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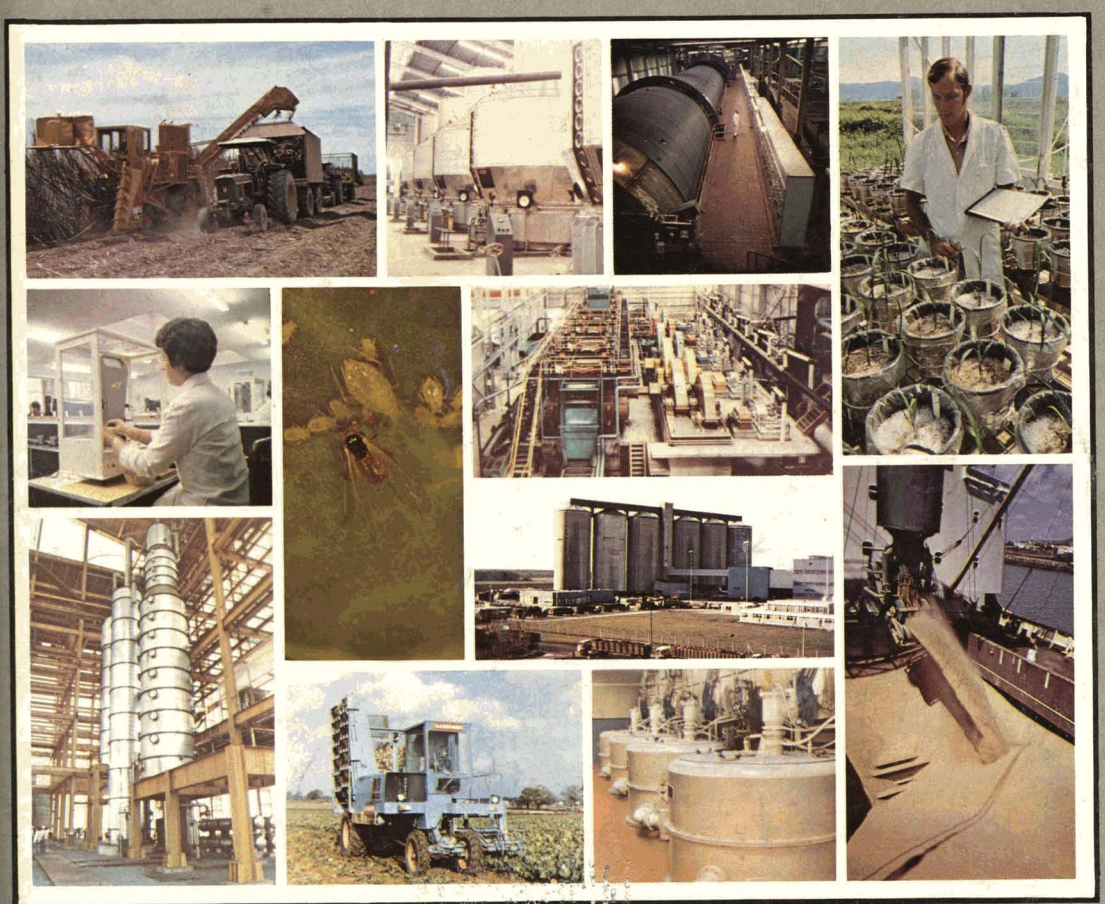

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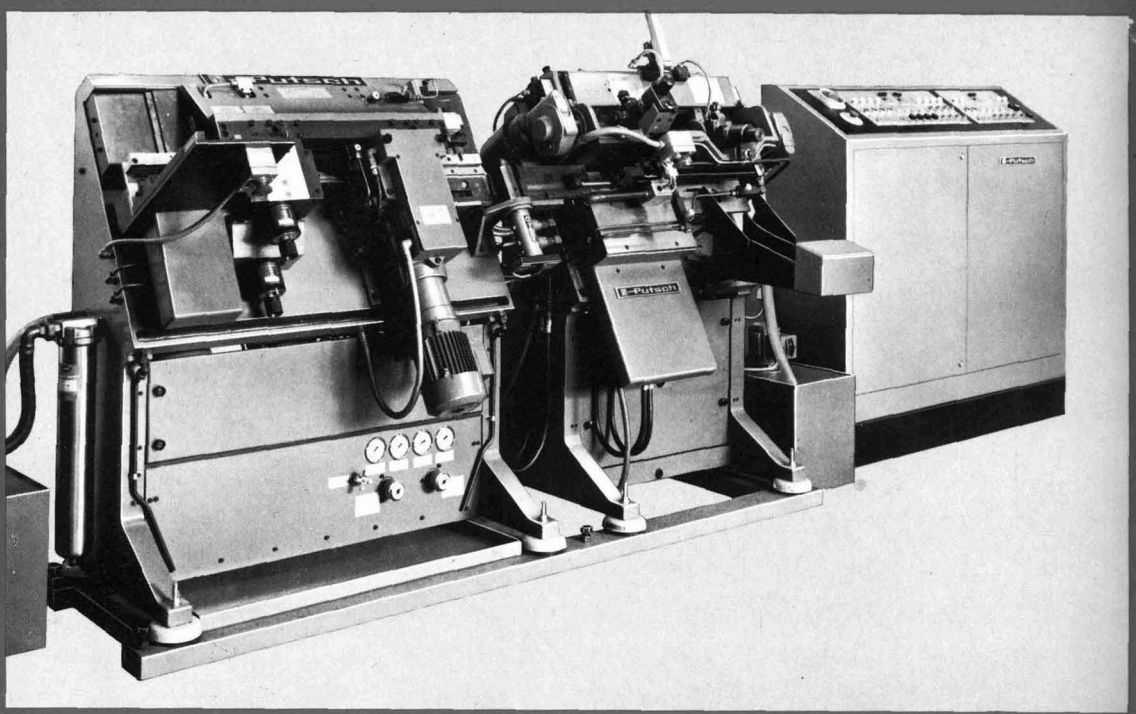

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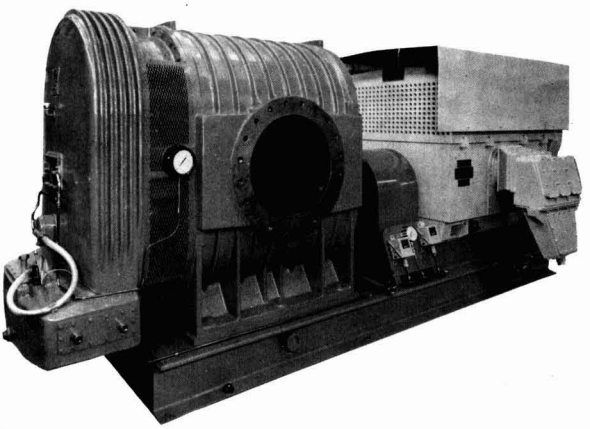

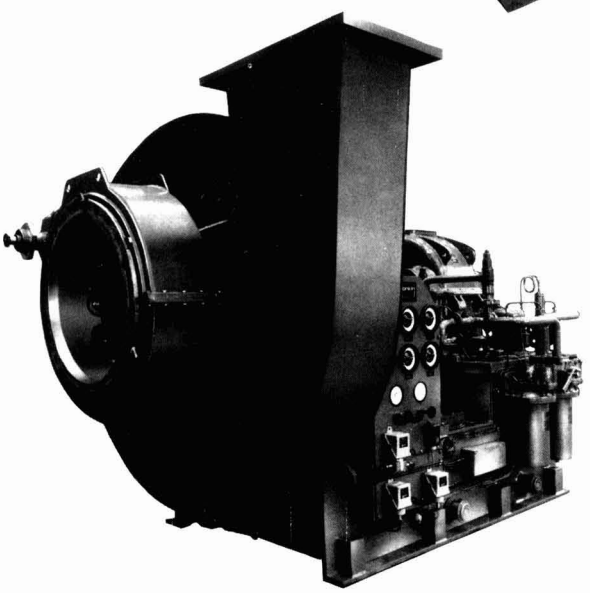

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NOTES AND COMMENTS

World sugar prices

The London Daily Price for raw sugar started the month of August at £105 and remained fairly steady during the first half of the month between extremes of £103 and £108, returning to £105 on August 13. During the same period, publication of the results of beet tests in various European countries showed that the good growing conditions were producing bigger sugar beets and that, in spite of a drop of some 8-9% in the EEC area, sugar production was likely to be little less than the record tonnage of the 1981/82 campaign. The prospect of even more surplus white sugar drove down the premium of white sugar over raws from £25 to £12 and the LDP(W) continued to sink during the rest of the month, driving the raw sugar price with it. From a level of £130 at the beginning of the month, the LDP(W) had fallen to £110 by August 31, while the LDP had fallen to £90, its lowest level since August 1978. Relief does not seem to be in prospect, moreover, since those initial world sugar production estimates so far published for the 1982/83 season indicate yet further additions to the sugar surplus which is hanging over the market.

The normal response to low prices would be a surge in consumption and reduced plantings of beet and cane, with a consequent fall in production. As *World Sugar Journal* points out[1], however, large-scale increase in consumption would appear to be excluded because of continuing universal recession, high unemployment and interest rates in developed countries coupled with the shortage of foreign exchange in developing countries and, most important, the development and expansion of HFCS.

World Sugar Journal questions whether a drastic reduction in production is a real possibility but does not think so since, with a new Conference to be called in the autumn of 1984 to negotiate a new International Sugar Agreement to take effect in 1985, all exporting countries will try their best to improve their negotiating positions by improving their production and exports, while the inflated level of ISA basic export quotas will encourage them to produce and export all of their entitlements.

"An attitude towards the negotiating Conference along the lines described above will almost ensure the failure of that Conference. It is unrealistic to think that unreasonable demands from a majority of exporters, well in excess of the import requirements of the importers, could possibly be met to more or less everybody's satisfaction. Failure of such an attempt to negotiate a new Agreement will have its own silver lining; exporters who were aiming at a fat b.e.t. as their target and planned their production accordingly, will be forced to reconsider their sugar policy . . . . Some will be forced to curtail production, some may make more sugar available to domestic consumers and others with access to preferential markets with more or less unlimited quantities, will be able to carry on without having to curtail production. Until world sugar production is curtailed to match the demand for it the prospects for the industry are not very bright."

World sugar balance, 1981/82

A fourth estimate of the world sugar balance for September 1981/August 1982 was published recently by F. O. Licht GmbH[2] and is reproduced below. World production is set 1 million tonnes higher than in the 3rd estimate as a consequence of record crops in India, Thailand and a number of smaller producing countries, and is expected to reach 8.7 million tonnes more than consumption for the same period. Not surprisingly, this gloomy outlook had a depressing effect on the sugar market.

	1981/82	1980/81	1979/80
	tonnes, raw value		
Initial stocks	24,915,000	25,793,000	31,207,000
Production	98,651,000	88,213,000	84,857,000
Imports	29,292,000	28,786,000	29,551,000
	152,858,000	142,792,000	145,615,000
Exports	29,791,000	29,307,000	30,226,000
Consumption	90,299,000	88,570,000	89,596,000
Final stocks	32,768,000	24,915,000	25,793,000

Production is set 10,438,000 tonnes higher than in 1980/81 and this is the prime cause of the low prices. It might have been expected that, with such low prices, consumption would have expanded much more than the 1,729,000 tonnes shown in the balance, particularly in the developing countries where per caput consumption is low. Dr. A. Viton has discussed this, however, and considers that, strange to say, it is partly due to the low price[3]. Governments of sugar exporting countries have been forced to sanction internal price increases to save producers from bankruptcy and such increases have been numerous and substantial. They have occurred in low-income countries where price elasticity is greatest and sugar consumption has fallen as a result.

Corn sweeteners have taken part of the potential for higher consumption but the world recession and reduced incomes have played their part in giving an offtake smaller than might have been expected in other times.

C. Czarnikow Ltd. note[4] that part of the final stocks – set at historically high levels – have been segregated by the EEC and by exporting members of the ISA, while it is clear that India will increase stocks considerably during the course of this season. Nevertheless, real surplus stocks are a large and depressing influence on world prices.

US sugar import quota system changes

On August 5 the US Department of Agriculture announced changes in the sugar import quota system designed to improve the administration of quotas, facilitate access to the US market and help meet US international trade obligations. The changes provide for a shift from quarterly to annual quotas, establish a "certificate of eligibility" system and modify quota allocation provisions, including those covering the "basket" category of "other specified countries and areas." The certificate system became effective on August 11 whilst the other changes become effective with the new quota period beginning October 1.

Under the certificate of eligibility system, the USDA will issue certificates to foreign countries which have sugar import quotas. Each country, in turn, will issue

[1] 1982, **5**, (2), 4-5.
[2] *International Sugar Rpt.*, 1982, **114**, 369-373.
[3] *ibid.*, 387-388.
[4] *Sugar Review*, 1982, (1605), 116.

these certificates to consignees or shippers of sugar to the United States. Sugar from a country participating in the certificate system would not be permitted to enter the United States for consumption or be withdrawn from a US warehouse for consumption without an accompanying certificate. Participation in the certificate system is optional but most foreign countries have asked for such a system.

EEC export quota sugar for 1982/83[1]

It has been reported that the Commission has indicated that releases of quota sugar for export from the European Economic Community during the 1982/83 season will amount to about 3.2 million tonnes in terms of white sugar. Bearing in mind the level of quotas and also the imports which will come from the ACP countries and from East Germany, as well as the movement of sugar in consumer goods, this would appear to indicate that there is, at present, no intention to reduce stock levels this season, which started on July 1. This, of course, will not affect the 992,000 tonnes of C-sugar which were set aside last season by the producers and which now automatically become quota sugar.

Whether, and to what extent, producers may be expected to establish stocks of C-sugar again in 1982/83 will no doubt reflect not only production but also political decisions both in Brussels and elsewhere within the Community. Although the results of the first beet tests are generally published in August it will be some time before close indications of likely output in the 1982/83 campaign will be possible. To achieve the level of exports mentioned it will be necessary to release an average of rather more than 60,000 tonnes each week. This was not achieved during the first month of the new season, when a total of only 92,750 tonnes was achieved, with export rebates up to 308.7 e.c.u. per tonne.

Sugar outlook for 1982/83

Sucres et Denrées S.A. of Paris have recently published[2] an assessment of the outlook for the sugar market in 1982 based on their interpretation of developments over the past crop year and circumstances they foresee in the current one. They expect another substantial surplus to add to that of 1981/82 since, while certain reductions of a more or less voluntary nature are likely e.g. in the EEC and the USA where sowings have been reduced and in India and Thailand where the crops have been extraordinarily large in 1981/82, increases may be expected in the USSR, Brazil, Cuba, Mexico, Guatemala, Turkey, Indonesia, China, Fiji and several African countries. With normal weather conditions, therefore, Sucres et Denrées expect world sugar production next season to be about the same as 1981/82. The general world situation with regard to consumption shows no sign of improvement and the increase next season is thus likely to be about 2%. Thus a further addition of some 5 million tonnes may be expected to add to the current surplus, bringing stocks to more than 40% of the annual consumption, a level higher than the crisis levels (32, 35%, etc.) of previous sugar slumps.

"It remains to be hoped, therefore, that after the 1982/83 crop, . . . there will be an appreciable reduction in production. It may be noted that to date the sharpest decrease to be recorded from one campaign to another – but one of a disastrous, involuntary nature – was 7 million tonnes in 1979/80. The possibilities of a recovery would coincide with the expiry of the International Sugar Agreement, that is at the end of 1984. With prospects of recovery so uncertain, the gravity of the crisis could justify stringent measures. It is therefore not impossible that all producers, without exception, may begin to consider, faster than one would suppose, setting up new structures for keeping production within limits more compatible with requirements."

Paris white sugar market[3]

The Paris white sugar terminal market has been, in recent years, a fairly active hedging tool for white sugar producers, consumers and traders. Originally the market was intended to handle high quality white sugar in 50 kg jute bags with polyethylene linings; the largest suppliers of such sugar were East and West Europe. Delivery ports were all in Europe so that other world origins were absent from the market except occasionally lower grade crystals from Brazil or Argentina in cotton or single jute bags.

More recently white sugar market activity has increased and high quality whites have become available in standard packing from Brazil and Argentina, while the USA has also re-exported refined sugar in important amounts. In order to make the Paris market more representative of world trade, some amendments have been made which will apply from July 1983 on; these include delivery from a number of ports in USA, Brazil and Argentina while the sugars must have a minimum pol of 99.8 and be packed in 50 kg net new polyethylene-lined bags.

As in the No. 4 London Contract, a Freight Committee will establish differentials from North Sea ports to a hypothetical Eastern Mediterranean port of destination and the new delivery ports to the same destination. Paris will become a market where sugar from the new origins may be hedged and potentially a point of delivery.

The UK sugar market

The structure, size, trends and developments within the UK market for sugar have been studied by market analysts Key Note Publications Ltd., who have published the results in a booklet obtainable from 28-42 Banner Street, London EC1Y 8QE at a price of £35, post-paid. The market, worth some £750 million annually, is very roughly split in half between consumer and industrial sectors and both have been in decline for some time. Direct consumption per person has fallen by 38% since 1961, partly because of attacks on sugar as associated with health problems. In addition there has been a trend away from sugar confectionery to chocolate, while other sweeteners have made inroads into the soft drinks sweetener market. In the medium term such competition is likely to increase and permission to use new sweeteners such as Aspartame has been recommended.

The long-term prospects are clouded by general imbalance in the world sugar market; the prosperity of the protected EEC sugar industry contrasts with the depressed state of industries dependent on the world sugar market. Lower world prices mean that subsidization of EEC sugar exports is more costly and the resulting pressure on the EEC to cut its over-production raises some doubts on the long-term prospects for EEC and, hence, UK producers.

Barbados sugar factory closure. – The Lower Estate sugar factory of Barbados Sugar Factories Ltd. has been closed.

[1] C. Czarnikow Ltd., *Sugar Review,* 1982, (1608), 127.
[2] *Sugar Rpt.,* 1982, (2).
[3] *World Sugar J.,* 1982, **5**, (1), 34.

Calibration of saccharimeters with particular reference to use at temperatures differing from 20°C

By R. J. KING* and J. F. T. OLDFIELD†

Pol measurement of sugar solutions is an essential feature involved in commercial transactions with raw sugar and in the technical control of sugar factories and refineries.

The 100°S point of the International Sugar Scale is defined in terms of a procedure based on measurements made at 20.00°C[1] and ideally all pol measurements should be made at this temperature. In many parts of the world this is achieved by conducting all the operations in temperature-controlled rooms, but in some tropical and sub-tropical regions this is not a practical possibility and the measurements necessarily have to be made at temperatures higher than 20°C; the values so obtained must then be converted as accurately as possible into the values which would have been obtained if the operations had been conducted at 20°C. It is not possible to apply temperature corrections precisely if the solution contains unknown proportions of several optically active materials but this conversion is feasible for a solution of pure sucrose; for technical sugar solutions it is usual to accept the errors in assuming that the optical rotation will have the same temperature variation as if sucrose alone were responsible for the rotation.

At the 10th Session of ICUMSA in 1949, Einsporn[2] submitted a formula combining temperature coefficients for the specific rotation of sucrose, and for the rotation of quartz plates, as determined by Schönrock and Gumlich, respectively. The validity of this temperature formula, to allow the sugar value S_{20} of a quartz control plate at 20°C to be converted into the sugar value S_t at t°C, was confirmed by other workers and was officially adopted at the 13th Session of ICUMSA in 1962[3].

More recently, Emmerich[4,5] has re-examined all the latest measurements and produced a much more sophisticated formula to include not only the temperature dependence of the sucrose solution and of the quartz plate but also the influence of temperature on the volume of the graduated flask used to prepare the sugar solution, on the length of the polarimeter tube, and on the polarimeter itself. The formula provided for situations in which the sugar solution was prepared at a temperature t_m which might differ from the temperature t_r of the solution during measurement, while the quartz wedge compensator might again be at a different temperature t_q. Coefficients were tabulated according to whether the volumetric flask was of borosilicate or soda glass, and whether the polarimeter tube was of borosilicate glass, soda glass, or steel; the formula also included an adjustment for the effect of invert sugar on the temperature dependence of the optical rotation of the sample.

The Emmerich analysis[4] contains all the information needed to formulate a procedure for measurements at temperatures differing from 20°C and the formula was tentatively adopted at the 17th Session of ICUMSA in 1978[6] "for the temperature correction of polarimetric sugar determinations using saccharimeters calibrated at 20.00°C."

The actual sequence of operations to be followed in calibrating a saccharimeter either at 20°C or at other temperatures has never been specified by ICUMSA.

Those who are fully conversant with the principles of polarimetry should be able to deduce a method for calibration as indicated by the 1978 ICUMSA Recommendation[6] but many of those engaged in measurements of pol are not so conversant with the principles and, to avoid the possibility of misapplication, it is desirable that ICUMSA should adopt standard procedures for the calibration of saccharimeters. Some lack of uniformity can arise even in the apparently straightforward calibration at 20°C, and so the procedure should include calibration at 20°C in addition to the more complex procedure for calibration at other temperatures.

In considering why calibration is required, and the means by which calibration should be achieved, it is necessary to differentiate between the provision and adjustment of the scale insofar as this can be undertaken by the instrument manufacturers, and calibration of that scale which must essentially be undertaken periodically during the day-to-day use of the saccharimeter.

With the exception of some electronic sacharimeters with fully variable readout, most saccharimeters are fitted with a scale which has been engraved by the manufacturers. This operation will be referred to as graduation. It is preferable that the scale should be graduated so that 100°S corresponds to the nominal rotation at 20°C for the normal sugar solution[1], with the light source normally fitted to the saccharimeter. Nevertheless, the calibration procedures suggested below are not limited to a scale so graduated; the procedure can be applied to any scale, including an arbitrary readout such as that from a photoelectric Faraday effect polarimeter,

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1 *Proc. 16th Session ICUMSA*, 1974, 72-73, Recommendations 1, 2 & 4.
2 *Proc. 10th Session ICUMSA*, 1949, 20.
3 *Proc. 13th Session ICUMSA*, 1962, 26-27.
4 *Zucker*, 1977, **30**, 658-661.
5 *Proc. 17th Session ICUMSA*, 1978, 55-56.
6 *ibid.*, 79.

provided the scale divisions correspond to equal increments of rotation (i.e. a linear scale) and it is possible to adjust the scale to read zero when the instrument is on balance with no sample in the light path.

However the scale has been graduated, it will in general be necessary to calibrate the saccharimeter in order to derive the pol value of a sugar solution. Calibration is required even though the scale has been graduated precisely in accordance with the recommendations of ICUMSA, and all operations are carried out at 20°C, because the effective wavelength of most light sources is subject to periodic variations during the life of any single source with the probability of larger variation when it is necessary to replace the lamp or other source of light.

The effective wavelength of the light source as used for polarimetry may therefore differ from that for which the scale graduations apply. The effects of wavelength variations are minimized in quartz-wedge saccharimeters in which the optical rotation of the sugar solution is balanced by the opposite rotation of the moveable quartz-wedge compensator. As the rotary dispersion of quartz is very similar to that of a sugar solution, small changes in the effective wavelength of the source affect the optical rotation of the sugar solution and compensator to almost exactly the same extent. However, saccharimeters employing a rotating polarizer or analyser rather than quartz-wedge compensation are in widespread use; in these instruments the optical rotation of the sugar solution, which is strongly wavelength-dependent, is measured directly as an angular rotation and the need for regular instrument calibration is evident.

The close correspondence between the rotary dispersions of quartz and sucrose solutions over narrrow wavebands does however ensure that quartz plates can be used for calibration of saccharimeters, without significant errors arising from the variations between the effective wavelength and the nominal wavelength of the light source, regardless of the type of compensatory system.

Suggested procedures are given below for calibration when all operations and measurement are carried out at 20°C or alternatively when solution preparation and/or measurements are carried out at temperatures differing from 20°C.

A. Calibration for use at 20°C

With the saccharimeter at equilibrium with an enviroment at 20°C, the instrument is initially set to zero when on balance with no sample in the light path.

The quartz control plate, having a calibration value S_Q at 20°C in °S, is introduced into the light path and the scale reading S_Q' determined.

Measurements with sugar solutions can be made without physical adjustments to the saccharimeter scale. If the sugar solution is prepared and and measured at 20°C, the ratio between the true pol value P and the measured value P' will be equal to the ratio between the calibration value S_Q and the measured scale reading S_Q' for the quartz plate.

$$\frac{P}{P'} = \frac{S_Q}{S_Q'} \text{ and } P = P' \frac{S_Q}{S_Q'} \quad \ldots\ldots\ldots \quad (1)$$

Hence the ratio $\frac{S_Q}{S_Q'}$ represents the calibration factor C by which all readings throughout the scale range of the saccharimeter should be multiplied to obtain the true pol value.

It will be appreciated that this calibration procedure is applicable to any linear scale.

Note: It has been the practice in some laboratories to calibrate by adjusting the graduated scale of the saccharimeter physically so that a scale reading of S_Q is obtained when on balance with the quartz control plate in the light path. This procedure does not introduce significant errors if all measured pol values are within a narrow band of scale readings close to the sugar value of the quartz plate. This situation may be achieved if the saccharimeter is used only to measure the pol value of raw sugars, but significant errors will be introduced if a rigid scale saccharimeter, so adjusted, is used for general polarimetry.

