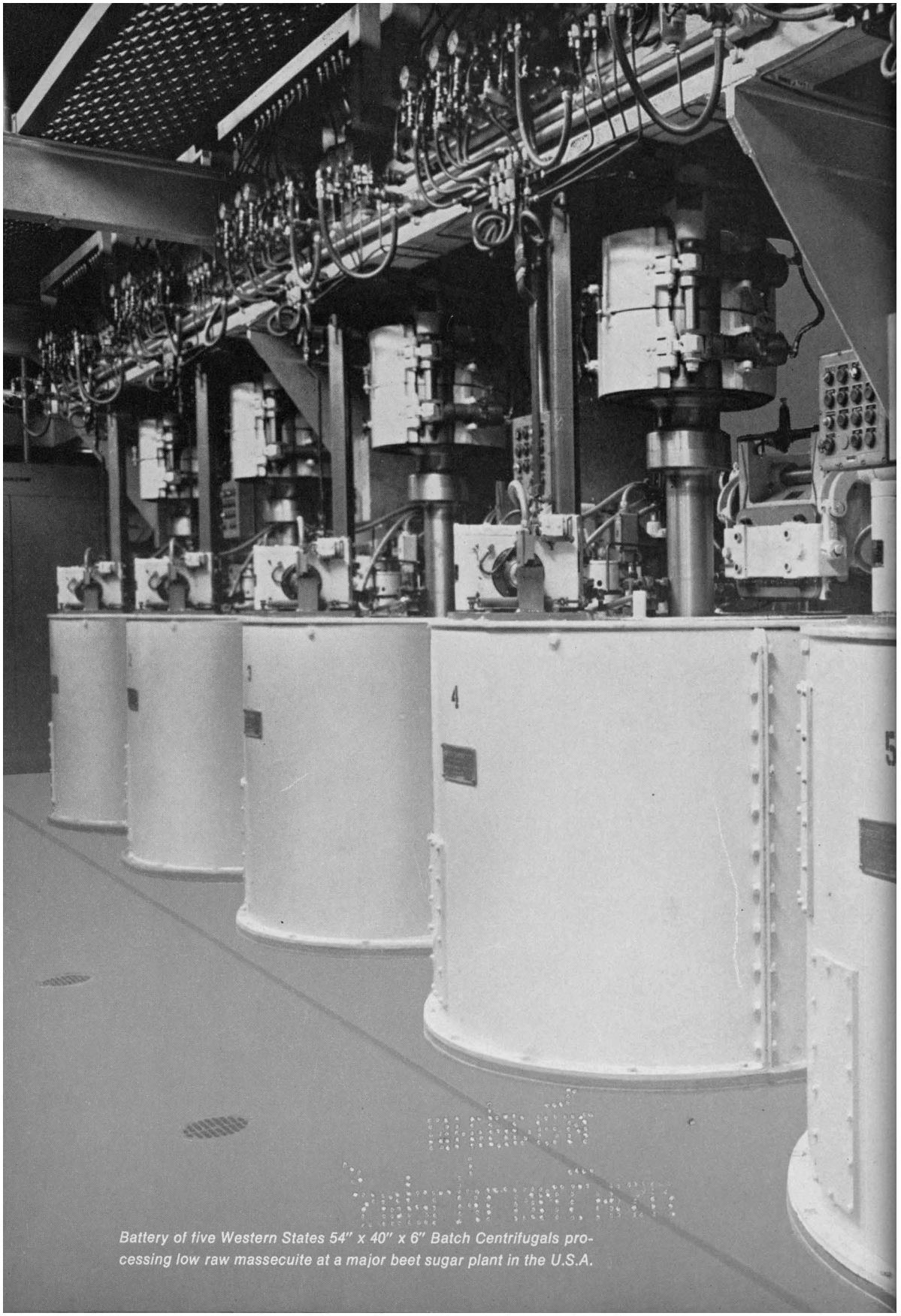
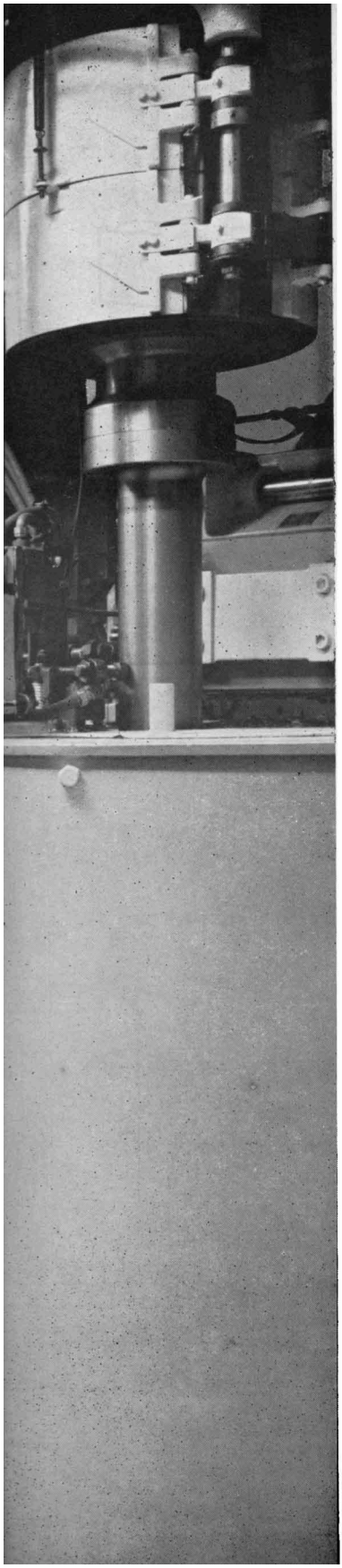
THE International Sugar Journal

FEBRUARY 1970



Battery of five Western States 54" x 40" x 6" Batch Centrifugals processing low raw massecuite at a major beet sugar plant in the U.S.A.



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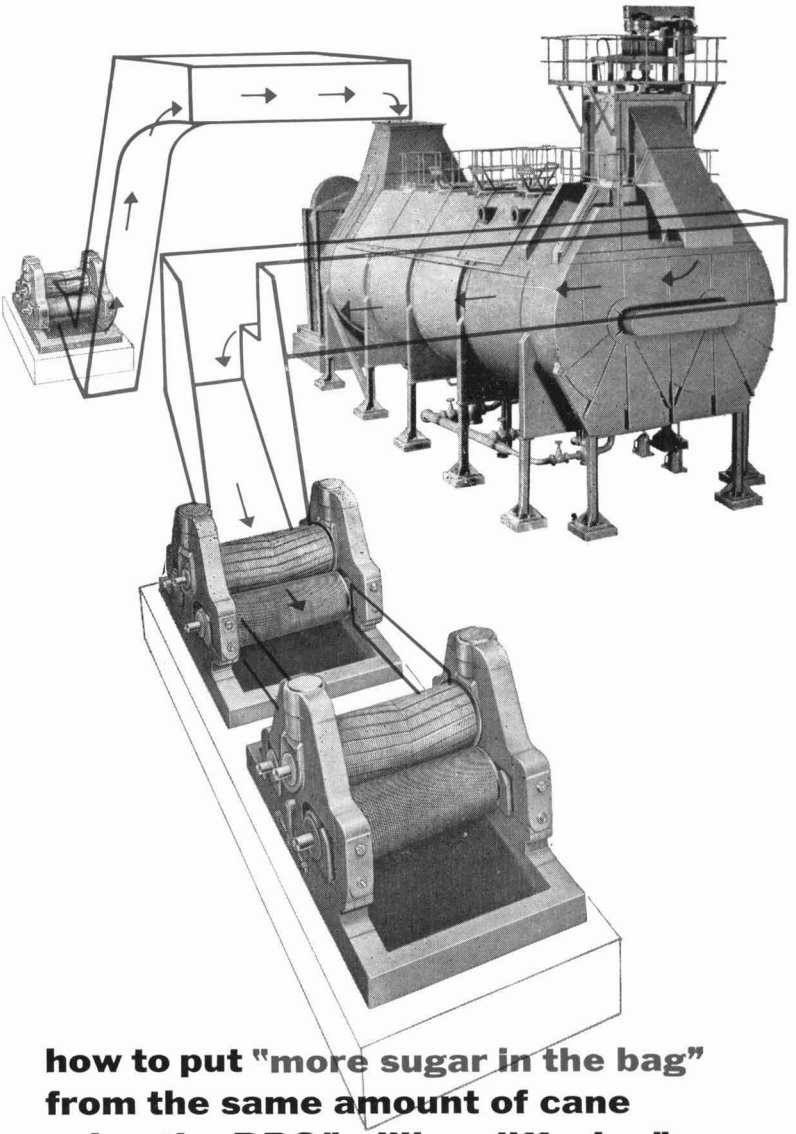

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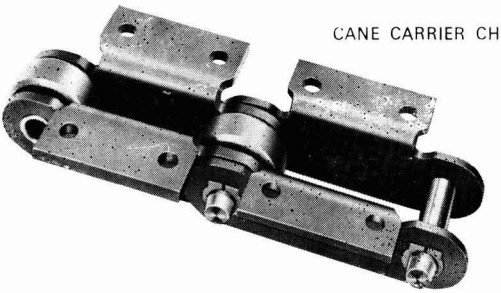

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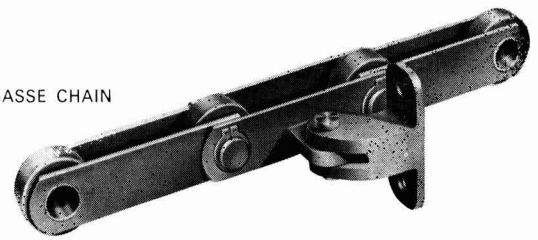

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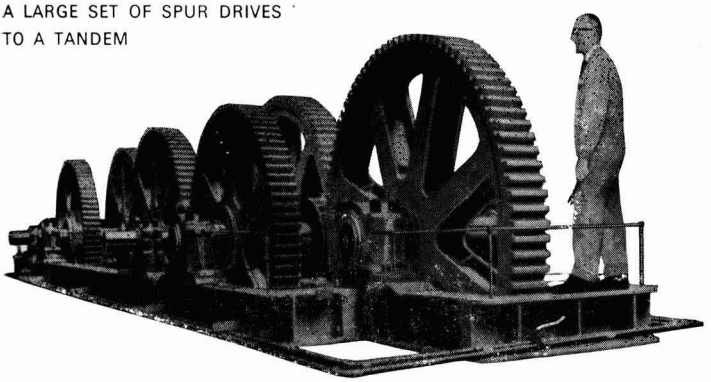

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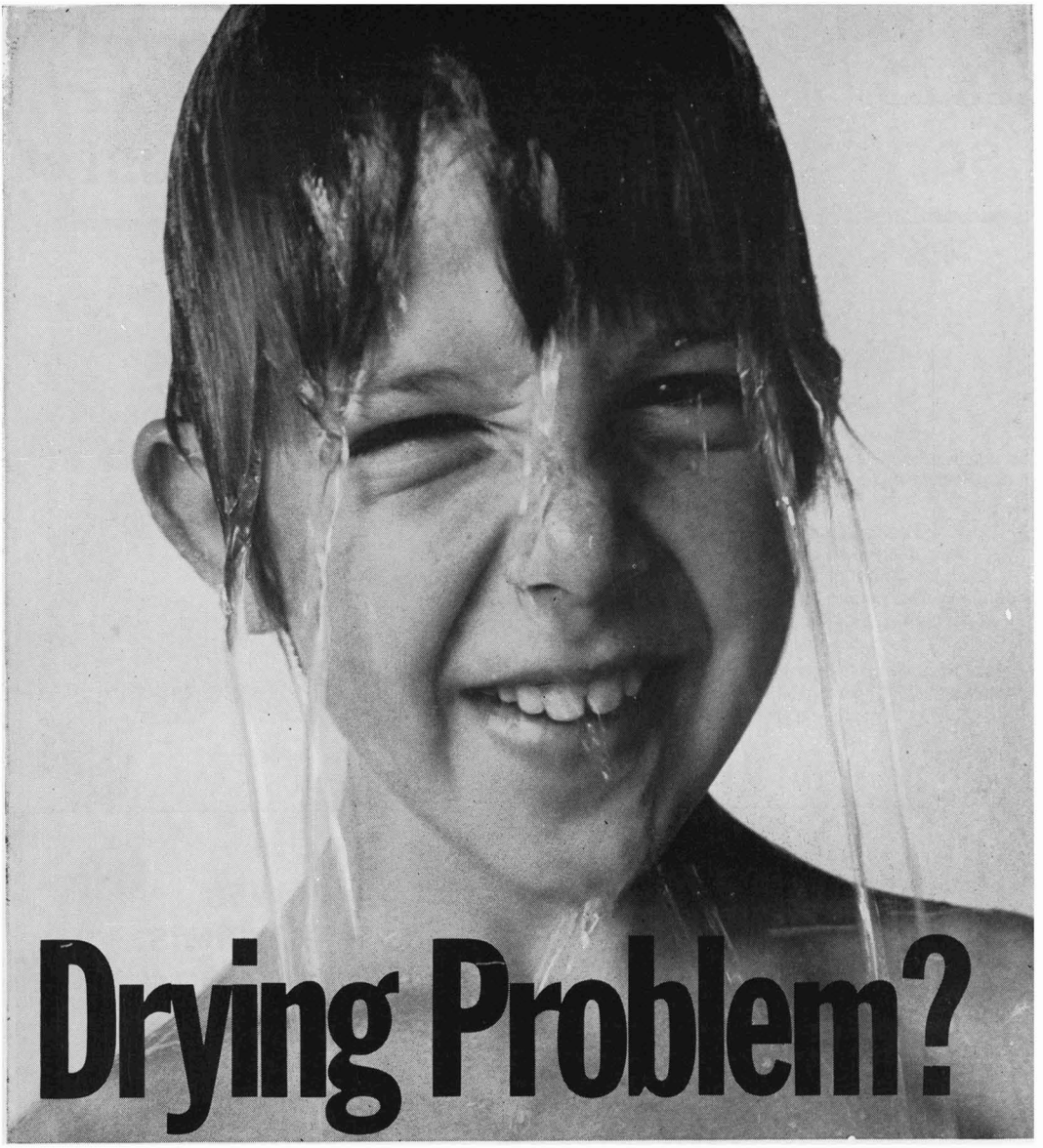

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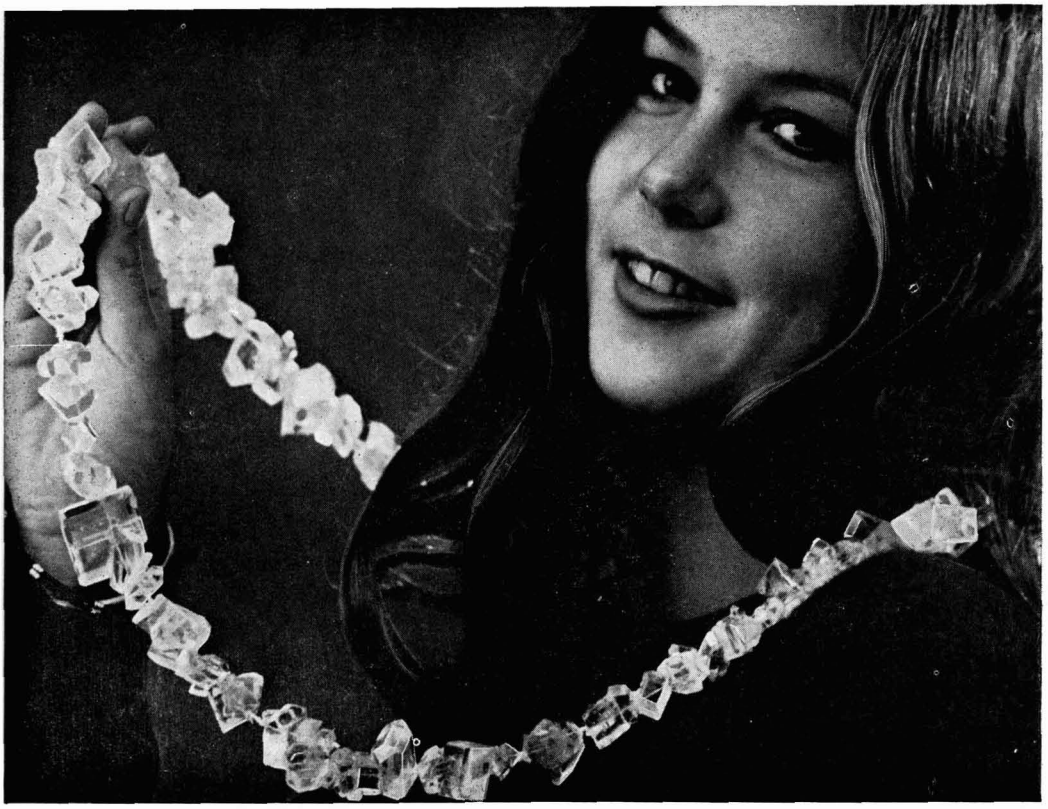

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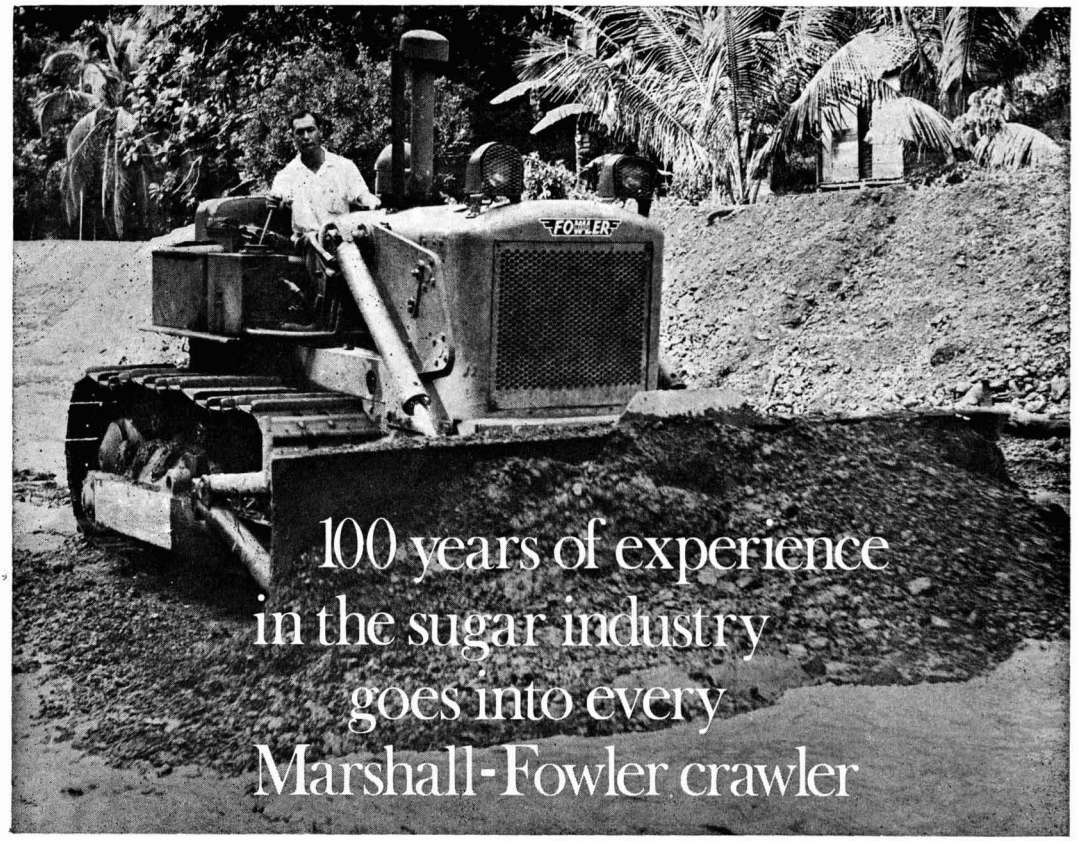

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Published by
The International Sugar Journal Ltd.
23a Easton Street, High Wycombe,
Bucks., England.
Telephone: High Wycombe 29408
Cable: Sugaphilos, High Wycombe

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Annual Subscription: 50s 0d or $8.00 post free

Single Copies: 6s 0d or $1 post free

February 1970

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On décrit une méthode rapide par chromatographie en phase gazeuse (support liquide) pour la détermination directe de l'acide lactique dans les mélasses et dans les jus de l'industrie de la betterave sucrière. Les résultats obtenus sont comparés à ceux de la méthode par échange ionique et par colorimétrie décrite dans la 1ère partie de l'article. On donne également des détails sur une méthode pour la détermination de l'acide lactique dans le jus vert, dans laquelle l'acide lactique est d'abord séparé par échange ionique, suivi ensuite d'un analyse par chromatographie en phase gazeuse (support liquide). Les résultats sont à nouveau comparés avec ceux de la méthode à la semicarbazide comme ci-dessus.

* * *

Diffusion DDS pour canne à sucre au Brésil. J. B. KARLSSON. *p.* 40–43

On donne des informations au sujet du diffuseur à canne DDS installé à l'Usina São Francisco Açúcar e Alcool S.A. au Brésil. Les données relatives à la performance mensuelle moyenne pour la saison 1968/69, la première saison complète au cours de laquelle de diffuseur opérait, sont rassemblées en tableaux.

* * *

Evaluation de nouvelles boutures de canne à sucre issues de croisements avec des espèces Indiennes, faite à Houma, Louisiana, 1966–69. P. H. DUNCKELMAN et R. D. BREAUX. *p.* 43–44

On présente un bref rapport sur le travail effectué par le U.S. Dept. of Agriculture dans le cadre du projet quinquennal de coopération entre le Sugarcane Breeding Institute à Coimbatore en Inde et la USDA au sujet du croisement d'hybrides US et Indiens avec des pousses de l'espèce sauvage, *Saccharum spontaneum.*

Die Bestimmung der Milchsäure bei der Rübenzuckerherstellung. Teil II. Eine Schnellmethode zur Bestimmung der Milchsäure in Abläufen und Fabriksäften. J. F. T. OLDFIELD, R. PARSLOW und M. SHORE. *S.* 35–40

Es wird eine gaschromatographische Schnellmethode zur direkten Bestimmung der Milchsäure in Abläufen und Fabriksäften der Rübenzuckerherstellung beschrieben. Die mit dieser Methode erhaltenen Ergebnisse werden mit denjenigen verglichen, die nach der Abtrennung der Milchsäure über Ionenaustauscher die kolorimetrische Bestimmung erfolgt. Es werden ausserdem Einzelheiten über ein Verfahren zur Bestimmung der Milchsäure in Rohsaft angegeben. Bei dieser letzteren Methode wird die Milchsäure zuerst über Ionenaustauscher abgetrennt und anschliessend mit Hilfe der Gaschromatographie bestimmt. Auch die hier erhaltenen Resultate werden wieder mit denen der Semicarbazidmethode verglichen.

* * *

DDS-Rohrdiffusion in Brasilien. J. B. KARLSSON. *S.* 40–43

Es wird über die DDS-Rohrdiffusion berichtet, die in der Usina São Francisco Açúcar e Alcool S.A. in Brasilien aufgestellt wurde. Angaben über die durchschnittliche Leistung der Anlage sind tabellarisch für die Kampagne 1968/69 aufgeführt, in welcher der Diffuseur das erste Mal voll arbeitete.

