impregnated with potassium silicate and treated with saline solution. Amyl alcohol- (or butanol-) pyridine-water was used as solvent and the spots were revealed with 1·5 g:20 ml:10 ml:20 ml cysteine hydrochloride:ethanol:95% H_2SO_4:water.

[1] VOLMER: Kinetik der Phasebildung (Kinetics of phase formation). (Dresden, 1939.)

Patents

UNITED KINGDOM

Beet thinner. H. CRAMER and K. CRAMER, trading as MASCHINENFABRIK CRAMER, INH. CRAMER & SOEHNE, of Leer, Ostfriesland, Germany. **1,090,048.** 9th July 1965; 8th November 1967.

* * *

Mingler. THE WESTERN STATES MACHINE COMPANY, of Hamilton, Ohio, USA. **1,091,152.** 27th January 1965; 15th November 1967.—See US Patent 3,272,649[1].

* * *

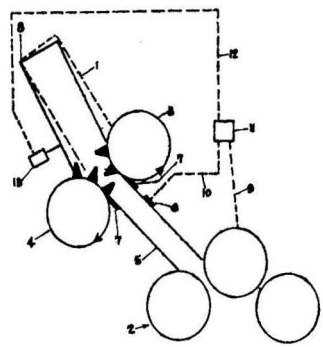
Preparation of instantaneously soluble porous granular sugar. NISSIN SUGAR MFG. CO. LTD., of Tokyo, Japan. **1,092,279.** 21st December 1965; 22nd November 1967.—A concentrated sugar syrup (normal refinery syrup or a solution of a refined sugar) is agitated while being cooled from 110–130°C to normal temperature, whereby the sugar crystallizers in the form of micro-size fine crystals. The mixture of crystals and mother liquor is mixed with (40–100% by weight of) a hydrophilic organic solvent (ethanol) which at normal temperature does not dissolve sugar appreciably and is easily recoverable by evaporation, which produces a thin film on the crystal surfaces of the solvent and uncrystallized sugar solution. The crystals are then separated from the excess of liquid and (spray-dried or) granulated.

* * *

Production of free-flowing icing sugar. HENKEL & CIE. GMBH, of Düsseldorf-Holthausen, Germany. **1,092,770.** 28th October 1966; 29th November 1967. A free-flowing icing sugar powder is produced by spraying [5–40% (about 15%) on weight of end-product] molten finely-divided fat (hydrogenated groundnut oil) (having a melting point of 30–35°C) into freshly sifted powdered sugar (to which other powdered components or flavouring materials have been added) which is either falling freely (from a vibrating trough or shaking screen) or is in a retarded state of fall (produced by an upward air current). The icing powder falls onto a rotating (oblique or conical drum) container, any sugar sticking to the inner wall being constantly stripped off by means of a brush.

Cane mill feeder. THE COLONIAL SUGAR REFINING CO. LTD., of Sydney, N.S.W., Australia. **1,094,015.** 4th March 1966; 6th December 1967.

The mill 2 is supplied with cane or bagasse through the pressure chute 5 through the action of a pair of identical feeder rollers 3, 4 which are equipped with identical sets of uniformly spaced teeth having dimensions suitable to impel the feed through the chute but such that the teeth are readily retractable from the feed when passing through the scraper



plates 7. The arcs described by the teeth overlap so that with a separation between the rollers of 7 inches the height of each tooth above the roller surface is of the order of 4 inches. A computer 11 receives a signal from the pressure responsive element 6 in the chute and a signal along the connexion 9 which records the power consumption of the mill 2. The combined effect is to produce a signal sent along connexion 12 to the hydraulic cylinder 13 which in the case of excessive pressure or power alters the position of the feeder chute 1 whereby the feed blanket is compressed between the roller 3 and the opposite wall of chute 1, reducing the amount of cane or bagasse available to enter chute 5.