If a rigid scale is adjusted physically so as to change the reading of S_Q' to S_Q, the polarimeter zero will also be changed by an amount S where $S = S_Q - S_Q'$ and an error E which varies throughout the scale will be introduced such that

$$E = S\ (1 - \frac{P}{S_Q})$$

The error is therefore zero if $P = S_Q$ but increases with increasing difference between P and S_Q, becoming equal to S if P = zero.

B. Calibration at temperatures differing from 20°C

The coefficients used in the following procedure correspond to those in the Emmerich formula[5] as adopted by ICUMSA[6]. However the latter Recommendation requires use of a saccharimeter "calibrated at 20°C".

Calibration is required relatively frequently, and it is probable that those laboratories which do not possess facilities for measuring pol at 20°C do not have facilities for calibrating at 20°C. Consequently it is desirable that a practical procedure should not require the use of any measurements at 20°C.

Also, the Emmerich formula incorporates one term, $d(t_q\text{-}20)$, which represents an instrument correction applicable only to the quartz wedge saccharimeter, this term representing the correction for a difference in temperature of the quartz wedge between calibration at 20°C and use at t_q°C.

As several types of saccharimeter are currently used for sugar determinations, it would seem preferable to devise a calibration method that avoids the use of an instrument correction factor.

As demonstrated in the analysis below, this can be achieved and the whole procedure can be simplified by calibration using a quartz control plate provided the calibration and measurements are both carried out at the same temperature. In addition this procedure eliminates the need for calibration of the saccharimeter at 20°C.

Suppose a sugar solution is prepared at temperature t_m and is then measured in a saccharimeter at temperature t. Calibration is carried out using a quartz control plate, possessing a °S value of S_Q at 20°C, i.e. the usual calibration figure provided by a national standardizing laboratory. All measurements are assumed to be made at the same wavelength.

With the saccharimeter at temperature t the instrument is initially set to zero with no sample in the light beam

and the reading S_Q' taken with the quartz control plate introduced. Then

$$S_Q' = K\, S_Q \left\{1 + 0.000144(t - 20)\right\} \quad \ldots\ldots \quad (2)$$

Equation (2) includes the effect of temperature on the optical rotation of quartz in the standard plate (this is given in equation (17) of the Emmerich paper), while K is the instrument calibration factor and includes possible changes in saccharimeter calibration with temperature (for example temperature effects in the quartz wedge of a quartz wedge saccharimeter).

If the sugar solution is prepared at temperature t_m and measured at temperature t, the measured pol P' and the pol P corrected to 20°C will be related by the following equation:

$$P = \frac{P'}{K}\left\{1 - a\,(t_m - 20) - b\,(t_m - 20)^2 + C\,(t - 20)\right\} \quad . \quad (3)$$

where the coefficients a, b and c are given in the table below (see also Table 3, Subject 5, 1978 ICUMSA Proceedings). These coefficients represent the corrections necessary owing to the effect of temperature on the volume of the volumetric flask and the sugar solution and on the length of the polarimeter tube. For simplicity the effect of invert sugar is ignored in this analysis.

Temperature Correction Coefficients

Volumetric flask	Tube	Coefficients x 10^6		
		a	b	c
BS	BS	270	3	467
BS	N	270	3	462
BS	St	270	3	455
N	BS	255	3	467
N	N	255	3	462
N	St	255	3	455

Note BS = borosilicate glass
N = normal glass
St = steel

Combining equations (2) and (3)

$$P = \frac{P'S_Q}{S_Q'}\left\{1 - a\,(t_m - 20) - b\,(t_m - 20)^2 + c\,(t-20) + 0.000144(t-20)\right\} \quad . \quad (4)$$

It will be seen that equation (4) is very similar to the Emmerich formula, particularly as the coefficient d in the latter is equal to 144×10^{-6}. However in equation (4) of the present analysis this coefficient is introduced because of temperature effects in the quartz control plate rather than in the quartz wedge of a saccharimeter.

Summarizing, equation (4) allows the pol value of a sucrose solution to be corrected to 20°C from measurements at temperature t, provided a quartz control plate with a known sugar value at 20°C is also measured at temperature t. In addition, the user must record the temperature at which the sugar solution is prepared and know the type of material used in the manufacture of the volumetric flask and the polarimeter tube so that the correction factors in equation (4) can be evaluated.

If facilities are available such that the temperatures t and t_m are reproducible from day to day, and the materials used for the tubes and volumetric flasks are not changed, the terms within the bracket of equation (4) will remain unchanged and can be evaluated as a constant factor F so that equation (4) becomes

$$P = P'\,F\,\frac{S_Q}{S_Q'} \quad \ldots\ldots\ldots\ldots \quad (5)$$

Hence the term $F\,\frac{S_Q}{S_Q'}$ represents the calibration factor C' by which the scale readings for any sucrose solution should be multiplied to correct the pol value to 20°C. (It will be appreciated that the factor F becomes unity and equation (5) and (1) become identical if t and t_m are equal to 20°C.)

This calibration method would appear to have the advantages that no instrument correction factor and no calibration of the saccharimeter at 20°C are required. Furthermore, as a calibration value for the quartz control plate is only needed for a temperature of 20°C, it would seem unnecessary to extend the calibration operations of the national standardizing laboratories to cover temperatures other than 20°C.

Summary

Regular calibration of saccharimeters is necessary, particularly for circular scale instruments where the calibration can be significantly affected by slight variations in the effective wavelength of the light source. Additional calibration is required if the saccharimeter is to be used at temperatures other than the standard 20°C. At the 17th Session of ICUMSA in 1978, the Emmerich formula giving all the coefficients required for the temperature correction of polarimetric sugar determinations was tentatively adopted. However, the formula is applicable to saccharimeters calibrated at 20°C, a procedure that may not be a practical possibility in tropical countries. Furthermore the actual sequence of operations to be followed in calibration has not been specified. This paper outlines a procedure for calibrating saccharimeters at 20°C and at other temperatures by using a quartz control plate which has been calibrated at 20°C by a national standardizing laboratory. The procedure allows pol values to be corrected to 20°C from measurements carried out at other temperatures on the sugar solution and the quartz plate; under these circumstances, no calibration of the saccharimeter at 20°C is required.

Calibrage des saccharimètres, en particulier pour leur utilisation à des températures différentes de 20°C

Un calibrage régulier des saccharimètres est nécessaire, en particulier pour les instruments à échelle circulaire où le calibrage peut être fortement influencé par des légères variations dans la longueur d'onde effective de la source lumineuse. Un calibrage supplémentaire est requis si le saccharimètre doit être utilisé à d'autres températures que la valeur standard de 20°C. A la 17me Assemblée de l'ICUMSA en 1978 on a adopté tentativement la formule de Emmerich que donne tous les coefficients dont on a besoin pour effectuer les corrections de température dans les déterminations polarimétriques du sucre. La formule est cependant applicable pour des saccharimètres calibrés à 20°C et cette procédure peut ne pas représenter une possibilité pratique pour des pays tropicaux. En plus, on n'a pas spécifié la succession réelle des opérations à effectuer pour le calibrage.

Calibration of saccharimeters with particular reference

L'article résumé ici stipule une procédure pour calibrer des saccharimètres à 20°C et à d'autres températures en utilisant une plaque de contrôle de quartz qui a été calibrée à 20°C par un laboratoire national de standardisation. La procédure permet une correction vers 20°C des valeurs de pol qui ont été mesurées à d'autres températures pour la solution sucrée et pour la plaque de quartz. Dans ces conditions, un calibrage du saccharimètre à 20°C n'est pas nécessaire.

Kalibrierung von Saccharimetern, besonders hinsichtlich der Anwendung bei Temperaturen, die von 20°C abweichen

Eine regelmäßige Kalibrierung von Saccharimetern ist notwendig, besonders bei Kreispolarimetern, bei denen die Kalibrierung durch geringe Veränderungen der effektiven Wellenlänge der Lichtquelle beträchtlich beeinträchtigt werden kann. Eine zusätzliche Kalibrierung ist erforderlich, wenn Saccharimeter bei Temperaturen, die vom 20°C-Standard abweichen, benutzt werden. Auf der 17. ICUMSA-Tagung 1978 wurde die Emmerich-Formel, die alle für die Temperaturberichtigung bei polarimetrischen Zuckerbestimmungen benötigten Koeffizienten enthält, versuchsweise angenommen. Die Formel kann jedoch nur für die Kalibrierung von Saccharimetern bei 20°C angewendet werden, ein Verfahren, das in den Tropen nicht praktisch durchzuführen ist. Die eigentliche Folge der Schritte bei der Kalibrierung ist im einzelnen noch nicht festgelegt worden. Die vorliegende Arbeit beschreibt die Durchführung der Kalibrierung von Saccharimetern bei 20°C und bei anderen Temperaturen unter Verwendung einer Quarz-Kontroll-Platte, die bei 20°C durch eine nationale Eichbehörde geeicht worden ist. Das Verfahren ermöglicht die Korrektur des Pol-Wertes auf 20°C für Messungen, die bei anderen Temperaturen der Zuckerlösung und der Quarz-Platte durchgeführt wurden. Unter diesen Umständen ist keine Kalibrierung des Saccharimeters bei 20°C erforderlich.

Calibración de sacarímetros con referencia especial a su empleo a temperaturas otro de 20°C

Calibración regular de sacarímetros es necesario, especialmente para instrumentos de escala circular en que la calibracion puede afectarse significamente por variaciones menores en la efectiva longitud de onda del fuente de luz. A la 17ª Sesión de ICUMSA en 1978, la fórmula de Emmerich, con todo los coeficientes necessario para correcciones de determinaciones polarimétricas de azúcar para temperatura, se ha adoptado tentativamente. Sin embargo, la fórmula es aplicable a sacarímetros calibrado a 20°C, un procedimiento que puede estar imposible en práctico en paises tropicales. Además, la secuencia de operaciones que tiene que seguirse en calibración no ha sido especificada. Esta comunicación indica un procedimiento para calibrar sacarímetros a 20°C y a otras temperaturas por uso de una placa de control en cuarzo que se ha calibrado a 20°C por un laboratorio nacional de estandardización. El procedimiento permite corrección a 20°C de valores de pol de medidas obtenido con una solución de azúcar y una placa de cuarzo en otras temperaturas; en estas circunstancias, calbración del sacarímetro a 20°C es innecesaria.

Low-grade massecuite boiling using resistivity as a reference variable

By PAWAN KAPUR and V. L. PATIL
(Central Electronics Engineering Research Institute, Pilani, Rajasthan, India 333 031)

Introduction

The pan boiling operation in the sugar crystallization process is one of the most important process steps in the manufacture of direct consumption cane sugar. Efforts have continually been made towards the development of a reliable instrument for measuring the degree of supersaturation of the massecuites which must be held within the metastable zone in order that only the existing crystals should grow, while avoiding the formation of false grain which might occur should supersaturation enter the intermediate and labile zones.

P. Kapur

V. L. Patil

Designing an instrument for the direct on-line measurement of the degree of supersaturation is not straightforward because one requires to compute the total solids content of the massecuite at any given state relative to the solids content in a saturated solution under the same conditions. Since direct measurement is ruled out, one must therefore assess supersaturation by indirect methods. This may be done by correlating the degree of supersaturation with one of a number of measurable physical variables, such as electrical conductivity, viscosity/consistency, boiling point elevation (BPE), etc., and then drawing the corresponding calibration curves.

The BPE method, although simple in theory, requires the determination of the temperature difference between the massecuite and that of water both subjected to similar conditions of vacuum. However, it is found that the temperature shown by a temperature sensor immersed in the massecuite is higher than the actual massecuite temperature as the level of the pan builds up. By contrast the electrical conductivity and viscosity/consistency methods are simpler in practical use though more complicated in theory. The viscosity/consistency is very sensitive to temperature variations so that temperature correction has to be incorporated. However, the

effects due to temperature variation in the working temperature zone are not very stringent in the case of electrical conductivity measurement. Furthermore, instruments based on conductivity are cheaper and easier to maintain than those based on viscosity which have moving parts.

It has been observed by the authors that it is more convenient to measure the A.C. resistivity rather than the conductivity as the former bears an almost linear relationship with the Brix of the magma (and hence also with its viscosity). Based on the above reasoning an instrument for boiling control has been specially designed (to cover the range of the resistivity in low-grade boiling) and used for boiling low grade massecuites. It is designated the "Panometer". The design considerations of the equipment and field trial results are presented below.

Brief description of the Panometer

The conventional instrument based on electrical conductivity, e.g. the Cuitometer, utilizes a simple ohm-meter circuit consisting of an ammeter, transformer and a conductivity cell connected in series. It suffers from poor sensitivity and performance, however, and, apart from line voltage fluctuations, secondary effects due to variation in capacitance are not eliminated, resulting in erronous readings. Further, the readings do not lead to any well defined boiling profile. The Panometer design is based entirely on a new technique which eliminates the above factors completely as described below.

The Panometer utilizes a pseudo bridge configuration such that only the real part of the A.C. resistivity is taken while the imaginary part (which contains the effects due to capacitive coupling and dielectric effects) are totally eliminated. The real part of the A.C. resistivity is then directly indicated on the meter scale which can be calibrated in terms of the various critical process steps of low-grade boiling.

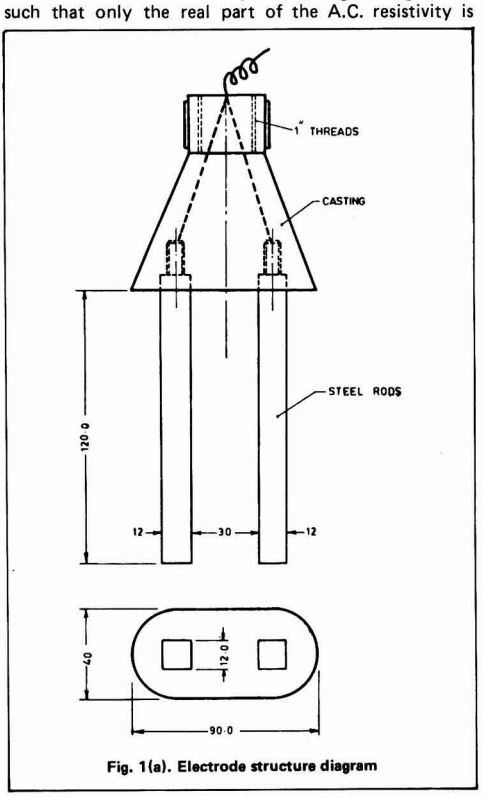


Fig. 1(a). Electrode structure diagram

Theory of operation

Figures 1(a) and 1(b) show, respectively, the Panometer electrode cell and its equivalent circuit. The simplified equivalent circuit of the cell can be represented by a bulk resistance R_S in series with a capacitance C_S formed owing to the liquid layer at the electrode surface. One is, therefore, interested in getting the information about R_S and to eliminate the effects due to C_S.

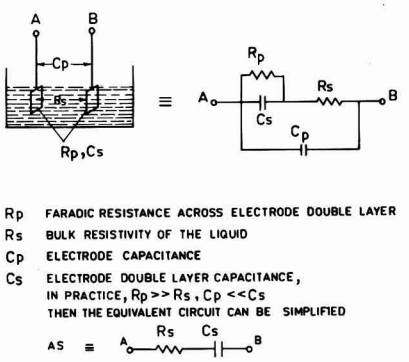


Fig. 1(b). Equivalent circuit of the electrode cell

Figure 2 shows the schematic block diagram of the Panometer circuit consisting of amplitude-stabilized oscillator, differential amplifier, synchronous phase detector, active low-pass filter and amplifying stages. The amplitude-stabilized sine-wave signal is fed to the electrode through a high resistance R_O to ensure better stability, eliminating small random fluctuations. Signals e_1 and e_2 are derived such that e_2 is the amplified version of the signal across the electrodes and contains both resistive and reactive parts arising from the bulk resistance R_S and series capacitance C_S, respectively. The signal e_1 is used to sample reactive and resistive parts of the signal e_2 such that the sampled reactive part is symmetrical around the reference. After sampling e_2 with the square wave derived from e_1 the symmetrical reactive part is averaged to zero by an active low-pass filter. The filter output thus contains only the resistive component of the voltage e_2 which is proportional to the bulk resistance R_S. This signal is further rectified and filtered to obtain a smooth D.C. current which is displayed on a meter.

Technical specifications of the unit	
Range	0 – 1000 ohm (selectable in two different ranges)
Accuracy	± 1%
Linearity	± 1%
Resolution	2 graduations on an indicating meter scale of 100 graduations
Input Supply	(220 ± 10%) V, 50 Hz
Size & weight	25 x 20 x 13 cm^3, 2½ kg

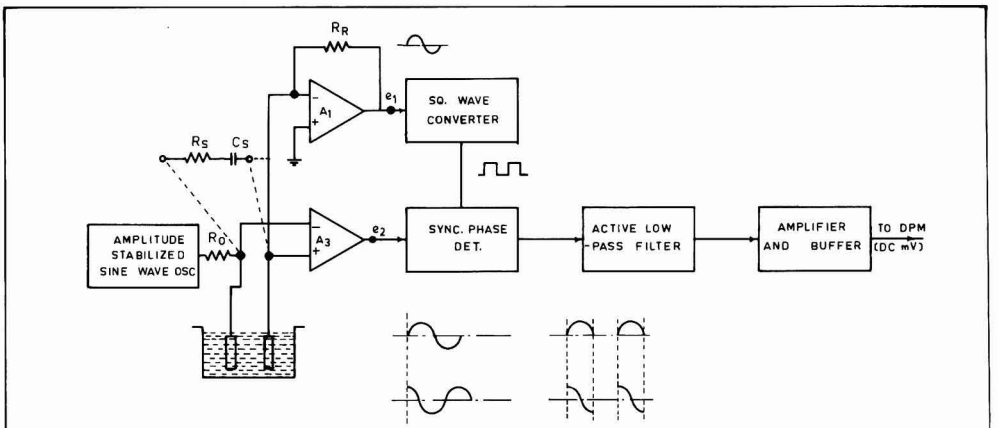


Fig. 2. Block diagram of the Panometer circuit

Electrode structure and installation

The electrode assembly, as shown in Fig. 1(a), consists of two identical stainless steel square bars structurally made stable in epoxy/M-Seal casting. To get better results the electrodes were installed inside the downtake of the calandria, as shown in Fig. 3, where mixing of the massecuite takes place, giving better circulation and more uniform density. The actual positon of the electrode is about 45 cm below the upper tube plate and about 30 cm away from the centre of the calandria column towards the nearer side of the sample key. Information on the massecuite behaviour may be obtained by taking the measurements at this location rather than above the calandria or in the space beneath the calandria because of the time lag after proper mixing has taken place.

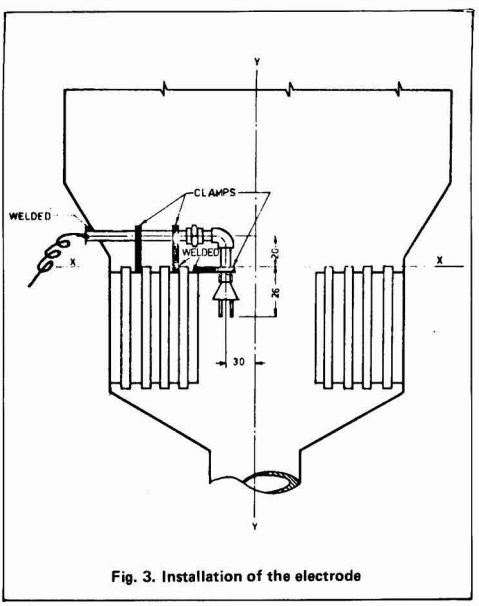


Fig. 3. Installation of the electrode

Low-grade boiling using Panometers

Panometers were installed in each of the pans used for the *C*-graining, *C*-footing and *C*-massecuite in a commercial sugar factory. The steam pressure and pan vacuum were kept approximately constant, thereby maintaining a uniform temperature of the boiling strikes. The pans, of the 60-tonne, low-head calandria type, were provided with molasses conditioners in which the incoming molasses (*A*-heavy, *B*-heavy and *C*-light) were mixed with water to dissolve any fine crystals contained in the molasses. Steam was circulated inside the conditioner to maintain the temperature of the molasses at around 65°C before taking it into the pan. The observations made are presented below.

C-graining operation

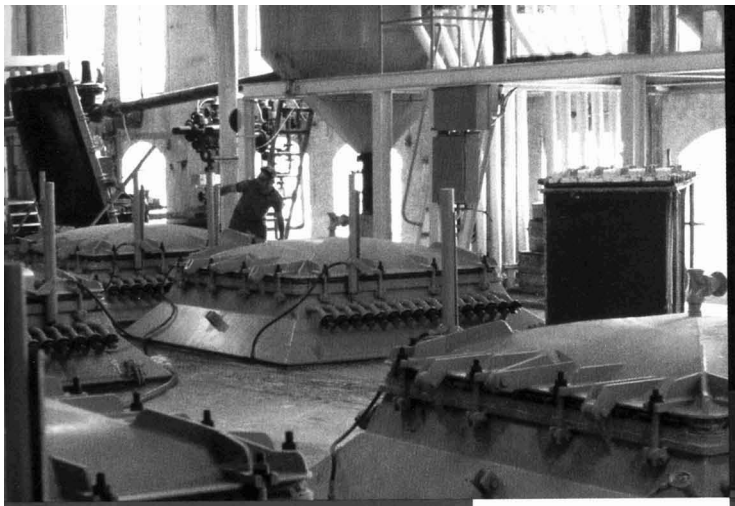
The three basic boiling zones, viz. the metastable, intermediate and labile zones, were established for syrup media with the help of a Panometer. The meter reading for each zone is given in Table I.

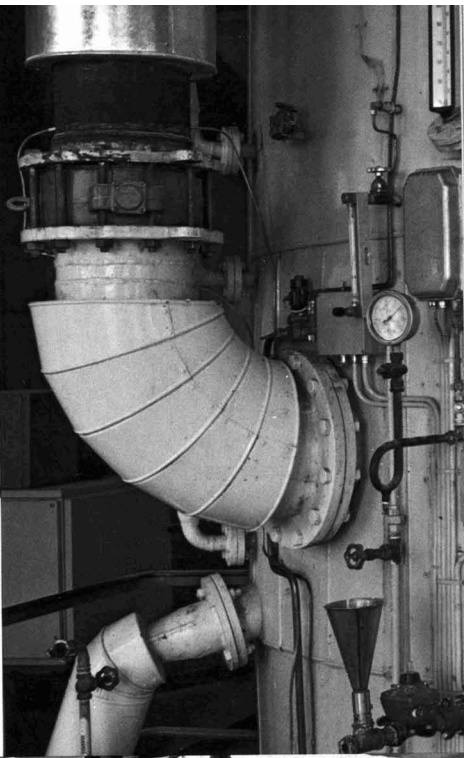
Table I. Establishments of the various zones

Meter reading	Zone identified
Below 15	Undersaturated
15-20	Saturated
Above 20	Supersaturated
20-50	Metastable
50-70	Intermediate
Above 70	Labile

The *C*-graining operation was completed with the help of the Panometer and the meter readings at the various critical points, i.e. the slurry feeding point, grain hardening, molasses feeding, bringing the mass together, etc., were standardized with respect to the meter readings.

The slurry feeding point for different purities of the media was studied and a graph showing their relationship is shown in Fig. 4. The slurry was therefore dropped only when the desired value of the meter reading was reached for any particular value of the purity of the starting media.