* * *

Neue Kreuzungen von Zuckerrohr-Klonen aus Indien 1966 bis 1969 in Houma, Louisiana, getestet. P. H. DUNCKELMAN und R. D. BREAUX. *S.* 43–44

Es wird kurz über die im US-Department of Agriculture als Teil eines Fünfjahresplanes durchgeführten Arbeiten berichtet. Im Rahmen dieses Planes arbeitet das Institut für Zuckerrohrzüchtung in Coimbatore in Indien gemeinsam mit dem US-Department an der Kreuzung US-amerikanischer und indischer Hybride mit Klonen der wildwachsenden Spezies *Saccharum spontaneum.*

La medida de ácido láctico en la fabricación de azúcar de remolacha. Parte II. Un método rápido para la determinación de ácido láctico en melaza y jugos de la fábrica. J. F. T. OLDFIELD, R. PARSLOW y M SHORE. *Pág.* 35–40

Se describe un método rápido empleando cromatografía gas-líquida para determinar directamente el ácido láctico en melaza y jugos de la fábrica de azúcar de remolacha. Resultados obtenido por el método se comparan con esos obtenido por el método de cambio de iones—colorimetría que se describe en el primer parte del artículo. Se presentan también detalles de un procedimiento para la determinación de ácido líquido en jugo crudo, en que el ácido láctico se separa inicialmente por cambio de iones y entonces se determina por cromatografía gas-líquida. Las resultados se comparan de nuevo con esos del método de semicarbazido como antes.

* * *

Difusión de caña tipo DDS en el Brasil. J. B. KARLSSON. *Pág.* 40–43

Se presentan un informe sobre el difusor de caña marca DDS instalado a Usina São Francisco Açúcar e Alcool S.A. en el Brasil y, en forma tabular, dados promedios mensuales de cumplimiento en la zafra de 1968/69—la primera en que el difusor operaba.

* * *

Nuevos clones para crianza de caña de azúcar de cruces de la India evaluados en Houma, Louisiana, en 1966-69. P. H. DUNCKELMAN y R. D. BREAUX. *Pág.* 43–44

Un breve informe se presenta del trabajo del Depto. de Agricultura de los E.U.A. (el U.S.D.A.) como parte del 5-año proyecto en que el Instituto de Crianza de Caña de Azúcar de Coimbatore en la India ha cooperado con el U.S.D.A. para efectuar cruces de híbridos de los E.U.A. y de la India con clones del especie silvestre *Saccharum spontaneum.*

THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXXII FEBRUARY 1970 No. 854

Notes & Comments

Sugar market prospects in 1970.

After reviewing factors affecting the sugar market during 1969 recently, C. Czarnikow Ltd. considered prospects for 1970[1], as follows:

"Forecasting commodity price trends is always a difficult undertaking, but it is particularly hazardous in the sugar market, which reflects not only the basic facts of the supply and demand situation but also unpredictable climatic and political events in all parts of the world. Most countries produce sugar and all consume it and political changes and fiscal decisions can have a marked effect on production and consumption, while weather conditions naturally play a large part in deciding the level of output.

"To some extent the supply of sugar will be limited by the controls that the International Sugar Agreement will have over the tonnage of sugar which can be marketed by some of its members. The statistical situation for 1970 has been carefully examined by the ISC and quotas have been set again at ninety per cent of basic export tonnages.

"At this level, according to the statistics published by the ISC, there will be a theoretical surplus of supplies over requirements of a few hundred thousand tons, but this does not take into account either the growth in the market which will follow from the banning of cyclamates or the fact that some exporting member countries will be unable to fulfil their quotas. Either of these factors will, we feel, be more than adequate to close the gap between supply and demand, as shown by the Council's figures.

"It is our impression that there has been consistent under-reporting of the quantity of cyclamate used by manufacturers in many countries and the expansion in the sugar market which will result from the recent prohibitions may be larger than has been generally estimated.

"So far as probable shortfalls are concerned, it is difficult to forecast availabilities for as much as one year ahead with any degree of exactitude, but it is our impression that they will be in the region of 500,000 tons while, depending upon weather conditions or, in some cases, political decisions, they could amount to much more. It is true that the Council can redistribute this tonnage among other member exporters, but this is not mandatory and in any case they are precluded from doing so until the prevailing price exceeds 3·50c per lb.

"If the Council's estimates of supplies and requirements—and particularly those supplies likely to be forthcoming from non-members—are correct, buying requirements will be sufficient to bring the price level over 3·50c per lb. However, the Council has no control over supplies from non-members and it now seems possible that actual exports from these countries to the free world market will be in excess of the 1·2 million tons shown in the Council's figures. It remains to be seen whether this excess will be so large as to counteract the effects of the ban on cyclamates and the export quota shortfalls".

* * *

International Sugarmark design competition.

The banning of cyclamates in many countries focussed attention on the artificial sweeteners which have been used in a number of consumer products to replace all or, more insidiously, part of the sugar formerly employed as the sole sweetening agent. The purchaser is liable to find only if he reads the small print on the label that he has bought a product with "Artificial Sweeteners Added".

First steps have now been taken to remedy this situation by a project with international cooperation for the introduction of an International Sugarmark. This is intended to symbolize the qualities of sugar as a pure energy-giving food and sweetener and will also guarantee a minimum standard of 99·7% sucrose with no artificial additives. It will be the focal point of all promotional activities connected with sugar and will eventually appear on sugar packets and containers as well as, for instance, the bulk tankers carrying sugar from refiner to its destination. Until such time as wide recognition has been established, the slogan "Pure sugar" (in the appropriate language) will be incorporated with the mark, and eventually it is anticipated that manufacturers of consumer goods will apply to be allowed to use the mark on their goods to symbolize and announce that they are sweetened only with pure sugar.

[1] *Sugar Review*, 1969, (950), 235–236.

The Sugarmark is to be chosen by a competition, promoted by the Committee of European Sugar Manufacturers and organized by the British Sugar Bureau, and countries expected to participate include the 14 Committee members in Europe as well as others having a close relationship, such as Australia, South Africa and Venezuela. Each country will submit three designs for the International Competition by 1st September 1970 and the winning design will be announced on 1st December 1970. An International prize of £1000 is offered for the best design selected by an International Panel of Judges, and additional prizes totalling £500 will be awarded nationally, while fees for copyright will be £500. The successful designer thus stands to win a sum approaching £2000.

The scheme was launched from the headquarters of the International Sugar Organization and received a warm welcome from its Executive Director—an indication of the strong probability of support to be expected from many of the 47 countries adhering to the International Sugar Agreement.

* * *

US sugar supply quota, 1970.

In December, the US Dept. of Agriculture announced the initial Overall Supply Quota for 1970 at 10,800,000 short tons, raw value. As a result of the high carry-over stocks of the mainland cane sugar producers and the ability of beet sugar producers to supply much of their outturn during the first quarter of the year, it was decided to limit deliveries by foreign suppliers to 800,000 tons up to the 31st March 1970, later raised to 850,000 tons. Details of the initial quotas for individual countries appear elsewhere in this issue.

* * *

World sugar balance 1968/1969.

F. O. Licht K.G. have published their fifth estimate of the world sugar balance[1], as a result of revised information obtained from a number of individual countries.

	1968/69	1967/68	1966/67
	(*metric tons, raw value*)		
Initial stocks, 1st Sept.	19,116,203	19,032,338	19,133,134
Production	68,686,231	67,800,654	65,616,562
Imports	21,797,791	22,188,076	21,398,183
	109,600,225	109,021,068	106,147,879
Exports	21,967,974	22,064,860	21,483,021
Consumption	69,673,823	67,840,005	65,632,520
Final stocks, 31st Aug.	17,958,428	19,116,203	19,032,338
Production increase	885,577 (1·31%)	2,184,092 (3·33%)	2,514,893 (3·99%)
Consumption increase	1,833,818 (2·70%)	2,207,485 (3·36%)	2,839,112 (4·52%)

The increase of only 2·70% in sugar consumption is considered unsatisfactory but is thought not to reflect a sudden fall in the rate of increase during the 1968/69 crop year. Although the figures for the two previous years are higher, they have been inflated —so far as human consumption is concerned—by an increasing use of sugar for animal feeding purposes, according to Licht. Presumably, the higher free market prices for sugar during 1969 has made this outlet less economical and so prevented an increase in sugar usage as fodder.

* * *

International Sugar Agreement members and 1970 quotas

Current membership of the International Sugar Agreement totals 47 countries, of which 35 are exporters and 12 importers. The latter include Canada, Finland, Ghana, Ireland, Japan, Kenya, Malawi, New Zealand, Portugal, Sweden, the UK and the USSR. It is of interest that a purchase of 5000 tons of white sugar by Kenya from the EEC has been announced[2] and it is surprising that an importing member (and a member of the Executive Committee of the International Sugar Council) should apparently be able to purchase non-member sugar at a time when this appears to be specifically excluded under the Agreement because the current price is below the floor of the Agreement's range.

The ISA export quotas for 1970, set at 90% of basic quotas except where non-reducible, are as follows for the 35 exporting members; the quotas are rounded off to the nearest thousand tons:

	Basic quota	1970 *quota*
	(*metric tons, raw value*)	
Argentina	25,000	23,000
Australia	1,100,000	990,000
Bolivia	10,000	10,000
Brazil	500,000	450,000
British Honduras	22,000	20,000
China (Taiwan)	630,000	567,000
Colombia	164,000	148,000
Congo (Brazzaville)	41,000	37,000
Cuba	2,150,000	1,935,000
Czechoslovakia	270,000	243,000
Denmark	41,000	37,000
Dominican Republic	75,000	68,000
Fiji	155,000	140,000
Guatemala	22,000	22,000
Honduras	11,000	11,000
Hungary	51,000	46,000
India	250,000	225,000
Malagasy Republic	41,000	37,000
Mauritius	175,000	158,000
Mexico	96,000	86,000
Nicaragua	11,000	11,000
Peru	50,000	45,000
Poland	370,000	333,000
South Africa	625,000	563,000
Swaziland	55,000	50,000
Thailand	36,000	32,000
Uganda	39,000	35,000
West Indies (Antigua, Barbados, Guyana, Jamaica, St. Kitts and Trinidad)	200,000	180,000
	7,215,000	6,502,000

Indonesia, nominally an exporting member, has a net entitlement of 81,000 tons but has become, in fact, an importer, taking 37,524 tons in 1967 and 120,000 tons in 1968. The Philippines, also a member, has a net export entitlement of up to 60,000 tons in any quota year when the level of the aggregate of quotas in effect is above 100% of the total basic export tonnages; this does not therefore exist currently for 1970.

[1] *International Sugar Rpt.*, 1969, **101**, (32), 1–2.
[2] C. Czarnikow Ltd., *Sugar Review*, 1970, (952), 5.

The measurement of lactic acid in beet sugar processing

Part II. A rapid method for the determination of lactic acid in molasses and process juices

By J. F. T. OLDFIELD, R. PARSLOW and M. SHORE
(British Sugar Corporation Ltd., Research Laboratories, Colney, Norwich)

Introduction

THE determination of lactic acid in molasses and beet sugar process juices is generally accomplished by a colorimetric procedure applied to an ion exchange eluate. The eluate is obtained from an anion exchanger after separation of lactic acid from cationic material and sugars[1,2,3,4]. The relatively high precision of these methods is offset by the amount of time required to carry them out. To obtain acceptable recoveries of lactic acid with an ion exchange procedure requires flow rates of about 3 to 10 ml per minute for the applied solutions and eluates. The processing time for determinations requiring the application of up to 500 ml of diluted juice can therefore be appreciable. Lactic acid is eluted from the anion exchanger after it has been washed sugar-free. Large volumes of wash with low flow rates make this step a fairly long process even when small columns are used[4]. The colorimetric procedure carried out on the anion exchange eluate may itself require from one to three hours for completion.

Very little time is actually lost when dealing with routine analysis, as determinations are run concurrently at staggered intervals, but for any single determination the time interval between receipt of the sample and the final answer may be as long as one or perhaps two working days. Attempts have been made to overcome this time lag and methods have been devised which make use of the direct application of juices to paper chromatograms[5,6]. The chromatograms are run in volatile solvents, dried and then sprayed with an indicator. The intensities of the acid spots are compared visually with those of standards applied to the same chromatograms. The precision of both methods is low. The faster procedure[6], which takes only 30 minutes, is reported to give a 20% spread in results and a comparison of the slower procedure[5] with the colorimetric method of BARKER and SUMMERSON[7] showed that large deviations could occur.

The application of a rapid gas-liquid chromatographic procedure for the determination of lactic acid has been studied and the results obtained were compared with those obtained by the semicarbazide method[4].

The direct determination of lactic acid is based on the procedure of HOFFMAN *et al.*[8], in which a dilute aqueous solution of lactic acid acidified with periodic acid is injected into a heated injection port preceding the chromatographic column. The injection temperature is sufficient to give rapid evaporation of the water and the resultant high concentration of periodic acid produces the oxidation reaction:

$$CH_3 . CH(OH). COOH + HIO_4 \longrightarrow CH_3CHO + CO_2 + H_2O + HIO_3$$

The product acetaldehyde is swept by the carrier gas on to the column where it is resolved from other volatile materials and determined with a flame ionization detector.

Despite the numerous potential competing reactions when applied to carbohydrate solutions, it was found that the periodic acid oxidation may be applied to dilute molasses solution without pretreatment to produce a discrete peak for the acetaldehyde from the lactic acid even with a column retention time of only 46 seconds. A plot of peak height against lactic acid concentration is linear in the range 0 to 10 μg lactic acid. Calibration curves remain stable throughout the day, but some day-to-day variation in response is found. Solutions free from lactic acid give a small and reasonably reproducible blank. The mean difference between duplicate molasses samples was found to be less than 3%.

The procedure may also be applied to beet process juices diluted to contain 5% sucrose but the direct determination is unsatisfactory with raw juice. By use of a rapid ion exchange clean-up procedure, however, the lactic acid in raw juice may be determined by the G.L.C. procedure. The total time required for the clean-up and G.L.C. determination with raw juice is 100 minutes, whereas a complete determination with molasses and suitable process juices requires 6 minutes.

Materials and reagents

A Pye Panchromatograph fitted with a flame ionization detector is used as the analytical chromatograph. A standard chromatographic column was modified by removing the carrier gas preheating section and replacing with a heated injection port. The injection port was made from a 5 cm × 11 mm o.d. glass tube fitted with a B7 socket to take a stand-

[1] STARK *et al.*: *J. Agric. Food Chem.*, 1953, **1**, 564.
[2] SHORE: *Compt. Rend. X Ass. Comm. Int. Tech. Sucr.*, 1957, 196; *I.S.J.* 1958, **60**, 24.
[3] PREY *et al.*: *Zeitsch. Zuckerind.*, 1959, **84**, 614.
[4] OLDFIELD and SHORE: *I.S.J.*, 1970, **72**, 3–4.
[5] OLSON: *J. Amer. Soc. Sugar Beet Tech.*, 1964, **13**, 59–61.
[6] PREY *et al.*: *Zeitsch. Zuckerind.*, 1964, **89**, 205–206.
[7] *J. Biol. Chem.*, 1941, **138**, 535.
[8] *Anal. Biochem.*, 1964, **9**, 175–179.

ard injection head, from which the needle guide had been removed, and a B7 cone to fit the chromatographic column (Fig. 1). The tube was loosely filled

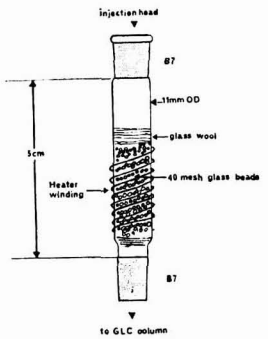

Fig. 1. Injection port

with 40-mesh glass beads. Ten turns of resistance wire were wound around the lower 2 cm of the tube and connected to a variable low voltage source to provide the required operating temperature.

The effect of different injection port temperatures on the detector response for a standard solution containing 50 μg lactic acid is shown in Fig. 2. Although

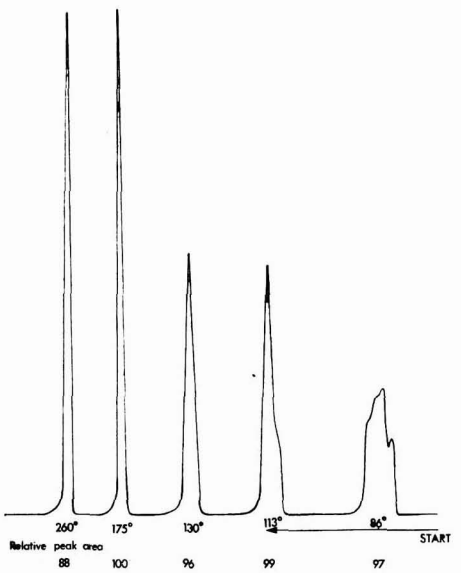

Fig. 2. Effect of injection temperature on acetaldehyde peak, 50 μg lactic acid

the peak areas were not significantly changed, the shape of the peak improved with increasing temperatures to permit calibration in terms of peak height. The value for peak height was at its maximum and virtually constant between 175°C and 260°C and all measurements were therefore made with an injection port temperature of 260°C.

The analytical glass column, 3 ft × 4 mm i.d., is packed with 15% polyethylene glycol 20 M (W. G. Pye Ltd.) on 100/120 mesh "Chromosorb W" H.M.D.S. The column is conditioned by heating to 200°C for 48 hours with a nitrogen flow of 40 ml per minute, cooling to the operating temperature, followed by several injections of 5 μl aliquots of acetaldehyde.

The column is operated at 75°C with a dry oxygen-free nitrogen flow of 40 ml per minute and uses a flame ionization detector. The detector is operated at 350V with a hydrogen flow of 30 ml per min, and an air flow of 450 ml per min. The acetaldehyde peaks are recorded at a setting of 300 × 10^{-12} amps full scale deflection.

A standard solution equivalent to 10 mg lactic acid per ml is prepared by dissolving 1·6518 g of zinc lactate trihydrate in the minimum of dilute sulphuric acid and making up to 100 ml with distilled water. Aliquots of this solution added to 1 ml of a solution containing 25% A.R. sucrose and 15% A.R. potassium chloride are diluted to 50 ml to provide a series of standards containing 0·5% sucrose and 0 to 0·2 μg lactic acid per μl. From these standards the linear relationship between lactic acid concentration and peak height is determined.

Procedure

Duplicate 1 ml aliquots of a 1% w/v solution of beet molasses in a 5 ml glass-stoppered flask are acidified with 50μl of periodic acid (50% $HIO_4,2H_2O$). A 4·5 μl portion of each acidified solution is injected into the gas chromatograph and the peak height of acetaldehyde recorded after a retention time of 46 seconds. A standard lactic acid solution is injected between each duplicate molasses solution.

If the instrument has not been in use for some time, it is advisable to make 2 or 3 injections of lactic acid solutions containing 20 μg/μl before commencing the determinations.

Standard curve

Peak heights are expressed as peak currents (amps × 10^{-12}) and a plot of these against lactic acid concentration is linear in the range from 0 to 0·2 μg/μl. The highest concentration gave 58 to 67% of full scale deflection under the experimental conditions but, using increased attenuation, it has been established that the linearity is maintained up to a concentration of 2·0 μg/μl.

The calibration remains constant throughout the day, but some variation in day-to-day response is found. The use of 2-propanol as an internal standard gives no improvement in the stability of this response.

Solutions without lactic acid give peak current values from 8 to 12 × 10^{-12} amps. A peak height equivalent to 200 × 10^{-12} amps is obtained for the 0·2 μg/μl standard.

Peaks other than acetaldehyde

Several peaks are eluted after acetaldehyde and an interval of 6 minutes is required to clear these from the column before injection of the next sample. Similar patterns are obtained both for molasses and for the standard lactic acid solutions containing sucrose and potassium chloride. The peaks obtained for all these solutions are illustrated in Fig. 3.

It will be noted that there is little difference in the response pattern of the peaks other than acetaldehyde.

Experimental results

The above technique applied to duplicate molasses samples gave mean differences no greater than 3%. Recoveries of lactic acid added to molasses solution equivalent to 1% lactic acid on molasses were 97·25% ±1·25%.

A series of molasses solutions was prepared and the lactic acid contents were determined by the semicarbazide method[4] and by the new method using gas-liquid chromatography. The results are reported in Table I.

Table I. Determination of lactic acid in molasses Comparison of semicarbazide and gas-liquid chromatographic methods

	% *lactic acid in molasses*		
Factory Molasses	*Semicarbazide method*	*G.L.C. method 1% molasses*	*G.L.C. method 10% molasses*
Ely	1·54	1·54	1·54
King's Lynn	1·14	1·30	1·26
Brigg	1·17	1·19	1·21
Ipswich	1·49	1·53	1·50
Kidderminster	1·05	1·20	1·16
Cantley	1·81	1·85	1·79
Newark	2·42	2·35	2·42
York	1·84	1·93	1·96
Felsted	2·29	2·09	2·34
Bardney	1·64	1·47	—
Nottingham	1·29	1·38	1·42
Allscott	0·7	0·80	—

Typical chromatograms obtained in the analysis of molasses samples are shown in Fig. 4.

The G.L.C. method using 1% molasses showed good agreement with the semicarbazide method.