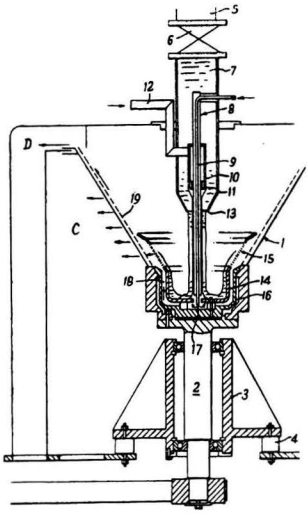
* * *

Feeding device for continuous centrifugals. SOC. FIVES LILLE-CAIL, of Paris 8e, France. **1,094,675.** 13th May 1966; 13th December 1967.

Massecuite is supplied to the conical-type continuous centrifugal through a pipe 5 and so to pipe 7 through control valve 6. At the bottom of this pipe

[1] *I.S.J.*, 1968, **70**, 61.

is a calibrated nozzle 13 through which the massecuite passes into the bowl 14. The latter comprises a solid-wall cylindrical portion surmounted by a perforated conical portion 15, the holes in which will permit passage of the largest crystals in the massecuite.



Centrally within the pipe 7 is a chamber 10 having a calibrated orifice 11 and supplied with dilution water through pipe 12. The central pipe 8 passes through the chamber 10, orifice 11, and nozzle 13 to the base of the bowl 14. It houses a smaller conduit 9 through which steam is admitted and carried down to the opening 17 between the bottom of the bowl and the bottom 16 of basket 1.

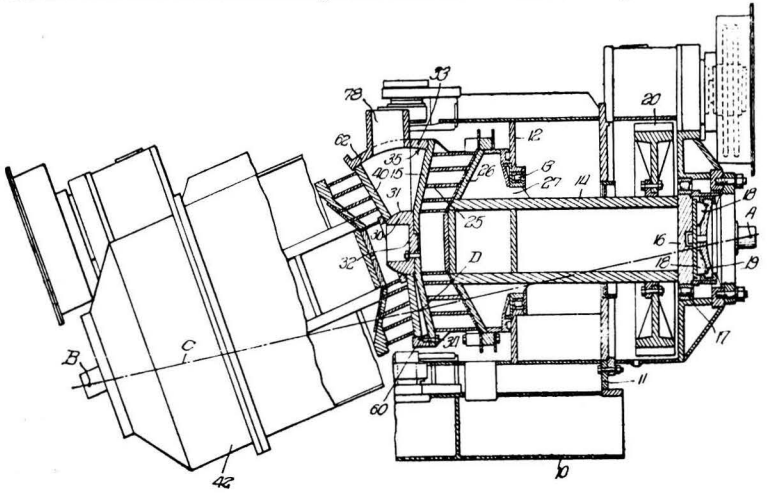
Water admitted through pipe 12 flows in an annular stream to the bowl 14 without appreciable mixing with the massecuite stream surrounding it and delivered through nozzle 13. In the bowl 14, however, the streams are rapidly mixed and finely divided by the conical section 15 into streams which impinge onto the screen 19 where the diluted mother liquor is separated into compartment C. Steam admitted through conduit 9 passes into the chamber 18 and is brought into good contact with the streams; it raises the temperature of the mother liquor and simultaneously dilutes it, reducing the viscosity greatly immediately before the massecuite reaches screen 19, so aiding crystal separation.

* * *

Bagasse press. AMERICAN FACTORS ASSOCIATES LTD., of Honolulu, Hawaii, USA. **1,095,108.** 27th September 1966; 13th December 1967.

The press includes a stationary part 10 having a frame 11 which houses the rotary conical screen disc 15. A partition 12 serves as a mounting for the bearing 13 which supports shaft 14 on which disc 15 is located. The end plate 16 of the shaft is supported by bearing 17 and by thrust bearings 19 which engage with race 18. The shaft carries a spur gear 20 driven by suitable motor and gearing which is not shown. The conical disc 15, of perforated plate, is supported by ribs 25 which separate it from the conical plate 26 which is itself supported by radial ribs 27, the combination providing the necessary strength and rigidity for disc 15. A similar portion 42 having an opposed conical disc 40 is pivotally mounted to one side of the stationary portion on hinges at the top and bottom of the housing 11, the axis of the hinges passing through point 32 which is the point of intersection of the axes of the two discs 15 and 40. It is also the centre from which are generated the spherical surfaces 35, 31 of the flange 33 and hub 30, of the inner opening of feed pipe 78 and the inner surface of flange 62.