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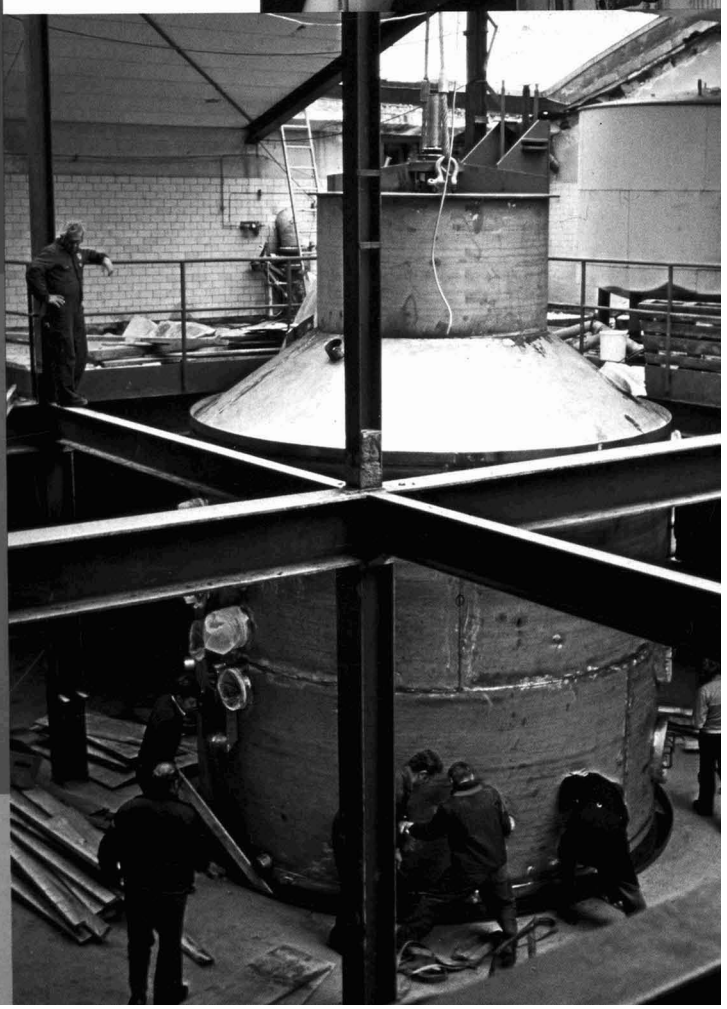

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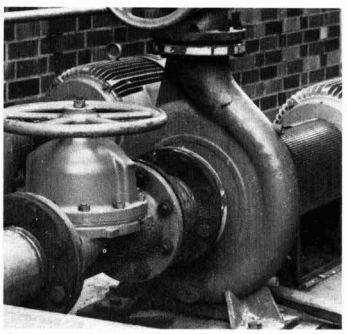
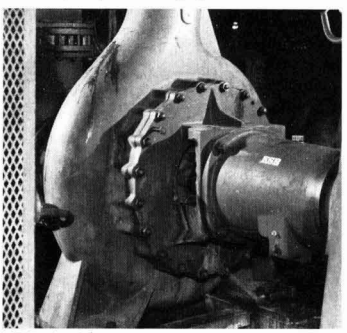


CPK-U pump handling hydrochlorid acid



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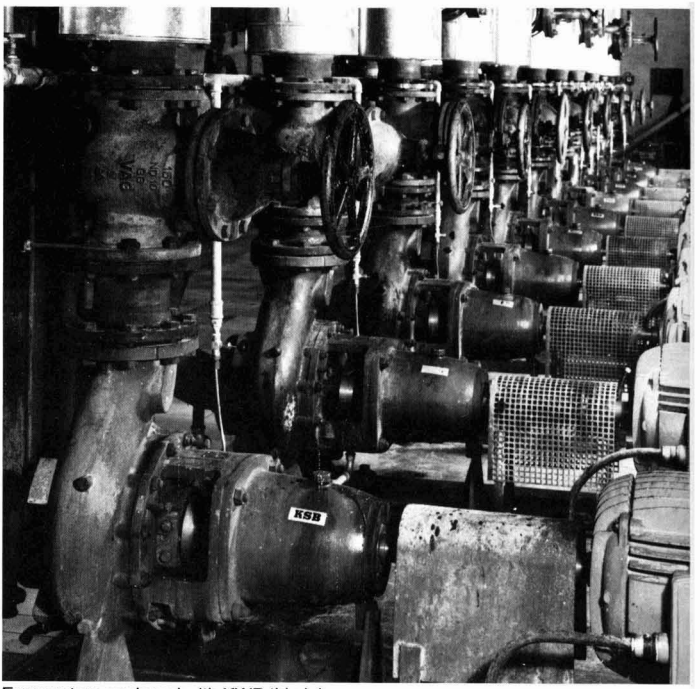

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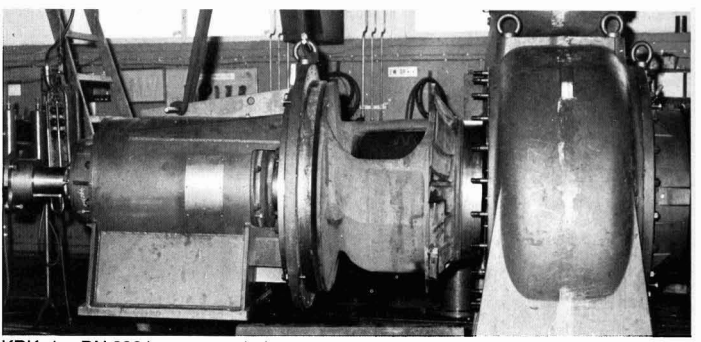

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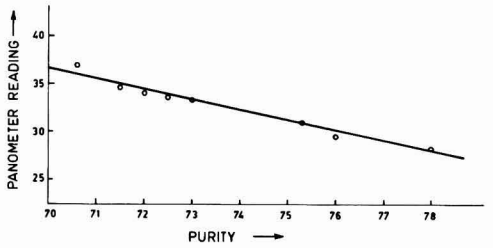

Fig. 4. Relationship between slurry feeding point and purity of the starting media for *C*-graining

During the grain hardening phase, a water valve was opened at a meter reading of 50-55 and was regulated such that the meter readings were maintained for about 15 minutes between 20 and 22 to ensure a uniform evaporation rate.

After hardening, a continuous feed of molasses (first *A*-heavy and then *C*-light) was maintained throughout the boiling period till the pan was full. Before feeding of the slurry and molasses, the media of different purities were taken and Panometer readings were also recorded at the different Brix values. The relationship between Panometer reading and Brix is shown in Fig. 5.

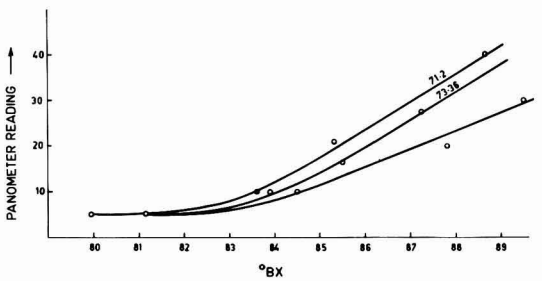

Fig. 5. Relationship between Panometer reading and Brix

From the graph showing the inter-relationship among Panometer reading, Brix and purity of the intake media, one can estimate the purity of the media by just measuring two of the physical variables, viz. viscosity (which corresponds to Brix) and resistivity (Panometer reading) and reading the corresponding purity from the graph (this can be done automatically by using a microprocessor). One can therefore avoid taking the samples into the laboratory and observing the angle of rotation of the plane of polarization. It is possible to drop the slurry at a particular Panometer reading corresponding to the value of the purity estimated for each individual strike. This avoids anomalies arising from the variations in the purities of the syrup occurring with day-to-day and season-to-season variation in the cane quality.

In Fig. 6 is a typical profile showing the variation in the meter reading during the boiling period of the graining cycle.

In the *C*-graining pan the grain was developed to a uniform size of approximately 65 μm.

It has been observed that the establishment of the various critical points was in accordance with the standardization chart and the quality and quantity of grain were good and sufficient. (The slurry was prepared by following the Appelboom method which gave uniform size slurry of 5 to 7 μm.)

C-*footing operation*

Using the grain formed (as described above) a *C*-footing boiling was also standardized with the help of the Panometer. A standardization chart was prepared after studying about 6 complete operations adopting tight boiling such that the rate at which evaporation was taking place was counterbalanced by the rate at which the water (present in the feeding molasses) was entering the pan. This was possible by maintaining the meter readings constant within the zone set by the standardization chart which is given in Table II.

Table II. Standardization chart for *C*-footing

Pan level	Panometer reading
155 hl	20-22
155-195 hl	34-36
195-235 hl	36-38
235-275 hl	36-38
275-320 hl	38-40
Pan-cut/transfer	30

The relationship between the meter reading and the pan level is shown in Figure 7. Data regarding Brix, purity and crystal size were also recorded for different pan levels.

It was observed that one could finish a *C*-footing operation in 3 hours with the help of the Panometer whereas a total boiling period of 4 hours was needed with manual operation, i.e. a 25% reduction in the total boiling period was observed in this case, while the resulting grain size was about 150 μm. About 10 different *C*-footings were boiled to establish the above figures.

Table III. Standardization-chart for boiling *C*-massecuite

Pan level	Panometer reading
Initial level (hl)	40
160-190 hl	50-60
190-210 hl	60-65
210-235 hl	65-70
235-255 hl	70-75
255-275 hl	75-80
275-300 hl	80-85
300-320 hl	85-90
Pan drop at purity	
57-58	100-103
56-57	103-107

C-massecuite boiling operation

Starting from the *C*-footing, of size approx. 150 μm, boiled as per the above standardization chart, *C*-massecuites were boiled using the Panometer. Based on the study made on 7 different *C*-massecuite boilings, a

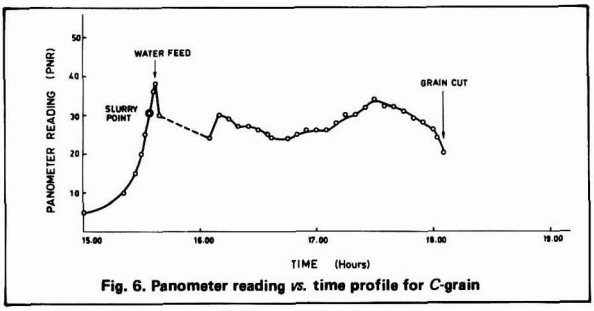

Fig. 6. Panometer reading *vs.* time profile for *C*-grain

standardization chart was prepared, and subsequently 20 *C*-massecuites were boiled following the chart. The feeding was maintained continuous such that the Panometer reading was kept within close limits depending upon the pan level. The Panometer reading *vs.* the pan level is given in Table III and a graph taking the average of all the 20 strikes is shown in Figure 8.

In this way the degree of supersaturation was kept within the metastable zone by maintaining a steady rise in the meter reading from a value of 40 to 105 when the pan was dropped.

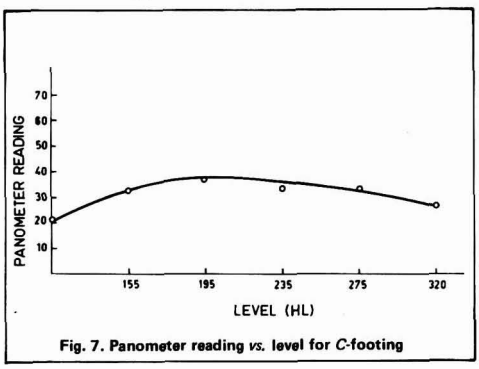

Fig. 7. Panometer reading *vs.* level for *C*-footing

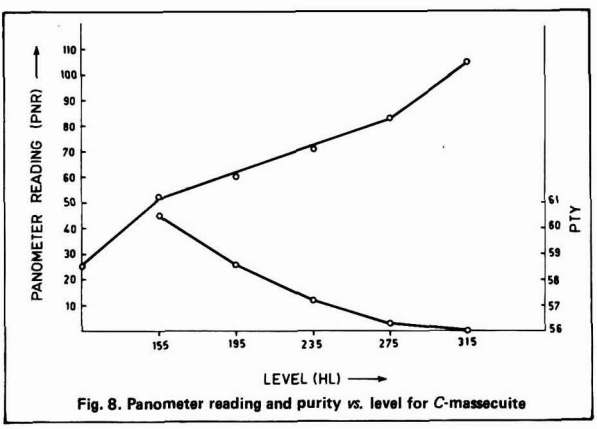

Fig. 8. Panometer reading and purity *vs.* level for *C*-massecuite

Fig. 8 also shows the relationship between the fall in purity and pan level. A typical graph of purity *vs.* pan level is shown in Fig. 9. Fig. 10 displays a profile showing the variation of Panometer reading *vs.* time. It was observed that the average boiling period (with the help of the Panometer) was around 5¾ hours and 20% of boiling time could be saved by comparison with manual control. This resulted in a saving in the overall steam consumption also.

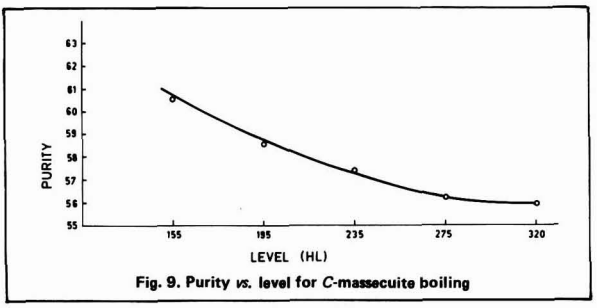

Fig. 9. Purity *vs.* level for *C*-massecuite boiling

Conclusion

The present paper describes how low-grade boiling can be done by monitoring the A.C. resistivity (hence the degree of supersaturation) of the massecuite within the metastable zone as identified with the help of a Panometer. One of the significant achievements made with the Panometer is that one can give long, continuous molasses feeds while keeping the evaporation rate constant by maintaining the Panometer reading within the set limits. This has resulted in boiling uniform size crystals in shorter time, thereby effecting fuel economy. It may also allow the boiling system to be switched from an intermittent to a continuous feed system by regulating the feed automatically with respect to a definite resistivity program which could be stored in the memory of a microprocessor-based system for automatic communication and control. The pan could then be dropped automatically as soon as the final end points are reached. Work on such a microprocessor-based pan boiling system incorporating the Panometer, in combination with other variables such as viscosity, level, etc., is also in progress at this Institute.

Acknowledgement

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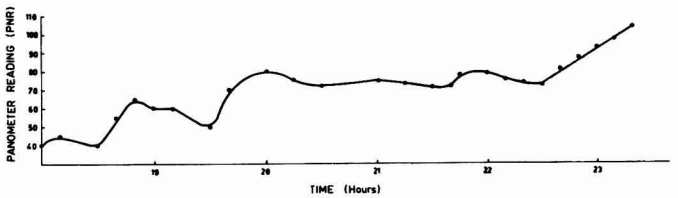

Fig. 10. Typical *C*-massecuite boiling profile

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Summary

An account is given of the design and use of an instrument to determine the values of resistivity at the various stages in low-grade boiling and, from these values, to control boiling to achieve good crystal quality and absence of false grain with economy in steam. The instrument, called the Panometer, has been used successfully for manual control of low-grade boiling and is the basis of continuing work on automatic control.

Cuisson d'arrière-produits en utilisant la résistivité comme variable de référence

On décrit le développement et l'utilisation d'un instrument qui peut déterminer la valeur de la résistivité au cours des différents stades de la cuisson arrière-produits. Ces valeurs permettent de contrôler la cuisson afin d'obtenir une bonne qualité de cristal et l'absence de faux grains ce qui amène une économie de vapeur. L'appareil est appelé le Panometer et a été utilisé avec succès pour le contrôle manuel de la cuisson arrière-produits. Il constitue la base d'une recherche poursuivie au sujet du contrôle automatique.

Nachproduktarbeit unter Verwendung des spezifischen Widerstandes als Steuerparameter

Berichtet wird über den Aufbau und die Verwendung eines Gerätes zur Bestimmung des spezifischen Widerstandes während der verschiedenen Stadien eines Nachproduktsudes und zur Kochkontrolle, um eine gute Kristallqualität zu erhalten und Falschkorn bei Dampfeinsparungen zu vermeiden. Das Gerät, das Panometer genannt wird, wurde erfolgreich für die manuelle Kontrolle von Nachproduktsuden eingesetzt und ist die Basis für weiterführende Arbeiten zur automatischen Kontrolle.

Cocción de masa cocida de bajo grado con uso de resistividad como variable de referencia

Se presenta un informe sobre el diseño y aplicación de un instrumento para medir los valores de resistividad a las varias etapas de cocción de bajo grado y, de estos valores, controlar la cocción para lograr buena calidad de cristales y ausencia de grano falso, con economía en vapor. El instrumento, denominado el "Panometer", se ha empleado con éxito para control manual de la cocción bajo-grado y es la base de trabajo continuando sobre control automático.

British Sugar plc 26th Technical Conference

In addition to 33 guests from 12 other countries and a representative of this Journal, 59 of the executive and technical staff, as well as two retired Directors of Research of British Sugar plc (Dr. A. Carruthers and John Oldfield), met in Eastbourne during July 5 – 8 for the 26th Technical Conference, the latest in a series which began in 1948.

All gathered at the Grand Hotel and were welcomed by the Conference Chairman, Mr. T. Rodgers, Assistant Chief Executive, who discussed the development of the European beet sugar industry and pointed to the high efficiency level reached in terms of yields, recoveries, and financial and energy economy. The first paper, presented by M. Shore and N. W. Broughton, described studies on the use of gypsum and other materials as aids to pulp pressing. They and their co-authors conclude that the economic return, in terms of savings in fuel for pulp drying, were greater for gypsum than for calcium cloride or aluminium sulphate while other benefits also resulted.

J. S. Hogg, J. D. F. Wilkie and R. D. Morgan then reviewed the history of automatic pulp drying control in British Sugar over the past 23 years and described trials in the 1981/82 campaign of Siemens and Holec systems at Peterborough and King's Lynn factories, respectively. Both worked well, although the variation in product moisture at Peterborough indicates scope for further improvement, while later results at King's Lynn were affected by the gypsum trials mentioned in the first paper.

Ensilage trials with pressed pulp in 100-tonne and 5000-tonne pits were described by Dr. C. Heller of Pfeifer & Langen. The pulp was a good animal fodder but problems arose with movement of the large heap so that the plastic cover was damaged and exposure of the pulp led to some deterioration; however, means to overcome this were suggested.

After lunch, Mr. T. P. J. Dyke presented a review of the current crop situation in the UK. The beet area is 2-3% down on 1981 but growing conditions have been

good and even the fields which had to be resown because of wind and frost damage to seedlings had caught up. The crop was ahead of its usual state and there was the potential for a record crop with sugar production extending to C-quota; this depends to some extent, however, on whether the winter is severe and whether farmers lift and clamp their beet before it becomes impossible to do this because of frost, etc. Representatives from the other countries then summarized conditions and crop prospects in each, most expecting average to good crops on areas either the same or rather less than 1981. Summarizing, Mr. Dyke said that it appeared that sugar production appeared likely to be the same in 1982/83 as in the previous campaign in spite of the smaller area, perhaps owing to the efforts of seed breeders and to farmers' expertise.

Mr. A. Rossi of Eridania Zuccherific Nazionali S.p.A. described some studies carried out using tower diffusers in his company for developing mathematical functions which describe residence time distributions for cossettes and their use to improve diffuser efficiency and reduce losses. The last paper of the day, presented by N. R. Twaite and M. Shore, was concerned with the removal of insoluble matter from standard liquor in British Sugar factories; equipment used for this over the years was surveyed and an account of trials with screening followed by centrifuging as an alternative to filtration. From the results obtained in respect of liquor suspended solids remaining it seems adequate for most purposes to employ only screening of lower Brix thick juice or standard liquor treatment in hydrocylones except where the factory production called for more complete elimination of suspended solids.

The day concluded with the Conference Dinner for delegates who were welcomed by Mr. J. M. Beckett, Chief Executive of British Sugar plc, while Mr. H. Doblhoff of Austria responded on behalf of the guests. Mr. R. Hulpiau of Belgium then presented a silver tray to Mr. Rodgers on behalf of guests absent and present who wished to indicate their appreciation of Mr. Rodgers' chairmanship of the conferences over the past 12 years, that of 1982 being his last before retirement. Mr. Hulpiau also presented a crystal vase to Mrs. J. E. Foxon who has served as Conference Secretary to all the Conference Chairmen since the first, Mr. J. Campbell Macdonald.

On the following morning, M. Shore and J. V. Dutton presented a paper on the evaluation of deteriorated beet, describing the diastrous effects on factory throughput of even 5% of frost-damaged beet which contained dextran owing to infection by micro-organisms. The effect of invert sugar and dextran on polarization was examined in relation to true sucrose content as measured by gas-liquid chromatography and the additional monetary losses in payment for optically-active non-sucrose demonstrated. Frost damaged beets may be rejected by the factories but some beet, frozen in the ground, can be of normal appearance while having severe deterioration internally in the top part of the root.

Dr. K. M. Bliesener then described laboratory work in the Braunschweig sugar institute on the reactions of juice non-sucrose material which contributes to colour formation, specifically the reactions of reducing sugars with amino-acids, formation of melanoidins and the enzymic oxidation of phenolic compounds. Dr. P. Mottard then presented two papers, the first by himself on the the experience of three French sugar factories with the Akzo-Imacti process for juice decalcification which uses caustic soda in juice as regenerant for the ion exchange resin instead of brine or molasses. He compared this system with others in respect of both cost and other factors including pan scale formation and crystallization rate, etc. The second paper, presented on behalf of its author, Mr. F. Heitz, concerned the saturation and melassignenic coefficients used to estimate the exhaustion of molasses. It was pointed out that sucrose is held in solution by the water molecules and that, at low non-sucrose levels, the last competed with the sucrose molecules for molecules of water of hydration and so reduced the sucrose solubility; hence the initial shape of the saturation coefficient curve. Thus the sucrose held in solution at higher non-sugar concentrations is the result of two actions – that of the e.g. inorganic salts as non-sugar and that of water – and recognition of this fact requires recalculation of the melassignic coefficients of individual non-sugars. These are tabulated with comparative figures calculated by P. M. Silin and his daughter N. P. Silina.

The last paper of the morning was by Mr. J. Ponant who described the development of the Gryllus process for juice decalcification and its application in the Artenay sugar factory in France, as well as its advantages and disadvantages. The afternoon was then free for golf or visits to local places of interest.

On the following morning, J. S. Hogg, J. S. Unwin, A. L. Jenkins and A. J. Randall described the introduction of thermographic surveying in British Sugar factories where it is used to investigate the temperature of and heat losses from relatively inaccessible surfaces and thereby contribute to energy conservation. The paper described the theory of infra-red thermal imaging and equipment used as well as specific plant examined at Newark, Brigg and Bury St. Edmunds factories.

Finally, P. S. Worthington described a very detailed cost survey into the possibility and economics of changing from thick juice storage at Bury St. Edmunds for post-campaign boiling to in-campaign processing with an enlarged sugar end. Cost savings were calculated at some £450,000 per campaign but this was not sufficient to provide an adequate return on the capital which would have to be invested in making the change so that the latter was therefore not economically viable.

Mr. Rodgers then closed the conference, thanking all who had participated and indicating that he hoped to be present at the 27th among the retired staff, whereupon delegates parted for their homes.

Syria sugar expansion[1]. – Four new sugar factories, built at a cost of $50 million, will be in operation in Syria during the 1982 campaign. The government has been encouraging farmers to increase beet production and this is expected to rise to 750,000 tonnes, as against the unofficial estimate of 550,000 tonnes for 1981 and 1980's confirmed total of 513,000 tonnes. If Syria's average extraction rate – a low 10.3% – is achieved, domestic sugar production should reach 80,000 tonnes in 1982. 121,500 tonnes of imported raw sugar will be refined locally to produce a further 108,000 tonnes of white sugar, and 142,000 tonnes of white sugar are to be imported to cover the 330,000 tonnes of domestic demand. At the start of 1981 Syria's beet processing capacity was 365,000 tonnes but by the end of 1982 this should have risen to 1,100,000 tonnes and this is expected to rise further to 1,400,000 tonnes by 1985 when beet production is expected to reach 1,540,000 tonnes. Only two of the new factories were in operation in 1981: at Tal Salhab near Hama, managed by Italy's Snamprogetti and at Deir-al-Zor, managed by Technoexport of Czechoslovakia. The other two, built by ABR Engineering at Meskenah and Raqqa, should be operational for the 1982 campaign. All have a capacity of 4000 tonnes of beet per day and will provide facilities for processing of raw sugar.

[1] F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 350.

SUGAR CANE AGRONOMY

Determination of the annual renewal of sugar cane from the economic point of view. F. Cortés. *Rev. Técn. Inst. Nac. Técn. Agropec.* (Tucumán), 1981, **1**, (1), 1-7 *(Spanish).* – The yields of first and second ratoon crops are higher than that of plant cane in Argentina but fall in subsequent ratoons. It is shown how analysis of fixed and variable costs can be used to determine the point at which it is justifiable to replant the cane crop; this was found to be after the 4th ratoon.

The Australian sugar industry. A sketch of its past, present and future development. G. A. Ferguson. *Sugar y Azúcar,* 1981, **76,** (9), 29, 32, 34-35, 38-39. The socio-economic aspects of cane growing in Australia are discussed.

The contribution of BSES to the Queensland sugar industry. O. W. Sturgess. *Sugar y Azúcar,* 1981, **76,** (9), 43, 46-47, 50, 53. – A survey is presented of the activities of the Bureau of Sugar Experiment Stations in cane and milling research, with an outline of the history and development of the Bureau and future prospects.

Erosion control practices in sugar cane and their effeciveness. H. N. Means. *Rpts. 38th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 68-70. – Terracing as a means of reducing run-off in cane fields is described and the designing of a layout in conjunction with drip irrigation discussed. The most difficult problem to solve in the installation of a terrace system is provision of suitable outlets, while maintenance of terraces and waterways is another important consideration. Mention is made of the advantage of a fast-growing legume crop in reducing erosion during the critical period of early cane growth (while also contributing to N fixation).

Effects of drought stress on drip-irrigated sugar cane at Kekaha Sugar Company. P. H. Koehler. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 79-83. – Since reduced rainfall in the mountainous watersheds providing water for drip-irrigated cane fields in Hawaii causes a periodical drought stress in the cane, studies were undertaken to determine whether current estimates of potential evapotranspiration are accurate, to evaluate rapid methods of detecting incipient drought stress that can be used for accurate estimation of the soil profile water content, and to relate the level of soil moisture to stalk elongation, leaf water potential, leaf osmotic potential, leaf turgor potential and the accumulation of free sugars and amino-acids in leaf and apical meristem tissue. Results are discussed for six fields characterized by a silty clay loam and one field having a clay soil.

