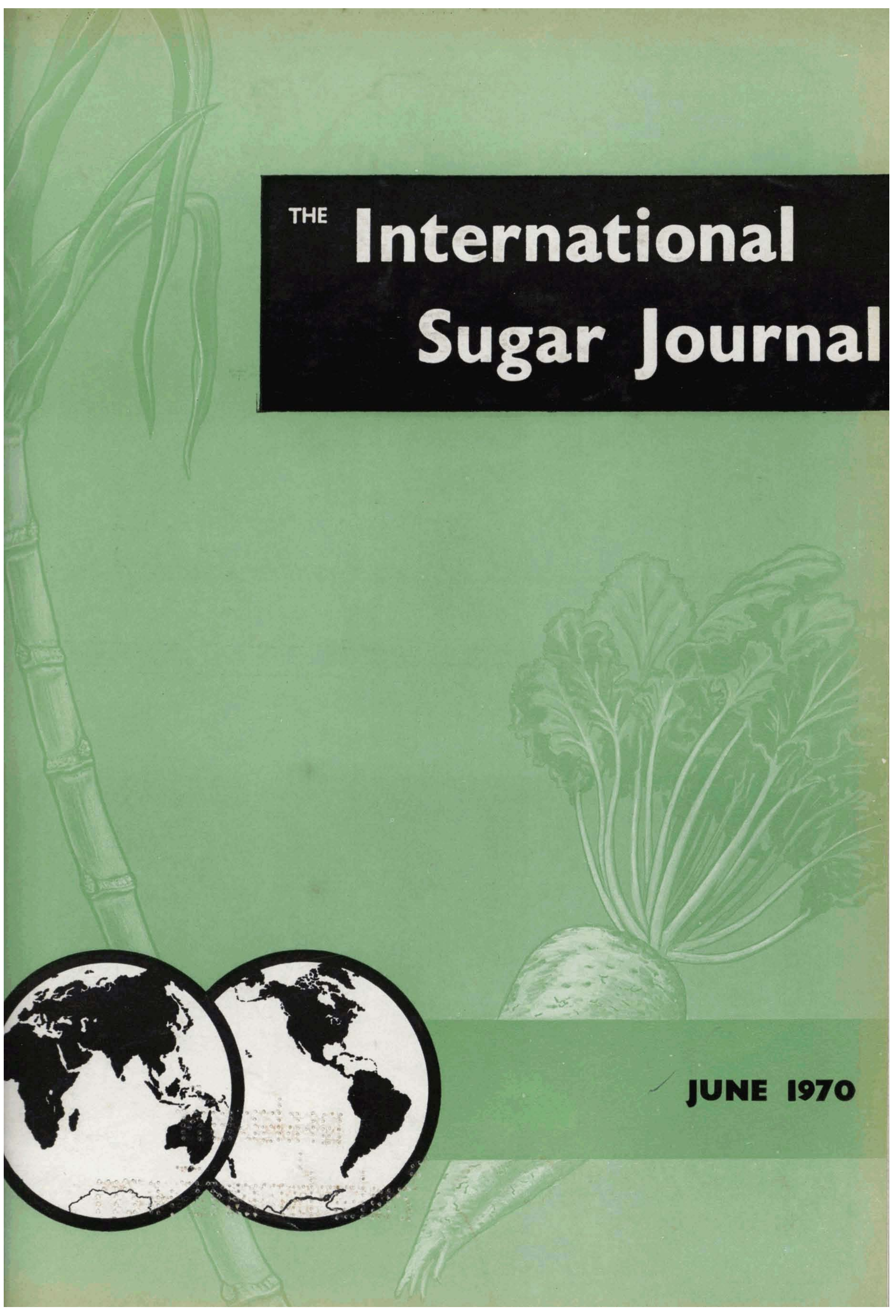

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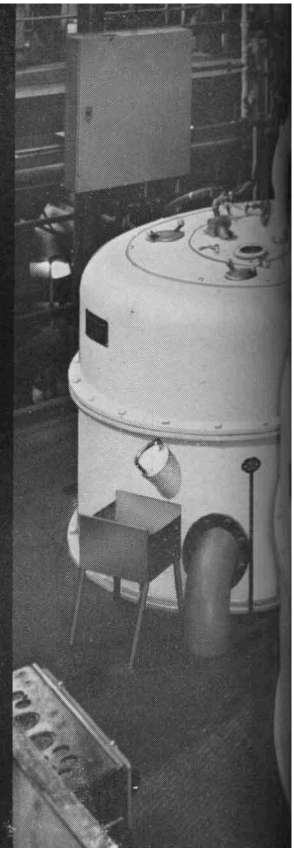
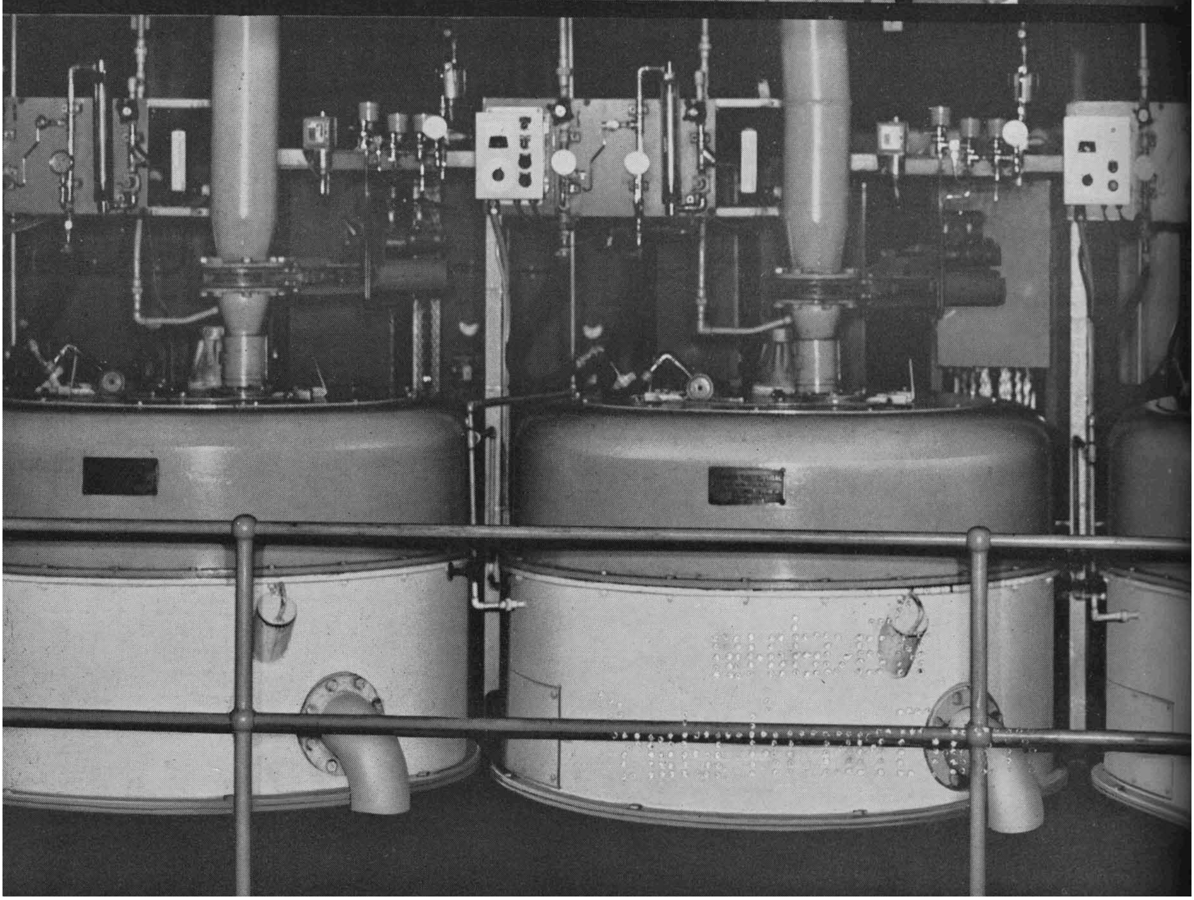

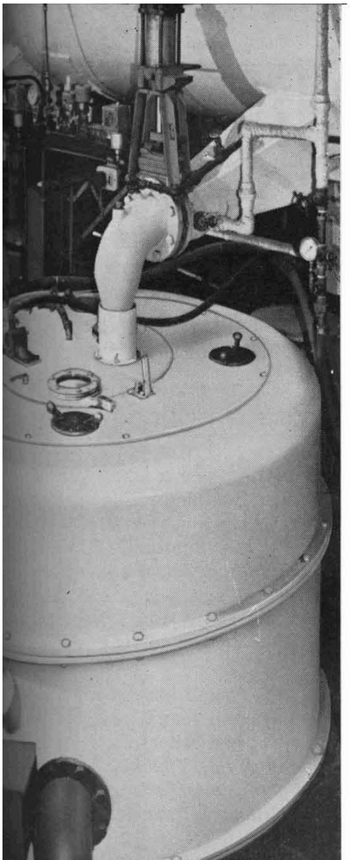

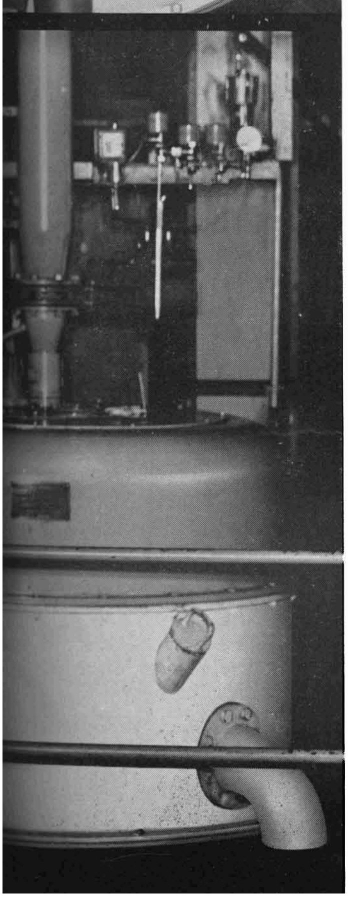

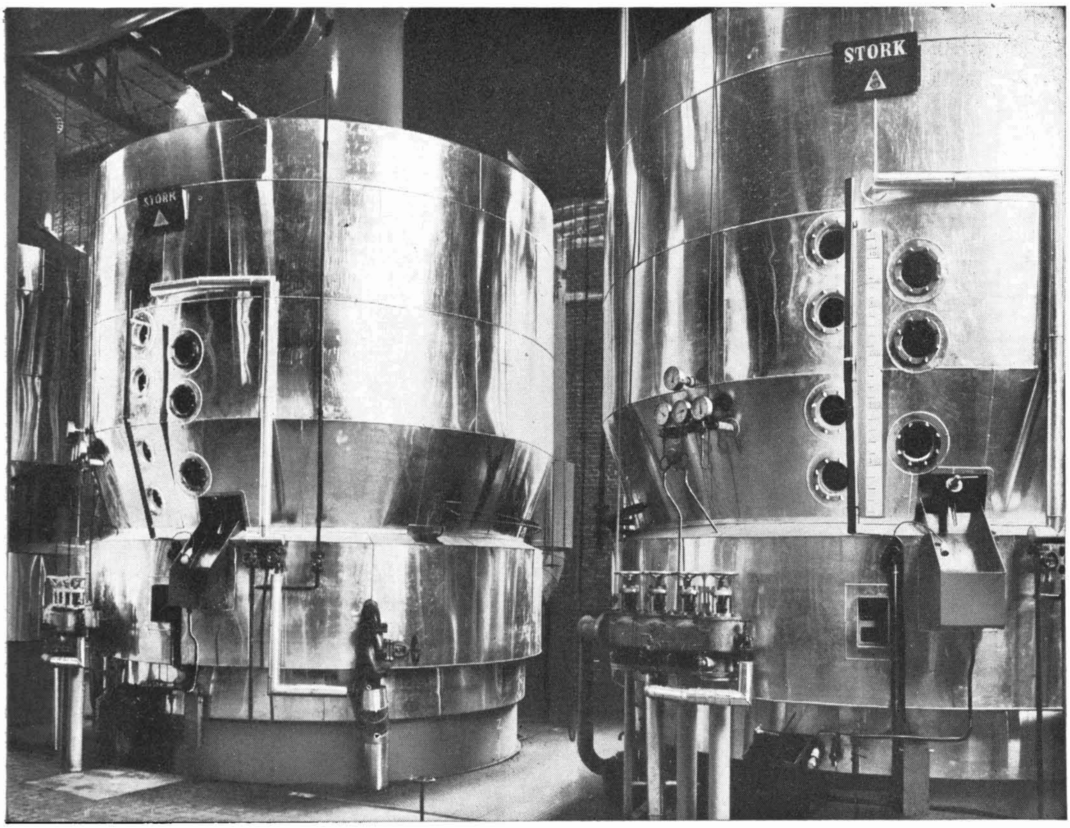
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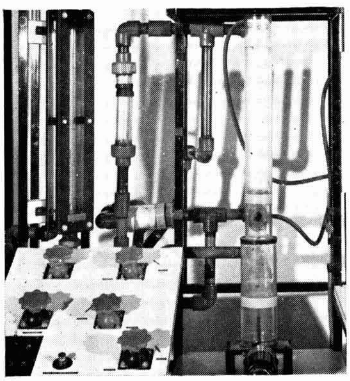

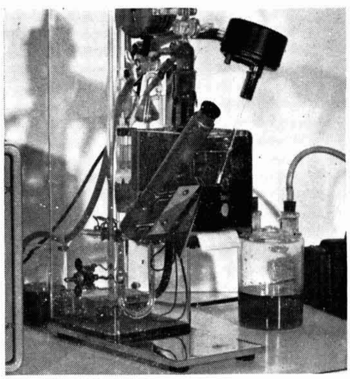

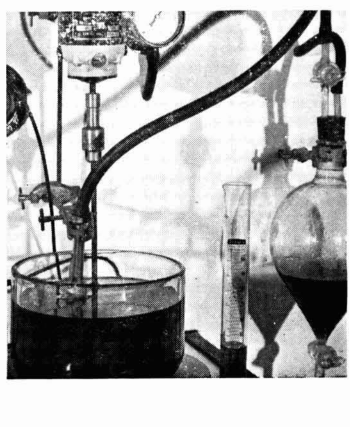

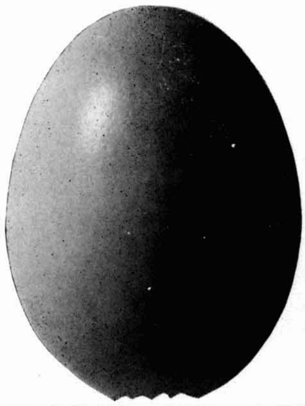

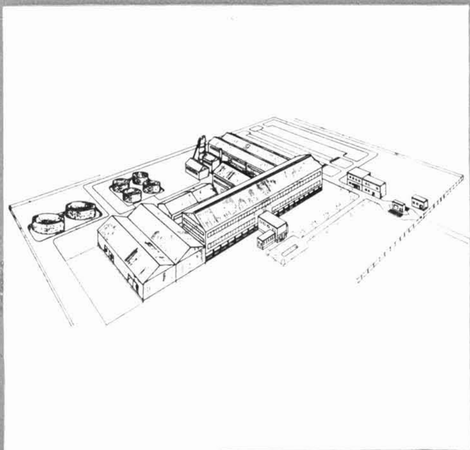

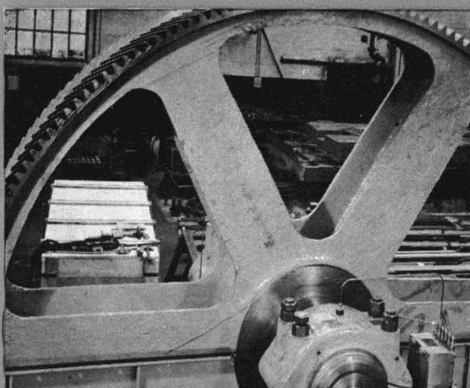

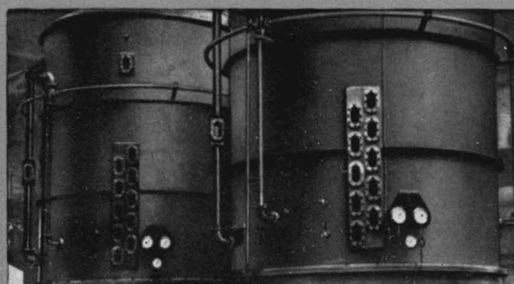

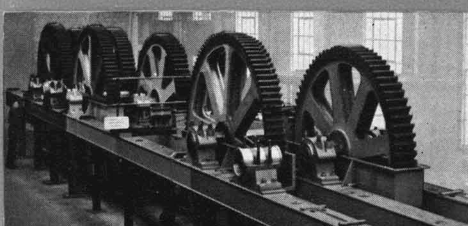

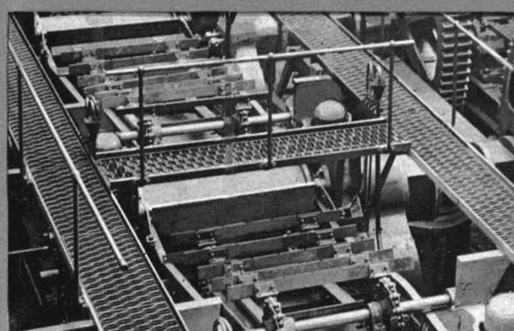

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On décrit le système de diffusion discontinue utilisé en Egypte jusqu'en 1962 et l'on donne des détails sur une modification du système pour l'opération en continu. On discute de la production de bagasse avec l'aptitude requise de pouvoir flotter et l'on considère les avantages du schéma de diffusion proposé.

* * *

Résponse à l'application d'azote pour certaines variétés de canne à sucre dans le Nord de l'Inde. I. J. SINGH et P. P. SINGH. *p.* 167–169

Les données obtenues au cours de la période 1968–69 sont utilisées dans une étude économique comparative sur l'application de fertilisant azoté aux variétés de canne croissant sur une large échelle dans le Nord de l'Inde, à savoir Co 1148, Co 1305 et Bo 32. Les résponses pour des quantités croissantes en azote sont enregistrées, et atteignent des maxima situés à des niveaux qui sont cependant plus élevés que ceux trouvés comme étant les plus avantageux.

* * *

Cristallisoir en continu sous vide. IIe Partie. G. W. LUCE. *p.* 169–172

On discute du rapport de la surface de chauffe au volume de masse-cuite aux divers étages de l'appareil en continu sous vide élaboré par l'auteur, rapporté dans la Ie Partie de cet article, et l'on donne des détails sur l'appareil et son fonctionnement. Après avoir renseigné les données techniques, l'auteur décrit les paramètres qu'on devrait pouvoir attendre d'une unité pilote en vue d'arriver à une installation continue industrielle efficiente.

Kontinuierliche Bagasseextraktion durch Immersion und Flotation. P. NEUVILLE. *S.* 164–167

Es wird das bis 1962 in Ägypten angewandte diskontinuierliche Extraktionssystem beschrieben. Ferner werden Einzelheiten über die Modifizierung des Systems zur kontinuierlichen Arbeitsweise engegeben. Die Gewinnung von Bagasse mit der erforderlichen Flotationsfähigkeit wird diskutiert. Schliesslich werden die Vorteile des vorgeschlagenen Extraktionsschemas aufgezeigt.

* * *

Das Verhalten einiger Zuckerrohrsorten gegenüber Stickstoffdüngergaben in Nordindien. I. J. SINGH und P. P. SINGH. *S.* 167–169

Im Jahre 1968/69 erhaltene Werte wurden zu einer Untersuchung über die Wirtschaftlichkeit von Stickstoffdüngergaben zu den in Nordindien weit verbreiteten Zuckerrohrsorten Co 1148, Co 1305 und Bo 32 verwendet. Das Verhalten dieser Sorten gegenüber steigenden Stickstoffmengen wurde geprüft. Die Mengen, bei denen Maxima festgestellt wurden, lagen jedoch über denjenigen, die sich als am wirtschaftlichsten erwiesen haben.

* * *

Kontinuierlicher Vakuumkochapparat. II Teil. G. W. LUCE. *S.* 169–172

Das Verhältnis von Heizfläche zu Füllmassevolumen in den einzelnen Kammern des vom Autor konstruierten kontinuierlichen Vakuumapparates, über den im ersten Teil dieser Arbeit berichtet wurde, wird diskutiert. Ferner werden Einzelheiten über den Kochapparat selbst und seine Arbeitsweise mitgeteilt. Schliesslich werden die Daten der benutzten Konstruktion und die Parameter aufgeführt, die nach Meinung des Autors aus einem Versuchsapparat erhalten werden müssen, um zu einer leistungsfähigen kontinuierlichen Anlage in Betriebsgrösse zu gelangen.

Difusión continua de bagazo por inmersión y flotación. P. NEUVILLE. *Pág.* 164–167

El autor describe la sistema no-continua de difusión de bagazo que se emplea hasta 1962 en el Egipto y presenta detalles de una modificación a la sistema para operación continua. Discute obtención de bagazo de la requerida habilidad a flotar, y considera las ventajas del esquema sugerida.

* * *

Respuesta de algunas variedades de caña de azúcar al aplicación de nitrógeno en el norte de la India. I. J. SINGH y P. P. SINGH. *Pág.* 167–169

Dados obtenido mientras 1968–69 se usan en un estudio de la economía comparativa de la aplicación de abonos nitrógenos a las muy difundidas variedades de caña del norte de la India, a saber Co 1148, Co 1305 y Bo 32. Se registran respuestas a creciente cantidades de nitrógeno, que alcanzan niveles máximos que exceden ellos que los autores calculan como los más provechosos.

* * *

Cristalizador continuo al vacío. Parte II. G. W. LUCE. *Pág.* 169–172

El autor discute la relación mencionada en el primer parte de este artículo entre la superficie de calentamiento y volumen de masa cocida, a las varias etapas en su diseño de tacho continuo. Presenta detalles del mismo tacho y de su operación, y refiere a los dados utilizados en el diseño y a los parámetros que considera indispensable a obtenir de una planta pilota para arribar a un eficiente planta continua de escala de fábrica.