The edge surface 60 of disc 40 is also spherical and matches the inner surface of flange 62 so that a closed compartment is maintained, the peripheral width of which varies as the movable part 42 pivots under the action of links connected with a hydraulic cylinder. Bagasse is admitted through port 78 and the rotation of the discs, in the same direction and at approximately the same speed, carries it down and then up again to the point opposite the side entry. The pressure which has increased during the passage reaches its peak and then is reduced as the bagasse continues up and over



between the separating surfaces of the discs. Scraper plates between the discs collect the pressed bagasse which is removed through a discharge outlet. The juice content of the initial bagasse passes through the perforations in the discs 15, 40 and falls by gravity into a chamber from which it is withdrawn.

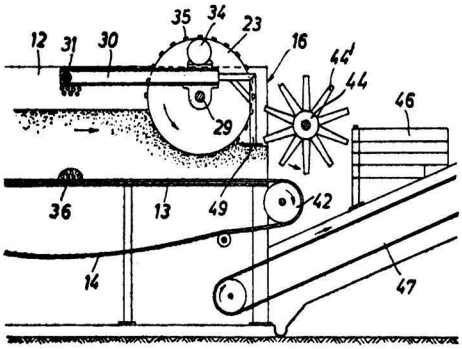
* * *

Beet toppers. SOC. SUCRIERE D'ETUDES ET DE CONSEILS SA, of Tirlemont, Belgium. **1,095,510.** 20th December 1965; 20th December 1967.

* * *

Cane diffuser. BRAUNSCHWEIGISCHE MASCHINENBAU-ANSTALT, of Braunschweig, Germany. **1,095,787.** 29th September 1965; 20th December 1967.

The diffuser is in the form of a trough 12 having a stationary screen bottom 13 along which prepared cane is carried by means of a rake conveyor 14. As it approaches the discharge end 16 of the trough, the bagasse is subjected to compression under the weight of a ballasted drum 23 which is carried on an axle 29 mounted on a two-armed swinging frame 30 which pivots about spindles 31 in the trough walls. The drum



is provided with a motor and variator to give a pulsating peripheral speed to aid preliminary separation of water from the cane, adequate discharge facilities being provided by the apertures 36 in the side walls of the trough. The bagasse blanket leaving the trough is caught by the stripping element 44 the arms 44' of which break open the bagasse to a looser blanket, which falls onto conveyor 47 between guide plates 46, and conduct it to a dewatering mill. The juice extracted by the drum 23 is used for treatment of bagasse nearer the head of the diffuser in a conventional counter-current lixiviation process.

* * *

Beet thinner. G. GUGENHAN, of Düren, Rheinland, Germany, trading as H. FÄHSE & Co. **1,096,791.** 15th January 1965; 29th December 1967.

* * *

Sugar polarimeter. FRANZ SCHMIDT & HAENSCH, of Berlin 62, Germany. **1,096,817.** 17th February 1965; 29th December 1967.—The measuring range of sugar polarimeters is extended by having a pulse-generating transmitting system including an analogue digital converter for converting the rotary movement of a graduated circle connected to the analyser, or displacement of a quartz wedge, into electrical pulses which are electronically counted and indicated. Between the converter and the electronic counter is provided a change-over switch and a pulse-varying stage which can be optionally connected in circuit by means of the change-over switch, corresponding to the different weighed amounts of the substance examined, referred to standard weights. The pulse varying stage may be a bistable multivibrator or capacitor-resistor elements or monostable multivibrators which are bridged by diodes and convert each flank of the input pulses into an output pulse of a duration less than that of the input pulse.