Computer-aided plantation management system. G. Prothero. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 84-92. – Application of water balance data processing to evaluation of an irrigation system is described to show how a computer is of advantage in managing cane plantations.

Roundup applicator at McBryde Sugar Company. S. Uyeda. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 96-97. – A brief description is given of a low-volume knapsack applicator in which the conventional nozzle has been replaced with a small, stainless steel metering disc; this ejects a needle-thin stream of herbicide onto the weed and thus reduces the risk of injuring cane.

HC & S Company development of Roundup applicators. D. W. Hughes. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 98-99. – Development of applicators for Roundup herbicide is briefly recounted and a rope applicator described which has proved suitable for applying a 10% solution to grasses and broadleaf weeds in cane fields.

The effect of several growth regulators on dry matter production and partitioning in sugar cane cv. H 59-3775. R. V. Osgood and A. H. Teshima. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 100-102. – Four growth regulators were tested on H 59-3775 cane at eight sites. Results, determined over an eight-week period up to harvest, showed that Ethrel and Embark caused the greatest increase in dry matter per stalk but least partitioning of dry matter toward sucrose storage; however, the overall effect was an increase in sucrose content by comparison with untreated cane. Polaris and Polado (Glyphosate) induced considerably less change in the total dry weight per stalk, but the proportion of dry matter increase that contributed to sucrose was greater, so that both gave more recoverable sucrose per stalk than Ethrel or Embark. The ratio of fresh cane weight to recoverable sucrose fell as a result of Ethrel treatment, rose with Polaris and Polado treatment, and remained unchanged with Embark. The rates applied were 1.1 $kg.ha^{-1}$ for Ethrel and Embark 4.2 $kb.ha^{-1}$ for Polaris and 0.3 and 0.6 $kg.ha^{-1}$ for Polado; the higher dosage of Polado had a greater positive effect on the sucrose content than the lower dosage.

Drip ratoon practices and problems. R. Smith. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 103-104. A brief account is given of drip irrigation and ratooning practices in cane fields of Wailuku Sugar Co. Major problems include the lower yield of ratoon cane by comparison with plant cane, pinching of irrigation tubing (increased by marked exposure, amounting to 15-20% in most of the ratoon cane fields) and difficulties in preparation of truck roads in fields harvested during wet weather.

Drip ratooning practices at Oahu Sugar Company. M. Furukawa. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 105-106. – Experiences with drip irrigation are described. A major problem was difficulty in placement of tubing, resulting in pinching and exposure, so that water was sprayed into the air. Ratooning is not favoured because of a lower yield by comparison with plant cane, because of the need to eliminate smut (harboured by ratoon stools) and because of the lack of suitable methods and equipment for ratooning.

Update of drip irrigation at HC & S Company. K. Shoji and J. Sakuma. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 107-110. – While the average cane and sugar yields for 1977-80 were greater in drip-irrigated

fields than in furrow-irrigated fields, there have been many cases where the results from drip irrigation have been disappointing because of such problems as tube failures, clogging and damage caused by ants and rats. The question of optimum crop age for harvesting drip-irrigated cane to give maximum sugar yield is discussed; the average optimum lies between 24.5 and 25.5 months. The positive relationship between effective water utilization and yield is also examined; field data have confirmed that better use is made of water under stress conditions. Moreover, drip irrigation permits reduction in the inter-row spacing by comparison with furrow irrigation, and evaluation of yield per effective acre-inch of water per foot of cane line per month shows that drip irrigation does increase both cane and sugar yields, although other factors undoubtedly influence the results. A study of potential evapotranspiration in furrow-irrigated fields suggests that it would be possible to maintain the high total net water supply (rainwater plus irrigation water) by conversion to drip irrigation and give cane yields higher than any yet achieved in the company's fields.

Progress in reducing ant damage to drip irrigation tubes. A. K. Ota and V. C. S. Chang. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 111-112. – While Heptachlor has proved highly effective against ants and has thus reduced ant damage to drip irrigation tubing, it is possible that the pesticide will not be available after 1983, so that alternative control means are desirable. Amdro ant bait has given promising results, although it has yet to be registered for use in Hawaiian cane fields; favourable results have also been obtained with parallel-ridge tubing, where the space between the ridges is sufficiently small to prevent ants reaching and chewing the edges of the orifices.

An important factor affecting yield and quality of sugar cane ratoons. A. P. Gupta. *Maharashtra Sugar,* 1981, **6**, (9), 37, 39, 41-42, 44. – Theoretically, the amount of sugar recoverable from ratoon cane has been found to be greater than from plant cane on a percentage basis; however, falls in recovery after an initial period of crushing have occurred as a result of deterioration in the cane, so that it is suggested that proper attention be paid to correct scheduling of ratoon vis-à-vis plant cane processing.

Association between systems of soil preparation and and phosphating in sugar cane. A. A. Casagrande, R. Rodrigues and D. Perecim. *Brasil Açuc.,* 1981, **98**, 29-46 *(Portuguese).* Trials were conducted on a red latosol where there was a problem of compaction in a layer between 20 and 53 cm deep. The soil was ploughed and harrowed, but one group of experiments also included subsoiling. Rock phosphate was applied at five levels plus zero and the effects on cane yield and characteristics determined for a plant and first ratoon cane crop. The subsoiling promoted an increase in cane yield and pol.ha^{-1}, averaged over the two crops, while the phosphate levels did not produce a statistically significant reaction except in juice phosphate.

Application of silicon to sugar cane in the state of São Paulo. J. C. Casagrande, E. Zambello and J. Orlando. *Brasil Açuc.,* 1981, **98**, 54-60 *(Portuguese).* – The effect of applying silicon as calcium metasilicate (cement) to cane of two varieties in a yellow podzolic soil in São Paulo was studied. No increase was found in cane or sugar yield, although the level of silicon in cane rose with application of 2 and 4 tonnes.ha^{-1}. The silicon level did not affect N, P, K, Ca or Mg absorption by cane. The soil calcium content and pH rose while toxic Al fell.

Energy management in sugar cane agriculture. S. C. Srivastava and A. K. Srivastava. *Maharashtra Sugar,* 1981, **6**, (11), 19, 21, 23-27. – The distribution of energy consumption in cane agricultural practices is discussed and means of reducing consumption are indicated.

Factors affecting sugar cane juice quality and methods of improvement. S. Thangavelu and K. C. Rao. *Maharashtra Sugar,* 1981, **6**, (11), 29-31, 33-34, 36-38, 40. – Observations from the literature on the effects of cane agronomic factors on juice quality are presented and a brief list is given of measures to improve quality and increase sugar recovery.

Changes in the nutrient content of filter cake. R. A. Wood. *S. African Sugar J.,* 1981, **65**, 341. – See *I.S.J.,* 1982, **84**, 269.

Chemical ripening with Polado – a new management tool. Anon. *S. African Sugar J.,* 1981, **65**, 347. – Reference is made to trials with Polado (Glyphosate) conducted over the past four years in Natal and Swaziland. The ripener has proved particularly effective on cane having a low natural juice purity and, unlike other ripeners, also gives extra sucrose in the lower, more mature part of the stalk. It has increased sugar yield by 0.75-1.5 tonnes.ha^{-1}.

Description of sugar cane field operations of Taiwan Sugar Corporation. Anon. *Taiwan Sugar,* 1981, **29**, 134-135. – An outline is given of agricultural practices in TSC cane fields.

Effect of varying plant density on performance of plant and ratoon cane of different sugar cane varieties. S. Shanmugasundaram, A. Misra, K. Venugopal and A. S. Ethirajan. *Indian Sugar,* 1981, **31**, 171-174. – Trials showed that seed rate had no significant effect on cane and sugar yield per ha within the range between 135,000 and 360,000 buds per ha, while lower yields were obtained when only 90,000 buds/ha were planted. However, varietal yield differences were observed between Co 419, Co 658 and Co 6304.

Studies on the effect of different levels of press mud cake in combination with various levels of nitrogen on yield and quality of sugar cane (Co 740). V. D. Patil and A. K. Shingate. *Indian Sugar,* 1981, **31**, 187-191. – Application of filter cake increased cane and sugar yield by comparison with the control (treated with farmyard manure), while nitrogen had a further beneficial effect when applied at 224 kg.ha^{-1} but not at 168, 280 or 336 kg.ha^{-1}. Optimum filter cake application rate was 11 tonnes.ha^{-1} (against 7.5, 14.8 and 18.5 tonnes.ha^{-1}).

Effect of intercropping on the growth and yield of sugar cane varieties. S. S. Narwal and D. S. Malik. *Indian Sugar,* 1981, **31**, 193-198. – While cowpea as intercrop reduced cane yield, moong increased it, the highest net income being obtained with two rows of moong grown in the 75-cm space between cane rows. Some cane varietal differences in compatibility with intercrops were observed.

CANE SUGAR MANUFACTURE

Assessment of the Gledhow and Tongaat Fives-Cail Babcock continuous pans. L. M. S. A. Jullienne and S. Munsamy. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.,* 1981, 79-82. — The performances of two FCB continuous pans operating on low-grade massecuite were assessed. While the evaporation rates, at a maximum of 5.3 $kg.m^{-2}.hr^{-1}$ for the Gledhow pan and 6.0 $kg.m^{-2}.hr^{-1}$ for the Tongaat pan, were about half that of a conventional low-grade batch pan, the continuous pans had about 20% greater throughput than a batch pan of identical volumetric capacity as a consequence of continuous operation and their greater heating surface:volume ratio. Details are given of the evaporation rates under varying conditions and of massecuite residence times. Steam injection into the massecuite proved necessary in order to obtain optimum heat transfer rates and massecuite circulation. Crystal size distribution was comparable to that for a batch pan. In addition to continuous operation, the FCB pans had the advantages of ease of operation and control as well as benefits associated with steady process steam and condenser water requirements.

Assessment of final molasses coolers. L. M. S. A. Jullienne and S. Munsamy. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.,* 1981, 83-84. — For curing of high-viscosity *C*-massecuite, reheating to a high temperature (sometimes approaching 70°C) is necessary; this, plus the use of steam and hot water in the centrifugal, results in a molasses having a temperature seldom below 60°C on discharge. However, it has been found[1] that heating molasses to a temperature higher than 40°C may cause more rapid decomposition in storage tanks, so that cooling has to be carried out. Tests on three coolers are reported. While a tubular heat exchanger at Empangeni (originally designed as a liquid-liquid mixed juice heater) had a molasses flow rate which was much lower than in two plate-type exchangers at Gledhow and Sezela, it gave a lower heat transfer coefficient; other advantages of the plate exchangers were their compactness, the ease with which the heat transfer area could be increased by adding more plates, ease of cleaning, ready accessibility of the plate surfaces for inspection, and much lower capital costs.

Boiler water treatment technology. J. J. Opelka. *Sugar J.,* 1981, **44**, (3), 24-28. — Treatment of boiler feedwater and the effect each type of treatment has on hardness, alkalinity, dissolved solids, silica and steam CO_2 are described, showing that the best results are given by demineralization of raw water or use of condensate from the evaporators. For scale prevention, four chemical programs are described, involving adding sodium hydroxide and/or carbonate or adding phosphate with or without a chelating agent such as EDTA. Oxygen pitting and normal forms of corrosion, and their control, are also discussed, as well as entrainment and its prevention, Common problems facing operators of sugar factory boilers are examined, and advice is given on treatment and maintenance of boilers during and after operation.

Review of sugar milling research carried out in the Department of Mechanical Engineering of the University of Queensland, Australia. M. Shaw. *Sugar Technol. Rev.,* 1981, **8**, 1-39. — Cane milling research carried out during 1950-69 is summarized. The work covered included development of a small experimental two-roller mill; many of the results obtained with it were applicable to full-size mills, e.g. concerning the permeability of prepared cane and its coefficient of friction on metal surfaces. A theory was developed for quantifying extraction and reabsorption as well as roller forces and pressures and their effects on mill feeding and capacity. From measurements of roller loads and torques it was possible to assess energy consumption. Dimensional analysis was used to simplify many of the equations derived; a digital computer was used to solve the 800 simultaneous equations involved in calculation of the juice flow in the mouth of a mill. Computer programs MILSIM and MILSET (further developed at the Sugar Research Institute since mill research ceased at Queensland University in 1969) were used to apply research work to full-size mill trains of up to eight mills with complicated imbibition recirculation.

Alloyed cast iron for the impellers of sugar industry pumps. R. Monduí, R. Caro, D. Esson and N. Trujillo. *CubaAzúcar,* 1981, (Jan./March), 36-42 *(Spanish).* The corrosive action of cane juices of different pH values and at two temperatures was observed on test pieces of cast iron alloyed with Ni + Cu and with Ni, Cr + Cu as well as unalloyed iron. In all cases, the alloyed pieces were attacked to a lesser extent and it is recommended therefore that such alloys be used for the manufacture of pump impellers.

Complete syrup clarification at Davies Hamakua Sugar Company, Haina factory. T. T. Bennett. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 113-116. Details are given of the flotation system used at Haina for syrup clarification, and some preliminary results are reported. Average purity rise of the 65°Bx syrup was 1.86 (ranging from 0.21 to 3.60), while there was considerable reduction in turbidity as indicated by an average increase in transmittance (measured at 900 nm) of 26.52% between in- and outflowing syrup. Results of colour measurement were inconclusive, while carbonate ash was reduced by 3.5%.

Flue gas drying principles and considerations for the sugar industry. S. P. Thompson. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 117-121. — The history of dryer development is briefly recounted, and the use of boiler flue gas to pre-dry bagasse described. Comparison is made between the burning of bagasse of 50% moisture content and bagasse of 35% moisture content after pre-drying; under otherwise identical conditions, boiler efficiency is raised by 9% and steam generation per lb of bone-dry bagasse significantly increased, while gas emission from the boiler is reduced. Other advantages of burning drier bagasse are listed.

The flue gas drying system. — heat and mass balances. J. F. Mullen. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 122-131. — The heat and mass balances of a bagasse pre-drying system are calculated and a scheme

[1] Meade & Chen: "Cane sugar handbook", 10th Edn. (Wiley, New York) 1977, p.365.

designed for Paia factory is described, in which the bagasse is screened before the rotary dryer (which uses boiler flue gas), the fines then mixed with the dried bagasse before the furnace, and bagasse dust passed through a large settling chamber that also acts as a flash dryer to reduce the loading on the collector and decrease stack emission.

The application of the light two-roll continuous feeder to existing three-roll milling units. N. Jeppesen. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 132-136. The continuous two-roller feeder as used in the Queensland sugar industry provides increased extraction by permitting the handling of highly prepared cane together with high levels of hot imbibition at reduced roller speed. The feeder is described and reference made to results obtained with it at various factories. Advice is given on optimum installation of the feeder before a 3-roller mill, including calculation of the angle of nip and hopper dimensions relative to crushing rate, roller speed and mill setting.

Trash processing at Hilo Coast Processing Company. E. A. Kennett. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 137-141. — Because of the large volumes of trash delivered to Pepeekeo sugar factory, a system was developed for washing and dewatering the trash before milling it together with normal cane. Details are given of the plant and modifications made to it, and processing data are discussed. While trash milling has had an adverse effect on mill performance because of the additional amount of fibre to be milled, the quantity of water still adhering to the trash, the additional imbibition water required and the lower purity juices, the scheme has brought benefits in the form of additional fuel, extra sugar and elimination of trash disposal expenses; the savings had a monetary value equivalent to production, at no extra cost, of an additonal 7800 tons of sugar priced at $600 per ton (fuel oil being priced at $25 per barrel).

Lotus roll update. E. A. Kennett. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 142-146. — Eperiences with a Lotus roll[1] installed at the first mill at Pepeekeo are described. After initial improvements in extraction and reduction in bagasse moisture, mill performance was eventually reduced to its earlier level as a result of blockage of the juice openings by bagasse. However, after modifications had been made to the design of the plugs inserted in the juice openings, performance increased again. Trials were also carried out with the Lotus roll installed at the last mill, but blockage of the juice openings occurred as predicted. However, modifications were being made, and it is believed that further improvements can be made to the roll to increase its reabsorption reducing ability. The theory of mill settings is briefly explained.

Control and monitoring of sugar factory condensates. J. W. Kaiser. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 147-149. — Of contaminants of major concern that may occur in condensate used as boiler feedwater, iron and copper resulting from corrosion are the chief ones discussed. Organic polymers can greatly reduce their quantity, while condensate that has been lying in pipes and tanks for more than 24 hours during shutdown should be discarded. Since oxygen greatly accelerates corrosion, periodical checks should be made to ensure that none is entering the system from the suction side of packed pumps. Condensates should be checked for quality and used as boiler feedwater in descending order of this, the poorest being used only when absolutely necessary. Continuous monitoring is most important; the best device is a multi-point recorder which automatically diverts condensate of an unacceptable quality as indicated by its conductivity.

An introduction to international milling technology. M. D. Sullivan. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 153-157. — A number of aspects of cane mill operation and performance are discussed, including fibre rating, hydraulic load, mill ratio, trash plate settings, imbibition/maceration, cane preparation and mill feeding aids (the underfeed roller, apron feeder with overfeed roller, heavy-duty continuous pressure feeder and the light-duty two-roller feeder). Calculations are made of the performance of a hypothetical 12-roller tandem (four mills), with particular attention to control of the readsorption factor at each mill.

Life Prolonging Factor through maintenance welding. E. Selbe. *Rpts. 39th Ann. Conf. Hawaiian Sugar Tech.,* 1980, 158-162. — Life Prolonging Factor(LPF) is defined as extension of the service life of machine parts by application of wear-resistant alloys. Its importance in connexion with determination of repair costs relative to the costs of replacement is explained. Examples taken from Hawaiian sugar factories are used to show how preventive maintenance can result in significant monetary savings.

The Australian sugar industry. R. E. Camm. *Sugar y Azúcar,* 1981, **76,** (9), 23-25. — An outline is presented of the Australian sugar industry, particularly legislation governing the industry and sugar marketing.

The Australian sugar industry. Manufacturing. J. R. Allen. *Sugar y Azúcar,* 1981, **76,** (9), 55-59, 64. — Descriptions are given of cane transport and of the equipment and processes used in Australian sugar factories.

Why stainless steel tubes for the Indian sugar industry. Anon. *Maharashtra Sugar,* 1981, **6,** (9), 45-46, 48-52. Advantages of stainless steel tubes over brass tubes for heaters and evaporators are discussed.

From cane weighing to mixed juice. C. Ebeling. *Brasil Açuc.,* 1981, **98,** 14-22 *(Portuguese).* — A survey is presented of the functions of a sugar factory or autonomous distillery up to production of mixed juice, including cane reception and weighing, control and antifraud systems, cane payment on sucrose content, cane storage, cane feeding, soil in cane and washing, cane preparation and extraction by milling and diffusion, with a discussion on the problems of each and a comparison of the two.

Study of the influence of variation in the levels of temperature, time of heating and juice pH on the sedimentation process. L. Gómez R., A. P. Nikolaiev, P. M. Fabregat P. and F. R. González G. *Centro Azúcar,* 1981, **8,** (1), 77-87 *(Spanish).* — Application of a computer to the results of clarification experiments has produced formulae relating the mud pol, purity, true sucrose, reducing sugars content and settling rate of clear juice to the temperature, heating time and pH of liming. Only the last two conditions had a significant effect on the clear juice characteristics and settling rate, the relative influence of each depending on the liming system used.

[1] *I.S.J.,* 1980, **82,** 23, 31, 194.

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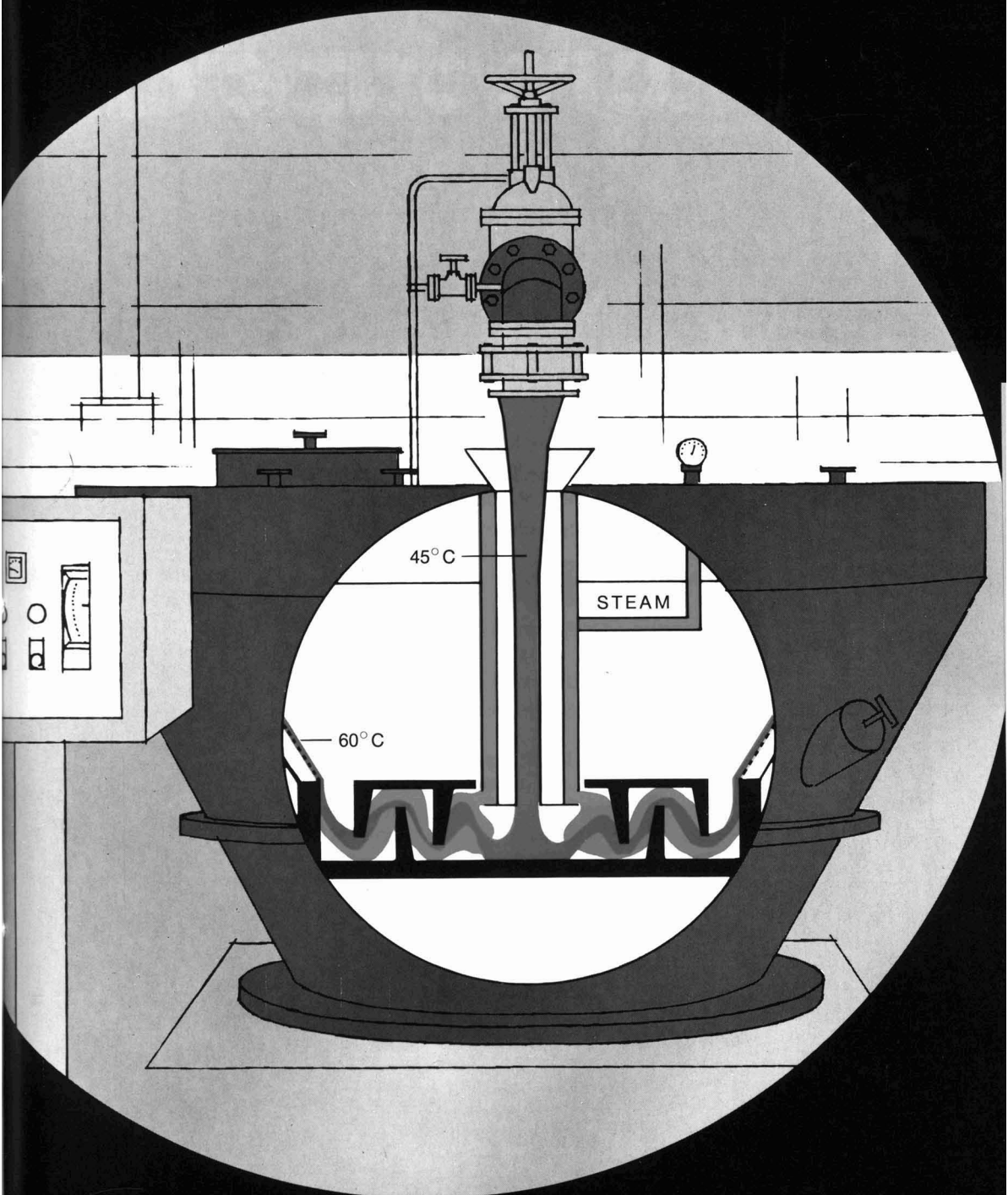

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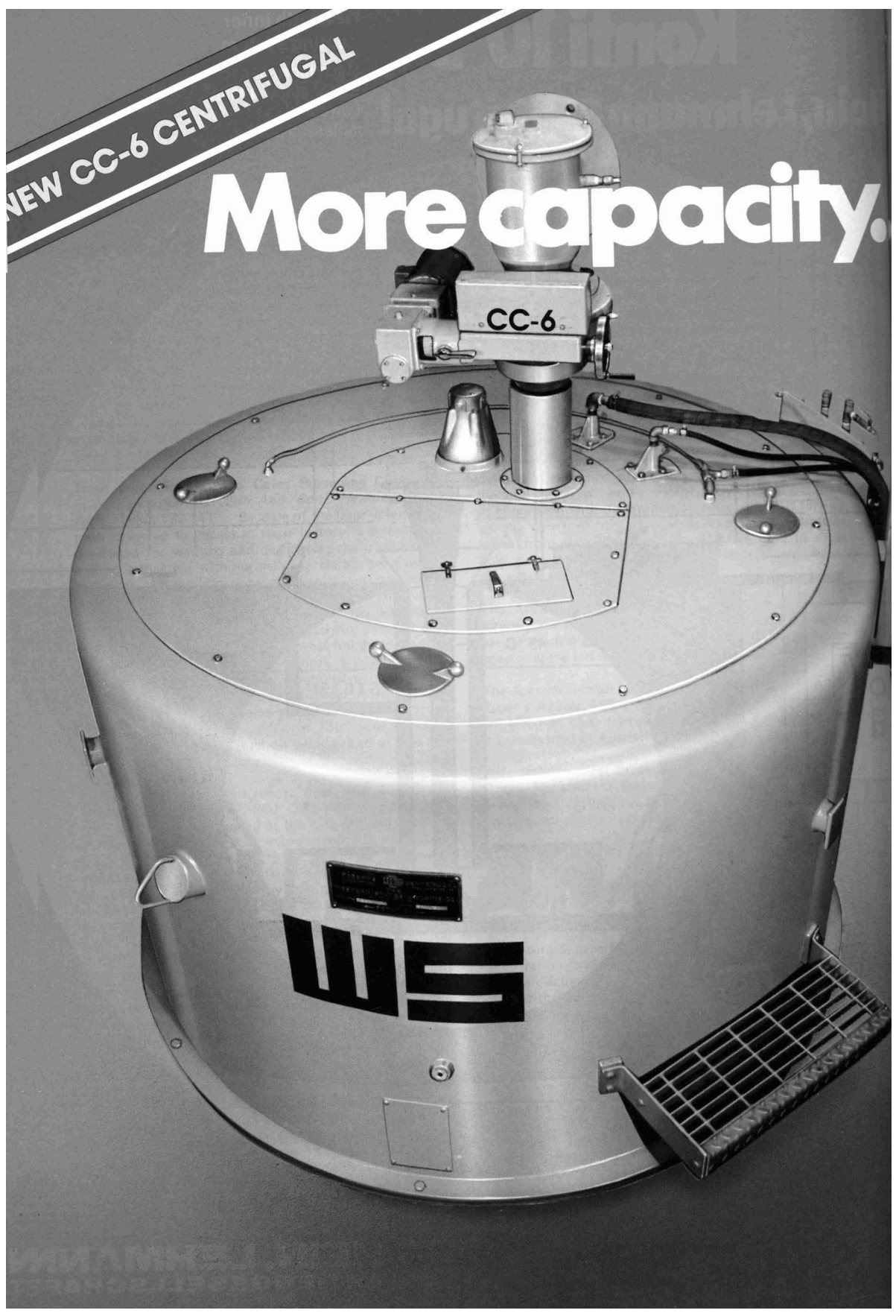
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BEET SUGAR MANUFACTURE

Possibilities of reducing the heating steam consumption in the sugar house. H. J. Krombach. *Zuckerind.*, 1981, **106**, 793-804 *(German)*. — A number of possible ways of reducing heating steam consumption in the sugar house are discussed, the aim being to decrease the quantity of make-up water used primarily for run-off dilution and sugar melting. While one possible solution would be to raise the Brix of thick juice to e.g. 75°, there is risk of false grain formation; however, a 3-product boiling scheme is described which uses a 75°Bx syrup from the last evaporator effect, but injects 70°Bx syrup (withdrawn from the evaporator before the final effect) at the start of nucleation, reverting to use of the higher Brix syrup at the end of this boiling phase. Remelt liquor from the Quentin process cannot be filtered unless its Brix is below 70°, while the Quentin process itself requires dilution of raw sugar run-off to some 65°Bx. However, the liquor can be treated in separate evaporators using pan vapour, i.e. so-called waste heat, before the vacuum pans. The operation of a falling-film evaporator and plate heat exchanger system for Quentin run-off is described. Details are given of a scheme in which the raw sugar and affined low-grade sugar are mingled with saturated run-off to give a magma which is then used as footing. Apart from the advantage of reduced steam consumption (because of the absence of need to evaporate water normally used for melting), the scheme is of benefit as regards the actual boiling process, since the high boiling phase can be started immediately after the pan is charged, while the syrup feed can be of higher Brix. The scheme is described for manufacture of raw sugar alone and for raw sugar plus white sugar. Cooling of higher-purity massecuite helps to reduce steam consumption, and a scheme is described in which cooling is applied to all massecuites in a 4-product scheme.