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Notes & Comments

European beet area, 1970.

F. O. Licht K.G. have recently made their first estimate of the areas to be planted to sugar beet for the 1970/71 campaign in Europe[1]. With the late spring in a number of countries, these estimates must include preliminary proposals and may be subject to considerable revisions as the year progresses. Compared with 1969, the only major change is indicated for Turkey where the beet area is set at 134,205 hectares against 101,908 ha last year. A fall from 97,540 to 84,000 ha is indicated for Hungary while there are minor increases or decreases in other cases. The total area is estimated at 6,634,211 ha, compared with 6,587,077 ha in 1969 but, as is pointed out by C. Czarnikow Ltd.[2], the latter figure is some 160,000 ha less than the initial estimate produced by Licht a year earlier.

* * *

UK sugar beet research.

Programmes of research and education on sugar beet growing have been financed by the industry ever since its reorganization and regulation in 1936. The current programme includes research into breeding, diseases, seed production, machinery, plant physiology, agronomy and variety trials, while advice and education is provided for growers through publications, films, demonstrations, etc. Under the Sugar Act, 1956 the Minister of Agriculture draws up annual programmes of research and education and collects toward their cost contributions from growers and the British Sugar Corporation for each ton of beet delivered. The Act specifies a maximum rate of 3d per ton but this was increased to 4d per ton for three years in 1967, and this maximum rate has now been extended for a further two years from 1st April 1970.

The *British Sugar Beet Review*[3], in an editorial entitled "Good business", has pointed out that this levy represents fractionally under one-quarter of 1% of the 1969 basic price of beet. In the debate in Parliament three years ago the average yield was officially said to have risen from 9·2 to 14 tons per acre in the preceding decade and on the recent occasion the current average was given as about 15 tons, an increase of a further 7%. "By any standards this is good business and the benefit that has accrued to growers over the years would be difficult to overemphasize".

* * *

International Sugar Research Foundation Inc.

At the conclusion of a two-day conference on sugar research in March, Dr. PHILIP ROSS, President of the ISRF, announced in Brussels a major $600,000 research programme designed to increase world sugar consumption. The programme will concentrate on new food applications and the transformation of sugar through chemical and biological processes into products of increased value. These include the use of invert sugar in ice cream manufacture, improvement of finishes for leather and anti-static agents for plastics and textiles. The new programme represents a shift away from research into artificial sweeteners and a concentration of effort into positive research designed to probe deeply into the intricate problems of sucrochemistry.

* * *

World sugar production, 1969/70[4].

The third estimate of world sugar production for 1969/70 campaigns published by F. O. Licht K.G. estimates total world sugar production at 72,323,372 tons against 69,093,899 tons in 1968/69. Figures for Western Europe are almost unchanged from the second estimate[5], at which time official figures for most countries were available. However, the USSR beet sugar crop has proved worse than thought earlier and Licht has again reduced his estimate, now at 8·6 million metric tons, raw value. The Hungarian estimate is raised by 12,000 tons but overall European production is set at 24,372,213 tons as against 25,722,750 tons in 1968/69, while beet sugar production outside Europe is expected to be 85,500 tons less.

[1] *International Sugar Rpt.*, 1970, **102**, (9), 1.
[2] *Sugar Review*, 1970, (963), 58.
[3] 1970, **38**, 107.
[4] F. O. Licht, *International Sugar Rpt.*, 1970, **102**, (11), 1–5.
[5] *I.S.J.*, 1970, **72**, 130.

World cane sugar production is set at 42,769,668 tons, as compared with 38,104,202 tons in 1968/69; the major increase is that for Cuba, from 4,700,000 to 8,000,000 tons. Changes for individual countries in the Caribbean have cancelled each other out so that the estimate for North and Central America is almost unchanged from the 2nd estimate. The estimate for South Africa has been raised, however, by 115,000 tons which accounts for almost all the net change in the estimate for all Africa. Similarly, the 35,000 tons rise in the South American estimate is almost wholly due to a rise in that for Venezuela, and the 46,000-ton increase for Asia is due to a higher estimate for Thailand.

* * *

Puerto Rican sugar industry difficulties.

The US Department of Agriculture has reported that, after two months of the 1970 sugar cane harvest, which started five weeks earlier than last year, only 667,517 tons of cane have been cut—a drop of 730,000 tons—and only 44,844 tons of sugar produced, more than 36,000 tons lower than in 1969[1]. Only 14 of the island's 23 mills are now in production. Spiralling costs and lack of cane cutters have reduced production and another factor has been unusually rainy weather which has contributed to the low average sucrose content, calculated at 6·18% compared with 8·22% in 1968/69 and 9·07% in 1967/68[2]. Operations at Central Mercedita, the island's largest mill, have been crippled by a strike of 800 of the mill's 1000 workers, demanding a 20 cents/hr wage increase over three years.

Some of the Puerto Rican sugar industry's problems were described by JULIO RODRÍGUEZ CHACON, Administrator of the Rehabilitation Programme, at a meeting of the Sugar Club in New York on 10th February[3]: he referred to the laws introduced in 1940 which limited land ownership to 500 acres and thus prevented the sugar companies operating their own plantations and making them dependent on small suppliers. Limits were placed on the working day and week for field workers, and cane growers were taxed to provide unemployment for seasonal workers, even though they might have employment in the off-season. Workers had to have a 40-hour period—a "day of rest"—during the week or be paid double time for the seventh day of work, and a single hour's work counted as a full day for such payment. The statute of limitations on labour claims was set at ten years instead of the 2–3 years applying on the US mainland which again cost the industry millions of dollars.

The extra costs were offset for a time by savings achieved by technical advances, e.g. adoption of bulk handling (although this incurred an extra tax to compensate the stevedores for the loss of their jobs, although there was a shortage of stevedores at the time). With low productivity the cost of labour is so high that it invites mechanization but this has met opposition from the unions, who have also resisted payment by incentive rates rather than hourly rates which apply irrespective of the amount of cane cut.

However, an effective cane harvester has now been developed and opposition to its use has subsided, so that it is anticipated that its use will counteract the effect of the falling numbers of cane cutters, although it is appreciated that mechanically-harvested cane can cause problems in the factory as a result of its higher trash content than manually cut and cleaned cane.

A team is also studying agricultural operations and field techniques in order to modernize and improve them to raise the yield of sugar per acre. It is hoped that solution of these two problems will restore competitiveness and profitability to the Puerto Rican sugar industry.

* * *

UK Sugar Board Annual Report.

The Annual Report for 1969 of the UK Sugar Board was published on the 25th March. During the year—the first of the new International Sugar Agreement—the world market price of sugar fluctuated between extremes of £39 5s and £27 10s, averaging £33 16s 6d, which compares with £21 16s 6d in 1968. The basic domestic ex-refinery price of granulated sugar was kept at an average of £76 5s per ton in January/March 1969 but thereafter averaged a little less than £75 per ton.

The Board's deficit on trading amounted to £32·6 million on 1·7 million tons of Commonwealth and Irish sugar, and the Board also paid £15·8 million to the British Sugar Corporation Ltd. Net receipts of surcharge collected in the year amounted to £54·7 million. The net expenses of the Board and of H.M. Customs and Excise (who collect the surcharge for the Board) were more than offset by dividends received by the Board on their shares in the British Sugar Corporation and by a surplus on interest account. After making provision of £2·1 million for taxation, a cumulative surplus of £2·6 million is carried forward into 1970.

There were 13 changes in the rate of surcharge during the year, varying between $1\frac{3}{4}$d per lb and 3d per lb.

* * *

Cuban harvest progress.

According to official announcements by the Ministry of the Sugar Industry, Cuba produced its 6,000,000th ton of sugar on the 16th April and the 7,000,000th on the 8th May. Although the all-time harvest record of 7,225,000 tons may be broken, the delay between target dates and production dates is increasing and production has fallen 1,000,000 tons below what was scheduled for the 8th May. Daily production figures are down to around 40,000 tons instead of the planned 58,823 tons, and the normal spring rains have started in some areas. While efforts will obvi-

[1] *The Times*, 12th March 1970.
[2] *Sugar y Azúcar*, 1970, **65**, (2), 45.
[3] *Willett & Gray*, 1970, **94**, 71–74.

ously be made to harvest as much cane as possible, the Cuban authorities will no doubt be considering the possible damage to next season's crop in wet fields by heavy machinery, and it has been emphasized before that the current crop was to be not a single large outturn but the start of a new era of large crops in Cuba.

* * *

World sugar balance.

F. O. Licht K.G. recently published their second estimate of the world sugar balance in the crop year September 1969/August 1970[1], as follows:

	1969/70	1968/69	1967/68
	(metric tons, raw value)		
Production	72,389,226	68,254,554	67,841,250
Imports	24,434,925	21,425,791	22,125,635
Initial stocks	18,215,649	19,498,735	19,101,239
	115,039,800	109,179,080	109,068,124
Exports	24,334,973	21,540,438	21,944,939
Consumption	72,005,814	69,422,993	67,624,450
Final stocks	18,699,013	18,215,649	19,498,735
Production increase	4,134,672	413,304	2,199,696
„ „ (%)	6·06	0·61	3·35
Consumption increase	2,582,821	1,798,543	2,167,568
„ „ (%)	3·72	2·66	3·31
Final stocks % consumption	25·96	26·23	28·83

The estimate shows considerably revised figures compared with Licht's first estimates for the period[2]. This is largely due to revision of figures made possible by late publication of official statistics, and the initial stock figure for 1969/70 was therefore reduced by 200,000 tons largely owing to correction of the Cuban figure. Production in 1969/70 is now expected to be 700,000 tons less than in the first estimate, the principal cause being a cut in the USSR crop forecast from 9·5 to 8·6 million tons.

Final stocks are numerically higher by nearly 500,000 tons but are somewhat lower in relation to annual consumption and so are nearer to the three months' requirements figure which used to be considered the normal stock. Licht points out, however, that this stock includes the figure of 2·3 million tons for India, which is not likely to go for export unless a shortage of sugar develops so that prices rise to enable India to export with profit. Against this, he also points out that the consumption estimate includes a figure for the USSR which must be taken with some reserve as it would require the importation of some 4·1 million tons of sugar.

* * *

Guyana sugar crop fears[3].

Mr. Roy Holland, the joint general manager of the UK Sugar Board, said in Georgetown on the 14th April that the Board is deeply concerned about Guyana's serious shortage of sugar for export. He said that the signs are not very promising for Guyana, and the West Indies as a whole, to honour its 1970 sales commitment to Britain. Production at that date in the current spring crop in Guyana was 25,535 tons, 28,155 tons less than expected and over 40,000 tons less than for the same period last year.

The Sugar Producers' Association Chairman, Mr. John Hailwood, attributed the big drop in production to rainfall from early in the crop, a general strike in the industry, a series of national holidays and the payout of nearly $3,000,000 in interim relief, causing a high rate of absenteeism. Mr. Holland said that failure of the Commonwealth Caribbean to fulfil its export market commitments could be disadvantageous to the area during next year's review of the Commonwealth Sugar Agreement.

* * *

Tate & Lyle Ltd. 1969 report.

The fall in profits of the Tate & Lyle Group forecast in the half-year report has been exceeded, according to the full year's figures which show a figure of £8,128,000 compared with £11,309,000 in 1968. The Chairman points out, however, that comparison should be made with the 1967 figure of £9,508,000 since the 1968 accounts included exceptional items resulting from devaluation and a low tax charge resulting from credits for balancing allowances on redundant plant.

Although home and export sales of UK refined sugar were almost the same as in 1968 the profit resulting was cut by a quarter from £3,345,000 to £2,512,000. Rising costs and falling revenue appear to have been halted and prospects for 1970 seem brighter. Production of refined sugar in Canada has increased, and diversification into other fields is continuing. The two Rhodesian refineries continue to operate profitably in the domestic market. Drought reduced the crop and the profit for Caroni Ltd. in Trinidad, while the West Indies Sugar Co. Ltd. in Jamaica suffered a disastrous year. New problems arising in British Honduras are being tackled but the future of the industry in that country depends on obtaining a larger US quota when the Sugar Act is renewed in 1971.

The heavy cost of the starting of the sugar industry in Zambia, with its high loan interest charges, resulted in a heavy loss; however, the higher price for the sugar and raising of further capital should permit increased production at lower cost and greater prospect of profitability. During the year, the Group acquired a 60% holding in Illovo Sugar Estates Ltd. of Natal which produces some 11% of South African output of sugar.

UK engineering subsidiaries—A. & W. Smith & Co. Ltd. and The Mirrlees Watson Co. Ltd.—achieved better results than in any previous year for either Company. Development of associated companies is continuing although certain unprofitable operations, namely Unit Loads Ltd. and Bagasse Products Co. Ltd., are being run down.

[1] *International Sugar Rpt.*, 1970, **102**, (12), 1–2.
[2] *I.S.J.*, 1970, **72**, 65.
[3] *The Times*, 15th April 1970.

Continuous bagasse diffusion by immersion and flotation

By P. NEUVILLE

SUGAR extraction from bagasse by diffusion with water was used from 1908 to 1962 at two Egyptian sugar factories having capacities of 6000 and 10,000 tons of cane per day, respectively. It had the serious drawback of being a batch process and requiring bulk and costly equipment as well as a large, specialized staff. Because of this, the process has been replaced with a so-called continuous diffusion process, which consists rather of washing by a sugar-extracting liquid which percolates through a bed of bagasse.

The process abandoned in 1962 has been succinctly described by DEERR[1]. It involved a series of vessels, filled successively with bagasse and sugar extracting juices, which were linked and through which the juices flowed. The operation was briefly as follows:

Juice withdrawn from the earliest vessel in the battery was chemically treated with a corresponding quantity of mill juice; the mixture was then sent to a vessel freshly charged with bagasse to its maximum level. This same juice was then drawn off by pump from the bottom of the vessel, heated to above 100°C and reintroduced at the top of the same vessel. In this way the juice was clarified and all the bagasse was heated. When the juice filtered by the bagasse was clear on withdrawal from the bottom of the vessel, recirculation was stopped and the clear purified juice sent directly to the evaporator, while the vessel took its place in the normal cycle of battery operation.

The process had the following features: it could only operate with bagasse of good floatability, and the juice in which the bagasse was immersed had a pH of around 7·0 and a temperature of 100°C so that it did not dissolve any harmful or melassigenic substances and sterilized the complete contents of the vessel. Despite a vessel charge averaging 620 kg of cane per cu.m., juice circulation through the vessels of a battery took place without any interruption, no matter what the direction of flow or its changes.

Over many years the bagged sugar yield % sugar in cane was similar to that obtained by the conventional milling process at two other sugar factories subjected to the same chemical control by the same technical personnel. From 1954, following modifications to the process, the yield was increased by 4%. This increase may be attributed to operation in a sterile medium, to greater extraction of sugar from the bagasse, to the absence of sugar losses in clarifier muds and to lower undetermined and molasses losses.

Although the process was a batch operation, it could be made continuous in the following manner: The diffuser would essentially be a vertical column A divided into two parts A_1 and A_2 by a transverse partition (see Fig. 1). This partition is impermeable to the bagasse and has a door D_1 in it as well as an opening connected to a pipe B which leads towards the bottom of the column.

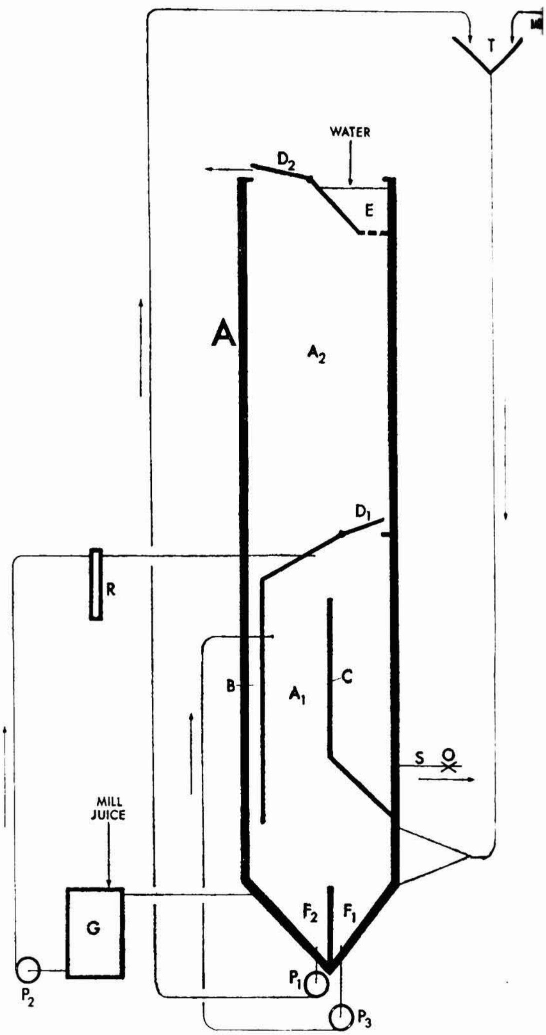

Fig. 1

The lower section A_1 has two partitions: one of them, C, forms with the sides a liquid-tight trough

[1] "Cane sugar", 2nd edn. (Norman Rodger, London) 1921, pp. 253–255.

which is open at the top and is linked to pipe S for valve-controlled discharge of juice from the column; the other partition F divides the bottom of the column into two troughs F_1 and F_2.

Section A_1 is connected to: (1) a bagasse feed funnel T located above the top of the column and connected to the column by a pipe which branches where it leads into the column; (2) a pump P_1 which withdraws juice from the base of the column F_2 and feeds it to funnel T; (3) a chemical treatment station G receiving juice from the bottom F_2 of the column and juices from the cane mills, whence the mixture is delivered by pump P_2 via preheater R to the column; and (4) a pump P_3 which withdraws juice from the bottom F_1 of the column and delivers it back into the column section A_1. The upper section A_2 of the column carries at its top a door D_2 and a constant-level tank E provided with a perforated floor impermeable to the bagasse.

Briefly, the vessel operates as follows: The bagasse enters funnel T to which pump P_1 is continuously feeding juice withdrawn from the bottom of the column. The mixture of juice and bagasse is fed under gravity into the column through the pipe and branched feed. The bagasse introduced into the column rises by virtue of its low density and is stopped by the transverse partition while any heavier particles it contains sink into trough F_1.

The layer of bagasse retained by the partition, which should be as thick as possible, should always, however, have its lower surface at a level above that of the juice discharge via pipe S. The bed thickness is kept constant by operation of door D_1 manually, or automatically by mechanical or electronic means. Automation by mechanical control is based on the pressure drop in the liquor passing through the bed, which is proportional to the bed thickness. Automation by electronic control is based on the difference in conductivity of sugar juice according to whether it contains bagasse or not.

The bagasse continuing to be fed into the column passes through door D_1, the opening of which is proportional to the feed rate, and flows into the upper section A_2 of the column where it is halted at the top by door D_2. The bed of bagasse which forms beneath door D_2 is maintained at a constant thickness by one of the methods described for the bed beneath the partition. Door D_2 is opened in proportion to the bagasse entering the upper section A_2 of the column and allows an appropriate amount of bagasse to leave the column.

Juice circulation takes place as follows: Water circulates from the constant-level tank E, becoming charged with sugar during its progress towards the bottom of the column. It is admitted in an amount proportional to the amount of juice withdrawn through pipe S, allowance being made for the mill juice entering the chemical treatment plant G and the amounts of fresh and exhausted bagasse entering and leaving the column, respectively.

On arrival at the transverse partition, the juice enters the lower section A_1 of the column through pipe B. Pump P_1 takes the juice from trough F_2 to funnel T in a closed circuit while pump P_2 delivers juice from the column via the chemical treatment plant to preheater R. The hot juice then percolates through the bagasse so that part will flow towards the discharge pipe S while the rest is handled by pumps P_1, P_2 and P_3. The delivery of pump P_2 is regulated so as to maintain the contents of the lower section of the column at the optimum temperature. Pump P_3 withdraws from trough F_1 juice which carries heavy particles not attached to the floating bagasse, and delivers them to the lower bed of bagasse which absorbs them.

Various arrangements not shown in the diagram complete the equipment; upper section A_2 of the column is arranged to allow systematic circulation of the juices in counterflow to the bagasse. Control of the mechanical operation of the apparatus is reduced to adjustments in the opening of valve O in proportion to the bagasse feed in the column or to the sugar content of the discharged juice. From the chemical standpoint, control consists in maintaining the pH and the temperatures of the contents of the column at such levels as to obtain good bagasse exhaustion and a discharged juice which is purified and clear.

It will be seen, in any case, that the juice withdrawn through valve O will have been purified and filtered in its passage through a fairly thick layer of bagasse which leaves it clear, suitable for evaporation. And it must be acknowledged that the apparatus described reproduces exactly the Egyptian batch process in a continuous fashion.

Bagasse Floatability

Theoretically a bagasse can be made floatable, just as it can be completely unfloatable, according to the equipment from which it comes. Fresh cane has a specific gravity in the neighbourhood of 1, this overall figure being the resultant of fibre of S.G. 1·5, juice of S.G. 1·08 and a little air. The fibre contains pith which is rich in juice cells and a dry rind which does not hold any juice. When pressed between two smooth surfaces, the pith gives up a large part of its juice. Its cells rupture under pressure and the juice is replaced, more or less, by air. The pith so obtained has a high floatability in liquids because of the air trapped in the cells. The cane rind, having no juice content, is more or less broken under pressure and is discharged without any change in its density. It is obvious that bagasse can float if it is made up of relatively large pieces each of which comprises pith, in which the cells are more or less filled with air, plus a proportionate amount of rind. On the other hand, in a highly defibrated bagasse, the pith in the fragments is more or less separated from the rind. The rind fragments will have a higher specific gravity the less pith that is associated with them, the value reaching 1·5 in some cases.

The pith fragments without any rind contain a proportion of ruptured cells which cannot retain any air, the more so as the cane is defibrated; in the extreme case we have bagacillo or cush-cush which accumulates on the flat bottoms of tanks because of its higher density.

Cane pressed by one or two mills with smooth rollers gives a coarse bagasse of high floatability; it is this bagasse which was used for nearly 20 years in diffusion in Egypt. On the other hand, shredded cane, or cane which has been simply passed through cane knives and then pressed, or even cane which has been squeezed between rollers having low-pitch acute-angle grooves, is more or less highly defibrated. Such bagasse could not be used in the Egyptian batch diffusion process.