* * *

Production of L-glutamic acid by fermentation. AJINOMOTO CO. INC., of Tokyo, Japan. **1,096,882.** 26th November 1964; 29th December 1967.—A micro-organism capable of producing L-glutamic acid from a nitrogen source and sucrose as a carbon source, e.g. *Brevibacterium lactofermentum* or *Brevib. flavum*, is cultured on a medium containing molasses, raw juice, beet sugar, sugar cane, etc. as well as sucrose, glycerol or sorbitan mono-palmitate in an amount sufficient to promote glutamic acid formation but insufficient to inactivate the glutamic acid-producing enzyme of the micro-organism (e.g. 1–3 mg/ml).

* * *

Continuous centrifugal. DORR-OLIVER INC., of Stamford, Conn., USA. **1,097,093.** 5th February 1965; 29th December 1967.—See U.S. Patent 3,289,843[1].

* * *

L-Glutamic acid production by fermentation. ASAHI KASEI KOGYO K.K., of Osaka, Japan. **1,097,966.** 13th July 1965; 3rd January 1968.—Glutamic acid is produced by the aerobic fermentation of a carbohydrate medium (molasses) with a hypoxanthine-, L-histidine-, a hypoxanthine- and L-histidine-, or a L-arginine-requiring mutant strain of *Microbacterium ammoniaphilum* ATCC 15354 in the presence of a nitrogen source, inorganic salts, biotin and the growth factor required by the bacteria, the biotin being present in an amount greater than and the growth factor in an amount less than the amounts necessary in each case for maximum growth of the bacteria.

* * *

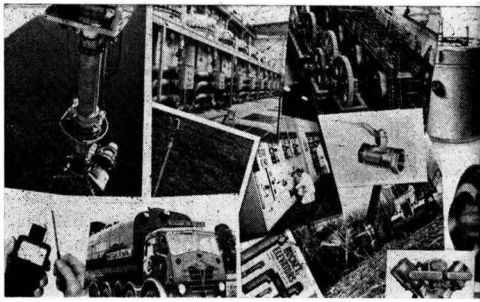
Solidification of sugar solutions. YOKOHAMA SEITO K.K., of Kanagawa-ken, Japan. **1,099,723.** 25th May 1965; 17th January 1968.—See US Patent 3,271,194[2].

* * *

Centrifugal baskets. THE WESTERN STATES MACHINE COMPANY, of Hamilton, Ohio, USA **1,100,641.** 27th January 1965; 24th January 1968.—See US Patent 3,283,910[3].

[1] *I.S.J.*, 1968, **70**, 93.
[2] *ibid.*, 61.
[3] *ibid.*, 92.

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.

Cane cultivators. Thomson Machinery Co. Inc., P.O. Box 71, Thibodaux, La., 70301 USA.

A special feature of the new front- and rear-mounted cane cultivators announced by Thomson are hydraulic lifts which fold the outer gangs in to approximately the width of the tractor and give flotation for following of contours. Both the "Hydra-Fold 1-2-3R" rear-mounted and the "Hydra-Fold 3-2-1F" front-mounted machines are equipped with chopper blades (disc hoes) and will cultivate three 70- or 72-inch rows. In a three-row cane strip, one, two or three rows can be cultivated at a time. Maximum width of the "Hydra-Fold" in working position is 18 ft, which allows all types of cultivation tools for 3–8 row cultivation where row widths are from 24 to 72 inches. An exclusive 3-point hitch is provided for all makes of standard tractors. Approximate width of the cultivators in transport position is 9 ft 8 in.

* * *

Improvement in *C*-massecuite fluidity. Fabcon Inc., 314 Public Square Building, Cleveland, Ohio, 44113 USA.