The results for the G.L.C. determinations are not systematically higher or lower than those for the semi-

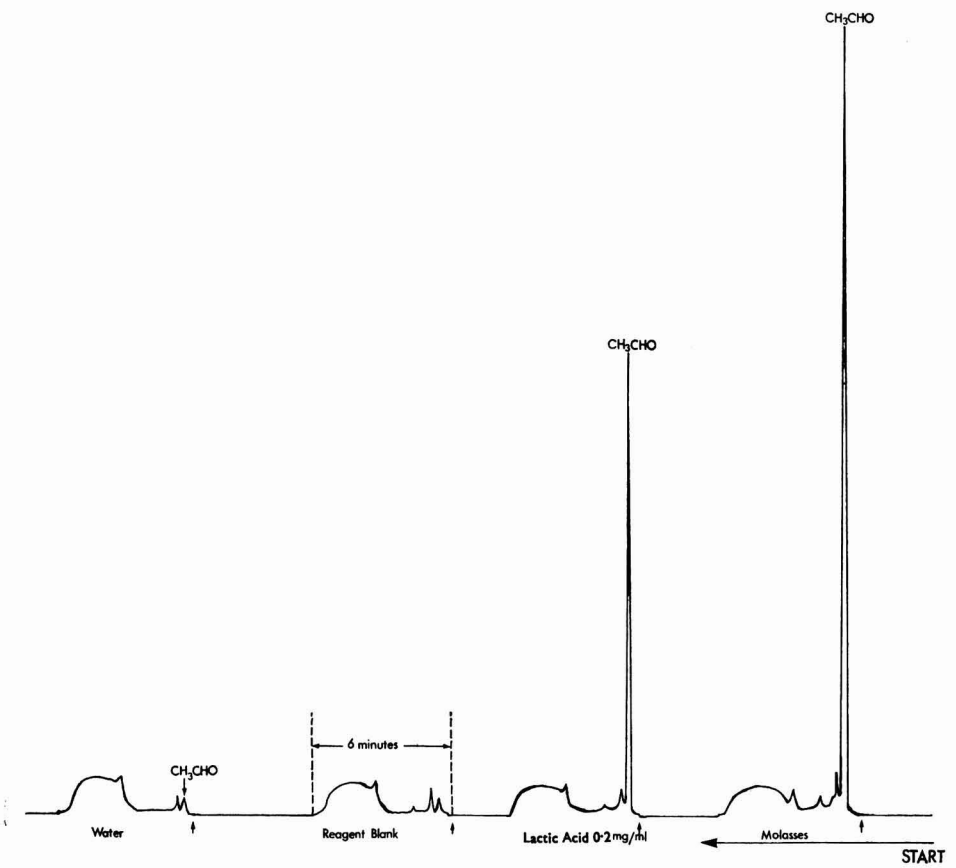

Fig. 3. G.L.C. determination of lactic acid in beet molasses

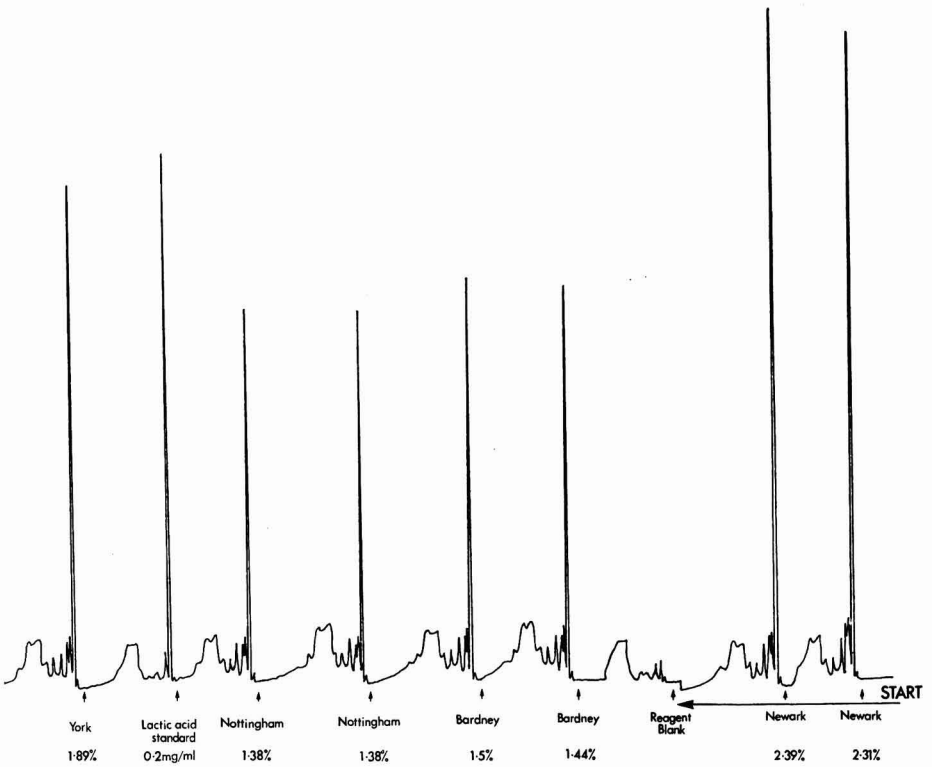

Fig. 4. G.L.C. determination of lactic acid in beet molasses—typical chromatogram

carbazide method, indicating freedom from interferences of the type which could be removed by the ion exchange procedure used in the semicarbazide method.

Limits of detection

The value obtained for the acetaldehyde blank varied from 8 to 12 μg/ml, confirming the value of 8 μg/ml given by HOFFMAN[8]. The molasses samples determined contained 80 to 240 μg lactic acid per ml when diluted to 0·5% sucrose so that variation in the blank value could be neglected.

For process juices diluted to 0·5% sucrose and containing 200 mg lactic acid per 100S the variation in the blank could give an overall error of 40%. Experience has shown that the lactic acid content of some juice samples may be as low as 50 mg/100S; dilution of such juices to 0·5% S for determination would introduce appreciable errors because of the blank variation and so the effects of higher sucrose concentration were examined.

Effect of sucrose concentration

The procedure as used for molasses may be extended for determination of lactic acid in beet process juices. The application of some juices, diluted to give levels of lactic acid similar to those obtained with molasses, would mean having a higher concentration of sucrose in the reaction mixture.

The effect of the higher sucrose concentration was investigated by increasing the molasses concentration to 10%. The increase in response produced by the addition of increasing amounts of periodic acid showed the optimum addition to be 500 μl of periodic acid for a 1 ml aliquot of 10% molasses solution. At this concentration a small amount of potassium periodate was precipitated in the reaction mixture.

An increased response for standard lactic acid was obtained when sucrose was added. Pure sucrose solutions alone gave no more response than blank determinations and the effect may be due to the reduced water concentration or elevation of the boiling point.

The response obtained from standard solutions containing 1 μg of lactic acid per μl in different sucrose concentrations is recorded in Fig. 5. 1 ml of each solution covering the range 0 to 10% sucrose was acidified with 500 μl of periodic acid and 4·5 μl aliquots were applied to the chromatograph.

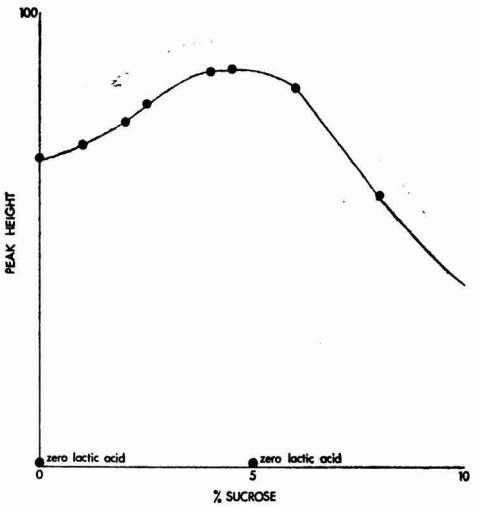

Fig. 5 Variation of response with sucrose concentration; lactic acid 1 mg/ml, 0·5 ml HIO_4 and 1 ml solution.

A steady increase in peak height was recorded up to a sucrose concentration of 4·4%, remaining steady to 5·5% and thereafter falling rapidly as the sucrose concentration increased to 10%. The fall in response at the higher sucrose concentration is probably due to there being insufficient periodate to oxidize both the sucrose and the lactate quantitatively.

To ensure that the change in response was not related to peak shape the responses for 1 μg lactic acid per μl solutions containing 0 and 4% sucrose were determined. The ratios of the peak heights, peak areas (height × width at half height) and peak weights (weight of cut out recorder trace) are recorded in Table II.

Table II. Ratio of lactic acid response 0% sucrose:4% sucrose

Measurement	*Ratio*
Peak height	1 : 1·32
Peak area	1 : 1·29
Peak weight	1 : 1·30

The ratios, which are constant for the different methods of assessment, show that an increased yield of acetaldehyde was obtained with the addition of sucrose but there was no change in peak shape.

The direct injection procedure can be applied to beet process juices and lower purity products diluted to contain 5% sucrose. 4·5 μl aliquots of a mixture containing either 1 ml of 10% molasses or an evaporator thick juice diluted to 5% sucrose + 500 μl of periodic acid were applied to the G.L.C. column with standards containing 5% sucrose.

The mean difference between the results obtained with 10% and 1% molasses solutions and reported in Table I is no greater than 3% while a comparison of the results obtained for thick juice samples diluted to 5% sucrose with the ion exchange/colorimetric procedure[4], reported in Table III, shows a mean difference of less than 4%.

Table III. Determination of lactic acid in beet process juices; comparison of semicarbazide and gas liquid chromatographic methods

	mg lactic acid per 100S	
Factory	*Semicarbazide method*	*G.L.C. method*
York	570	570
Cantley	360	374
Kidderminster	435	410
Felsted	480	450
King's Lynn	650	624

Contamination of the chromatographic column

It was found that there was a loss in response after about 4 hours' running time when injecting the 10% molasses solutions. The loss in response was not due to the water in the mixture nor to the build-up of residues on the glass beads in the injection port.

No short term solution could be found but heating the column overnight at 125°C with the normal nitrogen flow returned it to a usable condition. For routine determinations with molasses, dilution to 0·5% sucrose is to be preferred to avoid this contamination.

To obtain an adequate lactic acid response, dilution to this sugar content may be unpractical with thick and thin juices but with these high purity juices dilution to 5% sucrose is acceptable, as no fall-off in response was obtained during 6 hours of continuous analysis.

Determination of lactic acid in raw juice

Owing to the rather different make-up of the impurities in raw juice the direct estimation of lactic acid was unsatisfactory. At the 5% sucrose level a consistent response was unobtainable and at the 0·5% sucrose level the response for low lactic acid concentrations was of the same order as the variation in the blank.

It was found however that the ion exchange procedure described in Part I[4] could be carried out in about 90 minutes if the wash was decreased to 50 ml followed by elution of the acids from the column with 0·1M sodium chloride solution to give 100 ml of eluate. The eluate, which represented a 2× dilution of the raw juice, was acidified with periodic acid, using 50 μl per ml of eluate, and 4·5 μl aliquots were applied to the G.L.C. column in comparison with standards containing 0·1M sodium chloride but without sucrose.

Using this method an estimate of lactic acid in raw juice, of relatively high precision, could be obtained within about 1 hour 40 minutes. A series of raw juices were analysed for lactic acid by the above method and by the semicarbazide method[4]; the results are reported in Table IV.

Table IV. Determination of lactic acid in raw juice: comparison of semicarbazide and gas-liquid chromatographic methods

	lactic acid, mg/litre	
Sample	*Semicarbazide method*	*G.L.C. method*
1	117	110
2	217	220
3	4*	0
4	105	100

* Juice produced in the laboratory micro-diffuser: the recorded value is equal to the uncertainty in the semicarbazide procedure.

The results for the G.L.C. determinations show good agreement with the semicarbazide method. This procedure can also be applied to other beet process juices containing very low levels of lactic acid.

Interfering compounds

Acetaldehyde or any compound which would produce acetaldehyde under the experimental conditions would give interference in the determination of lactic acid. Several interfering compounds are listed by HOFFMAN[8] but of these only malic acid is present in molasses. Malic acid has 1/40 the response of lactic acid and the low level in molasses would give negligible interference. The highest concentration of malic acid occurs in raw juices but the content is unlikely to give an error greater than 5 mg lactic acid per litre. The results in Table IV do not in fact show a systematic error of this type.

No interfering peaks were obtained on running formaldehyde which gave a wide poorly-resolved peak after a retention of 2·5 min. The same peaks were obtained after formaldehyde was injected directly on to the analytical column.

SUMMARY

The measurement of lactic acid in molasses and beet process juices has hitherto been made using either fast chromatographic methods with low precision or slow ion exchange/colorimetric methods with relatively high precision.

A fast G.L.C. procedure for the direct estimation of lactic acid in molasses and process juices is described and the high precision is illustrated by comparison of the results with those obtained by an ion exchange/colorimetric procedure.

A combination of an ion exchange separation followed by the G.L.C. procedure for the determination of lactic acid in raw juice is described. The results are again compared with those obtained by an ion exchange/colorimetric procedure.

ACKNOWLEDGEMENTS

The authors wish to thank Mr. B. TWITE for the determinations of lactic acid using the semicarbazide method.

DDS cane diffusion in Brazil

By J. B. KARLSSON (A/S De danske Sukkerfabrikker, Copenhagen, Denmark)

IN March 1969 the DDS cane diffuser at Usina São Francisco Açúcar e Alcool S.A., Rio Grande do Norte, Brazil (Fig. 1), completed its first full-length season.

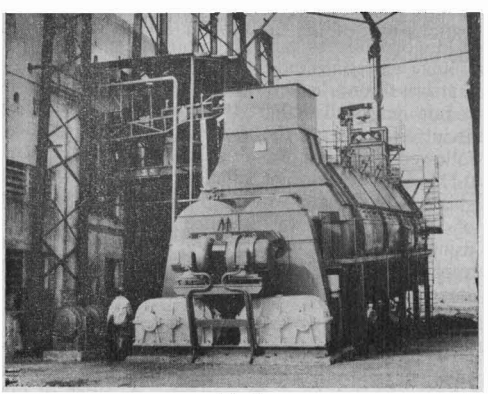

Fig. 1

As published previously[1], the diffuser was erected during the 1967/68 season and inaugurated in early 1968, only about two weeks before the end of the season. The installation was arranged so that the factory could change over within minutes from straight milling to milling-diffusion.

The extraction results during the above-mentioned two weeks were satisfactory, but as the mill rollers were set and grooved for straight milling, certain minor difficulties were, as expected, encountered at the mills, especially regarding the feeding of the first dewatering mill. Moreover, many and long factory stops due to shortage in the cane supply during the last two weeks of the season reduced the actual working time of the diffuser considerably.

By contrast, in the 1968/69 season the diffuser was in continuous operation and average operational results for the whole season are available.

Description of the diffuser

The working principle of the DDS cane diffuser has been described on many previous occasions but, to summarize, the fundamental design is as follows: The diffuser itself consists of a sloping vessel which fits around two intermeshing screw conveyors (Fig. 2).

[1] *I.S.J.*, 1968, **70**, 350.

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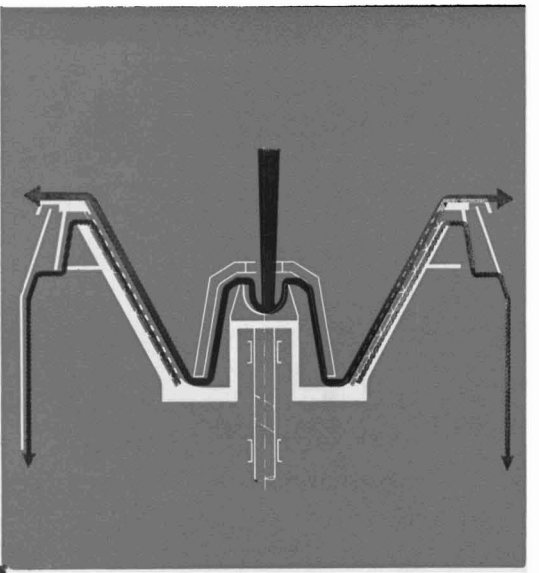

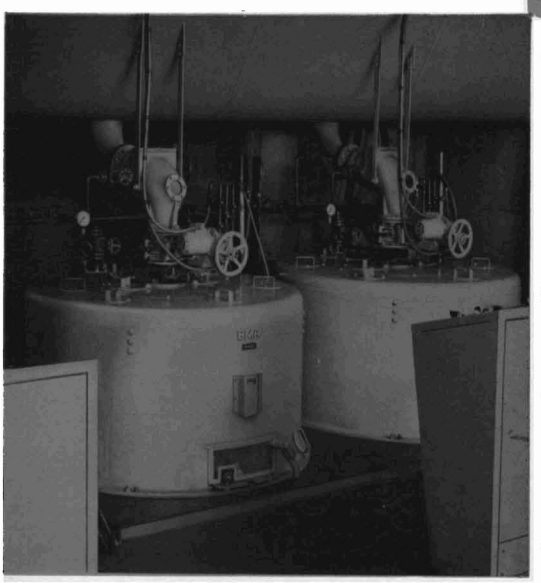

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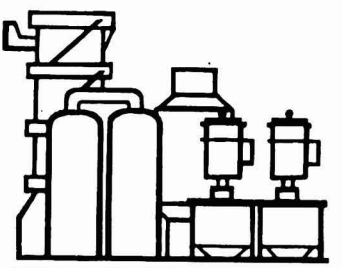

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Planning and construction of complete beet and cane sugar factories as well as of chemical plants, among others for the production of alcohol, yeast, acetaldehyde, glacial acetic acid, acetone, glutamat, starch, glucose, etc.

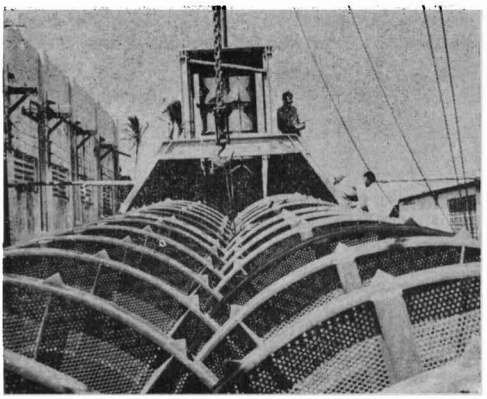

Fig. 2

The screw conveyors, rotating in opposite directions, carry the prepared cane upwards through the sloping vessel in counter-current to the juice which flows downwards through the bagasse by gravity, thus eliminating the need of recirculating pumps. At the highest end of the diffuser the spent bagasse is discharged onto a rubber belt conveyor by means of two vertical screws. The enriched juice leaves the vessel through a screen at the lowest end of the diffuser. The vessel is provided with steam jackets for heating of the mixture of bagasse and juice to the desired temperature. The capacity within the range for which the diffuser has been designed is determined by the rotational speed of the screws, the throughput being approximately proportional to the speed. A higher speed consequently means a shorter retention time of the material in the diffuser. However, as the bagasse is not only conveyed forwards but also rotated by the screws, the bagasse is subjected to a light squeezing every time it is taken through the narrow space between the two screw shafts. After having passed the space between the shafts, the bagasse is again immersed and soaked with the less concentrated juice a little further upwards in the diffuser, whereupon the squeezing is repeated. The number of squeezing actions increases with increasing speed of the screws owing to a certain decrease of their specific conveying efficiency. In this way the extraction is, within rather wide limits, independent of the acual throughput and of the retention time.

In order to prevent the dissolution of impurities from the cane fibre, such as pectins, gums, and the like, the extraction is carried out without lime addition and at the natural pH of the cane juice. Under these conditions the use of stainless steel is necessary. All parts of the diffuser which come into contact with the juice are therefore executed in or clad with stainless steel.

Installation

Usina São Francisco is equipped with four 23 in × 44 in 3-roller mills. The whole tandem is driven by one single Corliss engine of 550 h.p. The mill roller speed is about 35 ft per minute.

The cane is prepared by means of two sets of revolving knives, both of the standard type and both having 26 knives at 1⅝ in. pitch. The first set runs at a speed of 600 r.p.m. and is driven by a 75 h.p. electric motor. The clearance between the carrier slats and the extremity of the knives is about 4 inches. The second set, which runs at a speed of 800 r.p.m., is driven by a 125 h.p. electric motor and has a clearance between the carrier slats and the knives of about 1 inch. Both knife sets rotate in the direction of cane travel.

The actual factory capacity is around 1000 tons of cane per day, but future expansion is planned. In view of this, a type II diffuser with a capacity range of 1000–2000 tons of cane per 24 hours was selected to meet the future requirements.

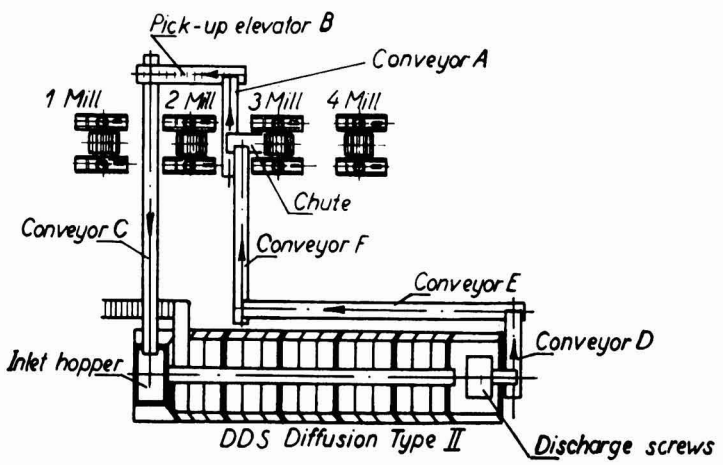

Fig. 3

The diffuser was installed beside the existing mill train, using the first and second mills for pre-extraction and the third and fourth mills for dewatering (Fig. 3). The bagasse from the second mill is conveyed to the diffuser by belt conveyor A, elevator B, and belt conveyor C. Conveyor C is provided with a continuous belt weigher with rate recorder and integrator recording the amount of bagasse going to the diffuser. The imbibition rate is automatically controlled by the belt weigher according to the desired and set ratio between the amount of bagasse feed and water. The ratio can be set at different values within wide

Table I. Average monthly results, crushing season 1968/69 at Usina São Francisco Açúcar e Alcool S.A., Brazil

	Cane			*Final Bagasse*			*Extraction*	*Mixed Juice*	*Imbibition*
Month	*Worked metric tons/24hr*	*pol %*	*fibre %*	*pol %*	*moisture %*	*fibre %*	*reduced % cane pol*	*weight % cane*	*% fibre in cane*
October	880	12·6	14·8	1·44	44·5	53·4	97·6	95·8	159
November	932	12·0	14·9	1·38	45·9	52·1	97·4	93·4	145
December	950	12·1	14·9	1·33	48·4	49·5	97·3	92·4	151
January	989	11·8	15·0	1·37	50·1	47·9	97·1	91·9	155
February	975	11·2	15·2	1·39	50·9	47·0	97·0	91·1	154
March	981	10·6	15·2	1·41	51·2	46·5	96·7	92·0	163

limits to meet varying conditions and possible changes in the cane quality.

The belt conveyors D, E, and F take the exhausted bagasse from the diffuser to the third and fourth mills for dewatering. The unscreened and untreated liquid from the dewatering mills is pumped by two chokeless pumps to an overhead gutter by which the mixture of juice and cush-cush flows by gravity to the low Brix end of the diffuser.

The diffuser juice is pumped to the juice tray at the first and second mills, where it mixes with the primary juice. The rate of flow of the diffuser juice is determined by the automatically controlled juice level in the diffuser.

Steam is supplied to the diffuser at a pressure of 5–6 p.s.i., and the temperature along the diffuser is maintained at 65–70°C.

Hot imbibition water (about 70°C) is applied and added partly to the diffuser and partly to the bagasse mat before the last dewatering mill. The imbibition water system is laid out in such a way that whether the water is added solely to the last mill or to the diffuser or divided between both, the total amount of water remains the same and is dependent only on the feed of 2nd mill bagasse to the diffuser.

Diffuser performance

Fig. 4 shows the bagasse and juice flow for mills and diffuser.

The primary juice extraction by the first and second mills averaged 66% on cane, corresponding to an extraction of about 77% pol on cane. As the total pol extraction averaged about 97%, the balance of 20% pol was extracted by the diffuser and the dewatering mills. That this extraction was achieved without much difficulty can be seen from the small amounts of mixed juice and imbibition water totalling only 93 and 23% on cane, respectively.

In Table I are presented the average monthly results during the season.

There was a slight increase in the crushing rate of 2–3% compared with the 1967/68 season. Further increase was not possible as the limit was set by the capacity of the boiling house. The pol in final bagasse and the low imbibition rate show the good performance of the diffuser and the pre-extraction mills. An interesting—or one may say disappointing—thing to note is the steadily increasing moisture content of the final bagasse from 44·5% in October to 51·2% in March, and the consequently slightly decreasing extraction. This extraordinary increase of the moisture content was a result of faulty casting of the roller pinions of the last dewatering mill. After only two months crushing the pinions were worn to such an extent that they had to be replaced. However, only spare pinions of the same poor quality were available, so in order to be able to complete the season without serious breakdowns, the pressure on the top roller of the last mill was gradually reduced to far below normal.

As has been the case with all other factories with DDS cane diffusers in operation, it was once more proved that the introduction of the diffuser did not prevent a reduction of the final molasses purity. The molasses purity went down from 42·8 in 1967/78 to 39·3 in 1968/69.