Bagasse produced by smooth roller mills, without the use of a shredder or knife sets, when plunged into water, floats with about one-half sticking out of the water and the other half submerged. One kg of such bagasse, kept immersed in water by whatever means, displaces about 2 litres of water, so that its S.G. is about 0·5; this figure is taken as the average below.

Bagasse is composed of fibre and juice in a rough proportion of 1:2. Knowing the S.G. of the bagasse, fibre and juice (respectively 0·5, 1·5 and 1·08) we can find the volume of air retained by immersed bagasse, which is about 1·15 litres per kg of bagasse at 20°C. A sample of this bagasse, completely immersed in water and rubbed by hand to effect a physical classification by flotation of its fragments by size, will only have short and fine fibres sinking to the bottom of the container, and their proportion will be smaller than that given by dry screening. By contrast, a sample of shredded bagasse, totally immersed in water can float, strickly speaking, but with the slightest rubbing or with an increase in hydrostatic pressure, a classification will be effected and a fairly large proportion of heavy fibres of varying size will sink to the bottom of the container.

The Egyptian system of batch diffusion with vessels could only be carried out with a bagasse of good floatability, under which circumstances the following phenomena were found to occur:

(1) The circulation of the sugar-extracting juices through the vessels in a discontinuous battery diffuser could be accelerated or decelerated instantaneously.

(2) The perforated screens in the bottom of the vessels were never blocked, since otherwise diffusion would have been impossible in practice.

(3) The pressure loss in juice flowing from top to bottom of the vessel was about 70 g/sq.cm., which corresponded to the force of floatability of the bagasse contents and which was present no matter what was the rate of flow.

(4) Considerable pressure was exerted on the internal face of the upper door in a vessel full of bagasse and juice which had been isolated from the battery and exposed to atmospheric pressure by opening the air valve.

(5) Circulation in the vessels was always from top to bottom and was impossible from bottom to top, since the bagasse would then have hit against the perforated screens at the top of the vessel and would have blocked the holes.

However, it is not sufficient for the process just to produce a bagasse of high floatability; the floatability must also not be lost subsequently. When a fragment of mill bagasse having great floatability is kept under water and squeezed in the palm of the hand, for instance, it loses its floatability; the air retained by the bagasse is expelled and its specific gravity becomes greater than 1. The bagasse discharged from the batch diffusers no longer has any floatability, because it has lost all its air through packing.

Some of the fragments of a bagasse passed through a centrifugal pump will lose all floatability, whereas bagasse immersed in water under hydrostatic pressure of 1 kg/sq.cm. will retain all its floatability. Thus:

(a) Tests have shown that bagasse introduced under gravity at the bottom of a column about 12 metres high, filled with water, will keep all its floatability.

(b) Knowing the fibre, juice and air content of a bagasse, we can find its S.G. at different pressures and temperatures. Calculation shows that under pressure heads of 10 metres and above, even at 20°C, the bagasse S.G. is very much lower than 1 and this is even more the case for temperatures above 20°C.

(c) The use of a battery of 12 vessels, of which 10 are in operation, involved a thrust on the tail vessel of about 700 g/sq.m. Allowing for a vessel depth of 3 metres, immersion of the bagasse corresponded to a head of 10 metres. Since circulation of the juices through the battery was maintained, it is certain that the bagasse did not clog the perforated bottoms of the vessels and that it retained all is floatability.

Other evidence demonstrates the floatability of the bagasse used in the Egyptian batch diffusion process; if the bagasse had not floated, it would have remained stationary in the vessels and the solid impurities in the juices percolating through the bagasse during the heating circulation or the filtration of juice in the bagasse filters would have been forcibly retained by the upper layer of the bagasse bed in the vessel or filter. This was not the case; all the bagasse was uniformly contaminated, which is proof of the mixing of the bagasse and, consequently, of its flotation.

It may be concluded that bagasse of the type produced in Egypt for batch diffusion undoubtedly does have great floatability.

Production of Bagasse of High Floatability

Bagasse having high floatability was produced in Egypt by two methods: (1) up to 1925, by mills with smooth rollers; the bagasse had considerable floatability but included numerous pieces of flattened cane in the form of crushed "cigars" which were therefore not open and which made sugar extraction difficult; and (2) subsequently, by mills with rollers having deep, wide-pitch rollers which exerted a moderate grinding effect on the bagasse. This bagasse was composed of very open pieces which floated well and made sugar extraction easy, but also contained a greater proportion of fine particles than did bagasse from the smooth roller mills. Since the crushing capacity of the grooved rollers was 2–3 times that of the smooth rollers, despite the slight reduction in floatability that they cause, no thought was ever given to the idea of reverting to smooth rollers.

SUMMARY

Bagasse diffusion by immersion and flotation was used for more than 50 years in two large Egyptian sugar factories without trouble. The process was abandoned because it was a discontinuous process and after 50 years the very expensive machinery used was due for replacement. However, the process, notable for its results as regards bagged sugar recovery, could have been made continuous.

From an economics viewpoint its advantages are numerous: it permits a greater extraction of sugar, since the process takes place in a perfectly sterile medium at around neutral pH which is uniform for all the bagasse, and because it does not involve unknown losses through various spoilages in clarifier muds and melassigenic substances formed during processing. It has low power requirements, since the cane is only slightly crushed, and its displacement in the vessel is brought about by its own force of flotation.

It eliminates clarifiers and mud filters, and obviates the need for disposal of clarifier muds. It permits steam economies through less heating, more complete use of recycled condensate, and the possible reduction in live steam consumption as a result of reduced exhaust steam formation and hence a drop in fuel consumption. It also permits a reduction in labour requirements and in maintenance costs. For the reasons stated it involves lower capital investment costs than any other process giving similar results.

Response of some sugar cane varieties to nitrogen application in North India

By I. J. SINGH and P. P. SINGH*

SUGAR cane is a cash crop to the Indian farmers and is a source of export sugar which can earn foreign exchange for the country. Since the introduction of the high-yielding and short-duration varieties of cereal crops in 1966, more emphasis has been laid on growing two to three or four crops of cereals in a crop year instead of growing only one crop of sugar cane. Nevertheless, sugar cane continues to occupy about 2·2 million hectares of land out of the 135·8 million hectares of net cropped area in India. New high-yielding and disease-resistant varieties of sugar cane are being evolved in different research stations all over the country. All these efforts are being made to increase sugar cane yield because of the importance of this crop from the individual farmer's and the national point of view.

One of the important measures to step-up sugar cane production has been application of fertilizers. In view of the limited supply and increasing demand for fertilizers, it is necessary to know the most profitable level of fertilizer application for the farmer who ultimately sells his produce to the factory owner for making sugar. Estimation of the optimal dose of fertilizer becomes even more important in the regions where sugar cane occupies a larger area. In North India, for example, sugar cane occupies about 68% of the total area devoted to the crop in the country. As a result, more sugar factories are concentrated in this part of the country.

High-yielding sugar cane varieties such as Co 1148 and Co 1305 were developed at Central Research Station, Coimbatore (Tamil Nadu) and are widely sown in North India. In addition to these two varieties, Bo 32 is a common variety in Bihar and Orissa where it was developed.

A wealth of published data on fertilizing sugar cane is available for North India. For example, SINGH[1] reviewed earlier work done by MUKERJI[2], IYER and PANDE[3] and PRAMANIK *et al.*[4] and observed that ammonium sulphate application did not accelerate sugar cane yield decline as claimed by earlier workers. Further on the basis of experimental evidence, SINGH[5] concluded that the best way of securing high sugar cane yield is by heavy and balanced fertilization of the crop. SETH and KHANNA[6] worked out the economics of various crops, including sugar cane, grown by farmers in North and South India. JAKATE[7] concluded that a balanced application of

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[1] *Fertilizer News.*, 1963, **8**, (4), 9–13.
[2] *Symp. National Chemical Lab.* (Poona), 1951.
[3] *Proc. Conf. Sugarcane Res. Workers*, 1954, 32–33.
[4] *Indian Farming*, 1954 **4**, (4), 175–181.
[5] *Fertilizer News*, 1966, **11**, (4), 1–5.
[6] *ibid.*, 1963, **8**, (11), 14–18.
[7] *ibid.*, 1965, **10**, (7), 21–25.

N-P-K on sugar cane gave maximum yield and highest net profit per acre. SETH and ABRAHAM[8] estimated the response of different crops, including sugar cane, to nitrogen application and their related economics. CHANDNANI[9], on the basis of results of experiments conducted in different parts of India, concluded that urea is a very good source of nitrogen for sugar cane and is preferred to ammonium sulphate because of its low cost. Discussion on the varietal response of sugar cane to nitrogen, however, has been left untouched by these workers; this may have been due to paucity of data on this aspect when these authors reported their findings. The introduction of high-yielding varieties such as Co 1148 and Co 1305 however, has necessitated a comparative study of fertilizing these varieties. Therefore, the present article attempts to study comparative economics of fertilizing the common sugar cane varieties of north India, viz. Co 1148, Co 1305 and Bo 32, with the following specific objectives:

(1) to study the response of the three varieties to various levels of nitrogen application,

(2) to determine the most profitable level of nitrogen application for all the three varieties, and

(3) to compare the total revenue, total cost and net profit resulting from the application of nitrogen to the three varieties.

DATA AND METHODOLOGY

The data used in this article were obtained from an experiment conducted at the Experiment Station of U.P. Agricultural University, Pantnagar, (Nainital) India, during 1968–69. Three varieties of sugar cane (Co 1148, Co 1305 and Bo 32) were tested at five nitrogen levels (0, 75, 150, 225 and 300 kg N/ha) in a split plot design with three replicates. Varieties were taken in main plots and levels of nitrogen in sub-plots. The experimental crop was planted in the fourth week of October 1967 and harvested in the first week of February 1969. A uniform dose of P_2O_5 (as single superphosphate) and K_2O (muriate of potash) each at the rate of 100 kg per hectare was applied at the time of planting. Nitrogen was applied in the form of urea with 46·60% nitrogen. All plant protection measures were followed whenever they were required. The crop was irrigated four times before the monsoon and once after the monsoon.

A quadratic production function of the following form was fitted to the nitrogen-sugar cane yield data for each variety:

$$Y_e = a + bN - cN^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where Y_e is estimated sugar cane yield in metric tons per hectare, N is nitrogen application in kilograms per hectare, a is sugar cane yield per hectare in metric tons at zero level of nitrogen application and b and c are coefficients of N and N^2 indicating transformation ratios at different magnitudes of N. The values of a, b and c were calculated by the method of least squares.

The most profitable level of nitrogen application (N) for each variety was estimated by differentiating equation (1) with respect to N and then equating to the nitrogen-sugar cane price ratio. That is,

$$\frac{dY_e}{dN} = b - 2cN = \frac{P_N}{P_Y} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

or

$$N = \frac{bP_Y - P_N}{2cP_Y}$$

where P_N/P_Y is the nitrogen-sugar cane price ratio.

[8] *Fertilizer News*, 1965, **10**, (12), 31–39.
[9] *ibid.*, 122–127.

Table I. Estimated total and response yield due to nitrogen application

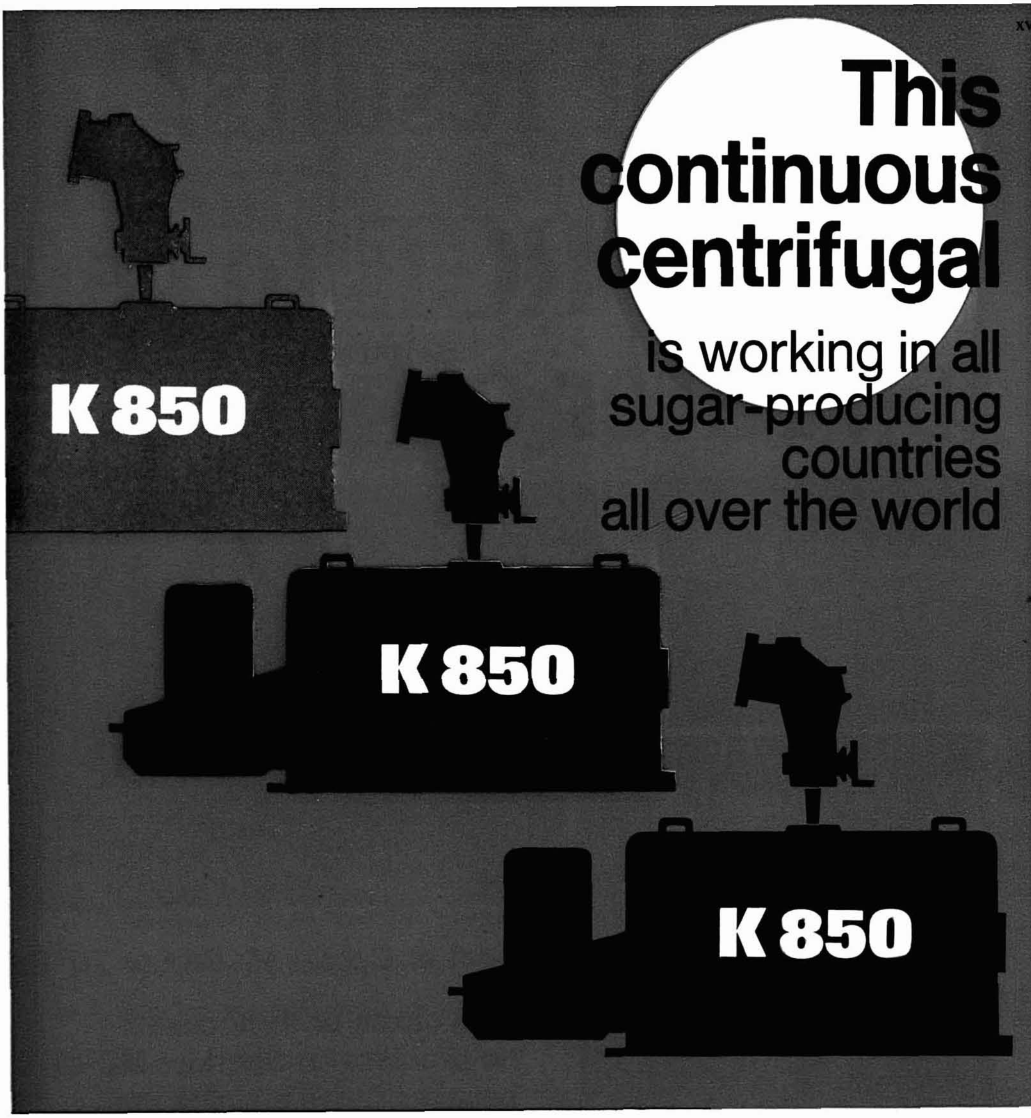
Amount of nitrogen applied (kg/ha)	Co 1148: *Total expected yield (metric tons/ha)*	Co 1148: *Response yield (metric tons/ha)*	Co 1305: *Total expected yield (metric tons/ha)*	Co 1305: *Response yield (metric tons/ha)*	Bo 32: *Total expected yield (metric tons/ha)*	Bo 32: *Response yield (metric tons/ha)*
0	108·27	0	101·22	0	86·44	0
25	114·59	6·32	107·64	6·42	90·13	3·69
50	120·07	11·80	113·32	12·10	93·37	6·93
75	124·72	16·45	118·24	17·02	96·15	9·71
100	128·53	20·26	122·40	21·18	98·48	12·04
125	131·50	23·23	125·81	24·59	100·36	13·91
150	133·64	25·36	128·47	27·25	101·78	15·33
175	134·94	26·66	130·37	29·15	102·74	16·30
200	135·40	27·12	131·51	30·29	103·25	16·81
225	135·02	26·75	131·90	30·68	103·31	16·86
250	133·81	25·53	131·54	30·32	102·91	16·47
275	131·76	23·48	130·42	29·20	102·06	15·61
300	128·87	20·59	128·55	27·33	100·75	14·31

NOTE: Total sugar cane yields in metric tons per hectare (Y_e) for respective levels of nitrogen (N) application were estimated by fitting the following equations:—

(a) Co 1148: $Y_e = 108{\cdot}27 + 0{\cdot}269576N - 0{\cdot}000669N^2$, $R^2 = 0{\cdot}870$
(b) Co 1305: $Y_e = 101{\cdot}22 + 0{\cdot}272246N - 0{\cdot}000603N^2$, $R^2 = 0{\cdot}831$
(c) Bo 32: $Y_e = 86{\cdot}44 + 0{\cdot}156786N - 0{\cdot}000363N^2$, $R^2 = 0{\cdot}864$

Sugar cane yield responses (Y_r) due to nitrogen application for each variety were estimated by fitting the following functions:—

(1) Co 1148: $Y_r = 0{\cdot}269576N - 0{\cdot}000669N^2$
(2) Co 1305: $Y_r = 0{\cdot}272246N - 0{\cdot}000603N^2$
(3) Bo 32: $Y_r = 0{\cdot}156786N - 0{\cdot}000363N^2$



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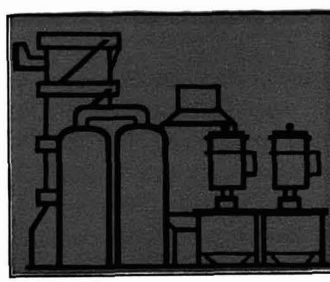

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Empirical Results

Varietal Response to Nitrogen

Table I as well as Fig. 1 show that Co 1148 variety of sugar cane gave maximum total as well as response yield per hectare when 200 kg of nitrogen were applied. With Co 1305 and Bo 32 the maximum total as well as additional yields due to nitrogen application were obtained by applying 225 kg nitrogen per hectare. They show that, even at the higher nitrogen dosage, the total and response yields of Co 1148 and Bo 32 varieties were smaller than the total and response yields of Co 1305 cane. At 200, 225 and 225 kg nitrogen application, total yield per kg of nitrogen for Co 1148, Co 1305 and Bo 32 were 677, 586 and

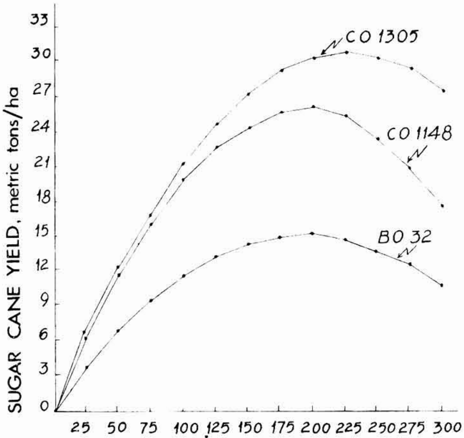

Fig. 1. Varietal response to nitrogen application

458 kg per hectare respectively. Response yield per kg of nitrogen application at 200, 225 and 225 kg nitrogen per hectare were 136, 136 and 75 kg per hectare with Co 1148, Co 1305 and Bo 32 varieties respectively. These findings reveal that variety Bo 32 is a low yielder and gives much lower response to nitrogen application compared with Co 1148 and Co 1305 varieties. They further show that Co 1148 gives higher total yield than Co 1305 at various levels of nitrogen application but that the yield response to nitrogen application is lower from the former than the latter.

Most Profitable Level of Nitrogen Application and Net Profit

The most profitable level of nitrogen application and net profit incident to nitrogen application from each variety are shown in Table II. For estimating the most profitable level of nitrogen application, cane was valued at the mill delivery price of Rs.96.20 per metric ton and nitrogen in the form of urea (including the purchase price of the fertilizer and the cost of application) was valued at Rs.210.30 per quintal.†

† The breakdown of nitrogen cost was as follows:
Urea with 46·6% nitrogen at Re 0.95 per kilogram and Re 0.03 cost of applying one kilogram of urea. Thus the cost of nitrogen is Rs. 2.1030 per kilogram.

Table II. Quantity of nitrogen applied and net profit per hectare due to nitrogen application at the most profitable level of nitrogen application

Variety	*Most profitable level of nitrogen (kg/ha)*	*Total revenue (Rs.)*	*Total cost (Rs.)*	*Net profit (Rs.)*
Co 1148	185	2563.10	389.06	2174.04
Co 1305	208	2901.30	437.43	2463.87
Bo 32	186	1577.00	391.16	1185.84

At the most profitable level of nitrogen application, net profit per hectare due to nitrogen application was higher from Co 1305 than from Co 1148 and Bo 32. Net profit per kilogram of nitrogen was also higher from Co 1305 than from Co 1148 and Bo 32, being Rs.11.84, Rs. 11.75 and Rs.6.38 respectively (Table II). These findings show clearly that Co 1305 and Co 1148 have good potential for increasing production as well as farm incomes. Bo 32 variety gives low yield as well as low profit compared with Co 1148 and Co 1305 varieties.

Conclusion

This study showed that cane variety Co 1305 was highly responsive to nitrogen application followed in order by Co 1148 and Bo 32 varieties. The optimum doses of nitrogen application giving maximum production response to nitrogen were 200 kg, 225 kg and 225 kg per hectare for Co 1148, Co 1305 and Bo 32, respectively. The most profitable levels of nitrogen application for Co 1148, Co 1305 and Bo 32 were 185, 208 and 186 kg per hectare, respectively. Net profits incident to the application of nitrogen at the most profitable levels of nitrogen application were Rs.2174.04, Rs.2463.87 and Rs.1185.84 per hectare from Co 1148, Co 1305 and Bo 32, respectively, showing the relative profitabilities of these varieties.

Acknowledgments

The authors wish to express their sincere gratitude to Dr. N. K. Anant Rao, Dean, College of Agriculture, and Dr. R. L. Paliwal, Director, Experiment Station, for providing all the facilities for completing the experiments. Thanks are due to Dr. Ambika Singh, Professor of Agronomy, for his constructive criticism of the original manuscript.

Brevities

Malaysian sugar expansion prospects[1].—The Malaysian Government is soon to open up 10,000 acres of land in the northern state of Perlis for sugar cane planting. Similar schemes are also being prepared in some west Malaysian states.

* * *

New sugar factory for Nigeria[2].—The Commonwealth Development Corporation is to establish a sugar cane plantation and to build a sugar factory in Nigeria. The cost of the project will amount to £5,000,000.