Data provided by the Erath Sugar Co., of Erath, La., USA, covering three seasons, show that when diluted "Pan Aid Concentrate" solution (3 pints/25 gal water) was added to *C*-massecuite in crystallizers after cooling to below 120°F, the purity fell from an average of 59·13 for *C*-massecuite to 27·04 for final molasses, i.e. a drop of 32·09 compared with only 25·98 obtained when using another surface-active chemical.

* * *

Pneumatic indicating controller. Taylor Instrument Companies (Europe) Ltd., Gunnels Wood Rd., Stevenage, Herts., England.

The 440R series of low-cost pneumatic indicating controllers comprises a universal instrument which is available with all Taylor standard measuring elements for control of pressure, vacuum, load temperature flow and liquid level. It is suitable for use in simple or sophisticated control loops with single-, two- or three-term response modes plus on/off and differential gap. An internally mounted automatic-to-manual unit is an optional extra, and cascade control is also provided for.

PUBLICATIONS RECEIVED

DDS CANE DIFFUSER. Kawasaki Dockyard Co. Ltd., 14 Higashi-Kawasaki-cho, 2-chome, Ikuta-ku, Kobe, Japan.

Full details are given of the DDS cane diffuser made under licence by Kawasaki Dockyard Co. Ltd., including construction, drive, principles of operation, cane preparation, flow, bagasse dewatering and operational experience.

* * *

"SUGAR WORLD BULLETIN". A. &W. Smith & Co. Ltd., Cosmos House, 1 Bromley Common, Kent, England; The Mirrlees Watson Co. Ltd., Cosmos House, 1 Bromley Common, Kent, England.

This is the title of a quarterly bulletin aimed at informing everybody in the sugar industry about the activities of the two companies, both members of the Tate & Lyle group. The text in this issue is in English and Spanish. A data sheet attached (only in English) gives a sugar liquor concentration table, a table of approximate viscosity conversions, and various conversion factors.

* * *

"GLOQUAT" BACTERICIDES. Glovers (Chemicals) Ltd., Wortley Low Mills, Whitehall Rd., Leeds 12, England.

A recently published booklet gives the latest information on "Gloquat C" quaternary ammonium compound, applicable in a number of fields as a surface-active agent and as a bactericide, and on "Gloquat SD" and "Gloquat SD Extra", which contain 16% "Gloquat C" plus 16% selected non-ionic detergent and 40% "Gloquat C" plus 40% non-ionic detergent, respectively. Possible applications of all three preparations are described.

* * *

LARGE A.C. MOTORS. Mather & Platt Ltd., Park Works, Manchester 10, England.

Publication No. E2842 gives information on Mather & Platt large A.C. induction motors which have a range up to 20,000 h.p. and operate on any voltage up to 13·8 kV.

* * *

De Smet cane diffusers.—A 4000-ton cane diffuser manufactured by Extraction De Smet S.A. is being incorporated in the new sugar factory being built by Gutehoffnungshütte Sterkrade A.G. for the Passi Sugar Co. at Iloilo (Panay) in the Philippines. This will bring to 14 the number of De Smet cane diffusers in operation and on order.

* * *

Beet pulp presses from Norway.—Stord Bartz Industri A/S has become the world's leading supplier of beet pulp presses, almost 300 of which have been supplied to 18 countries in the 10 years since the firm started production. The largest single market is the USA where 70 Stord presses have been installed and where all new beet factories are being supplied with them. Recently 12 Stord presses were delivered to Morocco in cooperation with two German firms which formerly made their own beet pulp presses, but which three years ago started marketing Stord presses.