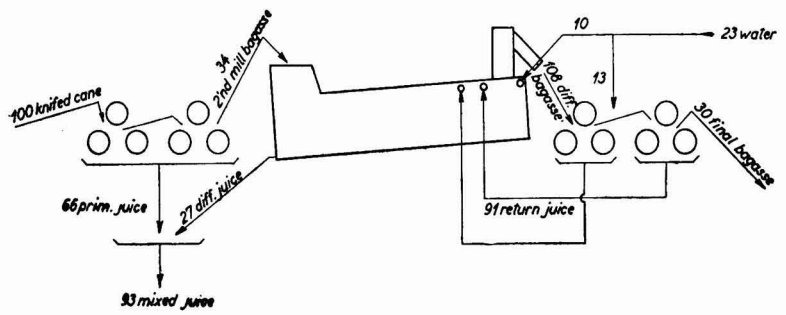

Fig. 4

Apart from the above-mentioned problem with the last dewatering mill, no serious difficulties were encountered during the season. As the mill train is driven by one single engine, some difficulties were expected in regard to feeding of the first dewatering mill, since it is not possible to regulate the speed of the mills

individually. However, with proper setting of the dewatering mills to suit the diffuser bagasse and regular feeding of the pre-extraction mills, these problems failed to appear.

General

Assembly of the diffuser was carried out in about two and a half months utilizing erection tools and other equipment from the workshops of the factory. All conveyors for handling of the bagasse to and from the diffuser were supplied locally, and with the conveyor supports made beforehand installation of the conveyors was done by the factory staff during a week-end stop.

The intermediate carrier between the second and third mills was removed and the third mill was equipped with a feeding roller and a chute for feeding of the bagasse from the diffuser. Otherwise no essential changes were made to the existing mill train.

Unskilled labour trained during the running-in period of the diffuser attended to the diffuser operation. Only one operator is needed per shift, and with uninterrupted and regular milling the diffuser itself can be left unattended for short periods, giving the operator time for inspection of conveyors, pumps, steam traps, etc.

An increase in the reduced pol extraction from 91·6 to 97·3 was achieved, and it is expected that the factory will be able to increase the capacity of the milling plant by 25 to 30%, as a result of the introduction of the diffuser.

New sugar cane breeding clones from Indian crosses evaluated at Houma, Louisiana, 1966-69

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IN 1963 the Sugarcane Breeding Institute at Coimbatore, India, in co-operation with the U.S.D.A., initiated a 5-year project to cross U.S.A. and Indian interspecific hybrids with clones of the wild species, *Saccharum spontaneum*[1]. The project was supported by U.S. Public Law 480 funds.

The primary purpose of the project was to develop new genetic lines with greater resistance to diseases, pests and cold damage, and with better agronomic quality. Seed from crosses made in India and selected clones have been sent to the United States to determine their local breeding potential. Approximately 40,000 seedlings grown from the seed produced in India have been screened through co-operative research at the Plant Industry Station, Beltsville, Maryland, and the U.S. Sugarcane Field Station, Houma, Louisiana. A brief report of the work done by the U.S. Department of Agriculture is presented in this paper.

Résumé of clones evaluated

During 1965 and 1966 approximately 40,000 seedlings from crosses made in India between interspecific hybrids and *S. spontaneum* clones were screened in the quarantine greenhouse at Beltsville, Maryland, for susceptibility to strains of sugar cane mosaic prevalent in Louisiana. Cuttings of 921 healthy clones from the crosses having the best breeding potential were sent to Houma for evaluation in greenhouse and field trials.

Single-eye pieces of each clone were germinated in an incubator. Ten plants from each clone were established in 3-inch peat pots in the greenhouse. Separate tests were conducted for clones from each series and commercial control varieties were used in each test. When the plants were well-established, they were inoculated by the air-brush method[2] with a mixture of mosaic strains A, B, D and H. Five weeks after inoculation, mosaic reaction of the clones was recorded. Of 675 U.S. 1965 clones in the test, 453 or 67% took from 10–100% mosaic and were discarded; 222 clones did not take mosaic, whereas all of the control varieties became infected (Table I). Of 246 U.S. 1966 clones inoculated, 69·9% took mosaic; 74 did not take mosaic. Again all of the control varieties became infected (Table II).

The clones which did not take mosaic were transplanted from the 3-inch peat pots to 8-inch clay pots and overwintered in the greenhouse. In the spring of 1967, the mosaic-free clones were transplanted to first-line trials in the field at Houma. In the autumn, 57 clones of the U.S. 1965 series (Table I) and 36 of the U.S. 1966 series (Table II) were selected and replanted to second line trials. Selection in plant cane of the second trials was based on erectness, tillering, barrel size, freedom from pith, and resistance to mosaic and borers. Laboratory juice analyses were made from 15-stalk samples. C.P. 48-103 and C.P. 52-68 were used as control varieties in the line trials. As a result of data from second line trials, 26 clones from 9 new breeding lines of the U.S. 1965 series, and 9 from 5 lines of the 1966 series were selected for further evaluation. A final selection will be made in the stubble crop in the autumn of 1969, and the best of the new breeding clones from India P.L. 480 crosses will be sent to Canal Point, Florida, for backcrossing to select commercial breeding canes.

[1] DUNCKELMAN: *Sugar Bull.*, 1965, **44**, 25–29.
[2] DEAN: *Plant Diseases Reporter*, 1960, **44**, 874–876.

Table I. Summary of greenhouse and field data from U.S. 1965 breeding lines from India (Houma, Louisiana, 1966–69)

		Mosaic in greenhouse		*Field selection*	
Breeding line No.	*Parentage*	*Number of clones inoculated*	*% clones infected*	*Number of clones to field*	*Number replanted in Autumn 1967*
U.S. 65–1	C.P. 807 × S.E.S. 2	17	35·3	11	1
U.S. 65–2	C.P. 807 × S.E.S. 84 A	46	65·2	16	0
U.S. 65–4	C.P. 807 × S.E.S. 146	41	17·1	34	5
U.S. 65–5	C.P. 27–108 × S.E.S. 146	43	74·4	11	6
U.S. 65–6	C.P. 27–108 × S.E.S. 147 B	37	89·2	4	3
U.S. 65–8	C.P. 29–320 × S.E.S. 2	46	56·5	20	7
U.S. 65–10	C.P. 29–320 × S.E.S. 103	39	89·7	4	2
U.S. 65–11	C.P. 29–320 × S.E.S. 125 B	46	84·4	7	3
U.S. 65–12	C.P. 29–320 × S.E.S. 146	44	56·8	19	7
U.S. 65–13	C.P. 29–320 × S.E.S. 147 B	49	81·6	9	4
U.S. 65–14	C.P. 29–320 × S.E.S. 158	34	100·0	0	–
U.S. 65–15	C.P. 36–13 × S.E.S. 124	42	21·4	33	6
U.S. 65–16	C.P. 36–13 × S.E.S. 146	46	41·3	27	9
U.S. 65–17	C.P. 48–103 × S.E.S. 158	44	100·0	0	–
U.S. 65–18	U.S. 49–7 × S.E.S. 84 A	57	91·0	5	0
U.S. 65–19	U.S. 49–7 × S.E.S. 517	44	50·0	22	4
Total or average		675	67·0	222	57

Reaction of control varieties to mosaic:

C.P. 47–193 6% C.P. 48–103 13% C.P. 55–30 16% C.P. 52–68 28% N:Co 310 30%

Table II. Summary of greenhouse and field data from U.S. 1966 breeding lines from India (Houma, Louisiana, 1966–69)

		Mosaic in greenhouse		*Field selection*	
Breeding line No.	*Parentage*	*Number of clones inoculated*	*% clones infected*	*Number of clones to field*	*Number replanted in Autumn 1967*
U.S. 66–1	C.P. 33–224 × I.A. 1041	9	77·8	2	1
U.S. 66–2	C.P. 33–224 × I.A. 1100	33	81·8	6	6
U.S. 66–3	C.P. 33–224 × S.E.S. 147 A	38	50·0	19	9
U.S. 66–7	C.P. 48–103 × I.A. 1231	93	80·6	18	9
U.S. 66–11	C.P. 52–68 × I.A. 1436	16	93·7	1	1
U.S. 66–15	I.A. 1399 × C.P. 52–68	9	66·6	3	1
U.S. 66–16	I.A. 1393 × Co 1148	26	61·5	10	5
U.S. 66–17	N:Co 310 × S.H. 147	22	31·8	15	4
Total or Average		246	69·9	74	36

Reaction of control varieties to mosaic:

C.P. 48–103 88% C.P. 52–68 92% C.P. 55–30 92% L. 60–25 100%

Discussion

The 5-year P.L. 480 breeding project in India to cross interspecific hybrids of good breeding potential and *S. spontaneum* clones ended in 1968. Since 1964, the U.S.D.A. has consistently expanded its own basic breeding programme for more rapid and effective use of the new recurrent parents developed in Louisiana and Florida, and also for better utilization of *S. spontaneum* clones evaluated for mosaic resistance and agronomic quality at Houma, Louisiana.

In the early years of sugar cane breeding the U.S. Department of Agriculture depended heavily on other breeding programmes to rehabilitate the Louisiana sugar cane industry. Today, because of progress in breeding, the Louisiana sugar cane industry has very exacting standards for locally adapted varieties that have erectness, early high sucrose, cold tolerance, and borer and disease resistance. The Florida sugar industry also has unique high standards for commercial varieties. In the future, breeding to meet the exacting objectives of the U.S. mainland sugar cane producing areas will require specific parental material.

The long-range beneficial aspects of the basic breeding programme cannot be overemphasized. Effective use of evaluated *S. spontaneum* clones offers a valuable breeding potential to supplement and improve gains being made in conventional breeding programmes in Louisiana and Florida. In the future more inbred resistance to mosaic from locally developed breeding stocks will surely be needed to control the spread of this insidious disease in Louisiana sugar cane fields[3]. Biological resistance to the sugar cane borer will become increasingly important to aid in the control of this pest which causes a loss estimated at more than $6,000,000 annually in the United States[4]. More cold tolerance to improve stubbling vigour, promote rapid cool-weather growth and decrease post-freeze inversion will increase farming efficiency in areas where cold is a problem.

[3] BREAUX and DUNCKELMAN: *Proc. 13th Congr. I.S.S.C.T.*, 1968, 927–932.

[4] CHARPENTIER *et al.*: *Proc. 12th Congr. I.S.S.C.T.*, 1965, 1383–1387.

Sugar cane agriculture

Interrelationships of nitrate and 6-azauracil in the growth, enzymology, and sucrose production of immature sugar cane. A. G. ALEXANDER. *J. Agric.* (Univ. Puerto Rico), 1969, **53**, 1–92.—Control of nitrate supply has proved to be a good tool in the study of sugar synthesis and storage in sugar cane. Nitrate generally increased the activity of invertase, amylase, phosphatase and oxidases; 6-azauracil retarded enzyme action, but was less effective when the NO_3 supply was high. This chemical is believed to be translocated to meristem and immature storage tissues, while leaves remain relatively undamaged and presumably photosynthetically active.

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Flight activity periods of the sugar cane borer, *Diatraea saccharalis*, in Puerto Rico. F. W. FISK and R. P. PÉREZ. *J. Agric.* (Univ. Puerto Rico), 1969, **53**, 93–99.—Studies are reported of investigations on the apparent behavioural differences between the North American and Puerto Rican populations of this borer, particularly on the timing of flight and mating activities. Traps baited with unmated female moths were used. It was concluded that the flight activity of the Puerto Rican population differs from that of the same species in Louisiana.

* * *

Experiments on the damage done by harmful weeds in sugar cane production. G. M. AZZI, J. FERNANDES and D. A. OLIVEIRA. *Brasil Açuc.*, 1968, **72**, 411–417.—A report is given of weed trials at the Araras Experiment Station involving 7 treatments, hand or mechanical weeding being carried out at different times. The variety of sugar cane grown was CB 47.15, which was spring planted for a one year crop. The trials were carried out in accordance with the method proposed by AZZI and FERNANDES[1], using the scale 1–9 for the factors: (a) stage of development of the weeds, (b) density of coverage of weeds and (c) relative height of weeds in relation to cane. The main weeds present were indicated.

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The use of bipyridyls in sugar cane. G. M. CHAMBERS. *Proc. 9th Br. Weed Control Conf.*, 1968, 763–767; through *Weed Abs.*, 1969, **18**, 274.—The uses of "Diquat" and "Paraquat" as herbicides and pre-harvest desiccants in sugar cane and for controlling undesirable flowering in cane are briefly reviewed.

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Pre-emergence weed control in sugar cane—Studies with some substituted urea and uracil herbicides. W. N. L. DAVIES. *Proc. 9th Br. Weed Control Conf.*, 1968, 756–762; through *Weed Abs.*, 1969, **18**, 275. Of the newer substituted ureas tested during 1965 and 1966, some gave good weed control but were toxic to cane even at relatively low rates. "Terbacil" at 0·5 to 1·5 lb/acre and EH 767 gave excellent pre-emergence control but were toxic to plant cane at rates in excess of 1 lb/acre. "Lenacil" caused no apparent injury to plant cane even at 4 lb/acre and was worthy of further evaluation.

* * *

Supression of "arrowing" of sugar cane with bipyridyl desiccants. A. C. ARVIER. *J. Aust. Inst. Agric. Sci.*, 1968, **34**, (3), 178–181; through *Weed Abs.*, 1969, **18**, 275.—Results are given of trials in three locations during 1967. Treatment with "Diquat" at 1·5 and 2 oz/acre and "Paraquat" at 1·5 oz/acre effectively prevented flowering or arrowing if applied in early March but not when applied in February or late March. No significant differences in yield were detected and "Paraquat" showed a tendency to depress both sugar content and stalk weight. Further trials will be with "Diquat" only.

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Biology of the sugar cane stem maggot. M. SHIBUYA and A. TANAKA. *Memoirs of the Faculty of Agriculture* (Kagoshima University), 1969, **7**, (1), 137–147. A new sugar cane pest (named *Althigona shibuyai*), discovered in sugar cane in Japan, is described. An account is given of a study made on its life history and habits during 1966–67.

* * *

Screening sugar cane populations for cold tolerance by artificial freezing. J. E. IRVINE. *Crop Sci.*, 1968, **8**, 637–638; through *Plant Breeding Abs.*, 1969, **39**, (3), 698.—The study showed that artificial freezing can reveal degrees of cold tolerance in the progeny of cold-tolerant parents. Young plants were exposed to a temperature of —3°C for 6 hours after growth in sunlight in a cool greenhouse. The most outstanding variety proved to be CP 57-526.

* * *

Occurrence of forked root-hairs in the genus *Saccharum*. R. NARASIMHAN and B. V. NATARAJAN. *Curr. Sci.*, 1968, **37**, 654; through *Plant Breeding Abs.*, 1969, **39**, (3), 699.—A low frequency of forked root hairs was observed in *Saccharum officinarum*, *S. robustum* and *S. spontaneum* while a high frequency was ob-

[1] *Brasil Acuc.*, 1966, **68**, (5), 42–48.

served in the closely related species *S. barberi* and *S. sinense*. A high frequency was seen in some experimental hybrids. This character may have significance in studying evolution in sugar cane.

* * *

Improved cane handling system at Okeelanta. A. KIRSTEIN and P. A. CARRENO. *Sugar y Azúcar*, 1969, **64**, (3), 46–47.—Improved methods of handling cane to feed the Okeelanta Mill (South Bay, Florida) which grinds 9000 tons of cane a day are described. The mill has no storage space for cane in its own yard. Hauling is done 24 hours a day and 7 days a week throughout the crop season.

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Field observations on the seasonal occurrence of the pink mealy bug, *Saccharicoccus sacchari* Ckl1. with special reference to varietal susceptibility. J. M. SATPATHY and R. K. DAS. *Indian Sugar*, 1969, **18**, 753–755.—This investigation was undertaken to obtain information on the seasonal fluctuation of populations of the pink mealy bug in parts of Orissa. A report is made on the relative susceptibility of many high yielding sugar cane varieties in addition to seasonal fluctuations in the activity of the insect. Cane varieties showing a high degree of resistance are indicated. In general, late maturing varieties were more severely attacked than early maturing ones.

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First record of *Lepidiota mansueta* Burm. A new white grub of beetle damaging sugar cane in Uttar Pradesh. K. M. GUPTA, K. M. RAI and R. DYAL. *Indian Sugar*, 1969, **18**, 757–758, 763.—Observations on the life history and habits of this insect, known to attack sugar cane, are given. Grubs remain in the soil for about 20 months and cause heavy damage to sugar cane roots and underground portions of the stem. The total life cycle is completed in 2 years. Likely control measures are given ("Telodrin" and BHC).

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Better germination of sugar cane and high yield. P. S. TOMER. *Indian Sugar*, 1969, **18**, 765–766, 772.—The various factors likely to affect the germination of sugar cane setts are discussed and recommendations made to the grower to achieve good germination. Under the dry conditions prevailing soaking setts in water for 4 hours is a standard recommendation. Lime treatment is also recommended. Setts are soaked in a saturated lime solution for at least 8 hours to soften the dry scales on the bud, to improve germination and yield.

* * *

Insect pests of sugar cane in Ceylon. Z. A. SIDDIQUI. *Indian Sugar*, 1969, **18**, 767–770.—A short general account is given of the small sugar industry in Ceylon, with only two factories, each with about 2000 ha of cane. Sugar cane insect pests found on the island, during a year's sojourn by the author, are enumerated and discussed. The overall level of insect damage to the cane was not considered to be high. Greater damage is done to cane by wild elephants and wild pigs than by all the insect pests put together. Local difficulties in exercising control over these animals are discussed.

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Effect of planting time and planting density on the yield of plant and ratoon crop of autumn-planted sugar cane. R. S. CHEN and C. C. TSE. *Taiwan Sugar*, 1969, **14**, (1), 20–23, 19.—Results of experiments carried out at the Machia Sugarcane Improvement Station during 1962–65 are reported. It was found that the earlier the planting time the higher was the yield of plant cane; mid-July planting gave highest yields. A row spacing of 1·25 m proved superior to one of 1·37 m. A planting rate of 20,000 double-node cuttings per hectare gave the highest yield in both plant and ratoon crops.

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Limiting factors to production in sugar cane areas. D. ONTIVEROS H. *Bol. Azuc. Mex.*, 1968, (228), 2–7. It is pointed out that in Mexico sugar cane is cultivated under a wide range of climatic and edaphic conditions. Some of the common causes of reduced yields with the crop in that country are discussed. These include cultivation on shallow soils, soils with an accumulation of alkali or alkaline salts, cultivation in areas subject to flooding, competition from excessive weed growth and damage due to pests.

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The use of herbicides with sugar cane. A. VELAZCO P. *Bol. Azuc. Mex.*, 1968, (228), 9–14.—Today it is more than ever necessary to consider all possible means of reducing costs in the production of sugar cane and sugar. One of the most important of these is the more extensive use of herbicides because of the ever-mounting cost of hand weeding. The different kinds of chemical weedkiller now available to the cane grower are described and their use explained.

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Leaf scald in Q 63. C. G. STORY. *Cane Growers' Quarterly Bull.*, 1969, **32**, 118–119.—The dangerous nature of this bacterial disease is emphasized and the results given of a roguing campaign carried out for the first time in the central area of Queensland in 1968. Some 5000 stools were dug out, treated with "Dieseline" and burnt. Unfortunately with the variety Q 63 symptoms can remain dormant for long periods before suddenly erupting. The disease is spread by the planting of diseased cane setts and the use of contaminated cane knives or cane harvesters.

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Non-arrowing N:Co 310? J. E. BARNES. *Cane Growers' Quarterly Bull.*, 1969, **32**, 123.—The famous sugar cane variety N:Co 310, now the leading commercial variety in Queensland, has good agricultural characteristics, high yield and good sugar content but its most detracting character is its very free arrowing. A recent experiment to test the effects on flowering of irradiation with gamma rays is referred to. It will be some time before results are known.

A machine for easier weighing of cane in experimental trials. I. T. FRESHWATER. *Cane Growers' Quarterly Bull.*, 1969, **32**, 143–144.—This consists of a boom with spring balance attached, the boom being operated by tractor hydraulics. A specially designed grab lifts the bundles of cane for weighing.

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Notes on the control of some soil-inhabiting cane pests in the Mackay district. S. GREENAWAY. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 49–54. The advent of certain modern insecticides, such as "Dieldrin", "Aldrin", "Heptachlor", etc. has revolutionized control of the soil-inhabiting cane pests of Queensland of which there are several, e.g. soldier fly, frenchi and greyback grubs, wireworms, etc. Some details are given on what are now regarded as the best methods of controlling these pests.

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Head width in grubs of *Lepidiota frenchi* Blackb. G. WILSON. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 55–56.—Head widths of frenchi grubs (*Lepidiota frenchi* Blackb.) from three different localities averaged 6·97, 7·36 and 7·61 mm. The earlier entomologists recorded head widths of 6 or 6·5 mm only. It is suggested that they may have had grubs reared under artificial conditions which hindered their development, or collected from heavy field infestations in which restrictive factors were present.

* * *

Notes on the large moth borer (*Bathytricha truncata*). A. MACQUEEN. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 57–65.—As a result of extensive study, information on the biology and habits of this comparatively little known sugar cane pest is given. The pest was noticed to be bad in areas where soil insecticides had been applied to control other pests such as the soldier fly. It is believed that natural predators of this moth borer, which would include ants, may be destroyed by the soil insecticides.

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Damage in young cane by the black beetle (*Heteronychus arator*). C. L. TOOHEY. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 67–71.—This insect was accidentally introduced from South Africa to New South Wales and may damage sugar cane, cereal and garden crops. It is one of the insects that impair sugar cane germination. Its biology and habits are described, as are some field trials for its control. These showed that "Dieldrin" and "Heptachlor" (at 0·75 lb/acre or more) gave good control.

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Red rot in North Queensland. B. T. EGAN. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 73–75.—In North Queensland the 1968 season was the worst for red rot for many years. The strain of the disease responsible is considered to be the same as that responsible for earlier attacks. Emphasis is placed on the testing of promising northern seedlings for red rot resistance. What is needed is a variety similar to Q 83 but carrying greater resistance to red rot disease.

An economic evaluation of pre-emergent weed control at Mackay. L. S. CHAPMAN. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 131–142.—It is pointed out that cane farmers in Queensland still rely largely on mechanical methods of weed control. Results of various trials with pre-emergent herbicides are given. It is considered that a herbicide for pre-emergent application which would give satisfactory results under all the varying conditions encountered in Mackay could enhance the chances of adoption by farmers. The physical requirements of the various herbicides tested to date are too exacting to meet with the farmers' requirements and the variable weather pattern which prevails at Mackay to allow full scale acceptance. The prohibitive price of herbicides to the farmer is a curb to their more extended use.

* * *

Further studies of chemical control of arrowing. A. C. ARVIER. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 143–145.—It is pointed out that very little work has been done on this subject in Queensland and that it is mainly in southern districts with the variety N:Co 310 that the arrowing problem is acute. Details are given of two small trials established in early March 1968 in the Moreton district. With "Diquat", rates greater than 1½ oz of ion per acre are liable to have an adverse effect on growth and subsequent yield. Further trials are proposed with applications at less than 1½ oz of ion per acre.