Exergetic analysis of a sugar factory with vapour compression, using Aarberg sugar factory, Switzerland, as example. O. Auerswald. *Zuckerind.*, 1981, **106**, 804-815 *(German)*. — Potential industrial applications of heat pump systems are discussed, and the thermodynamics of processing at Aarberg are analysed; the electricity requirements of the individual process stations are covered exclusively by imported power, thus minimizing consumption of oil as primary energy source. All the vapour is compressed; thin juice is concentrated from 15.4°Bx to 20.4°Bx in a pre-evaporator, using a steam-jet heat pump, and then taken to 68.63°Bx by thermocompression in the evaporator proper. Although no overall comparison is made between the scheme at Aarberg and that at a factory of comparable capacity but generating its own electricity, the exergy calculations permit comparison between individual processes at Aarberg and another factory. Advantages of the Aarberg system are discussed; they include a lower energy consumption (18.5 kWh per 100 kg beet by comparison with 30 kWh/100 kg in a conventional factory), high heat transfer coefficients in evaporation, and low thick juice colour formation as a result of reduced residence time and careful thermal handling in the evaporator at a pressure of 0.92 bar.

Calculation of pressure loss during forced ventilation of piled beet. O. Mikus, J. Rejsek and L. Budicek. *Ind. Alim. Agric.*, 1981, **98**, 559-564 *(French)*. — A mathematical model of forced ventilation of a beet pile has been developed to permit calculation of pressure loss and factors responsible for such loss. Results showed that the loss increased markedly with amount of tare, fell slightly as the average size of the roots increased, and was practically unaffected by height of the pile; most of the pressure loss took place immediately after the air discharge port in the duct, so that of major importance is the location of the port whereby air flows through it at minimum velocity.

Application of the Cheops coordinated management process to crystallization. G. Windal and A. Deleurence. *Ind. Alim. Agric.*, 1981, **98**, 581-588 *(French)*. — The Cheops process of hierarchic control of sugar manufacture by computer interlink is a system in which each process station has its own controller, but a central controller governs the overall manufacturing process. In a simplified scheme, successive modules are made up of the stock of product to be processed and control of the forward flow of the product, such as in evaporation and boiling. Application of the system to the 3-massecuite boiling system at Artenay factory is described. Results have shown that daily white sugar output and *A*-sugar yield per 100 kg massecuite were above the French average, while massecuite volume, electricity consumption and labour requirements per tonne of sugar were below the national average.

The new direct reception centre using sub-sampling at Roye sugar factory. M. Le Blanc. *Ind. Alim. Agric.*, 1981, **98**, 625-630 *(French)*. — The computerized system introduced at Roye for beet reception, sampling and analysis is described. Three samples are automatically taken from each truck as soon as it is positioned below the samplers with the aid of a light panel controlled by photoelectric cells and a punched card carrying details of the weighed consignment inserted in a sampler control box. The samples are washed, re-weighed, subsampled (to obviate the need for topping) and the pol content measured. Details of the gross weight, tare and analysis are printed out for the truck driver, while the grower also has access to a print-out of data on the previous day's consignments from the memory bank.

Particulars of heat usage at sugar factories producing, storing and processing thick juice. V. N. Gorokh *et al. Sakhar. Prom.*, 1981, (8), 24-27 *(Russian)*. — Analysis of steam usage at factories storing thick juice for post-campaign processing has shown that there is a net increase which, expressed as ideal fuel consumption, is 0.12-0.28% on beet for every 10% of the amount of thick juice produced for storage, depending on the process conditions and technical standard of the factory. Ways in which the fuel consumption can be reduced are listed.

Measures for economizing in energy in the sugar house. Yu. D. Kot *et al. Sakhar. Prom.*, 1981, (8), 27-29 *(Russian)*. — Factors governing the steam consumption in massecuite boiling are analysed, particularly syrup Brix and the positive effects of massecuite stirrers and continuous vacuum pans, which permit use of steam of

reduced potential, e.g. 3rd and 4th evaporator effect vapour.

Use of deammoniated condensates from juice vapours for sugar extraction. V. S. Samoilenko, L. P. Reva, N. A. Arkhipovich and E. A. Grivtseva. *Sakhar. Prom.*, 1981, (8), 30-32 *(Russian)*. — Results of experiments showed that much better raw juice and 2nd carbonatation juice properties were obtained by using, as diffusion supply water, deammoniated, SO_2-treated condensate rather than the same water without ammonia removal and at the same pH.

Maximum utilization of the adsorptive capacity of calcium carbonate mud under carbonatation conditions. L. I. Tanashchuk and N. A. Arkhipovich. *Sakhar. Prom.*, 1981, (8), 32-34 *(Russian)*. — Laboratory experiments are reported in which three preliming/liming schemes were compared with the conventional system used in Soviet sugar factories (progressive preliming with 0.25% CaO on beet and 100% unfiltered 1st carbonatation juice at 88-90°C and liming with 2.5% CaO for 10 min at 88-90°C). The basic feature of the experimental schemes was the use of approx. 0.3% CaO on beet plus recycled 1st carbonatation juice or 2nd carbonatation mud in preliming, 0.4-0.5% CaO in main liming and 1.7-1.8% CaO in 1st carbonatation. Tabulated data show that the experimental methods gave generally better results than the standard scheme as regards 1st carbonatation juice settling and filtration and 2nd carbonatation juice properties.

Tests on an automatic FiLS-100 unit at Elan'-Kolenovskii sugar factory. I. A. Musatov *et al. Sakhar. Prom.*, 1981, (8), 34-35 *(Russian)*. — Trials of a FiLS-100 filter-thickener for 1st carbonatation juice are reported and performance data tabulated. By comparison with a gravity settler, the filter-thickener reduced undetermined losses by 0.03-0.04% on beet, obviated the need for check filtration of 1st carbonatation juice and decreased molasses sugar.

Technological diagnostics in sugar manufacture. J. Dobrzycki. *Gaz. Cukr.*, 1981, **89**, 49-52 *(Polish)*. The diagnosis of processing problems in the sugar factory is discussed, and the roles played by analytical chemistry, automatic measurement and simulation are indicated. The value of the computer in this work is stressed.

The advisability of decolorizing sugar factory juices. H. Zaorska. *Gaz. Cukr.*, 1981, **89**, 63-65 *(Polish)*. The positive effects of thin juice decolorization with 2% granular active carbon (on Brix) were determined. The treated juice was concentrated to 65°Bx and then subjected to laboratory-scale boiling (three strikes). The results indicated a 0.2% increase in sugar recovery, a 20% cut in total boiling time, and a reduction in sugar colour. A major advantage of decolorizing with carbon is the absence of noxious effluent.

Changes in the composition of colloids during the campaign. K. Szwajcowska. *Gaz. Cukr.*, 1981, **89**, 67-69 *(Polish)*. — Changes in the colloidal constituents of raw juice at Dobrzelin factory during the 1978/79 and 1979/80 campaigns were plotted. Block diagrams and tables are given for total colloids, dextran, levan, pectins and albumin.

A raw juice heater using pan vapour. V. N. Gorokh, B. F. Us, K. O. Shtangeev and A. Ya. Khomenko. *Sakhar. Prom.*, 1981, (8), 36-39 *(Russian)*. — Details are given of a tubular raw juice heater which uses pan vapour to heat the juice, flowing at 2-2.5 $m.sec^{-1}$, from 30° to 47°C. In order to raise the heat transfer coefficient to a sufficiently high level, the heater includes means of partial condensation of the vapour and simultaneous withdrawal of incondensables.

Measures for economizing in fuel and energy resources. L. P. Ignat'ev. *Sakhar. Prom.*, 1981, (8), 43-46 *(Russian)*. Advice is given on how to achieve optimum energy consumption in a sugar factory by judicious use of steam-generating and electrical plant and efficient use of steam in processing.

Prevention of frosting of beet during their refrigeration with natural cold. V. A. Knyazev and V. I. Shelud'ko. *Sakhar. Prom.*, 1981, (8), 52-53 *(Russian)*. — Advice is given on ventilation of piled beet with cold air without risk of frosting (caused by condensation of water vapour on the surface of the beet at a temperature below dew point) and subsequent processing difficulties.

Observations on low-grade centrifugalling. J. Lichtenstein. *Cukoripar*, 1981, **34**, 95-98 *(Hungarian)*. — Investigations on the effect of wash water quantity and massecuite temperature on mother liquor purity are reported. Optimum was a mother liquor viscosity no greater than 18 poises.

Results and aims of an energy economy in the sugar industry. A. Zsigmond. *Cukoripar*, 1981, **34**, 99-15 *(Hungarian)*. — Results achieved in Hungarian sugar factory energy economies in recent years are discussed and future tasks indicated. Problems encountered in the use of back-pressure turbines for power generation and concerning thermocompression are examined; it is emphasized that lack of understanding on these inhibits development of a rational energy plan.

The efficiency and limitations of additives for heavy fuel. J. Durafour. *Sucr. Franç.*, 1981, **122**, 373-375 *(French)*. — Advantages of fuel additives are discussed together with some limitations on their use. Generally, such additives help to reduce: pre-burner cleaning that is otherwise necessitated by the presence of muds (chiefly sediment, metal oxides, asphaltenes and water), some of which accompanies the oil from the refinery while the rest forms during storage; deposition and corrosion in the hot zone; corrosion in the cold zone; and the quantity of unburnt material.

Storage of damaged beets. G. Mantovani. *Ind. Sacc. Ital.*, 1981, **74**, 93-97 *(Italian)*. — The nature of damage to beet roots in harvesting and the losses caused thereby are discussed, with reference to studies on the subject in the USA. The "Bruise Index" has been developed as a criterion on which to assess damage, and attempts have been made to limit the extent of losses in storage of damaged beet by means of spraying with chemicals. Other techniques to minimize loss include the breeding of beets with roots showing increased resistance to impact damage and modification of harvesting and handling techniques to reduce the incidence and force of impacts. A program of study is to be carried out in Italy to determine the losses under Italian weather conditions in order to tell whether adoption of the American techniques of modification of these would be worthwhile.

SUGAR REFINING

Raw sugar quality standards: a producer's comments. P. A. Carreño. *Proc. 39th Meeting Sugar Ind. Technol.*, 1980, 160-176. – The author briefly describes the processes involved in raw sugar manufacture from cane and argues for a fairer basis of payment by refiners for high-pol raw sugar, and sets out reasons for producing sugar having a pol higher than 96°, viz. to increase sucrose recovery and thereby give a higher return on investment, to maintain the storage properties and avoid losses, to facilitate handling by mechanical equipment of a free-flowing sugar, to save on freight costs by moving a smaller amount of non-sugars, and to satisfy the needs of the market.

An in-line ultra-violet sterilizer unit for liquid sucrose. M. K. Faviell. *Proc. 39th Meeting Sugar Ind. Technol.*, 1980, 186-189. – After pockets of white sugar from a silo at the Taber, Alberta, beet sugar factory of B.C. Sugar were found to be the cause of contamination of batches of liquid sugar as a result of relatively high counts of mesophiles and particularly yeasts, an in-line U.V. sterilizer, normally used for water treatment, was installed, a similar unit also being installed at Winnipeg factory after a trial evaluation period. The unit treats 110 gal.min^{-1} 67°Bx sucrose or 77°Bx 50% invert syrup at a retention time, at maximum flow, of 15 sec. Weekly averages over a 14-month period showed that the system reduced the micro-organism count by approx. 80%. It was discovered that the increase in micro-organisms and the formation of lumps in the stored white sugar resulted from moisture migration within it; the problem was solved by installing a sugar spreader in a new silo as well as an aeration system for complete conditioning of the sugar before storage.

Computer-controlled evaporator on refined syrups in the Tirlemontoise refinery. The use of a Fox III mini-computer for controlling two syrup evaporators. M. Braeckman. *Proc. 39th Meeting Sugar Ind. Technol.*, 1980, 216-235. – See *I.S.J.*, 1982, **84**, 251.

The new recovery plant at the Thames refinery of Tate & Lyle, England. J. O. Smith and H. Wheeler. *Proc. 39th Meeting Sugar Ind. Technol.*, 1980, 236-255. – Details are given of the equipment installed in the new recovery house at Thames refinery, where the process system remained unchanged, viz. a three-boiling, double-einwurf scheme. Economic aspects are also discussed.

Measures of pressure in a large sugar silo. O. D. Larsen. *Sucr. Franç.*, 1981, **122**, 343-348 *(French)*. – Twenty-five pressure boxes were incorporated in the structure of a cylindrical pre-stressed concrete silo erected at Nakskov sugar factory in Denmark in 1975 and having a capacity of 30,000 tonnes of white sugar. A central concentric section has a capacity of only 2000 tonnes. Readings registered by the boxes gave an overall picture of the pressures on the wall of the central section and on the outer wall of the annular section as well as on the floors of both sections during charging, storage and retrieval of the sugar. The results are discussed with the aid of diagrams.

New ion exchange processes in the sugar industry. D. Hervé and X. Lancrenon. *Ind. Alim. Agric.*, 1981, **98**, 613-622 *(French)*. – After a short survey of ion exchange processes used in the sugar industry and innovations in the use of ion exchange resins that have led to their greater application, the authors discuss the advantages (for both manufacturer and user) of liquid sugar. Descriptions are given of a scheme for liquid sugar manufacture from *B*-molasses in a sugar factory and of a number of schemes for liquid sugar manufacture in a refinery.

Thermotechnical trials at Gnivan sugar factory during the raw sugar processing period. V. N. Gorokh *et al. Sakhar. Prom.*, 1981, (8), 39-43 *(Russian)*. – A detailed balance was made of the energy production and consumption during two months of post-campaign refining of cane raw sugar. After analysis of the many parameters involved, a list is presented of measures whereby fuel, steam and electricity consumption can be cut and the technological standard of the factory raised to a high level.

Arrangement of an efficient hydrochemical system for power plants in sugar refineries and beet sugar factories processing raw sugar. E. D. Yarmilko, I. D. Stepchuk and V. N. Plemyannikov. *Sakhar. Prom.*, 1981, (9), 35-38 *(Russian)*. – Because of problems (including corrosion) caused by use of demineralized water as boiler feed, a scheme has been developed in which water is softened by treatment with cation exchange resin in Na^+ form, heated to 120-130°C and then passed to a single evaporator effect, the condensate from which is used as boiler feed. The sodium bicarbonate in the treated water decomposes on heating to form NaOH and CO_2, but addition of ammonium nitrate before the evaporator helps to neutralize the caustic soda while also combining with the CO_2 to form non-corrosive ammonium bicarbonate. The economic effect of the scheme is discussed.

The recovery of sucrose from low-grade refinery syrups. J. A. Watson. *Sugar Tech. Rev.*, 1981, **8**, 81-147. – Plant and processes used in cane sugar refining are described, and molasses exhaustion, sugar recovery and utilization discussed. Problems created by the presence of dextran are examined, and optimum operating conditions set out for a refinery. The review includes 340 references to the literature.

Some features of the sugar refinery of Central El Palmar. F. Cordovez Z. *Proc. 40th Meeting Sugar Ind. Technol.*, 1981, 32-40. – Information is given on the refinery section of Central El Palmar situated some 70 miles south-west of Caracas in Venezuela. The mill crushes 6000 tcd, while the refinery can melt up to 900 tonnes of raw sugar per day, although its average throughput is 700-800 tonnes/day. The sugar factory operates from November to May, whereas the refinery works throughout the year, processing cane syrup from two other factories as well as raw sugar from other Venezuelan factories and from the Dominican Republic and Brazil. Domestic production in Venezuela covers only half of its sugar requirements.) Since the Venezuelan government fixes the price of sugar, which is sold through a single distribution agency, there is no incentive for

competition between producers and only one type of granulated sugar is manufactured. The refining process used is somewhat simple in accordance with market requirements and includes phosphate flotation purification and aeration of the melt under pressure in a specially designed vessel. Surfactant, lime and phosphoric acid are added to the screened melt, which is then exposed to air at 70 psi pressure; the melt is then heated from 70° to 90°C and flows to flotation clarifiers, where reduction in pressure to atmospheric and the rise in temperature causes the dissolved air to be released. carrying up the calcium phosphate in the form of a highly stable scum. Since heating destroys the floc formed in the melt, further flocculant (preferably Taloflote) is added at the inlet to the clarifiers. During the cane crushing season the clarifier scum is added to the raw juice in the liming tank; at other times it has to be sweetened-off as in conventional refining. After active carbon treatment, the melt is polish filtered and the filtrate mixed with run-off to be used as feed for the white sugar pans.

Operation of a small refinery in the Los Angeles area. H. C. Wilson and J. A. Richmond. *Proc. 40th Meeting Sugar Ind. Technol.,* 1981, 41-75. – Details are given of the processes and equipment used at Santa Ana refinery which started cane raw sugar processing in 1979 after conversion from a beet sugar factory. Some of the equipment is new, while some is that used in the original factory. Since the refinery is located about 12 miles inland from the Pacific Ocean, with no direct link by waterway, a port receiving and storage facility had to be established. Flow sheets and balances are given of the steam and hot water/condensate make-up schemes and of the overall heat economy.

Improvement in boiler control using carbon monoxide measurement. A. O. Maylott. *Proc. 40th Meeting Sugar Ind. Technol.,* 1981, 85-94. – After it had been found at Crockett refinery that measurements of oxygen in boiler flue gas varied with the sample point and as a result of stratification (requiring insertion of a probe more than four feet beyond the wall), which also shifted dynamically as the boiler load changed, it was decided to measure the CO content as an indicator of the optimum air:fuel ratio. Incorporation of the measurement system (based on passage of an infra-red beam across the chimney and back to a photocell) in a computerized system for control of the ratio is described. The flue gas analyser in the scheme not only measures CO but also CO_2, combustibles, temperature and opacity. Tests with the system on No. 1 boiler showed an average increase in boiler efficiency of 0.73%, while subsequent tests on a No. 2 boiler gave an average increase of 0.93%; the monthly fuel costs at the refinery are calculated at $1,000,000.

The effect of dextran on the distortion of hard candy. G. W. Vane. *Proc. 40th Meeting Sugar Ind. Technol.,* 1981, 95-102. – Distortion of high-sucrose candy pieces led to packing difficulties and considerable quantities of waste candy. The problem was attributed to dextran. Tests in which dextran supplied by Pharmacia, a Swedish company, were added to sucrose showed that the distortion increased both with dextran molecular weight and its concentration. However, use of an endodextranase enzyme reduced distortion. Investigations of the possible sources of the dextran showed that it was not formed in the refinery but entered with the raw sugar; the various refining processes removed little or none of it, while the raw sugar liquor would have to be cooled and diluted before dextranase treatment, assuming that the enzyme is allowable as a food processing aid.

V.H.P. raws – some pertinent facts for producer and refiner. J. B. Alexander. *Proc. 40th Meeting Sugar Ind. Technol.,* 1981, 130-143. – Experience in manufacture and storage of Very High Pol raw sugar (having a minimum pol of 99.3°S) in South Africa is described. Reasons for the preference of high-test molasses as coating material for the sugar when exported are given as: a smaller quantity required than in the case of final molasses and a significant reduction in ash and colour, thus reducing refining costs. However, the award system applied by North American refiners to raw sugar on the basis of pol does not favour V.H.P. sugar, the maximum premium being awarded for sugar of 96-97°S.

Some characteristics of refining beet raw sugar. H. Eichhorn. *Proc. 40th Meeting Sugar Ind. Technol.,* 1981, 144-162. – See *I.S.J.,* 182, **84,** 135-139.

Experiences with V.H.P. and beet raws. B. W. Drean. *Proc. 40th Meeting Sugar Ind. Technol.,* 1981, 163-170. Experience in handling Very High Pol cane raw sugar and beet raw sugar at Tate & Lyle Thames refinery is described. While V.H.P. sugar has posed no particular problems in refining, this free-flowing sugar is easily spilt during unloading from ships, while it may also be very dusty because of its fine grain. Beet sugar may also be fine-grained and may contain syrupy lumps, probably because of the use of continuous centrifugals, making affination an unsatisfactory process; its ash content tends to be higher and its colour lower than those of cane raw sugar.

New remelt station at Refined Syrups & Sugars. E. D. Gillette. *Proc. 40th Meeting Sugar Ind. Technol.,* 1981, 171-177. – The new recovery plant at the Yonkers refinery of the author's company is briefly described. A two-boiling scheme with double purging of *A*-sugar and continuous centrifugalling of all massecuites is operated. The colour of melted *A*-sugar has proved unsatisfactory and it contains dark lumps, some larger than peas, that emanate from *C*-sugar. These do not disperse during *A*-massecuite boiling and are attributed to unsatisfactory spinning, failure of *C*-sugar lumps to break up in mingling, and use of dark *C*-sugar as footing for the *A* pans. A high proportion of needle crystals has been found, and this has been associated with unsatisfactory molasses purities.

New sucrose recovery stations for mud and lint at the Colonial Sugar refinery. R. L. Knecht and J. D. McCulla. *Proc. 40th Meeting Sugar Ind. Technol.,* 1981, 188-207. Details are given of the approaches made to solve the problem of sugar recovery from clarifier muds and from "lint" (the debris removed from the washed sugar liquor stream by screening). The mud is handled by an Enviro-Clear clarifier as used for mud treatment in beet sugar factories, while the lint is treated in a modified Hycor Disco-Strainer of Swedish manufacture (originally designed to recover cellulose from paper mill waste streams). Flow sheets and balances are given of the two systems. Total losses average approx. 0.015% on melt sucrose. One operator per shift controls the mud station, lint station and several other operations in the char house.

NEW BOOKS

Australian sugar yearbook, 1982 edition. 320 pp; 18 x 24.5 cm. (Strand Publishing Pty. Ltd., GPO Box 1185, Brisbane, Australia 4001.) 1982. Price $A 21.00.

If you wish to know about the Australian sugar industry, this is the book for you. It is packed with material of all kinds pertaining to the industry, and even the advertisements add to the information available. The yearbook opens with an outline of the industry, complete with map, and then follows with a section containing details of sugar industry organizations, a directory of all the sugar factories, a review of the 1980 season and comments from sugar industry leaders, reports from conferences and field days as well as from the Sugar Research Institute and the Bureau of Sugar Experiment Stations, and a collection of statistics. Well illustrated and clearly printed, the yearbook is a credit to its publishers.