US Sugar Quotas, 1968[1]

	Initial entitlements for 1968	*Amendments*	*Shortfalls/ Reallocations*	*New Entitlements*
	(short tons, raw value)			
Domestic beet	3,025,000	95,333	—	3,120,333
Mainland cane	1,100,000	34,667	—	1,134,667
Hawaii	1,200,000	–8,296	—	1,191,704
Puerto Rico	1,140,000	—	–400,000	740,000
Virgin Islands	15,000	—	–15,000	—
Philippines	1,126,020	—	—	1,126,020
Argentina	53,273	1,704	7,885	62,862
Australia	187,945	3,117	—	191,062
Bolivia	5,156	163	763	6,082
Brazil	433,061	13,852	64,095	511,008
British Honduras	11,520	191	1,680	13,391
British West Indies	158,132	2,623	23,055	183,810
Colombia	45,827	1,464	6,782	54,073
Costa Rica	50,981	1,631	7,545	60,157
Dominican Republic	433,061	13,852	139,095	586,008
Ecuador	63,011	2,016	9,326	74,353
Fiji	41,243	685	—	41,928
French West Indies	49,744	826	7,253	57,823
Guatemala	42,963	1,374	6,359	50,696
Haiti	24,059	769	3,561	28,389
Honduras	5,156	163	763	6,082
India	75,178	1,247	—	76,425
Ireland	5,351	—	—	5,351
Malagasy	8,875	148	—	9,023
Mauritius	17,229	285	—	17,514
Mexico	442,799	14,162	65,536	522,497
Nicaragua	50,981	1,631	7,545	60,157
Panama	32,079	1,026	4,748	37,853
Peru	345,417	11,049	51,124	407,590
Salvador	31,506	1,008	4,663	37,177
South Africa	55,339	918	—	56,257
Swaziland	6,787	113	—	6,900
Taiwan	78,310	1,299	—	79,609
Thailand	17,229	285	—	17,514
Venezuela	21,768	695	3,222	25,685
	10,400,000	200,000	—	10,600,000

The late Sir Frederick Seaford.—The death recently occurred of Sir FREDERICK SEAFORD, C.B.E., who contributed so much to the sugar industry of Guyana. He was born in what was then British Guiana in 1886 and apart from schooling and University education in England, spent almost his entire life in the Colony until he retired in 1949. All his working life as an engineer was spent with the Booker Group, of which he was a Director, and he was for many years chairman of the British Guiana Sugar Producers' Association, also representing British Guiana on the B.W.I. Sugar Association. He was both an elected and nominated member of the British Guiana Legislative Council and was active in many other spheres of public life.

* * *

Verenigde H.V.A.-Maatschappijen N.V. 1967 report.—In Ethiopia, with a crop of 76,869 metric tons of sugar produced from an area of 3330 ha, as against 68,861 tons from an equal area in 1965/66, a new record was set up. The increase was largely attributable to the coincidence of favourable weather conditions which promoted a high sugar content in the cane. It is anticipated that a return to the former level will occur in the 1967/68 crop. Work on the establishment of the new Metahara sugar estate has started, including industrial premises and housing, the irrigation system, rail track and a road and rail bridge. The new plant will have a capacity of 1800 metric tons of cane per 24 hours, against 1600 for Wonji and Shoa estates, and it will be capable of expansion to 2500 t.c.d. Production of the Kilombero sugar estate in Tanzania, which the Company manages, rose to 30,750 tons as against 26,100 tons in the preceding season, in spite of unfavourable weather at the beginning and end of the season. The factory capacity was extended during the year to 1750 t.c.d.

Brevities

Bagasse paper pulp mill project for Hawaii.—Mitsui & Co. Ltd. and C. Brewer & Co. Ltd. recently announced plans for a joint venture which will investigate the feasibility of establishing a paper pulp mill near Brewers' sugar plantation subsidiaries on the Hilo coast of Hawaii. Preliminary economic and technical studies are to be completed before the end of the year; these will include determining specific production processes which would be used by the plant and which would be compatible with local community considerations. Under the terms of the joint venture agreement, should the study be successful, Mitsui will provide technical assistance to the operation and will market all export production under long term contract.

* * *

De Smet cane diffuser for Cuba.—A De Smet cane diffuser, made under licence in France, is to be bought and installed at Central Gregorio A. Mañalich (formerly Mercedita) in Havana Province[2].