* * *

Aerial rat baiting of the 1968 Macknade crop. R. BARRINGHAM. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 147–149.—Details are given of how a whole cane district, involving many growers, was successfully rat-baited by air, at a very low cost. A high percentage of growers joined the scheme. The bait consisted of thallium sulphate-treated wheat (1:300), machine packeted in heat-sealed "Glassine" paper sachets each containing 3·5 g poisoned bait. Raw linseed oil was used as an attractant.

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The economic significance of the Tully cane transport schedule. R. P. VICKERS and L. P. SCHAFER. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 219–223.—In the Tully area, increase in chopper harvested cane has been combined with a comprehensive programme of cane deterioration control. Night harvesting, so widely practised in the United States, is a new proposition and is considered to have a future. Its advantages and disadvantages are discussed.

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An experiment in containerization of cane. L. F. J. PRINCE. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 377–380.—During the 1968 season about 10,000 tons of cane were cut on one cane farm by chopper harvester with side delivery to a 10-ton bin (20 × 8 × 6 ft) drawn on a trailer by a heavy tractor, transfer being made later to a mill road transport

trailer. It is expected that in the 1969 season 100,000 tons of cane will be handled in this way, in "Canetainers". Details are given of this method of handling cane[1].

* * *

Biological control of stalk moth-borers in the Old World. I. V. P. RAO. *Indian Sugar*, 1969, **18**, 813–823.—A review is given of what has taken place so far in this field. Discussion then relates to: use of *Trichogramma* spp.; trial of other hymenopterous parasites; trial of dipterous parasites; predators; insect pathogens; nematodes; conclusions and future work. A plea is put forward for intensive surveys in other, mainly Asian, countries in a search for other insects likely to control cane borers.

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Studies on water relations of sugar cane. Performance of some improved canes under different levels of irrigation and their relative ability in enduring the stress of drought conditions. U. S. SINGH and V. S. NEGI. *Indian Sugar*, 1969, **18**, 825–832.—In view of the great importance of varietal selection in relation to drought endurance in northern India experimental work in this field was started two years ago. Results are here reported. Water supply was by means of controlled irrigation. Varieties showing minimum and maximum response to water stress are listed.

* * *

Field drainage for sugar cane. I. ANON. *S. African Sugar J.*, 1969, **53**, 244–247.—This is the first of three articles on the subject of field drainage with sugar cane. To decide whether drainage is necessary the soil profile should be examined. For this an auger may be used. Orange-yellow or blue-grey patches in the soil should be looked for, as these are a sign of seasonal fluctuations in the height of the water table. Where rainfall is adequate and the water table stable, drainage is necessary only if rooting depth is substantially less than 5 feet.

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Summary of agricultural data: sugar cane crop 1966-67. J. L. DU TOIT and M. G. MURDOCH. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 109–115. The summary is based on a survey conducted by the Sugar Industry Central Board early in 1967. A map shows the location of the various cane growing districts. Statistics are presented, largely in tabular form. The average yield of cane for the season was 21·9 tons per acre of cane land under cultivation, compared with 15 tons for the 1957 season, 10 years before, a 46% increase. The changing cane variety position is discussed, the decline of N:Co 310 and the steady increase of N:Co 376 being stressed, the latter now representing 47% of the total plant cane area.

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Anatomical differences in the stem epidermal structure of sugar cane varieties grown in South Africa. G. ROTH. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 116–122.—The research work here reported is based on that of WIELER and ARTSCHWAGER and deals with the anatomical structure of the stem epidermis in sugar cane. A number of South African varieties of cane were studied. Photomicrographs showing the cell structure after staining with Sudan 111 and with chlor-zinc iodine are included. Differences in structural pattern, which could be correlated with different varieties, were found. There were variations in length and width of the long cell, cork cells and silica cells.

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Further results from the Mount Edgecombe root laboratory. J. GLOVER. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 123–132.—Studies have included effects of irrigation and spacing with different sugar cane soils and the effects of deep level soil disturbance. Disturbance of the soil below the usual level of ploughing has led to some outstanding results, i.e. better root growth with consequent better top growth and higher yields. This points to the benefit that might result from sub-soiling before planting in the case of some soils.

* * *

The behaviour of the root system of sugar cane at and after harvest. J. GLOVER. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 133–135.—The growth of sugar cane roots in different soils was observed and measured behind the windows of the Mount Edgecombe root laboratory. This was done at and after harvest of the plant crop of two cane varieties. Conclusions reached were that the old roots, which normally die within 8 weeks, can be of great use to the ratoon crop in the supply of moisture and nutrients from some depth in the soil when conditions are too dry for the development of new roots by the ratoon crop. Within 3 days of harvest the active growth of existing roots ceased. The ratoon crop appears to derive some benefit from the persistence of the old root system, especially if it has penetrated some distance into the soil. The old roots seem to be relatively unimportant when new roots are free to develop rapidly in a moist soil.

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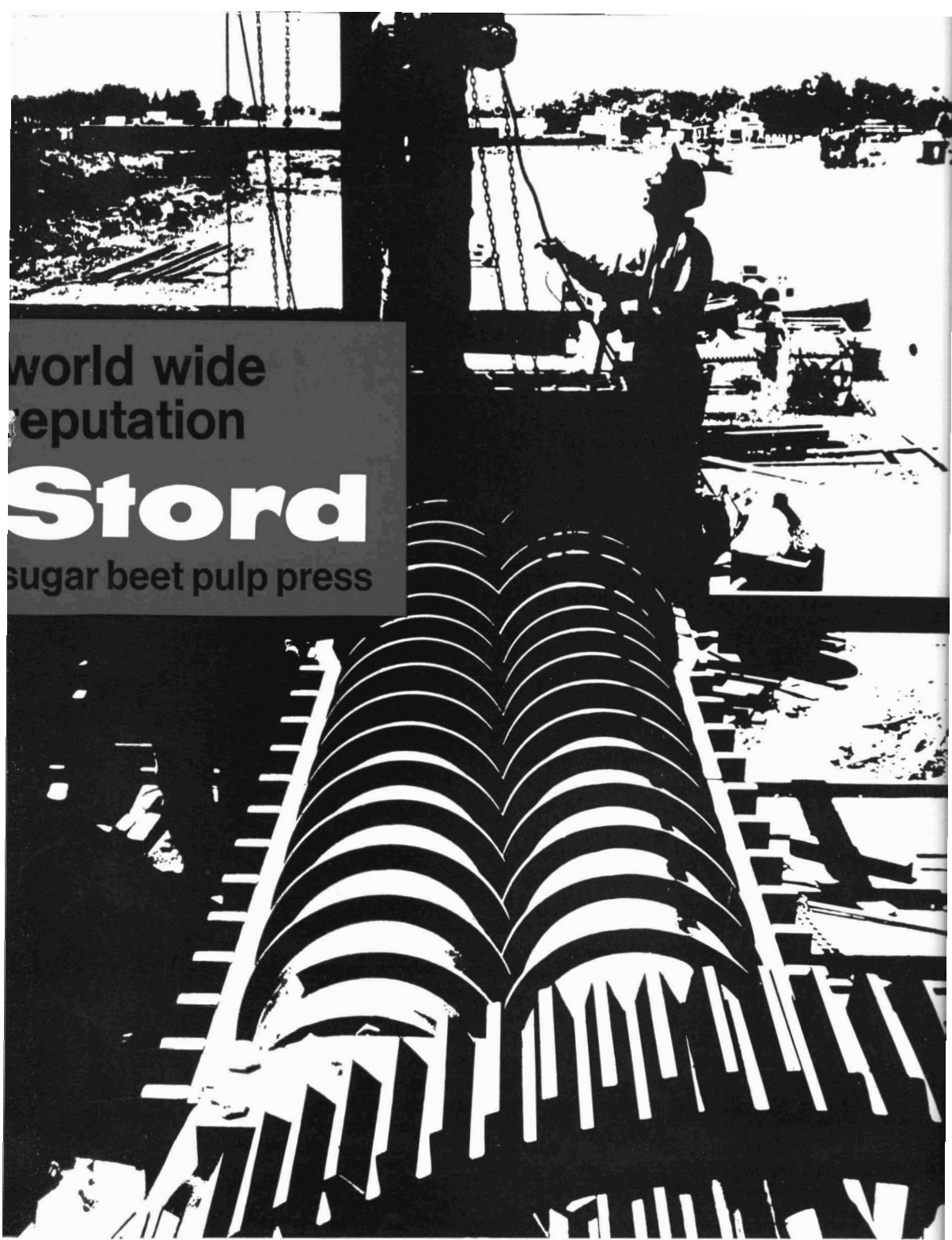
Plant crop results of a row spacing experiment at Pongola. J. P. BOYCE. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 136–142.—The trials reported were carried out under heavily irrigated conditions with normal fertilizer application (50 lb N and 83 lb P per acre). Row spacing varied from 2 ft 11 in to 7 ft 2 in. It was found that a closer row spacing than the conventional 5 ft 3 in would give higher yields (more and thinner stalks) assuming adequate soil moisture to be present. However, the increase was too small to encourage farmers to change from an established spacing for which their equipment and management are designed. Furthermore, narrower row spacing would mean more seed cane needed and a greater length of row per acre to be hand-weeded.

[1] *See also I.S.J.*, 1969, **71**, 18.



Stord Bartz Industri a·s

The plant crop results of two irrigation experiments at Pongola. G. D. THOMPSON and J. P. BOYCE. *Proc. 42nd Congr. S. African Sugar Tech., Assoc.* 1968, 143–153.—The application of two inches of effective water every 19 days on the deep Makatini series soil at Pongola (a sandy clay) was found to be sufficient in a year of well-distributed rainfall (25 in per annum) to produce potential yields. The production of approximately one ton of cane per inch of effective water at Pongola is similar to the productivity obtained in experiments in Natal and in Hawaii. Sugar cane exploits soil moisture to a depth of 8 feet on the deep soil in question. Drying off of the sugar cane crop before harvest was found to be warranted in terms of increased sugar production under the conditions of the experiment.

* * *

A note on the biological control of a stem rot pathogen affecting sugar cane. G. ROTH. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 154–156.—Reference is made to a troublesome stem rot disease (an unnamed fungus) at the higher altitudes of cane cultivation in Natal that was first noticed in 1964. It has now been found that it may be controlled by another fungus (*Trichoderma lignorum*). Details are given of this stem rot fungus and its parasite and the results of laboratory studies. It is thought that the discovery of this hyperparasite could have a bearing on the control of the stem rot disease.

* * *

The influence of root C/N ratio on nitrogen availability in soils. R. A. WOOD. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 157–161.—Nitrogen immobilization and mineralization were measured in three soils to which sugar cane root material of two different C/N ratios (approximately 50 and 100) had been added at two rates (0·5% and 1·0%). Tagged ammonium sulphate solution was added and treatments incubated. Results are shown in tables and indicate that C/N ratios within the rhizosphere (or cane root-stock) may strongly influence nitrogen nutrition, especially where an extensive root system exists.

* * *

Nitrogen in sugar cane and the fecundity of *Numicia viridis* Muir. R. H. G. HARRIS. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 163–166.—Having in mind work in Jamaica where it was shown that increased nitrogen status of sugar cane leaves resulted in increased fecundity of the West Indian cane fly, it was decided to test the reaction of the South African cane pest, *Numicia*, to increased nitrogen by means of laboratory and insectary investigations. These are described. Results showed that the fecundity of *Numicia* increased with increasing rates of nitrogen application to the sugar cane plant. How this could explain the distribution of the pest in South Africa is indicated.

* * *

Smut incidence survey in the Rhodesian lowveld. G. L. JAMES. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 172–179.—In the Rhodesian lowveld smut is the main disease problem in cane growing. This caused the Rhodesia Sugar Association Experiment Station to initiate a survey of the disease. The results of the survey are given and discussed. Susceptibility varies greatly with variety and location. Varieties more or less immune in Natal have proved susceptible under the different environmental conditions prevailing in Rhodesia.

* * *

Average of three tons of cane per acre per month at Hillcrest (Natal). K. DYMOND. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 180–182.—The writer is a cane grower and describes the conditions on his farm previously under black wattle, gum trees (*Eucalyptus*) or virgin veld. Some portions were too steep to plough except with mules. The higher-than-average yields are attributed to early weed control, which is very strongly emphasized.

* * *

Farm planning as the basis for peak productivity. C. H. O. PEARSON. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 183–185.—Efficiency in sugar cane production is dependent upon a number of different factors, such as fertilizer use, irrigation, harvesting, pest and weed control. Great emphasis is placed on weed control, i.e. attacking weeds at the right time and in the right way. With rain-grown cane, as in Natal, conservation of water is of primary importance and is the basic requirement for farm planning. In the replanning of farms the Experiment Station can provide valuable assistance.

* * *

Notes on the design of a herbicide boom sprayer. E. C. GILFILLAN. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 186–188.—A 3-section collapsible boom, 26 feet wide, along with two 100-gal glass fibre tanks, is fitted to a tractor with wheels spaced apart at the maximum. The set-up is described in detail and illustrated. At Tongaat it has proved very satisfactory, being supplementary to aerial and knap-sack spraying. It is considered to be capable of spraying about 80 acres per 8-hour day.

* * *

Some notes on drainage design procedure. E. D. COLES. *Proc. 42nd Congr. S. African Sugar Tech. Assoc.*, 1968, 189–199.—The writer points out that irrigation schemes or schedules are often carried out with sugar cane without any regard as to whether efficient drainage exists or not. This highly technical article deals mainly with the use of design formulae for planning sub-surface drainage.

* * *

Studies on the host-parasite relationship in the pineapple disease of sugar cane. H. W. BOYD and C. C. ALLISON. *Phytopathology*, 1968, **58**, 839–842.—A wide range of observations and inoculation experiments are recorded with this fungus disease (*Ceratocystis paradoxa*). Inoculation concentration was critical for one Brazilian variety but not for another.

Sugar beet agriculture

Multi-row sugar beet harvesting. ANON. *British Sugar Beet Rev.*, 1968, **37**, 88.—Multi-row sugar beet harvesting was a major feature of the autumn demonstration at Thriplow, near Cambridge, on 4th October, 1968. There was a notable increase in the number of grab-type loading equipments in use. Photographs of two five-row machines in action are included.

* * *

Further trials on the significance of damage caused by aphid feeding in areas of epidemic virus yellows of sugar beet. W. STEUDEL and R. THIELEMANN. *Zucker*, 1968, **21**, 690–693.—Field trials confirmed the results of earlier greenhouse experiments. The significance of the black bean aphid (*Aphis fabae*) in the epidemic spread of virus yellows disease and of the heavy feeding damage caused by it are discussed.

* * *

Research on the selection of sugar beet in 1967. H. LABY, P. SOREAU, J. P. DENIZOT and M. GOULETTE. *Publ. Inst. Tech. Français de la Betterave Industrielle*, 1967, 3–14.—Breeding work and the techniques employed during the year are discussed and the performance of a large number of hybrids indicated by means of tables. Figures are given for root yield and sugar per acre, percentage sugar and fibre and resistance to *Cercospora* or leaf spot.

* * *

Research on the *Atomaria* sugar beet pest in 1967. L. BONNEMAISON, X. PORTE and S. WATTIEZ. *Publ. Inst. Tech. Français de la Betterave Industrielle*, 1967, 15–18. General information on the biology of the insect (*Atomaria linearis*) is given and the effect of temperature on the insect discussed. As a control measure "Heptachlor" was found to be very efficient.

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Thiabendazole and other products for controlling *Cercospora beticola* in sugar beet. H. DARPOUX, A. LEBRUN and B. DE LA TULLAYE. *Publ. Tech. Inst. Français de la Betterave Industrielle*, 1967, 19–23.—As a preventive measure triphenyl acetate proved to be the most effective but as a curative agent thiabendazole was the most efficaceous. A combination of these two products gave good results.

* * *

Planning, calculation and evaluation of field trials in sugar beet breeding by electronic data processing. W. HAUFE. *Zucker*, 1969, **22**, 40–46.—With extended trials traditional methods of handling data could not be completed in time or soon enough by available staff; hence the use of electronic processing. How this has been achieved with satisfactory results is explained, and probable future developments are indicated.

* * *

Sugar beet harvesting in Switzerland. H. MEYER. *Zucker*, 1969, **22**, 95–98.—Sugar beet production in Switzerland is well organized but does not constitute a large industry. It is mainly carried on by the small farmers providing their own family labour. Yields are good. The harvesters used are mainly imported. It is probable that carrier harvesters will predominate in the future.

* * *

Investigations on the pelleting of mono-germ sugar beet seed. R. SCHILDBACH. *Zeitsch. Zuckerind.*, 1969, **94**, 84–89.—Two conditions are achieved by pelleting mono-germ sugar beet seed: improved spacing accuracy and improved germination and field emergence. The latter may be dependent on a number of factors, which are discussed.

* * *

Spacing for seed crops of sugar beet. A. V. DOBROTVORTSEVA. *Sakhar. Svekla*, 1968, **13**, (4), 24–25. Trials at six locations in the Ukraine and Belorussia showed that beet spacing of 70 × 35 cm yielded 3–7 hkg/ha more seed than spacing at 70 × 70 cm.

* * *

Suffolk's varied techniques of cleaner-loading beet. ANON. *British Sugar Beet Rev.*, 1969, **37**, 137–142. The various methods used by the larger or more progressive sugar beet growers in the country are discussed. In choice of equipment much may depend upon prevailing soil type and availability of labour. The relative merits of fore-end-loaders and grab-loaders are discussed.

* * *

Machine thinning of sugar beet: field trials with low seed rates. L. F. HANBURY. *J. Agric. Sci.*, 1968, **70**, (3), 313–321; through *Field Crop Abs.*, 1969, **22**, (1), 57.—In 1964–66 31 field trials in 12 factory areas of the British Sugar Corporation led to the following conclusions. Where chemical weed control was effective in machine-thinned crops no hand labour was required for establishment but there were mean losses in yield of 1·3 tons/acre or 7% compared with similar crops that were hand-singled. These losses in yield were unaffected by variations in seed rate. Mechanical harvesters worked more efficiently when seed rates were low.

The healing of sugar beet by cork formation after wounds in its surface skin. E. SWIETLICKA. *Socker Handl.* II, 1968, **22,** (2), 23–30.—The losses caused by mechanical damage to sugar beet during and after harvest are discussed. Certain factors such as temperature, air humidity and lying time affect wound healing or degree of suberization. This seems to occur only in small superficial wounds. Large wounds remain unprotected. There is no suberization of the injury caused by frost damage. The paper is illustrated with line drawings.

* * *

A comparison of methods of growing sugar beet seed. R. HULL and R. K. SCOTT. *J. Agric. Sci.*, 1969, **72,** (1), 109–117.—Experiments carried out during 1963–64 are described, in which transplanting was compared with various direct drilling techniques. Some experiments were made with multigerm varieties and others with genetic monogerm varieties. Direct drilling under a barley crop controlled virus yellows in one instance and yielded more multigerm seed suitable for processing than did transplanting. Direct drilling produced seed that germinated better. To establish a regular dense stand of plants was more difficult with, than without, cover crops. The time the cover crop was removed did not consistently affect yield. Crops sown in summer without a cover crop yielded most seed but were susceptible to disease and unsuitable for areas with a disease risk.

* * *

Studies on the formation of microflora in the rhizosphere of sugar beet seedlings. P. GYURKO. *Acta Agron. Acad. Sci. Hung.* (Hungary), 1968, **17,** (1/2), 101–114. The amount and distribution of bacteria multiplying on the roots of sugar beet seedlings grown from inoculated and non-inoculated soil with rhizosphere bacteria were studied. The effects of inoculation were still manifest on the roots of 2-weeks old seedlings. Around the roots an area of a certain diameter was established where the amount of soil micro-organisms was influenced by root secretion, this zone being regarded as the rhizosphere.

* * *

Sugar beet seed treatment. A. ZAKHARIEV *et al. Izv. Inst. Zakh. Tsveklo*, 1967, 93–120; through *Field Crop Abs.*, 1969, **22,** (1), 59.—A device for polishing sugar beet seed has been developed at the Sugar Beet Research Institute, Sumen, Bulgaria. It utilizes friction between seeds rather than between seeds and a hard surface. Polishing increased the bushel weight of seed by 45% and reduced the 1000 seed weight by 18–25%. Seed germinability was increased by 5–8%.

* * *

Seedbed design for minimizing sugar beet seedling damage by mild radiation freezes. H. F. MAYLAND and J. W. CARY. *Agron. J.*, 1968, **60,** (3), 311–314; through *Field Crop Abs.*, 1969, **22,** (1), 56.—The result of seed sowing in various ways in field and greenhouse and survival from terrestial radiation are discussed. Best results were obtained from sowing in pockets 7·5 cm in diameter and 5 cm deep in south facing slopes of soil ridges 20 cm high. It is considered this system could add two weeks to the spring growing season for sugar beet in Idaho, provided soil temperatures are high enough for germination.

* * *

Irrigation requirements of sugar beet under the conditions of central Vah valley. M. VENENI. *Pol'nohospodárstvo*, 1968, **14,** (2), 86–94; through *Field Crop Abs.*, 1969, **22,** (1), 57.—A minimum soil moisture content of 40% was necessary for growing sugar beet in the Vah valley, Czechoslovakia. Maximum yields were obtained at a soil moisture content of 60%.

* * *

A contribution to the problem of yield and quality of sugar beet with irrigation. L. HÁJEK. *Rostl. Vyroba*, 1968, **14,** (1), 85–94; through *Field Crop Abs.*, 1969, **22,** (1), 57.—It was found in Czechoslovakia that high rates of spray irrigation applied at less frequent intervals and high rates of N P K produced highest yields of roots and tops, but low sugar content. The yield of amide N in the harvested sugar beet increased with increase in the fertilizer rate, and was higher without irrigation. Irrigation and high rates of fertilizers stabilized yield.

* * *

The effect of light on the translocation from sugar beet leaves. D. HABESHAW. *J. Exp. Botany*, 1969, **20,** (62), 64–71.—Laboratory and greenhouse experiments are described. These were undertaken in an attempt to provide a quantitative basis for the investigation of the part played by translocation in plant development by a study of the effect of light on the translocation of sucrose in sugar beet. Illumination increased the rate of translocation from sugar beet leaves. This was dependent on carbon fixation by the leaf, in a manner similar to that of assimilation rate.

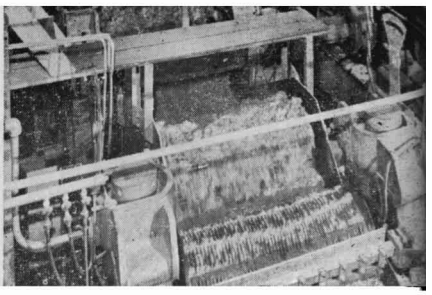
* * *

Results of international sugar beet variety trials in 1964-66. N. S. YAKIMENKO. *Sakhar. Svekla.* 1968, **13,** (7), 38–39.—Variety trials in Latvia, Lithuania and other parts of the Soviet Union showed that forms from Hungary, Germany, Rumania, Poland and Czechoslovakia gave lower yields of roots and sugar than the Soviet standards, although some were more resistant to various diseases or to bolting.

* * *

Influence of locality, year, fertilizing and irrigation on quality and yield of sugar beet. E. VON BOGUSLAWSKI. and R. SCHILDBACH. *Zucker*, 1969, **22,** 123–132. Results of field trials on light sandy soils for 11 years and on clay soils for 4 years are discussed. The effect of season and locality was of great importance. In warm season increased N and irrigation on sandy soils gave increased yield and sugar content.