[1] *Public Ledger*, 11th April 1970.
[2] F. O. Licht, *International Sugar Rpt.*, 1970, **102**, (9), 6.

Continuous vacuum crystallizer

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PART II

Ratio of heating surface area to massecuite volume

The first step towards the design of the continuous vacuum pan is to select the most desirable boiling temperature for the massecuite and the maximum safe crystallization velocity at this temperature. The next step is to determine the concentration of the syrup required to produce the desired crystallization velocity at the given temperature which will then make it possible to select the proper operating pressure within the unit to maintain the boiling temperature constant at the given concentration.

Now comes the problem of designing into the unit the proper balance between evaporation and crystallization which will produce the desired crystallization velocity. The rate of evaporation is a function of the overall coefficient of heat transfer, the temperature differential between the steam used as the heating medium and the temperature of the boiling massecuite, and the heating surface area available. The rate of crystallization is a function of temperature, concentration and the crystal surface area available.

The overall coefficient of heat transfer, the steam temperature or pressure, the temperature of the boiling massecuite and the concentration of the syrup are all essentially constant. With these factors remaining constant the rate of evaporation is then a function of heating surface area and the rate of crystallization a function of crystal surface area which in turn can be related to massecuite volume.

The ideal operating conditions can be realized by determining the proper relationship between heating surface area and crystal surface area at all stages of crystal growth, by relating crystal surface area to massecuite volume and designing each chamber for the proper ratio between heating surface area and massecuite volume.

In the Luce continuous pan the volume of each chamber increases in proportion to the increase in massecuite volume, so that there is the same number of crystals in the first chamber as in the last. Owing to the increase in crystal size the last chamber will have a much greater total crystal surface area available than the first chamber but, conversely, a given volume of massecuite in the first chamber will have a greater crystal surface area available than an equal volume of massecuite in the last chamber. This point should be clearly understood since the total heating surface in each chamber increases from the first to the last but the ratio of heating surface area to massecuite volume is progressively reduced.

As an illustration, a cubic foot of massecuite made up of 80% syrup and 20% commercial powdered sugar would contain a total crystal surface area of approximately 830 square metres. Even by increasing the crystal content to 55%, a cubic foot of massecuite made up of syrup and granulated crystals would contain a total crystal surface area of only 276 square meters.

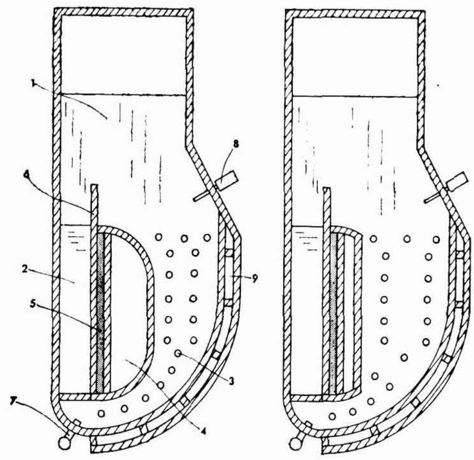


Fig. 5. Cross-sections of continuous crystallizer

1—vertical baffle; 2—sloped baffle; 3—heating element; 4—hollow core used as heating element; 5—insulation; 6—retainer plate; 7—feed syrup inlet; 8—thermometer; 9—steam jacket.

As previously stated, it would be possible to design an ideal unit which would produce the optimum crystallization velocity in each chamber by designing each chamber for the proper ratio of heating surface area to crystal volume. This could be done with a unit constructed similar to that shown in Fig. 2 but the cost of construction would be prohibitive for this type of heating arrangement. The arrangement shown in Fig. 1 is more practical, allowing one steam inlet at the feed end and one steam outlet at the discharge end of the unit. With this construction the ratio of heating surface to massecuite volume, from feed to discharge, can be reduced uniformly but each chamber cannot be treated individually. The most desirable crystallization velocity is then designed into the first and last chambers and the crystallization velocities of the intermediate chambers calculated to ensure that they approach the desired value without going beyond the safe limit of growth rate.

Fig. 5 gives two cross-section views of the unit drawn in Fig. 1 and shows the manner in which the ratio of heating surface area to massecuite volume is reduced from feed to discharge in this particular unit. The cross-section of the shell is constant, the cross-section of the heating surface is reduced slightly and the massecuite volume increased uniformly as the cross-section of the shaft is reduced uniformly.

Also shown in Fig. 5 are cross-sectional views of another important item, the retaining plates. Their function is to maintain the proper volume of massecuite in each chamber and to maintain the level of the massecuite above the heating surfaces under non-boiling conditions.

Details of the continuous crystallizer

The complete unit as drawn in Fig. 1 consists of an enclosed shell (1) which is maintained under vacuum during operation. At each end of the shell are attached steam chests (2). At the top of the shell is a catch-all (3) of standard design which connects to a barometric condenser through the vapour outlet (4). Within the shell are vertical flat plate partitions (5) forming individual boiling compartments, the partitions being spaced an increasing distance apart beginning at the feed end of the unit. Sloped flat plates (6) form individual non-boiling compartments and connect the upper portion of one boiling compartment to the lower portion of the succeeding boiling compartment. The combination of one boiling compartment and the adjacent non-boiling compartment comprises a single-pass evaporating and crystallizing chamber.

Running through the centre of the shell is a hollow shaft (7) terminating in the tube sheets (8) at each end and opening into the steam chests. The thickness of this shaft decreases towards the discharge end of the apparatus, proportionately increasing the cross-sectional area of the space occupied by the massecuite and reducing the ratio of heating surface area to massecuite volume from feed to discharge. The shaft also forms a portion of the heating surfaces with which the pan is equipped but is insulated from the non-boiling compartments by the heat barrier (12). Running through the vertical partitions (5) are heat exchanger tubes (10) terminating in the tube sheets and open to the steam chests. These tubes supply another portion of the unit's heating surfaces and are spread out slightly towards the discharge end in proportion to the decrease in the shaft thickness. This provides even heat distribution throughout the space occupied by the boiling massecuite. To complete the heating surface requirements, the shell is partially jacketed (11) on the boiling side of the unit. This jacket also terminates in the tube sheets and is open to the steam chests at each end of the shell. The steam chest at the feed end of the unit is equipped with a steam inlet (13) and the steam chest at the discharge end of the pan is equipped with a condensate outlet (14), the entire heating system functioning as a single-pass heat exchanger. In operation it is desired to isolate the tube sheets from contact with the massecuite. At the feed end a dead space (15) is inherent in the construction of the unit while at the discharge end a bulkhead (16) is provided for installing a suitable insulating material (17) between this bulkhead and the tube sheet.

An inlet (18) for introducing a seed magma is provided in the non-boiling compartment of the first chamber. At the entrance to each boiling compartment are syrup inlets (19) extending from a syrup header (20). Each individual syrup inlet is provided with a control valve (not shown) and the header is equipped with a master control valve (also not shown). The last non-boiling compartment (22) connects to a massecuite discharge chute (23) leading to the rotary airlock (24) where the finished product is discharged from the pan. A barometric leg could be used to replace the airlock which would require no moving parts and would eliminate any danger of shearing the crystals as could happen in the airlock.

In operation a seed magma is continuously introduced into the first non-boiling compartment through the seed inlet where it moves downward, joining with feed syrup introduced through the first syrup inlet at the opening to the first boiling compartment. In the first boiling compartment the massecuite reaches a state of ebullition and spills over the retaining plate into the second non-boiling compartment. In this manner the massecuite flows continuously from feed to discharge, the crystals continuously growing by means of the evaporative and crystallizing process taking place in each individual single-pass chamber and through the introduction of a continuous supply of feed syrup in each chamber.

In the continuous crystallizer the depth of the massecuite is never more than a few inches above the heating surfaces, almost eliminating the effects of hydrostatic head, and each elementary volume of massecuite must follow the same positive flow path as every other elementary volume of massecuite.

It should also be understood that the number of passes or circuits the massecuite makes past the heating surfaces, has little to do with promoting crystal growth; only temperature, concentration and time affect the growth of the crystals. It is highly desirable to maintain the temperature and concentration as uniform as possible throughout the massecuite, both on the boiling side and non-boiling side and although there will be some variation in these factors they will approach uniformity a great deal closer than that found in batch pans. Although the above suggests the actual number of passes made by each elementary volume of massecuite is irrelevant, the number of passes made in the continuous unit is comparable to those in the calandria pan and can be made more or less, as desired, by installing the desired number of partitions forming the process chambers.

The effects of the high viscosity of the massecuite on circulation or flow of material in process should also be considered. In the continuous unit these effects will be much less detrimental than in calandria pans because the linear velocity of the elementary volumes of massecuite will not be as high as in the calandria pans. In the calandria pan, to circulate 2000 cubic feet of massecuite in one minute through a downtake six feet in diameter requires an average linear velocity of over 70 feet per minute. For an elementary volume of massecuite to make the same number of circuits in the continuous crystallizer the linear velocity will be less than 15 per minute. This reduced velocity is the result of two factors: first, the path the massecuite follows in the continuous crystallizer, passing downwards through the non-boiling compartment and then upwards past the heating surfaces, is much shorter than in the calandria pans. Second, a greatly reduced quantity of massecuite is retained in the continuous unit for the same production rates as a calandria pan. It might also be mentioned at this time that though the massecuite is not actually boiling on its downward travel in the non-boiling compartment it will still maintain a temperature near that of boiling consistent with the absolute pressure in the unit. On the boiling side of the continuous unit the spacing between the heating elements is quite close in the first stage at the feed end (one inch at feed and two inches at discharge) but the grains are small and the true crystal volume low. In the second stage the spacing is one and one-half inches at feed, opening up to three and one-half inches at discharge. A horizontal discontinuous pan with plate heaters is now on the market with a spacing of only two inches between the heating elements which of course also means this same spacing when the massecuite is matured and has a high true crystal volume and high viscosity.

Design data and pilot unit

A complete set of calculation and mathematical procedures has been prepared for the design of a two-stage continuous granulated sugar unit and has been corroborated by an acknowledged expert in the field of the mathematics of sugar boiling. Because the calculations are quite lengthy and the data upon which these calculations are based are not reliable for practical applications, they are not presented herein.

Data concerning crystallization velocities were obtained from published works of investigators whose results are not only somewhat conflicting but have been determined from laboratory experiments under ideal conditions. For the temperatures found in the continuous pan, the laboratory data break off at a supersaturation of 1·03. Since it is generally accepted that during the crystal growth period the supersaturation approaches 1·20 for granulated strikes, it is almost impossible to correlate published data with actual practice.

As noted by G. V. GENIE in his paper presented to the 15th Technical Conference of the British Sugar Corporation Ltd.[1]: "Unfortunately, we have in the sugar industry very few reliable tables of parameters even as simple as liquor specific gravity, sucrose solubility or crystallization velocity at temperatures between 60°C and 80°C and this restrains the practical use of such calculations. Sugar technologists should be conscious that the need of fundamental research in their industry is critical and will shortly impede its progress."

To ensure efficient results from a continuous unit of commercial size it will first be necessary to obtain the following data from a pilot unit:

1. Overall heat transfer rates.

2. Data concerning crystallization velocities, particularly the maximum growth rates possible without danger of false grain.

3. The influence of the distance between the walls of the circulating path on the flow of movement of the massecuite.

4. The increase in massecuite volume under boiling conditions and hence the proper heights for the retainer plates.

5. The influence of introducing the feed syrup at different points of the individual chambers.

[1] *I.S.J.*, 1962, **64**, 260.

Brevities

Denmark sugar industry contraction[1].—According to the US Dept. of Agriculture, the Danish Government is to adopt from 1st May 1970 a ten-year plan for the gradual reduction of sugar production to the level of domestic needs and thereby reduce the financial cost to the State. Sugar production at the Government-guaranteed price reached 248,000 metric tons in 1969 and will fall to 240,000 tons in 1970 and to no more than 170,000 tons by the end of the plan. It is expected that this policy will entail the closure of one of the six Danish factories.

* * *

Spanish sugar industry reorganization[2].—A reorganization programme for the sugar industry has been prepared for the Minister for Industry in Spain. It covers the period 1970–78 and includes among its objectives raising average factory capacity from the present 1670 tons of beet per day to not less than 3000 tons/day, introduction of modern techniques in the new factories (analytical laboratories, automatic unloading, continuous diffusion, mechanical handling of sugar and pulp, etc.), and closure of 12 factories of between 700 and 1400 tons/day capacity. Construction of eight factories is envisaged, as well as the enlargement of three others. Thus by 1978 Spain will have 36 beet sugar factories with a total daily capacity of 108,650 tons (averaging 3018 tons/day each). The cost of the programme will total 9,790,000,000 pesetas (£59,000,000).

[1] *Agence France-Presse*, 10th January 1970; through *Sucr. Belge* 1970, **89**, 168.
[2] *L'Usine Nouvelle*, 1970, (8), 37; through *Sucr. Belge*, 1970, **89**, 168.

Sugar cane agriculture

Studies on the weed flora of sugar cane fields and their influence on growth, tillering, millable cane production and yield. R. P. SINGH and I. D. VERMA. *Indian Sugar*, 1969, **19**, 17–20.—Results are given of a number of field trials laid out at the Sugarcane Research Station, Shahjahanpur from 1957 to 1965. Normally weeded and unweeded control plots were maintained. Among the various weeds infecting the cane, 8 were common and important. The prevalence of individual weeds varied from plot to plot. On the unweeded plots cane growth, tillering, millable cane production and yield were all very adversely affected. as would be expected.

* * *

Response of sugar cane to nitrogenous and phosphatic fertilizers in the alluvial soils of Maholi Zone (District Sitapur), U.P. B. SINGH and A. N. VERMA. *Indian Sugar*, 1969, **19**, 23–26.—An account is given of 16 manurial trials, to assess the fertilizer needs in cultivators' fields, over two consecutive years. There were four levels of nitrogen and 3 of phosphate, 3 popular cane varieties being used. Results showed that one type of soil needed only N and the other N plus P_2O_5 for high yields and economical returns.

* * *

Effect of growth regulating substances on juice quality and yield of sugar cane (a review). K. SOOKASHTHAN and M. S. S. RAO. *Indian Sugar*, 1969, **19**, 29–36.—In this article experimental work with growth-promoting substances in sugar cane countries all over the world is reviewed. Results have not been consistent, probably because of the large number of uncontrollable factors involved. So far the use of hormones or growth-promoting substances in improving cane quality or yield has remained of academic interest only.

* * *

Progress of mechanical harvesting in Queensland sugar cane fields. L. G. VALLANCE. *Australian Sugar J.*, 1969, **61**, 133–146, 150–165.—This is a special and lengthy report on all aspects of mechanical harvesting of sugar cane in Australia. For the 1968 season there was again a marked perference for chopper-harvesters and 236 new machines went into operation compared with 63 new whole-stalk harvesters. In all, 1622 machines harvested about 12½ million tons of cane.

* * *

Studies on orchard farming for the sugar industry. ANON. *Sugarland* (Philippines), 1969, **6**, (3), 12–14, 36–37, 40.—The advisability of converting some of the marginal sugar cane areas to fruit orchards or tree crops is discussed and recommendations made for specific areas. Among the fruits recommended are various citrus fruits, guava, chico or sapodillo, lanzan, rambutan, bananas, mango and mangosteen. Coffee, coconuts and cocoa are also suggested for some areas.

* * *

The use of bipyridyls in sugar cane. G. M. CHAMBERS. *Sugarland* (Philippines), 1969, **6**, (3), 22–24, 27.—The bipyridylium compounds "Paraquat" and "Diquat" were discovered in 1955 in England. The paper presents the ways in which they may be utilized in sugar cane production by improved weed control, increased harvesting efficiency, and by providing a chemical method of controlling undesirable cane flowering.

* * *

Labour versus mechanization: competition or co-operation. D. K. MORROW. *S. African Sugar J.*, 1969, **53**, 498–501.—The writer states that despite opinions to the contrary, abundant labour is available in the South African agricultural framework. According to the Department of Bantu Affairs, a considerable reservoir of untapped, unskilled labour exists. It is considered that the sugar cane industry in South Africa can make substantial savings by: (1) training, organizing and motivating its labour and providing it with better tools, (ii) increasing the use made of existing machinery and (iii) introducing light, mobile power units for specific field operations. It is thought that greater use might be made of light 2 to 10 h.p. pedestrian controllable power units, as in other countries. The hand-hoe, favoured by the Bantu for weeding, is a heavy tool, really a soil-turning implement. Greater use might be made of the Dutch hoe and the swan-necked hoe for hand-weeding.

* * *

The future of mechanization in South Africa. G. S. BARTLETT. *S. African Sugar J.*, 1969, **53**, 503–511. This subject is reviewed and discussed from every angle. With regard to mechanical harvesting, the type of harvester used will depend upon whether cane is burned or not. If chopper-harvesters are to predominate eventually, as in Australia, with their ability to deal with lodged cane, considerable changes will be called for in the methods of transporting cane to the factory. As a substantial area of steep land is under cane in Natal and Zululand, attempts should be made to ensure that this area will not suffer unduly from labour shortages. This may be achieved by devising and introducing new harvesting techniques. This is an immediate objective for the Natal industry with its many hilly cane farms. Other recommendations are made.

* * *

Results of calcium silicate experiments at C. Brewer P.R. Co. E. REYES S. and A. VELEZ R. *Proc. Ann. Congr. Assoc. Sugar Tech. Puerto Rico,* 1966, 8 pp. The field trials reported were initiated as a result of the remarks of another investigator-"the most exciting and gratifying episode in cane and sugar production at Kilauea since it was incorporated as a sugar plantation is the terrific response obtained after the application of silicates". Similar satisfactory results were obtained in these experiments. The soil in question had low pH (4,0-5,0), low fertility, was poorly drained and heavily loaded with iron and magnesium aggregate. The calcium silicate used was basic slag, a by-product of the recovery of phosphorus from rock phosphate by the electric furnace process. The advantages from the use of the slag are outlined, one of them being that the absorption of minor elements, especially manganese and boron, which can be toxic to plant growth, is reduced.

* * *

Fundamental research on the physiology and biochemistry of sugar cane-is it really necessary? A. J. VUTOS. *Proc. Ann. Congr. Assoc. Sugar Tech. Puerto Rico, 1966,* 10 pp.-Reasons are put forward for more research on this aspect of sugar cane investigation which has not kept pace with other lines of research on sugar cane such as varietal selection, fertilizers, herbicides, insecticides, irrigation and cultivation methods. More knowledge is needed about how the sugar cane plant grows, how it makes and transports sugar, how it ripens and how each of these processes may be manipulated to assist the grower. Since sugar is initially manufactured within the chloroplast, more knowledge is needed about the sugar cane chloroplast (there are known to be two). Some recent research on sugar cane chloroplasts is described.

* * *

Overhead irrigation at Aguirre. E. S. WILUAMS. *Proc. Ann. Congr. Assoc. Sugar Tech. Puerto Rico,* 1966, 7 pp.-The three types of irrigation at Aguirre are described. Fifteen portable units are used with a capacity of 215 acres per night applying 2·7 inches of water in 2 hours. They are operated only at night because of prevailing high winds during the day and are completely portable. Moving and set-up are done during the day. All the night operator has to do is to move three sprinklers every two hours and clean the strainers. The latest system to be installed is the automatic permanent overhead sprinkler system. This requires very little labour after initial installation. It is expected that this system will be considerably expanded.

Understanding sugar cane physiology for better yields. G. SAMUELS. *Proc. Ann. Congr. Assoc. Sugar Tech. Puerto Rico,* 1966, 13 pp.-The sugar cane plant is considered from a physiological viewpoint, taking into account the various parts of the plant and their functions. Root systems, growth, maturity and post-harvest physiology are discussed. It is shown how the understanding and use of plant physiology has opened up many new approaches to sugar cane management, examples being the method of crop-logging as developed by Dr. H. CLEMENTS, the control of sugar cane flowering, increased knowledge of mineral nutrition and control of ripening. Other likely economic applications of sugar cane physiology are discussed.

* * *

Cane ripening. R. A. YATES. *Proc. Ann. Congr. Assoc. Sugar Tech. Puerto Rico,* 1966, 16 pp.-The natural and artificial conditions which induce the ripening of sugar cane are reviewed, with special emphasis on those which may be artificially imposed. Doubt is felt about prolonged drying-off to induce ripening because of the potential loss of yield accompanying it. Similarly, leaf desiccation by pre-harvest sprays appears to have more adverse than useful effects. Of chemical sprays which may be used to induce ripening, certain growth suppressants appear to offer the greatest promise.

* * *

The soil and low sugar production in Puerto Rico. A. RODRiGUEZ G. and F. MIRANDA. *Proc. Ann. Congr. Assoc. Sugar Tech. Puerto Rico,* 1966, 25 pp. Examination of records relating yields of cane and sugar to the varieties and soil types of Puerto Rico indicated the importance of soil pH and base exchange capacity. Experiments were made on addition of lime to the low-yielding acid soils and demonstrated the improvements possible, viz. up to 42% higher cane yield and up to 36% higher sugar yield.

* * *

Observations on pests and diseases in relation to spacing in sugar cane. S. HATMOSOEWARNO. *8erita Akademi Gula Negara* (Indonesia), 1969, 1, 62-77. Spacing trials with sugar cane were carried out in Indonesia. Rows were 8 m in length with 22, 27, 32, 37 or 42 setts or plants to the row. The variety of sugar cane used was POJ 3016 and the setts single-eyed. Plants suffered attack from stem borer *(Proceras sacchariphagus)* and top borer *(Scirpophaga nivella).* The closer the spacing the more severe was the borer attack. The number of millable canes could not be directly related to spacing. Further experiments are needed.

* * *

Sugar industry in Bihar facing many difficulties. P. L. DHANUKA. *Indian Sugar,* 1969, 19, 101-103.- The unfortunate decline of the sugar industry in Bihar, with the closing of mills, especially in south Bihar, and the reasons for it are discussed. The two main reasons are considered to be neglect of the industry by the Government and out-moded or worn-out sugar factory equipment. The need for improved or better varieties of cane for Bihar conditions is stressed.