Beet-sugar technology. 3rd Edition. Ed. R. A. McGinnis. 855 pp; 15.5 x 23 cm. (Beet Sugar Development Foundation, P.O. Box 1546, Fort Collins, CO 80522, USA.) 1982. Price: $35.00

This is the only book available in English that covers the subject of beet sugar technology, so that the appearance of a new, updated version is of some importance. In the eleven years since the 2nd Edition there have been quite significant advances in the field, and almost every chapter has been modified to take account of these; in particular, the chapter on crystallization (all of which, apart from a section on separation of crystals and syrup, has been written by G. W. Cossairt) is double the size of the corresponding chapter in the previous edition, while major revisions have been made to the chapters on beet agriculture, chemistry, storage, diffusion and juice purification, the environment and process control. Some material appearing in the 2nd Edition has been omitted because it is no longer of value. A new appendix has been included which gives conversion factors to SI units.

The 24 chapters contain material, contributed by 56 authors, on every aspect of beet sugar manufacture as carried out in North America. It must be stressed that there are some differences in both the equipment and the technology between North American and European practices; however, in the more important aspects there is little basic difference, so that the reader wishing to acquaint himself with beet sugar technology will find that this book provides a good general background. The chapters cover beet agriculture, the sugar beet and chemistry, the tare laboratory, beet storage, diffusion, juice purification (to which four chapters are devoted), evaporators and fuel economy, crystallization, granulated sugar, special sugar products, liquid sugars, sugar quality, lime and CO_2 manufacture, the Steffen process of molasses sugar recovery, by-products, power generation, the environment, process control, microbiology and plant sanitation, and technical accounting and process control. Besides the appendix on SI factors mentioned above, there are appendices showing a history of Canadian beet sugar manufacturing enterprises, beet sugar factories in operation in North America in 1979-80, and Grut's sucrose solubility table. After a subject and an author index is a flow diagram of a composite North American factory.

The printing is of high standard, and none of the illustrations and diagrams takes up too much space. To sum up, this is a very worthwhile book, and the editor and contributors are to be congratulated on the result of their efforts.

Cuban sugar industry at a glance. 28 pp; 21 x 28.5 cm. (World Sugar Journal, N. G. Osman & Associates Ltd., Hamilton Rd., Slough, Berks., England.) 1982. Price: £20.00.

This special issue of *World Sugar Journal* was published to mark the 20th Anniversary of the establishment of CubaAzúcar (the Cuban sugar marketing organization). It contains, amongst other things, a brief history of the Cuban sugar industry, and summaries of speeches given at the special dinner held in Havana. A loose insert provides a map showing the locations of Cuban sugar factories and bulk terminals.

A blue print for maximizing yields of sugar cane. S. A. Hussain. 30 pp; 20.7 x 10.7 cm. (Sind Sugar Corporation Ltd., Shaikh Sultan Trust Building, Beaumont Road, Karachi-4, Pakistan.) 1981.

Sind Sugar Corporation issues folders on each operation in cane growing in local languages used in Pakistan. However, in view of the wide interest shown by English-speaking growers in the program formulated for maximizing cane yields, the present booklet was published in English as a guide to all aspects of cane agriculture, covering the range from land selection and preparation to harvesting, and including an example of a field book to be kept as a record of farming practices. While the program is based on operations in the areas of Thatta and Dadu sugar mills, it is a worthwhile exercise which could well be copied elsewhere. It is stated that the technology developed by the Corporation has resulted in a crop yield, by some growers in the Thatta mill region, which is up to ten times the Pakistan average.

Queensland Canegrowers annual report 1982. 56 pp; 20.7 x 27.2 cm. (The Queensland Cane Growers' Council, GPO Box 1032, Brisbane, Australia 4001.) 1982.

After a synopsis of the 1981 cane crop in Queensland and a brief look at various aspects of the world sugar situation, the report summarizes research work conducted during 1981 and recounts events within the industry in which the QCGC has taken a leading role. The Council offers technical, financial and legal advice to the cane grower, and this report, liberally supplied with excellent colour photographs, clearly illustrates the type of work carried out.

LABORATORY STUDIES

The conductivity of sugar beet tissue. J. Kubiak and G. Konieczynski. *Gaz. Cukr.*, 1981, **89**, 52-55 *(Polish)*. Tissue electrical conductivity was measured at 10°C at various points internally along and across a beet and at the surface. For healthy beet samples that had been stored for a prolonged period the average value was 143 ± 21.1 $\mu S.cm^{-1}$; it rose to 1460 $\mu S.cm^{-1}$ with thermal denaturing, while putrefaction resulted in a value of 1939 $\mu S.cm^{-1}$. Cell juice from healthy beet had an average value (at 15°C) of 2651 $\mu S.cm^{-1}$. The conductivity of tissue from beets that had been frozen and then stored for varying periods (up to 16 days) at 2, 5, 10 and 15°C was also measured at 10°C; the values rose markedly with storage period at the two higher temperatures and with temperature rise, whereas there was little difference between the values at the two lower temperatures for the same storage period.

Extraction from beet cossettes by percolation. H. Zaorska. *Gaz. Cukr.*, 1981, **89**, 55-57 *(Polish)*. – Cossette fractions weighing 1 kg were subjected to diffusion in distilled water in a vertical tube at a constant temperature; the sugar content of the cossettes ranged from 16.24 to 19.90%. Optimum conditions, at which 0.2-0.3% sugar (on beet) remained in the cossettes after diffusion, were a temperature of 76-78°C and a time of 70 minutes. Under these conditions, the raw juice had a purity about 1 unit higher than that of the cell juice.

A method for measuring the compressibility of sugar factory muds. J. Grabka. *Gaz. Cukr.*, 1981, **89**, 58-59 *(Polish)*. – The compressibility of defecation mud was determined by a method based on pressure filtration. Addition of flocculant caused a marked reduction in compressibility and thus improved mud separation, whereas compressibility was little affected by the final pH in preliming.

Optimum conditions of thin juice deliming by means of ammonia and soda. J. Makowski. *Gaz. Cukr.*, 1981, **89**, 60-63 *(Polish)*. – Laboratory experiments were conducted on 2nd carbonatation juice deliming by the ammonia and sodium carbonate method[1]. Results, shown in the form of graphs, indicated the following optimum conditions: a juice alkalinity that was approximately zero after carbonatation, ammonia and lime dosages which were equivalent to 40% and 90-95%, respectively, of the stoichiometric lime salts concentration at optimum alkalinity, addition of up to 0.2% CaO (on juice) before 2nd carbonatation (the actual amount depending on the lime salts content at optimum alkalinity), a deliming temperature as low as practical, and a deliming period of 15-20 minutes.

Electrochemical determination of invert in intermediate sugar factory products. J. Dobrzycki and M. Ludwicki. *Gaz. Cukr.*, 1981, **89**, 65-67 *(Polish)*. – Details are given of the method[2] based on use of Müller's reagent and a copper selective electrode, and test results are reported.

Recent developments in and aspects of research on sugar accumulation in the beet. H. Barbier. *Sucr. Franç.*, 1981, **122**, 367-372 *(French)*. – Research on the mechanism of sugar accumulation in the beet root is described. Studies on sugar distribution showed that the fascicular tissues (having an average diameter of 70 μm) contained slightly more sugar than the parenchymatous tissues (of 130 μm average diameter). However, all the cells in the root have the same structural characteristics, with a large central vacuole occupying 95% of the cellular space and constituting the most probable storage compartment. Previous studies have shown that each cell can be represented as three compartments arranged in series; the parietal compartment in which no sugar is accumulated and any sugar circulating in the wall does so by diffusion; the cytoplasmic compartment containing some 10% of the cellular sugar which is used for respiration or synthesis of wall material or other enzymically produced metabolite, and in which movement of sugar through the cytoplasmic membrane is also brought about by diffusion; and the vacuolar compartment. Studies with radio-active sucrose have shown that the sucrose molecules are not hydrolysed when they pass from one compartment to another or when they enter the vacuole. The selective stage of sugar accumulation occurs in the tonoplast (the membrane between the cytoplasm and the vacuole). Investigations involving vacuole suspensions prepared from cells of a number of beet varieties have shown that the vacuoles from tetraploid varieties had an average diameter double that of the vacuoles from diploid varieties. The techniques used to obtain the suspensions and purify them are described. Transfer of sugar through a cellular membrane is shown to be due to a "proton pump" created by a proton concentration gradient and a potential difference (pd) across the membrane. It has been well established that the pH inside the vacuole is lower than that of the surrounding cytoplasm, proving that a proton concentration gradient exists, whereas hitherto there has been a scarcity of data on a pd. Details are given of a method used to measure the pd of a vacuolar suspension using silver/silver chloride electrodes. It was found that the pd was slightly positive and independent of age of root and period of cold storage. It was not directly related to the sucrose content in the tissues at the time of preparation of the vacuole suspensions. At all stages of the investigation sugar beet had a higher pd than forage beet, and it was subsequently found that there is a positive correlation between the ability of a given variety to accumulate sucrose in the vacuole and the pd across the tonoplast. It is suggested that ATP created by respiration provides the energy required for operation of the ionic pumps in the vacuolar membrane; these pumps energize the membrane, thereby creating the proton concentration gradient and pd necessary for transfer of sucrose from the cytoplasm to the vacuole. A model of this mechanism proposed by Saftner & Wyse[3] is presented.

A study of water activity prediction for molasses solutions. J. Chirife, C. Ferro F. and S. Vigo. *J. Agric. Food Chem.*, 1981, **29**, 1085-1086. – The experimental determination of the water activity, a_W, in solutions of cane molasses (which has a direct effect on molasses shelf life and that of an end product) and its comparison with a_W of sucrose solutions is reported. An attempt was made to

[1] Zagrodzki & Zaorska: *I.S.J.*, 1973, **75**, 254.
[2] Dobrzycki & Ludwicki: *ibid.*, 1980, **82**, 28.
[3] *Plant Physiol.*, 1980, **66**, 884.

predict molasses a_W from knowledge of its main non-electrolyte components, viz. sucrose, invert sugar and organic acids. Results showed that prediction was reasonably good at a_W below 0.92; at higher values, electrolytes present in molasses also played a role in depressing a_W, and allowance has to be made for these in accurate prediction of molasses behaviour.

Collaborative study on the determination of trace elements in dried sugar beet pulp and molasses. III. Lead. P. B. Koster, P. Raats, D. Hibbert, R. T. Phillipson, H. Schiweck and G. Steinle. *Zuckerind.*, 1981, **106**, 895-900 *(German)*. – See *I.S.J.*, 1981, **83**, 291-296.

Washing sugar crystals – differential dissolution of corners, edges and faces. F. H. C. Kelly. *Zuckerind.*, 1981, **106**, 900-903. – It is well known that washing in centrifugals causes rounding of the corners and edges of the sugar crystals, and studies were carried out to determine the relative dissolving rates of the individual faces, edges and corners of raw cane sugar crystals obtained from a number of countries; optical and electron microscopy was used. Sugar crystals having undamaged edges and corners were isolated from massecuite and a study made of dissolution in selected aqueous ethanol solutions. On the basis of proportionality of dissolving to growth rate, the relative dissolving rates were calculated for a "normal" crystal having 12 faces and a crystal having 14 faces with two left clinodomes. It was found that the upper and lower righthand corners dissolved fastest and did so at a rate that was approximately double that of the slowest dissolving face, the front or orthopinacoid face, which is the most difficult area from which to remove the film of impurities. With a crystal having a left clinodome, this was the fastest dissolving face. For crystals elongated along the *c* axis, the ratio between the highest and lowest dissolving rates rises from 2 to 3:1; this finding is in agreement with the poorer washing achieved in the case of elongated crystals.

The magic of small numbers. Molecules of water per molecule of sucrose. E. J. Culp. *Sugar J.*, 1981, **44**, (4), 7-10. – The properties of pure sucrose solutions, factory sugar solutions and solutions of amorphous sugar having 1, 2.5, 3.5, 4.5, 9 and 12 water molecules per molecule of sucrose have been studied and are discussed with the aid of graphs.

Metallic impurities content in sugar cane molasses. C. Faifé H. and R. Hernández L. *Centro Azúcar*, 1981, **8**, (1), 89-92 (Spanish). – Methods employed for quantitative determination of Na, K, Ca, Fe and Cu in five molasses samples are reported and the results of such analyses tabulated. They ranged from 2000 to 45000 ppm, 43,000 to 74,000, 12,000 to 29,000, 65 to 247 and 4 to 10 ppm, respectively.

An improved automated colorimetric analysis of fructose in fermentation media. R. B. Roy and A. Buccafuri. *J. Automatic Chem.*, 1981, **2**, (3), 159-161; through *S.I.A.*, 1981, **43**, Abs. 81-1419. – Production of D-glucose isomerase (for high-fructose syrups) is monitored by incubating fermentation broth with D-glucose and then determining fructose produced. An automated method for determination of fructose in the presence of other carbohydrates is fully described. It is based on the use of a Technicon Auto Analyzer II together with a Sampler IV, a colorimeter and other associated modules. The sample is mixed with H_2SO_4 + cysteine hydrochloride, reacted with carbazole, heated and cooled, and its absorbance measured at 560 nm. CV for standard curves was ± 1.11%. Recoveries of fructose added to samples were 95-101%. No significant interference was observed from glucose, maleic acid, maltose or $CaCl_2$ at concentrations up to 0.6, 1.0, 0.25 and 0.47 $g.litre^{-1}$, respectively.

Microbiological investigation of standard granulated sugar and of its production process, with particular regard to *Bacillus stearothermophilus*. L. Kerekes. *Elelmiszervizsgalati Közlemenyek*, 1970, **26**, (4-5), 183-194; through *S.I.A.*, 1981, **43**, Abs. 81-1431. Yeast-containing agar was the best nutrient medium for determining the spore count of thermophilic aerobic bacteria. In representative samples of sugar, more than 40% of the thermophilic aerobic spores were of flat sours; thus there was a high proportion of the most resistant spores *(B. stearothermophilus)*. The average number of flat sours in granulated sugars from various factories did not exceed internationally accepted limits. However, the counts of yeast and *Leuconostoc* spp. were in some cases well above the limits. Micro-organisms present in the sugar had not come from the juice directly via the processing stages, but resulted from secondary infections. Temperatures during sugar manufacture do not cause complete destruction of spore-forming flat sours, and the spore count may increase in processing stages where conditions are suitable.

Immunological assays of dextran in white sugar. B. C. Goodacre and G. L. Martin. *Proc. 40th Meeting Sugar Ind. Technol.*, 1981, 103-128. – Details are given of three immunological methods used to determine dextran in samples of cane white sugar: a nephelometric assay and two gel diffusion methods, viz. reverse single radial immunodiffusion (RSRI) and single radial immunodiffusion (SRI). The nephelometric method is by far the most sensitive and rapid of the three, measuring dextran down to 10 ppm, but is also the most costly in terms of instrumentation, requires a relatively clean environment and uses somewhat more antiserum than does the RSRI method, which suffers from the long incubation time required as well as lower sensitivity and reproducibility. The SRI method is the simplest, provided the plates can be obtained ready-made, but it suffers from the same disadvantages as the RSRI method. All three methods have the disadvantage of measuring only alpha-1,6-linked dextran, although this has been found to be the predominant form in cane sugar and, at high contents, causes greater crystal elongation as well as a higher dextran concentration in sugar. Use of Pharmacia dextran standards that are 95% alpha-1,6-linked permits the methods to give correct values, but the degree of branching can be much higher in dextrans from different sources, and the effect of this on the immuno-complex formation remains to be studied.

Flavour components in sugar products. M. A. Godshall. *Proc. 40th Meeting Sugar Ind. Technol.*, 1981, 178-187. The volatile constituents in fresh cane leaves, raw sugar, blackstrap molasses and brown sugars were determined by gas chromatography/mass spectrometry and their association with flavour indicated. Sources of some flavour compounds found in sugar products are listed, including microbial activity during processing, degradation of metabolites from the cane plant (via raw sugar), degradation of products of long-chain fatty acids from the cane plant, amino-acid degradation during processing, acid or thermal degradation of carbohydrates, metal from corrosion of equipment, ash and adsorbents.

BY-PRODUCTS

The development of a micro-distillery for fuel alcohol in Brazil. D. J. L. Hulett. *Proc. 55th Ann. Congr. S. African Sugar Tech. Assoc.,* 1981, 64-66. — Details are given of a micro-distillery designed to produce 2400 litres of hydrated ethanol per day from sugar cane or sweet sorghum. With only five people per shift needed to operate the entire plant, the distillery is intended to be run by the farmers themselves, thus making them self-sufficient in fuel alcohol and allowing excess to be sold to the Brazilian government. The capital and running cost as well as the return on investment are given for a plant erected at Predregulho, São Paulo.

Studies on the utilization of bagasse pulp sludge. I. Chemical alteration of mixed sludge and swine wastes. S. W. Li and W. C. Liu. *Rpt. Taiwan Sugar Research Inst.,* 1981, (92), 9-18 *(Chinese).* — The disposal of active sludge cake from a soda bagasse pulp factory has become a serious problem in regard to environmental protection. The cake contains a considerable amount of lime and organic matter (with a lignin content above 5%). The heavy metal contents are far lower than the tolerable criteria for field application. The presence of lime causes the pH of the fresh sludge cake from the filter press to rise to 11-12, after which it falls to about 8 after several days' exposure to air. The fresh sludge may be mixed with pig waste, to reduce the latter's odour, and then used as a lime substitute. Analysis for organic C, total and available N, soluble BOD and crude fibre showed that humification of the mixture becomes steady within 2-3 weeks, implying that the lignin in the sludge might be incorporated with N in pig waste during the humification process. This could be of help in increasing the disposal of the two organic wastes.

Plant growth regulated by crude extract of cane wax. S. W. Li and W. C. Liu. *Rpt. Taiwan Sugar Research Inst.,* 1981, (92), 43-47. — A diethyl ether extract of cane wax scraped from a stalk was found to stimulate the growth of rice seedlings as well as nitrogen uptake; maximum effect was achieved at an extract concentration of 0.01-0.1 mg.litre^{-1}.

Storage of moist and pre-dried bagasse in Cuba — comparative analysis. J. Lois C., R. Suárez R. and L. González P. *CubaAzúcar,* 1981, (Jan./March), 27-35 *(Spanish).* Bagasse produced during the crushing season needs to be stored for utilization during the year in the manufacture of paper, board, etc., and the various methods are briefly reviewed. Formerly, bagasse was stored in small bales in Cuba, but recent installations have employed storage in larger bales with pre-drying to 17-20% moisture. This is beneficial because of the deterioration and loss which can occur in moist bales through fermentation of residual sugars and consequent temperature rise. Technical, energy and economic aspects of three systems are considered: (A) pre-drying of all the bagasse, (B) pre-drying of half and baling of the remainder for storage, and (C) baling of all bagasse, with drying from 50% to 20% moisture in the pre-dryer and also naturally during storage. Losses are greater in (B) and (C) than (A), while the area required for storage is also greater. (A) and (B) require fuel oil, unlike (C); however, if the loss from pre-dried bagasse is 7% or less and that from moist bagasse 20% or more, (A) and (B) represent a net saving of fuel. The economics are complicated, since they include the cost of extra land to store bagasse in systems (B) and (C), the value of the energy in the stored material, investment and other costs; the authors conclude, however, that system (A) is the most economical of the three.

Pressed sugar beet pulp. J. Harland. *British Sugar Beet Rev.,* 1981, **49,** (3), 47-49. — Preliminary results are reported from a number of trials in which pressed pulp was fed to beef and dairy cattle; they indicated the advantages of the pulp as a palatable source of high energy which could replace dried pulp without detriment to milk yield and was of particular value where high rates of liveweight gain were desirable. Another trial demonstrated the ease of ensilage and showed that the silage had a nutritional value comparable to that of the fresh material.

Sugar beet by-products fully utilized by south Lincs. livestock enterprise. B. Morrish. *British Sugar Beet Rev.,* 1981, **49,** (3), 67-68. — Mention is made of the feeding of Green Keil pellets (made from dried molassed beet pulp and dried grass with added minerals) to sheep and of a silage made from pressed beet pulp and brewers' grains to cattle.

Bagasse production from high-fibre sugar cane hybrids. M. J. Giamalva, S. Clarke and K. Bischoff. *Sugar J.,* 1981, **44,** (3), 20-21. — By crossing CP 52-68 commercial cane variety with Tianan 96, a wild cane from Argentina, progeny were produced that grew a large number of stalks per stool; these small-diameter stalks were of low sucrose content but high fibre content. L 79-1002 was selected for trials, as was L 79-1003, which was of lower fibre content and was the offspring of N:Co 310 x US 61-21. At a normal inter-row spacing, L 79-1002 yielded 71.3 short tons of total biomass per acre, L 79-1003 gave 64.8 tons.acre^{-1} and CP 65-357 (a standard variety) 40.0 tons.acre^{-1}. L 79-1002 is undergoing further studies on its use as a source of fibre for direct combustion and for paper manufacture, while L 79-1003 is being investigated for sugar production from the pith and fibre from the rind, for which a Tilby separator is first used; because of a soluble solids:fibre ratio near that of standard varieties such as CP 65-357, the pith can be processed in a similar manner to whole cane.

National fuel alcohol plans — sugar cane and cassava, the potential energy crops to produce fuel alcohol. P. J. M. Rao. *Indian Sugar,* 1981, **31,** 11-35. — Fuel alcohol production from various crops, including cane and cassava, the programs initiated in a number of countries, research being conducted on different aspects of alcohol production, the processes used, and the economics of production are reviewed.

Ethanol production from sugar beets in Tasmania. H. Kampf. *Sugar y Azúcar,* 1981, **76,** (8), 34-35. — In the light of a contract, awarded to W. S. Atkins & Associates Pty. Ltd. by the Dept. of National Development and Energy in Australia, to assess the viability of producing ethanol from sugar beet grown in Tasmania, the author reports on beet growing trials on the island

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and examines the possibilities of growing beet on some 140,000 ha of land as part of the normal rotation in five areas. The production of ethanol would require two plants having an optimum daily beet processing capacity each of 2500 tonnes and a joint production capacity of about 75 million litres of ethanol annually; it is suggested that the alcohol could be used in a 15% ethanol-gasoline blend. Mention is made of the ATPAL (Atkins Power Alcohol Process) system of continuous fermentation and distillation tested over a period of many months in a pilot plant at the University of Manchester.

Next-generation distilleries. E. A. Jackman. *Sugar y Azúcar,* 1981, **76,** (8), 42-43, 46, 48. — The author states that during the past fifty years only two major advances have been made in fermentation technology, viz. the Boinot yeast recycling concept and the removal of volatile products as they are formed. Mention is made of the Vacuferm process, based on pressure reduction in the fermenter so as to allow evaporation of the volatiles in the vapour phase at normal fermentation temperatures; some disadvantages of the scheme are noted. Another proposed system is use of a multi-stage centrifugal exhauster with discharge above atmospheric pressure for subsequent gas separation and liquid recovery. The continuous Biostil process[1] involves a separate yeast recycling system and a deyeasted circulating liquid slipstream, and does not necessitate reduced pressure at or near the fermentation temperature in order to maintain yeast viability. While it is widely accepted that future large-scale ethanol distilleries must be continuous, it is stressed that continuous fermentation must proceed in an aseptic environment; but developments in fermentation technology in the USA or Europe must allow for the greatly increased bacterial activity that is typical of tropical countries, i.e. a 15% increase per °C rise in temperature, coupled with the greater risk of airborne and other bacterial infections. Since, in the Biostil process, neither evaporation temperature nor pressure is related to maintenance of yeast viability, the problem of maintaining strictly aseptic conditions is lessened. The author is of the opinion that it is better to aim for a higher ethanol concentration in the fermented wash, particularly when the fermentation vessels are made of carbon steel and so do not constitute a large proportion of capital investment, than for a rapid fermentation to reduce production costs — energy can be a major cost factor, while rapidity can often generate waste. Vinasse water reduction as a prerequisite for further treatment is discussed, and vinasse recycling mentioned as one solution. When a high Brix molasses substrate is used in the Biostil process, the concentrated effluent can contain up to 35% dissolved solids, and an evaporated ethanol/water vapour produced that contains 30-40% ethanol by weight. The question of the inhibiting effect of osmosis on yeast is discussed, as is the composition of the substrate used for high Brix fermentation, for which *A*- massecuite is considered highly suitable.

By-products utilization in the sugar industry. P. J. M. Rao. *Maharashtra Sugar,* 1981, **6,** (9), 17, 18, 21-25, 27-31, 33, 35-36. — A survey is presented of utilization of bagasse, molasses, filter cake, bagasse ash (found to be suitable for manufacture of special types of glass) and cane trash.

Conception and development of a micro-distillery for production of fuel alcohol. D. J. L. Hulett. *Brasil Açuc.,* 1981, **98,** 23-28 *(Portuguese).* — The design and operation of a small-scale autonomous distillery is discussed. It employs a single three-roller mill to extract 65% of the juice from cane or sweet sorghum and converts this to alcohol in a yield of 50 litres per tonne of cane. The costs, revenue and profit are calculated for a plant producing 5000 litres per day.