Cane sugar manufacture



Mill gearing—where are we going? S. G. CLARKE. *Proc.* 36th *Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 183–187.—Cane mill gear design is discussed in relation to overloading, particularly with steam turbine drives. Possible ways in which the overloading problem can be solved are listed.

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Dryer tests at Isis and Tully mills. A. K. RAPSON. *Proc.* 36*th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 197–203.—Test results at Isis, which has a single rotary drum dryer, and at Tully, equipped with two rotary drum dryers in series, have shown that at both factories the sugar drying efficiencies could be improved by slightly altering the operating procedures. The data are discussed and results tabulated.

* * *

Gallons of *C*-massecuite per ton cane. E. D. JENSEN. *Proc.* 36*th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 213–217.—Because of differences between the number of gallons of *C*-massecuite calculated per ton of cane and the actual figure at a number of Australian sugar mills, it is recommended to calculate the *C*-massecuite yield per ton of cane in terms of gal/100°Bx.

* * *

Some guidelines for flocculation and clarification in the sugar industry. B. P. BUTLER. *Proc.* 36*th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 225–232. Prerequisites for good clarification are discussed and the significance of the ζ-potential of the dispersed particles on their agglomeration considered with reference to means of measuring the ζ-potential. The mechanism of agglomeration by means of flocculation aids is explained.

* * *

Pilot studies on the settling of cane muds. D. J. HALE and E. WHAYMAN. *Proc.* 36*th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 233–244.—Tests with a pilot-scale "non-tray" subsider at Farleigh over a given range of flow rates and settling conditions showed that multi-tray subsiders at present being used in Queensland are not designed to take advantage of the rapid mud settling produced by modern techniques using flocculants. Throughputs of these subsiders are 25–50% of those predicted by the tests for a simple tank of the same cross-section area. There was no agreement between the results obtained with the subsider under ideal conditions and values given by the laboratory clarification test of BURGESS *et al.*[1].

A comparison of two ATV clarifiers. R. I. DENNY and G. P. JAMES. *Proc.* 36*th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 245–250.—An ATV clarifier installed at Isis sugar mill in 1968 had a 33% greater throughput, produced muds averaging 47% higher solids content at the same juice clarity, and operated without any of the undesirable characteristics found in an ATV clarifier of identical capacity and number of trays installed at the factory in 1964. The two clarifiers do have design differences, and these and their effects on the performances are discussed.

* * *

Capacity of Tully clarifiers. P. N. STEWART and K. J. NIX. *Proc.* 36*th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 215–254.—Comparative tests on a Dorr ATV, a Bach and a Sargeant clarifier showed that the clear juice Brix, pH and turbidity were about the same for all three clarifiers, while the filtrability was higher at 42 for the Bach than the other two at 36 (ATV) and 37 (Sargeant). The mud solids content was increased from 0·73% in the juice to 9·99% in the mud from the ATV clarifier, from 0·68% to 5·75% in the Bach and from 0·79% to 5·90% in the Sargeant. The capacity of the ATV was far greater than that of the other two clarifiers.

* * *

Cane train performance investigations. C. R. MURRY and R. A. JAMES. *Proc.* 36*th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 255–260.—Investigations at a number of Queensland sugar mills are reported and the results discussed. It is concluded that some cane field locomotives perform far below the manufacturers' specification. Means of improving performance and locomotive utilization are suggested.

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Cane railway rolling stock utilization. C. R. MURRY and E. E. SHEPHERD. *Proc.* 36*th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 261–264.—From surveys made of the use of cane railway rolling stock, it is concluded that the main duty of the trucks is to act as cane storage, which takes up about half of their working time, while they are used only about 23% of their working time as transport means. How to improve their utilization is discussed.

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The preparation and operation of a cane transport schedule. G. HERITAGE, R. BARRATT and G. SMITH. *Proc.* 36*th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 265–273.—Since it has been found that chopped

[1] *I.S.J.*, 1964, 66, 90.

cane in the Tully area of Queensland suffers a relatively high rate of deterioration, a cane transport schedule was worked out with the aim of developing and maintaining a deterioration control programme consistent with the expansion of chopped cane supply. The positive effect of the scheduling on cane haulage efficiency and economy is discussed.

* * *

String-lining sugar mill tramway curves. H. D. WEBBER. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 275–282.—The article is concerned with means of calculating and carrying out curve adjustments on sugar mill cane railways using the so-called "string-lining" method.

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Mechanical ballast tamping of sugar plantation tramway tracks. L. S. EDWARDS. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 283–289. Factors involved in ballast tamping for cane railways are discussed and a description, performance and operating costs are given of a light-weight ballast tamper manufactured by the Swiss firm of Matisa Matériel Industriel S.A.

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Mechanics of swing-hammer shredders. W. R. CRAWFORD. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 329–342.—See *I.S.J.*, 1969, **71**, 259–262, 293–296.

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A simulated crushing experiment. G. E. RUSSELL and C. R. MURRY. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 343–347.—Results of mathematical simulation of cane milling based on a digital computer programme showed that for the same levels of cane preparation and filling ratios, the number of mills in the train, the imbibition level and the cane quality have marked effects on mill performance expressed as overall Brix extraction, but that the effects are greater with short trains than with long trains.

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First steps in the dynamic simulation of a crushing train. W. MCWHINNEY and C. R. MURRY. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 349–355.—Details are given of a dynamic simulation system for which a digital computer programme is used. Among the factors required for the programme are the time delays between successive mills. These can be directly determined by using a concentrated dye ("Edicol Supra Blue") as well as by simulation. Application of the dye tests and DYSMIL simulation results to the milling tandem at Pleystowe is demonstrated, and the two sets of values are compared. The data logging system and instrumentation used for the experiments are briefly described.

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The research work of G. E. Russell. M. SHAW. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 357–366.—A review is presented of the work of G. E. RUSSELL on cane milling. Mr. Russell is a member of the research team at the Dept. of Mechanical Engineering, University of Queensland.

Planning evaporator stations by computer simulation. D. B. BATSTONE and R. G. H. PRINCE. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 367–375.—Details are given of two case studies carried out by computer simulation at Pleystowe and Kalamia sugar mills. Both studies involved the evaporator stations, and thirteen different arrangements were quickly and economically evaluated. The conclusions drawn at each factory are discussed, although it was impossible to arrive at an optimum modification because of the lack of certain data.

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The application of hydraulics to sugar mill drives. D. J. WRIGHT. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 381–388.—The possible application of standard hydraulic motors to drive a cane mill instead of a turbine and gear train is discussed and the advantages and requisite ancillary equipment are described.

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Pressure feeder chute settings. D. S. SHANN. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 389–396.—Some of the theoretical factors affecting pressure feed chute operation are discussed, from which it is concluded that the manner in which the compressed bagasse is allowed to expand at discharge from the pressure feeder rollers may have a major effect on operation stability. A method of checking chute settings is suggested which may be used in conjunction with empirical methods to ensure that satisfactory pressure conditions are established in the chute.

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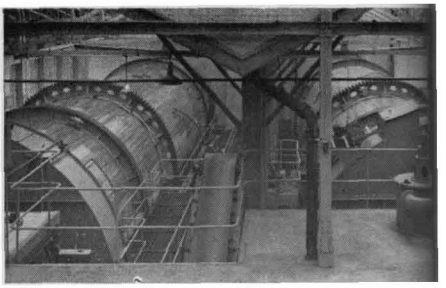
Disposal of sugar mill wastes. D. BEVAN. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 401–407.—Descriptions are given of mill effluent treatment by aeration at Pleystowe (2 plants) and Moreton Central (1 plant) sugar mills. All three plants, which were of different sizes, used a Simcar aerator, which is described. The results were used to plot a graph relating carbohydrate removal (lb/day) to the aerator motor h.p. required. The Simcar aerator rotates at about 90 r.p.m. and supplies air through a number of radial arms which may be above or below the surface level of the liquid.

* * *

Walking on the mill platform. I. D. M. CHAUX. *Brasil Açuc.*, 1969, **73**, 19–30.—This is the first of a series concerned with milling by the Technical Director of the Brazilian subsidiary of the French sugar machinery manufacturers, Soc. Fives Lille-Cail. Topics discussed include the change of mill operation to increase throughput at the expense of extraction at the end of a season when the cane quality is falling, and theoretical and practical aspects of mill regulation.

Beet sugar manufacture



Production of non-caking powdered sugar. M. GAWRYCH. *Gaz. Cukr.*, 1969, **77,** 57–58.—Among recommendations given for powdered sugar production are: a moisture content no greater than 0·03% in the pre-crushed white sugar, so that the active water content in the powder will not exceed 0·05%; and no cooling by air of the powder before packaging, since this will not dry the sugar but will merely increase microbial infection. During crushing it has been found that the sugar temperature rises by about 35°C; this is accompanied by a slight increase in colour and a noticeable degree of inversion.

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Tests on application of plastic coatings in order to prevent scale formation on evaporator tubes. M. WIEKLUK. *Gaz. Cukr.*, 1969, **77,** 58–61.—Although tests over a number of campaigns with evaporator tubes coated on the juice side with silicone (hardened by heating the tubes to 220°C for 4 hr) have given inconclusive results, these have been sufficiently encouraging for further tests to be considered.

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Heat losses in sugar manufacture. W. VON PROSKOWETZ. *Zucker*, 1969, **22,** 258–267.—After a discussion on heat transfer in general, the quantities of heat discharged from a sugar factory in various forms in which they are only partly considered as losses (steam, condensate, air, etc.) are calculated, examples being given for a factory slicing 4000 tons of beet per day.

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Make-up water supply to steam boiler units. H. ANDERS. *Zucker*, 1969, **22,** 274–276.—The preparation of feed and make-up water for Benson and cylindrical boilers, the treatment of condensate and chemical control of water, steam and condensate are discussed.

* * *

Juice purification. The effect of juice purification on filtration. H. GELEN. *Seker*, 1969, **18,** (70), 1–6.—The aims of beet juice purification are discussed and the carbonatation process described. The effect of liming and gassing indirectly on filtration, with or without return of unfiltered juice to liming, is considered.

* * *

Juice recycling to preliming. P. GÜRAY. *Seker*, 1969, **18,** (70), 11–18.—Results from Ankara sugar factory are reproduced to show how important it is to determine the correct quantity of juice to recycle to preliming (Brieghel-Müller progressive preliming is used) and to control the quality of the recycled juice so as to avoid increasing juice colour. The most suitable point at which to add the juice is also discussed.

The storage of Turkish crystal sugar and storage conditions. Y. SARAY. *Seker*, 1969, **18,** (70), 26–30. The requirements for white sugar storage in unconditioned warehouses in Turkey are discussed, including such factors as material for bags and conditions for production of sugar suitable for bagging. Methods of determining white sugar moisture contents are described.

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The sugar industry of the GDR. G. BUDAI. *Cukoripar*, 1969, **22,** 52–53.—A survey is presented of the East German sugar industry organization, with a mention of the system at Güstrow sugar factory where beet delivery is synchronized with the slicing.

* * *

A newer, cheaper filter perlite. I. SALÁNKI. *Cukoripar*, 1969, **22,** 54–56.—Information is given on a new form of perlite, P_3, which is applicable to juice and liquor filtration as a pre-coat.

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Stone catchers. S. VERMES. *Cukoripar*, 1969, **22,** 56–59.—A brief survey is presented of the types of stone catchers used at various Hungarian sugar factories. Location of stone catchers below ground level is costly, while those located at a height of about 3 metres above ground level remove the stones from flumed beet sufficiently well.

* * *

Waste water storage at Selyp sugar factory (Hungary). K. HANGYÁL. *Cukoripar*, 1969, **22,** 60–64.—The previous position at the factory with regard to fresh water supply and effluent disposal is described and the purpose in building an effluent reservoir is explained. Construction of the reservoir and the results obtained with it are discussed.

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Use of a flue gas generator in a direct-fired pulp dryer. J. LEHÓCZKI. *Cukoripar*, 1969, **22,** 65–67.—Details are given of a small oil-fired ceramic-lined furnace, the flue gas from which is fed to the beet pulp dryer at a regulated temperature at Szerencz sugar factory.

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Removal of filter-press mud by a single-helix pump. I. PÁVEL. *Cukoripar*, 1969, **22,** 68–69.—The system used at Kaposvár sugar factory, where a Seeberg single-helix pump is used to remove undiluted press mud which is fed into a pipeline, is described.

Biotreatment of Steffen house waste. K. ICHIKAWA, C. G. GOLUEKE and W. J. OSWALD. *J. Amer. Soc. Sugar Beet Tech.*, 1968, **15**, 125–150.—While bubbling CO_2 through Steffen waste reduced its COD slightly, subsequent inoculation with various yeast cultures, after filtration of the waste to remove the carbonate precipitated by bubbling, reduced the COD to a much greater extent, the maximum reduction being obtained with *Mycotorula japonica*, which gave an average COD reduction of 23% in 48 hr in 400-ml aliquots of Steffen waste having an initial COD of 10,800 mg/litre. During the same period there was a noticeable increase in the yeast biomass. The rate and extent of COD reduction were still further increased by adding KH_2PO_4 or $Mg_3(PO_4)_2$. Full details are given of the test procedures and quantities involved (the minimum yeast:waste ratio should be 1:9), and a basic design for Steffen waste treatment is described.

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Decolorization-demineralization of sugar juices using macroreticular resins. G. ASSALINI. *Sucr. Belge*, 1969, **88**, 261–268.—The properties of mactoreticular resins in the "Amberlite" series are discussed and compared with those of gel-type resins. Tests showed that preceding "Amberlite IRA-900" with "Amberlite XAD-2" gave generally higher decolorizing efficiencies (particularly after 35–50 cycles) than with "Amberlite IRA-900" alone. "Amberlite XAD-2" is a new resin which adsorbs soluble organic matter and retains, for example, colloidal iron which normally blocks resin surfaces after a number of cycles. It is regenerated with hot alkaline water.

* * *

Method for calculating (the dimensions of) a multi-compartment vacuum pan. YU. D. KOT and L. P. POLOZENKO. *Sakhar. Prom.*, 1969, **43**, (5), 5–7. Equations are given for use in calculating the quantities involved in the conversion of Soviet vacuum pans to multi-sectioned pans by installing annuli of flattened tubing. Advantages noted include greater throughput and smaller quantities of massecuite and steam (because of elimination of water drinks).

* * *

Unit for investigation of simultaneous defeco-saturation. KH. I. MICHEV and I. F. BUGAENKO. *Sakhar. Prom.*, 1969, **43**, (5), 8–10.—Details are given of an experimental carbonatation unit installed at Gorna Oryakhovitsa (in Bulgaria) for research in simultaneous liming and gassing. The unit features automatic pH control.

* * *

Adjustment of the electric drive of BMA centrifugals provided with a Soviet electric motor. YA. B. SKIBINSKII. *Sakhar. Prom.*, 1969, **43**, (5), 20–26.—A Soviet MA93-65/74-5SV motor was installed in a BMA 2nd massecuite centrifugal in place of the standard ZR 20/26-4 motor with which the centrifugals are equipped. The features of the two motors are compared and details are given of the adjustments which had to be made to the drive and control system.

Experience at Turbovskii sugar factory with vacuum filters. V. A. ZAMBROVSKII, A. YA. ZAGORUL'KO, Z. A. PIVOVAR and O. V. STRATIENKO. *Sakhar. Prom.*, 1969, **43**, (5), 26–29.—Modifications to the BOU-40 vacuum filter station at Turbovskii are described to show that it is possible to obtain good filtration of 1st carbonatation mud with low sugar losses. The innovations described include a system for maintenance of feed level in the filter and a scheme whereby the filtrate is kept separate from juice from the Dorr clarifier (they are combined at many Soviet sugar factories).

* * *

At Kirgiz sugar factories. A. S. GAL'PERIN and M. T. IBRAGIMOV. *Sakhar. Prom.*, 1969, **43**, (5), 32–37.—A number of modifications to processes and equipment at Kirgiz sugar factories are described.

* * *

Scheme for heating and feeding barometic water to a rotary diffuser. A. A. PYSHNAYA. *Sakhar. Prom.*, 1969, **43**, (5), 37–39.—A system for heating and feeding condenser water to a continuous rotary diffuser is described.

* * *

Increasing the resistance to rotting of piled sugar beet. M. I. ZHIGAILO. *Sakhar. Prom.*, 1969, **43**, (5), 47–50. The resistance to rotting of different beet varieties stored for up to 65 days was investigated in 1967 and 1968, and favourable results obtained with a number of varieties which did not start to rot until after 60 days. Poor correlation exists between resistance to rotting and beet yield and sugar content.

* * *

Rotting of sugar beet. L. D. KAZENAS. *Sakhar. Prom.*, 1969, **43**, (5), 55–56.—Sources of danger for stored beet (mechanical damage, putrefaction, wilting, etc.) are discussed and means of preventing rotting are considered.

* * *

Beet conveyor—promising equipment for beet feeding to the flume. N. A. EMEL'YANOV, N. M. KICHIGIN and I. B. SOMOROV. *Sakhar. Prom.*, 1969, **43**, (5), 57–58.—The use of a conveyor fitted to an excavator for removing beets from piles and feeding them to the flume is described.

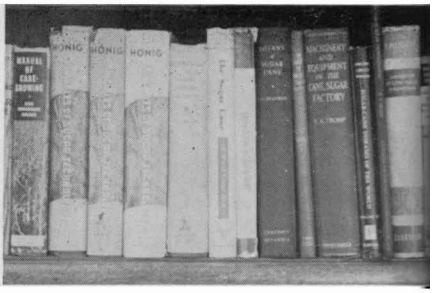
* * *

Observations on the Quentin process. L. GULMINELLI. *Ind. Sacc. Ital.*, 1969, **62**, 73–81.—The basis of the Quentin process, i.e. increasing sucrose recovery from beet molasses by replacement of more melassigenic cations with Mg using ion exchange resins, is discussed as are the effect on boiling, plant required, its operation and the economics.

* * *

Column-bed decolorization of juices and sugar factory products by means of active carbon. S. ZAGRODZKI, H. ZAORSKA and S. M. ZAGRODZKI. *Gaz. Cukr.*, 1969, **77**, 77–82.—See *I.S.J.*, 1968, **70**, 373.

New books



A study of sugar. ANON. 32 pp; $8\frac{1}{4} \times 11\frac{3}{4}$ in. (British Sugar Bureau, 140 Park Lane, London W.1, England.) 1969.

This is the second edition of a work produced by the British Sugar Bureau, an organization formed by the British sugar refiners—the Tate & Lyle Group, the British Sugar Corporation Ltd., and the Manbré & Garton Group—to provide information on sugar for the British public. This booklet, intended to provide such information, is a well-printed and attractive work, plentifully illustrated with pictures and charts, and covers the biology, history, sources, and refining of sugar, sugar production and storage in the cane and beet, sugar in domestic science, the chemistry of sugar in the body and the commerce of sugar, the latter referring both to world trade and that of the United Kingdom, including the operation of the UK Sugar Board.

* * *

Sugar price movements in world and US domestic markets 1961-1968. (C. Czarnikow Ltd., Plantation House, Mincing Lane, London E.C.3.) 1961.

This is the latest version of the 22 × 30-inch graph published each year to show the trends in raw sugar prices during the 8-year period up to and including the December preceding publication. It features the world market price as expressed by the London Daily Price (bags, c.i.f. UK including discharge, and bulk, c.i.f. UK, free out) and the New York No. 8 Contract Spot Price; the US domestic market price (New York No. 7/10 Contract Spot Price); and the Commonwealth Negotiated Price. The vertical axes give the prices in cents/lb and £/ton, the left-hand scale representing the pre-devaluation sterling values and the right-hand scale the post-devaluation values. An inset panel gives a graph showing average world values for the period 1931–1968. The value of the chart is enhanced by the notes on those factors having significant effect on the prices at any given period, so that the overall picture is a very clear one indeed.

* * *

Zuckerwirtschaftliches Taschenbuch 1969 (Sugar economic pocket book). 212 pp.; $4 \times 5\frac{3}{4}$ in. (Verlag Dr. Albert Bartens, 1 Berlin 38, Lückhoffstr. 16, Germany.) 1969. Price: DM 17·60; £2 0s 0d.

The contents of the 16th edition of this well-known publication are arranged in the same manner as in the 1968 edition, but it contains seven more tables (giving a total of 82) as well as 14 graphs and 7 maps. Its three main sections cover: (I) world, European, West German and East German sugar production, consumption, imports, exports, balances and prices besides beet and cane areas, yields per ha and factory outputs; (II) international, EEC and German trade regulations; and (III) international and West and East German authorities and organizations, buying and selling agencies in West Germany, and details of European sugar factories (with location, daily throughput and type of sugar produced). Main headings and captions are in French, German and English, although the basic language used is, naturally, German. The information has been brought up to date to cover 1967/68 and sometimes 1968/69. The data are well presented and the book is so small and yet so easily readable as to make this a most useful source of information.

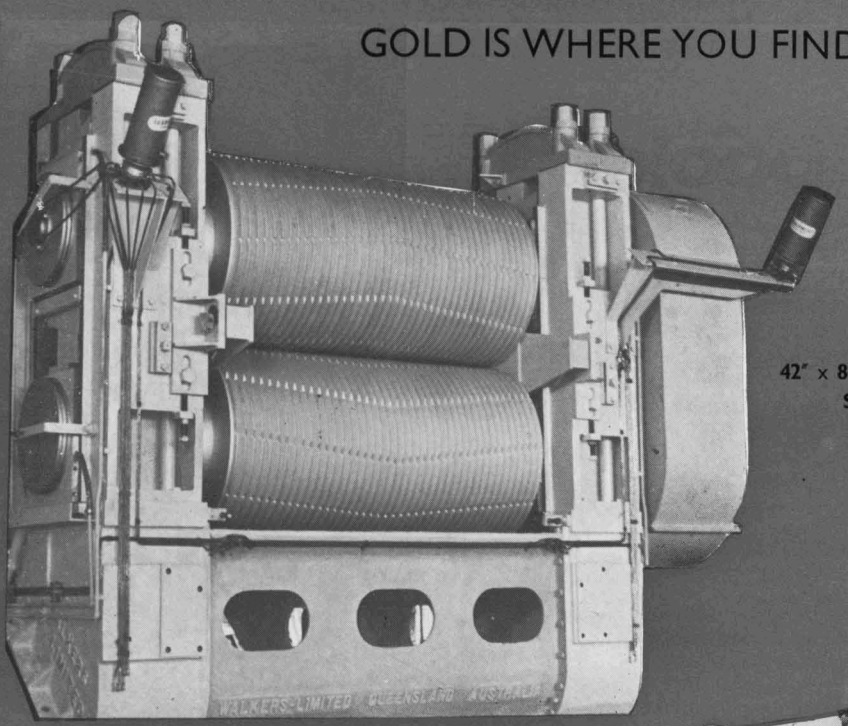
* * *

Proceedings of the 13th Congress of the International Society of Sugar Cane Technologists, Taiwan, 1968. Ed. K. C. LIU. civ + 2015 pp.; $6\frac{3}{4} \times 10\frac{1}{4}$ in. (Elsevier Publishing Co., Amsterdam, Holland.) 1969. Price: £45

In this volume are the texts of the papers read at the ISSCT 13th Congress held in Taiwan from 2nd to 17th March 1968. The papers are preceded by a 104-page section giving details of the Congress activities, programme and opening ceremony, names and addresses of members of the ISSCT, geographical distribution of the membership, names of regional vice-chairmen and photographs of the members attending the 13th Congress. It concludes with reports of the various committees and speeches and messages from a number of dignitaries. An author index is given, but instead of a subject index, which would have been preferable, there is merely a list of the papers under their appropriate section headings. In our review of the Proceedings of the 12th Congress[1] we expressed the view that the unwieldiness of that volume might reduce its value as a work of reference. Unfortunately, the present volume has yet more pages and hence is even heavier, making reference to any of the material included in it rather a laborious task. It is to be hoped that the suggestion of the editor is taken up, i.e. each paper to be limited to 20 typewritten pages, and that if the number of papers presented at future congresses is sufficiently large to warrant it, the publishers will consider dividing the Proceedings into two volumes.