* * *

The loss of sugar production in western Uttar Pradesh due to *Pyrilla* in the 1968-69 season. S. C. GUPTA and A. P. GUPTA. *Indian Sugar*, 1969, **19**, 159–167. The severe damage to the cane crop and heavy loss in sugar production due to the sugar cane leaf-hopper (*Pyrilla perpusilla*) is described. The best means of checking the pest would be by aerial spraying just after the monsoon. This could be done at a cost of Rs. 12–14 per acre.

* * *

Sugar cane culture in autumn in subtropical India. P. S. GILL. *Indian Sugar*, 1969, **19**, 173–181.—Autumn planting of sugar cane with intercrops is on the increase. Reasons why this system is now advantageous under the local conditions are discussed. It is felt that more investigation or research is needed on this dual system of cultivation.

* * *

Preliminary observations on the Cuban Fly, *Lixophaga diatraeae*, an exotic parasite of moth borers in India. A. N. KALRA, H. DAVID and D. K. BANERJI. *Indian Sugar*, 1969, **19**, 183–190.—An account is given of the successful breeding of the Cuban fly under controlled laboratory conditions at the Indian Institute of Sugarcane Research at Lucknow. This parasite has been used against the borer *Diatraea saccharalis* in other countries. Under laboratory conditions the optimum temperature for breeding was found to be 28–30°C and relative humidity 85 to 95%. Soft sunlight or artificial daylight induced greater sex activity. Top borer, shoot borer, stalk borer and pink borer were used as laboratory hosts. Preliminary field releases showed that the parasite could survive under field conditions in north India during the winter months.

* * *

Co 6911—a new sugar cane variety for Bhat soil of east U.P. N. K. PARIK. *Indian Sugar*, 1969, **19**, 195–196.—As a result of variety trials conducted by the United Provinces Sugar Co. Ltd., Seorahi, the variety Co 6911 was selected for cultivation on the Bhat soils of eastern U.P. and is to be increased for seed material. Details concerning the variety are given.

* * *

The control of soldier flies. ANON. *Producers' Rev.*, 1969, **59**, (6), 21.—The sudden increase in this endemic cane pest in Queensland cane fields is believed to be due to the cessation of the scarifying or inter-row cultivation which exposed the eggs of the pest to desiccation and destruction. The pest is controlled by means of soil insecticides, at a high cost, and it is hoped that biological control might become possible.

* * *

Cane burning as authorized by the Rural Fires Act. ANON. *Producers' Rev.*, 1969, **59**, (6), 25–26.—The provisions of this Act, as they apply to the cane farmer, are explained as well as the 3 types of burning permitted, these being (1) preharvest burning of cane, (2) disposal of tops and trash and (3) clearing fires (including fire breaks, destruction of rat harbourages, etc.).

* * *

A decade of mechanical harvesting. ANON. *Producers' Rev.*, 1969, **59**, (6), 65.—The history of mechanical harvesting in Queensland and the important rôle played by Massey Ferguson, especially with their MF 515 machine, is discussed. A new machine, the MF Cane Commander, is described, having created much interest in the cane belt. It is a big high-capacity machine designed with the trend to larger contracts and groups in mind. These are evident in many cane areas.

* * *

Badly drained soil adversely affects cane. ANON. *La Ind. Azuc.*, 1969, **74**, 90–91.—The need for good soil drainage with sugar cane is discussed and illustrated with diagrams. Good drainage is necessary for free movement of the cane roots and free movement of air and water. It is also necessary for the establishment of healthy colonies of the beneficial soil organisms.

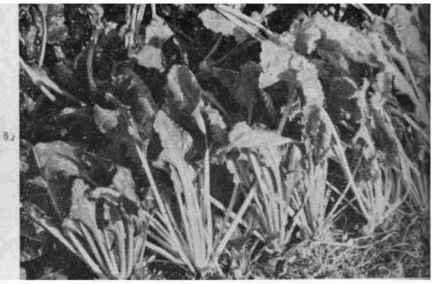
* * *

Nematicides for control of plant-parasitic nematodes on sugar cane in Louisiana. W. BIRCHFIELD. *Plant Disease Reporter*, 1969, **53**, 530–533.—Field tests made on Mississippi alluvial soil with recently discovered nematicides are reported. During the last two years the most promising nematicides have been "Aldicarp", B-25141 and VC 9-104, used in 10% granular form and incorporated in the furrow at planting time. They proved to be consistent and effective at low dosages, were easy to apply, gave increased yield of cane, and had no adverse effect on sucrose content.

* * *

Susceptibility of seven species of *Saccharum* to sugar cane mosaic virus, with special reference to Talur, a variety of *S. edule*. B. A. BOURNE. *Plant Disease Reporter*, 1969, **53**, 576–579.—A summary is given of work carried out hitherto on susceptibility of species of *Saccharum* to mosaic. The Talur variety of *Saccharum edule* proved to be exceptionally susceptible to mosaic strains A, B, D and E and to a mixture of them. Results were severe stunting and eventually death of the shoots. This high susceptibility supports the view that Talur originated through crossing of *S. robustum* and *Miscanthus*, all species of *Miscanthus* being extremely susceptible.

Sugar beet agriculture



Comparison of the effect on beet seed production of spring and fall infestations of beet leafhoppers carrying curly top virus. O. A. Hills and R. W. Brubaker. *J. Amer. Soc. Sugar Beet Tech.*, 1968, **15**, 214–220. Experiments made in the Salt River Valley of Arizona from 1964 to 1967 are reported. Plots were laid out and artificially infected with the curly top infective beet leafhopper (*Circulifer tenellus*). Both autumn and spring infestations reduced seed yields and sometimes the germination of the seed was also affected. The greatest reductions in germination resulted from infestations that occurred just before the plants bloomed. Seed size was unaffected by the virus.

* * *

The use of systemic insecticides to reduce the incidence of curly top virus disease in sugar beets. N. R. Malm and R. E. Finkner. *J. Amer. Soc. Sugar Beet Tech.*, 1968, **15**, 246–254.—Experiments are reported designed to test the effectiveness of four systemic insecticides in controlling or reducing loss from curly top, a virus disease spread by the leafhopper *Circulifer tenellus*, which infects sugar beet from the wild flora or weeds of neighbouring semi-desert land. The insecticides used were NIA 10242, "Timek", "Phorate" and "Di-syston". They were applied before planting, about 8 inches below the soil surface, at rates of 1 and 2 lb per acre. The insecticides were effective in reducing the amount of curly top-infected plants and in increasing yield. "Phorate" and NIA1 0242 gave the best control and the highest yield. Differences between rates were not significant but the 2 lb rate consistently gave better results.

* * *

Evaluating soil samples for fungus pathogens of sugar beet seedlings. D. L. Mumford. *J. Amer. Soc. Sugar Beet Tech.*, 1968, **15**, 255–258.—Soil-borne fungi infecting sugar beet seedlings were identified by incubating infected seedlings in water and examining them at low magnification combined with a plant infection test. Photographs show 5 different pathogens or fungi isolated in this way. Diagnostic characters are given.

* * *

Herbicidal control of weeds in sugar beets. E. E. Schweizer and D. M. Weatherspoon. *J. Amer. Soc. Sugar Beet Tech.*, 1968, **15**, 263–276.—Extensive trials are reported involving many herbicides, applied both before planting and after emergence, in an attempt to find better means of controlling some of the more "difficult" weeds of sugar beet such as kochia (*Kochia scoparia*), Russian thistle (*Salsola kali*), barnyard grass (*Echinochloa crus-galli*) and others. Kochia was controlled satisfactorily for the first time by 2 lb/acre of "Benzadox" applied as a post-emergence spray following a pre-planting treatment of 4 lb/acre of "Cycloate". The effects of other treatments on various weeds are given. The annual cost of weed control in the USA is said to exceed $20 million.

* * *

Progress in the breeding of sugar beets. E. Bornscheuer. *Zucker*, 1969, **22**, 353–354.—Since beet breeding began in 1850 the sugar yield has been raised from 18 dz/ha to over 60 dz/ha, much of this improvement being the result of breeding improved varieties. The goal is the combination of high root yield with good sugar content to give a good sugar yield, and the variety KWS Polybeta is claimed to achieve this. Interspecific crosses have been only partially successful in transmitting resistance and monogerm nature to cultivated beets, but monogerm varieties worth cultivating have been developed by intensive breeding with naturally occurring mutants and with sugar beet strains developing two-flowered seed bearers.

* * *

The place of "Betanal" in modern sugar beet culture. M. Martens and J. M. Belien. *Publ. Trimest. Inst. Belge pour Amél. Betterave*, 1969, (1), 1–8.—Results of 1968 trials with the herbicide "Betanal" on good sugar beet stands are given, special attention being paid to stability of the herbicide emulsion, spraying pressure and residual effect of the treatment. Consideration was given to the possibility of mixing other herbicides with "Betanal" to improve its persistence.

* * *

Combination possibilities of "Phenmedipham" with other herbicides. L. Detroux, J. M. Belien and G. Latteur. *Publ. Trimest. Inst. Belge pour Amél. Betterave*, 1969, (1), 9–22.—It is pointed out that "Phenmedipham" ("Betanal") has no residual herbicidal action and its action on grasses is weak. Experiments are described in which "Phenmedipham" was mixed with other herbicides, i.e. "Pyrazon" (PCA), CP 52.223, "Lenacil" and "Dalapon". Only the mixture with "Lenacil" gave weed control without toxicity to the beet, but its action on grasses was slow. The mixture with "Dalapon" gave more rapid action on grasses or monocotyledons but toxicity to beet was stronger. Combination with CP 52.223 was promising but showed toxicity to beet.

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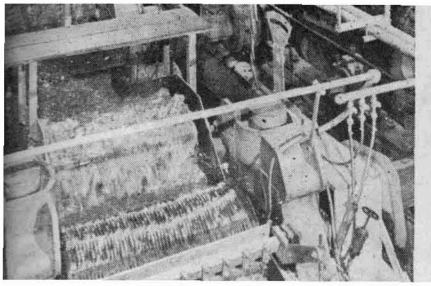

Cane sugar manufacture

Application of ion exchange. XV. Industrial applications: sugar processing. R. KUNIN. *Amber-Hi-Lites* (Rohm and Haas Co.), 1968, (106). **XVI, XVII. Industrial applications: cane sugar processing.** *idem ibid.*, 1968, (107, 108). **XVIII. Industrial applications: sugar processing and sucrose inversion.** *idem ibid.*, 1969, (109). **XIX. Industrial applications: beet sugar processing.** *idem ibid.*, 1969, (110). **XXI. Industrial applications: new ion exchange technology in sugar industry.** *idem ibid.*, 1969, (112).

This series of papers is devoted to the application of "Amberlite" ion exchange resins to the treatment of beet and cane juices and syrups and of a modification of the "Desal" ion exchange process (originally developed for desalination of brackish water) for beet juice carbonatation. In this the diffusion juice is passed through "Amberlite IRA-68" anion exchanger in HCO_3^- form, limed, filtered and gassed with CO_2 before treatment with "Amberlite IRC-84" cation exchanger in H^+ form and finally with "Amberlite IRA-68" in OH^- form or "Amberlite IRA-93" in the same form. Ion exchange treatment of syrup in a monobed system is compared with bone char treatment. How to avoid inversion during the ion exchange treatment of juices and syrups is described, the advice also being applicable to the preparation of invert syrups.

* * *

A concept and design for a syrup sulphiter. B. B. PAUL. *Indian Sugar*, 1969, **19**, 137–141.—Calculations and graphs are presented for use in the design of a continuous syrup sulphitation tower based on a sulphur consumption of 0·0075–0·0080% on cane and a sugar factory capacity of 1250 t.c.d. A diagram of the tower is reproduced.

* * *

Recent advances in the sugar industry in India. M. MOHAN. *Indian Sugar*, 1969, **19**, 143–145.—A survey is given of recent developments in Indian sugar factory technology.

* * *

Recent advances in sugar technology in India. R. N. AGARWAL. *Indian Sugar*, 1969, **19**, 147–150.—A review of developments in sugar factory technology in India is presented with 19 references to the literature.

* * *

Recent advances in field and factory technology in the sugar industry (1968). S. C. SHARMA. *Indian Sugar*, 1969, **19**, 153–157.—Cane agriculture and sugar factory technology are covered in this review of developments in India in which 60 references are given to the literature.

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Concept and design of a vacuum pan for low-grade massecuites. B. B. PAUL. *Sugar y Azúcar*, 1969, **64**, (8), 21–24.—Details are given of a low-head calandria pan designed by the author for *C*-massecuite treatment. In tests with massecuites of approximately 100°Bx (about 60 purity), a crystal content of about 42% (on Brix) was obtained. Molasses purity averaged 34.

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The African sugar economy. II. B. BADINAND. *Sucr. Franç.*, 1969, **110**, 357–365.—The sugar industries and projects in African countries are reported and future developments planned are described.

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Continuous crystallizer operation. P. E. CANCIENNE. *Sugar J.*, 1969, **32**, (2), 9–10.—The nine batch crystallizers at the author's sugar factory were converted to a continuous system in which the massecuite dropped from the pan is fed to a holding vessel and thence under gravity to No. 1 crystallizer, after which it passes in turn through the other crystallizers. Advantages of the scheme are listed.

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Effect of deaeration of treated cane juice before boiling and settling in the sulphitation process. S. C. GUPTA, N. C. VARMA, K. K. GUPTA, J. K. P. AGARWAL, R. C. BHANDARI and D. N. BAJPAI. *Sharkara*, 1969, **11**, 6–16.—See *I.S.J.*, 1970, **72**, 145.

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New developments in handling and storage of bagasse. J. H. PAYNE. *Ind.-Agric. Research and Management Newsletter*, 1969, **9**, (2), 3.—The developments described include pneumatic feeding of bagasse to boilers and to storage bins with subsequent reclaiming for boiler feed, outside storage of bagasse by the RICHTER process, in which it is kept wet with an acid solution prepared from fermented molasses, or by a process used by the International Paper Co. in which water is pumped and repumped over the storage pile on a sloping concrete slab. Freshly baled bagasse undergoes a rapid temperature rise (as a result of chemical reactions caused by the bacteria in it) to a maximum of 60°C at which further bacterial growth practically ceases and the sugar content is destroyed. The temperature then falls gradually. However, the initial sharp rise in temperature is sufficient to dry the bagasse which can then be stored. Tests at Southdown sugar factory in Louisiana are referred to.

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Sealed downtake evaporator proved through experience. G. ALEMAN. *Sugar J.*, 1969, **32**, (3), 23–24.—In answer to the points made by ZIEGLER[1] regarding evaporators with sealed downtakes, the author refers to his experience with a conventional evaporator "of good design" in which the downtake in each vessel was sealed in order to improve performance. The advantages which resulted included increased evaporator capacity, reduced frequency of cleaning and lower juice levels. The author agrees that automatic control of evaporators with sealed downtakes is difficult, but describes a means of overcoming this, which, although giving the effect of only a semi-sealed downtake, still sufficiently separates the thinner incoming juice from the heavier outgoing juice.

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Deterioration suffered by cane between cutting and milling at Ingenio El Carmen. A. VELASCO P. and A. RUEDA R. *Bol. Azuc. Mex.*, 1969, (232), 44–50. Samples of 120 stalks of freshly cut cane of six varieties were divided into 15 sub-samples of 8 stalks each and the latter weighed and analysed at daily intervals to determine the effects of delay between cutting and milling. Weight losses were insignificant but juice quality suffered to a greater or lesser extent depending on the variety. The order of falling susceptibility to deterioration was: POJ 2714, Co 419, Co 421, Co 290, H 37-1933, POJ 2878.

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Development and production of "Instol" for use in the industry. ANON. *Sharkara*, 1969, **10**, 126–127.—See *I.S.J.*, 1967, **69**, 273.

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Thrust generation in sugar mill drive. D. B. MOSTERT. *S. African Mech. Engr.*, 1968, **17**, 221–224; through *S.I.A.*, 1969, **31**, Abs. 69-568.—A gearbox used in conjunction with a sugar mill showed displacement of the output shaft in relation to its bearings, and overloading of one bearing. The cause was found to be the very large external forces generated in the square-type couplings used between the gearbox and the mill. These forces could be reduced by lower surface pressures, better provision for swivelling, better lubrication and more satisfactory mating materials.

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Computer technology assists cane testing. J. C. WILLIAMS and T. R. LOUDON. *S. African Sugar J.*, 1969, **53**, 598–607.—Information is given on the computerized system used by the Sugar Industry Central Board in South Africa to process data on the quantity of sucrose entering each of the 20 sugar factories from the individual cane growers (this is calculated by the Java Ratio method) and to prepare cane deliveries to the factories. The system has to allow for variations in the methods used to calculate the weight of sucrose in cane at "sidings" (old sugar factories which are closed but act as delivery sites) and for cane diverted from one sugar factory to another.

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Impressions of visits to diffusers in Africa and Hawaii. R. RODRÍGUEZ, A. CABRER and F. J. SERRALLÉS. *Proc. Ann. Congr. Assoc. Sugar Tech. Puerto Rico, 1967, 116–157.*—General aspects of cane diffusion are discussed, including comparison with beet diffusion, combination with milling to extract primary juice, juice purity, avoidance of sucrose destruction, clarification, bagasse dewatering, steam consumption, power required, maintenance, and economic considerations. Descriptions and performance data are recorded and discussed for a number of diffuser installations including the DDS unit at Arusha Chini in Tanzania, the BMA unit at Dalton in South Africa, the De Smet unit at Malelane in South Africa, and the Silver ring unit at Pioneer mill in Hawaii.

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Production of high quality raw sugar for sugar refineries. J. C. P. CHEN. *Sugar J.*, 1969, **32**, (4), 9–15.—In a discussion of the refining quality of cane raw sugars, the point is made that the absence of a standardized process for all refineries makes it difficult to establish quality criteria. However, the requirements generally considered important to the refinery and possible ways in which to raise raw sugar quality so as to meet some if not all of these requirements are indicated. The non-sugars compositions of raw sugars from different countries are compared and data covering a number of raw sugar parameters and obtained in the author's own investigations are tabulated.

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Undetermined losses in cane sugar factories. D. SUERTE. *Proc. 16th Conv. Philippines Sugar Tech.*, 1968, 81–83.—The main causes of undetermined losses and places in the factory where they may occur are listed and the losses categorized under three classes: apparent, mechanical, and inversion and decomposition.

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Two years' experience with the use of "Pan Aid" in sugar boiling. C. M. MADRAZO. *Proc. 16th Conv. Philippines Sugar Tech.*, 1968, 84–90.—Data obtained at San Carlos Milling Co. Inc. are reproduced to show the improvements in low-grade massecuite purging and in sugar quality as a result of the use of Fabcon "Pan Aid" surface-active additive in boiling.

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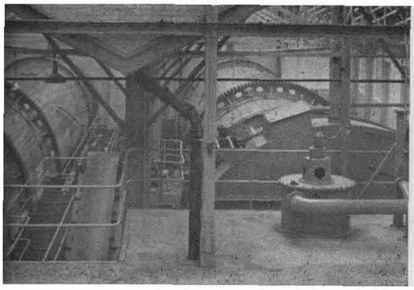
Hodag "CB-6" as used in Central Pilar. D. TANCO. *Proc. 16th Conv. Philippines Sugar Tech.*, 1968, 91–93. Results from the author's factory indicate the benefits derived from the use of Hodag "CB-6" surface-active additive when processing low-quality cane. Massecuite purging has been improved with a resultant increase in purity of the sugar used for seed magma.

[1] *I.S.J.*, 1970, **72**, 146.



Beet sugar manufacture

Manufacture of sugar from sugar beet. V. SUD. *Indian Sugar*, 1969, **19**, 109–112.—See *I.S.J.*, 1969, **71**, 170–172.

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Morocco's sugar industry sees rapid growth. M. R. BULL. *Sugar y Azúcar*, 1969, **64**, (8), 25, 33.—Information is given on the Moroccan beet sugar industry and on cane cultivation trials.

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Automatically controlled unit for drying and cooling sugar in a fluidized bed. V. V. ZVORYKIN, S. I. TEMPER and N. M. RENKIS. *Sakhar. Prom.*, 1969, **43**, (8), 29–32.—Details are given of automatic controls for regulation of various parameters involved in the drying and cooling of white sugar in a fluidized bed unit first installed at a Soviet sugar factory in 1966[1]. In tests during the 1967/68 and 1968/69 campaigns the automatic unit had a throughput of 13·3 tons/hr, reduced the sugar moisture content from 0·7% to 0·04% and cooled it from 48°C to 24°C.

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Installation, repair and use of external pipelines. B. S. ZHALOV. *Sakhar. Prom.*, 1969, **43**, (8), 35–37. The article concerns the use of cast iron, steel, asbestos-cement and polyethylene piping and its installation and maintenance. The purposes for which the different materials are suitable are also discussed.

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Boiling of massecuites when processing low quality beet at North Caucasian (sugar) factories. M. P. PRIIMAK. *Sakhar. Prom.*, 1969, **43**, (8), 38–39.—A two-massecuite boiling scheme was introduced to overcome problems associated with poor quality beet. In it, the low-grade product is washed, melted in condensate and fed to the 1st massecuite. This is of about 94 purity and yields the 1st product white sugar.

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Distribution of residence time of sugar beet cossettes in a technical extraction unit. D. SCHLIEPHAKE and A. WOLF. *Zucker*, 1969, **22**, 493–497.—Cossette residence time distribution was determined in a BMA tower diffuser located after a heat exchanger. The distribution is theoretically depicted as an energy transfer system in which the kinetic energy of all the particles is assumed to be constant per unit volume. Since a linear relationship was established between particle velocity and residence time distribution, the vertical velocity was used as distribution parameter. A "normal" distribution was found to occur at a mean velocity which was the velocity of the centre of gravity of the cossette stream. The effect of velocity distribution of the cossettes, generally known as back-mixing, on the diffusion process is discussed.