Energy savings in the distillery. P. Cogat. *Ind. Alim. Agric.,* 1981, **98,** 595-600 *(French).* — Among schemes designed for distilleries to permit a reduction in energy consumption is one for a beet distillery in which the theoretical reduction is 52.7% by comparison with the conventional system. The energy saving is brought about by use of mechanical steam compression and electricity generation by a gas engine; if the gas used is recovered from vinasse by methane fermentation, the saving is increased to 80%. Application of a SPEICHIM system at one French distillery in which a compressor is used for heat recycling has permitted a 25% saving in energy consumption.

The use of sugar beet leaf and pressed pulp silage in cattle fodder. E. Pfeffer. *Die Zuckerrübe,* 1981, **30,** 192-194 *(German).* — Comparison is made between the average compositions of beet leaf silage and pressed pulp silage, showing that the latter has a higher net energy content but less crude protein and phosphorus, differences that must be allowed for when conversion is made from one form of feed to the other.

Recovery of latent heat in pulp and lucerne drying. L. Schorter. *Ind. Alim. Agric.,* 1981, **98,** 633-638 *(French).* — Three possible methods of reducing energy consumption in beet pulp (or lucerne) drying are compared: (1) using a low-temperature pre-dryer in which heated air is passed through a blanket of pulp in order to reduce the moisture content, (2) using the same type of dryer as in (1) but operating it in parallel with the main drum dryer and using it to dry only some of the total quantity of pulp (comparison is made between the author's AGEI system and that used at Tirlemont), and (3) post-drying. Of the three systems, the best as regards energy saving is (2), although its investment costs are higher than those of (1), the next best system.

Fuel consumption in pulp drying. V. D. Orlov, A. F. Zavorsin, L. G. Ivanitskaya and V. N. Ushenko. *Sakhar. Prom.,* 1981, (8), 46-48 *(Russian).* — Reasons for the high fuel consumption in beet pulp drying (typically 600-700 kg of nominal fuel per tonne of pulp) in the USSR are examined, and recommendations given on ways of reducing it.

The technique for pressed pulp ensilage. J. P. Vandergeten and R. Vanstallen. *Le Betteravier,* 1981, **15,** (157), 10 *(French).* — Guidance is given on ensilage of beet pulp. It is stressed that the operation should be completed no later than 24 hours after pressing and that the silo should not be opened up during the first 30 days.

Prospects of non-food uses of beet and sugar. S. Tourlière. *Le Betteravier,* 1981, **15,** (157), 4-5, 18-19 *(French).* — A representative of French alcohol distillers discusses the practicality of producing ethyl and methyl alcohol from beet or cane, and possible approaches to the use of alcohol as an automotive fuel are described. Use of alcohol as a chemical feedstock is also examined, as is the question of a combined system whereby white

[1] UK Patent 2,013,716.

sugar would be produced from beet but at a reduced recovery, so that the molasses would contain more sugar and be of greater value for alcohol manufacture.

The use of fibrous sugar cane by-products by ruminants. VI. The effect of supplementation on the performance of dairy heifers fed predigested bagasse pith. P. C. Martín. *Cuban J. Agric. Sci.,* 1981, **15,** 9-14. – A ration containing bagasse pith and crude protein was fed to one group of heifers, while the same ration to which a concentrate mixture (including calcium phosphate and vitamins) had been added was fed to another group. Both groups fed on grass for 4 hours each day. The ration with concentrate added greater daily weight gains and final weights than did the other ration, and heifers fed on it consumed much more crude protein; these results suggest that both crude protein and P are necessary in rations containing bagasse pith as the main energy source.

The effect of final molasses:manure silage on chemical composition of pork and lard. C. P. Díaz, R. J. Alvarez and A. Elías. *Cuban J. Agric. Sci.,* 1981, **15,** 53-58. Trials in which pigs were fed on final molasses:manure silage showed that the feed (containing up to 30% final molasses on dry matter) did not cause any appreciable changes in the quality of the pork, although more research on the subject is considered necessary.

Functional modifications induced by sugar cane final molasses in the digestive tract of poultry. Some observations. R. S. Ibáñez and C. T. González. *Cuban J. Agric. Sci.,* 1981, **15,** 59-70. – The effects of different concentrations of molasses in poultry rations on live weight and relative weights of various digestive organs were investigated. Tabulated results showed that the maximum live weight after 56 days was obtained at a molasses level of 13.7% (on dry matter), but that the next highest weight was obtained without molasses and was far higher than the values obtained with 41% and 54.7% molasses. Further studies are recommended.

The Florida raw sugar industry. Molasses marketing. J. C. Rainbow. *Proc. 40th Meeting Sugar Ind. Technol.,* 1981, 282-286. – Marketing and transport of cane molasses in Florida are briefly described. Most of the blackstrap molasses is used as animal fodder, and aspects of this are discussed.

Energy from biomass using the example of beet in West Germany. M. Burba. *Zuckerind.,* 1981, **106,** 890-895 *(German).* – Various aspects of ethanol manufacture from beet are discussed, including a list of ten reasons for the choice of beet as raw material. The quantities that could be produced in West Germany are calculated on the basis of results already obtained there and in other countries, and energy inputs and outputs are indicated. Current obstacles to a major beet alcohol industry in West Germany include the high energy consumption in processing, the high agricultural costs and the considerable area of land required.

Ensilage of enriched pressed pulp and its use in fattening. J. P. Vandergeten and R. Vanstallen. *Sucre Belge,* 1981, **100,** 282-291 *(French).* – Experiments in which an additive (containing 70% molasses, 10% urea, minerals, trace elements and vitamins) was mixed with pressed beet pulp before ensilage showed that the fermentable sugars in the additive improved the keeping properties of the resultant fodder by comparison with pressed pulp silage on its own. In feed trials, the daily weight increase of bulls was extremely good as a result of the homogeneity of the pulp:additive mixture and the increased energy component in the form of urea.

High-test molasses: a possible solution to the crisis in the Puerto Rico sugar and rum industry. G. Samuels. *Sugar J.,* 1981, **44,** (4), 11-14. – Possible solutions to the problem of a declining sugar industry in Puerto Rico and its reliance on imports of molasses for rum manufacture are discussed. They include normal production of sugar and blackstrap molasses as at present, but with an increase in cane area to supply the required quantity of molasses for rum; production of sugar and high-test molasses; or production of high-test molasses only and use of cane as a source of boiler fuel. Each scheme is discussed and the economics considered.

Bulk storage of bagasse. Laboratory-scale study. A. García R., I. Vega R., Z. Herrera R. and M. Benito B. *Centro Azúcar,* 1981, **8,** (1), 101-114 *(Spanish).* – Experiments were carried out in which bagasse was stored in glass columns 150 cm long and 10 cm in diameter in order to observe the effect of a number of variables on various characteristics. In some cases the bagasse was irrigated with water, with and without recirculation and adjusted to pH 4 and 5. In the latter cases the moisture content rose to 80% and stayed at this level during the experiments. Unirrigated bagasse gradually dried out to 40% moisture. The pH of the fibre rose to 4.5-5, depending on that of the water with which it was treated; in the absence of irrigation it fell from pH 4 to pH 3 after two weeks and then gradually rose to 3.6 at which it stabilized. The microbial count in irrigated bagasse rose to a maximum after four weeks and then fell quite sharply, presumably when all the sugar content had been used and only micro-organisms that could live on fibre were able to survive. The degradation of the bagasse, as measured by the % soluble in hot 1% NaOH solution, was highest in untreated bagasse, lower in water-treated bagasse and lowest in bagasse treated with a "biological liquor" used in the Ritter process[1]. Degradation was also found to be lower when bagasse was irrigated with water at pH 4 and pH 5 than with water at pH 4.5. X-ray diffraction measurements showed that their use, with a 1% crystallinity standard, provided an adequate, rapid indication of degradation pending development of a more sensitive method. Statistical study showed that the storage time and temperature were the only significant factors affecting degradation, at least over the period studied (4-12 weeks). Further study of interactions, e.g. pH x temperature, is needed. The investigations showed, however, that wet storage of bagasse is potentially as efficient as the Ritter method, but that it could cause a certain loss of brilliancy in the fibre.

The kinetics of ethanol production by *Zymomonas mobilis* on fructose and sucrose media. K. J. Lee, M. L. Skotnicki. D. E. Tribe and P. L. Rogers. *Biotechnology Letters,* 1981, **3,** (5), 207-212; through *S.I.A.,* 1981, **43,** Abs. 81-1482. – *Z. mobilis* strain ZM4 was cultured batchwise on media containing 250 g of fructose or sucrose per litre and continuously on media containing 100 or 150 g of sucrose/litre. Compared with a glucose medium, the fructose media gave a lower growth rate and cell yield but a similar ethanol yield. The sucrose media gave a lower ethanol yield, owing to levan formation, and a lower final concentration of ethanol. Inhibition of metabolism occurred at lower ethanol concentrations with sucrose than with glucose.

[1] Paturau: "By-products of the cane sugar industry" (Elsevier, Amsterdam) 1969.

PATENTS

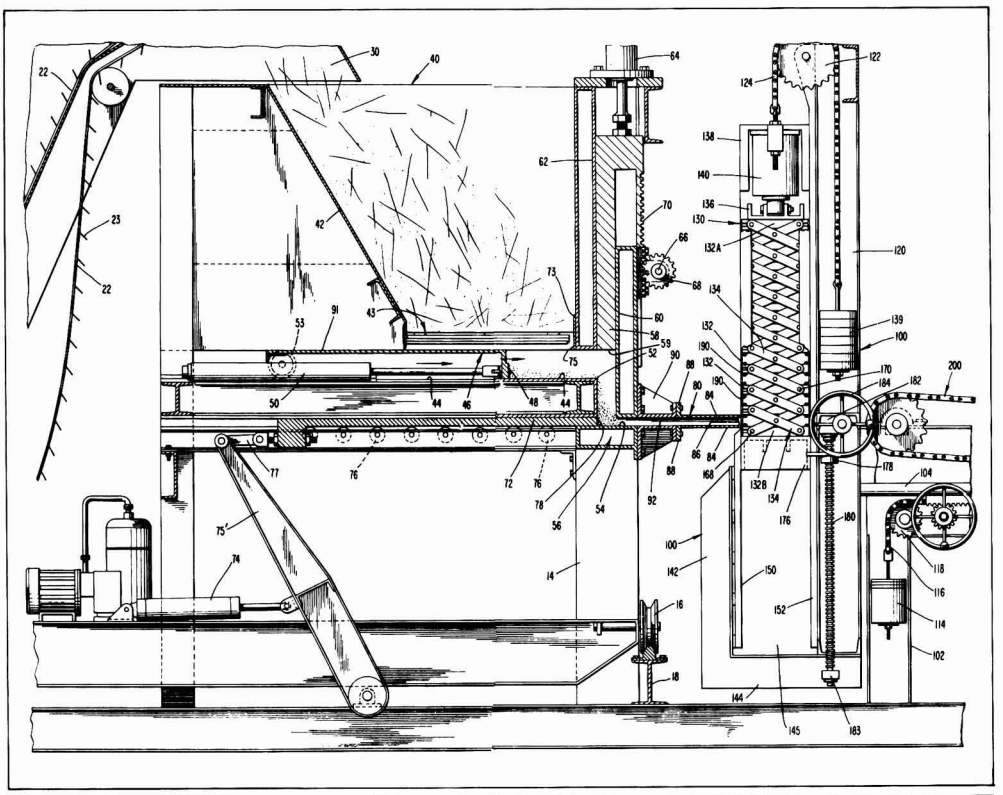
UNITED STATES

Purifying industrial sugar solutions. G. Quentin, of Neuss, Germany. **4,211,579.** August 2, 1978; July 8, 1980. — Non-sugars in an industrial sugar solution, e.g. molasses, are adsorbed using an ion exchanger (in the Ca^{++} form) whereby the solution is applied to the bottom of the (1 or more) ion exchange column(s) thereby displacing a volume of water. The purified sugar solution is withdrawn through the upper part of the column(s). The latter is eluted by water applied to the top, so displacing the remaining impure solution. The desorbed non-sugars are then withdrawn from the bottom of the column(s). A second intermediate fraction, of approximately the same volume as the purified solution, may be withdrawn after the latter and delivered as a pre-run to a second column or to the same column before the cycle is repeated. The column(s) may consist of two parts — a lower exchanger stage and an upper adsorption stage, the amounts of resin in each corresponding to the inverse ratio of the exchange and adsorptive capacities of the resin. The exchanger stage is regenerated with a salt solution after withdrawal of the non-sugars.

Manufacture of D(-)-3-hydroxybutyric acid. R. M. Lafferty, of Graz, Austria, *assr.* Agroferm AG. **4,211,846.** August 4, 1977; July 8, 1980. — The title acid is produced by cultivating a mutant micro-organism *(Alcaligenes eutrophus* ATCC 23440, *Azotobacter chroococcum* DSM 281, *Bacillus megatherium* ATCC 32, *Zoogloea ramigera* ATCC 19623, *Clostridium butyricum* ATCC 19398 or *Mycoplana rubra* CBS 385.76) on a carbon source (glucose, fructose, sucrose, molasses, etc.) at 2 – 25% concentration, 25 – 40°C and pH 4 – 8.

Cane fibre board manufacture. S. E. Tilby, of Victoria, Canada, *assr.* Intercane Systems Inc. **4,212,616.** August 10, 1978; July 15, 1980.

Clean cane fibres, cut to suitable length, are delivered to the hopper section of a forming station from which they are reclaimed by conveyor 22 provided with spikes 23 and so delivered through opening 30 into chute 40. This has a sloping wall 42 and delivers to an open end 43 under which is a reciprocating plate 91 forming the upper surface of plunger 46 having a sweep face 48 and



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, England (price £1.45 each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C., USA 20231 (price 50 cents each).

operated by rams 50. Movement of the face 48 tends to align fibres cross-wise to it and pushes a slug of them under the cutting edge 75 and so over the edge 52 of table 44 into the chamber bounded by the end of table 44, wall 60 and base 54. The piston 64 causes plunger 58 to move downwards, movement being governed by toothed wheel 68 and rack 70, and this compresses the slug to a depth whereby it can be pushed into the passage 92 by reciprocation of the front face 78 of plunger 72.

A series of such slugs are compressed and pushed into the passage and thence into the column of platens 132 of bonding station 100. When these are all full, the forming station is moved sideways by means of its wheels 16 on tracks 18 to a second bonding station and so on while the boards are heated and the resin incorporated in the raw material is cured to bond the compressed fibre. The platens are then discharged before the forming station returns to its original place.

Molasses-containing animal feed. A. V. Brown and R. J. Karrasch, *assrs.* The Jim Dandy Co., of Birmingham, AL, USA. **4,212,896.** May 10, 1978; July 15, 1980. The animal fodder comprises 50-60% of ground cereal grains, 15-35% of a non-adhesive protein inclusive of the protein in the cereal grains, 7½-20% of invert molasses and 10-15% of water. The fodder has a resilient structure and can be compressed by more than 20% without disintegrating.

Method for preconditioning lumps of sugar. L. G. Corse, of Chaumont-sur-Tharonne, France, *assrs.* Machines Chambon. **4,213,249.** November 29, 1978; July 22, 1980. — Tablets of sugar passing from the moulding machine to a dryer undergo a severe thermal shock when passing from room temperature and low R.H. to high temperature and high R.H. There is a risk also of condensation of steam on the cold surface of the tablet. To avoid this the lumps are subjected on the conveyor to a short but sufficient period of infra-red radiation which raises the surface temperature to higher than the dew point, so obviating the risk of condensation and avoiding thermal shock.

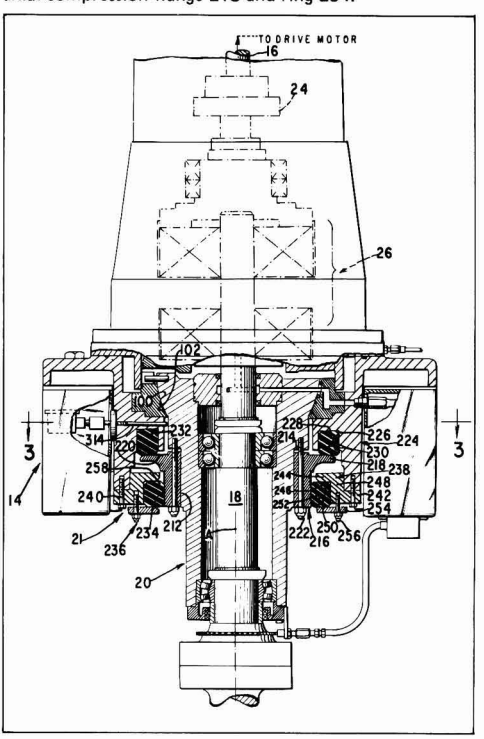
Sugar crystallization process. A. Monti, of New York, NY, USA. **4,216,025.** April 3, 1979; August 5, 1980. Sugar is crystallized from a supersaturated syrup having a total solids content of at least 75% (at least 80%) by weight and the sugar comprising at least 85% of the total solids, by spraying the syrup at a temperature of >250°F (260-290°F) in the form of droplets of size between 50 and 500 μm into a (vertically) flowing gas (air) stream (of velocity at least 4000 ft.min^{-1}) having a temperature <200°F (70-80°F), whereby the droplets crystallize to form solid particles which are removed pneumatically in the gas stream. Seed crystals not exceeding 3% by weight of the total solids in the syrup may be introduced into the gas stream.

Beet harvesters. (A) R. Bonfatti and L. Bonfatti, of Stellata di Bondero, Italy. **4,219,085.** August 3, 1978; August 26, 1980. (B) G. E. Maust, of Bay Port, MI, USA. **4,226,566.** March 30, 1978; October 7, 1980.

Batch centrifugal drive. J. B. Bange, of Hamilton, OH, USA, *assr.* The Western States Machine Co. **4,223,829.** January 2, 1979; September 23, 1980. — In conventional electric drives, the low speed windings of an AC induction motor are energized and the basket accelerated to the corresponding motor speed. Before this is reached, the low-speed windings are de-energized and the high-speed windings energized, when the basket is accelerated up to the corresponding speed. The "slip energy" results in considerable heat release and the motor must be built to withstand this. In the new system, the motor and basket are connected through a hydraulic clutch whereby the low speed windings are energized and liquid admitted to the clutch whereby the driven clutch members are brought up to speed by the driving members and any heat produced is conducted away by the liquid, after which the high-speed windings are energized and the basket brought to operating speed in the same way.

Batch centrifugal. T. R. Laven, D. L. Hurley, J. B. Bange and F. H. Wessel, *assrs.* The Western States Machine Co., of Hamilton, OH, USA. **4,224,165.** December 14, 1978; September 23, 1980.

Any imbalance in the load on a sugar centrifugal can cause gyration and measures to counter this includes the use of elastic buffer rings 232, 258 between the outer and inner housings at the top of the shaft 18. Their radial compression forces are adjustable by means of axial compression flange 218 and ring 254.



Excessive gyration can be dangerous, however, and also reduces the capacity of a machine which has to be shut down until gyration reaches acceptable levels. By use of two relatively small rods 314, spring loaded in bores in the outer housing, excessive gyration, which will cause the inner housing to make contact with the rods, can be detected and the rods can be connected to microswitches which can be used to disconnect power to the centrifugal motor.

Silica guard bed for adsorbent used in an aqueous system (for separating sugars in a mixture). E. Michalko and A. J. deRosset, *assrs.* UOP Inc., of Des Plaines, IL, USA. **4,226,639.** May 25, 1979; October 7, 1980. – When a crystalline aluminosilicate (a zeolite) is used as the material for selective adsorption of monosaccharides from a mixture with oligosaccharides (see UK Patent 1,585,369[1]), there is, on desorption with water, a tendency for the silicon constituent of the zeolite to dissolve in the aqueous system. To reduce this, the water and/or feed mixture are brought into contact with a bed of silica gel before application to the zeolite.

Method for immobilizing enzymes. M. Yoshida, M. Kumakura and I. Kaetsu, of Takasaki, Japan, *assrs.* Japan Atomic Energy Research Institute. **4,226,938.** September 21, 1978; October 7, 1980. – Enzymes are immobilized by adsorption on either inorganic natural earth adsorbents (active terra alba, bentonite, kaolin, alumina, silica gel or molecular sieves), synthetic inorganic adsorbents or active carbon, in aqueous medium and mixing the enzyme/adsorbent system with a polymerizable monomer CH_2=CX–CO–Y where X is H or CH_3 and Y is either $(CH_2)_n$–OH, where n is 2, 3 or 4 or $(R_1O)_m$–R_2, where R_1 is $-CH_2-$ or $-CH(CH_3)-CH_2-$ and R_2 is H, CH_3 or CH_2=CX–CO– and m is an integer from 2 to 20 (2–hydroxyethylmethacrylate; triethylene glycol monomethacrylate). Polymerization is affected at –20° to –80°C to give a porous gel lump in which the enzyme is distributed and through which a substrate can pass. The monomer may also contain up to 30% of a second monomer having a water-miscibility different from the first (methylolacrylamide, diallyl itaconate, ethylene glycol dimethylacrylate, hexanediol diacrylate, vinyl pyrrolidone, trimethylolpropane trimethacrylate).

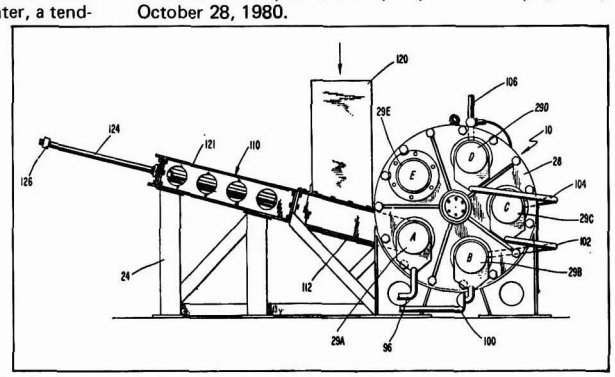
Separation of fructose from glucose by selective adsorption. R. W. Neuzil and J. W. Priegnitz, *assrs.* UOP Inc., of Des Plaines, IL, USA. **4,226,977.** May 27, 1976; October 7, 1980. – A mixture of the two sugars is brought into contact, under adsorption conditions, with an X-zeolite containing at exchangeable cation sites a cation pair which may be Ba^{++} + K^+ or Ba^{++} + Sr^+, whereby the fructose is selectively adsorbed and is recovered by elution with water after separation of the glucose.

Sugar cane ripeners. S. R. Siemer, of Fresno, CA, USA, *assr.* W. R. Grace & Co. (A) **4,229,203.** September 4, 1979; October 21, 1980. (B) **4,229,206.** September 4, 1979; October 21, 1980.

(A) The yield of cane is increased by applying, 2-10 weeks before harvesting, (3-20 gal.acre^{-1} of) a liquid (aqueous) composition (containing 0.6-16% of) an active ingredient comprising diphenyl chlorophosphate, phenyl dichlorophosphate, triethyl phosphite, dimethyl phosphite, triphenyl phosphite, 2-cyanoethyl phosphate barium salt dihydrate, or bis-(2,2,2-trichloroethyl) chlorophosphate. The formulation may also include a surfactant.

(B) The cane, of variety CL 59-1052 or CL 41-223, is treated as above, the active ingredient being a *s*-triazine of formula $C_3N_3RR'Cl$ where R is C_2H_5NH– and R' is $-N(CH_2CO_2CH_3)_2$, $-N(CH_2CONH_2)_2$, $-NH.CH_2COOC_2H_5$, $-N(CH_2COOH)_2$, or R is $(CH_3)_2CHNH$– and R' is $-NH.CH_2COOH$, $-N(CH_2COOC_4H_9)_2$, or R and R' are both $-N(CH_2COOH)_2$ or $-N(CH_3)CH_2COOH$.

Cane juice extraction. S. E. Tilby, of Victoria, Canada, *assr.* Intercane Systems Inc. **4,230,733.** January 4, 1979; October 28, 1980.



In the device shown, cane or cane pith from a hopper 120 is pushed by a ram mechanism, the piston of which may be arc-shaped, into a duct from which it is directed by a horizontal ram into a cylindrical chamber A which forms one of a series of cells spaced around the carrier unit 10. The carrier unit is rotated so that the cells take up the sequence of positions A to E and in each are subjected to the action of a liquid under pressure, directed through perforated end-walls by pistons and discharging as juice to the cell nearer the feed. The exhausted material is discharged from the final cell E before it is rotated to position A ready for fresh material to be filled into it.

High fructose corn syrup production. I. Ehrenthal, L. F. Slapshak and J. Rajpara, *assrs.* Anheuser-Busch Inc., of St. Louis, MO, USA. **4,230,802.** January 5, 1976; October 28, 1980. – A glucose-isomerizing enzyme is added to a glucose substrate, comprising at least 90% glucose, free of added Co (and Mg) salts, and at least 0.1% by weight on dry solids of a starch conversion mud comprising fatty acids, esterified fatty acids, coagulated proteins and hemicellulose. From the treated solution (after isomerization at 40-90°C and pH 5.5-9) is recovered a solution of at least 30% fructose. The mud may be replaced by a solvent extract from the mud obtained with hexane or other hydrocarbon, ether, petroleum ether or mixtures of these.