* * *

Raffinerie Tirlemontoise S.A. expansion[3].—According to reports from Belgium, Raffinerie Tirlemontoise S.A. will take over three sugar factories, namely Sucrerie Dumoulin, Sucrerie de Brugelette and Sucrerie de Barry-Maulde. The capital of the Company is to be increased by 1·95 million to 918·30 million Belgian francs.

* * *

Bagasse newsprint project in India[4].—According to press reports, a group of four cooperative sugar factories in Maharashtra have formed the Bharat Cooperative Paper Mills Ltd. to produce newsprint from bagasse. A preliminary feasibility study report on behalf of the factories has been prepared by a Canadian firm and is under consideration. It is further reported that another group of sugar factories in the state has also proposed to set up a newsprint factory with a capacity of 300 metric tons per day.

* * *

USSR beet area[5].—According to the Soviet newspaper *Izvestiya*, sugar beet plantings in the USSR have been terminated, with a total area sown of 3·5 million hectares, compared with 3·8 million hectares in 1967.

* * *

New Malaysia sugar refinery[6].—A new sugar refinery with a capacity of 60,000 tons of sugar per year is to be set up in Kota Tinggi in south-east Malaysia. Construction of the mill and refinery, which it is estimated will cost about 15 million Singapore dollars, (£2,000,000), is planned to be started by the end of the year. The project is a joint venture between Johore Sugar Plantations and Industries Ltd., and Taito Company and Sumitomo Shoji Kaisha of Japan. The Japanese firms will contribute 20% of the capital to develop a 20,000-acre plantation and build the mill and refinery.

* * *

South Africa production restriction[7].—Exports of sugar from South Africa to Western world markets will be limited by reducing production during the forthcoming season to 1·8 million tons, according to an announcement by the South African Sugar Association. Production in the 1967/68 season reached the record level of 2,008,704 short tons.

[1] C. Czarnikow Ltd., *Sugar Review*, 1968, (866), 99.
[2] *CubaAzucar*, 1967, (March/April), 30, (May/June), 33.
[3] F. O. Licht, *International Sugar Rpt.*, 1968, **100**, (15), 4.
[4] *Indian Sugar*, 1968, **17**, 733.
[5] F. O. Licht, *International Sugar Rpt.*, 1968, **100**, (14), 4–5.
[6] *Public Ledger*, 20th April 1968.
[7] F. O. Licht, *International Sugar Rpt.*, 1968, **100**, (12), 10.

Brevities

USSR sugar imports[1].—Imports of sugar by the USSR totalled 2,482,516 metric tons, raw value, in 1967, of which 2,479,736 tons were from Cuba, 1657 tons from Hungary and 1123 tons from Poland. In 1966 the bulk of the total imports of 1,843,444 tons was also supplied by Cuba at 1,840.894 tons. while Hungary supplied 1278 tons and Poland 1272 tons.

* * *

Egypt sugar factory start-up[2].—Sugar production commenced recently in the Kous sugar mill[3], according to Egyptian press reports. This is believed to be the most modern of a group of six in the country, and the entire project has cost some £E 30 million.

* * *

Philippines sugar development[4].—A contract has recently been signed between the Philippine Passi (Iloilo) Sugar Central Inc. and a group of West German firms for an agricultural development project on the island of Panay. The project will include the establishment of new sugar cane plantations as well as the extension of existing plantations, the erection of a new sugar mill, and the development of the transport system. The agricultural parts will be carried out by Agrar- und Hydrotechnik G.m.b.H. of Essen, the installation of the sugar factory by Gutehoffnungshütte Sterkrade A.G. of Oberhausen, and all building work by Lucks & Co. of Braunschweig. The sugar factory will have a capacity of 4000 metric tons of cane per day.

* * *

Indonesia sugar imports[5].—The difficulty of forecasting statistical patterns is reflected by the news that Indonesia, a traditional exporter and a substantial quota holder under the 1958 International Sugar Agreement, has recently acquired 40,000 tons of white sugar from Taiwan, bringing Indonesian purchases so far this year to a total in the region of 100,000 tons.