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Application of ion exchangers in the sugar industry. E. FELBER. *Zucker*, 1969, **22**, 457–465, 497–505. Using a three-massecuite boiling scheme as example, the author discusses the effect of thin juice and run-off demineralization on sugar house efficiency. In fact, it is shown that the limitations on thin juice treatment (particularly too great a purity rise), which are discussed, are sufficient to preclude its use with a 3-boiling scheme. On the other hand, demineralization of the higher purity run-offs will have a more favourable effect on the purity gradient and relieve the pan station of the heavy load incurred with the subsequent products. Demineralization of a mixture of 1st and 2nd product run-offs is proposed as a compromise. The degree of demineralization (expressed in terms of non-sugar elimination) is limited by the raffinose content in the final massecuite, and above 4% raffinose difficulties will occur in boiling. Examples of demineralization application are quoted and a continuous BMA process is described. The advantages and disadvantages of continuous ion exchange treatment compared with batch operation are considered in a subsequent discussion.

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Some questions regarding optimum technological conditions and control of purification of beet sugar intermediate products by electrodialysis. I. M. LITVAK, L. D. BOBROVNIK, A. A. LIPETS and R. Ts. MISHCHUK. *Pishch. Prom.*, 1968, (7), 23–28.—The specific resistances of molasses solution and green syrup to demineralization electrodialysis were established as functions of Brix, temperature and purity, carbonate content (green syrup) and sulphate content (molasses). These relationships are shown in graph form. The optimum concentration was also determined as a function of temperature and degree of deionization. Equations are derived which may be used for conductimetric control of the process.

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A study of the crystallization capacity of products purified by electrodialysis with ion exchange membranes. A. P. KOZYAVKIN, L. D. BOBROVNIK and K. D. ZHURA. *Pishch. Prom.*, 1968, (7), 31–35.—Laboratory

[1] *I.S.J.*, 1969, **71**, 345.

boiling tests were conducted on electrodialysed green syrup. The yellow sugar obtained had a higher purity and lower colour content than did sugar from untreated green syrup, and the standard molasses purity and viscosity at 40°C were lower than for molasses from untreated syrup. Decolorization of the syrup by an anion exchange resin in Cl^- form after electrodialysis reduced the colour content of the sugar obtained by boiling still further and the molasses had a standard purity some 3 units lower than did molasses from non-decolorized electrodialysate.

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Hydrodynamics of massecuite vacuum pans. V. P. TROINO. *Pishch. Prom.*, 1968, (7), 169–176.—From experimental data are obtained a number of equations for calculation of hydrodynamic parameters for the steam-massecuite mixture. Various inter-relationships between the parameters have also been established.

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Production without crystallization of a very pure sugar syrup from purified juices. P. DEVILLERS and M. LOILIER. *Sucr. Franç.*, 1969 **110**, 414–417.—Laboratory tests involving ion exchange treatment of 2nd carbonatation juice are described, in which the juice was first demineralized by passing through "Amberlite IR 120" strongly acid cation exchanger followed by "Amberlite IRA 68" weakly basic anion exchanger. After concentration to 65–66°Bx, the juice was treated with "XE 258" strongly basic anion and "Amberlite IRC 50" weakly acid cation exchanger. Mixed bed treatment proved more effective than did separate bed treatment. The resultant syrup had a purity of at least 97, a colour content of 10–12 ICUMSA units compared with 54 before mixed bed treatment, and a conductivity at 28°Bx of 1·7–2·1 mhos compared with 38·5 mhos before treatment. Hence, the syrup could be used directly in the same way as Grade 1 white sugar remelt liquor. However, the treatment did not completely remove foaming products, mainly saponins.

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Use of synthetic flocculants in the sugar industry. W. BRIESE. *Sucr. Franç.*, 1969, **110**, 419–425.—Guidance is given on how to obtain optimum results in the use of synthetic flocculation aids in clarification. The article covers the carrying out of laboratory tests, preparation of flocculant solutions in laboratory and factory, and handling and dosing of the solutions. The optimum point at which to add the flocculants to the material to be clarified is also considered.

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Fluidization capability of grains of dried carbonatation mud, W. STANKIEWICZ. *Sucr. Belge*, 1969, **88**, 535–544.—In researches at Lodz Polytecnnic in Poland the hydrodynamic properties of fluidized muds have been studied. From determinations of the critical air velocity, the height of the fluidized bed, pressure drops across the bed and the types of disturbances for different size fractions, an empirical formula has been derived for particle sizes in the range 0·1–0·2 mm relating the Reynolds' number to Archimedes' number for a given critical velocity. The expression takes the form:

$$Re_{cr} = 0{\cdot}058\ Ar^{0{\cdot}75}.$$

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Effect of sucrose concentration on the kinetics of ion exchange and swelling of KU-2X8 sulpho-cation exchange resin. V. P. MELESHKO and M. V. ROZHKOVA. *Izv. Vuzov, Pishch. Tekhnol.*, 1969, (4), 98–102. Tests with 0·25N NaCl solutions containing sucrose in the concentration range 0–60% were conducted with KU-2X8 strongly acid sulphonic acid-type cation exchange resin in H^+ form. The sucrose caused the rate of exchange of Na^+ ions for H^+ ions to be lower than in its absence through a rise in viscosity, a fall in the relative swelling capacity of the resin and an increase in its rate of contraction, the effects being greater with increase in sucrose concentration.

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Some reflections on beet preservation. P. DEVILLERS. *Sucr. Franç.*, 1969, **110**, 379–383.—The author describes various methods used to determine losses in stored beet, lists causes of deterioration and factors having effect on stored beet, and finally discusses means of minimizing the losses.

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Results of tests on forced ventilation of stored beet at Šurany (sugar factory) 1964-68. A. HAVRÁNEK, L. SCHMIDT, J. ZAHRADNÍČEK and P. FEKETE. *Listy Cukr.*, 1969, **85**, 222–229.—Detailed results are given of 5-year tests, in which it was found that the use of forced ventilation reduced the daily sugar losses in stored beet by 47·1%. From the results indications have been obtained on the length of the ventilation ducts and on other aspects of forced ventilation, which should be applied until the difference between ambient and pile temperature is reduced to 1·6°C. The economic limit for application of forced ventilation was found to be 34–40 days depending on beet quality.

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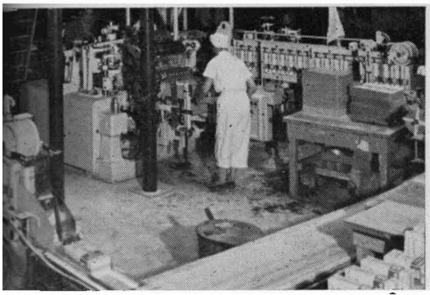
Occurrence of micro-organisms in beet sugar factory juice purification stations. I. JANUSZEWICZ and K. MOSSAKOWSKA. *Gaz. Cukr.*, 1969, **77**, 245–249. Bacteriological investigations are reported, in which is was found that a considerable increase in the bacterial counts occurred in the initial preliming stages, causing sucrose decomposition and increase in the lime salts content (through formation of lactic acid and its combination with calcium to form calcium lactate). However, further development of bacteria in the subsequent juice purification processes is inhibited by the high pH, high temperature and/or sugar concentration. The ranges of bacterial counts in products from defecation juice to massecuite are tabulated.



Sugar refining

Pittsburgh type "Cane-Cal" in moving beds at Emiliano Zapata. F. M. Williams. *Proc.* 1968 *Tech. Session Cane Sugar Refining Research*, 19–23.—Details are given of the liquor decolorization station at Emiliano Zapata refinery in Mexico, which uses moving beds of Pittsburgh "CAL" granular active carbon mixed with 5% by weight of dead-burned magnesite. The economics are discussed. Performance data indicate removal of 75–85% of the initial colour in the 60°Bx liquor, although it is not known how this compares with the previous system using powdered carbon.

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Review of sugar oriented ion exchange practices. J. F. Zievers and C. J. Novotny. *Proc.* 1968 *Tech. Session Cane Sugar Refining Research*, 35–50.—In this review of ion exchange processes 37 references are given to the literature and some new uses of contacting equipment for continuous ion exchange demineralization are explained. It is considered that new combinations of resin and equipment will make ion exchange economically more favourable than hitherto.

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The refining of cane sugar by ion exchange. R. Kunin and F. Pollio. *Proc.* 1968 *Tech. Session Cane Sugar Refining Research*, 62–74.—Preliminary tests with a monobed composed of 3 parts "Amberlite IRA-93" weakly basic anion exchanger to 1 part "Amberlite IRC-84" carboxylic acid cation exchanger showed that the syrup demineralization and decolorization capacity was greater than that of bone char and yielded a higher purity syrup than the char. The capacity of the monobed was limited by the capacity of the anion exchanger. Sucrose inversion was the same at 60°C as with bone char at 82°C. Further investigations of the technique are in progress.

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Sugar dust explosion variables. R. E. Edwards. *Proc.* 1968 *Tech. Session Cane Sugar Refining Research*, 128–138.—Experimental studies showed that the minimum explosive concentration (MEC) and the minimum ignition energy (MIE) of dry sugar dust increased with increase in particle size. Values of MEC and MIE obtained for Australian refined and raw sugar samples are discussed. Differences between laboratory and factory dust measurements are attributed to agglomeration of the particles, and hence factors other than dust particle size are considered to affect experimental determination of the two variables.

Filtration and sweetening-off in place of carbonatated liquors—a critical evaluation. R. Y. Jehu and S. Stachenko. *Proc. 27th Meeting Sugar Ind. Tech.*, 1968, 86–117.—Details are given of preliminary tests at Montreal refinery on sweetening-off the cake on Sweetland leaf filters for carbonatation liquor instead of collecting the mud from a battery of liquor filters and sweetening-off on plate-and-frame presses. Although sugar losses were higher, the overall filtration economics were better and the tests were considered sufficiently promising to justify using the scheme continuously with just one filter over a long period, in order to obtain data on various factors such as cloth life. A Taylor digital set programmer has been used for automatic control of the filter and the first results are considered promising.

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An idealized affination station. F. M. Chapman. *Proc. 27th Meeting Sugar Ind. Tech.*, 1968, 132–139.—See *I.S.J.*, 1968, **70**, 234–237, 263–268.

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The patented Fives Lille-Cail continuous crystallization process. F. Dambrine, J. C. Giorgi and G. Windal. *Zeitsch. Zuckerind.*, 1969, **94**, 71–74.—See *I.S.J.*, 1969, **71**, 376.

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Crystallization of refined sugar massecuite in air-fed mixers. S. A. Brenman, A. L. Sokolova and Yu. D. Kot. *Izv. Vuzov, Pishch. Tekhnol.*, 1969, (2), 60–63.—Laboratory and factory tests in which hot air (75–80°C) was blown over massecuite during cooling showed that the crystallization rate was considerably higher than without hot air blowing. The final crystal yield was also greater, more so in the laboratory tests than in the factory experiments.

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Decolorization of remelt in the refineries with ion exchange resins. T. Ionescu and F. Domsa. *Cuba-Azucar*, 1968, (Jan./Feb.), 20–26, 55–60.—Comparison of ion exchange resin decolorization of remelt liquor with that of vegetable carbon and bone char showed that the resin, Kastel A-501-D, had a capacity 5½ times that of carbon and a decolorization efficiency 3½ times greater. To achieve the same degree of decolorization as the resin, 50 times the quantity of carbon is needed. Compared with bone char, the resin is 1·49 times as efficient and, to decolorize the same amount of sugar, 13·7 times its weight of bone char is needed. Further, bone char required heavier and more costly plant and maintenance and regeneration costs are higher.

New books

Sugar price movements in world and US domestic markets 1962–1969. (C. Czarnikow Ltd., Plantation House, Mincing Lane, London E.C.3.) 1970.

The 1970 copy of this now well-established graph, which measures 22×30 inches, gives a somewhat brighter picture of world sugar prices as reflected in the 1969 values compared with the very low prices obtaining over the 1964–68 period (with its maximum around £32 per ton in June 1967 and the nadir at just above £12 per ton). The graph, issued annually and obtainable free from the publishers, features (i) world market prices, expressed as the London Daily Price (in bags, c.i.f. UK including discharge up to January 1966 and bulk, c.i.f. UK, free out thereafter) and the New York No. 8 Contract Spot Price (f.o.b.s.), (ii) the US domestic price, given as the New York No. 7/10 Contract Spot Price (c.i.f. duty-paid New York, etc.), and (iii) the Commonwealth Negotiated Price (in bags c.i.f. UK for 1962–64 and bulk f.o.b.s. for 1965–69). The prices are given in cents/lb and £/ton, the latter being provided with pre- and post-devaluation scales. The pattern of the prices can be easily followed, each year covered being divided into months and those factors having any substantial effect on the prices being noted in the appropriate places. An inset panel shows the average world values during the period 1932–1969. In all respects this is a most admirable effort to show world and US price trends as clearly as possible.

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Food industries manual, 20th Edn. Ed. A. WOOLLEN. 509 pp.; 8¼ × 11¼ in. (Leonard Hill Books, 158 Buckingham Palace Rd., London S.W.1, England.) 1969. Price: 210s 0d.

The 20th edition of this book contains much concerning the UK food industry. It is divided into 15 sections, each covering either a particular branch of the industry, such as baking, the dairy industry, and meat and meat products, or a process, e.g. canning and freezing, packing, and storage, refrigeration and handling. Each section is written by a different author or authors. It is an impressive volume, with the information brought up to date and indicating the advances made in the industry since the previous edition published some 7 years ago. However, the sugar industry is not one of the branches covered by the book, and the only mention made of sugar is in connexion with its use (in various forms) in the baking, confectionery, preserves and fruit juice beverages industries.

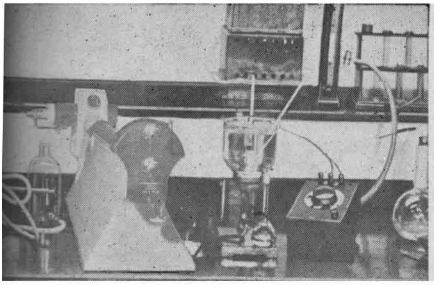
Laboratory manual for Queensland sugar mills, 5th Edition. 250 pp.; 6 × 9½ in. (Division of Mill Technology, Bureau of Sugar Experiment Stations, Brisbane, Queensland, Australia.) 1970. Price: 42s 0d.

While the form of the fourth edition of the Queensland manual has been retained in this latest edition, it has been brought up to date as of the middle of 1969, each chapter having been subjected to a critical review and changed or completely re-written to conform to present-day knowledge and to take into consideration the new apparatus, methods and techniques which have been introduced into sugar mill laboratories. Wherever possible, descriptions and illustrations of apparatus cover the most modern equipment available, and new sections on the automatic polarimeter and the spectrophotometer have been included. The chapter on analytical methods has been expanded and includes many new aspects, including the direct analysis of cane. Boiler water treatment has been given more space and the chapter on soil analysis deleted as it is felt that this subject is better covered in specialized text-books. A new chapter is included on the Bureau's metrology laboratory which examines apparatus and equipment used in factory laboratories to ensure their accuracy—thermometers, Brix hydrometers, polarimeter tubes, quartz plates, etc. The Director of the Bureau, in his preface, writes: "The equipment and methods of analysis set out are those which, in the considered opinion of the officers of the Mill Technology Division, are the most suitable presently available, but there will doubtless be some sections which are the subject of diversity of opinion, and there are some sections which are in such a state of rapid change that the procedures set down will be out of date in the near future."

In spite of this proviso we feel sure that this new edition will be as well received as its predecessors, and the Queensland Bureau is to be congratulated not only on its thoroughly-prepared and most useful manual but also on the generous way in which it has made its collective experience available in published form for the rest of the sugar world.

Guatemala sugar crop, 1969/70[1].—The estimated Guatemala 1969/70 sugar crop is 430,000 metric tons, compared with 370,000 tons in 1968/69. Internal consumption is set at 250,000 tons (240,000 tons in 1968/69), exports to the USA at 130,000 tons (110,000 tons in 1968/69) and other exports at 30,000 tons (20,000 tons in 1968/69).

Bank of London & S. America Review, 1970, **4**, 156.



Laboratory methods & Chemical reports

Mathematical investigations on certain relationships of magnitude between the Brix, pol and purity of juices extracted from cane in milling by successive stages. J. J. GÓMEZ. *Proc. Ann. Congr. Assoc. Sugar Tech. Puerto Rico*, 1966, 17 pp.—On a basis of the extraction in later stages of milling of juice of lower pol, Brix and purity than that obtained in earlier stages, a series of calculations are made of the relationships between the ratios of earlier: later pol, Brix and purity values. Some of the ratios are calculated from data for Central Igualdad recorded in the 1956 Gilmore Puerto Rico Sugar Manual, and further data obtained by extension.

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Data report on a practical index to evaluate final molasses exhaustibility (1963-1966 crops). J. J. BALSA and G. R. SERBÍA. *Proc. Ann. Congr. Assoc. Sugar Tech. Puerto Rico*, 1966, 7 pp.—See *I.S.J.*, 1966, **68,** 121.

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The deterioration of cane and its effects on factory performance. G. R. SERBÍA. *Proc. Ann. Congr. Assoc. Sugar Tech. Puerto Rico*, 1966, 14 pp.—The effects of cane deterioration on processing are discussed and a Deterioration Index derived, which takes the form

$$DI = \frac{Y_0 - (S - 0{\cdot}3B)}{Y_0} \times 100$$

where Y_0 is the expected sugar yield at zero deterioration, and S and B are crusher juice pol and Brix, respectively.

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A study of the effect of non-sugars on sucrose solubility by means of physico-chemical analysis. N. P. SILINA. *Sakhar. Prom.*, 1969, **43,** (8), 17–21.—The investigation involved the use of a phase diagram for the three-component system water:sucrose:non-sugar to establish the mechanism of sucrose solubility increase and decrease in impure solutions. It is shown that the effect of non-sugars on sucrose solubility is complex and multiform.

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The rôle of amino-acids and sugars in colouring matter formation reactions. A. R. SAPRONOV, N. M. POTAPOVA and I. N. VORONKOVA. *Sakhar. Prom.*, 1969, **43,** (8), 22–26.—Laboratory experiments under process conditions indicated that all the amino-acids tested increased sugar solution colour formation by participating in melanoidin formation with the exception of cysteine and l-cysteine, the sulphur group of which blocks the aldehyde group in the sugar molecule and so prevents its participation in the reaction. The activity of the amino-acids was found to depend on their molecular structure, thus explaining the behaviour of cysteine and differences in the colour formation intensity. At an identical excess of fructose and glucose the same quantity of colouring matter was formed in the sugar solution. In monosaccharide solutions colouring matter, formation was almost linearly dependent on the monosaccharide concentration. Although increase in the concentration of one of the components in a sugar-amino acid reaction caused a linearly proportional increase in the colour content, increase in the concentrations of both reactants (e.g. in evaporation or boiling) by n times causes a n^2 increase in the colour content.

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Viscosity and density of pure sugar solutions, liquor and green syrup at 70, 80 and 90°C. A. A. GERASIMENKO and Z. B. SHAPOSHNIKOVA. *Sakhar. Prom.*, 1969, **43,** (8), 27–28.—The densities and dynamic viscosities were determined for pure sugar solutions in the refractometric Brix range 76·7–82·2° at 70, 75, 80 and 90°C, for 93·08 purity liquor in the Brix range 78·3–85·0° at 70, 80 and 90°C and for green syrup of 79·28 purity in the Brix range 81·3–87·6° at 70, 80 and 90°C. The corresponding supersaturation coefficients are also given in the tables which are presented.

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Laboratory unit for testing various diffusion juice purification schemes. S. L. SHOIKHET and A. K. KARTASHOV. *Sakhar. Prom.*, 1969, **43,** (8), 32–34.—A laboratory carbonatation scheme with a throughput of 15–20 litres of raw juice per hr is described with the aid of a flow diagram.

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The thermal stability of pure highly-concentrated sugar solutions. L. I. TREBIN, K. D. ZHURA and L. P. REVA. *Pishch. Prom.*, 1968, (7), 39–43.—During heating over an oil bath at temperatures in the range 80–120°C for up to 24 hr the extent of sucrose decomposition in 65°Bx sugar solutions having initial pH values in the approximate range 7–9 was almost proportional to the time of heating. Using this relationship, calculations were made of the mean hourly change in colour content and reducing matter concentration, as well as the quantity of sucrose decomposing as a function of the initial pH and of the heating temperature. A reduction in the Brix of the solutions reduced the thermal stability and increased sucrose decomposition, colour content and reducing matter concentration.

Polysaccharide-forming micro-organisms in sugar manufacture. II. F. SCHNEIDER, H. P. HOFFMANN-WALBECK and M. A. F. ABDOU. *Zucker*, 1969, **22**, 465–473.—Rod-shaped fluorescent strains of laevan-producing bacteria, isolated from intact beet tissue and frost-damaged beet, have been identified as *Pseudomonas fluorescens* biotype B. The properties and characteristics of the bacteria have been determined in tests, which are described in detail.

* * *

Investigation of heat transfer from an immersed surface to sugar and alcohol solutions and pure liquids. N. YU. TOBILEVICH, I. I. SAGAN' and A. P. GORDIENKO. *Pisch. Prom.*, 1968, (7), 130–137.—Sugar solution of 64·5°Bx was one of a number of liquids heated in an experimental unit comprising basically an electric tubular heater immersed in a vessel carrying the test liquid. Results of the tests, carried out over a wide range of heat load and pressures, are discussed and the effect of "working" time of the heating surface on the heat transfer coefficient is examined in detail.

* * *

Heat transfer from vibrating coils to sugar solutions and massecuites. D. E. SINAT-RADCHENKO and V. D. POPOV. *Pishch. Prom.*, 1968, (7), 162–165.—Tests with an experimental unit consisting of a water-carrying coil immersed in the test solution are reported. The possibility of effecting intense heat transfer by means of low-frequency vibrations was demonstrated. Change in the oscillation frequency did not affect heat transfer from the copper coil to the water inside it. With simultaneous stirring by a ribbon coil rotating at up to 30 r.p.m. the effect of the mixing was greater at a low oscillation frequency. An equation is derived from the findings for calculation of the heat transfer effect for sugar solutions and massecuites of $\leqslant 45\%$ crystal content.

* * *

Unit for rapid production of saturated sugar solutions. D. E. SINAT-RADCHENKO and V. D. POPOV. *Pishch. Prom.*, 1968, (7), 165–169.—In the unit which is described the sugar is dissolved in an unsaturated solution by submitting it to the effect of low-frequency oscillations. A molasses solution of $\leqslant$ 84°Bx was saturated within 40 min, while for pure sugar solutions a maximum of only 20 min was required.