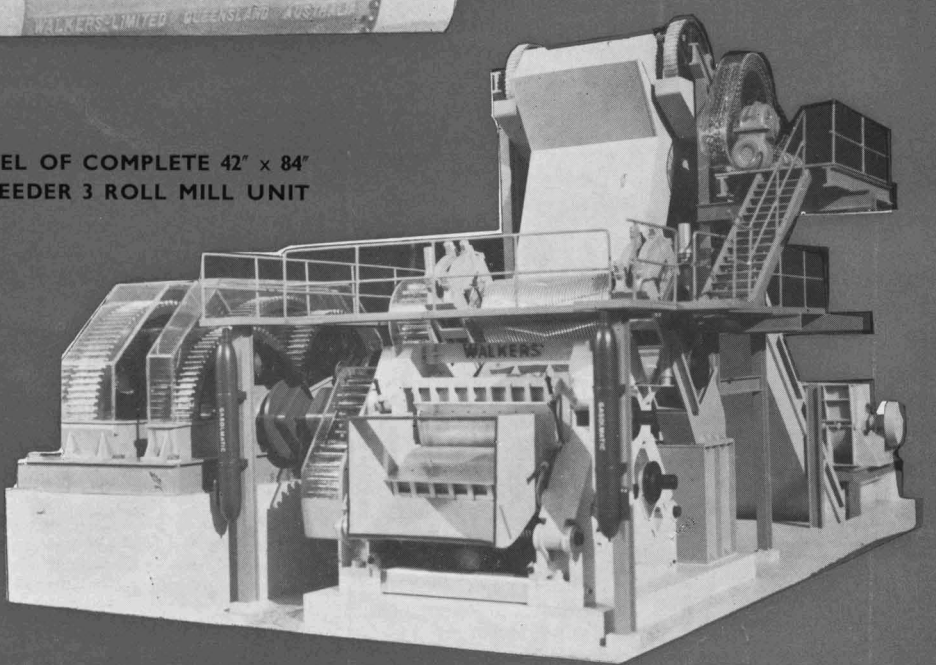
[1] *I.S.J.*, 1968, **70**, 248.

GOLD IS WHERE YOU FIND IT



42″ x 84″ PRESSURE FEEDER
SHOP ASSEMBLY

SCALE MODEL OF COMPLETE 42″ x 84″
PRESSURE FEEDER 3 ROLL MILL UNIT



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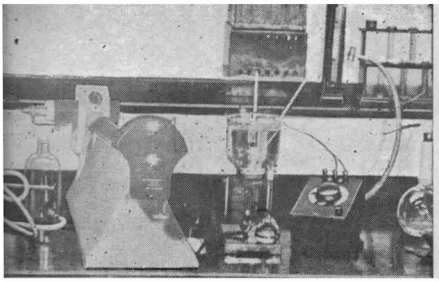


Laboratory methods & Chemical reports

Quantitative determination of lignin in sugar cane bagasse by the sulphuric acid method. ANON. *Cuba-Azucar*, 1967, (Nov./Dec.), 6–10, 30–32.—Tests were made in which prepared bagasse was extracted with a benzene-ethanol mixture of b.p. 68°C, prehydrolysed with dilute (1% and 5%) hydrochloric acid for 1–5 hours, and the holocellulose removed from the lignin residue by hydrolysis with 72%, 70% and 68% sulphuric acid over 2, 3 and 4 hours, respectively. Lignin compounds were removed with other extractives by the benzene-ethanol mixture, and this should therefore be limited to 2 hours. Only mild prehydrolysis is necessary, practically all pentosans being removed by 1 hour treatment with 1% HCl. The most suitable sulphuric acid treatment is for 3 hours with 70% acid; 72% acid gives a lower yield and lower methoxyl content, while 68% acid gives as high a yield but reproducibility is poor and lignin filtrability slow.

* * *

Phosphate surveys on first expressed cane juice. P. C. IVIN. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 29–34.—Determination of the phosphate content in first expressed juice from a number of cane varieties grown in various types of soil showed such considerable variation in the values for each combination of soil type and cane variety that it was impossible to detect any varietal differences, except in the case of Q 64 and the older varieties Pindar and Vidar, all of which showed marked phosphate deficiencies. The variations are attributed to differences in such factors as irrigation, fertilization and farming practices.

* * *

A quick method of fibre determination. P. N. STEWART. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 157–160.—While the dry substance method[1] holds much promise for rapid cane fibre determination provided the problem of cane moisture determination is overcome, a new modification of the bag method has been tested which, despite the fact that it gives slightly higher values than the true contents, is recommended. It involves cold water washing of the samples in tared cylinders with 200-mesh gauze bottoms for 5 min (which removes the sucrose content), draining, transferring the cane to a calico bag and removing excess water by spinning, after which the bags are agitated in boiling water for 15 min, and excess hot water removed by spinning before drying in a hot-air oven to constant weight at 103–105°C. The bags are soaked for 1 min in cold water before spinning followed by drying in a Spencer oven for 1 hr. The bag contents are emptied out, dried, weighed and the % fibre calculated from the relation between the dry fibre weight and the original weight of the prepared cane.

* * *

Identifying juice samples using integrated circuit digital logic. J. D. MALAN. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 189–196.—Details are given of the DTL (Diode Transistor Logic) system installed at Millaquin to streamline juice sampling from cane trucks. Under the system, spot sampling has been replaced by single samples representing the average over a number of trucks, thereby reducing the number of samples taken per number of trucks, while the number of trucks from which samples are taken has been increased from below 20% to above 70%. A minimum of special training is required to handle the equipment involved in the system, which has proved highly reliable with no component failure over 2450 hours' operation.

* * *

Enclave inclusions in sugar crystals. D. L. MACKINTOSH and E. T. WHITE. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 291–298.—Photomicrographs of enclave inclusions are reproduced to show their nature and development, and quantitative studies of inclusion formation are discussed. Since the quantity and pattern of inclusions is apparently closely linked with defects and dislocations on the crystal surface, which can vary considerably from crystal to crystal and within the same crystal, the number of dislocations being governed by the previous history of the crystal, e.g. growth rate, all the measurements were carried out with large numbers of crystals. The results, recorded in the form of graphs, showed that the water content in sugar crystals could be increased by up to 0·2% by one cycle of dissolution and regrowth. The quantity of mother liquor included increased with higher growth rate, higher degree of dissolution and lower regrowth temperature.

* * *

The determination of crystal shape in shipment sugars. A. L. JONES. *Proc. 36th Conf. Queensland Soc. Sugar Cane Tech.*, 1969, 311–315.—Details are given of a method for determining the average crystal shape of a sugar sample using a low-power microscope (with a total magnification of $\times 30 - \times 45$). Results from the 1968 season are given.

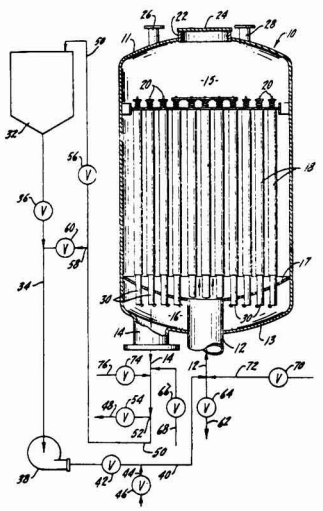
[1] SAVAGE: *I.S.J.*, 1910, **12**, 498–501.

Patents

UNITED KINGDOM

Cleaning a filter element (having an ion exchange resin precoat for sugar solution purification). UNION TANK CAR CO., of Chicago, Ill., USA. **1,124,603.** 3rd November 1965; 21st August 1968.

The filter tank 10 has an inlet line 12 and an outlet line 14, and is divided into an influent zone 15 and a filtrate zone 16 by a convex tube sheet plate 17 through which the influent pipe 12 delivers to zone 15. Annular filter elements 18 are held by pressure assemblies 20 against seats 30 which are located in plate 17. A precoat layer of ion exchange resin particles of 60–400 mesh is deposited on the outside of the filter elements and then the feed solution admitted. Insoluble material is deposited on the precoat of resins which eventually also become exhausted and require regeneration.



The vent 26 and the drain valve 64 are opened until the level of influent liquid is below the filter elements 18. A gas (air) is introduced into the interior of the filter elements 18 at their lower ends (at a flow rate of 3–10 c.f.m./sq.ft. of filter area) while simultaneously wash liquid (water, at 100–200°F) is also introduced at such a rate that the water level rises (by 2–3 inches/min, by 3–4 inches/min). The air entering the tank tends to pass through the filter element, removing the precoat which is diluted and carried away by the water, this cleaning process progressing from the bottom to the top of the element. The water and precoat are then drained off (at such a rate that the water level falls by 4–6 inches/min), after which the elements are cleaned by backwashing with more water.

* * *

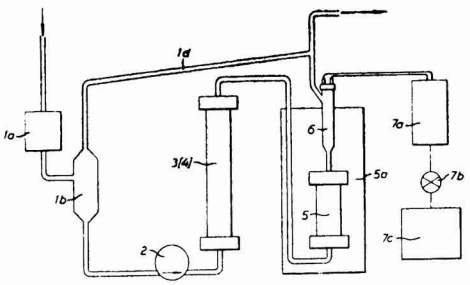
Activated carbon tablet (for sugar solution decolorization). PITTSBURGH ACTIVATED CARBON CO., of Pittsburgh, Pa., USA. **1,124,878.** 13th April 1967; 21st August 1968.—To prepare tablets of activated carbon (and thus avoid dust nuisance), a finely-divided carbon (having an iodine number of 900–1000 and of more than 100 mesh) is mixed with an aliphatic hydrocarbon sulphonate detergent (a sodium sulphonate having 8–18 C atoms in the hydrocarbon group) to the extent of 20–60% by weight of the tablet, as a binder. The binder may include a solvent for the detergent, such as a hydrocarbon or chlorinated hydrocarbon (perchloroethylene).

* * *

Method and apparatus for detecting traces of soluble carbohydrates in a return flow of water in an industrial process. SVENSKA SOCKERFABRIKS AB., of Malmö, Sweden. **1,144,843.** 1st August 1967; 12th March 1969.

A branch flow of the return water is brought to a temperature not higher than 50°C by passing through cooler 1a. It passes to air bubble vent 1b, bubbles and excess water being discharged through overflow pipe 1d. The cooled water is delivered at a required rate (e.g. 7 ml/min) by peristaltic pump 2 to an ion exchange column 3 or electrodialyser 4, which simultaneously acts as a filter, giving a deionized effluent (of e.g. not more than 3μS/cm conductivity). The effluent passes into a bed of catalyst in the form of palladium or platinum (13% by weight) precipitated on quartz particles (0·3–0·5 mm) by reduction of a corresponding salt, the bed being mounted in a thermostatically-controlled block 5a. Sugar is catalytically oxidized by the oxygen in the water to

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

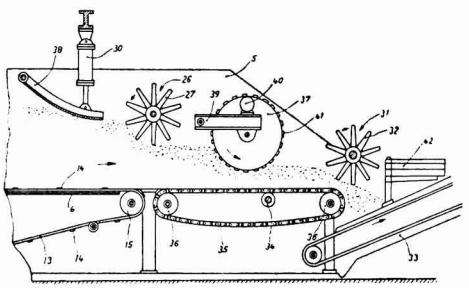


form uronic acids which are dissociated in solution and cause a pH drop which is measured by the device 7a,b,c, using electrodes in the cell 6. The acidity produced by the oxidation is a measure of the sugar content of the water and can be determined with a sensitivity of down to 3 mg/litre. The device 7a,b,c can be such as to produce a continuous chart record, operate a warning signal, etc.

* * *

Cane diffuser. BRAUNSCHWEIGISCHE MASCHINENBAU-ANSTALT, of Braunschweig, Germany. **1,145,784.** 24th August 1966; 19th March 1969.

Bagasse leaving a diffuser is compressed in mills to remove press-water which is returned to the diffuser to aid sugar extraction. To improve this press-water recovery, the bagasse leaving the diffuser trough by screen conveyor 14 is partly compressed by a



hydraulically loaded pressure plate 38 and delivered to a stripping and throwing roller 26 which directs it to a second screen conveyor over a separate collecting tank. This conveyor moves at a higher speed than the first, giving a thinner, faster-moving bagasse blanket, which is compressed either by a single pressure roller 37 as shown or by a number of hydraulically loaded rollers, so as to extract press-water, before being discharged and directed by kicker roller 31 to elevator 33 which takes it to the dewatering mills.

* * *

Animal feeding stuffs. N. P. BRAY, of Sherborne, Dorset, England. **1,145,838.** 20th June 1966; 19th March 1969.—A mixture, suitable for use e.g. in inducing cows to enter a milking parlour, is prepared by dissolving 60 lb of granulated sugar and 10 lb "pieces"-type brown sugar in ½-gal water and the solution stirred and heated while 32 lb of liquid glucose is added. The mixture is boiled until the temperature rises to 300°F (about 20 min), 2 lb of molasses is warmed and added with stirring and the mass transferred to an oiled slab. 14 lb of whole grain barley and 4 oz of aniseed oil are mixed and kneaded into the mass, which is then cut into pieces and left to harden in moulds where it forms solid blocks.

* * *

Continuous centrifugal. HITACHI SHIPBUILDING & ENGINEERING CO. LTD., of Osaka, Japan. **1,145,938.** 4th July 1967; 19th March 1969.—See U.S. Patent 3,419,148[1].

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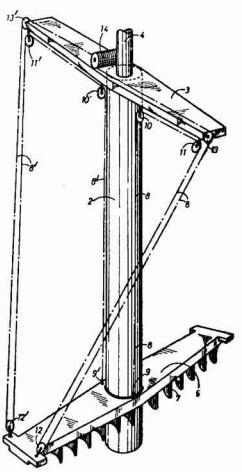
Beet thinner. M. W. ALDOUS and J. C. HITCHCOCK. **1,146,795.** 12th July 1967; 26th March 1969.

* * *

Bulk sugar silo. A-B-R ATELIERS BELGES REUNIS, of Petit Enghien, Belgium. **1,146,938.** 19th September 1967; 26th March 1969.

The silo in is the form of a vertical cylinder having a central shaft 2. At the top of shaft 2 is a horizontal beam 3 attached to a shaft 4 concentric with shaft 2 and rotated slowly. A second horizontal beam 5 is mounted on shaft 2 and carried on its under surface inclined blades 7 so that as it rotates about shaft 2 the sugar is moved either outwardly or inwardly depending on the direction of rotation. The lower beam is sus-



pended from the upper beam by a system of cables 8,8', attached at 9, 9' to the former, and pulleys 10, 10', 11, 11', 12, 12', 13, 13' such that, as the winch 14 is turned, the lower beam is raised or lowered while maintaining its perpendicularity to the upper beam. Sugar entering the silo is admitted through a circular hopper above beam 3 to telescopic pipes delivering to either side of the lower beam which rotates to spread it outwards. For reclaiming, the sugar is

[1] *I.S.J.*, 1969, **71**, 316.

brought by blades 7 towards shaft 2 and so through openings in the latter to internal shafts leading to a lower hopper from which it is withdrawn.

* * *

Glutamic acid production. INTERNATIONAL MINERALS & CHEMICAL CORPORATION, of Skokie, Ill., USA. **1,146,963.** 28th April 1966; 26th March 1969.—An initial fermentation medium is prepared having a carbohydrate (e.g. beet molasses) content of less than 3% and containing less than 10 γ (< 7·5γ) of biotin per litre. After an initial growth period of 1–8 hours for the micro-organism (e.g. *Corynebacterium lilium* NRRL-B-2243, *Brevibacterium divaricatum* NRRL 2312 or *Micrococcus glutamicus* ATCC 13032) a carbohydrate (beet molasses) containing 0·02–0·3γ (0·03–0·17 γ) of biotin per gram is added incrementally to maintain the carbohydrate level in the medium at no higher than 1% w/w (> 0·5%) and such that a total of 7·5% of carbohydrate is added during the fermentation.

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Beet cleaner. ERNEST A. WEBB LTD., of Newmarket, Suffolk, England. **1,152,923.** 3rd July 1967; 21st May 1969.

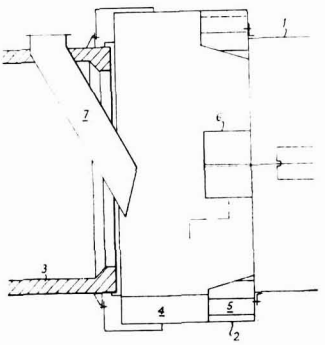
* * *

Polyether polyols. IMPERIAL CHEMICAL INDUSTRIES LTD., of London S.W.1, England. **1,154,161.** 27th April 1966; 4th June 1969.—A polyether polyol is obtained by reacting [at 50–150°C (90° C)] an alkylene oxide (propylene oxide) with a mixture of a compound having active hydrogen atoms, which is a polyhydric alcohol having a melting point in excess of 100°C (sucrose, sorbitol or methyl glucoside) or an amine having at least three active hydrogen atoms and no hydroxyl groups in the molecule (a toluene diamine or *p*, *p*'-diaminodiphenylmethane) or a mixture of these, with (10–50% on the total weight of) a hydroxyalkylamine that is liquid at 100°C and contains at least two active hydrogen atoms in the molecule. Sufficient alkylene oxide is used to give a polyether polyol having a hydroxyl value such that it is suitable for use in the manufacture of rigid foams. A polyurethane is produced by reacting the polyether polyol with an organic isocyanate (toluene di-isocyanate, diphenylmethane di-isocyanate) (in the presence of a gas-generating agent so as to produce the foam).

* * *

Beet pulp dryer. BÜTTNER WERKE A.G., of Krefeld-Uerdingen, Germany. **1,154,695.** 1st September 1966; 11th June 1969.

In order to avoid hardening of the surfaces of the pulp during the initial contact between wet slices and hot gases, the feed end of the dryer drum is provided with an enlarged section where the hot gas flow is low and pneumatic entrainment does not occur. The slices fall to the bottom of the section and are transported only by the conveyor blades, thus ensuring only slight initial evaporation from a surface which is not directly in the path of the hot gases.



This is achieved by feeding the wet slices through a chute which delivers them towards the side of the extension 2 which is located between the furnace 3 and the dryer drum 1. The extension has an area at least 30% greater than the drum and is provided with conveyor blades 4 and lifter blades 5, while a cruciform baffle element 6 through the drum breaks the fall of the slices which have been carried upwards by blades 5 as the drum rotates.

* * *

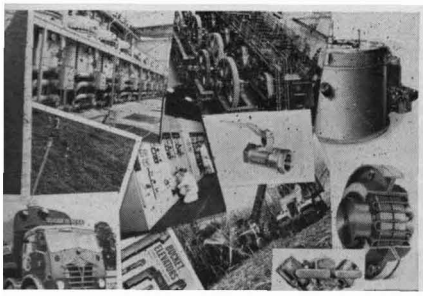
High viscosity (dextran) gums. COLONIAL SUGAR REFINING CO. LTD., of Sydney, N.S.W., Australia. **1,154,993.** 15th January 1968; 11th June 1969. Dextran (purified by organic solvent precipitation from an aqueous solution of crude dextran) is mixed with the alkali metal (Na) salt of a phosphorus oxy-acid (polyphosphate, pyrophosphate, orthophosphate, hexametaphosphate or metaphosphate) in a mutual solvent (water) (which is removed at <100°C) and the mixture (powdered and) heated to 100–200°C (under reduced pressure) for a sufficient time to obtain the desired high viscosity gum. This is dissolved in water and a purified high viscosity gum obtained by precipitation with an organic solvent. The gum may be added to sugar solutions to flocculate the colloidal and insoluble materials in suspension.

* * *

Bagasse pressing. THE FRENCH OIL MILL MACHINERY CO., of Piqua, Ohio, USA. **1,155,632.** 27th September 1966; 18th June 1969.—The pressure required to expel residual juice from bagasse in a screw press may be markedly reduced, while maintaining the same throughput, by heating it to a temperature of at least 160°F (180–200°F), e.g. by passing into it hot water or steam from a manifold surrounding a screw conveyor between the mills and the press.

* * *

Cane harvesters. MASSEY-FERGUSON (AUSTRALIA) LTD., of Sunshine, Victoria, Australia. (A) **1,155,991.** 7th June 1967; 25th June 1969. (B) **1,156,662.** 6th July 1966; 2nd July 1969.



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.

Boiler deposit prevention. The Polar Group, 34 Ebury St., London S.W.1, England.

The company's latest contribution to solution of the problem of boiler deposits is a powder formulated from alkali nitrates. Known as "Panorin", it is injected periodically into the furnace during operation and the resultant vapour condenses throughout the boiler, oxidizing up to 75% of fire-side unburnt deposits (soot), thus removing the bulk of the "store-house" for sulphuric acid and increasing the pH of the residue. Vanadium/sodium complexes can also be broken down by "Panorin". The treatment takes only a few minutes a week and is suitable for all types of boilers with use of the simple injection equipment.

* * *

Continuous level indicator. The Thirty Ninety Eight Co. Ltd., Gatwick House, Povey Cross Rd., Horley, Surrey, England.

The "BIN-DEX" continuous level indicator is a straightforward electro-mechanical device consisting essentially of a metal weight or float suspended by a stainless steel cable which runs over a weight-sensitive pulley system. The pulley senses three weights: (1) that of the cable alone, (2) that of the cable plus weight, and (3) that of the cable plus weight plus "drag" if the weight is covered by any material. The cable reel is driven by a geared reversing motor in a direction determined by the tension on the cable. Where condition (1) applies it remains stationary, with (2) the weight is lowered, and with (3) the weight is raised. The pulley motor is energized at selected pre-set intervals to raise the weight. If condition (3) applies and hence an extra drag is felt, the weight is raised clear of the material, and if condition (2) then applies it is lowered to the surface of the material. When condition (1) is reached the system is in equilibrium with the weight resting on the new surface, and indication of the level of the contents in the bin is given by a remote meter or bank of meters operated by a D.C. signal from a potentiometer which is gear-driven from the pulley motor shaft. Micro-switches shut off the motor at the extremes of cable travel and are also used to indicate high and low levels. No electrical source is in direct communication with the bin, and the system incorporates a fail-safe relay. The cable has a maximum measuring length of 120 ft.

The "BIN-DEX" may be easily converted for use as a liquid level indicator and works equally well with finely divided powders and granular or lumpy materials. In tests carried out by the British Sugar Corporation it has operated successfully with sugar beet. Tate & Lyle Refineries Ltd. and Westburn Sugar Refinery Ltd. figure amongst firms already using the "BIN-DEX".