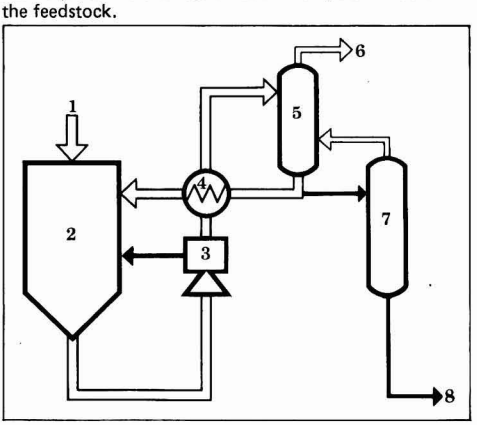
Sucrose-based polyether polyols. N. H. Nodelman, of New Martinsville, WV, USA, *assr.* Mobay Chemical Corporation. **4,230,824.** June 12, 1978; October 28, 1980. The title chemicals, used in making rigid polyurethane foams, are prepared by alkoxylation of sucrose with an alkylene oxide (partly ethylene oxide, followed by propylene oxide) in the presence of up to 1.3% of water, 4-50 parts of a polyalkylene polyamine $R_2N-[(CH_2)_m-NR]_p-(CH_2)_n-NR_2$, where p = 1 – 10 (1 or 2), R = H or C_1 – C_{18} (C_1 – C_4) alkyl as long as 4 (5) R groups are H and m, n = 2 or 3 (diethylene triamine), and 50-100% of an aromatic hydrocarbon solvent (toluene). An alkali metal hydroxide catalyst is added to the mixture once all the sucrose has dissolved in the reacting polyol.

[1] *I.S.J.*, 1982, **84**, 190.

TRADE NOTICES

Continuous fermentation/distillation. Alfa-Laval AB, Bioventure, P. O. Box 500, S-147 00 Tumba, Sweden.

Higher alcohol yields, lower energy consumption and greatly reduced effluent problems are claimed for a new integrated fermentation and distillation process developed by Alfa-Laval AB. The system, known as the Biostil process, differs from conventional schemes in that highly concentrated feedstocks may be fed direct to the fermenter and need not be diluted with large quantities of process water to protect the yeasts from poisoning; the alcohol formed is continuously stripped from the fermenter broth. The vinasse is therefore concentrated and requires little or no energy input for evaporation before final drying or combustion. A Biostil demonstration plant producing 12,000 litres of ethanol per day from 40° Bx molasses or 53° Bx evaporated cane juice has been in operation in Queensland, Australia, since April 1981 as a venture jointly financed by Alfa-Laval and CSR Ltd. It has given consistently higher alcohol yields than a neighbouring batch distillery and has required neither sterilization nor pasteurization of the feedstock.



The feedstock (1) is pumped at a fixed rate into aerated fermenter (2). Some of the broth is continuously withdrawn from the fermenter and pumped first to centrifuge (3) for yeast separation and recycling, then through a regenerative heat exchanger (4) to the upper section (5) of a split distillation column. Ethanol (6) is removed as a 30-40% vapour for subsequent rectification, while most of the liquid phase is returned via the heat exchanger to the fermenter; the remainder passes to lower section (7) of the distillation column, in which it is separated into an alcohol-containing phase (returned to the upper section) and a concentrated vinasse (8). The splitting of the column into two sections permits the liquid:vapour ratios in each to be optimized, minimizing energy consumption for a given solids concentration and simplifying stabilization of fermentation conditions. Alcohol concentration in the fermenter is maintained between 4.5% and 6% by weight and fermentable sugar concentration below 0.1%. Vinasse quantity is 2-5 litres (at 23-40% solids content) per litre of ethanol for a cane molasses feed having a fermentables:non-fermentables ratio between 1.5 and 3; with cane juice, having a ratio greater than 4 and evaporated to e.g. 60% (the feed concentration recommended to give an auto-combustible vinasse concentration of 55% solids), less than 1 litre of vinasse is obtained per litre of alcohol. In the Biostil system, the only limiting factor for the yeast is osmotic pressure, which is determined by the dissolved non-fermentable components in the feedstock.

PUBLICATIONS RECEIVED

Conveyors. C. J. R. Fyson & Son Ltd., Soham, Ely, Cambs. CB7 5UR, England.

A new brochure illustrates the many types of conveyor available from C. J. R. Fyson & Son Ltd., a company which has been in existence since 1848. The list includes various types of belt conveyor, mobile conveyors, hoppers and belt feeders, bulk handling systems, stockpilers, etc.

Knitted wire mesh. KnitMesh Ltd., Sanderstead Station Approach, South Croydon CR2 0YY, England.

Literature from KnitMesh Ltd. describes the many applications of the company's knitted wire mesh, which is designed to meet the needs of modern industry in regard to insulation covering. Advantages of KnitMesh-covered high-temperature insulation over other forms are listed.

Marshal insecticide. FMC Corporation, Agricultural Chemical Group, 2000 Market Street, Philadelphia, PA 19103, USA.

A recent brochure from FMC Corporation concerns Marshal insecticide. Among crops for which it is recommended is sugar beet, in which its use is suggested for control of wireworms, root maggot, aphids and the flea beetle.

Papua New Guinea cane sugar project. — The Prime Minister of Paupua New Guinea has officially opened the $100 million project of Ramu Sugar Ltd. at Gusap in Madang Province. The scheme, developed by Booker Agriculture International Ltd. following completion of a feasibility study, incorporates a 2800 tcd factory(supplied by Kawasaki Heavy Industries) and 6000 ha of rain-fed cane land, together with ranching of some 18,000 head of cattle. The project is expected to provide 40,000 tonnes of white sugar per year by the mid-1980's.

Motor controller order from British Sugar. — Renold Power Transmission Ltd. have won an order for three 3.7-kW A.C. motor controllers complete with worm gear and couplings for automatic control of the speed of a conveyor belt and two screw conveyors supplying sugar packaging lines at Bury St. Edmunds factory. The controllers are electrically linked to one another to provide a system that can supply various packaging lines at the same time. When one of the screw conveyors stops, the speed of the belt feeding granulated sugar to it is automatically reduced to supply sugar at a required rate for the other screw conveyor. The conveyor system is being supplied by George Robson & Co. (Conveyors) Ltd.

Water demineralization plant. — The water treatment division of the Dewplan Group has been awarded a contract to supply a demineralization plant for boiler feedwater at the Bardney factory of British Sugar plc. The plant will also provide water for use in liquid sugar and syrup manufacture. Another installation, for King's Lynn factory, is similar to that at Bardney and will bring to seven the total number supplied by Dewplan to British Sugar.

Bangladesh distillery orders. — ABAY S.A. have signed two contracts for the construction of two distilleries for the production of alcohol from cane molasses in Bangladesh. The two clients, both based in Dacca, are Jadz Distilleries Ltd. and Rangpur Distilleries & Chemical Ltd. Both distilleries, each capable of producing 1000 hectolitres of rectified alcohol per day, will be located in the north-west of the country. The orders cover construction of a molasses preparation station, an open batch fermentation station, vacuum distillation plant and ancillary equipment.

Dominican Republic sugar statistics 1981[1]

	1981		1980	
	tonnes, raw value			
Initial stocks		213,493		194,878
Production		1,107,609		1,012,604
		1,321,102		1,207,482
Exports				
Algeria	21,388		10,500	
Dominica	1,957		780	
Haiti	0		4,536	
Portugal	0		11,695	
Puerto Rico	70		0	
St. Lucia	1,648		0	
St. Vincent	1,030		0	
Senegal	6,180		28,298	
USA	711,177		525,084	
USSR	0		9,450	
Venezuela	119,297		201,191	
Virgin Islands	1,287		0	
West Indies	0		1,200	
		864,034		792,734
Consumption		206,309		208,536
Adjustment		1,112		− 7,281
Final stocks		249,647		213,493

Florida cane harvesting field day. — The 11th Field Day, organized by the Sugarcane Harvesting Research Unit of the USDA Agricultural Research Service at Belle Glade, Florida, wil be held on February 9-10, 1983 and will involve both static displays of equipment and demonstrations by manufacturers of their harvesters, transport equipment, towing tractors and other cane loading or handling equipment. A $25 registration fee will be charged to all except US farmers and Experiment Station and University representatives. Intending visitors and participants should write to Mr. J. E. Clayton at the Research Unit, P.O. Box 758, Belle Glade, FL 33430, USA.

US sugar import fees. — Sugar import fees were reduced by one cent per pound with effect from August 28, when they became 0.4193 cents/lb for raw sugar and 1.4193 cents/lb for refined sugar. The changes in the fees, which reflect stronger US sugar prices, were triggered by the terms of a presidential proclamation that provides for a flexible import fee system responsive to changes in domestic sugar prices. The average domestic spot price on the New York market during August 11-24 was 22.383 cents/lb, which compares with the market stabilization price established under the US support program for the crop year to end-September 1982, of 19.88 cents/lb. In May the president imposed import quotas on sugar and these have brought down supplies, strengthening internal prices and so permitting a gradual reduction in the import fees.

Tongaat Group Ltd. 1982 annual report. — A record cane crop of 2,030,803 tonnes of cane were produced in 1981/82 against the 1,246,006 tonnes of the previous drought-affected crop. Because of the drought and damage by the Eldana borer, the cane:sugar ratio was poor so that outturn was not a record, reaching 207,921 tonnes or a little more than 10% of the total South African production of 2,055,441 tonnes of sugar, compared with 140,604 tonnes, 8.8% of the 1980/81 production of 1,600,552 tonnes. The cane diffuser was modified to permit steadier running with improved extraction, and a new Dorr-Oliver rotary vacuum filter was installed. A new continuous B-pan is to be installed, and it is planned to introduce microprocessor control for many of the pan floor operations, while a new 150 tonnes.hr^{-1} high-efficiency boiler is scheduled to come on stream in November 1983. Agreement has been reached regarding the merger of the company with Huletts Corporation Ltd., with the formation of The Tongaat-Hulett Group Ltd.

Tanzania distillery project[2]. — France is to help the financing of a plant for manufacture of 10 million litres per year of alcohol from sugar cane, the equipment to be supplied by SPEIChim. The alcohol will be blended with petrol in a 20:80 ratio and will help to cut the country's oil imports bill. The plant will be located at Moshi and will have an annual capacity of 10 million litres, using molasses from TPC Ltd. as raw material[3].

Hungary beet crop, 1981/82[4]. — From an area of 121,800 hectares (104,400 ha in 1980/81) a crop of 4,719,000 tonnes of beet (3,927,000 tonnes in 1980/81) was produced in 1981/82, corresponding to a yield of 38.75 tonnes.ha^{-1} (37.64 tonnes.ha^{-1}).

Jamaica sugar statistics 1981[5]

	1981		1980		1979	
	tonnes, raw value					
Initial stocks		3,304		13,949		18,025
Production		204,010		236,389		291,025
Imports						
Brazil	8,052		0		0	
Cuba	8,259		0		0	
USA	12,856		4,725		0	
		29,167		4,725		0
		236,481		255,063		309,050
Consumption		99,522		117,233		101,190
Exports						
Canada	0		0		32,242	
EEC	124,512		91,318		86,692	
Morocco	0		0		14,740	
USA	0		43,208		60,237	
		124,512		134,526		193,911
Final stocks		11,050		3,304		13,949

Third Inter-American Sugar Cane Seminar. — The third in the series of annual seminars organized by Inter-American Transport Equipment Co. will be held in Miami and the sugar cane area of Florida. It will be devoted to cane breeding and varieties and 32 authors have sent abstracts of papers to be presented at six working sessions at Florida International University in Miami on October 6-7. On October 8 participants will visit various fields in the Lake Okeechobee neighbourhood, the USDA station at Canal Point and the US Sugar Corporation at Clewiston. We hope to publish abstracts of the papers in due course.

South African investment in US beet sugar[6]. — C. G. Smith Ltd., of Durban, one of the world's largest private sector companies, recently paid about $30 million to acquire the privately-owned Monitor Sugar Co., a US beet sugar producer in Bay City, Michigan. The acquisition may herald a corporate advance into the US by Smith's parent group, Barlow Rand Ltd. The Monitor purchase may not allow Smith to bypass the quotas on its exports to the US but it gives it an internal foothold from which to expand its market share in the longer term.

El Salvador distillery[7]. — A plant to produce 60,000 litres per day of anhydrous alcohol from cane molasses is to be installed in El Salvador, according to that country's Planning Ministry which has just completed feasibility studies. At full capacity the plant will produce 4,800,000 gallons annually. It will be financed by the Venezuelan Investment Fund on terms involving 2% interest, 10 years payback period and a 4 years grace period.

Sugar explosion in France[8]. — A massive explosion on May 11 destroyed three bulk sugar silos, a transport bridge and a packing station at Boiry-Ste.-Rictrude sugar factory in the Pas-de-Calais Département of France. It occurred shortly after the start of the lunch break and, almost miraculously, no-one was injured. The roof of one silo was thrown 700 metres. The cause of the explosion and associated fire is not known but it is assumed that sugar dust in one of the silos had become heated and this had resulted in spontaneous combustion. In spite of the damage, the factory management gave an assurance that the 1982/83 campaign would begin as normal.

Record Bangladesh sugar output 1981/82[9]. — Bangladesh produced a record of about 200,000 tonnes of sugar, white value, in its 14 sugar factories during the 1981/82 season, according to official sources. In 1980/81 production was 145,000 tonnes, white value. The record crop was due to a low rate of smuggling sugar cane to India and to a rain-free crushing season.

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1 C. Czarnikow Ltd., *Sugar Review*, 1982, (1608), 129.
2 *World Sugar J.*, 1982, **4**, (12), 37.
3 *Standard Chartered Review*, July 1982, 12-13.
4 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 420.
5 *I.S.O. Stat. Bull.*, 1982, **41**, (5), 20-21.
6 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 348.
7 *World Sugar J.*, 1982, **4**, (12), 33.
8 *Zuckerind.*, 1982, **107**, 760.
9 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 349.

Trinidad sugar statistics 1981[1]

	1981	1980	1979
		tonnes, raw value	
Initial stocks	19,551	8,831	15,301
Production	93,317	113,580	143,521
Imports	19,577	20,090	5,923
	132,445	142,501	164,745
Consumption	38,854	38,721	45,138
Exports*	67,333	64,175	93,877
Final stocks	6,938	19,551	8,831

* 1980 and 1981: all to EEC; 1979: 71,394 to EEC, 21,451 to USA and 1032 to Central American countries.

Kenya sugar scheme uncertainty[2]. — The future of the proposed Busia sugar project in Kenya is now uncertain as a result of a change in government policy. The project was to have been a joint project between the government and a foreign company which was to provide the technology. The government has now decided against any further equity holding because past investments have run into trouble and so the scheme is likely to be scrapped unless private finance can be arranged.

Hungary molasses utilization studies[3]. — The first large-scale experimental plant for beet molasses utilization in Hungary is being erected at Mezöhegyes agricultural combine which includes a sugar factory. The plant will produce fodder yeast, thereby eliminating the need for imports of this material, as well as citric acid and alcohol.

Moroccan cane sugar factory from Japan[4]. — The Moroccan government has signed a contract with a Japanese consortium (Hitachi Zosen and Marubeni Corporation) to build a cane sugar plant worth 310 million dirhams (about $50 million). The plant, which is to go on stream in January 1984, will have a daily crushing capacity of 3500 tonnes and a production capacity of 45,000 tonnes of white sugar a year. It is to be built in Tetuan in north Morocco.

Cuban sugar production 1982. — The Cuban Prime Minister, Dr. Castro, broke a long tradition of reticence over Cuban sugar statistics when he announced at the end of July that the 1982 crop had just ended with an outturn of 8,207,178 tonnes, raw value[5]. This was more than had been expected by most observers and shows a remarkable recovery following the replanting of rust-resistant varieties during the past two years. The crop is the highest since the 8.6 million tonnes of 1970.

China sugar production expansion[6]. — China's sugar production has nearly doubled in five years, from only 1.8 million tonnes in 1977 to 3.4 million tonnes in 1981, according to a government spokesman. The increase has relieved the sugar shortage in some parts of the country and has made China less dependent on imports, which were 780,000 tonnes in 1981 or about 19% of domestic consumption. The rapid progress is attributed to flexible economic policies in the rural area since 1978 whereby peasants are now encouraged to barter their sugar crop for grain and are no longer worried about getting enough food. In addition the price paid for the crops have been increased, which has encouraged higher production from the same growing area of 1 million hectares which was devoted to sugar crops in 1975. Sugar factories have been expanded and their capacity more fully utilized to handle the higher crops, rather than build new factories.

HFCS plants for sale in the US[7]. — Holly Sugar Corporation is planning to sell its high fructose corn syrup plant at Tracy, California, and may also sell its HFCS plant at Santa Ana, California. Both facilities have been idle because of the depressed state of the corn sweetener market.

US beet area decline[8]. — As at the end of June 1982, the Crop Reporting Board of the US Dept. of Agriculture estimated that 1,041,800 acres of beet would be harvested for the 1982/83 crop, against 1,229,100 acres in 1981/82, a reduction of 15.2%. Declines were reported from 12 of the 15 beet-growing states, with marginal increases in Arizona and North Dakota, and only Texas showing an appreciable increase from 25,200 to 29,000 acres. On a basis of the historical yields over 1979-81 the reported area would yield 21,052,060 short tons of beet and 2,519,000 tons of white sugar, against the 1981/82 campaign figures of 27,408,000 tons of beet yielding 3,075,000 tons of white sugar, reductions of 23.2% and 18.1%, respectively.

EEC sugar imports, 1981[9]

	1981	1980	1979
		tonnes, raw value	
Austria	15,404	22,679	21,370
Barbados	45,000	54,076	49,794
Belize	43,000	37,217	43,368
Brazil	424	10,699	75,612
Congo	0	5,352	5,426
Cuba	411	12,845	26,917
Cyprus	7,310	0	0
Czechoslovakia	50	392	2,472
Fiji	190,000	143,905	181,059
Germany, East	28,629	32,563	31,429
Guyana	184,800	148,707	160,726
India	71	26,550	27,047
Ivory Coast	4,932	0	0
Jamaica	124,000	92,144	88,777
Madagascar	0	12,371	10,284
Malawi	21,000	16,784	22,887
Mauritius	486,000	611,058	457,968
Mozambique	5,217	3,600	0
Philippines	2,453	4,145	0
Poland	0	3,443	29,413
St. Kitts	15,000	14,137	17,555
Surinam	65	903	2,838
Swaziland	123,000	115,131	144,162
Sweden	4	0	658
Switzerland	746	185	319
Tanzania	0	10,565	0
Trinidad	67,000	49,945	74,142
Yugoslavia	443	967	338
Other countries	569	540	438
	1,364,731	1,430,903	1,474,903

Poland campaign results, 1981/82[10]. — The 1981 beet area amounted to 470,000 ha, of which 106,000 ha was in the private sector. Beet production totalled 15,867,000 tonnes, of which 3,031,000 tonnes in the private sector corresponded to a yield of 33.79 tonnes.ha^{-1}, considerably higher than the 28.75 tonnes.ha^{-1} of the socialist sector. The total was 56% higher than the 10,139,000 tonnes of beet from the 1980 crop. All beets were bought by the state but only 15.5 million tonnes were processed, at an average slice of 151,700 tonnes against 132,900 tonnes in 1980/81, when the campaign lasted only 74 days compared with 102.4 days in 1981/82. The sugar content averaged 14.51% against 14.26% in 1980/81 and sugar outturn reached 1,723,000 tonnes, white value, against 1,043,000 tonnes.

Mauritius alcohol project[11]. — The government has decided to go ahead with the 60,000 litres/day alcohol plant proposed by Vogelbusch and Vereinigte Edelstahlwerke of Austria, following agreement by Austria's Girozentrale & Bank der Oesterreichischen Sparkassen to lend 186 million schillings ($10.8 million) to finance the project. The loan will be repayable over eight years, starting six months after the hand-over of the distillery to the government, at an annual interest rate of 8¼%. The factory's total cost is not yet known as this depends on which of two proposals put forward by the Austrian firms will be accepted. The first proposal is estimated to cost 124 million rupees ($14.41 million) while the second costs 104 million rupees ($9,660,000) and uses less sophisticated equipment with bagasse used for part of the power generation. Equipment for both schemes will be supplied by Vogelbusch, which has installed plant in more than 30 similar distilleries elsewhere.

PERSONAL NOTES

Dr. Renton Righelato has been appointed Director of Group Research and Development of Tate & Lyle Ltd.

Professor A. J. Vlitos is to succeed **Mr. J. A. C. Hugill** as Director General of the World Sugar Research Organization after March 1983. At a meeting of the WSRO **Mr. W. W. Sprague** of Savannah Foods & Industries Inc. was elected Chairman in succession to **Dr. Fernando Cordovez**, and **Mr. J. M. Beckett** was re-elected Treasurer.

1 *I.S.O. Stat. Bull.*, 1982, **41**, (5), 39-40.
2 *World Sugar J.*, 1982, **4**, (12), 35.
3 *Lebensmittelind.*, 1982, **29**, 277.
4 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 401.
5 C. Czarnikow Ltd., *Sugar Review*, 1982, (1607), 123.
6 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 403-404.
7 *World Sugar J.*, 1982, **5**, (1), 40.
8 *McKeany-Flavell Sweetener News*, July 6, 1982.
9 *I.S.O. Stat. Bull.*, 1982, 41, (7), 11.
10 F. O. Licht, *International Sugar Rpt.*, 1982, **114**, 420.
11 *World Sugar J.*, 1982, **5**, (1), 37.

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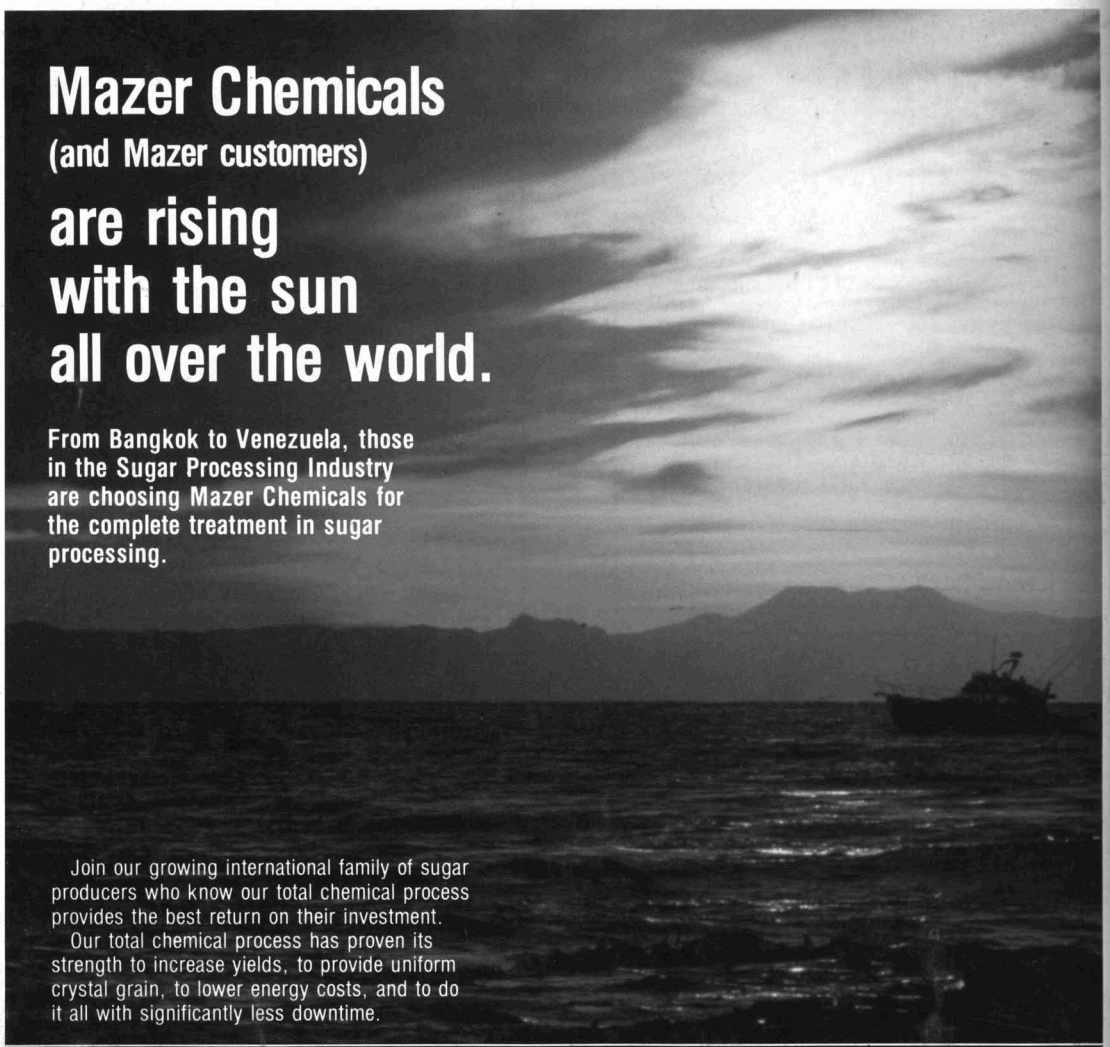

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