* * *

Chemical problems in the sucrose industry. K. J. PARKER. *Paper presented to the Sucrose Conference* (Queen Elizabeth College, London), 1969.—The hydrolysis of sucrose to glucose and fructose under acid and alkaline conditions is discussed as well as the further reaction of the hexoses with amino-acids to form compounds under industrial conditions which are believed to be caramel precursors.

* * *

Chemical reactivity of sucrose. L. HOUGH. *Paper presented to the Sucrose Conference* (Queen Elizabeth College, London), 1969.—The unique structure of sucrose and its consequent chemical properties have to some extent hindered its use as a raw material for chemical synthesis. With the advent of new solvents such as dimethyl formamide and dimethyl sulphoxide, however, it has become possible to extend the range of derivatives which have been prepared and these include mono-, di-, tri- and tetra-functional derivatives including deoxy-, halogeno-, thio- and amino-derivatives.

* * *

Determination of particle size distribution in fine sugar. E. A. NIEDIEK. *Zeitsch. Zuckerind.*, 1969, **94,** 495–506.—For sugar of grain size less than 30 μ a method has been developed for determination of particle size distribution. This wet sieve analysis using micro-mesh sieves is described in detail, as is a modification of the Coulter counter method which has application for sugar fineness of $<$ 8–10 μ. A photometric surface measurement method is also described, which is suitable for sugar of fineness $<$ 5–10 μ.

* * *

Thin-layer chromatographic determination of lactic acid in sugar factory raw juices. V. PREY and H. POLLIERES. *Zeitsch. Zuckerind.*, 1969, **94**, 510–511. The procedure described involves the use of 4:4:3 benzene:diethyl ether:formic acid as solvent and 0·2 g bromocresol green in 100 ml aqueous alcohol (1 part water:1 part alcohol) adjusted to pH 7 as developer. Lactic acid concentrations down to 0·1 μg/litre can be determined by this method, which takes 15–20 min.

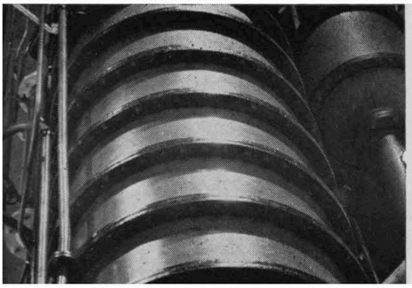
* * *

Recent Codex Alimentarius developments relating to sugar and other carbohydrates. C. B. BROEG. *Proc. 27th Meeting Sugar Ind. Tech.*, 1968, 19–27.—The efforts of the Sugars Committee of the Codex Alimentarius Commission[1] to draw up standards for various sugars and types of sugar are discussed and provisional standards for white and soft sugars are reproduced. The series of steps by which provisional standards advance to their finally accepted form is explained.

* * *

Occurrence and metabolic activity of the polysaccharide producing bacteria (genus *Bacillus*) in sugar refining[2]. R. D. SKOLE, H. NEWMAN and J. L. BARNWELL. *Proc. 27th Meeting Sugar Ind. Tech.*, 1968, 69–85. Laboratory investigations on the growth and metabolic activity of *Bacillus cereus* and *B. subtilis* in pure culture and in low-purity sweet-waters adjusted to 12°Bx at 37°C and pH 7·0 are discussed. Excellent sporulation rates were recorded in the sweet-waters, and all strains of the micro-organisms proved to be moderate to active laevan producers. Significant reductions in sucrose purities occurred in the presence of the bacteria.

[1] *I.S.J.*, 1966, **68**, 73–76.
[2] *See also I.S.J.*, 1969, **71**, 185.



By-products

Distillery development at Bybrook. Z. BACCHUS and E. ELLIOT. *J.A.S.T.J.*, 1967, **28**, 98–100.—The equipment and processes used in the remodelled fermentation station at Bybrook to increase rum and alcohol production efficiency in the face of rising molasses costs are described.

* * *

Lime-carbon dioxide purification of molasses and eluate in the recovery of betaine. I. P. CHERNIKOVA. *Izv. Vuzov, Pishch. Tekhnol.*, 1969, (3), 68–69.—Tests showed that for recovery of betaine and glutamic acid from molasses, it is preferable to elute the betaine and amino-acids from ion exchange resin with ammonia solution and treat the eluate with 35% CaO on weight of dry solids rather than first treat the molasses with lime and CO_2 and subject the eluate to two treatments with CaO, since in this case much glutamic acid is lost and the lime usage is unnecessarily high.

* * *

Intensive beef production from sugar cane. VI. Napier or maize as forage sources at two levels in diets based on molasses/urea. J. L. MARTIN, T. R. PRESTON and M. B. WILLIS. *Rev. Cubana Cienc. Agríc.*, 1968, **2**, 175–181.—Results are given of tests in which Brahman bulls were fed on diets (in restricted and unrestricted amounts) containing molasses and maize or Napier grass and were also allowed free access to a mixture containing 79% final molasses (90°Bx) and 3% urea. Live weight gains were the same with the two forage diets, although it was concluded that maize had the higher nutritive value. Substitution of molasses/urea for forage increased the feed utilization efficiency as was to be expected. Differences were found between the effect of restricted and *ad libitum* feeding. Molasses/urea may have different effects on the carcass when used at high levels to replace forage.

* * *

Beet pulp drying time. M. G. PARFENOPULO. *Sakhar. Prom.*, 1969, **43**, (2), 20–23.—A modified empirical formula is presented for calculating the overall drying time for beet pulp as a function of a number of variables, including method of heat application and temperature, and velocity and relative moisture of drying medium. Satisfactory agreement was found between experimental and calculated values under given conditions.

* * *

Adverse effects of some molasses components on fermentation. E. BERGANDER. *Die Lebensmittelind.*, 1969, **16**, 219–221.—Although beet molasses has a number of advantages for baker's yeast production, it does have some properties which can have an adverse effect on the fermentation process. These are discussed, particularly the presence of colloidal and suspended matter which must be removed before growth of the yeast on the molasses substrate, and the high alkalinity of the molasses, which should have a pH no higher than 6 and preferably 3·5–5. Other aspects mentioned include the disadvantages of using refinery molasses, which has been found to be poorer in vitamins and growth-promoting substances than raw or white sugar molasses.

* * *

Studies on the utilization of methanol by yeasts. K. A. AROJ, K. A. PRABHU and J. P. SHUKLA. *Proc. 36th Conv. Sugar Tech. Assoc. India*, 1968, (XXXXII), 6 pp. In fermentation tests with a *Candida* sp. culture, substitution of some of the sugar used as carbon source with methanol, the concentration of which was gradually increased from 0·6% to 2·0%, caused retardation of the process in the initial growth stages. However, in the later stages the culture became acclimatized to the higher methanol concentrations and its activity became normal.

* * *

Recovery of crude potassium salts from spent wash of molasses distilleries by fluidized incineration. S. C. GUPTA, J. P. SHUKLA and N. P. SHUKLA. *Proc. 36th Conv. Sugar Tech. Assoc. India*, 1968, (XXXXIII), 7 pp.—Spent wash at 9–10°Bx was evaporated to 30–40°Bx and sprayed as a mist into the top of a furnace in which the combustion zone temperature was maintained at 700°C. The crude K-containing ash was collected at the base of the furnace or from below a cyclone carrying off the furnace waste gases. Recovery was 70·6%.

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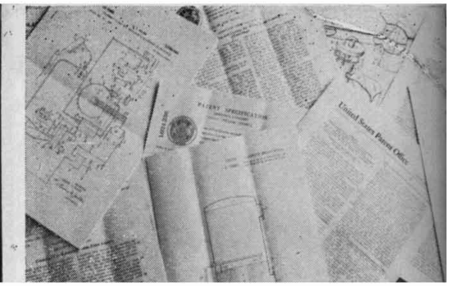
Studies on the use of carbonatation press mud in sintering and pelletizing of iron ore fines in the steel industry. V. SESHADRI, N. A. RAMAIAH, Y. BAHADUR and V. N. SHARMA. *Proc. 36th Conv. Sugar Tech. Assoc. India*, 1968, (XXXXVII, given as XXXXIII), 24 pp.—Tests are described in which carbonatation mud was substituted for limestone in the production of sinters and pellets from iron ore fines suitable for use as blast furnace charge in steel manufacture. Although the results were good, transportation of the mud from the carbonatation factories, situated in north India, to the steel plants in south-east India is considered to pose a problem, although briquetting of the mud could be one solution.

Patents



UNITED STATES

Preparation of instantaneously soluble porous granular sugar. M. Amano, T. Nishihashi, S. Shinada and Y. Ito, *assrs.* Nissin Sugar Manufacturing Co. Ltd., of Tokyo, Japan. **3,445,283.** 13th December 1965; 20th May 1969.—A sugar solution of 80–95% concentration at 110–130°C is cooled with agitation to crystallize the sugar in the form of micro-size fine sugar crystals. The mixture is mixed with 40–100% by weight of a hydrophilic organic liquid (ethanol) which does not dissolve sugar and which is easily recoverable by evaporation; the excess liquid is removed, leaving only a thin film on the crystals which are then spray-dried or granulated and dried.

* * *

Method of agglomerating sugar. W. J. Megowen, of Carlisle, Mass., USA, *assr.* The B. H. La Lone Co. Inc. **3,447,962.** 13th December 1965; 3rd June 1969. Sugar is passed through an agglomeration and breaking stage to produce particles not over a predetermined size. It is then air-classified to separate a powdered sugar of dimensions within a predetermined size range beneath the upper limit and this fraction re-processed in a second stage. The required size range of particles is separated and the remaining sugar recycled or subjected to a third stage.

* * *

Scale removal (from evaporator and boiler tubes, pipelines, etc.). J. W. Callahan, of Sulphur, La., USA. **3,447,963.** 4th October 1965; 3rd June 1969. The scale is contacted with 25–60% KOH at 180–235°F (for not more than 1 hour) and then rinsed. The scale dissolves and later precipitates from the KOH solution, from which it is separated.

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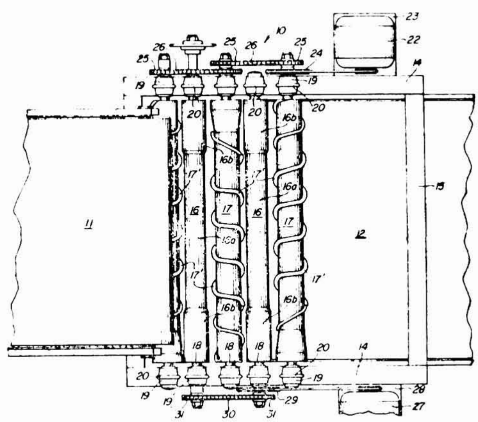
Cane harvester. H. J. Chauffe, of Jeanerette, La., USA. **3,448,564.** 27th May 1966; 10th June 1969.

* * *

Beet cleaner roll screen. J. M. Silver, of Ogden, Utah, USA, *assr.* Ogden Iron Works Co. **3,451,084.** 25th April 1967; 24th June 1969.

Alternate smooth and scrolled rolls 16, 17 extend across the direction of travel of beets from conveyor 11 to conveyor 12, and are driven at opposite ends by motors 22, 27 through appropriate chains and cogs, the shafts of the rollers being supported in bearing housings 19. The smooth rolls are slow-rotating and are covered with a thick layer of rubber, while the rolls 17 are of steel, with scrolls 17′ welded to them, and rotate at relatively high speed. The central part 16a of rolls 16 is of smaller diameter than the outer ends 16b while the scrolled rolls 17 are also provided with conical end sections which may either rotate freely with respect to the rest of the roll or may be locked with them.



The pitches of the scrolls 17′ are different on different rolls and the clearance between the adjacent rolls also varies. The size of the scrolls is also reduced where the roll 17 is adjacent a wider section 16b of the smooth rolls. Beets delivered onto the screen are carried over towards conveyor 12, the alternately wound scrolls tending to move them back and forth across the screen to spread out the roots and trash, the latter being forced down through the openings between the rolls. The smaller pitch scrolls tend to convey the beets along while the larger pitch scrolls tend to force the trash through the openings. Rocks and trash propelled by the scrolls towards the ends of the rolls are deflected by the conical ends up and off the screen and prevent roll damage by solid material becoming wedged between rolls.

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).

Glutamic acid production. R. L. HARNED, of Terre Haute, Ind., USA, *assr.* COMMERCIAL SOLVENTS CORPORATION. **3,451,891.** 17th December 1965; 24th June 1969.—Glutamic acid is produced from saccharide material containing excess biotin by absorbing the latter with micro-organisms and then sterilizing the material containing the micro-organisms and using it, still containing the sterilized micro-organism cells, as the carbon source in a fermentation medium for producing glutamic acid.

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Beet thinners. (I) I. D. PETZ, of Tracy, Calif., USA. **3,452,821.** 1st February 1966; 1st July 1969. (II) H. GUGENHAN and A. GEGO. **3,452,822.** 10th May 1966; 1st July 1969.

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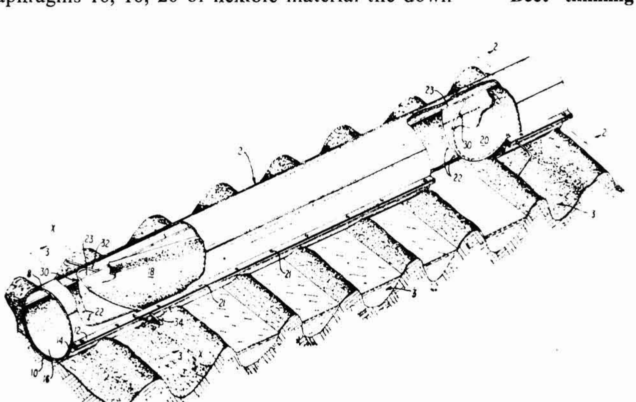
Refining and recrystallization of sugars using aqueous alcohols. B. SMYTHE and R. STAKER, *assrs.* THE COLONIAL SUGAR REFINING CO. LTD., of Sydney, N.S.W., Australia. **3,454,425.** 10th October 1966; 8th July 1969.—Sucrose crystals having a surface film of molasses are washed at 20-40°C with a sucrose-saturated mixture of 15–40% of water and 60–85% of methanol, ethanol, furfuryl alcohol, 2-methoxy ethanol or 2-ethoxy ethanol until the film is substantially removed. The cleaned crystals are separated and dissolved in aqueous methanol, ethanol, furfuryl alcohol, 2-methoxy ethanol or 2-ethoxy ethanol at 70–150°C under pressure to prevent boiling, insoluble impurities are separated and the hot liquor cooled to crystallize the sugar.

* * *

Flow controlling irrigation apparatus. W. M. REDDITT, of Honolulu, Hawaii, USA, *assr.* HAWAIIAN SUGAR PLANTERS ASSOCIATION. **3,464,209.** 6th February 1968; 2nd September 1969.

The conduit 2, which comprises flanged semi-cylindrical section 8, 10, extends across parallel irrigation furrows 3 in the ground and admits water to several of them at a time through ports in the lower section 10. The water flow is controlled by means of diaphragms 16, 18, 20 of flexible material the downstream ends of which are sealed and held by rivets 22 across the bottom section 10 while the side edges are sealed between the flanges 12 of the two sections 8, 10 by rivets 21. The upstream ends of the diaphragms are attached to the semi-circular rigid central sections 32 of a rod, the ends of which are horizontal, transverse to the conduit and pass out of the sides between the flanges, after which they are bent at right angles to form control rods 34.

The flexibility and size of the diaphragm and central sections 32 are such that an over-centre action is achieved by movement of the control rods whereby the end of the diaphragms are held in stable positions either against the upper or lower surface of the conduit. In the former position, water admitted from the upstream end of the conduit flows beneath the end of the diaphragm and so to those ports in section 10 below it. In the latter position, the diaphragm seals off these ports from the water supply but allows it to pass on to the next downstream set of ports. This flow selection is under the control of the rods 34 which may be operated manually or automatically by an actuator which may be time-controlled.



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Beet pulp processing. L. M. KOELSCH, of Pittsfield, Mass., USA, *assr.* BELOIT CORP. **3,455,235.** 29th September 1966; 15th July 1969.—Spent pulp from a beet diffuser is passed through a defibrating process which may involve the use of a hammer mill or a rotary disc attrition device in which the pulp is converted into a uniform mixture of fibrelets. These are then treated in a screw press to remove their excess water content to approximately 5–15%, and the pressed pulp then dried and pelleted for use as animal fodder.

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Cane harvester. J. P. SEXTON, of Clewiston, Fla., USA, *assr.* US SUGAR CORPORATION. **3,456,429.** 3rd February 1966; 22nd July 1969.

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Beet thinning method. J. TSCHUDY, of Shawnee Mission, Kansas, USA, *assr.* PRECISION AGRICULTURAL MACHINERY CO. **3,458,952.** 26th April 1968; 5th August 1969.

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Cane harvester. H. TOLAR, of Hilo, Hawaii, USA, *assr.* C. A. TOLAR. **3,460,324.** 10th February 1966; 12th August 1969.

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Beet harvester row finder. N. E. WELLS, of Boise, Idaho, USA. **3,461,967.** 14th March 1966; 19th August 1969.

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Continuous treatment of liquids such as sugar juice with an adsorbent

(ion exchange resins). W. HABERICH and E. H. G. FELBER, of Braunschweig, Germany, *assrs.* BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT. **3,462,299.** 11th January 1966; 19th August 1969. See UK Patent 1,139,692[1].

* * *

Removing starch from sweet sorghum juices. B. A. SMITH, of Weslaco, Texas, USA, *assr.* US SECRETARY OF AGRICULTURE. **3,464,856.** 22nd January 1968; 2nd September 1969.—The sorghum juice is adjusted to 12–16°Bx and pH 7·5–7·8 and about 3–5 p.p.m. of a flocculating additive incorporated at a temperature $\not>$60°C. The floc is separated and the juice concentrated to a 30–40°Bx syrup and the pH adjusted to 7·3–7·7; this syrup is heated to 60–90°C, 1–2 p.p.m. of a flocculating additive added, and the floc removed.

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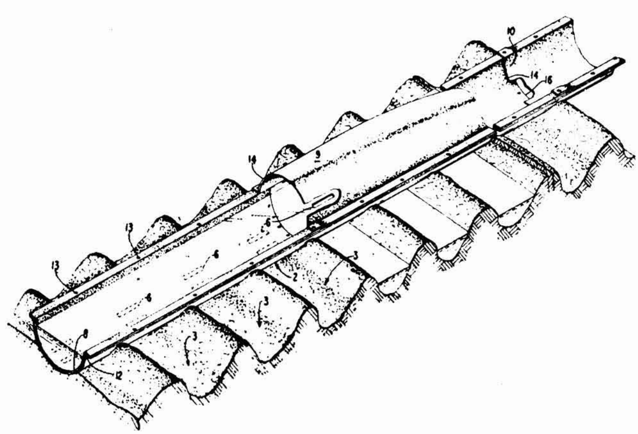
Surface irrigation device. W. O. GIBSON, of Kaneohe, Hawaii, USA, *assr.* HAWAIIAN SUGAR PLANTERS ASSOCIATION. **3,468,130.** 9th November 1967; 23rd September 1969.

The irrigation water channel 2 is of semicircular section and delivers water through slots 6 which are located over furrows 3 across which the channel is laid. Passage of water through the slots 6 is controlled by flexible diaphragms 8, 9, 10 which are fastened at the downstream ends to the bottom of the channel and the sides of which are fastened to the flanged sides 12 of the channel by e.g. rivets 13.



When water is to be run into the furrows beneath a particular diaphragm section, the upstream end is lifted either manually, with a tool or otherwise[2], when water flows beneath it and out of the slots, the sealed downstream preventing passage of water beyond the diaphragm section. When in its lower position, the diaphragm seals off the slots, allowing water to flow to the next downstream section.

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Cane processing (for bagasse board manufacture). R. B. MILLER, S. M. CREIGHTON and T. W. RACZUK, of Edmonton, Alta., Canada. **3,464,877.** 22nd July 1964; 2nd September 1969; R. B. MILLER and T. W. RACZUK, of Edmonton, Alta., Canada. **3,464,881.** 1st July 1965; 2nd September 1969.—Cane stalks are split longitudinally into segments from which the pith is removed without disturbing the fibre bundles; the unitized rind periphery strips are collected, and exterior material removed from the rind to expose the fibre bundles, all the while limiting forces being applied to maintain the bundles laterally interconnected and uncontaminated with juice. The bundles are then reduced into particulate material and subjected to drying, heat and pressure to form boards.

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Cane harvester topping mechanism. D. J. QUICK, of Highton, Australia, *assr.* INTERNATIONAL HARVESTER Co. **3,462,927.** 19th January 1967; 26th August 1969.

* * *

Screw presses (for beet pulp). P. SOLBERG, of Bergen, Norway, *assr.* STORD BARTZ INDUSTRI A/S. **3,461,793.** 26th June 1967; 19th August 1969.—See UK Patent 1,140,237[3].

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Apparatus for the continuous analysis of a liquid stream containing dissolved solids of which a portion are optically active in solution. G. E. SLOANE and K. M. ONNA, *assrs.* HAWAIIAN SUGAR PLANTERS ASSOCIATION, of Honolulu, Hawaii, USA. **3,468,607.** 6th December 1966; 23rd September 1969.—See UK Patent 1,157,718[4].

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Cane planter. J. J. COLLETTI, of Jeanerette, La., USA. **3,465,902.** 28th September 1967; 9th September 1969.

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Cane planter. S. E. LONGMAN, of Franklin, La., USA. **3,468,441.** 14th August 1967; 23rd September 1969.

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Beet harvester. E. BALLIGNAND, of Jemeppe-sur-Meuse, Belgium, assr. S. A. SOCIETER. **3,468,378.** 20th October 1965; 23rd September 1969.

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Beet thinner. D. H. GOMPERT, of Mitchell, Nebr., USA. **3,468,380.** 8th June 1966; 23rd September 1969.