* * *

High-speed granular weigher. Driver Southall Ltd., Villa St., Hockley, Birmingham 19, England.

A new high-speed automatic weigher, the D12.X14, has been introduced by Driver Southall primarily for the weighing of sugar. Operating on the double-beam principle, the weigher can work at speeds of up to 35 weighings per min with 2-lb bags of granulated sugar to within an accuracy of $\pm$ 0·1–0·25%. This is achieved by a fixed time feed coupled with automatic compensation for any variation in sugar density or flow. The length of a feed tube beneath the supply hopper determines the approximate volume of the first fill to the upper weigh pan. The fill is controlled by a sluice opening for a fixed time by means of a cam profile on the main camshaft. When the sluice opens, a small shutter is also opened, allowing a stream of sugar to bring the first weighing up to its pre-fixed weight value. The cam profile can be set at the start of each run to give the appropriate time cycle for a given weight. In the second and final weighing the sugar in the upper weigh pan falls to the lower pan which is supporterd on a new low-inertia "Flexure" beam specially designed by Driver Southall to minimize vibration. Coupled to this weigh beam is a contactless proximity switch of the oscillator type which operates a clutch brake system controlling a feed roller which adds a fine feed when the sugar falls to the lower weigh pan. This eliminates the tendency for sugar dust to cause the weigher to seize. The actual weight of sugar in the upper pan is analysed by an electrical system and is determined by the ability of the final feed to reach the target capacity within the pre-set time limits. If the weight varies beyond acceptable limits, the pull between a coil and permanent magnet on the upper beam is altered to compensate the next weighing and

bring it back to the accepted degree of accuracy. Small adjustments to the final weighing can be made by remote control where banks of the weighers are used. The electrical system uses a 90 V D.C. supply for the mechanical operations and 24 V D.C. for the logical analysis.

* * *

Ultrasonic level control. Sonicaid Ltd., Hook Lane, Nyetimber, Bognor Regis, Sussex, England.

A new solid level control having advantages over conventional types of level control is announced. It comprises a main control unit, which continuously feeds a high-frequency (40 kHz) signal to a transmitting sensor, which in turn converts the signal to ultrasonic waves and beams them to a receiving sensor. When the material in question rises or falls to a set level the ultrasonic beam is broken and a switch is operated which automatically empties or refills the holder to a pre-set level. The control unit may be mounted several metres away from the sensors and can be set for high or low level control. Power supply is 200–250 V at 50–60 Hz. Reliability is unaffected by variations in temperature or moisture content and it will operate accurately in conditions where dust, vibration, light and smoke are likely to be present. Sugar is one of the products for which the unit is considered suitable.

* * *

PUBLICATIONS RECEIVED

"ULTRAFILTRATION FOR INDUSTRY WITH THE DORR-OLIVER 'IOPOR' SYSTEM". Dorr-Oliver Inc., Stamford, Conn., 06904 USA.

A recently published 10-page booklet (Bulletin No. 10-1) defines and illustrates the Dorr-Oliver "Iopor" ultra-filtration system and equipment. The system is a low-pressure one (as low as 30 p.s.i.) using membranes selectively structured from a wide variety of organic polymers to provide separations in the 2000–2,000,000 molecular weight range. The units and systems are available in a wide range of capacity requirements. Possible applications include sugar solution purification.

* * *

HEATHKIT CATALOGUE 1970. Daystrom Ltd., Gloucester GL2 6EE, England.

The latest catalogue includes details of electronic equipment construction kits which cover a wide range of testing, recording and measuring instruments.

* * *

AUTOMATIC HIGH-SPEED BAGGING AND BULK WEIGHING. Howe Richardson Scale Co. Ltd., Bulwell, Nottingham NG5 5HD, England.

A new 4-page leaflet describes the EE50 range of automatic high-speed bagging and bulk weighing scales manufactured for a number of applications.

* * *

"GARDONA" SELECTIVE INSECTICIDE. Shell International Chemical Co. Ltd., Shell Centre, London S.E.1, England.

Reproduced from the Shell agricultural journal "Span" is an article concerning the company's new selective insecticide "Gardona". Although it is expected to be used mainly as an insecticide with fruit, "Gardona" has proved effected in pest control tests on a number of crops including sugar cane.

BÜHLER PRODUCTION PROGRAMME. Bühler Brothers Ltd., Uzwil, Switzerland.

A brochure gives details of the fields in which Bühler equipment is applicable, including bulk handling and mixing of animal feeds.

* * *

"BMA INFORMATION". Braunschweigische Maschinenbauanstalt, Braunschweig, Germany.

The latest issue (No. 8) of "BMA Information" contains three articles "Ion exchangers in the beet sugar industry" (describing the BMA continuous and batch ion exchange process for juice demineralization), "New type of beet unloading and piling units for a sugar factory in the USA", which concerns the 8 units supplied by BMA to Maine Sugar Industries Inc. for their factory at Easton, Maine, USA, and "Guide-lines for the layout of beet yards". All three articles are well illustrated. The booklet also contains brief items concerning orders placed with BMA for equipment and factories in various parts of the world.

* * *

"HUMBOLDT HAS THE ANSWER". Klöckner-Humboldt-Deutz AG, Köln-Kalk, Wiersbergstr., Germany.

This is the title of a well-produced illustrated booklet in which materials are listed alphabetically and against each entry is given information on plant made by KHD for processing of the material. An alphabetical list of equipment is given at the end of the book. Items for the sugar industry include rotary vacuum filters, lime kilns and equipment for continuous ion exchange demineralization of sugar solutions. Also applicable in the sugar industry is equipment for active carbon regeneration.

* * *

"TECHNOEXPORT '68". Technoexport, Václavské nám. 56, Praha 1, Czechoslovakia.

A well-printed brochure gives details of the various types of plant and equipment manufactured by Czechoslovak concerns for which Technoexport acts as import and export agency. Among the contracts and deliveries for 1968 is cane sugar factory equipment for Cuba, Egypt, Ghana, Kenya and Pakistan and beet sugar factory equipment for East Germany, Hungary and Rumania.

* * *

REMOTE CONTROL VALVES. The A.P.V. Co. Ltd., Crawley, Sussex, England.

Low-cost self-installed "Zephyr" remote-control valves are described and their range of applications and system of operation indicated.

* * *

POWER TRANSMISSION AND MATERIAL HANDLING. Rex Chainbelt Inc., Milwaukee, Wisconsin, 53201 USA.

Catalogue R-70 is a 600-page edition giving details of more than 350 product lines manufactured by Rex Chainbelt for mechanical power transmission and material conveying.

* * *

"THE PRINCIPLES OF THE DDS PAN BOILING AUTOMATICS". A/S De Danske Sukkerfabrikker, Langebrogade 5, 1001 Copenhagen K, Denmark.

Information on automatic boiling controls developed by DDS is given in a 15-page booklet. The standard equipment includes conductivity and vacuum controllers and conductivity recorder, all built into the same control panel, as well as remote controls for pan vapour feed and bottom valves, and for the circulator where this is incorporated in a pan. The sequence of control steps in boiling is described. More than 150 DDS pan control units have been supplied to various countries.

* * *

BMA beet diffusers.—Braunschweigische Maschinenbauanstalt have recently received orders for 8 beet diffusers to be delivered this year to sugar factories in Austria, France, Germany, Japan, Spain and the USA. The diffusers will have daily capacities in the range 2500–4000 tons of beet.

ICUMSA 15th Session

London, 10th—15th May 1970

The venue for the 15th Session of the International Commission for Uniform Methods of Sugar Analysis (ICUMSA) will be the Council Room of the International Coffee Organization, 22 Berners Street, London, W.1. Registration of delegates will take place on the afternoon of Sunday, 10th May. The International Coffee Organization is centrally located and conveniently situated for hotels of all classes. A limited number of rooms are being held for delegates at Berners Hotel, Berners Street, London W.1. Delegates to the Conference should make their own hotel reservations.

US sugar supply quotas, 1970

	(*Short tons, raw value*)
Domestic Beet	3,215,667
Mainland Cane	1,169,333
Hawaii	1,150,000
Puerto Rico	1,140,000
Virgin Islands	15,000
Philippines	1,126,020
Argentina	57,118
Australia	195,865
Bahamas	10,000
Bolivia	5,528
Brazil	464,316
British Honduras	12,005
British West Indies	164,783
Colombia	49,134
Costa Rica	54,661
Dominican Republic	464,316
Ecuador	67,559
Fiji	42,981
French West Indies	51,836
Guatemala	46,064
Haiti	25,795
Honduras	5,528
India	78,346
Ireland	5,351
Malagasy	9,250
Mauritius	17,955
Mexico	474,758
Nicaragua	54,661
Panama	34,394
Peru	370,348
Salvador	33,780
South Africa	57,671
Swaziland	7,073
Taiwan	81,610
Thailand	17,955
Venezuela	23,339
	10,800,000

New sugar factories for Greece[1].—The Greek Minister for Coordination has announced that the fourth sugar factory is to be erected in an area between the Xanthi and Kommotini Nomes. A fifth factory is scheduled to be erected in 1974 in the Evros area. The fourth sugar factory will allow Greece to cover its requirements of sugar; the three existing factories were expected to produce 135,000 tons in 1969, about 85% of the country's requirements. Extensions are being made to the factories so that at the completion of the 200 million drachmae programme in 1971, sugar production will reach 165,000 tons.

Brevities

EEC sugar production limitation proposals[2].—The EEC Executive Commission has submitted proposals to member governments aimed at reducing production of certain agricultural products and the cost of disposing of them. So far as sugar is concerned it is proposed that production quotas should be reduced by 5% in 1970/71, by 3% in 1971/72 and 1% in 1972/73. At the same time it has been proposed that a charge should be levied of up to one unit of account (equivalent to $1.00 US) per ton on all beet roots produced. It is, of course, by no means certain that these proposals will be adopted and further meetings on the subject will be held. The West German Sugar Trade Organization has written to the Government opposing the proposals which would reduce payments for beet at a time when higher processing costs were already cutting farmers' incomes[3].

* * *

Egypt sugar expansion[4].—During the period of the new Five-Year Plan, commencing 1st July 1970, the area under sugar cane is to be increased from 135,582 feddans (56,944 hectares) to 208,500 feddans (87,570 hectares). In addition, tests are to be made with sugar beets in the north of the El-Tahrir province as well as in the Nubaria province; the first crops yielded 15 tons per feddan (6·3 tons/ha) which is very low compared with European yields. It is expected that yields will rise in the future, however.

* * *

US sugar supply quota, 1969[5].—Early in December the US Dept. of Agriculture announced a shortfall of 15,897 tons in the quota for Haiti which was reallocated in its entirety to Puerto Rico. Entitlements for the two countries were thereby brought to 17,419 tons and 370,897 tons, respectively.

* * *

Morocco sugar microbiology seminar[6].—A seminar on microbiology in sugar manufacture was held during the 16th–24th October 1969 at Rabat. Among the contributors were Dr. J. HENRY of Raffinerie Tirlemontoise S.A., Prof. BUTTIAUX, Director of the Pasteur Institute at Lille, and M. LAMBION, Director of CERIA, Brussels.

* * *

Uganda sugar situation[7].—Sugar production in 1969 is estimated to have been 158,000 metric tons while, with a per caput consumption of 12·7 kg, domestic requirements total some 100,000 tons, leaving about 50,000 tons for export. With the erection of a new sugar factory at Kinyala, near Masindi, this export availability should be doubled. The new factory will be erected by the Mehta Group who will provide 12·5% of the capital required, the remainder being supplied by the state.

* * *

Typhoon damage in Taiwan[8].—An initial survey showed that heavy damage was caused to the Taiwan sugar crop by the September typhoon, and production is expected to be reduced by 100,000 tons.

* * *

Bagasse cellulose plant in Réunion[9].—Les Sucreries de Bourbon, which company operates four sugar factories with a total capacity of 92,000 tons of sugar/year, is intending to manufacture cellulose from bagasse.

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[1] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (31), 6.
[2] C. Czarnikow Ltd., *Sugar Review*, 1969, (946), 208.
[3] *Public Ledger*, 6th December 1969.
[4] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (32), 5.
[5] C. Czarnikow Ltd., *Sugar Re iew*, 1969, (947), 212.
[6] *Sucr. Belge*, 1969, **88**, 635.
[7] *Zeitsch. Zuckerind.*, 1969, **94**, 636.
[8] *Reuters Sugar Rpt.*, 7th October 1969.
[9] *Zeitsch. Zuckerind.*, 1969, **94**, 636.

Brevities

New Malaysia sugar factory[1].—Kawasaki Heavy Industries Ltd. and Sumitomo Shoji Co. are to supply sugar plant worth $5,000,000 to Johore Sugar Plantation and Industries, of Malaysia. The plant will be capable of processing 2000–3000 tons of cane per day and of refining 300 tons of sugar per day. It will be the first integrated manufacturing unit in the country and is due for delivery within 12 months.

* * *

Morocco crop damage by floods[2].—Floods in the sugar beet area of Rharb, in Morocco, have reduced the estimated 1969 sugar production by 100,000 tons and it is not expected now to have exceeded 75,000 tons. As domestic consumption in Morocco is of the order of 370,000 tons, it will be necessary to import about 300,000 tons.

* * *

Automatic beet thinner[3].—An electronically controlled beet thinner developed and tested in the USSR is reported. It has a working width of 5·5 m and can handle 12 rows at a time, covering 2·5 ha per hour. It is provided with an automatic system for thinning control, a programme device, a control block and electromagnets in the cutting heads. It is said to imitate manual thinning by maintaining given distances between plants.

* * *

Sugar transport investigation[4].—Three British shippers who between them carry more than half the Caribbean's sugar exports to Britain have announced that rising costs and falling revenue are forcing them to consider changing their transport systems between the Islands and the UK. The companies are Tate & Lyle Ltd., Booker McConnell Ltd. and Furness, Withy & Co. Ltd. The American Matson Research Corporation has been engaged to study the relative advantages of containerization, conventional ships, palletization barge systems, roll-on roll-off lo ding, and a system of loading lighters on to ships (L.A.S.H.). The survey is expected to be completed in ten months.

* * *

Philippines cooperative sugar mill project[5].—An association of sugar cane planters has been organized in Zambales for the establishment of Central Azucarera-Refineria de Bataan. The 75 million-peso central will be located at Dampe and will crush cane produced by 50 planters with some 5000 hectares of cane land.

* * *

Mexico sugar production, 1968/69[7].—Sugar production in Mexico during the 1968/69 season amounted to 2,393,964 metric tons of which 50·1% was in the form of refined sugar, 25·5% muscovados, and the remaining 24·4% as standard sugar. Sugar production was 9% greater than in the previous season.

* * *

Sodium glutamate factory in Argentina[8].—Construction is to start in early 1970, in the Province of Tucumán, of a factory for the production of sodium glutamate by the process of cane molasses fermentation. The factory is to be supplied by Asahi Chemical Co. and will cost $4,000,000.

* * *

Mauritius sugar factory closure[9].—Ferney sugar factory, the smallest in Mauritius, is to be closed.

* * *

Liquid sugar manufacture in Japan[10].—Production of liquid sugar is to be increased by the larger Japanese sugar factories, in order to meet the increasing demand for this product. First produced by Dai Nippon Seito K.K. in 1964, liquid sugar manufacture has increased from 1000 tons/year to 7400 tons in 1967 and 16,500 tons in 1968; nevertheless demand has always been greater than supply.

World per caput sugar consumption[11]

Crop year Sept.-Aug.	*World sugar consumption* (thousands of metric tons, raw value)*	*World populations† (millions)*	*World per caput consumption (lb raw value)*
1968/69	69,674	3550	43·27
1967/68	67,840	3485	42·92
1966/67	65,633	3420	42·31
1965/66	62,747	3355	41·23
1964/65	60,063	3295	40·19
1963/64	54,262	3239	36·93
1962/63	54,550	3179	37·83
1961/62	55,602	3119	39·30
1960/61	52,734	3061	37·98
1959/60	48,858	3004	35·86
1958/59	47,561	2948	35·57
1957/58	44,704	2892	34·08
1956/57	42,228	2836	32·83
1955/56	40,443	2782	32·05
1954/55	38,254	2730	30·89
1953/54	36,892	2680	30·35
1952/53	35,200	2631	29·50

* F. O. Licht estimates.
† UN estimates of mid-calendar year populations.

Greece beet crop, 1969[12].—The total beet harvest in Greece is estimated at 1,160,000 metric tons and of the quantity sliced up to the 22nd October, the average sugar content was 15·72%. The campaign was scheduled to end with the closure of the Larissa factory towards the end of November.

* * *

Jamaican sugar factory closure[13].—In addition to the three factory closures reported earlier[14], Richmond-Llandovery factory is to close this year.

* * *

Polish sugar factory[15].—The sugar factory being built at Lapy in Bialystok in East Poland[16] is expected to start roduction in 1971 and will have a daily throughput of 5000 tons of beet.

* * *

East Germany sugar beet production increase[17].—Production of sugar beet in East Germany is to be increased to 12·8 million tons/year by 1980; about 5 million tons of this will be used as animal fodder, however. Production in 1968 was 6,998,000 tons.[18]

* * *

New sugar refinery for the US[19].—The Old Dominion Sugar Corporation plans to build a sugar refinery with an annual capacity of 150,000 tons in Portsmouth, Virginia. Construction is to start in about April 1970 and should be completed by a further 18 months.

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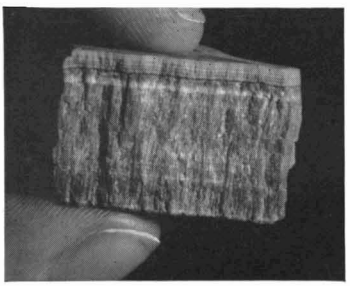
[1] *Reuters Sugar Rpt.*, 20th October 1969.
[2] *La Ind. Azuc.*, 1969, (906), 146.
[3] *Zeitsch. Zuckerind.*, 1969, **94**, 636.
[4] *Public Ledger*, 29th November 1969.
[5] *Sugarland*, 1969, **6**, (6), 31.
[6] *I.S.J.*, 1969, **71**, 31.
[7] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (32), 4.
[8] *Sucr. Belge*, 1969, **88**, 633.
[9] *Zeitsch. Zuckerind.*, 1969, **94**, 636.
[10] *Sucr. Belge*, 1969, **88**, 635.
[11] *Lamborn*, 1969, 47, 172 (modified by use of later consumption estimates for 1967/68 and 1968/69).
[12] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (31), 6.
[13] *Zeitsch. Zuckerind.*, 1969, **94**, 637.
[14] *I.S.J.*, 1969 **71**, 31
[15] *Die Lebensmittelind.*, 1969, **16**, 391.
[16] *I.S.J.*, 1969, **71**, 31.
[17] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (31), 5.
[18] *Zeitsch. Zuckerind.*, 1969, **94**, 635.
[19] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (35), 9.

Index to Advertisers

FOR THE BUYERS' GUIDE SEE OUR JANUARY ISSUE pp. xxviii-xlv

I-12 solves 5000 year-old scale problems



Here you see scale build-up in one of the largest rum stills in the Caribbean. Prior to using I-12, scale cleaning cycle was two to three times per month. Using only two pounds of I-12 per 10,000 gallons of fermented wash feed since October 1968, no cleaning has been required.

Now, over 24 distilleries in Puerto Rico, Central America, Santo Domingo, Guyana, Jamaica, and Barbados have clean stills that stay clean! Downtime for cleaning is completely eliminated and still capacity is increased.

Also, sugar juice evaporators and vacuum pans in cane and beet sugar factories use FABCON I-12 to solve scale problems. Twelve to twenty pounds of I-12 per 1,000 tons of juice is sufficient to double the operating time between cleanings. In addition, scale is softer and more easily removed. Here's what industry leaders say about I-12.

"The use of 10 ppm I-12 immediately doubled the throughput of our evaporators between cleanings and gave us 4% higher average syrup brix and much easier cleaning. Performance has been consistently good for two years."— *Mr. M. S. Elder, Jamaica, W. I.*

"Six ppm I-12 added to our cane juice evaporators enabled us to double the time of operation between cleanings last year."— *Mr. Wilton Roger, Louisiana, U.S.A.*

Ask a Fabcon Service Engineer to show you how to solve your scale problems.

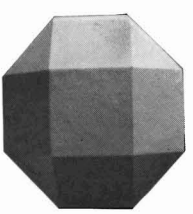
Name_____ Title _____

Company_____

Address_____

City_____ State _____

Country_____



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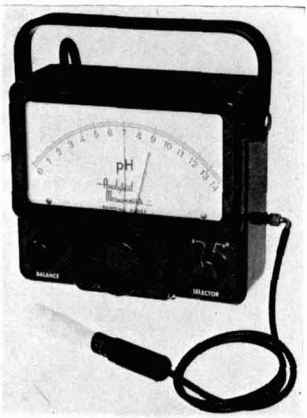


pH

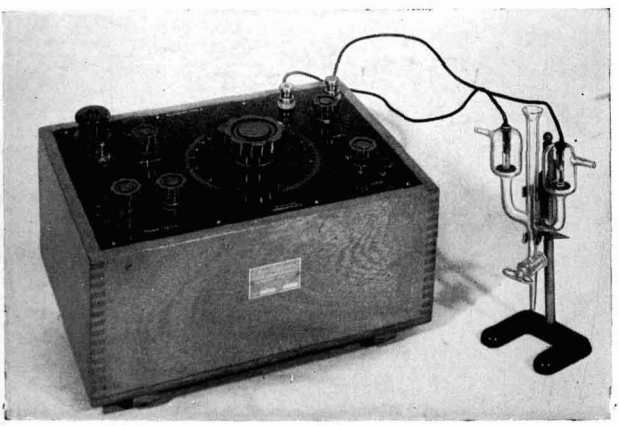
The illustrated model 700 has a scale length of 7 in from 0 to 14 pH with a readability of 0·02. This instruments is supplied with the exclusive polythene shielded pH probe unit. The amplifier is a printed circuit high output electronically modulated unit with a single operating control giving an accuracy and overall stability of better than 0.05 of a pH Unit. Operating the instrument is so simple that untrained personnel can make pH determinations with no danger of damaging sensitive components. The instrument is plugged into the mains supply, standardized with the buffer solution and is then ready to operate. An adjustable index pointer is provided so that frequent buffer checks are eliminated.

Other models available.

Colloids

Colloids in juices retard boiling, increase viscosity, hamper efficient work in the centrifugals, and generally reduce the capacity of the factory. They should be removed during the clarification stage to prevent these difficulties in the sugar house.

The **COLLIMETER** is the first instrument to permit comparison of the colloid-removing efficiency of alternative clarification procedures. This is done on the basis of the quantity of a standard dyestuff required to bring a sample in a cataphoresis cell to the iso-electric point as observed through the microscope.



Ash

The Type H **SALOMETER** for electronic determination of the ash content of sugar products retains the well-known characteristics of previous models, such as knife-edge accuracy, simple magic-eye tuning, and also is provided with temperature compensation (2% per°C), a main dial calibrated in micromhos for simplified calculation, a new power factor system to extend its range, and a special quick-action electrode system

The Sugar Manufacturers' Supply Co. Ltd.

196-204 BERMONDSEY STREET, LONDON, S.E.1, ENGLAND

Telephone: HOP 5422 *Cables:* "Sumasuco, London S.E.1"

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