West Indies Sugar Production[6]

	Production		Estimate
	1966	1967	1968
	(*long tons*)		
Antigua	7,716	4,747	4,000
Barbados*	171,910	200,612	170,000
Guyana	288,869	343,922	355,000
Jamaica	500,220	448,616	468,000
St. Kitts	37,753	38,526	37,500
Trinidad	210,394	197,855	242,200
	1,216,862	1,234,278	1,276,700

	Local and Neighbouring Consumption			Estimated Available for export
	1966	1967	Estimate 1968	1968
Antigua	1,344	245	500	3,500
Barbados*	11,005	11,752	11,300	163,853†
Guyana	24,175	25,822	25,500	344,421†
Jamaica	77,597	79,399	85,000	400,780†
St. Kitts	4,207	3,253	3,100	34,400
Trinidad	43,615	44,910	46,500	195,700
	161,943	165,381	171,900	1,142,654

* Production and export figures include fancy molasses.
† Includes stock at the end of 1967.

French Sugar Imports and Exports[7]

	1967	1966
Imports	(*metric tons, tel quel*)	
Australia	25,239	—
Belgium/Luxembourg	1,422	2,201
Brazil	36,101	68,113
Colombia	13,868	—
Congo (Brazzaville)	24,453	—
French West Indies	107,769	153,813
India	10,351	10,500
Malagasy	19,319	10,082
Mexico	10,160	—
Poland	31,260	20,716
Réunion	186,337	233,163
South Africa	20,981	10,056
Other countries	1,260	296
	488,520	508,940
Exports:		
Algeria	89,095	172,161
Andorra	1,140	789
Belgium/Luxembourg	1,512	8,062
Cameroons	3,815	2,455
Dahomey	6,025	5,917
Germany, West	130,818	218,849
Ghana	15,346	24,664
Greece	8,251	14,844
Guinea	761	4,790
Holland	43,153	53,822
Italy	12,609	25,196
Ivory Coast	12,940	16,711
Liberia	1,375	1,558
Mali	5,082	1,000
Mauritania	9,472	5,508
Morocco	3,993	46,285
Niger	6,133	8,107
Nigeria	13,775	11,973
Senegal	28,242	38,764
Sierra Leone	2,201	2,464
Spain	710	951
Spanish Africa	3,882	3,803
Sweden	6,701	—
Switzerland	30,381	77,968
Togo	4,371	4,227
UK	963	1,003
USA	831	—
Upper Volta	7,033	866
Other countries	2,979	2,371
	453,589	755,108

Sugar industry rationalization in Guadeloupe[8].—Sugar mills in Guadeloupe, in the French West Indies, are being modernized; two mills recently merged, leaving a present total of nine, while additional mergers are expected to lower the total of working mills to five within the next three years.

* * *

New cooperative sugar factories for India[9].—A cooperative sugar mill, the first of its kind in Rajasthan, is reported to have been set up at Keshoraipatan. The mill, which cost Rs. 21,800,000, will have a crushing capacity of 1250 metric tons of cane per day to be increased gradually to 2000 t.c.d. It is to start production in January 1969. A second cooperative sugar factory at Madhi in Surat district, Gujerat state, is expected to start working in the 1968/69 season.

[1] *Lamborn*, 1968, **46**, 69.
[2] C. Czarnikow Ltd., *Sugar Review*, 1968, (866), 99.
[3] *I.S.J.*, 1966, **68**, 255.
[4] F. O. Licht, *International Sugar Rpt.*, 1968, **100**, (11), 19.
[5] C. Czarnikow Ltd., *Sugar Review*, 1968, (865), 93.
[6] *West Indies Sugar Association Inc. Report*, 30th April, 1968.
[7] *Willett & Gray*, 1968, **92**, 154.
[8] *Sugar y Azúcar*, 1968, **63**, (5), 68.
[9] *Indian Sugar*, 1968, **17**, 733.