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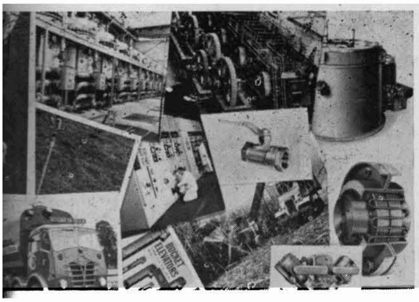
[1] *I.S.J.*, 1969, **71**, 187.
[2] *See* US Patent 3,464,209; *I.S.J.*, 1970, **72**, 186.
[3] *I.S.J.*, 1969, **71**, 188.
[4] *ibid.*, 1970, **72**, 93.



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.

Self-cleaning strainer. Filtration Dept., Serck Radiators, Warwick Rd., Birmingham 11, England.

The "Serclean" self-cleaning strainer has no moving parts but operates on the principle of fluidics, so that power supply and manual operation are obviated. It comprises two identical flow paths, each containing a filter element. When one element becomes partly clogged, the flow is switched to the other element by means of a fluidic bistable "gate". A constant backflow of clean filtrate returns through the standby element to wash off the impurities which are collected for later disposal. The strainer is designed for liquid-solid separation and is particularly suitable for the straining of water or low viscosity fluids for process or cooling. Separation levels as low as 100μ can be achieved. A range of sizes is available corresponding to flow rates from 25 to 200 gal/min.

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Panel-mounted pressure switch. Actuated Controls Ltd., Vale Lane, Hartcliffe Way, Bristol BS3 5RU, England.

A new range of pressure switches is announced which have been designed for direct mounting in the customer's own control cabinet or equipment. Produced in five ranges covering 0 to 30 in Hg vacuum, and 0 to 6, 20, 60 and 150 p.s.i. pressure, the switch incorporates the "ACTU" pivot-beam micro-switch mechanism which is simple, robust and adaptable. Use of stainless steel for certain close-tolerance components enables an average repetition accuracy of $\pm$ 0·5% to be obtained. The switches can be operated in an ambient temperature of up to 60°C, with a variation in operational accuracy over the range −20° — +60°C of less than 1%.

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PUBLICATIONS RECEIVED

CONTINUOUS CENTRIFUGAL. The Western States Machine Co., 1798 Fairgrove Ave., Hamilton, Ohio, 45011 USA.

A new brochure is announced which provides details of the Western States Type CC-IV continuous centrifugal, including the more important features such as the cast stainless steel conical basket and the rugged suspension system, and showing installations where the CC-IV machines are now in operation.

"CONTINUOUS PROCESSING CAPABILITIES". Dorr-Oliver Inc., Stamford, Conn., 06904 USA.

This is the title of Bulletin No. 7005, which gives information on Dorr-Oliver equipment and systems for material processing and water and effluent treatment, including all the well-known Dorr-Oliver plant used in the sugar industry.

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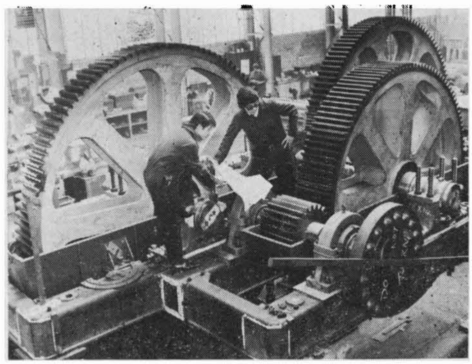
Fletcher and Stewart cane mill gears.—The illustration shows a cane mill gear drive for the sugar factory to be built at Dindings in Malaysia. The factory will be the first sugar factory to be built in Malaysia and will have a daily crushing capacity of 2000–2500 t.c.d. It is to be commissioned in January 1971.



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Hodag subsidiary in Mexico.—Hodag Chemical Corp., of Skokie, Ill., 60611 USA, announces the establishment of a new Mexican subsidiary, Productos Químicos Anahuac S.A. de C.V., of Mexico City, which will handle the distribution of all Hodag products in Mexico and Central America. The firm is already manufacturing some of the Hodag products, and plans eventually to manufacture the entire range of Hodag surface-active chemicals, including those used in the sugar industry.

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Bagasse plant in Thailand.—Parsons & Whittemore Inc., of 200 Park Ave., New York, N.Y., 10017 USA, announce the opening of a new bagasse paper plant built by them at Ban Pong in Thailand. The plant will produce 190 tons of kraft paper and 66 tons of pulp per day from bagasse supplied by nearby sugar factories.

* * *

De Smet diffusers.—An agreement signed in the past two years between Fletcher and Stewart Ltd. and Extraction De Smet S.A. allows for the construction by the UK firm of four De Smet diffusers for installation in four sugar factories. The first diffuser, a T.S. 35/3/9 of 3000 tons/day capacity, was successfully commissioned in Ethiopia in November 1969. The second, a T.S. 45 C of 4000 tons/day capacity, was ordered by The Mirrlees Watson Co. Ltd. for installation in the factory erected by them for Passi (Iloilo) Sugar Central Inc. at Panay in the Philippines, which is to be completed by June 1970. The other two De Smet diffusers are to be installed in the sugar factories being erected by Fletcher and Stewart at Davao (Philippines) and Dindings (Malaysia).

The late Josef Eisner

IT is with regret that we report the death on 9th April 1970 of Mr. JOSEF EISNER, after a 3-month illness. Mr. EISNER was born in Hungary in 1898 but came to England before the Second World War, becoming a British citizen in 1946.

He joined George Fletcher & Co. Ltd. of Derby in 1938 but was interned for a period on the outbreak of war, later being released to join the British Army. On release from the forces in 1945 he rejoined Fletchers and in March 1946 was appointed Technical Adviser to Booker McConnell Ltd. He immediately started to work on the design of new plant for Bookers' sugar factories in British Guiana, now Guyana. In 1949 he was appointed Technical Director to Bookers Sugar Estates Ltd. and worked in this capacity in Guyana until 1953.

On return to the UK in 1953 Mr. EISNER resumed his position as Technical Adviser to Booker McConnell Ltd. and worked closely with the Sugar London Advisory Committee which in 1960 became Bookers Agricultural Holdings Ltd. While with Bookers, Mr. EISNER was particularly involved with the post-war rehabilitation of the factories in Guyana. He played a key rôle in the complete reconstruction of the Uitvlugt factory, contributed substantially to the redesigning of Rose Hall and La Bonne Intention factories and to the planning of the new bulk sugar installation erected by Demerara Sugar Terminals. In 1958 he wrote his booklet "Basic calculations for the cane sugar factory", a deceptively simple but highly useful work; when it went out of print in 1968 he read it to amend it where necessary, but not a line needed to be changed.

Mr. EISNER retired in 1961 but continued to act as an independent sugar technology consultant.

This Journal owes a debt of gratitude to Mr. EISNER who served as one of our Panel of Referees from its inception, devoting his skill with languages as well as his profound technical expertise to the study of submitted papers, not only evaluating them but also providing suggestions for improving and making them acceptable and worthy of publication. He was a friendly and modest man with a wealth of knowledge and skill, and his loss will be keenly felt among his former colleagues in Derby, London and Guyana, as well as by his correspondents throughout the sugar world.

ISSCT
14th Congress, 1971

Names and addresses of the Sectional Chairmen for the 14th Congress of the ISSCT are as follows:

Agricultural Engineering

Mr. NORMAN J. KING, Bureau of Sugar Experiment Stations, 99 Gregory Terrace, Brisbane, Queensland, 4000 Australia.

Breeding and Genetics

Mr. JOE DANIELS, South Pacific Sugar Mills Ltd., Lautoka, Fiji.

Entomology

Mr. GEORGE WILSON, Sugar Experiment Station, P.O. Box 122, Gordonvale, Queensland, Australia.

Extension Education

Mr. CHARLES MILLER, Louisiana Coop. Extension Service, P.O. Box 717, New Iberia, La., 70560 U.S.A.

Fertilization, Soils and Cultural Practices

Mr. GEORGE SAMUELS, Puerto Rican Agricultural Experiment Station, Río Piedras, Puerto Rico.

Irrigation

Dr. T. G. CLEASBY, Tongaat Sugar Co. Ltd., P.O. Box 5, Maidstone, Natal, South Africa.

Plant Pathology

Mr. C. GRAHAM HUGHES, Bureau of Sugar Experiment Stations, 99 Gregory Terrace, Brisbane, Queensland, 4000 Australia.

Statistics

Sr. BASILIO A. ROJAS, Mariano Azuela Núm. 155, Ciudad Satelite, Mexico.

Weed Control, Plant Physiology and Biochemistry

Mr. WAYNE HILTON, Experiment Station, Hawaiian Sugar Planters' Association, Honolulu, Hawaii, 96822 U.S.A.

Processing

Dr. JOHN H. PAYNE, American Factors Associates, P.O. Box 3230, Honolulu, Hawaii, 96801 U.S.A.

Engineering

Dr. JOHN R. ALLEN, Sugar Research Institute, P.O. Box 21, Mackay, Queensland, 4740 Australia.

By-Products

Mr. CHARLES W. DAVIS, The Colonial Sugar Refining Co. Ltd., 1-7 O'Connell Street, Sydney, N.S.W., Australia.

Brevities

Argentina sugar production target 1970[1].—The Argentina Government has set a sugar production quota for 1970 of 970,000 metric tons. This compares with the original target of 800,000 tons set for 1969 which was raised later to 850,000 tons and then to 890,000 tons[2].

* * *

Canada beet sugar crop, 1969/70[3].—Sugar production from beet in Canada during the 1969/70 campaign amounted to 120,981 long tons, compared with 122,528 tons produced in the 1968/69 campaign. Beets delivered totalled 962,349 tons and were harvested from an area of 79,227 acres; in the previous campaign the beets delivered totalled 929,100 tons from an area of 81,753 acres.

* * *

New bulk sugar terminal for Brazil[4].—The Instituto do Açúcar e do Alcool plans the construction of a new sugar terminal in Maceio, Alagoas. The plant will be capable of handling 700 tons per hour and it will be able to load ships up to 25,000 tons d.w. Storage facilities will be provided for 200,000 tons of sugar and 100,000 hl of molasses.

Portugal sugar industry modernization[5].—Within the framework of a scheme entering in force in May 1970, some small refineries in Portugal will cease to exist and their commercial interests will be integrated into the remaining four which will need to be reconstructed to meet the country's needs. Production of "areado" soft sugar will cease[6] leaving only one type of granulated sugar. It is envisaged that production in Madeira will gradually be abandoned while its needs will be met from the Azores where output will be expanded. Consumption of sugar in Portugal was no more than 75,000 tons some thirty years ago but it has expanded to reach 207,000 tons in 1969 and is expected to reach at least 215,000 tons this year. In the past Portugal has bought free market sugar after meeting most of its needs from Mozambique and Angola. Production from the new factories of Maragra near Lourenço Marques and Açucareiro de Moçambique near Beira together with increased production from the existing factories in Angola will enable Portugal to attain self-sufficiency in the near future. It may well be that exports will need to be made to the free market if present production plans are brought to fruition in time. Portuguese imports in 1969 totalled 168,958 tons of which 130,041 tons came from Mozambique, 7,018 tons from Angola and the remaining 31,899 tons from other countries; in 1968, total imports had been 122,445 tons of which Mozambique supplied 111,452 tons and Angola 8944 tons, the remaining 2049 being supplied by other countries.

* * *

Texas sugar cane project[7].—A group of more than 100 Texas farmers have formed the Lower Rio Grande Valley Sugar Association and have pledged 26,000 acres for the production of sugar cane as well as, for payment by 1971, $175,000 toward a sugar-marketing quota. A recent study into the possibility of growing cane in the Lower Rio Grande Valley indicated that the plan is unusually sound and attractive provided a marketing quota can be obtained. A sugar mill was erected in the area in 1858 and improvement in transportat tion in the early 1900's allowed expansion to five mills by 1913. Market competition, salinity, insect pests and diseases contributed to the demise of the industry, the last factory closing in 1922. Reaction of other US cane areas depends on whether a quota for Texas would be from the foreign supply quota or as part of the mainland cane areas quota, already considered too small by Louisiana and Florida interests.

* * *

Colombia sugar data[8].—Production of sugar in the calendar year 1969 totalled 708,673 metric tons, raw value, while domestic consumption was 521,960 tons. Exports totalled 173,495 tons, so that stocks grew during the year from the initial 45,713 tons to the final figure of 58,931 tons. In the previous year production was 663,327 tons, consumption 446,772 tons and exports 238,311 tons and stocks had fallen from the initial 67,469 tons to 45,713 tons. Exports in 1969 included 80,138 tons to the US (99,870 in 1968), 58,880 tons to Japan (50,228), 22,050 tons to New Zealand (0), 7,200 tons to Canada (0), 5,014 tons to Hong Kong (0) and 213 tons to other countries. In 1968 exports had included 66,138 tons to Chile, 12,075 tons to Sweden, and 10,000 tons to the UK.

[1] *Bank of London & S. America Review*, 1970, **4**, 146.
[2] *I.S.J.*, 1970, **72**, 32
[3] C. Czarnikow Ltd., *Sugar Review*, 1970, (961), 49.
[4] F. O. Licht, *International Sugar Rpt.*, 1970, **102**, (9), 6.
[5] C. Czarnikow Ltd., *Sugar Review*, 1970, (961), 47–48.
[6] See CUNHA DA SILVEIRA: *I.S.J.*, 1970, **72**, 150.
[7] *Sugar y Azúcar*, 1970, **65**, (2), 45.
[8] C. Czarnikow Ltd., *Sugar Review*, 1970, (961), 49.

Brevities

Mauritius cyclone damage.—A cyclone passing near Mauritius over the Easter wreaked havoc in cane fields and the damage to the sugar crop has been estimated at about 20% destruction. The 1970 crop had been estimated at 675,000 tons but, in spite of the loss of production, the island will have enough sugar supplies to meet domestic needs and all export quotas.

* * *

UK sugar surcharge reduction.—In view of the rise in the world price of raw sugar, the UK Minister of Agriculture, Fisheries and Food has made Orders under the Sugar Act 1956 reducing the surcharge from 1¼d per lb (11s 8d per cwt) to 1d per lb (9s 4d per cwt) from the 5th May 1970.

* * *

Kenya sugar expansion[1].—It is estimated that white sugar production in 1970 will exceed 140,000 tons, or four times the production figure of 1963. Domestic consumption is estimated to be of the order of 170,000 tons and, if these estimated figures prove to be accurate, Kenya will save £2,000,000 per year on its sugar imports.

* * *

US beet area, 1970.—In October 1969 the US Dept. of Agriculture placed a limit on beet sowings of 1,450,000 acres for the 1970/71 crop in view of the record outturn expected from the 1969/70 campaign. With production falling short of expectations this limit was raised by 100,000 acres in February[2] but by early March farmers had announced their intentions to sow only some 1,495,000 acres. Final results of the 1969/70 crop may be as low as 3,325,000 short tons, raw value, and in April the Department consequently removed all limits on the 1970 crop[3]; it remains to be seen whether any additional acreage is planted as a result of this late action.

* * *

New sugar contract for the New York Sugar Exchange.—The new No. 11 Sugar Contract started trading on the 5th May and is expected to replace the No. 8 Contract gradually. The differences are that the new contract will provide for delivery in bulk and to a vessel which must be provided by the receiver within specified time limits. Trading in the new Contract will be permitted only for delivery months of January, March, May, July, September and October.

* * *

Philippines sugar factory re-erection[4].—The Agro-Industrial Co. of Silay-Saravia (AIDSISA) bought a 1500 t.c.d. sugar factory and re-erected it in 1965 near Silay City. Recently a new mill was built for AIDSISA, while a new group of more than 1000 planters have formed a cooperative, Dacongcogon Sugar and Rice Milling Company, which has acquired for 6,500,000 pesos the old ex-Puerto Rican mill which is to be reconditioned and transferred to Kabankalan in Negros Occidental.

* * *

Indonesian project for Hawaiian sugar consultants[5].—A contract has been awarded to American Factors Associates of Honolulu, Hawaii, for the development of new sugar cane plantations on the islands of Sumatra and Sulawesi. Construction of a modern sugar factory at Tjot Girek at the northern tip of Sumatra has been completed, but the cane supply has not been developed. American Factors Associates is to lay out a plantation of approximately 10,000 acres to support the new factory. Although the factory planned for southern Sulawesi has not been built, the machinery and equipment have been delivered. It will be necessary to determine the best location for the factory commencing detailed planning for the new plantation around it.

Switzerland sugar imports[6]

	1969	1968	1967
	(metric tons, tel quel)		
Belgium/Luxembourg	749	18,037	13,024
Cuba	2,583	16,084	59,934
Czechoslovakia	35,161	32,357	33,134
Denmark	10,963	38,943	14,686
Finland	986	464	11,487
France	49,376	71,891	30,693
Germany, West	13,997	18,611	4,788
Holland	4,981	—	20
Hungary	755	1,875	6,350
Italy	13,739	12,241	—
Peru	—	1,346	1,645
UK	48,508	47,944	58,309
Other countries	792	706	1,024
Total	182,590	260,499	235,094

Distillery waste for animal fodder in Australia[7].—Experiments have been made by the C.S.I.R.O. into the concentration of distillery waste or dunder by a submerged combustion technique whereby the 8% of carbohydrates, proteins and inorganic material content is raised to 50%. Experiments are being made on the suitability of the concentrated dunder as a constituent in animal fodder; a fodder of a similar nature is already imported from South Africa.

* * *

Canada sugar imports[8]

	1969	1968	1967
	(long tons, tel quel)		
Raw sugar			
Australia	215,489	142,509	154,643
Bahamas	4,505	—	—
Barbados	—	—	26,182
British Honduras	21,708	18,903	16,426
Colombia	6,398	—	6,398
Cuba	70,874	46,690	68,831
Fiji	74,289	55,752	75,419
Guyana	37,178	61,666	87,523
India	—	11,615	58,977
Jamaica	21,373	63,242	44,522
Malaysia	10,341	—	—
Mauritius	199,886	124,574	49,020
Mexico	—	—	4,500
Salvador	—	5,250	—
South Africa	213,366	288,017	266,337
Swaziland	30,539	—	—
Trinidad	14,036	27,937	16,896
Uganda	11,478	—	—
	931,460	846,155	875,674
Refined sugar			
Holland	252	129	107
UK	70	2,759	2,690
USA	126	75	13
Other countries	180	62	—
	628	3,025	2,810

[1] *Financial Times*, 29th December 1969.
[2] *I.S.J.*, 1970, **72**, 128.
[3] C. Czarnikow Ltd., *Sugar Review*, 1970, (968), 80.
[4] *Sugar News*, 1969, **45**, 743.
[5] *Ind. Agric. Research & Management Newsletter*, 1969, **9**, (4), 1.
[6] C. Czarnikow Ltd., *Sugar Review*, 1970, (958), 36.
[7] *Australian Sugar J.*, 1970, **61**, 524.
[8] C. Czarnikow Ltd., *Sugar Review*, 1970, (961), 48.

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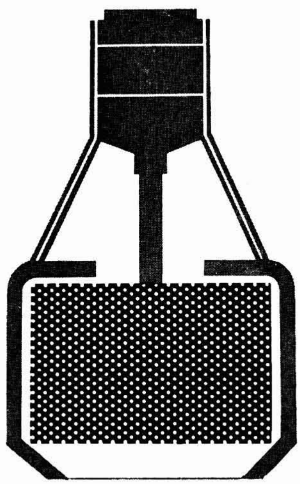

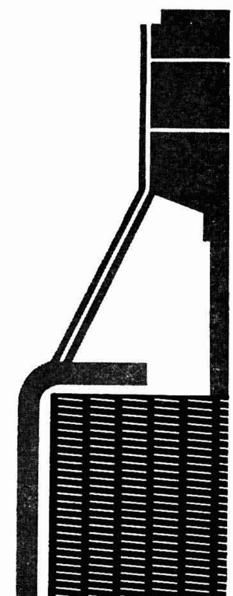

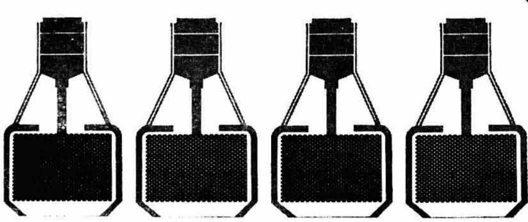

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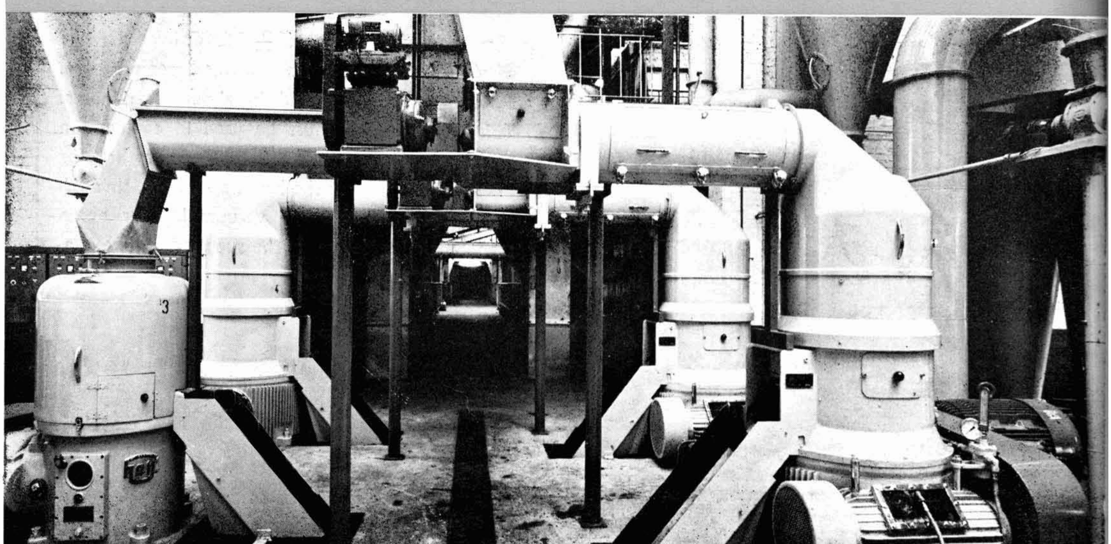

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